850 Professional IC

Anion – MSM-HC – MCS – Gradient – 2.850.2240

Manual

8.850.8027EN

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Although all the information given in this documentation has been checked with great care, errors cannot be entirely excluded. Should you notice any mistakes please send us your comments using the address given above.

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1 Introduction

1.1 Instrument description

The instrument **850 Professional IC – Anion – MSM-HC – MCS – Gradient** (2.850.2240) is one of the model versions of the Professional IC line of instruments manufactured by the Metrohm Company. The Professional IC line of instruments is distinguished by:

- the **intelligence** of its components, which are able to monitor and optimize all functions and to provide documentation according to FDA requirements.
- its **compactness**.
- its **flexibility**. A suitable model version exists for every application. Individual instruments can be converted, expanded or modified to create a different instrument as needed.
- its **transparency**. All components are easily accessible and arranged in a clear manner.
- its **safety**. Chemicals and electronics are separated and a leak sensor is integrated in the wet end.
- its **environmental compatibility**.
- **low noise emission**.

The instrument is operated with **MagIC Net** software. It is connected via a USB connection to a PC on which MagIC Net is installed. The software automatically recognizes the instrument and checks its functional readiness. MagIC Net controls and monitors the instrument, evaluates the measured data and administers it in a database. The operation of MagIC Net is described in the online help or in the tutorial for MagIC Net.

The low pressure mixing valve and two additional eluent degassers in the lower area of the instrument are used for the controlled mixing of up to 3 eluents.

The instrument contains the following components:

Eluent degasser

The eluent degasser removes gas bubbles and dissolved gases from the eluent. For degassing, the eluent flows into a vacuum chamber through a special fluoropolymer capillary.

High pressure pump

The intelligent and low pulsation high pressure pump pumps the eluent through the system. It is equipped with a chip on which its technical specifications and "life history" (operating hours, service data, ...) are saved.

Inline filter

Inline filters protect the separation column securely against possible contamination from the eluent. Inline filters can however also just as well be used for the purpose of protecting other sensitive components against contaminations in the solutions used. The fine 2 µm material of the readily and easily replaceable filter platelets removes particles such as bacteria and algae from the solutions.

Pulsation damper

The pulsation damper protects the separation column from damage caused by pressure fluctuations when switching the injection valve, and reduces interfering pulsations during highly sensitive measurements.

Sample degasser

The sample degasser removes gas bubbles and disolved gases from the sample. For degassing, the sample flows into a vacuum chamber through a special fluoropolymer capillary.

Injection valve

The injection valve connects the eluent and sample path through rapid and precise valve switchover. A precisely measured amount of sample solution is injected and rinsed with eluent onto the separation column.

Column thermostat

The column thermostat controls the temperature of the column and eluent channel and thus ensures stable measuring conditions. It provides space for 2 separation columns.

High Capacity Metrohm Suppressor Module (MSM-HC)

The MSM-HC is used for chemical suppression with high capacity during anion analysis. It is pressure-stable, robust and resistant to solvents.

Peristaltic pump

The Peristaltic pump is used for pumping sample and auxiliary solutions. It can rotate in both directions.

Metrohm CO_2 suppressor (MCS)

The MCS removes the CO_2 from the eluent flow. This reduces the background conductivity, improves the detection sensitivity and minimizes the injection and carbonate peaks.

Conductivity detector

The conductivity detector continuously measures the conductivity of the liquid passing through and indicates these signals in digital form (DSP – Digital Signal Processing). The conductivity detector exhibits outstanding thermal stability and thus guarantees reproducible measuring conditions.

Separation column

The intelligent separation column is the heart of the ion chromatographic analysis. It separates the different components corresponding to their interactions with the column. The Metrohm analytical columns are equipped with a chip on which their technical specifications and their history (first use / setting up, operating hours, injections, ...) are saved.

1.2 Intended use

The **850 Professional IC – Anion – MSM-HC – MCS – Gradient** is used for the ion chromatography determination of anions with binary **high pressure gradient** and **sequential suppression**:

Sequential suppression consists of:

- Chemical suppression by the Metrohm Suppressor Module (MSM) and subsequent
- CO_2 suppression by the Metrohm CO_2 Suppressor (MCS) *(see Chapter 3.18, page 60)*.

The use of this technology reduces background conductivity to an absolute minimum.

If required, the instrument can also be used for the determination of cations and anions without suppression.

The present instrument is suitable for processing chemicals and flammable samples. The usage of the 850 Professional IC – Anion – MSM-HC – MCS – Gradient therefore requires that the user has basic knowledge and experience in the handling of toxic and caustic substances. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories is also mandatory.

1.3 About the documentation

Caution

Please read through this documentation carefully before putting the instrument into operation. The documentation contains information and warnings which have to be followed by the user in order to ensure safe operation of the instrument.

1.3.1 Symbols and conventions

The following symbols and styles are used in this documentation:

*(5-**12**)*	**Cross-reference to figure legend** The first number refers to the figure number, the second to the instrument part in the figure.
1	**Instruction step** Carry out these steps in the sequence shown.
	**Warning** This symbol draws attention to a possible life hazard or risk of injury.
	**Warning** This symbol draws attention to a possible hazard due to electrical current.
	**Warning** This symbol draws attention to a possible hazard due to heat or hot instrument parts.
	**Warning** This symbol draws attention to a possible biological hazard.
	**Caution** This symbol draws attention to a possible damage of instruments or instrument parts.
	**Note** This symbol marks additional information and tips.

1.4 Safety instructions

1.4.1 General notes on safety

Warning

This instrument may only be operated in accordance with the specifications in this documentation.

This instrument has left the factory in a flawless state in terms of technical safety. To maintain this state and ensure non-hazardous operation of the instrument, the following instructions must be observed carefully.

1.4.2 Electrical safety

The electrical safety when working with the instrument is ensured as part of the international standard IEC 61010.

Warning

Only personnel qualified by Metrohm are authorized to carry out service work on electronic components.

Warning

Never open the housing of the instrument. The instrument could be damaged by this. There is also a risk of serious injury if live components are touched.

There are no parts inside the housing which can be serviced or replaced by the user.

Mains voltage

Warning

An incorrect mains voltage can damage the instrument.

Only operate this instrument with a mains voltage specified for it (see rear panel of the instrument).

Protection against electrostatic charges

Warning

Electronic components are sensitive to electrostatic charges and can be destroyed by discharges.

Always pull the mains cable out of the mains connection socket before connecting or disconnecting electrical appliances on the rear panel of the instrument.

1.4.3 Tubing and capillary connections

Caution

Leaks in tubing and capillary connections are a safety risk. Tighten all connections well by hand. Avoid applying excessive force to tubing connections. Damaged tubing ends lead to leakage. Appropriate tools can be used to loosen connections.

Check the connections regularly for leakage. If the instrument is used mainly in unattended operation, then weekly inspections are mandatory.

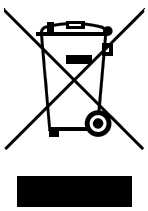
1.4.4 Flammable solvents and chemicals

Warning

All relevant safety measures are to be observed when working with flammable solvents and chemicals.

- Set up the instrument in a well-ventilated location (e.g. laboratory flue).
- Keep all sources of flame far from the workplace.
- Clean up spilled fluids and solids immediately.
- Follow the safety instructions of the chemical manufacturer.

1.4.5 Recycling and disposal



This product is covered by European Directive 2002/96/EC, WEEE – Waste from Electrical and Electronic Equipment.

The correct disposal of your old equipment will help to prevent negative effects on the environment and public health.

More details about the disposal of your old equipment can be obtained from your local authorities, from waste disposal companies or from your local dealer.

2 Overview of the instrument

2.1 Front

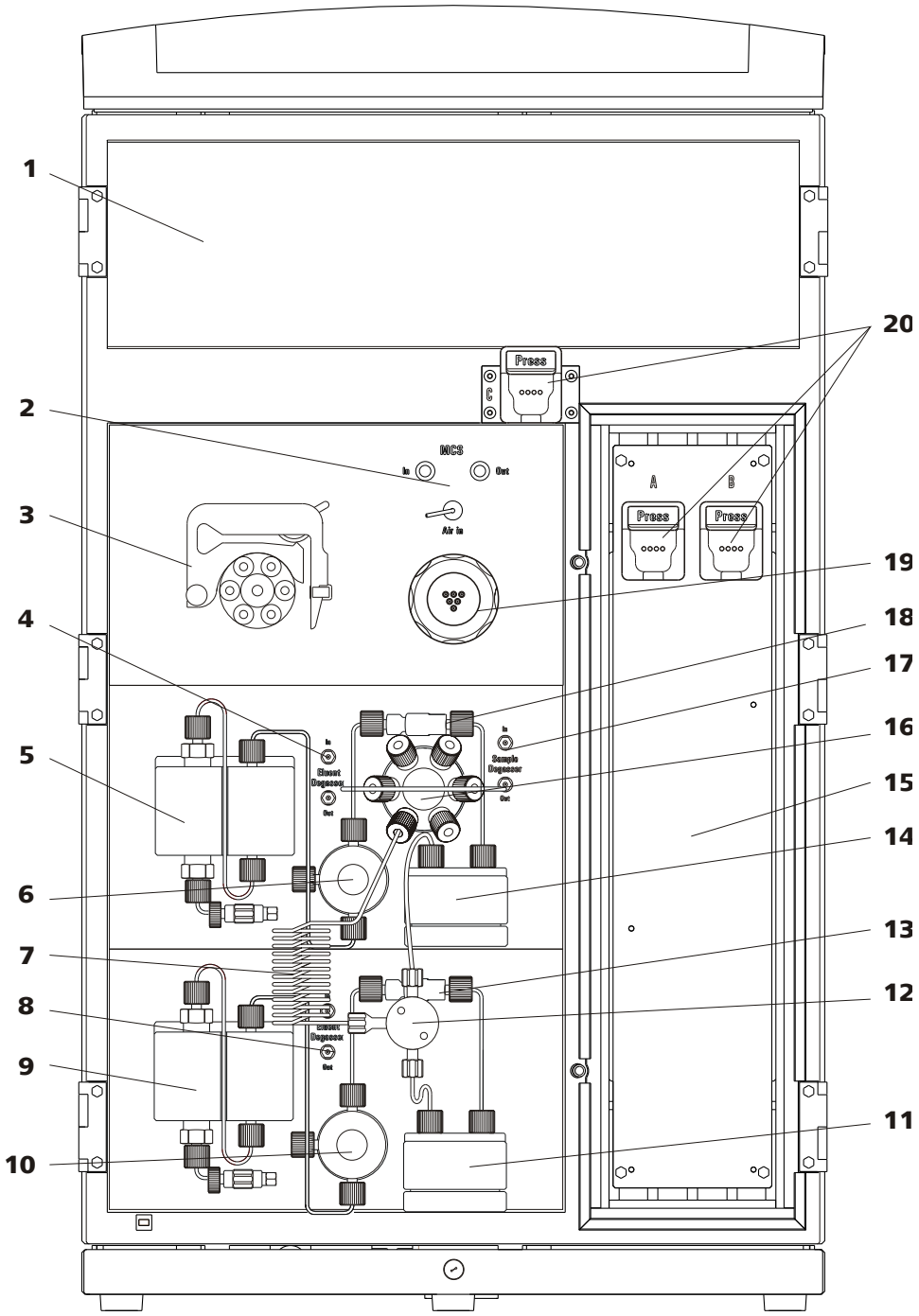


Figure 1 Front 850 Professional IC – Anion – MSM-HC – MCS – Gradient

1 Detector chamber Space for the conductivity detector *(see Chapter 3.19, page 63)*.	**2 MCS** *See Chapter 3.18, Page 60*.

3 **Peristaltic pump**
See Chapter 3.17, Page 55.

4 **Eluent degasser**
See Chapter 3.9, Page 36.

5 **High pressure pump**
See Chapter 3.10, Page 37.

6 **Purge valve**
For deaerating the high pressure pump *See Chapter 3.10.1, Page 37*.

7 **Mixing coil for high pressure gradients 6.2758.000**

8 **Eluent degasser**
For two additional eluents *(see Chapter 3.9, page 36)*.

9 **High pressure pump**
See Chapter 3.10, Page 37.

10 **Purge valve**
For deaerating the high pressure pump *(see Chapter 3.10.1, page 37)*.

11 **Pulsation damper**
See Chapter 3.12, Page 43.

12 **T connection 6.2744.150**

13 **Inline filter**
See Chapter 3.11, Page 42.

14 **Pulsation damper**
See Chapter 3.12, Page 43.

15 **Column thermostat**
See Chapter 3.15, Page 49.

16 **Injection valve**
See Chapter 3.14, Page 46.

17 **Sample degasser**
See Chapter 3.13, Page 45. Use optional.

18 **Inline filter**
See Chapter 3.11, Page 42.

19 **MSM-HC**
See Chapter 3.16, Page 52.

20 **Column holder**
For two separation columns *(see Chapter 3.22, page 69)* in the column thermostat and one outside the column thermostat.

2.2 Rear

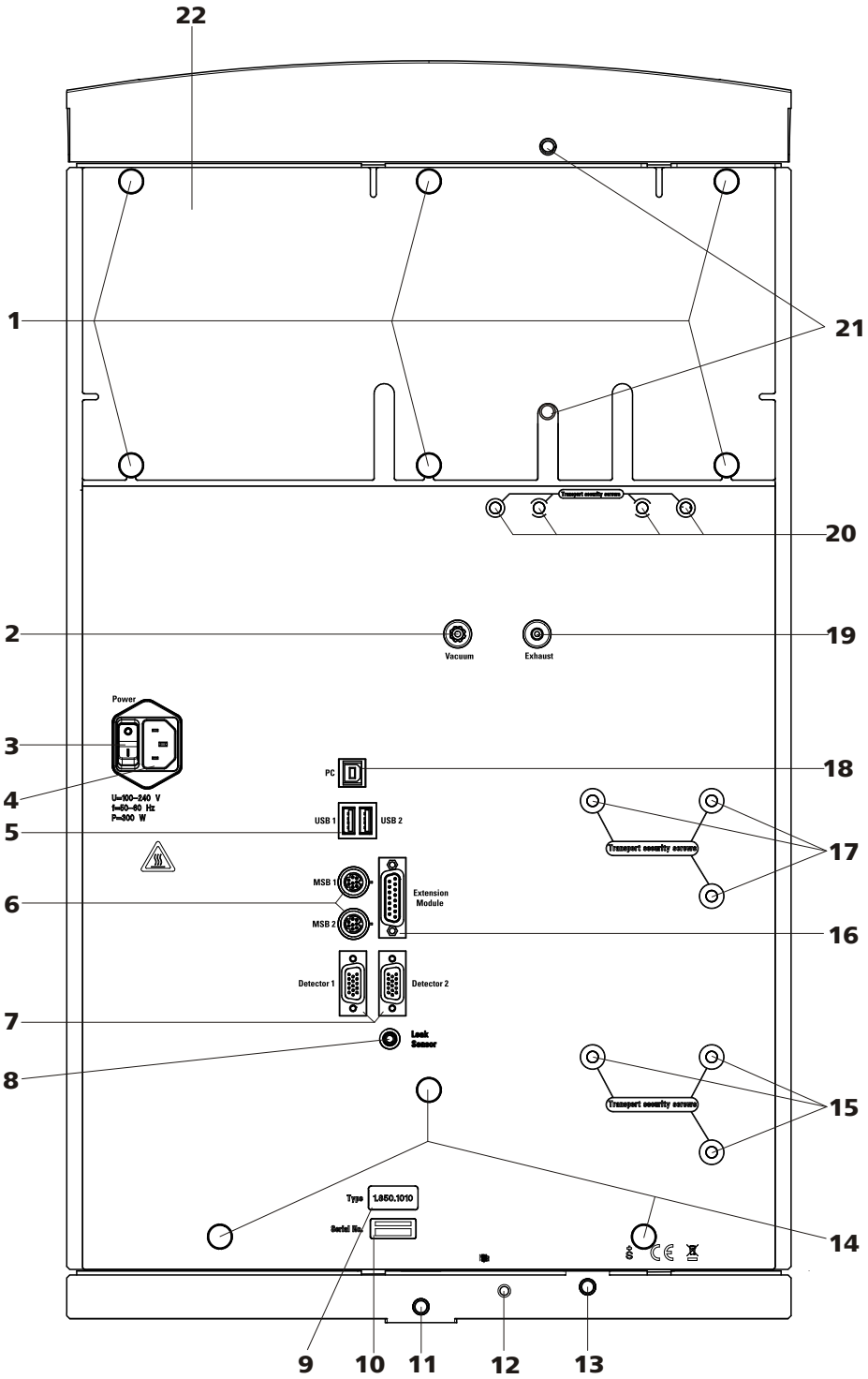


Figure 2 Rear 850 Professional IC Anion – MSM-HC – MCS – Gradient

1 Knurled screws
For fastening the rear panel *(2-**22**)* and handle *(5-**2**)*.

2 Vacuum connection
For connecting further degassing chambers in extension modules.
Labeled with *Vacuum*.

3 Mains switch
For switching the instrument on and off.
I = ON
0 = OFF

4 Mains connection socket
For connecting the mains cable.

5 USB connectors
2 USB connectors (labeled with *USB 1* and *USB 2*).

6 MSB connectors
2 MSB connectors (labeled with *MSB 1* and *MSB 2*) for connecting MSB devices
Caution: The 850 **must** be switched off when connecting a device.
MSB = Metrohm Serial Bus.

7 Detector connectors
2 detector connectors (labeled with *Detector 1* and *Detector 2* for connecting Metrohm detectors.

8 Leak sensor connection socket
For connecting the leak sensor connector plug *(8-**2**)*.

9 Instrument type

10 Serial number

11 Drainage tubing connection
For connecting a drainage tubing 6.1816.020 *(9-**8**)*.

12 Leak sensor connection cable
For connecting the leak sensor.

13 Drainage tubing connection
For connecting a drainage tubing 6.1816.020 *(9-**9**)*.

14 Knurled screws
For fastening the rollers.

15 Transport locking screws
For securing the lower high pressure pump *(18-**4**)* when transporting the instrument (only necessary for instruments with two high pressure pumps).

16 Extension module connection
For connecting an extension module (labeled with *Extension Module*).

17 Transport locking screws
For securing the high pressure pump *(18-**4**)* when transporting the instrument.

18 PC connection socket
For connecting the instrument to the computer with the USB cable 6.2151.020.

19 Waste air opening
For extracting the air from the vacuum chamber.
Labeled with *Exhaust*.

20 Transport locking screws
For securing the vacuum pump when transporting the instrument.

21 Drainage tubing connection
For connecting a drainage tubing 6.1816.020 *(9-**1**)*.

22 Rear panel
Removable. Access to the detector chamber.

Caution

When connecting an instrument to the MSB connector *(2-**6**)* you **must** switch off the 850 Professional IC .

3 Installation

3.1 About this chapter

The *Installation* chapter contains

- this overview
- a brief set of instructions for the initial installation of the 850 Professional IC – Anion – MSM-HC – MCS – Gradient *(see Chapter 3.2, page 13)* as an isocratic system. At each step you will find cross-references to more detailed installation instructions for individual components, should you require such aids.
- an installation diagram *(see Figure 3, page 17)*, showing a completely installed instrument.
- several chapters with detailed installation instructions for all components, including those that are already installed at the time the instrument is delivered.

3.2 Initial installation

Note

A large number of the capillary connections are already connected at the time the instrument is delivered.

Installing 850 Professional IC – Anion – MSM-HC – MCS – Gradient

1 Setting up the instrument

See Chapter 3.4, Page 19.

2 Installations on the rear of the instrument

- Remove handle and rollers *(see Chapter 3.6.1, page 21)*.
- Place the detector in the instrument and connect it *(see Chapter 3.6.2, page 24)*.
- Remove transport locking screws *(see "Removing transport locking screws", page 26)*.
- Connect the leak sensor *(see "Connecting the leak sensor", page 26)*.

- Connect drainage tubings *(see "Installing drainage tubing", page 29)*.

3 Connecting the eluent path

- Equip an eluent aspiration tubing for each of the two high pressure pumps and connect with the eluent bottle *(see Chapter 3.8.1, page 32)*.
- Instead of the column, connect the 6.2744.040 coupling with a 6.2744.010 pressure screw at the end of the pre-installed column inlet capillary.
- Use a 6.2744.014 pressure screw to connect the capillary of the MSM-HC labeled with *Eluent* to the other end of the 6.2744.040 coupling.
- Use a 6.2744.090 long pressure screw to connect the capillary of the MSM-HC labeled with *Detector* to the input of the MCS *(see Chapter 3.18.2, page 60)*.
- Connect the detector inlet capillary with a 6.2744.090 long pressure screw to the output of the MCS *(see Chapter 3.18.2, page 60)*.

4 Connecting the sample path

Note

The sample degasser does not have to be connected. We recommend the usage of the sample degasser only if the sample matrix requires it.

- Connect the 6.1803.040 sample aspirating capillary connected at the sample input of the injection valve to the output of the sample degasser with the aid of a 6.2744.090 long pressure screw *(see Chapter 3.13, page 45)*.
- Connect a part of the 6.1803.040 PTFE capillary with a 6.2744.090 long pressure screw to the input of the sample degasser. Guide the other end out of the instrument through a capillary feed-through and connect it to the Sample Processor.
- Guide the sample outlet capillary connected to the sample output of the injection valve out of the instrument through a capillary feed-through and onward to the waste container and then fasten it there.

5 Installing the peristaltic pump

(see Chapter 3.17.2, page 56).

- Connect the 6.1803.020 aspirating capillary for regeneration solutions with a 6.2744.034 tubing olive and a 6.2744.070 short pressure screw to the aspiration end of the 6.1826.320 pump tubing for the regeneration solution.
- Place the pump tubing in a tubing cartridge.
- Connect the 6.1803.020 aspirating capillary for rinsing solutions with a 6.2744.034 tubing olive and a 6.2744.070 short pressure screw to the aspiration end of the second 6.1826.320 pump tubing for the rinsing solution.
- Place the second pump tubing in the second tubing cartridge.
- Place both tubing cartridges into the peristaltic pump.

6 Connecting the MSM-HC

(see Chapter 3.16.2, page 52)

- Connect the capillary labeled with *H2SO4* with a 6.2744.180 pump tubing connection and a 6.2744.070 short pressure screw to the peristaltic pump on the outlet end of the pump tubing for the regeneration solution.
- Connect the capillary labeled with *H20* with a 6.2744.180 pump tubing connection and a 6.2744.070 short pressure screw to the peristaltic pump on the outlet end of the pump tubing for the rinsing solution.
- Guide the two capillaries labeled with *Waste* into a waste container and fasten them there.

7 Connecting the instrument

- Connecting the instrument to the PC with a 6.2151.020 USB cable *(see Chapter 3.20.1, page 66)*.
- Connect instrument to mains supply *(see Chapter 3.20, page 66)*.

8 Initial start-up

(see Chapter 4.1, page 71)

- Switch on the PC and start MagIC Net.
- Switch on the instrument.
- Deaerate the high pressure pump *(see Chapter 3.10.2, page 40)*.
- Set contact pressure of the peristaltic pump *(see "Set flow rate", page 59)*.
- Rinse instrument without column.

9 Installing guard and separation column

- Remove the 6.2744.040 coupling between the column inlet capillary and the eluent inlet capillary of the MSM-HC.
- Connect guard column (optional) *(see Chapter 3.21, page 67)*
  - Fasten the guard column to the end of the column inlet capillary according to the specifications contained in the leaflet accompanying the guard column.
  - Rinse guard column.
- Connect the separation column *(see Chapter 3.22, page 69)*
  - Fasten the inlet of the separation column either to the end of the column inlet capillary or to the guard column (if used) according to the specifications contained in the leaflet accompanying the column.
  - Fasten the MSM-HC capillary labeled with *Eluent* with a 6.2744.070 PEEK pressure screw at the output of the separation column.
- Hang separation column with chip in the column holder of the instrument.

10 Conditioning the instrument

(see "Conditioning the system", page 72)

3.3 Installation diagram

Figure 3 Installation diagram shows the capillary connections with the application of the gradient technique and sequential suppression (MSM-HC and MCS).

The arrangement of the modules in the diagram corresponds to the front view of the instrument. Liquid containers (eluent bottle, sample vessel, waste container, auxiliary solutions container) and guard column *(see Chapter 3.21, page 67)* are not shown in the diagram.

Most of the capillaries are already pre-installed at the time the instrument is delivered. Capillaries on which nothing needs to be done at the time of initial installation are not numbered in the diagram.

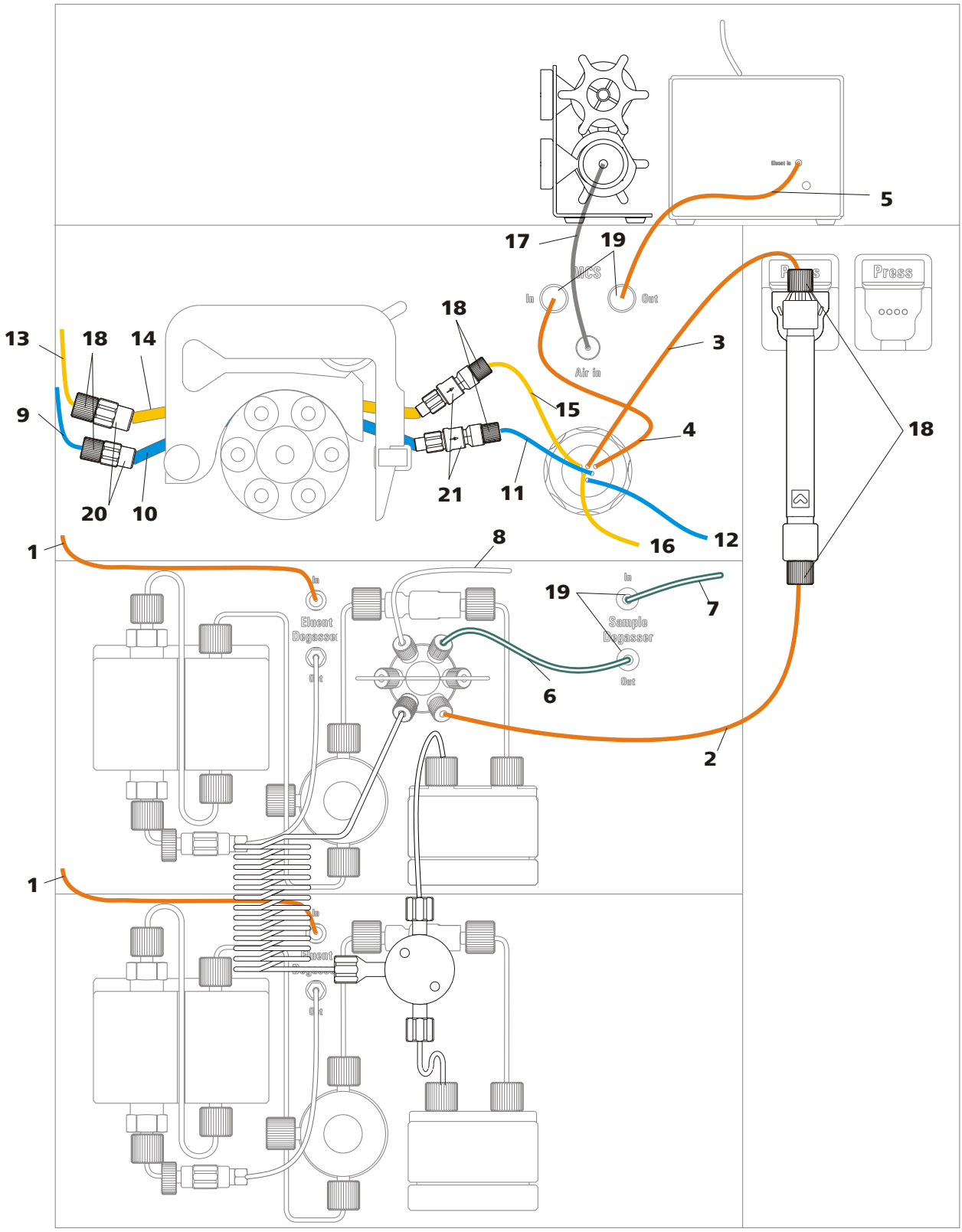


Figure 3 Installation diagram

1 Eluent aspiration tubing 6.1834.080
Two aspiration tubings for two different eluents *(see Chapter 3.8.1, page 32)*.

2 Column inlet capillary
Connected to the injection valve and threaded into the capillary recesses of the column thermostat.

3 **Connection capillary**
Capillary of the MSM-HC labeled with *Eluent*.

4 **Connection capillary**
Capillary of the MSM-HC labeled with *Detector*.

5 **Detector inlet capillary**

6 **Sample aspirating capillary 6.1803.040**
Connected to the injection valve. The other end can be connected either to the sample degasser or guided directly out of the instrument.

7 **PTFE connection capillary**
Section of the 6.1803.040 PTFE capillary. Connects sample degasser with sample processor (required only if the sample degasser is to be used).

8 **Sample outlet capillary**
Connected to the injection valve.

9 **Rinsing solution aspirating capillary 6.1803.020**
Connection to the bottle with rinsing solution.

10 **Pump tubing 6.1826.320**
Pump tubing with yellow-orange stoppers for conveying the rinsing solution.

11 **Connection capillary for the rinsing solution**
Capillary of the MSM-HC labeled with *H20*.

12 **Rinsing solution outlet capillary**
Capillary of the MSM-HC labeled with *Waste*.

13 **Regeneration solution aspirating capillary 6.1803.020**
Connection to the regeneration solution bottle.

14 **Pump tubing 6.1826.320**
Pump tubing with yellow-orange stoppers for conveying the regeneration solution.

15 **Connection capillary for the regeneration solution**
Capillary of the MSM-HC labeled with *H2SO4*.

16 **Regeneration solution outlet capillary**
Capillary of the MSM-HC labeled with *Waste*.

17 **Air aspirating capillary**
For aspirating CO_2-low air from the cartridges of the MCS.

18 **PEEK pressure screws, short 6.2744.070**

19 **PEEK pressure screws, long 6.2744.090**

20 **Tubing olive 6.2744.030**

21 **Pump tubing connection with safety device 6.2744.180**

3.4 Setting up the instrument

3.4.1 Packaging

The instrument is supplied in highly protective special packaging together with the separately packed accessories. Keep this packaging, as only this ensures safe transportation of the instrument.

3.4.2 Checks

Immediately after receipt, check whether the shipment has arrived complete and without damage by comparing it with the delivery note.

3.4.3 Location

The instrument has been developed for operation indoors and may not be used in explosive environments.

Place the instrument in a location of the laboratory which is suitable for operation, free of vibrations, protected from corrosive atmosphere, and contamination by chemicals.

The instrument should be protected against excessive temperature fluctuations and direct sunlight.

3.5 Capillary connections in the IC system

This chapter contains general information concerning the capillary connections in the IC instruments.

Generally speaking, capillary connections between two components of an IC instrument are made up of one connection capillary and two pressure screws with which the capillary is connected to the respective components.

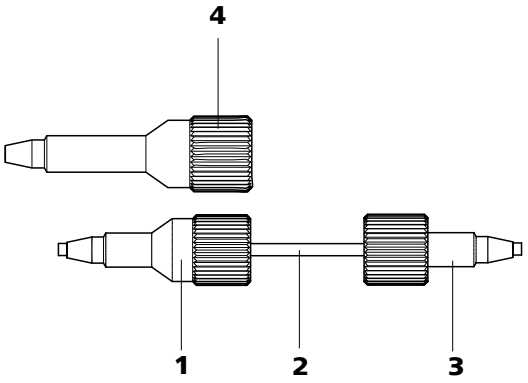


Figure 4 Connection of capillaries with pressure screws

1 **PEEK pressure screw 6.2744.014** Use on the injection valve.	**2** **Connection capillary**
3 **PEEK pressure screw, short 6.2744.070** For use on the high pressure pump, the purge valve, the inline filter, the pulsation damper, the guard column and the separation column.	**4** **PEEK pressure screw, long 6.2744.090** Usage on other components. Is not used on all instruments.

Note

In order to keep the dead volume as low as possible, capillary connections should generally be as short as possible.

Note

For an improved overview, capillary and tubing connections can be bundled with the 6.1815.010 spiral band.

Connection capillary

PEEK capillaries and PTFE capillaries are used in the IC system.

PEEK capillaries (polyetheretherketone)

PEEK capillaries are temperature-resistant up to 100°C, stable under pressure up to 400 bar, flexible, chemically inert and exhibit an extremely smooth surface. They can be readily cut down to the desired length with the capillary cutter.

Usage:

- 6.1831.010 PEEK capillary (internal diameter of 0.25 mm) for the entire high pressure range.
- 6.1831.030 PEEK capillary (internal diameter of 0.75 mm) for sample handling in the ultra trace range.

Caution

For the capillary connections between the injection valve *(see Chapter 3.14, page 46)* and detector *(see Chapter 3.19, page 63)*, PEEK capillaries with an internal diameter of 0.25 mm must be used. These are already connected to a newly delivered instrument.

PTFE capillaries (polytetrafluoroethylene)

PTFE capillaries are transparent and enable visual tracing of the liquids to be pumped. They are chemically inert, flexible and temperature-resistant up to 80°C.

Usage:

PTFE capillaries (6.1803.0x0) are used for the low pressure range.

- PTFE capillaries with internal diameter of 0.5 mm for sample handling.
- PTFE capillaries with internal diameter of 0.97 mm for the sample handling as for rinsing and regeneration solutions (they do not have to be in the scope of delivery of the instrument).

Note

Capillaries must have a flawless level cut edge. For cutting PEEK capillaries only use the 6.2621.080 capillary cutter.

3.6 Rear of the instrument

3.6.1 Rollers and handle

In order to make transport easier, the instrument is equipped with rollers and a handle.

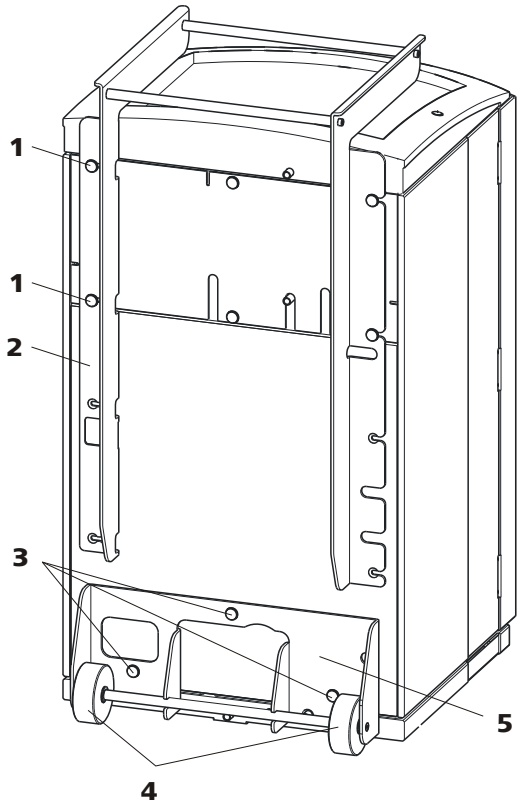


Figure 5 Rollers and handle

1	**Knurled screws** For fastening the handle *(5-**2**)* and the rear panel of the detector chamber.	**2**	**Handle**
3	**Knurled screws** For fastening the roller holder *(5-**5**)*.	**4**	**Rollers**
5	**Roller holder**		

Removing handle

1 Loosen knurled screws *(5-**1**)* and remove handle *(5-**2**)*.

Removing rollers

Proceed as follows to remove the rollers:

1 Remove knurled screws *(5-**3**)*.

2 Remove roller holder *(5-**5**)*.

Mounting handle as MPak holder

Note

When extended, the handle *(6-**2**)* can also be used for hanging up MPaks (eluent bags).

1 Move handle *(6-**2**)* upwards and screw in the knurled screws *(6-**1**)* again.

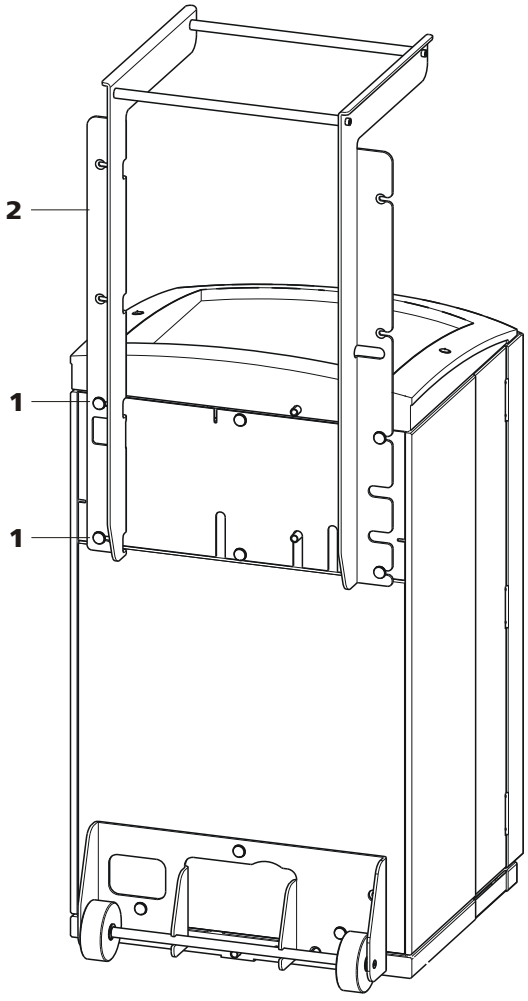


Figure 6 Handle as MPak holder

1 Knurled screws
For fastening the handle *(6-**2**)* and the rear panel of the detector chamber.

2 Handle
Extended. As holder for MPaks (eluent bag).

3.6.2 Positioning and connecting the detector

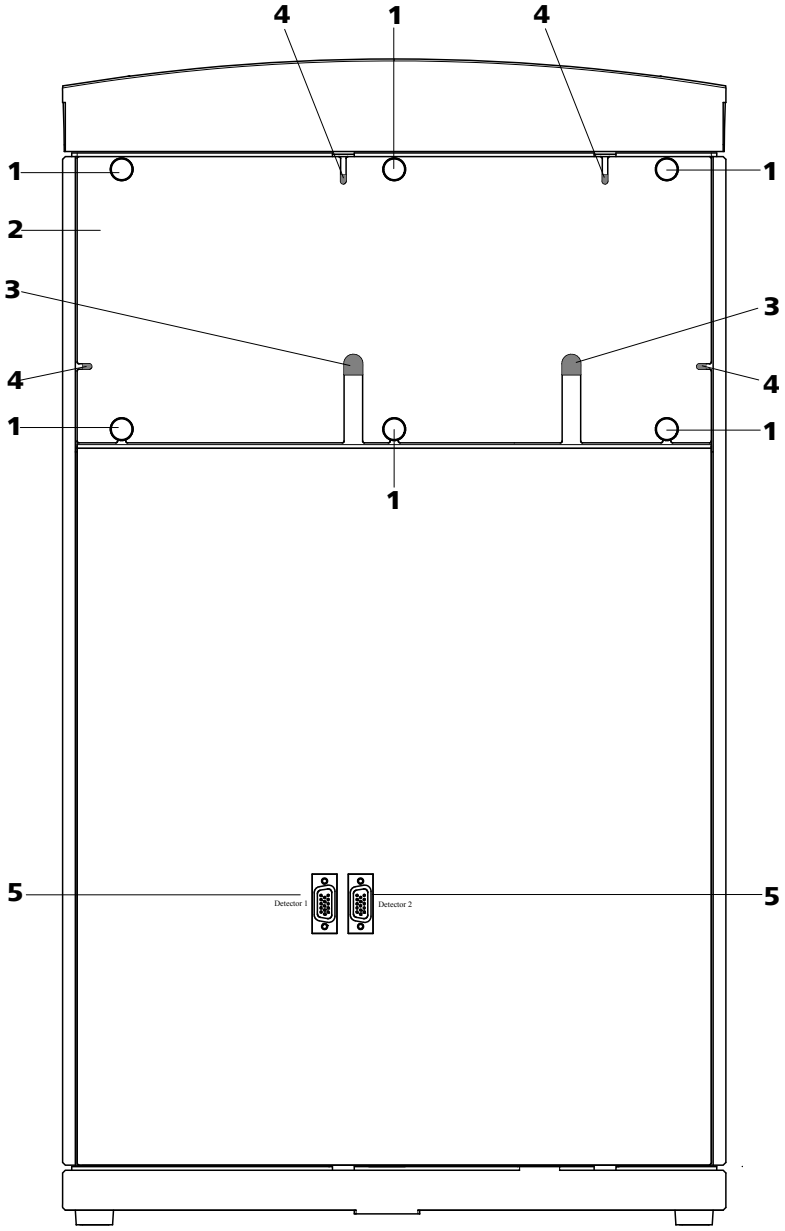


Figure 7 Removable rear panel

1 **Knurled screws** For fastening the removable rear panel.	**2** **Rear panel** Removable
3 **Cable feed-throughs** For feeding through detector cables.	**4** **Capillary feed-throughs**
5 **Detector connection sockets** Labeled with *Detector 1* and *Detector 2* for connecting Metrohm detectors.	

Note

Up to two detectors can be positioned and connected.

Caution

The instrument **must** be turned off when connecting a detector.

1 Removing rear panel

- Unscrew knurled screws *(7-**1**)* on the rear panel.
- Remove handle if still fastened to the instrument.
- Remove rear panel *(7-**2**)*.

2 Positioning the detector

- Put the detector through this opening and position it on the support surface intended for this purpose. Slide it right up to the front.

3 Replacing rear panel

- Insert the detector cable in a cable feed-through *(7-**3**)* on the rear panel *(7-**2**)*.
- Place the detector output capillary in a suitable capillary feed-through.
- Replace *(7-**2**)* rear panel.
  (Optionally, the handle can be remounted higher up and used as a holder for MPaks.)
- Tighten *(7-**1**)* knurled screws.

4 Connecting the detector

Note

The instrument has two detector connection sockets *(7-**5**)*, *Detector 1* and *Detector 2*. You must ensure that the selected connector corresponds to the connector entered in the MagIC Net method.

Recommendation: Use *Detector 1* as standard. In the AnCat system with 2 detectors: *Detector 1* for anions, *Detector 2* for cations.

- Connect the detector cable to the detector connection socket *Detector 1 (7-**5**)*.

5 **Conntecting detector output**

Note

The detector output capillary must be free of blockages (the measuring cell is tested to 5 MPa = 50 bar backpressure).

Guide the detector output capillary into a sufficiently large waste container and fasten it there.

3.6.3 Transport locking screws

To avoid damage to the high pressure pump and vacuum pump during transport, the pumps are secured with transport locking screws *(2-**17**) (2-**15**)(2-**20**)*.

Remove these transport locking screws before the initial start-up.

Removing transport locking screws

1 Remove and keep transport locking screws.

Warning

In order to avoid damage to the pumps, the transport locking screws must be remounted each time the instrument undergoes major transport.

3.6.4 Leak sensor

The leak sensor detects escaping liquid which collects in the base tray of the instrument.

To activate the leak sensor, the leak sensor connector plug *(8-**2**)* must be connected, the instrument switched on and the leak sensor switched to **active** in the software.

Connecting the leak sensor

1 Plug the leak sensor connector plug *(8-**2**)* into the leak sensor connector socket *(8-**1**)* on the rear of the instrument *(see Figure 8, page 27)*.

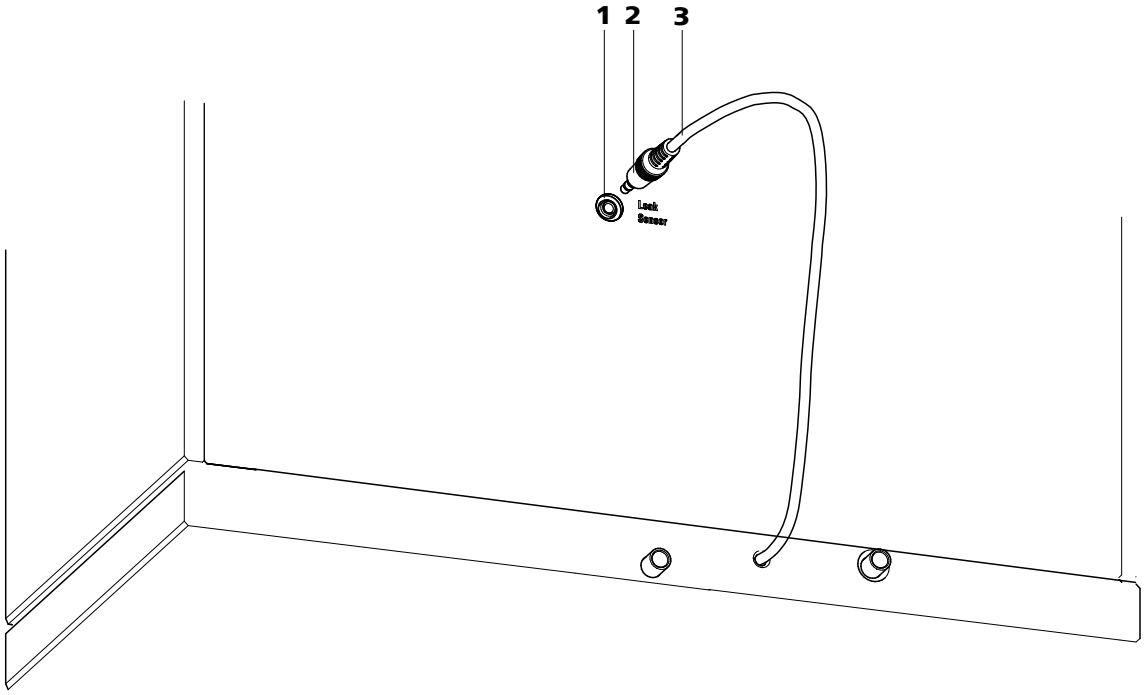


Figure 8 Connection for the leak sensor on the rear of the instrument

1 **Leak sensor connector socket** Is labeled with "Leak Sensor".	**2** **Leak sensor connector plug**
3 **Leak sensor connection cable** Is firmly mounted on the rear of the instrument.	

3.6.5 Drainage tubing

Fluid that escapes in the covering plate or in the detector chamber flows through the drainage tubing into the base tray and past the leak sensor into the waste container. This ensures that any leaks in the system will be detected by the leak sensor.

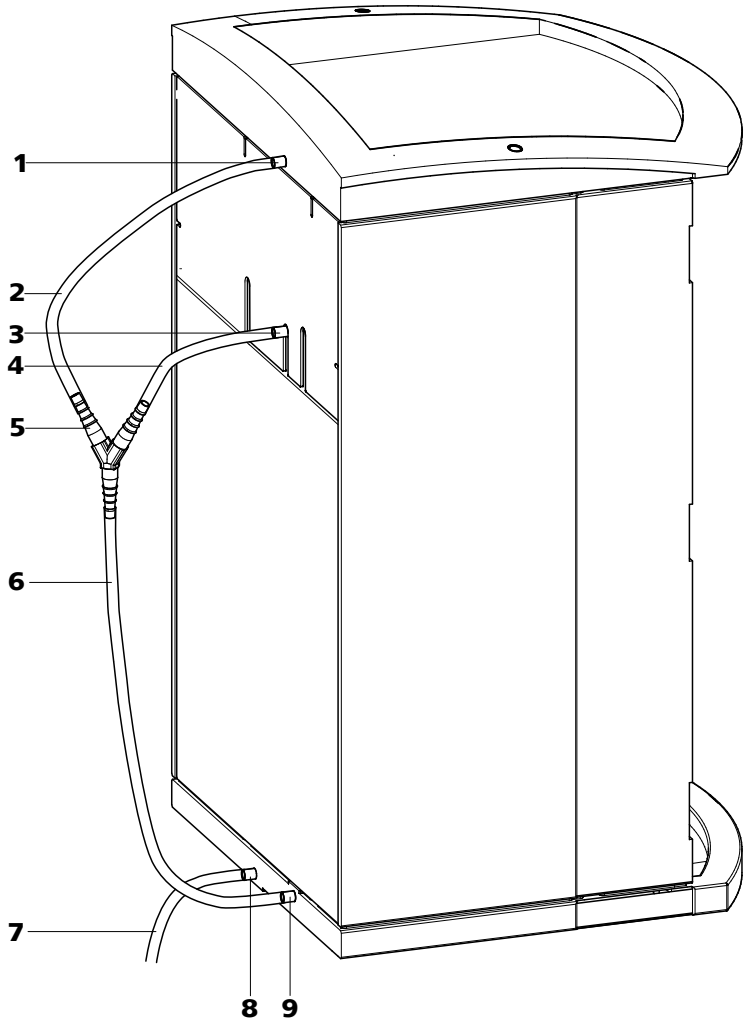


Figure 9 Drainage tubing

1	**Drainage tubing connection** For draining escaped fluid from the covering plate.	**2**	**Drainage tubing** Section of the 6.1816.020 silicon tubing. For draining escaped fluid from the covering plate.
3	**Drainage tubing connection** For draining escaped fluid from the detector chamber.	**4**	**Drainage tubing** Section of the 6.1816.020 silicon tubing. For draining escaped fluid from the detector chamber.
5	**Y connector 6.1807.010** For connecting the two drainage tubings *(9-**2**)* and *(9-**4**)*.	**6**	**Drainage tubing** Section of the 6.1816.020 silicon tubing. Guides escaped fluid to the leak sensor.

7	**Drainage tubing** Section of the 6.1816.020 silicon tubing. Guides escaped fluid into a waste container.
8	**Drainage tubing connection** For draining escaped fluid from the base tray through the connected drainage tubing.
9	**Drainage tubing connection** For supplying escaped fluid through the connected drainage tubing to the leak sensor.

Proceed as follows to install the drainage tubing:

Installing drainage tubing

1. Plug drainage tubing *(9-**2**)* into the drainage tubing connection *(9-**1**)* of the covering plate and shorten to required length.
2. Plug drainage tubing *(9-**4**)* into the drainage tubing connection *(9-**3**)* of the detector chamber and shorten to required length.
3. Connect drainage tubing *(9-**2**)* from the covering plate and drainage tubing *(9-**4**)* from the detector chamber to the Y connector *(9-**5**)*.
4. Connect drainage tubing *(9-**6**)* to the Y connector *(9-**5**)*, shorten to required length and plug the other end of the drainage tubing into the drainage tubing connection *(9-**9**)*.
5. Plug drainage tubing *(9-**7**)* into the drainage tubing connection *(9-**8**)* of the base tray and guide the other end into a waste container.

3.7 Capillary and cable feed-throughs

Several openings have been integrated for feeding through capillaries and cables. They are located on the doors *(see Figure 10, page 30)*, on the rear panel *(see Figure 7, Page 24)* or below the covering plate or above the base tray *(see Figure 11, Page 31)*.

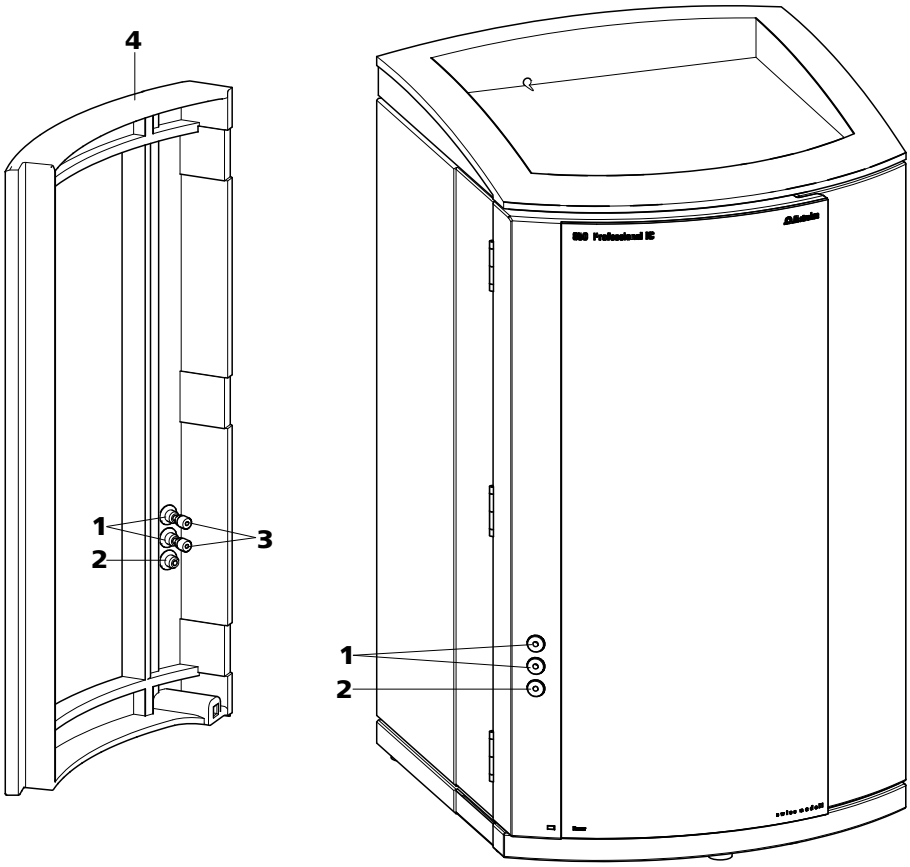


Figure 10 Capillary feed-throughs on the doors

1	**Luer connectors** For connecting a 6.2816.020 syringe. For manual sample feeding.	**2**	**Capillary feed-through**
3	**PEEK pressure screws, short 6.2744.070**	**4**	**Door**

Do not feed capillaries through the Luer connectors *(10-**1**)*. The capillaries are fastened with PEEK pressure screws *(10-**3**)* from inside to the Luer connector. From outside, liquid can be aspirated or injected with a syringe.

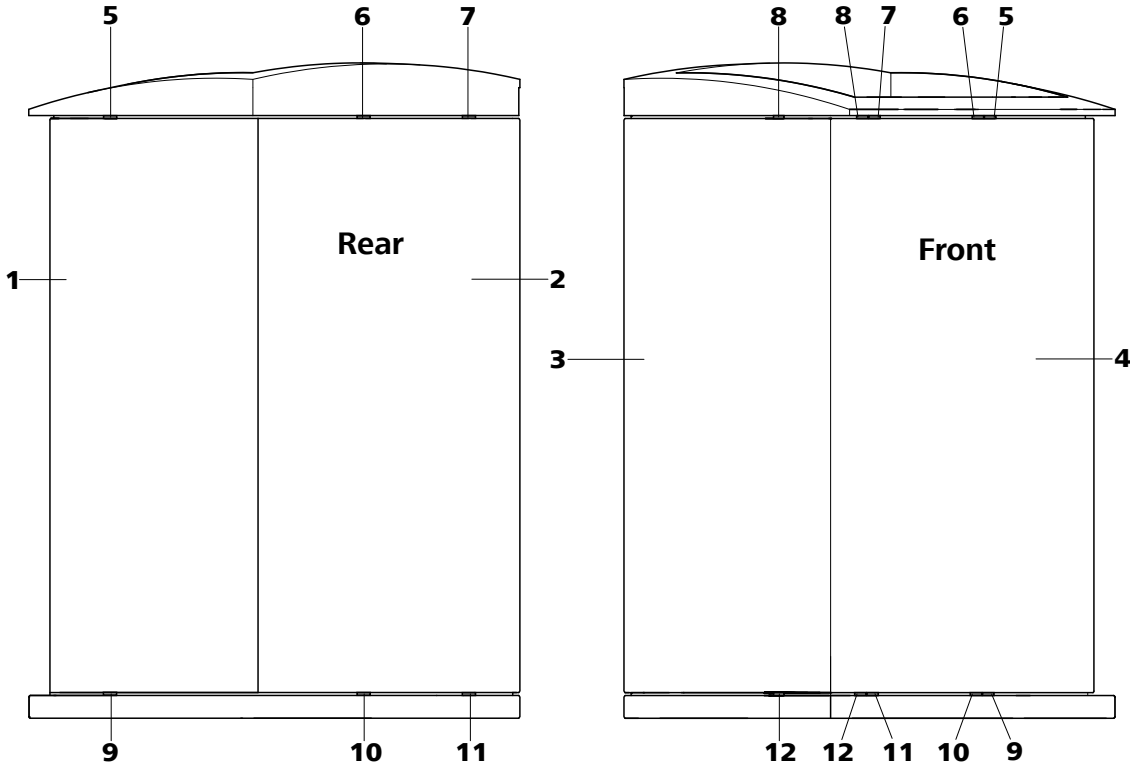


Figure 11 Capillary feed-throughs base tray/covering plate

1	**Side panel (right)** Right panel.	**2**	**Rear of the instrument**
3	**Side panel (left)** Left panel.	**4**	**Front of the instrument**
5	**Capillary feed-through** Upper. From front to right.	**6**	**Capillary feed-through** Upper. From front to back.
7	**Capillary feed-through** Upper. From front to back.	**8**	**Capillary feed-through** Upper. From front to left.
9	**Capillary feed-through** Lower. From front to right.	**10**	**Capillary feed-through** Lower. From front to back.
11	**Capillary feed-through** Lower. From front to back.	**12**	**Capillary feed-through** Lower. From front to left.

3.8 Eluent

3.8.1 Connecting eluent bottle

The eluent is aspirated out of the eluent bottle via the eluent aspiration tubing *(12-**1**)*.

The eluent aspiration tubing is connected to the eluent degasser *(see Chapter 3.9, page 36)*. The tubing must be threaded through a suitable capillary feed-through *(see Chapter 3.7, page 29)* of the instrument before the other end can be equipped.

You will require the parts from the following accessories for equipping the eluent aspiration tubing:

- 6.1602.160 eluent bottle attachment GL 45
- 6.2744.210 tubing adapter for aspiration filter
- 6.2821.090 aspiration filter

To equip the eluent aspiration tubing proceed as follows:

Assembling eluent aspiration tubing

1 Guide the free end of the eluent aspiration tubing *(12-**1**)* out of the instrument through a suitable capillary feed-through.

2 **Installing the 6.1602.160 eluent bottle attachment**

- Slide tubing nipple *(12-**2**)* and O-ring *(12-**3**)* onto the eluent aspiration tubing *(12-**1**)*.
- Push eluent aspiration tubing *(12-**1**)* through the bottle attachment *(12-**4**)* and screw tight.

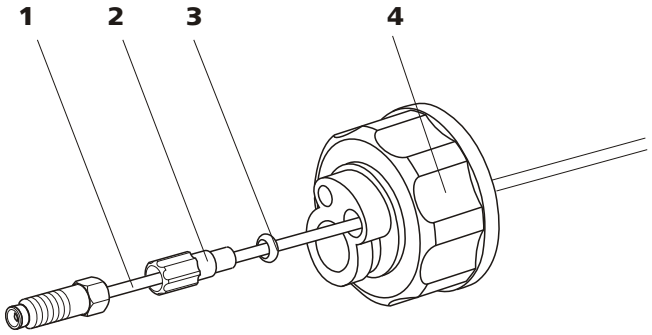


Figure 12 Installing eluent bottle attachment

1 Eluent aspiration tubing 6.1834.080	**2 Tubing nipple** From accessory set 6.1602.160.
3 O-ring From accessory set 6.1602.160.	**4 Bottle attachment** From accessory set 6.1602.160.

3 Mounting aspiration filter

- Insert filter holder *(13-**1**)* into the aspiration filter *(13-**2**)* and screw tight.

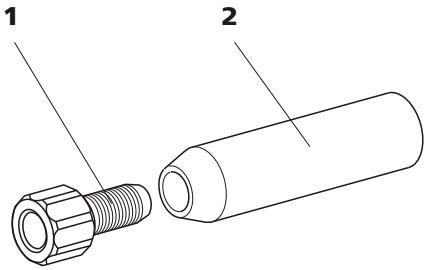


Figure 13 Mounting aspiration filter

1 Filter holder From accessory set 6.2744.210.	**2 Aspiration filter 6.2821.090**

4 Installing tubing weighting and aspiration filter

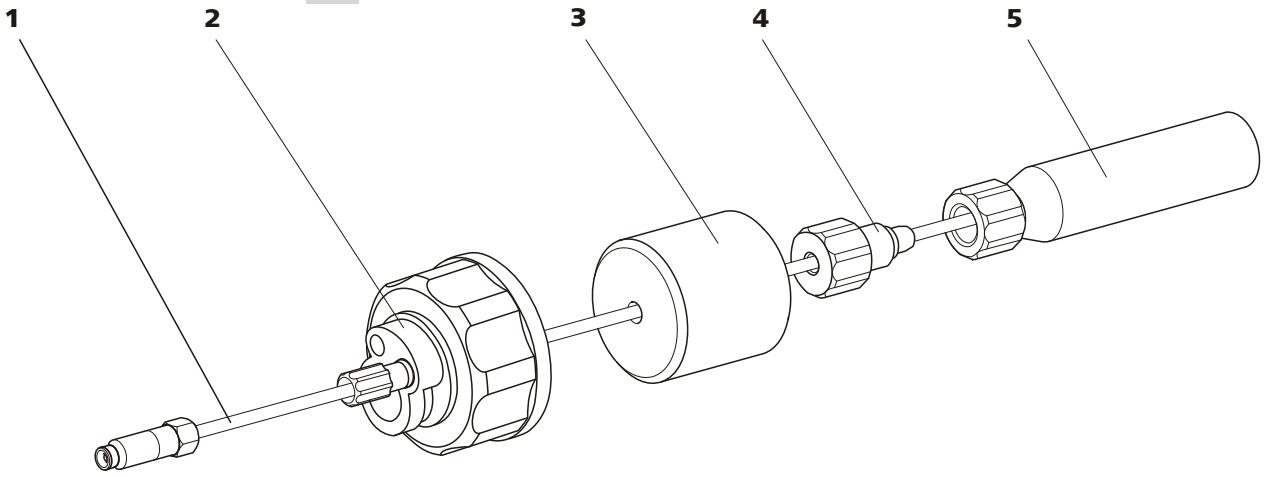


Figure 14 Installing tubing weighting and aspiration filter

1 **Eluent aspiration tubing 6.1834.080**	**2** **Eluent bottle attachment 6.1602.160**
3 **Tubing weighting** From accessory set 6.2744.210.	**4** **Clamping screw** From accessory set 6.2744.210.
5 **Aspiration filter 6.2821.090** With filter holder from accessory set 6.2744.210.	

- Slide the tubing weighting *(14-**3**)* onto the eluent aspiration tubing *(14-**1**)*.
- Slide the clamping screw *(14-**4**)* onto the eluent aspiration tubing *(14-**1**)*.
- Insert eluent aspiration tubing *(14-**1**)* into the aspiration filter *(14-**5**)*. The end of the tubing must touch the base of the filter.
- Screw together clamping screw *(14-**4**)* and filter holder *(13-**1**)*. The end of the tubing must still touch the base of the filter.

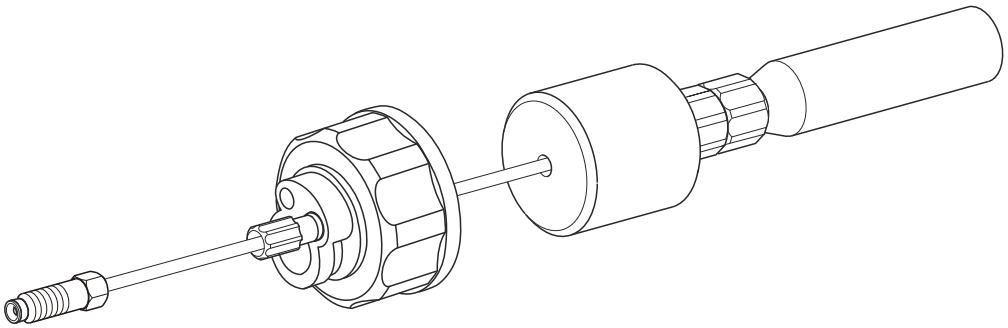


Figure 15 Eluent aspiration tubing fully equipped.

5 Mounting eluent aspiration tubing to the eluent bottle

- Insert the eluent aspiration tubing into the eluent bottle *(16-**10**)*.

- Fasten the bottle attachment *(14-**2**)* on the eluent bottle *(16-**10**)*. The aspiration filter *(16-**6**)* must rest on the base of the eluent bottle.

6 Mounting the adsorber tube

Note

In the case of alkaline eluents and eluents with lower buffer capacity, the eluent bottle must be equipped with a CO_2 adsorber *(16-**4**)*.

- First, place a piece of wadding *(16-**3**)*, then the CO_2 adsorber *(16-**4**)* in the large opening of the adsorber tube *(16-**2**)* and close with the plastic cover.
- Fasten the adsorber tube *(16-**2**)* using the SGJ clip *(16-**12**)* onto the bottle attachment *(16-**11**)*.

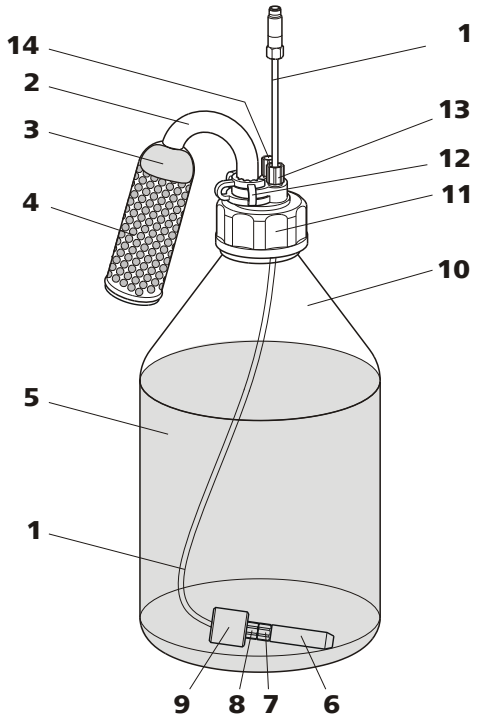


Figure 16 Eluent bottle – connected

1 Eluent aspiration tubing 6.1834.080 For aspirating the eluent. Pre-installed.	**2 Adsorber tube 6.1609.000**
3 Wadding	**4 CO_2 adsorber** Adsorbs CO_2 from the air (e.g. Merck soda lime with indicator, no. 6839.10).

5	**Eluent**
6	**Aspiration filter 6.2821.090**
7	**Filter holder** From accessory set 6.2744.210.
8	**Clamping screw** From accessory set 6.2744.210.
9	**Tubing weighting** From accessory set 6.2744.210.
10	**Eluent bottle 6.1608.070**
11	**Bottle attachment 6.1602.160**
12	**SGJ clip 6.2023.020**
13	**Tubing nipple**
14	**Thread stopper**

3.9 Eluent degasser

Gas bubbles in the eluent lead to an unstable baseline, as high pressure pumps can transport liquids, but not gases. The eluent therefore has to be degassed, before it reaches the high pressure pump.

The eluent degasser removes gas bubbles and dissolved gases from the eluent. For degassing, the eluent flows into a vacuum chamber through a special fluoropolymer capillary.

Note

The eluent degasser is already installed in the newly delivered instrument. The following installation instructions need **not** be carried out at the time of initial installation.

Connecting the eluent degasser

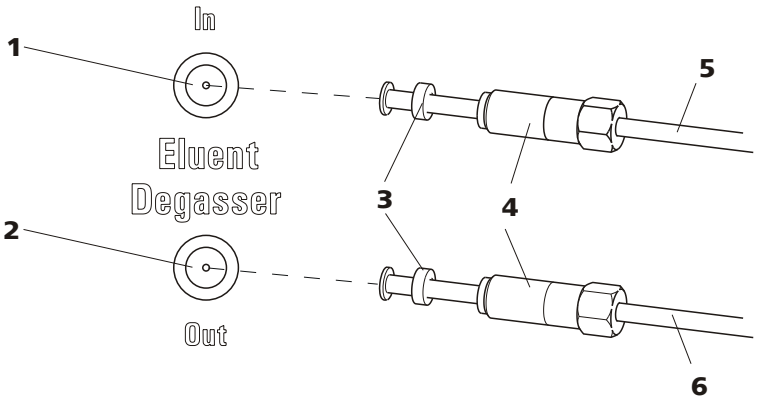


Figure 17 Eluent degasser

1	**Eluent degasser input**
2	**Eluent degasser output**

3	**Tubing flare** With tubing nipple.
4	**Clamping screw**
5	**Eluent aspiration tubing 6.1834.080** For aspirating the eluent. The clamping screw *(17-**4**)* is firmly mounted.
6	**Connection capillary 6.1834.090** Connection from the eluent degasser to the high pressure pump *(see Chapter 3.10, page 37)*. The clamping screw *(17-**4**)* is firmly mounted.

1

Caution

The clamping screws *(17-**4**)* must be tightened carefully. Use the 6.2621.050 wrench for this.

- Insert the eluent aspiration tubing *(17-**5**)* in the eluent degasser input *(17-**1**)*.
- Carefully tighten clamping screw *(17-**4**)*.

2

- Insert connection capillary *(17-**6**)* (the end with the longer clamping screw *(17-**4**)*) into the eluent degasser output *(17-**2**)*.
- Carefully tighten clamping screw *(17-**4**)*.
- Connect the other end of the connection capillary *(17-**6**)* (with the shorter clamping screw) to the high pressure pump *(see "Connecting inlet to the high pressure pump", page 39)*.

3.10 High pressure pump

The intelligent and low pulsation high pressure pump pumps the eluent through the system. It is equipped with a chip on which its technical specifications and "life history" (operating hours, service data, ...) are saved.

The purge valve is used for deaerating *(see Chapter 3.10.2, page 40)* the high pressure pump.

3.10.1 Capillary connections high pressure pump/purge valve

Note

All of the capillary connections of the high pressure pump and the purge valve are already installed in the newly delivered instrument.

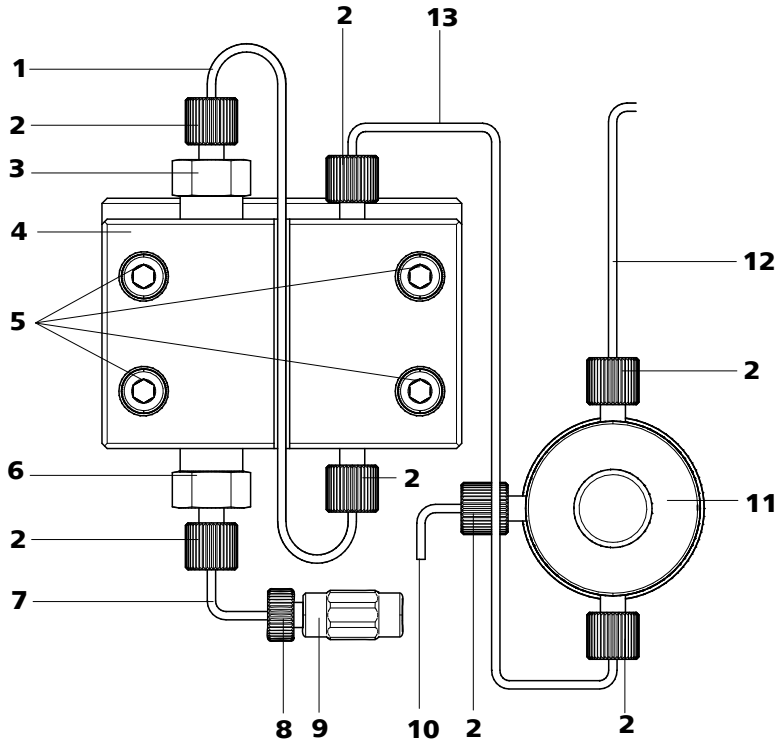


Figure 18 Capillary connections high pressure pump/purge valve

1 **Connection capillary** PEEK capillary, connects main piston and auxiliary piston.	**2** **PEEK pressure screw, short 6.2744.070**
3 **Outlet valve holder**	**4** **Pump head 6.2824.110**
5 **Fastening screws** For fastening the pump head.	**6** **Inlet valve holder**
7 **Pump head input capillary** PEEK capillary at the input of the pump head.	**8** **Pressure screw** For connecting a PEEK capillary to the coupling *(18-**8**)*.
9 **Coupling** For the connection of the eluent path at the input of the high pressure pump. Can be ordered together with the pressure screw *(18-**8**)* under the number 6.2744.230.	**10** **Deaerating capillary** For aspirating the eluent when deaerating the high pressure pump *(see Chapter 3.10.2, page 40)*.
11 **Purge valve** For deaerating the high pressure pump. With rotary knob in the center and pressure sensor.	**12** **Connection capillary** For connecting the inline filter *(see Chapter 3.11, page 42)*
13 **Connection capillary** Connects the output of the pump head with the purge valve.	

Note

The eluent aspiration tubing is already installed in the newly delivered instrument. The following installation instructions need **not** be carried out at the time of initial installation.

Connecting inlet to the high pressure pump

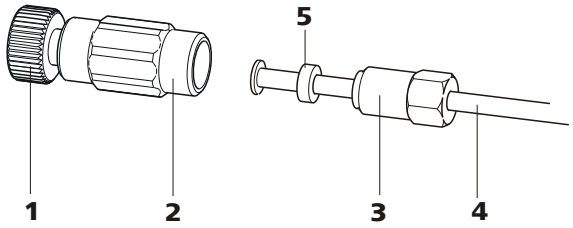


Figure 19 High pressure pump – Connect inlet

1 Pressure screw
For connecting the coupling *(19-**2**)* to the pump head input capillary *(18-**7**)*.
Can be ordered together with the coupling under the number 6.2744.230.

2 Coupling 6.2744.230
For connecting the eluent aspiration tubing *(19-**4**)* to the input of the high pressure pump.

3 Clamping screw

4 Eluent aspiration tubing
Eluent aspiration tubing 6.1834.080 or 6.1834.090.

5 Backup ring

1 Connecting coupling

Fasten the coupling *(19-**2**)* with a pressure screw *(19-**1**)* on the pump head input capillary *(18-**7**)*.

2 Connecting eluent aspiration tubing

Caution

The clamping screws must be tightened carefully. To tighten, grip the coupling *(19-**2**)* with the 6.2739.000 key and grip the clamping screw *(19-**3**)* with the 6.2621.050 wrench.

- Plug the eluent aspiration tubing *(19-**4**)* into the coupling *(19-**2**)*.
- Tighten clamping screw *(19-**3**)*.

3.10.2 Deaerating the high pressure pump

The high pressure pump will only operate perfectly if the pump head contains no more air bubbles. Therefore it must be deaerated during initial start-up and after every change of eluent.

Caution

The high pressure pump must **not** be deaerated before the initial start-up *(see Chapter 4.1, page 71)*.

Deaerate the high pressure pump as follows *(see Figure 20, page 41)*:

Deaerating the high pressure pump

The instrument must be connected to the PC and switched on to deaerate the high pressure pump.

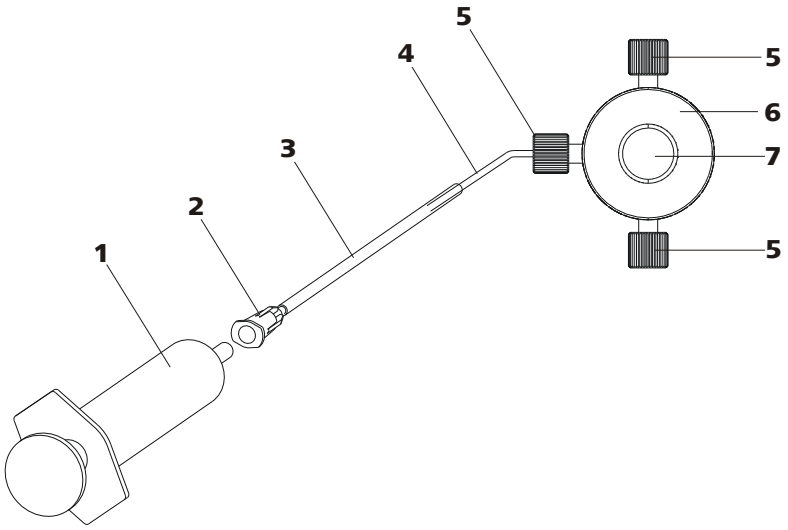


Figure 20 Deaerating the high pressure pump

1 **Syringe 10 mL 6.2816.020** For aspirating the eluent.	**2** **Luer connector** On purging needle.
3 **Purging needle 6.2816.040**	**4** **Deaerating capillary**
5 **PEEK pressure screws, short 6.2744.070**	**6** **Purge valve**
7 **Purge valve rotary knob**	

1 Connecting the purging needle

- Push the end of the purging needle *(20-**3**)* over the end of the deaerating capillary *(20-**4**)* on the purge valve.

2 Connecting the syringe

- Insert syringe *(20-**1**)* in the Luer connector *(20-**2**)* of the purging needle *(see Figure 20, page 41)*.

3 Opening purge valve

- Open the rotary knob *(20-**7**)* by approx. ½ rotation counterclockwise.

4 Setting the flow rate

- Start MagIC Net (if not yet started).
- Ensure that the eluent aspiration tubing is immersed sufficiently in the eluent.
- Let the high pressure pump run.

5 Aspirating eluent

- Aspirate with the syringe *(20-**1**)* until bubble-free eluent flows into the syringe.

6 Completing deaerating

- Turn off high pressure pump.
- Close rotary knob *(20-**7**)*.
- Remove syringe *(20-**1**)* from the Luer connector *(20-**2**)*.
- Pull the purging needle *(20-**3**)* out of the deaerating capillary *(20-**4**)*.

3.11 Inline filter

Between the purge valve and the pulsation damper the 6.2821.120 inline filter is installed as protection against particles.

Inline filters protect the separation column securely against possible contamination from the eluent. Inline filters can however also just as well be used for the purpose of protecting the suppressor against contaminations in the regeneration or rinsing solutions. The fine 2 µm material of the readily and easily replaceable filter platelets removes particles such as bacteria and algae from the solutions.

Note

The inline filter is already installed in the newly delivered instrument. The following installation instructions need **not** be carried out at the time of initial installation.

Installing the inline filter

Caution

Observe the flow direction marked on the filter housing for the connection of the inline filter.

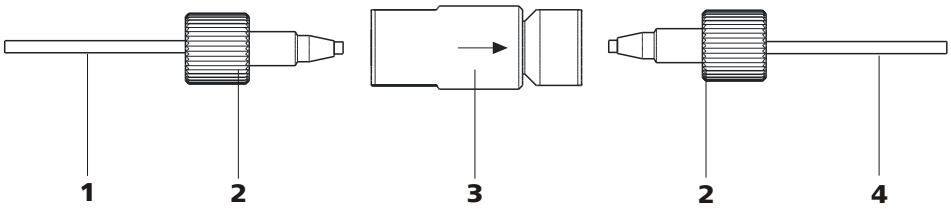


Figure 21 Connecting inline filter

1 **Connection capillary** Connects the purge valve with the inline filter	**2** **PEEK pressure screws, short 6.2744.070**
3 **Inline filter 6.2821.120** Protects against particles.	**4** **Connection capillary** Connects the inline filter with the pulsation damper.

1 Screw on the connection capillary running from the purge valve with a 6.2744.070 pressure screw to the input side of the inline filters.

2 Screw on the connection capillary running to the pulsation damper with a 6.2744.070 pressure screw to the output side of the inline filter.

3.12 Pulsation damper

Note

The pulsation damper is already installed in the newly delivered instrument.

Caution

The pulsation damper is maintenance-free and may not be opened.

The pulsation damper protects the separation column from damage caused by pressure fluctuations when switching the injection valve, and reduces interfering pulsations during highly sensitive measurements. In order to ensure these functionalities, it must be connected between the high pressure pump *(see Chapter 3.10, page 37)* and injection valve *(see Chapter 3.14, page 46)*.

The pulsation damper can be operated in both directions.

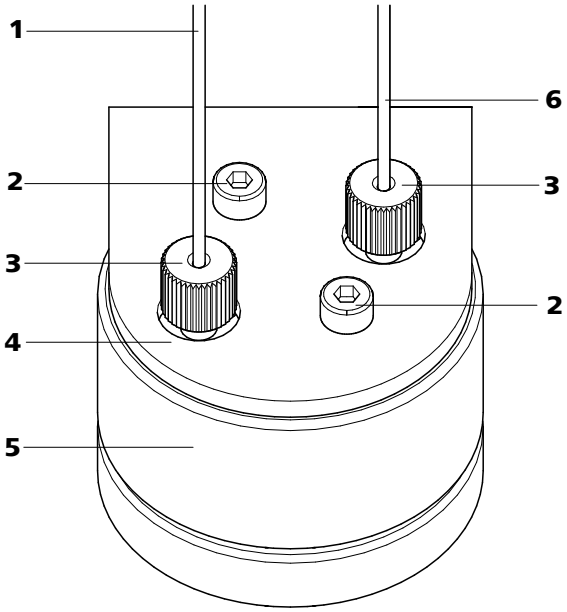


Figure 22 Pulsation damper – Connection

1	**Connection capillary** Connection to the inline filter.	**2**	**Fastening screws**
3	**PEEK pressure screws, short 6.2744.070**	**4**	**Holder for pulsation damper**
5	**Pulsation damper 6.2620.150**	**6**	**Connection capillary** Connection to the injection valve.

3.13 Sample degasser

The sample degasser removes gas bubbles and disolved gases from the sample. For degassing, the sample flows into a vacuum chamber through a special fluoropolymer capillary.

Gas bubbles in the sample lead to poor reproducibility, as the quantity of sample in the sample loop would not always be the same. Samples (containing gas) should therefore be degassed before injection. For this the sample is sucked through a degasser chamber before injection, whereby any gas bubbles are automatically removed.

Note

When using the sample degasser, the rinsing time extends by at least 2 minutes.

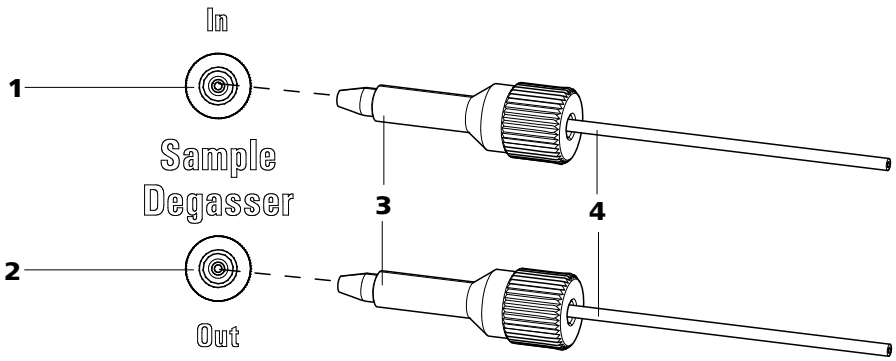


Figure 23 Sample degasser

1	**Sample degasser input**	**2**	**Sample degasser output**
3	**PEEK pressure screw, long 6.2744.090**	**4**	**Connection capillaries 6.1803.040**

Connecting the sample degasser

1 Remove and keep 6.2744.220 thread stoppers from the input and output of the sample degasser.

2 Connect the end of the 6.1803.040 sample aspirating capillary connected to the injection valve with a long PEEK pressure screw *(23-**3**)* to the output of the sample degasser *(23-**2**)*.

3 Connect 6.1803.040 connection capillary with a long PEEK pressure screw *(23-**3**)* to the input of the sample degasser *(23-**1**)*.

4 Guide the other end of the connection capillary out of the instrument through a capillary feed-through.

Caution

If the sample degasser is not used, the input and output **must** be sealed with the 6.2744.220 thread stoppers.

3.14 Injection valve

The injection valve connects the eluent and sample path. Through rapid and precise valve switchover a precise amount of sample solution defined by the size of the sample loop is injected and rinsed with eluent onto the separation column.

3.14.1 Connecting the injection valve

The injection valve has six connectors: two for the sample path (connectors 1 and 2), two for the eluent path (connectors 4 and 5) and two for the sample loop (connectors 3 and 6).

Note

The capillaries of the eluent path and the sample path and the sample loop are already installed in the newly delivered instrument.

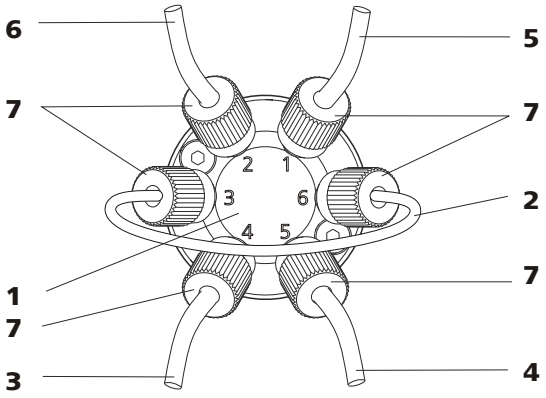


Figure 24 Injection valve – connected

1 Injection valve	**2 Sample loop** Connected to connectors 3 and 6.

3	**Connection capillary** Connected to connector 4. Carries eluent to the injection valve.
4	**Connection capillary (column inlet capillary)** Connected to connector 5. Carries eluent to the separation column.
5	**Connection capillary** Connected to connector 1. Carries sample to the injection valve.
6	**Connection capillary** Connected to connector 2. Carries sample to the waste container.
7	**PEEK pressure screw 6.2744.010**

Replacing the sample loop

The sample loop can be replaced, depending on requirements. For additional information concerning selection of the appropriate sample loop, *see Chapter 3.14.3, page 48*.

Note

Use only 6.2744.010 PEEK pressure screws for connecting capillaries and sample loop to the injection valve.

1 Removing existing sample loop

- Loosen 6.2744.010 pressure screws at connector 3 and connector 6.
- Remove sample loop.

2 Mounting new sample loop

- Fasten one end of the sample loop *(24-**2**)* with a 6.2744.010 PEEK pressure screw *(24-**7**)* to connector 3.
- Fasten the other end of the sample loop *(24-**2**)* with a second 6.2744.010 PEEK pressure screw *(24-**7**)* to connector 6.

3.14.2 Mode of operation of the injection valve

The injection valve *(see Figure 25, page 48)* can adopt two valve positions - **FILL** and **INJECT**. Switching back and forth between the two valve positions determines whether the sample path or the eluent path is guided through the sample loop. The following figure provides a schematic display of the flow paths of the two valve positions.

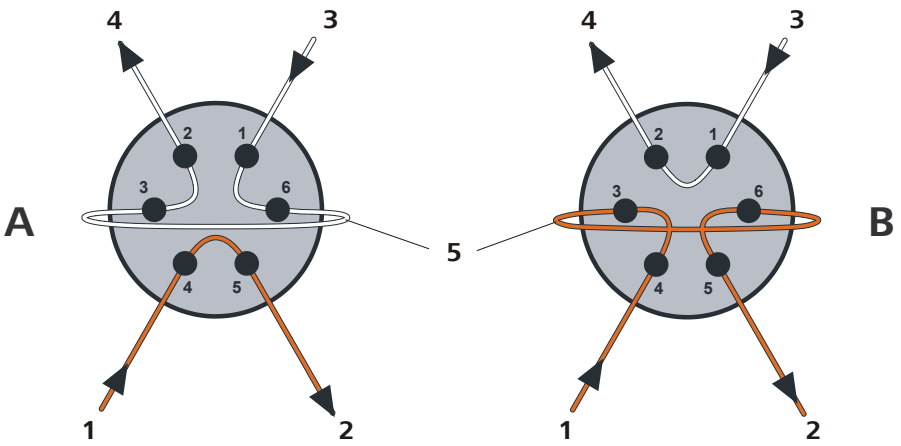


Figure 25 Injection valve – Positions

A	**Position FILL**	**B**	**Position INJECT**
1	**Eluent input** Capillary coming from the high pressure pump.	**2**	**Eluent output** Capillary to the column.
3	**Sample input** Sample aspirating capillary.	**4**	**Sample output** Capillary to waste container.
5	**Sample loop**		

Position A

In the position **FILL**, the sample solution flows through the sample loop to the waste container. The eluent flows directly to the separation column at the same time.

Position B

In the position **INJECT**, the eluent flows through the sample loop to the separation column. If sample solution is to be found in the sample loop at the time of the valve switchover, then this will be conveyed along with the eluent, thus making its way to the separation column. The flow in the sample path is either stopped or the sample flows directly to the waste container.

3.14.3 Selecting the sample loop

The amount of sample solution injected depends on the volume of the sample loop. The choice is made on the basis of the application. The following sample loops are normally used:

Cation determination	10 µL
Anion determination with suppression	20 µL
Anion determination without suppression	100 µL

3.15 Column thermostat

The column thermostat controls the temperature of the column and eluent channel and thus ensures stable measuring conditions. It provides space for 2 separation columns.

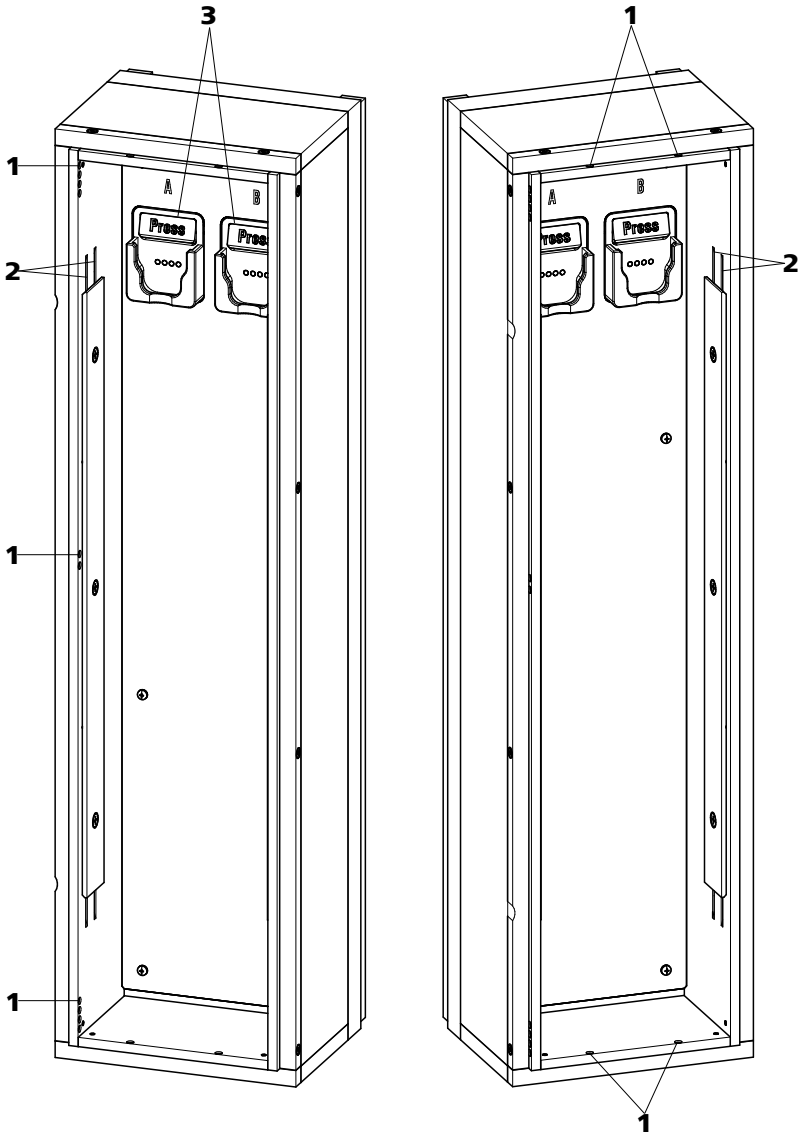


Figure 26 Column thermostat

1	**Capillary feed-throughs** For guiding the capillaries in and out.
2	**Capillary recesses** For controlling the temperature of the eluent. Preheating capillary already pre-installed.
3	**Column holder** For fastening the columns. With column recognition.

The column thermostat contains two column holders *(26-**3**)* equipped with chip recognition. The separation columns can be clicked into the column holder with the chip.

Note

The column input capillary is already threaded into the capillary recesses of the column thermostat at the time the instrument is first delivered. The following installation instructions need **not** be carried out at the time of initial installation.

Threading capillaries

1 Introduce column input capillary into the column thermostat via a suitable capillary feed-through *(26-**1**)*.

2 Slide the column input capillary from below into the outer of the two capillary recesses *(26-**2**)*. Slide it through under the holder plate until it emerges again at the top.

3 Carefully bend the column input capillary downward and slide from from above to below through the inner capillary recess until it emerges at the lower edge of the holder plate.

4 **Note**

The columns (guard column and separation column) may only be installed after the initial start-up *(see Chapter 4.1, page 71)*.

- **Before initial start-up**:
  Fasten the 6.2744.040 coupling with a 6.2744.010 pressure screw to the end of the column input capillary.
- **After initial start-up**:
  Fasten the guard column (if used) or the separation column with a 6.2744.010 pressure screw to the end of the column input capillary.

3.16 High Capacity Metrohm Suppressor Module (MSM-HC)

3.16.1 General information on the MSM-HC

The MSM-HC is used for chemical suppression during anion analysis if eluents with a high ionic concentration are used or if the concentration is being significantly increased in the course of a gradient application. It consists of 3 suppressor units in total, which are used for suppression, regenerated with sulfuric acid or rinsed with ultra pure water in rotation.

Suppression reaction in the MSM-HC

When using a carbonate eluent, the following reaction (amongst others) occurs in the MSM-HC:

$R\text{-}SO_3^-H^+ + NaHCO_3/Na_2CO_3 \rightarrow R\text{-}SO_3^-Na^+ + H_2O + CO_2$

3.16.2 Connecting the MSM-HC

Caution

To protect the MSM-HC against foreign particles or bacterial growth, a 6.2744.180 pump tubing connection with filter must be mounted between the peristaltic pump and the inlet capillaries of the MSM-HC.

The three inputs and outputs of the suppressor units numbered with 1, 2 and 3 on the MSM-HC each have 2 fixed mounted PTFE capillaries *(see Figure 27, page 53)*.

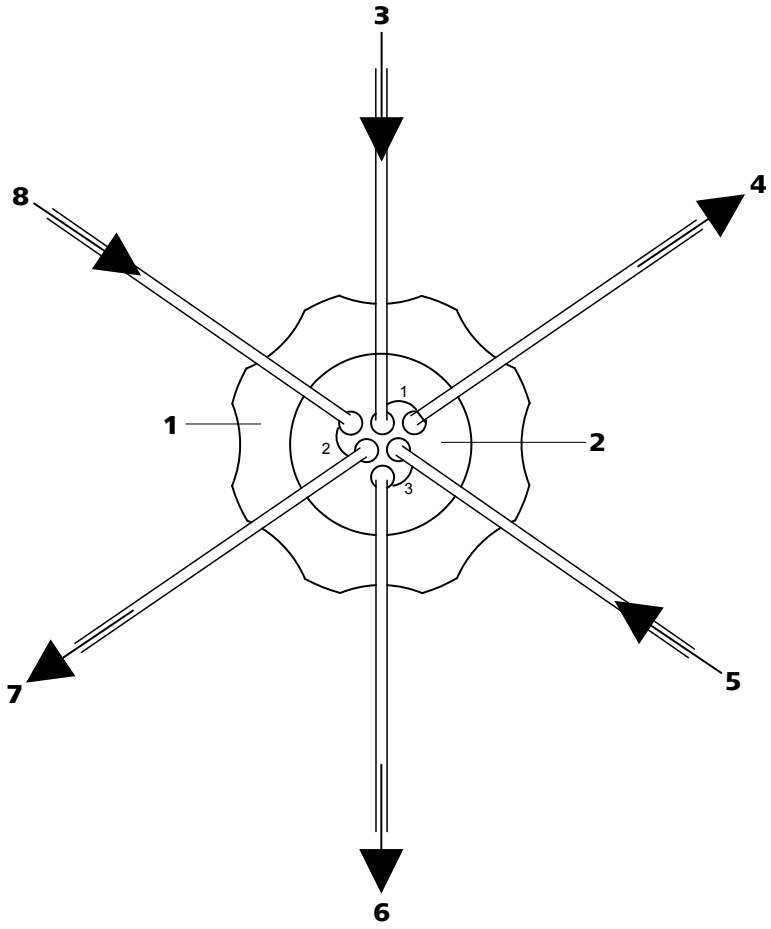


Figure 27 MSM-HC – Connectors

1	**Union nut**	**2**	**MSM-HC connecting piece 6.2835.010**
3	**Eluent inlet capillary** Labeled with *Eluent*.	**4**	**Eluent outlet capillary** Labeled with *Detector*.
5	**Rinsing solution inlet capillary** Labeled with *H2O*.	**6**	**Rinsing solution outlet capillary** Labeled with *Waste*.
7	**Regeneration solution outlet capillary** Labeled with *Waste*.	**8**	**Regeneration solution inlet capillary** Labeled with *H2SO4*.

The PTFE capillaries firmly mounted on the MSM-HC are connected to the other components of the IC system as follows:

Caution

As the PTFE capillaries are very soft, the pressure screws should not be overtightened.

Flattened capillaries can be shortened with the help of a capillary cutter.

Connecting the capillaries of the MSM-HC

1 Connecting the eluent inlet capillary

- Fasten the end of the inlet capillary labeled with *Eluent* with a 6.2744.070 short PEEK pressure screw to the output of the column.

2 Connecting the eluent outlet capillary

- Fasten the end of the outlet capillary labeled with *Detector* with a long PEEK pressure screw (6.2744.090) to the input of the MCS.
  OR
  Connect the end of the outlet capillary labeled with *Detector* and the detector inlet capillary with a 6.2744.040 coupling and two 6.2744.070 short pressure screws.

3 Connecting the rinsing solution inlet capillary

- Fasten the end of the inlet capillary labeled with *H20* with a 6.2744.070 short PEEK pressure screw to the pump tubing connection of the pump tubing which carries the rinsing solution.

4 Connecting the rinsing the solution outlet capillary

- Guide the other end of the outlet capillary labeled with *Waste* into a sufficiently large waste container and fasten it there.

5 Connecting the regeneration solution inlet capillary

- Fasten the end of the inlet capillary labeled with *H2S04* with a 6.2744.070 short PEEK pressure screw to the pump tubing connection of the pump tubing which carries the regeneration solution.

6 Connecting the regeneration solution outlet capillary

- Guide the other end of the outlet capillary labeled with *Waste* into a sufficiently large waste container and fasten it there.

The rinsing and regeneration solutions are pumped with a peristaltic pump *(see Chapter 3.17, page 55)*.

3.17 Peristaltic pump

3.17.1 Principle of the peristaltic pump

The Peristaltic pump is used for pumping sample and auxiliary solutions. It can rotate in both directions.

The peristaltic pump pumps liquids according to the principle of displacement. The pump tubing is clamped between the rollers *(28-**3**)* and the tubing cartridge *(28-**5**)*. During operation, the peristaltic pump drive rotates the roller hub *(28-**2**)*, so that the rollers *(28-**3**)* push the liquid forward in the pump tubing.

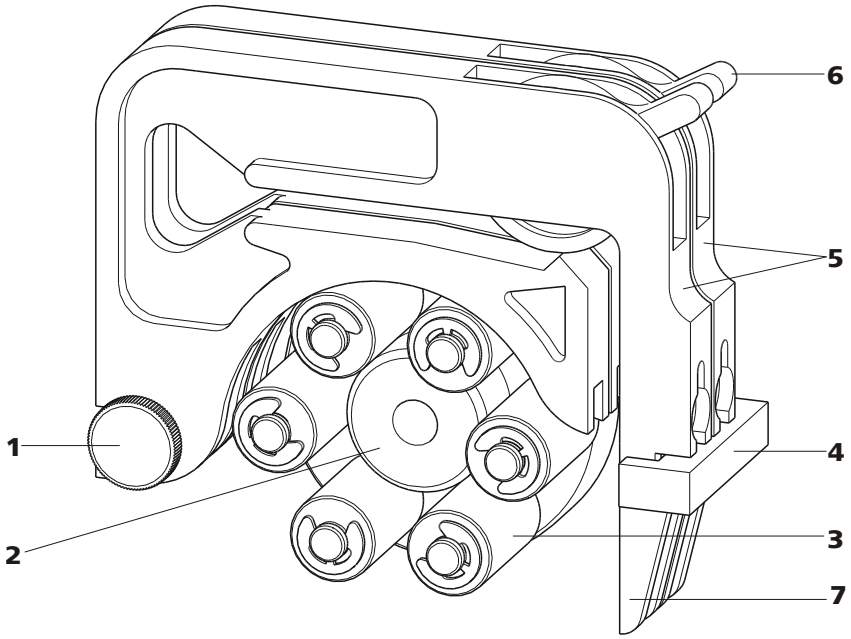


Figure 28 Peristaltic pump

1	**Knurled screw in the mounting pin**	**2**	**Roller hub**
3	**Rollers**	**4**	**Cartridge holder**
5	**Tubing cartridges 6.2755.000**	**6**	**Contact pressure lever**
7	**Snap-action lever**		

3.17.2 Installing the peristaltic pump

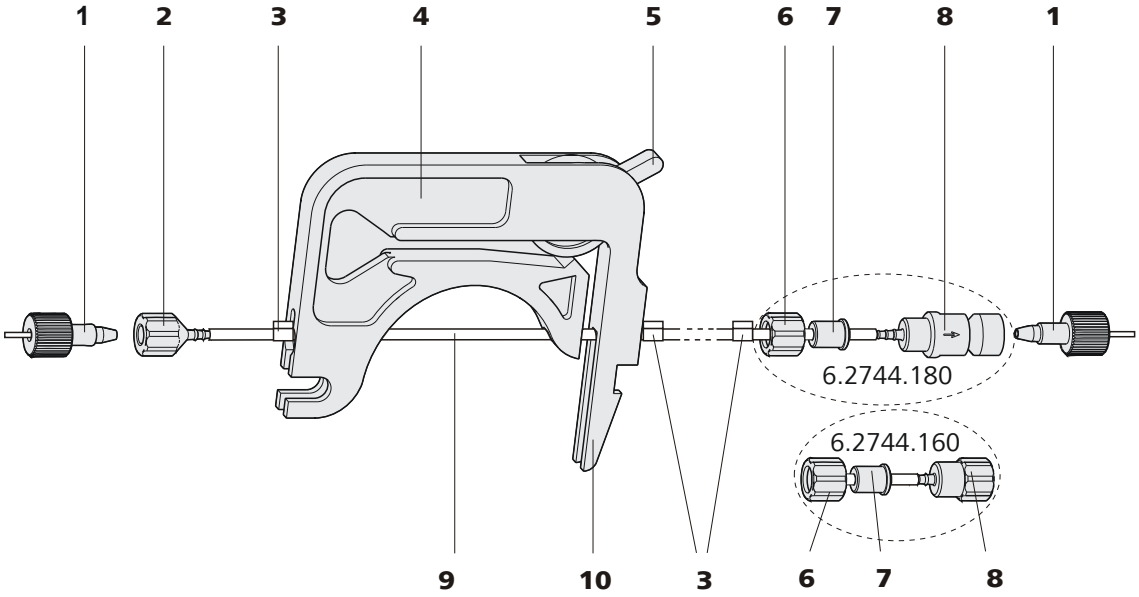


Figure 29 Installing the pump tubing

1	**PEEK pressure screws, short (6.2744.070)**	**2**	**Tubing olive (6.2744.034)**
3	**Stopper** The colors of the stopper indicate the inner diameter of the pump tubing.	**4**	**Tubing cartridge (6.2755.000)**
5	**Contact pressure lever**	**6**	**Union nut**
7	**Adapter**	**8**	**Tubing olive** Either with filter holder (6.2744.180) or without filter holder (6.2744.160).
9	**Pump tubing (6.1826.xx0)**	**10**	**Snap-action lever**

Mount the pump tubing as follows:

1 Removing the tubing cartridge

Release the tubing cartridge from the cartridge holder by pressing the snap-action lever and unhooking from the mounting pins *(28-**1**)*.

2 Connecting the aspiration side

Place a 6.2744.034 tubing olive *(29-**2**)* on the aspiration side of the pump tubing.

3 Connecting the pressure side

Note

Depending on the use of the peristaltic pump, on the pressure side you can either connect:

- **Case A:** a 6.2744.180 pump tubing connection **with filter** *(see Figure 30, page 57)* or
- **Case B:** a 6.2744.160 pump tubing connection **without filter** *(see Figure 31, page 58)*.

For pumping the auxiliary solutions to the MSM or to the SPM, a 6.2744.180 pump tubing connection **with** filter **must** be used.

Case A: 6.2744.180 pump tubing connection with filter:

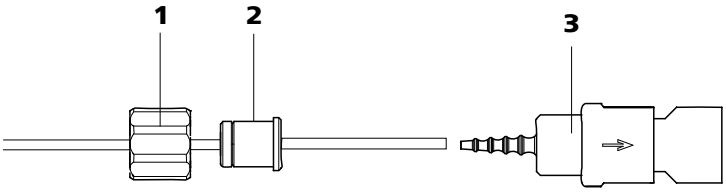


Figure 30 Install pump tubing connection with filter

1 Union nut	**2 Adapter**
3 Tubing olive with filter holder	

- Slide union nut *(30-**1**)* onto the pump tubing.
- Select a suitable adapter *(30-**2**)* and slide it onto the pump tubing. The type of adapter depends on the pump tubing *(see Table 1, page 58)*.
- Place the tubing olive with filter holder *(30-**3**)* onto the pump tubing.
- Screw the union nut *(30-**1**)* onto the tubing olive *(30-**3**)*.

or

Case B: 6.2744.160 pump tubing connection without filter:

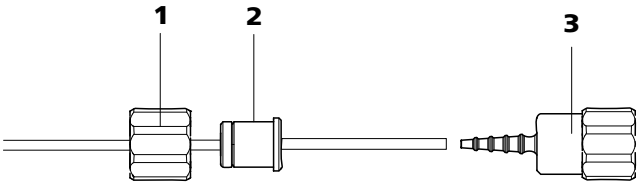


Figure 31 Install pump tubing connection without filter

1 Union nut	**2 Adapter**
3 Tubing olive	

- Slide union nut *(31-**1**)* onto the pump tubing.
- Select a suitable adapter *(31-**2**)* and slide it onto the pump tubing. The type of adapter depends on the pump tubing *(see Table 1, page 58)*.
- Place the tubing olive *(31-**3**)* onto the pump tubing.
- Screw the union nut *(31-**1**)* onto the tubing olive *(31-**3**)*.

4 Inserting the pump tubing

- Press the contact pressure lever all the way down.
- Place the pump tubing in the tubing cartridge. The stoppers *(29-**3**)* must snap into the corresponding holders of the tubing cartridge.

5 Inserting the tubing cartridge

- Hang the tubing cartridge in the mounting pin and press in the cartridge holder until the snap-action lever snaps in.

6 Connecting the capillaries

- Screw the respective capillaries tightly to the two tubing olives with PEEK pressure screws *(29-**1**)*.

Table 1 Pump tubings and suitable adapters

Pump tubing	Adapter
6.1826.020 (blue/blue)	
6.1826.310 (orange/green)	
6.1826.320 (orange/yellow)	
6.1826.330 (orange/white)	

Pump tubing	Adapter
6.1826.340 (black/black)	
6.1826.360 (white/white)	
6.1826.380 (gray/gray)	
6.1826.390 (yellow/yellow)	

Set flow rate

The contact pressure of the tubing cartridge must be adjusted in order to regulate the flow rate. Proceed as follows:

Set the contact pressure

1

- Fully loosen the contact pressure lever *(29-**5**)*, i.e. press it all the way down.
- Switch on the peristaltic pump.
- Raise the contact pressure lever one step at a time until liquid flows.
- When liquid starts flowing, raise the contact pressure lever by an additional 2 ratchet increments.

The contact pressure is now set optimally.

The delivery rate depends not only on the correct contact pressure but also on the interior diameter of the pump tubing and the rotational speed of the drive.

Note

Pump tubings are consumable material. The service life of the pump tubings depends on the contact pressure amongst other factors.

3.18 Metrohm CO_2 suppressor (MCS)

3.18.1 General information on the MCS

The MCS removes the CO_2 from the eluent flow. This reduces the background conductivity, improves the detection sensitivity and minimizes the injection and carbonate peaks.

The MCS is used for removing CO_2 from the eluent flow before detection. CO_2 can reach the eluent flow through the sample itself or arise through the suppression reaction in the MSM.

The CO_2 peak is effectively minimized through connection of the MCS between the MSM and detector. The principle is based on the gas permeability of the fluoropolymer membrane inside the degassing cell of the MCS. The eluent is guided through a capillary with a fluoropolymer membrane inside the degassing cell. A vacuum is generated in the degassing cell via a pump. At the same time, the pump sucks CO_2-free air (CO_2 is removed by a CO_2 adsorption cartridge *(33-**4**)*) through the degassing cell. The pressure and concentration difference in the degassing cell in comparison to the inside of the capillary now causes the CO_2 to diffuse out of the eluent flow.

3.18.2 Connecting MCS

The MCS is connected between the MSM *(see Chapter 3.16, page 52)* and detector.

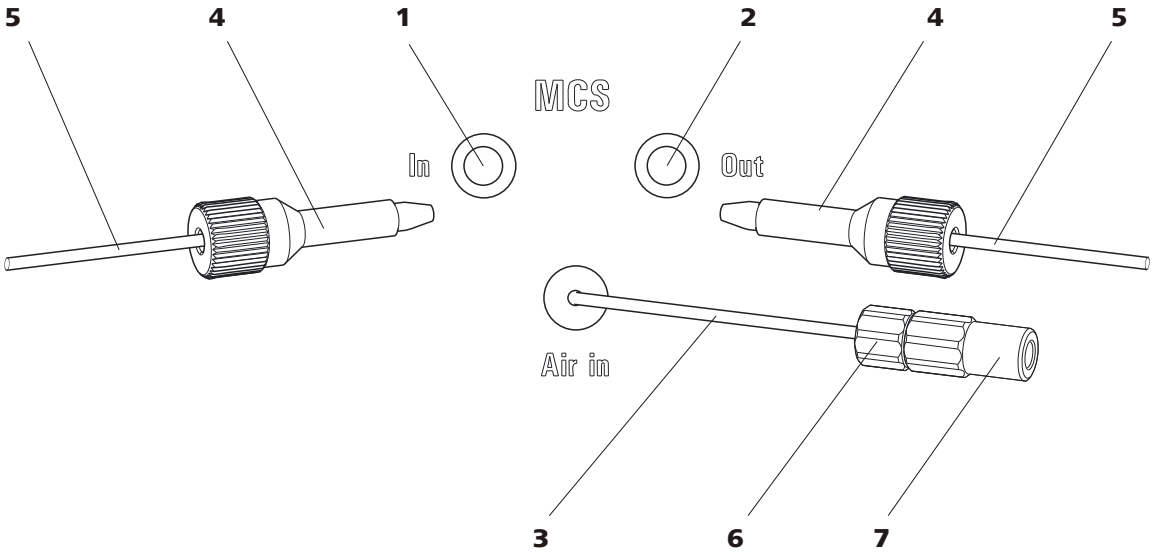


Figure 32 MCS – connection

1 **MCS input** Connection to the MSM.	**2** **MCS output** Connection to the detector.

3 **Aspirating capillary**
For aspirating air low in CO_2 (as a result of CO_2 adsorption cartridge *(33-**4**)*).

4 **PEEK pressure screw, long 6.2744.090**

5 **Capillary connection**

6 **Pressure screw, short 6.2744.070**
Mounted on the air aspirating capillary.

7 **Luer coupling 6.2744.120**
Mounted on the air aspirating capillary with pressure screw 6.2744.070.

Connecting the MCS

1 **Connecting the MSM**

Connect the eluent output capillary (labeled with *Detector*) using a 6.2744.090 long PEEK pressure screw *(32-**4**)* to the MCS inlet *(32-**1**)*.

2 **Connecting the detector**

Connect the detector input capillary *(34-**3**)* using a long PEEK pressure screw 6.2744.090 *(32-**4**)* to the MCS output *(32-**2**)*.

Caution

If the MCS is not used, the input and output should be sealed with 6.2744.220 stoppers.

3.18.3 Installing the adsorption cartridges

For effective CO_2 removal, the air sucked through the degassing cell should be as low in CO_2 as possible. To achieve this, the air is aspirated through a 6.2837.000 CO_2 adsorption cartridge *(33-**4**)*.

Moisture can block the CO_2 adsorption cartridge. In order to prevent this, a 6.2837.010 H_2O adsorption cartridge *(33-**7**)* is connected upstream.

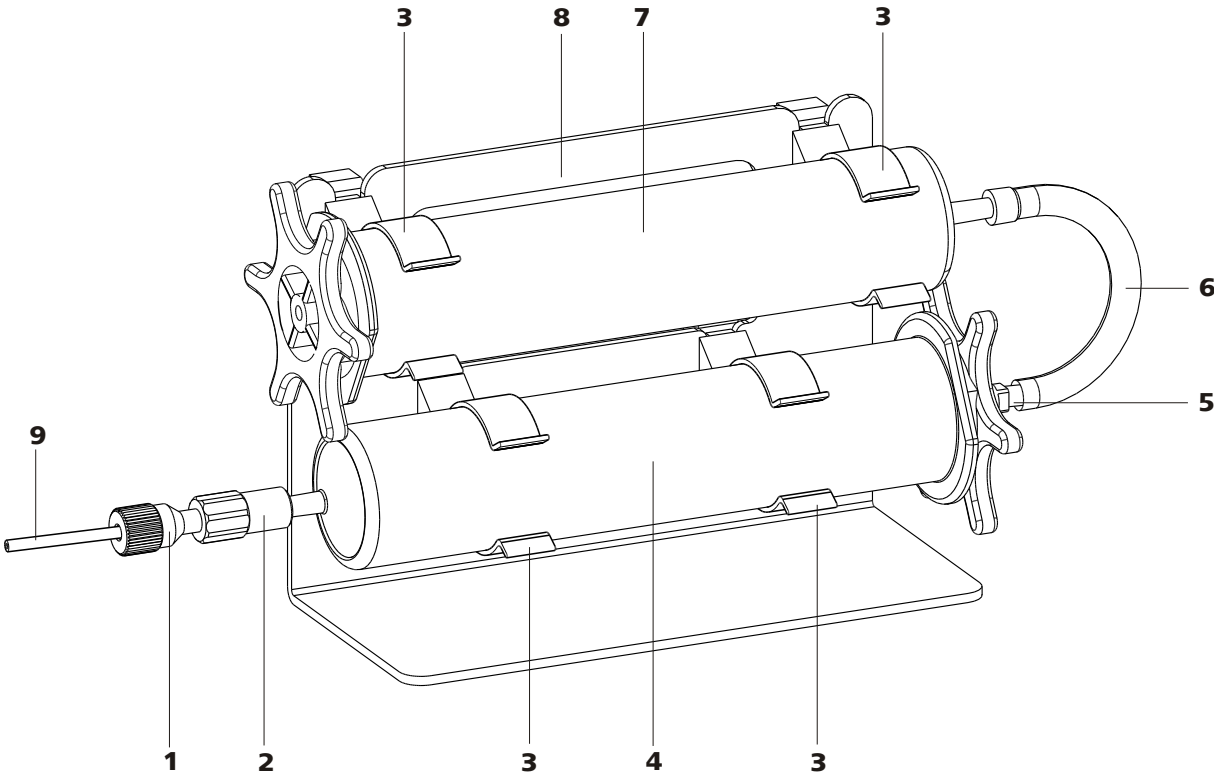


Figure 33 Adsorption cartridge holder

1 **PEEK pressure screw, short 6.2744.070**	**2** **Luer coupling 6.2744.120**
3 **Clips** For fastening the adsorption cartridges.	**4** **CO_2 adsorption cartridge 6.2837.000** For removing the CO_2 from the aspirated air. 3-layer filled, blue-brown-gray.
5 **Adapter 6.1808.190** For connecting the H_2O adsorption cartridge and CO_2 adsorption cartridge.	**6** **PVC tubing** For connecting the H_2O adsorption cartridge and CO_2 adsorption cartridge.
7 **H_2O adsorption cartridge 6.2837.010** For removing the H_2O from the aspirated air. Filled with bead desiccant.	**8** **Adsorption cartridge holder 6.2057.080**
9 **MCS aspirating capillary** Connection to the MCS. Corresponds to *(32-**3**)*.	

Installing the adsorption cartridges

1 Preparing the adsorption cartridge holder

Push the 4 clips *(33-**3**)* into the slot of the adsorption cartridge holder *(33-**8**)*.

2 Removing the caps

- Remove the two locking caps at the tip of the two cartridges.
- In the case of the H_2O adsorption cartridge, replace the round sealing cap on the larger end with the star-shaped sealing cap.

3 Connecting the CO_2 adsorption cartridge

- Insert the CO_2 adsorption cartridge into the coupling *(33-**2**)* on the end of the MCS aspirating capillary .
- Click the CO_2 adsorption cartridge into the two lower clips *(33-**3**)* of the adsorption cartridge holder *(33-**8**)*.

4 Connecting the PVC tubing

- Insert the adapter *(33-**5**)* into the CO_2 adsorption cartridge.
- Fasten the PVC tubing *(33-**6**)* on the adapter *(33-**5**)*.

5 Connecting the H_2O adsorption cartridge

- Place the H_2O adsorption cartridge into the PVC tubing *(33-**6**)*.
- Click the H_2O adsorption cartridge into the two upper clips *(33-**3**)* of the adsorption cartridge holder *(33-**8**)*.

6 Placing the adsorption cartridge holder in the instrument

- Place the adsorption cartridge holder with cartridges into the detector chamber of the instrument.

3.19 Conductivity detector

The conductivity detector continuously measures the conductivity of the liquid passing through and indicates these signals in digital form (DSP – Digital Signal Processing). The conductivity detector exhibits outstanding thermal stability and thus guarantees reproducible measuring conditions.

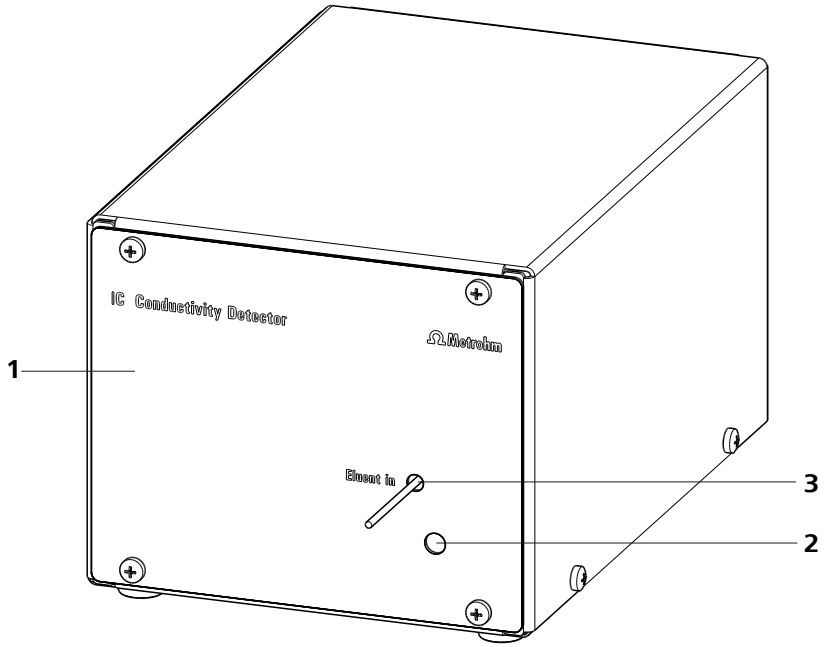


Figure 34 Conductivity detector front

1 **IC detector 1.850.9010**	**2** **Opening for temperature sensor**
3 **Detector input capillary** Permanently installed.	

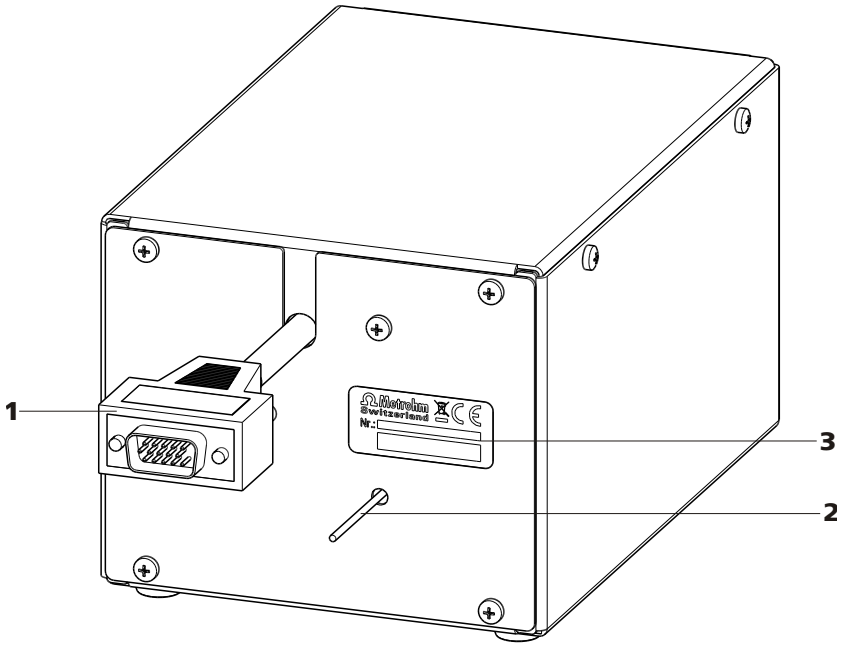


Figure 35 Conductivity detector rear

1 **Detector cable** With mounted plug.	**2** **Detector output capillary** Permanently installed.
3 **Type plate** With serial number.	

Note

In order to prevent unnecessary peak widening after separation, the connection between the outlet of the separation column and the inlet in the detector should be kept as short as possible.

Connecting the detector input capillary to the MCS

1 ▪ Fasten the detector input capillary *(36-**1**)* using a 2.2744.090 long PEEK pressure screw *(36-**2**)* on the output of the MCS *(36-**3**)*.

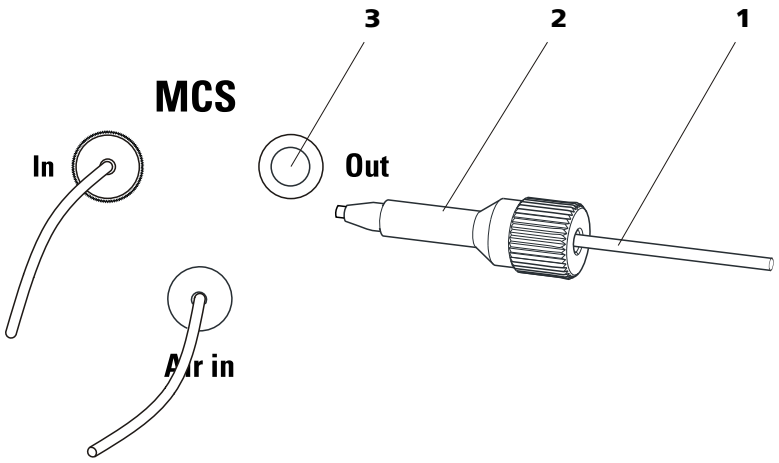


Figure 36 Connection detector – MCS

1 Detector input capillary	**2 Pressure screw, long 6.2744.090**
3 MCS output	

3.20 Connecting the instrument

3.20.1 Connecting the instrument to the PC

Note

The instrument must be turned off when connecting the PC.

1 Connecting the USB cable

Connect the PC connection socket *(2-**18**)* of the instrument to a USB connector of the computer via the 6.2151.020 USB cable.

3.20.2 Connecting the instrument to mains supply

Warning

The power supply unit must not get wet. Protect it against the direct effect of liquids.

Mains cable

Which mains cable is supplied depends on the location:

- 6.2122.020 with plug SEV 12 (Switzerland, …)
- 6.2122.040 with plug CEE(7), VII (Germany, …)
- 6.2122.070 with plug NEMA 5-15 (USA, …)

The mains cable is three-core and provided with a plug with grounding. If another plug has to be mounted, the yellow/green conductor (IEC standard) must be connected to the protective ground (protection class I).

1 Connecting the mains cable

- Plug the mains cable into the mains connection socket *(2-**4**)*.
- Connect the mains cable to the mains supply.

2 Switching the instrument on and off

Switch the instrument on and off with the mains switch *(2-**3**)*.

After switching on, the LED on the front of the instrument flashes while a system test is carried out and the connection to the software is established. Once the system test is complete and the connection to the software has been established, the LED lights up continuously.

3.21 Guard column

The use of guard columns serves for protecting the separation column and increasing their service life considerably. The guard columns available from Metrohm represent either actual guard columns or are so-called guard column cartridges which are used together with a cartridge holder. The installation of a guard column cartridge in the associated holder is described in the information sheet of the guard columns.

Note

Information regarding which guard column is suitable for your separation column can be found in the **Metrohm IC Column Program** (which is available from your Metrohm agent), the information sheet provided along with your separation column, the product information on the separation column at *http://www.metrohm.com* (product area Ion Chromatography), or obtained directly from your agent.

Caution

New guard columns are filled with solution and are sealed on both sides with stoppers or caps, respectively. Before using the guard column, you need to ensure that this solution is miscible with the eluents used (observe manufacturer's data).

Note

The guard column may only be installed after the **initial start-up** *(see Chapter 4.1, page 71)* of the instrument. Until then, use the 6.2744.040 coupling instead of the guard and separation column.

Connecting and rinsing the guard column

1 Connecting the guard column

Caution

When inserting the guard column, always ensure that it is inserted correctly corresponding to the flow direction (if indicated).

- Remove locking caps and/or stoppers from the guard column.
- Fasten the lower end of the guard column with a 6.2744.070 short PEEK pressure screw to the column input capillary .
- Fasten the connection capillary (3.4224.240) enclosed with the guard column to the upper end of the guard column with a 6.2744.070 short PEEK pressure screw.
  Guard columns are also available which can be screwed with the upper end directly onto the separation column.

2 Rinsing the guard column

- Place beaker under the outlet capillary of the guard column.
- Start the high pressure pump and rinse the guard column approx. 5 minutes with eluent. Set the flow according to the corresponding column information sheet.
- Switch off the high pressure pump again.

3.22 Separation column

The intelligent separation column (iColumn) is the heart of the ion chromatographic analysis. It separates the different components corresponding to their interactions with the column. Metrohm analytical columns are equipped with a chip on which their technical specifications and their history (first use / setting up, operating hours, injections, ...) are saved.

Note

Information regarding which separation column is suitable for your application can be found in the **Metrohm IC Column Program**, the product information for your separation column at *http://www.metrohm.com* in the product area ion chromatography, or obtained directly from your agent.

Caution

New separation columns are filled with solution and are sealed on both sides with stoppers. Before using the column, you need to ensure that this solution is miscible with the eluents used (observe manufacturer's data).

You can find the separation columns and guard columns currently available from Metrohm in the Metrohm IC Column Program, or in the Internet at *http://www.metrohm.com* in the product area Ion Chromatography. A test chromatogram and an information sheet are provided along with each column. You can request detailed information on special IC applications in the corresponding "**Application Bulletins**" or "**Application Notes**", available in the Internet at *http://www.metrohm.com* in the Applications area or via the Metrohm agent responsible free of charge.

Note

The separation column may only be installed after the **initial start-up** *(see Chapter 4.1, page 71)* of the instrument. Until then, use the 6.2744.040 coupling instead of the guard and separation column.

Connecting and rinsing the separation column

1 Connecting the separation column

Caution

When using the columns, always ensure that these are correctly inserted corresponding to the flow direction indicated.

- Remove stoppers from the separation column.
- Connect the lower end of the separation column with a 6.2744.070 short PEEK pressure screw to the outlet capillary of the guard column (if used), or to the column input capillary .

2 Rinsing the separation column

- Place beaker under the outlet end of the separation column.
- Set the flow rate of the high pressure pump to the value suitable for the separation column selected.
- Start the high pressure pump and rinse the separation column approx. 10 minutes with eluent.
- Switch off the high pressure pump again.

3 Mounting the separation column

- Hang separation column with chip into the column holder.

Note

The iColumns are equipped with a chip on which their operating data is saved. The chip has to be hooked into the chip holder provided for this so that the column recognition can function.

4 Start-up

The chapter *Start-up* is divided into 2 sections:

Initial start-up	The **initial start-up** is carried out during the **initial installation**.
Conditioning	Conditioning is carried out as a final installation step and each time after the system is started.

4.1 Initial start-up

The initial start-up is carried out during the initial installation. The entire system is flushed before guard column and separation column are installed.

Caution

The separation column and guard column may not be installed for the initial start-up.

Make sure that the 6.2744.040 coupling is being used instead of the columns.

Perform the following steps during the initial start-up:

1 Preparing the software

- Start the PC program **MagIC Net**.
- Open the **Equilibration** tab in **MagIC Net**.
- Select (or create) a suitable method.

2 Preparing the instrument

- Ensure that the eluent aspiration tubing is immersed in the eluent and that there is enough eluent in the eluent bottle.
- Switch on the instrument.

3 Deaerating the high pressure pump

- Deaerate the high pressure pump(s) via the purge valve *(see Chapter 3.10.2, page 40)*.

4 Setting the contact pressure of the peristaltic pump

Note

This work step needs to be performed only if a peristaltic pump is being used.

- If peristaltic pumps are used, set the contact pressure *(see "Set flow rate", page 59)*.

5 Rinsing the instrument without columns

- Rinse the instrument (without columns) with eluent for 5 minutes.

The instrument is now prepared for the installation of the columns *(see Chapter 3.21, page 67)*.

4.2 Conditioning

After the installation and after switching on the instrument, the system must be conditioned with eluent until a stable baseline is reached.

Note

After a change of eluent *(see Chapter 5.4.2.3, page 77)*, the conditioning time can lengthen considerably.

Conditioning the system

1 Preparing the software

Caution

Ensure that the flow set is not higher than the flow permissible for the corresponding column (see column information sheet and chip data set).

- Start the PC program **MagIC Net**.
- Open the **Equilibration** tab in **MagIC Net**.
- Select (or create) a suitable method.

2 Preparing the instrument

- Ensure that the column is correctly mounted in accordance with the flow direction indicated on the label (arrow must point in the direction of flow).
- Ensure that the eluent aspiration tubing is immersed in the eluent and that there is enough eluent in the eluent bottle.

3 Checking leak-tightness

- In **MagIC Net**, start the equilibration.
- Check all capillaries and their connections from the high pressure pump to the detector block for signs of liquid escaping. If eluent escapes anywhere, tighten the corresponding pressure screw or loosen the connection, check the end of the capillary, shorten it with a capillary cutter if necessary, and restore the connection.

4 Conditioning the system

Rinse the system with eluent until the required stability of the baseline is attained (normally 30 minutes).

The instrument is now ready for measuring samples.

5 Operation and maintenance

5.1 General information

5.1.1 Care

Warning

The instrument housing must not be opened by untrained personnel.

The instrument requires appropriate care. Excess contamination of the instrument may result in functional disruptions and a reduction in the service life of the sturdy mechanics and electronics.

Caution

Although this is extensively prevented by design measures, the mains plug should be unplugged immediately if aggressive media has penetrated the inside of the instrument, so as to avoid serious damage to the instrument electronics. In such cases, the Metrohm Service must be informed.

On the rear of the instrument, the drainage tubings must be mounted and the leak sensor must be plugged in and activated as protection against escaping liquids.

Spillages of chemicals and solvents should be cleaned up immediately. In particular, the plug connections on the rear panel of the instrument (especially the mains plug) should be protected from contamination.

5.1.2 Maintenance by Metrohm Service

Maintenance of the instrument is best carried out as part of an annual service, which is performed by specialist personnel of the Metrohm company. If working frequently with caustic and corrosive chemicals, a shorter maintenance interval is recommended. The Metrohm service department offers every form of technical advice for maintenance and service of all Metrohm instruments.

5.1.3 Operation

Caution

In order to avoid disturbing temperature influences, the entire system including the eluent bottle must be protected against direct sunlight.

5.1.4 Shutting down

If the instrument is shut down for a longer period, the entire IC system (without separation column) must be rinsed salt-free with methanol/ultra pure water (1:4), in order to prevent eluent salts from forming crystals which may cause subsequent damage.

Guard column and separation column are excluded from the eluent path for rinsing. The connection capillaries are directly connected to one another with a 6.2744.040 coupling. Rinsing is carried out with methanol/ultra pure water (1:4) until the conductivity drops below 10 µS/cm.

Rinse with eluent for at least 15 minutes at starting up again and before connecting the guard column and separation column.

5.2 Capillary connections

5.2.1 Operation

All connections between injection valve *(see Chapter 3.14, page 46)*, separation column *(see Chapter 3.22, page 69)* and detector *(see Chapter 3.19, page 63)* must be as short as possible, have a low dead volume and be completely leak-tight. The PEEK capillary after the detector must be free of blockages (the measuring cell is tested to 5 MPa = 50 bar backpressure). Only use PEEK capillaries with an internal diameter of 0.25 mm in the high pressure range between the high pressure pump *(see Chapter 3.10, page 37)* and the detector.

5.3 Door

Caution

The door is made of PMMA (polymethylmetacrylate). It must never be cleaned with abrasive media or solvents.

Caution

Never use the door as a handle.

5.4 Eluent

5.4.1 Production

The chemicals used for the production of eluents should have a degree of purity of at least "p.a.". Only ultra pure water (resistance > 18.2 MΩ*cm) may be used for dilution (this generally applies for reagents which are used in ion chromatography).

Newly produced eluents should always be microfiltered (filter 0.45 µm).

Caution

Only microfiltered (filter 0.45 µm) eluents may be used.

The composition of the eluent has a crucial effect on the chromatographic analysis:

Concentration An increase in the concentration generally leads to shorter retention times and faster separation, but also to higher background conductivity.

pH pH changes result in shifts in the dissociation equilibria and hence changes in the retention times.

Organic solvents The addition of an organic solvent (e.g. methanol, acetone, acetonitrile) to aqueous eluents generally accelerates lipophilic ions.

5.4.2 Operation

5.4.2.1 Supply bottle

The supply bottle with the eluent must be connected as indicated in *Chapter 3.8.1, Page 32*. This is above all important for eluents with volatile solvents (e.g. acetone).

Moreover, condensation must also be prevented in the eluent bottle. Drop formation can change the concentration ratio in the eluent.

5.4.2.2 Aspiration filter

To protect the IC system against foreign particles, we recommend aspirating the eluents via a 6.2821.090 aspiration filter *(13-**2**)*. This aspiration filter must be replaced should it show signs of yellow discoloration (but no later than every 3 months).

In the case of very sensitive measurements, the eluent should be stirred constantly with a magnetic stirrer.

5.4.2.3 Changing the eluent

When changing the eluent, it must be ensured that no precipitates can occur. Solutions following one another in direct succession must therefore be miscible. If the system has to be rinsed organically, several solvents with rising or falling lipophilia must be used.

5.5 High pressure pump

5.5.1 Protection

Caution

The pump head is filled ex works with methanol/ultra pure water. It must be ensured that the eluent used is freely miscible with the solvent remaining in the pump head.

To protect the high pressure pump against **foreign particles**, we recommend that the eluent undergoes a **microfiltration** (filter 0.45 µm) before being aspirated via a 6.2821.090 aspiration filter *(see "Assembling eluent aspiration tubing", page 32)*.

Salt crystals between the piston and seal cause abrasion particles which can find their way into the eluent. These lead to contaminated valves, a rise in pressure and in extreme cases scratched pistons. It is therefore essential to ensure that **no precipitates** can occur *(see Chapter 5.4.2.3, page 77)*.

Caution

In order to spare the pump seals, the pump should not be operated dry. Therefore ensure that the eluent supply is correctly connected and that there is enough eluent in the eluent bottle each time before turning on the pump.

5.5.2 Maintenance

Caution

Maintenance work on the high pressure pump may not be carried out unless the **instrument is switched off**.

Pump head maintenance

An unstable baseline (pulsation, flow fluctuations) is in many cases the result of contaminated valves *(43-**2**)*, *(43-**3**)* or defective, leaking piston seals on the high pressure pump. Proceed as follows for cleaning contaminated valves and/or replacing worn parts such as pistons, piston seal and valves:

This maintenance work should be carried out at least once a year.

Removing the pump head

1. Turn off high pressure pump and wait until pressure is released.
2. Loosen the pressure screw on the inlet valve holder *(18-**2**)* and unscrew the coupling *(18-**9**)*, the pump head input capillary *(18-**7**)* and the eluent aspiration tubing from the pump head.
3. Unscrew the pump head output capillary *(18-**13**)* from the pump head.
4. Remove pump head from the pump housing by loosening the 4 fastening screws *(18-**5**)* using the 6.2621.030 hexagon key. The main piston is on the left (viewed from the front), and the auxiliary piston is on the right.

Cleaning/replacing the zirconium oxide piston

Clean one piston after the other as follows:

1 Removing the piston cartridge from the pump head

Loosen the piston cartridge with a wrench and unscrew from the pump head by hand.

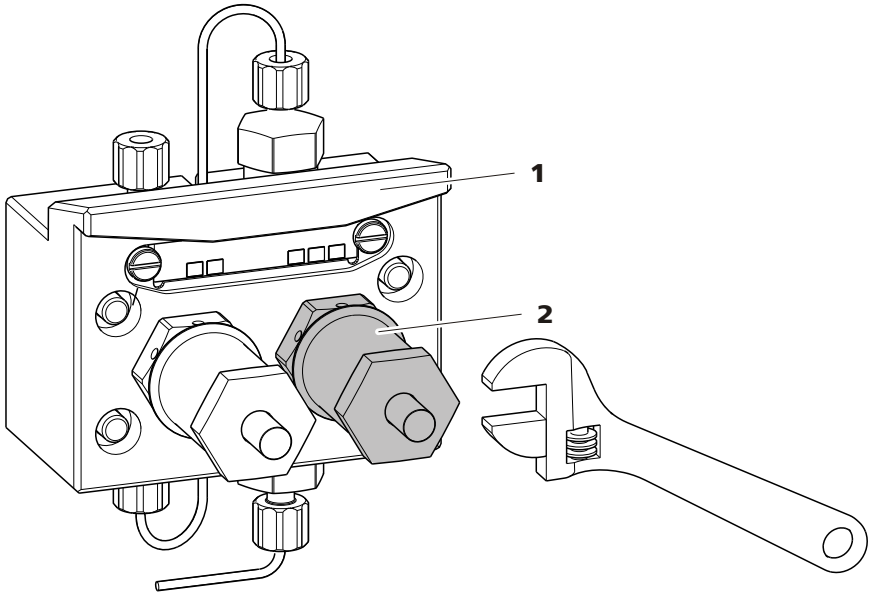


Figure 37 Removing piston

1 Pump head	**2 Piston**

2 Dismantle the piston

Caution

On the inside of the piston cartridge there is a taut spring than can jump out of the piston cartridge if suddenly loosing tension.

When opening the piston cartridge, hold pressure towards the spring and unscrew carefully.

- Loosen the screw of the piston cartridge with a wrench and unscrew carefully by hand and by holding pressure towards the taut spring.
- Remove the zirconium oxide piston and lay on a tissue.
- Remove the spring retainer, spring and the inner plastic sleeve from the piston cartridge and lay by.

- Remove the backup ring from the pump head and lay to the other parts.

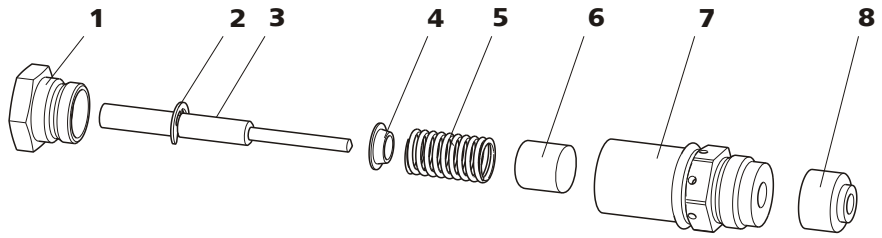


Figure 38 Components of the piston cartridge

1	**Piston cartridge screw**	**2**	**Retaining washer**
3	**Zirconium oxide piston with piston shaft** Order number: 6.2824.070.	**4**	**Spring retainer**
5	**Spring** Order number: 6.2824.060.	**6**	**Inner plastic sleeve** Protects from metallic abrasion.
7	**Piston cartridge**	**8**	**Backup ring**

3 Cleaning the components of the piston

- Clean zirconium oxide pistons contaminated by abrasion or deposits with pure abrasive cleaning powder, rinse particle free with ultra pure water and dry.
  Replace highly contaminated or scratched zirconium oxide pistons (spare part: 6.2824.070 zirconium oxide piston).
- Rinse the other parts of the piston and dry with a lint-free cloth.

4 Assembling the piston

- Insert the inner plastic sleeve, spring and spring retainer into the piston cartridge.
- Slide the zirconium oxide piston carefully into the piston cartridge until its tip emerges from the small opening of the piston cartridge.
- Attach screw and tighten by hand.

Replacing the piston seal

The 6.2617.010 special tool *(see Figure 39, page 81)* is necessary in order to remove the piston seal from the pump head. It consists of two

parts: a tip for removing the old piston seal and a sleeve for inserting the new piston seal.

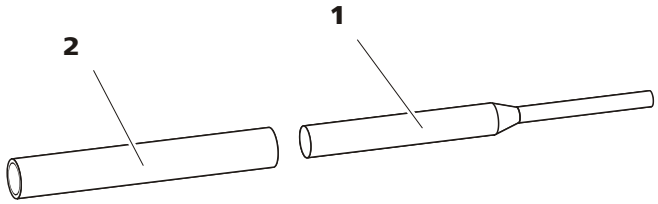


Figure 39 Tool for piston seal 6.2617.010

1 Pin Pin for removing the old piston seal.	**2 Sleeve** Sleeve for inserting the new piston seal.

Caution

Screwing the 6.2617.010 special tool for the piston seal into the piston seal destroys this completely!

1 Removing the piston seal

Caution

Avoid touching the sealing surface in the pump head *(18-**4**)* with the tool.

Screw the special tool for the piston seal *(39-**1**)* with the narrow side just as far into the piston seal as the same can be removed.

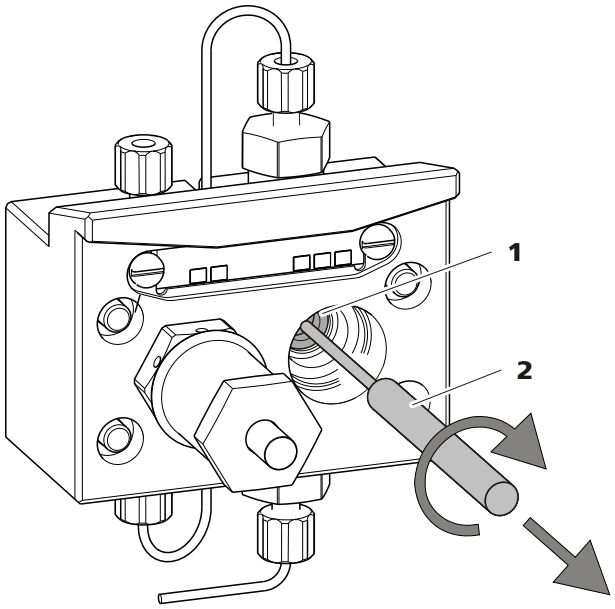


Figure 40 Removing the piston seal

1 Piston seal	**2 Tool for piston seal** Pin of the tool.

2 Inserting the new piston seal into the tool

Insert the new piston seal tightly by hand into the recess of the sleeve of the tool for the piston seal *(39-**2**)*. The sealing springs must be visible from the outside.

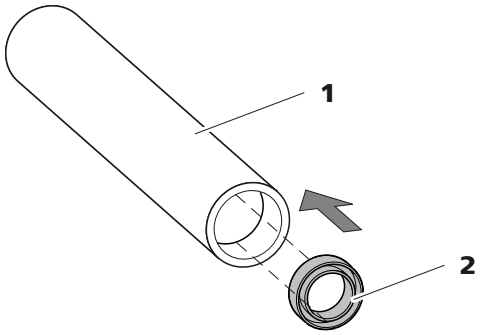


Figure 41 Insert the piston seal into the tool

1 Tool for piston seal 6.2617.010 Sleeve for inserting the new piston seal.	**2 Piston seal** Order number: 6.2741.020

3 Inserting the new piston seal into the pump head

Guide the sleeve of the tool for the piston seal *(39-**2**)* with inserted piston seal into the pump head and press the seal with the wide end of the tool for the piston seal *(39-**1**)* into the pump head recess.

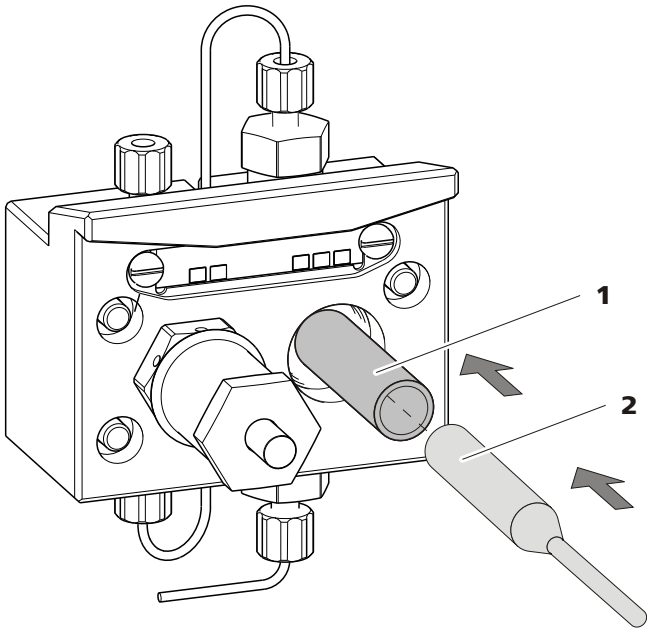


Figure 42 Inserting the piston seal into the pump head

4 Replacing the piston cartridge

Screw the assembled piston cartridge back into the pump head and tighten, first by hand, then additionally by approx. 15° with a wrench.

Cleaning the inlet valve and outlet valve

1 Removing valves

- Unscrew the connection capillary for the auxiliary piston *(18-**1**)* from the outlet valve holder.
- Unscrew the holders for the inlet and outlet valves and remove valves.

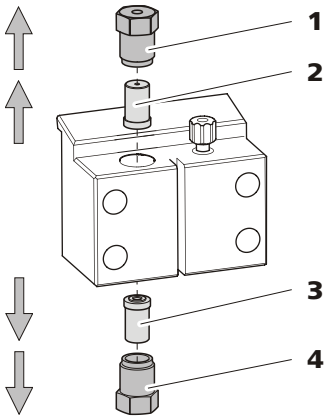


Figure 43 Removing valves

1 **Outlet valve holder**	**2** **Outlet valve** Order number: 6.2824.160
3 **Inlet valve** Order number: 6.2824.170	**4** **Inlet valve holder**

2 Cleaning undissected valve

Clean contaminated or blocked valves initially **without** dismantling them completely.

- Rinse the valve in eluent flow and counterflow direction using a spray bottle filled with ultra pure water, RBS solution or acetone.
- The rinsing effect is further increased through a short treatment (lasting for a maximum of 20 s) in an ultrasonic bath.

Note

Longer lasting ultrasonic baths can damage the ruby ball of the valve.

Only if this cleaning is useless, dismantle the valves separately and clean the components.

3 Dismantling valve

Dismantle every valve separately.

Note

For dismantling the valve the 6.2617.020 tool for valve cartridges is required.

- Place the valve with the seal faced downwards above the recess in the holder.
- Push the valve components out of the valve housing using the needle of the tool.

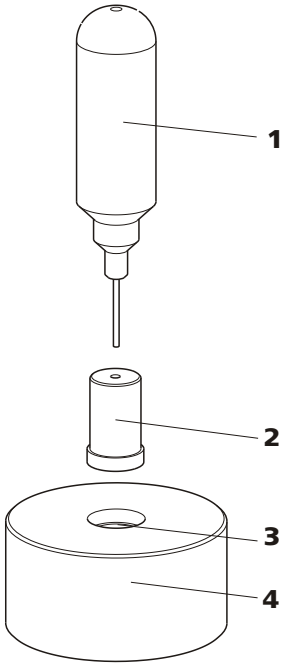


Figure 44 Dismantling valve

1 Needle For pushing the valve components out of the valve housing.	**2 Valve**
3 Holder	**4 Recess** For collecting the valve components.

The components of the valve are collected in the recess of the holder.

Note

The components of the valve are very small. In order not to lose them, put the components into a dish.

- The inlet valve and the outlet valve consist of the same, just differently arranged components *(see Figure 45, page 86)*.

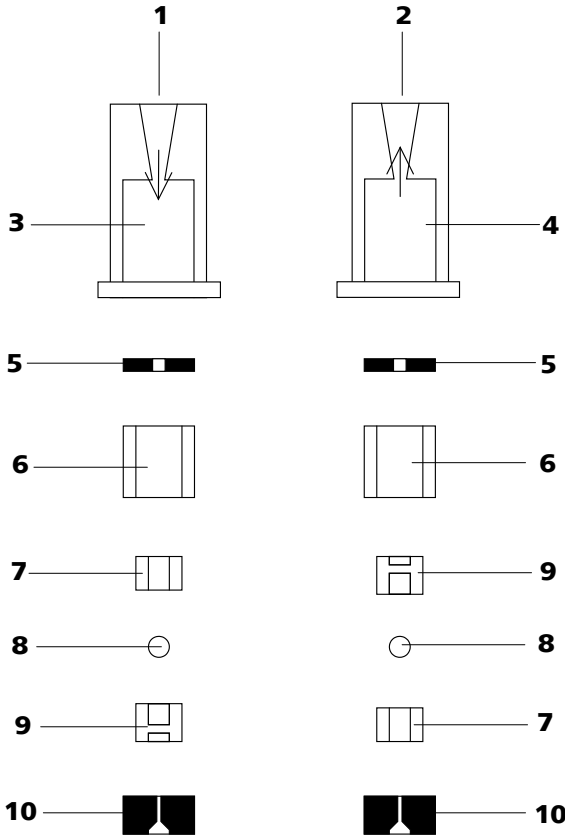


Figure 45 Components of the inlet valve and outlet valve

1	**Inlet valve 6.2824.170**	**2**	**Outlet valve 6.2824.160**
3	**Inlet valve housing**	**4**	**Outlet valve housing**
5	**Sealing ring (black)**	**6**	**Sleeve**
7	**Sapphire sleeve** The shiny side must point to ruby ball.	**8**	**Ruby ball**
9	**Ceramic holder for ruby ball**	**10**	**Seal** The larger opening must point outwards.

4 Clean the components of the valve

Rinse the valve components with ultra pure water and/or acetone and dry with a lint-free cloth.

5 Reassemble the valve

Reassemble valve components *according to figure 45, page 86*.

- Insert the seal with the larger opening faced downwards into the recess of the tool.
- Lay the other valve components above another in the correct sequence *(see Figure 45, page 86)*.

- Place the valve housing over the stacked components and hold it tightly.
- By tilting the tool, the valve components slide into the valve housing.
- Press the seal by hand well on the valve housing.

6 Checking the flow direction

Rinse the valve in the direction of the arrow on the valve housing and check wether liquid is escaping on the other end.

If this is not the case, the valve has to be dismantled again and be assembled correctly *(see Figure 45, page 86)*.

7 Inserting the valves back into the pump head

Caution

If by mistake, the inlet valve is mounted instead of the outlet valve, an extreme pressure builds up within the working cylinder, which can destroy the piston seal!

When inserting the valves, please take into account that the liquid is being pumped through the pump head from bottom to top.

- Insert the inlet valve into the inlet valve holder the way the seal is visible.
- Screw the inlet valve holder into the bottom of the pump head and tighten with a wrench *(43-**4**)*.
- Insert the outlet valve into the outlet valve holder the way the seal is visible.
- Screw the outlet valve holder into the top of the pump head and tighten with a wrench *(43-**1**)*.

Mounting the pump head

Note

To prevent the pump head from being positioned the wrong way, it is provided with different bore hole depths for the fastening bolts, i. e. a fastening bolt is longer than all others. The bore hole with the greatest depth must therefore be assigned to the longest bolt. If this is not the case, the pump will not function perfectly.

1 Mount the pump head on the pump again using the four fastening screws *(18-**5**)*. Firmly tighten the screws with the 6.2621.030 hexagon key.

2 Screw connection capillaries *(18-**1**)*, *(18-**7**)* and *(18-**13**)* onto the pump head again.

5.6 Inline filter

5.6.1 Maintenance

The 6.2821.120 inline filters comprise the filter housing *(46-**2**)*, the filter screw *(46-**4**)* and the flter *(46-**3**)*. New filters *(46-**3**)* are available under the order number 6.2821.130 (10 items).

The 6.2821.130 filters *(21-**3**)* should be changed every 3 months (more frequently at higher backpressure).

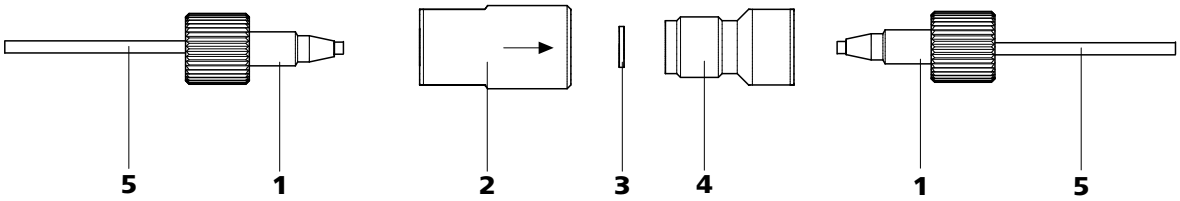


Figure 46 Changing the filter

1 PEEK pressure screws, short 6.2744.070	**2 Filter housing** Housing of the inline filter. Part of the 6.2821.120 accessories.
3 6.2821.130 filter Packaging contains 10 items.	**4 Filter screw** Screw of the inline filter. Part of the 6.2821.120 accessories.
5 Connection capillaries	

Changing the filter

The flow must be stopped before changing the filter.

1 Removing the inline filter

- Unscrew the pressure screws *(46-**1**)* from the inline filter.

2 Unscrewing the filter screw

- Screw the filter screw *(46-**4**)* out of the filter housing *(46-**2**)* with the aid of two 6.2621.000 adjustable wrenches.

3 Inserting the filter

- Remove the old filter *(46-**3**)* with tweezers.
- Place the new filter *(46-**3**)* flat in the filter housing with tweezers *(46-**2**)*.

4 Mounting filter screw

- Screw the filter screw *(46-**4**)* back into the filter housing *(46-**2**)* and tighten by hand. Then additionally tighten slightly with two 6.2621.000 adjustable wrenches.

5 Remounting the inline filter

- Screw the pressure screws *(46-**1**)* back onto the inline filter.

6 Rinsing the inline filter

- Dismantle the guard column (if present) and the separation column and replace with a 6.2744.040 coupling.
- Rinse the instrument with eluent.

5.7 Inline sample preparation

To protect the separation column *(see Chapter 3.22, Page 69)* against foreign particles which can affect the separating efficiency, we recommend that all samples undergo a microfiltration (filter 0.45 µm). The ultrafiltration cell can be used for **filtration** (see documentation on the *IC Equipment for Ultrafiltration*).

Samples containing significant amounts of **gas** should be degassed. The sample degasser *(see Chapter 3.13, Page 45)* (if available) is used for degassing.

Matrix-loaded samples (e.g. blood, oil) should be prepared for the measurement by means of dialysis (see documentation on the *IC Equipment for Dialysis*).

If the concentration of the sample is too high, it should be **diluted** before feeding (see documentation on the *IC Equipment for Sample Dilution*).

For the sample preparation methods **Neutralization** (replacement of e.g. Na^+ with H^+) and **cation exchange** (replacement of e.g. heavy metals with H^+), a sample preparation module (SPM) is used.

5.8 Rinsing the sample path

Before a new sample can be measured, the sample path must be rinsed with it so that the measuring result is not falsified by the previous sample (**Sample carry-over**).

In the case of automated sample feeding, the rinsing time should be at least 3 times the **transfer time**. The transfer time is the time required by the sample to flow from the sample vessel to the end of the sample loop.

Ascertaining the transfer time

The transfer time depends on the pump capacity of the peristaltic pump, the total capillary volume and the volume of the gas removed by the sample degasser (if used) - in other words the amount of gas in the sample.

1 Emptying the sample path

Pump air through the sample path (pump tubing, tubing connections, capillary in the degasser, sample loop) for several minutes until all liquid is displaced by the air.

2 Aspirating the sample and measuring time

Aspirate a sample typical for the later application and use a stop watch to measure the time required by the sample to travel from the sample vessel to the end of the sample loop.

The time measured corresponds to the "transfer time". The rinsing time should be at least 3 times the transfer time.

Checking the rinsing time

It is possible to determine whether the rinsing time is adequate via a direct measurement of the sample carry-over. Proceed as follows:

1 Preparing two samples

- **Sample A**: A typical sample for the application.
- **Sample B**: Ultra pure water.

2 Determining "Sample A"

Let "Sample A" pass through the sample path for the duration of the rinsing time, then inject and measure.

3 Determining "Sample B"

Let "Sample B" pass through the sample path for the duration of the rinsing time, then inject and measure.

4 Calculating sample carry-over

The degree of the sample carry-over corresponds to the ratio of the peak areas of the measurement for sample B to the measurement for sample A. The lower the ratio, the lower the sample carry-over. This ratio can be altered by varying the rinsing time – thus allowing the rinsing time required for the application to be ascertained.

5.9 Sample degasser

5.9.1 Operation

If you are working with sample degassing, the longer "transfer time" *(see Ascertaining the transfer time, page 90)* means that it is also necessary to rinse for longer (with the subsequent sample). The rinsing time should be at least 3 times the "transfer time" so as to minimize the carry-over effects. The "transfer time" itself depends on the pump capacity, total capillary volume and volume of gas removed (i.e. the amount of gas in the sample).

Note

When using the sample degasser, the rinsing time extends by at least 2 minutes.

5.10 Injection valve

5.10.1 Protection

To prevent contamination of the injection valve, a 6.2821.120 inline filter *(see Chapter 3.11, page 42)* should be mounted between the high pressure pump and the pulsation damper.

5.11 High Capacity Metrohm Suppressor Module (MSM-HC)

5.11.1 Protection

To protect the MSM-HC against foreign particles or bacterial growth, a 6.2744.180 pump tubing connection with filter *(see Figure 30, page 57)* must be mounted between the peristaltic pump and the inlet capillaries of the MSM-HC .

5.11.2 Operation

Note

The suppressor units must never be regenerated in the same flow direction in which the eluent is pumped. Therefore always mount the inlet and outlet capillaries according to diagram outlined in *figure 27*.

The MSM-HC consists of 3 suppressor units, which are used for suppression, regenerated with sulfuric acid or rinsed with ultra pure water in rotation. In order to record every new chromatogram under comparable conditions, you should normally work with a freshly regenerated suppressor.

Caution

The MSM-HC must never be switched over in a dry state, as there is a risk of jamming. If the MSM-HC is in a dry state, the MSM-HC must be rinsed for at least 5 minutes before it may be switched over.

Caution

In the case of reduced capacity or high backpressure, the MSM-HC must be regenerated *(see Chapter 5.11.3.1, page 93)*, cleaned *(see Chapter 5.11.3.2, page 94)* or replaced *(see Chapter 5.11.3.3, page 97)*.

5.11.3 Maintenance

5.11.3.1 Regenerating the MSM-HC

If the suppressor units are loaded for a longer period with certain heavy metals (e.g. iron) or organic impurities, these can no longer be completely removed with the regeneration solution (100 mmol/L H_2SO_4) normally used. The capacity of the suppressor units is consequently affected, which can result in reduced phosphate sensitivity in less serious cases and a significant rise in the baseline in more serious cases. If such capacity problems occur at one or more positions, the suppressor units must be regenerated:

Regenerating the MSM-HC

1 Disconnecting the MSM-HC from the IC system

- Disconnect the MSM-HC from the separation column and MCS or the detector.

2 Regenerating the MSM-HC

Caution

The pump tubings made of PVC must not be used for rinsing with solutions containing organic solvents. In this case, other pump tubings must be used for rinsing.

Note

The high pressure pump can be used for regeneration. For this, remove the guard column and separation column and connect the capillary directly to the MSM-HC (regenerate in opposite direction).

- Rinse the 3 suppressor units with the following solutions for about 15 minutes each:
  - **Contamination with heavy metals**:
    1 mol/L H_2SO_4 + 0.1 mol/L oxalic acid
  - **Contamination with organic cationic complexing agents**:
    0.1 mol/L H_2SO_4 **/** 0.1 mol/L oxalic acid **/** acetone 5%
  - **Severe contamination with organic substances**:
    0.2 mol/L H_2SO_4 **/** acetone ≥ 20%

3 Connecting the MSM-HC to the IC system

- Reconnect the MSM-HC to the IC system. If the capacity problems remain, the MSM-HC rotor A must be replaced *(see Chapter 5.11.3.3, page 97)*.

5.11.3.2 Cleaning the MSM-HC

It may be necessary to clean the MSM-HC in the following cases:

- Increased backpressure onto the connection tubings of the MSM-HC.
- Blockage of the MSM-HC which cannot be eliminated (solutions can no longer be pumped through the MSM-HC).
- Jamming of the MSM-HC which cannot be eliminated (MSM-HC can no longer be switched over).

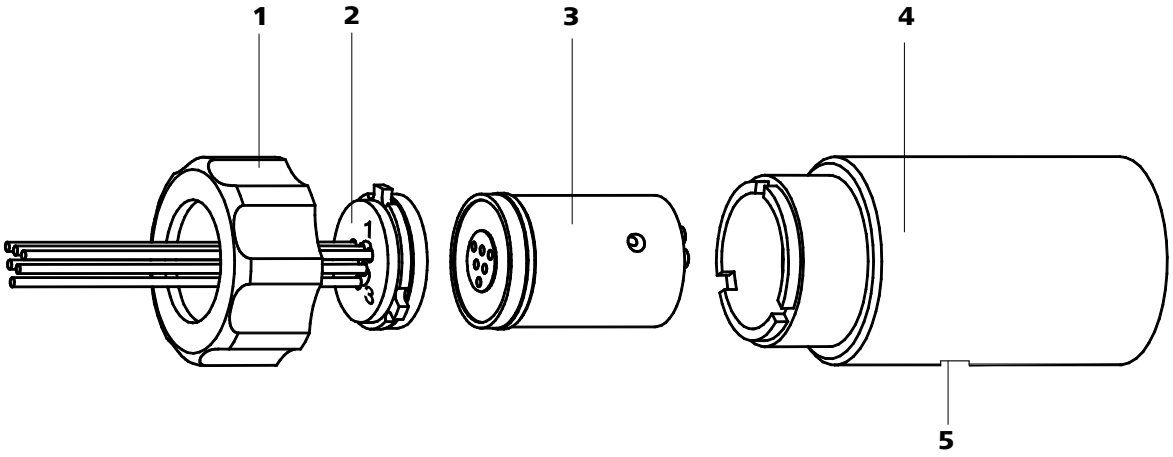


Figure 47 MSM-HC – Components

1 Union nut	**2 MSM-HC connecting piece 6.2835.010**
3 MSM-HC rotor A 6.2842.000	**4 MSM-HC housing**
5 Slot in the MSM-HC housing	

Cleaning the MSM-HC

Clean the MSM-HC as follows:

1 Disconnecting the MSM-HC from the IC system

- Switch off the instrument.
- Disconnect the MSM-HC from the separation column, peristaltic pump and detector.

2 Dismantling the MSM-HC

- Unscrew union nut *(47-**1**)* from the MSM-HC housing *(47-**4**)*.
- Pull the MSM-HC connecting piece *(47-**2**)* and the MSM-HC rotor A *(47-**3**)* out of the MSM-HC housing *(47-**4**)*. The connecting piece and the MSM-HC rotor A normally stick to one another – if this is not the case: Take a sharp object, insert into the slot *(47-**5**)* in the MSM-HC housing, and pull out the MSM-HC rotor A *(47-**3**)* in this way.
- Detach the MSM-HC connecting piece *(47-**2**)* from MSM-HC rotor A *(47-**3**)*.

3 Cleaning the supply and discharge lines

- Connect in turn each of the 6 capillary tubings fastened on the MSM-HC connecting piece *(47-**2**)* on the high pressure pump *(see Chapter 3.10, page 37)* and pump through ultra pure water.

- Check whether solution emerges at the MSM-HC connecting piece *(47-**2**)*. If one of the supply or discharge lines remained blocked, the MSM-HC connecting piece *(47-**2**)* must be replaced (order number 6.2835.010).

4 Cleaning the MSM-HC rotor A

- Clean the sealing surface of the MSM-HC rotor A *(47-**3**)* with ethanol using a lint-free cloth.

5 Inserting the MSM-HC rotor A

Caution

An incorrectly inserted MSM rotor A *(47-**3**)* can be **destroyed** during start-up.

- Insert the MSM-HC rotor A *(47-**3**)* into the MSM-HC housing *(47-**4**)* in such a way that the tubing connections on the rear of MSM-HC rotor A fit into the corresponding recesses inside the MSM-HC housing and one of the three holes of the MSM-HC rotor A is visible from below in the slot *(47-**5**)* of the MSM-HC housing.
- If the MSM-HC rotor A *(47-**3**)* is correctly inserted, its sealing surface will be approx. 4 mm within the MSM-HC housing *(47-**4**)*. If this is not the case, the MSM-HC rotor A must be moved into the right position from below using a sharp object (e.g. screwdriver).

6 Cleaning the MSM-HC connecting piece

- Clean the sealing surface of the MSM-HC connecting piece *(47-**2**)* with ethanol using a lint-free cloth.

7 Inserting the MSM-HC connecting piece

- Insert the MSM-HC conencting piece *(47-**2**)* into the MSM-HC housing *(47-**4**)* in such a way that the connector *1* is on top and the three pins of the connecting piece fit into the corresponding recesses on the MSM-HC housing *(47-**4**)*.
- Reattach the union nut *(47-**1**)* onto the coupling and tighten.

8 Connecting and conditioning the MSM-HC

- Reconnect the MSM-HC to the IC system.
- Before switching the MSM-HC over for the first time, rinse the three suppressor units with solution for 5 minutes.

5.11.3.3 Replacing parts of the MSM-HC

It may be necessary to replace parts of the MSM-HC in the following cases:

- Loss of suppression capacity which cannot be eliminated (reduced phosphate sensitivity and/or significant rise in the baseline).
- Blockage of the MSM-HC which cannot be eliminated (solutions can no longer be pumped through the suppressor).

Both the MSM-HC rotor A *(47-**3**)* and the MSM-HC connecting piece *(47-**2**)* with its supply and discharge lines can be replaced.

Replacing parts of the MSM-HC

Replace parts of the MSM-HC as follows *(see Figure 47, page 95)*:

1 Disconnecting the MSM-HC from the IC system

- Switch off the instrument.
- Disconnect the MSM-HC from the separation column, peristaltic pump and detector.

2 Dismantling the MSM-HC

- Unscrew union nut *(47-**1**)* from the MSM-HC housing *(47-**4**)*.
- Pull the MSM-HC connecting piece *(47-**2**)* and the MSM-HC rotor A *(47-**3**)* out of the MSM-HC housing *(47-**4**)*. The connecting piece and the MSM-HC rotor A normally stick to one another – if this is not the case: Take a sharp object, insert into the slot *(47-**5**)* in the MSM-HC housing, and pull out the MSM-HC rotor A *(47-**3**)* in this way.
- Detach the MSM-HC connecting piece *(47-**2**)* from MSM-HC rotor A *(47-**3**)*.

3 Cleaning the new MSM-HC rotor A

- Clean the sealing surface of the new MSM-rotor A *(47-**3**)* with ethanol using a lint-free cloth.

4 Inserting the new MSM-HC rotor A

Caution

An incorrectly inserted MSM rotor A *(47-**3**)* can be **destroyed** during start-up.

- Insert the new MSM-HC rotor A *(47-**3**)* in the MSM-HC housing *(47-**4**)* in such a way that the tubing connections on the rear of MSM-HC rotor A fit into the corresponding recesses inside the MSM-HC housing and one of the three holes of MSM-HC rotor A is visible from below in the slot *(47-**5**)* of the MSM-HC housing.
- If the MSM-HC rotor A *(47-**3**)* is correctly inserted, its sealing surface will be approx. 4 mm within the MSM-HC housing *(47-**4**)*. If this is not the case, the MSM-HC rotor A must be moved into the right position from below using a sharp object (e.g. screwdriver).

5 Cleaning the MSM-HC connecting piece

- Clean the sealing surface of the MSM-HC connecting piece *(47-**2**)* with ethanol using a lint-free cloth.

6 Inserting the new MSM-HC connecting piece

- Insert the MSM-HC conencting piece *(47-**2**)* into the MSM-HC housing *(47-**4**)* in such a way that the connector *1* is on top and the three pins of the connecting piece fit into the corresponding recesses on the MSM-HC housing *(47-**4**)*.
- Reattach the union nut *(47-**1**)* onto the coupling and tighten.

7 Connecting and conditioning the MSM-HC

- Reconnect the MSM-HC to the IC system.
- Before switching the MSM-HC over for the first time, rinse the three suppressor units with solution for 5 minutes.

5.12 Peristaltic pump

5.12.1 Operation

The pumping capacity of the peristaltic pump depends on the drive speed (set via software), the contact pressure and, above all, the internal diameter of the pump tubing. Depending on the application, different pump tubings are used.

Caution

The service life of the pump tubings also depends on the contact pressure. Therefore fully lift the tubing cartridges by loosening the snap-action lever *(29-**10**)* on the right-hand side if the peristaltic pump is to be turned off for a longer period. Once set, the contact pressure remains unaffected.

Caution

The 6.1826.xxx pump tubings consist of PVC or PP and therefore must not be used for rinsing with solutions containing acetone. In this case, use other pump tubings or use another pump for rinsing.

5.12.2 Maintenance

5.12.2.1 Pump tubing

The pump tubing used in the peristaltic pump is a consumable whose service life is restricted.

The LFL pump tubing with 3 stoppers is stretched in the tubing cartridge in such a way that it comes to rest between two stoppers. This results in two possible positions for the tubing cartridge. If the pump tubing should exhibit clear signs of wear, then this can be stretched a second time, in the respective alternate position.

Therefore replace the pump tubing periodically, or when used permanently approx. every 4 weeks .

Selecting the pump tubing

The pump tubing differs in material, diameter and hence also pumping capacity. Depending on the application, different pump tubings are used.

The following table provides information on the properties and use of the pump tubing:

Table 2 Pump tubing

Order number	Name	Material	Inner diameter	Use
6.1826.020	Pump tubing (blue/ blue), 2-stopper	PVC (Tygon ST)	1.65 mm	Pump tubing for online IC instruments and automation in voltammetry
6.1826.310	Pump tubing LFL (orange/green), 3-stopper	PVC (Tygon)	0.38 mm	Pump tubing for bromate determination using the triiodide method.
6.1826.320	Pump tubing LFL (orange/yellow), 3-stopper	PVC (Tygon)	0.48 mm	For suppressor solutions, acceptor solutions for inline dialysis and for inline ultrafiltration.

Order number	Name	Material	Inner diameter	Use
6.1826.330	Pump tubing LFL (orange/white), 3-stopper	PVC (Tygon)	0.64 mm	No special applications.
6.1826.340	Pump tubing LFL (black/black), 3-stopper	PVC (Tygon)	0.76 mm	For the sample solution in inline dialysis.
6.1826.360	Pump tubing LFL (white/white), 3-stopper	PVC (Tygon)	1.02 mm	For sample transfer.
6.1826.380	Pump tubing LFL (gray/gray), 3-stopper	PVC (Tygon)	1.25 mm	For inline sample dilution.
6.1826.390	Pump tubing LFL (yellow/yellow), 3-stopper	PVC (Tygon)	1.37 mm	For the sample solution in inline ultrafiltration.

5.12.2.2 Pump tubing connection with filter

The 6.2821.130 filters *(48-**2**)* should be changed every 3 months, more frequently at higher backpressure.

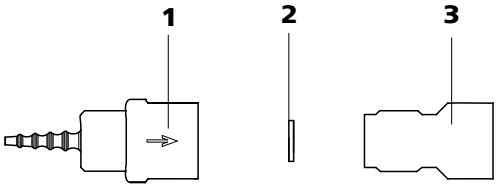


Figure 48 Pump tubing connection – Changing the filter

1 Tubing olive

2 Filter 6.2821.130
Packaging contains 10 items.

3 Filter housing

Replacing the filter

1 Unscrewing filter screw

- Screw the filter screw *(48-**3**)* out of the tubing olive *(48-**1**)* with the aid of two 6.2621.000 adjustable wrenches.

2 Replacing the filter

- Remove the old filter *(48-**2**)* with tweezers.
- Place the new filter *(48-**2**)* flat in the tubing olive *(48-**1**)* with tweezers.

3 Mounting filter screw

- Screw the filter screw *(48-**3**)* back into the tubing olive *(48-**1**)* and tighten by hand. Then additionally tighten with two 6.2621.000 adjustable wrenches.

5.13 Metrohm CO_2 suppressor (MCS)

5.13.1 Replacing the CO_2 adsorption cartridge

The CO_2 adsorption cartridge 6.2837.000 *(33-**4**)* must be replaced regularly. This is because of blockages and losses in capacity.

Blockage

Moisture can block the CO_2 adsorption cartridge. This is revealed by a change in color of the cartridge material (the orange part becomes colorless). As the air flow is reduced, the vacuum becomes lower. To protect the CO_2 adsorption cartridge, an H_2O adsorption cartridge *(33-**7**)* is installed upstream. Regular regeneration *(see Chapter 5.13.2, page 101)* of the H_2O adsorption cartridge extends the service life of the CO_2 adsorption cartridge.

Capacity loss

The adsorption capacity of the CO_2 adsorption cartridge is limited. Depending on the period of operation and laboratory environment, the adsorption capacity will diminish over time. This is manifested in a rising baseline (as more CO_2 reaches the detector).

5.13.2 Regenerating the H_2O adsorption cartridge

The function of the H_2O adsorption cartridge is to protect the CO_2 adsorption cartridge against moisture. The service life of the H_2O adsorption cartridge depends on the moisture content of the ambient air. Moisture reduces the capacity of the H_2O adsorption cartridge (which can be observed by a change in color). Before the color changes in the entire filling material (from orange to colorless, with Fluka Order No. 94098), the H_2O adsorption cartridge should be regenerated (see information sheet). The filling material is replaced during regeneration:

1 Allow material to dry loose (not in cartridge) at 140 °C overnight and refill. Or dispose of the old material, and fill with new material.

2 Cover the packed material with wadding.

5.14 Conductivity detector

5.14.1 Maintenance

Caution

The conductivity detector must not be opened!

Warning

When rinsing the detector, the pressure must not exceed **5 MPa**. In order to ensure this, the maximum pressure of the high pressure pump must be set to **5 MPa** in MagIC Net.

If the conductivity detector is blocked, you should first of all check whether the blockage results from the capillary ends being pressed together too firmly. In this case, shorten the detector input capillary *(34-**3**)* or the detector output capillary *(35-**2**)* by several millimeters.

If this does not help, the conductivity detector can be rinsed against the normal flow direction. For this, connect the high pressure pump to the detector output capillary *(35-**2**)* and rinse - **the pressure may not exceed 5 MPa**.

5.15 Separation column

5.15.1 Separating efficiency

Which analysis quality can be attained, depends to a great extent on the separating efficiency of the separation column used. The separating efficiency of the selected separation column must be sufficient for the analysis problems present. If difficulties occur, you should always first check the quality of the separation column by recording a standard chromatogram.

You can find detailed information on the separation columns available from Metrohm in the information sheet provided along with your separation column, in the **Metrohm IC-Column Program** (available via your Metrohm agent) or in the Internet at *http://www.metrohm.com* in the product area Ion chromatography. You can request free information on special IC applications in the corresponding "**Application Bulletins**" or "**Application Notes**", which are available in the Internet at *http://www.metrohm.com* in the Applications area or via the Metrohm agent responsible.

5.15.2 Protection

To protect the separation column against foreign particles, which can affect the separating efficiency, we recommend that both the eluent and the samples undergo a microfiltration (filter 0.45 µm) before being aspirated via the 6.2821.090 aspiration filter.

The use of guard columns *(see Chapter 3.21, page 67)* serves for protecting the actual separation columns and increases their service life considerably. Information regarding which guard column is suitable for your separation column can be seen in the **Metrohm IC Column Program** (which is available from your Metrohm agent), the information sheet provided along with your separation column, the product information on the separation column at *http://www.metrohm.com* (product area Ion Chromatography) or can be obtained directly from your agent.

The pulsation damper *(see Chapter 3.12, page 43)* must be installed in order to protect the column material from pressure concussion caused by injection.

5.15.3 Storage

Always store the separation columns sealed and filled according to the data of the column manufacturer when not using them.

5.15.4 Regeneration

Note

The regeneration is considered as the last measure, and not to be carried out regularly.

If the separating properties of the column have deteriorated, the column can be regenerated according to the specifications of the column manufacturer. In the case of separation columns available from Metrohm, the specification for regeneration can be found on the information sheet provided along with each column.

5.16 Quality Management and validation with Metrohm

Quality Management

Metrohm offers you comprehensive support in implementing quality management measures for instruments and software. Further information on this can be found in the brochure **«Quality Management with Metrohm»** available from your local Metrohm agent.

Validation

Please contact your local Metrohm agent for support in validating instruments and software. Here you can also obtain validation documentation to provide help for carrying out the **Installation Qualification** (IQ) and the **Operational Qualification** (OQ). IQ and OQ are also offered as a service by the Metrohm agents. In addition, various application bulletins are also available on the subject, which also contain **Standard Operating Procedures** (SOP) for testing analytical measuring instruments for reproducibility and correctness.

Maintenance

Electronic and mechanical functional groups in Metrohm instruments can and should be checked as part of regular maintenance by specialist personnel from Metrohm. Please ask your local Metrohm agent regarding the precise terms and conditions involved in concluding a corresponding maintenance agreement.

Note

You can find information on the subjects of quality management, validation and maintenance as well as an overview of the documents currently available at *www.metrohm.com/com/* under **Support**.

6 Troubleshooting

6.1 Problems and their solutions

Problem	Cause	Remedy
Marked drop in pressure	*Leak in the system.*	Check and seal connections *(see Chapter 3.5, page 19)*.
Marked rise in pressure	*6.2821.120 inline filter blocked.*	Replace 6.2821.130 filter *(see Chapter 5.6, page 88)*.
	MSM-HC – blocked.	▪ Regenerate the MSM-HC *(see Chapter 5.11.3.1, page 93)*. Note: 6.2821.180 pump tubing connection with filter must be used .
	Conductivity detector blocked.	▪ Shorten capillary ends by several mm *(see Chapter 5.14.1, Page 102)*. ▪ Rinse detector against the normal flow direction *(see Chapter 5.14.1, Page 102)*.
	Guard column – blocked.	Replace guard column *(see Chapter 3.21, page 67)*.
	Separation column – blocked.	▪ Regenerate separation column *(see Chapter 5.15.4, page 103)*. ▪ Replace separation column *(see "Connecting and rinsing the separation column", page 70)*. Note: Samples should always be microfiltered *(see Chapter 5.7, page 90)*.
	Injection valve – valve blocked.	Have the valve cleaned (by Metrohm service technicians).
Drift of the baseline	*Thermal equilibrium not yet attained.*	Condition *(see Chapter 3.15, page 49)* instrument with the column thermostat switched on .
	Leak in the system.	Check and seal connections *(see Chapter 3.5, page 19)*.

Problem	Cause	Remedy
	Eluent – Evaporation of the organic solvent in the eluent.	Check the eluent bottle attachment *(see Figure 14, page 34)*.
Peak areas lower than expected	*Sample – Leak in the sample path.*	Check the sample path.
	Sample – Blockage in the sample path.	Check the sample path.
	Sample – Sample loop not (completely) filled.	Prolong the sample transfer time.
	Sample – Gas bubbles in the sample.	Use the sample degasser *(see Chapter 3.13, page 45)* (if available).
	MCS – not connected.	Connect the MCS.
Peristaltic pump – insufficient or no delivery rate	*Peristaltic pump – contact pressure too weak.*	Correctly set contact pressure *(see "Set flow rate", page 59)*.
	Peristaltic pump – filter blocked.	Replace the filter *(see Chapter 5.12.2.2, page 100)*.
	Peristaltic pump – pump tubing defective.	Replace pump tubing *(see Chapter 5.12.2.1, page 99)*.
Very noisy baseline	*High pressure pump – contaminated pump valves.*	Clean pump valves *(see Chapter 5.5.2, page 78)*.
	Eluent – Leak in the eluent path.	Check the eluent path.
	Eluent – Blockage in the eluent path.	Check the eluent path.
	High pressure pump – defective piston seals.	Replace piston seals *(see Chapter 5.5.2, page 78)*.
	MCS – CO_2 adsorption cartridge exhausted.	Replace CO_2 adsorption cartridge *(see Chapter 5.13.1, page 101)*.
	Pulsation damper not connected.	Connect the pulsation damper *(see Chapter 3.12, page 43)*.
	Pulsation damper not connected.	Connect pulsation damper *(see Chapter 3.12, page 43)*.

Problem	Cause	Remedy
	MCS – vacuum pump defective.	Contact the Metrohm Service.
Background conductivity too high	*MSM-HC – not connected.*	Connecting the MSM-HC *(see Chapter 3.16, page 52)*.
	MCS – not connected.	Connect the MCS.
	Incorrect eluent.	Change eluent *(see Chapter 5.4.2.3, page 77)*.
	MSM-HC – regeneration or rinsing solution flow problems.	Check the flow of the regeneration and rinsing solution *(see Chapter 3.16.2, page 52)*.
Data of the separation column cannot be read.	*Column chip contaminated.*	Clean contact surfaces of the column chip (with alcohol).
	Column chip defective.	1. Save column configuration in MagIC Net. 2. Notify Metrohm Service.
Individual peaks greater than expected	*Sample – Carry-over of the samples from previous measurement.*	Rinse system longer between two samples.
MSM-HC – No (or insufficient) pumping of regeneration or rinsing solution	*Leak in the system.*	Check connections.
	Peristaltic pump – contact pressure too weak.	Correctly set contact pressure .
	Peristaltic pump – filter blocked .	Replace the filter .
	MSM-HC – backpressure too high.	Clean the MSM-HC *(see Chapter 5.11.3.2, page 94)* or replace parts *(see Chapter 5.11.3.3, page 97)*.
	Peristaltic pump – pump tubing defective.	Replace pump tubing .
Poor reproducibility of the retention times	*Eluent – Leak in the eluent path.*	Check the eluent path.
	Eluent – Blockage in the eluent path.	Check the eluent path.
Chromatograms have poor resolution	*Separation column – diminished separating efficiency.*	▪ Regenerate separation column *(see Chapter 5.15.4, page 103)*.

Problem	Cause	Remedy
		▪ Replace separation column *(see "Connecting and rinsing the separation column", page 70)*.
Conductivity detector is not recognized in the software	*No connection.*	▪ Check the cable connection *(35-**1**)*. ▪ Turn the instrument off and on again (after 15 seconds).
Extreme spread of the peaks in the chromatogram. Splitting (dual peaks)	*Connections – dead volume in the system.*	Check the connections *(see Chapter 3.5, page 19)* (use PEEK capillaries with an internal diameter of 0.25 mm between the injection valve and detector).
	Guard column – diminished performance.	▪ Replace guard column *(see Chapter 3.21, page 67)*.
	Separation column – dead volume at column head.	▪ Install separation column in reverse flow direction (if permitted by the information sheet). ▪ Replace separation column *(see "Connecting and rinsing the separation column", page 70)*.
Greater rise in the baseline	*MSM-HC – reduced capacity.*	Regenerate the MSM-HC *(see Chapter 5.11.3.1, page 93)*.
Precision problems - significant scattering of the measured values	*Sample – Gas bubbles in the sample.*	Use sample degasser *(see Chapter 3.13, page 45)*.
	Injection valve – sample loop.	Check installation of the sample loop *(see Chapter 3.14.1, page 46)*.
	Sample – Rinsing volume too low.	Prolong the rinsing time *(see Chapter 5.8, page 90)*.
	Injection valve – defective.	Request Metrohm Service.
	MCS – vacuum too low.	▪ Check connectors. If they are ok: ▪ Contact the Metrohm Service.
Unexpected change to the retention times in the chromatograms	*Separation column – diminished separating efficiency.*	▪ Regenerate separation column *(see Chapter 5.15.4, page 103)*. ▪ Replace separation column *(see "Connecting and rinsing the separation column", page 70)*.

Problem	Cause	Remedy
	Eluent – Gas bubbles in the eluent.	Check connections of the eluent degasser *(see Chapter 3.9, page 36)*.
	High pressure pump – defective.	Request Metrohm Service.
Vacuum is not being built	*Eluent Degasser – Connector **Vacuum** on the rear of the instrument not (tightly) sealed.*	▪ Seal the connector **Vacuum** tightly with a 6.144.6040 threaded stopper. or when using an 872 Extension Module: ▪ Connect an FEP tubing between the IC instrument and the Extension Module and tighten both clamping screws until they seal.

7 Technical specifications

7.1 Reference conditions

The technical data listed in this Chapter refers to the following reference conditions:

Ambient temperature	+25 °C (± 3 °C)
Instrument status	> 40 minutes in operation (equilibrated)

7.2 Instrument

IC system	▪ Metal-free IC system ▪ Compact system with modular design ▪ Up to two complete chromatographic systems in one housing
Material	Painted polyurethane hard foam without CFCs, fire class V0
Operating pressure range	▪ 0…50 MPa (500 bar) high pressure pump ▪ 0…35 MPa (350 bar) standard-PEEK system
Intelligent components	iPump, iDetector, iColumn, MagIC Net

7.3 Leak sensor

Type	Electronic, no calibration necessary

7.4 Ambient conditions

Operation	
Ambient temperature	+5…+45 °C
Humidity	20…80 % relative humidity
Storage	
Ambient temperature	–20…+70 °C
Transport	
Ambient temperature	–40…+70 °C

7.5 Housing

Dimensions	
Width	365 mm
Height	642 mm
Depth	380 mm
Material of base tray, housing and bottle holder	Polyurethane hard foam (PUR) with flame retardation for fire class V0, CFC-free, painted
Operating elements	
Indicators	LED for power display
On/Off switch	On the rear panel of the instrument

7.6 Eluent degasser

Material	fluoropolymer
Resistance to solvents	No restriction (apart from PFC)
Build-up time for the vacuum	< 60 s

7.7 High pressure pump

Type

- Serial dual-piston pump
- Intelligent pump head recognition
- Chemically inert
- Metal-free pump heads
- Materials in contact with eluent: PEEK, ZrO_2, PTFE/PE
- Self-optimizing flow and pressure

Flow rate	
Adjustable flow range	0.001…20.0 mL/min
Flow increment	1 µL/min
Reproducibility of the eluent flow	< 0.1 % deviation

Pressure range

Pump	0…50.0 MPa (0…500 bar)
Pump head	0…35.0 MPa (0…350 bar) (applies for the standard PEEK pump head)
Residual pulsation	< 1 %

Safety shutdown

Function	Automatic shutdown upon reaching the pressure limit values
Maximum pressure limit	▪ Adjustable from 0.1…50 MPa (1…500 bar) ▪ The pump is automatically shut down at the first piston stroke above the maximum limit value
Minimum pressure limit	▪ Adjustable from 0…49 MPa (0…490 bar) ▪ The shutdown mechanism is inactive at 0 MPa ▪ The shutdown mechanism only becomes active 2 minutes after system start ▪ The pump is automatically shut down after 3 piston strokes below the minimum pressure limit
Gradient capacity	Isocratic or gradient (extendable to quaternary)
Profile	Step, linear, convex and concave
Resolution	< 1 nL/min flow increments

7.8 Sample degasser

Material	fluoropolymer
Resistance to solvents	No restriction (apart from PFC)
Build-up time for the vacuum	< 60 s

7.9 Injection valve

Actuator time	typ.100 ms
Max. operating pressure	35 MPa (350 bar)
Material	PEEK

7.10 Column thermostat

Type	Peltier technique thermostat for two intelligent separation columns
Adjustable temperature range	0…+ 80 °C, in increments of 0.1 °C
Heating	Ambient temperature +50 °C
Cooling	Ambient temperature –20 °C
Temperature reproducibility	± 0.2 °C
Stability	< 0.05 °C
Heating up time	< 30 minutes from 20 to 50 °C
Cooling time	< 40 minutes from 50 to 20 °C

7.11 High Capacity Metrohm Suppressor Module (MSM-HC)

Resistance to solvents	No restriction
Switching duration	typ.100 ms
Operating pressure	2.5 MPa (25 bar), valve function prevents damage at overpressure

7.12 Peristaltic pump

Type	2-channel peristaltic pump
Rotating direction	Counterclockwise/Clockwise rotation
Rotational speed	0…42 rpm in 7 stages at 6 rpm.
Pumping properties	0.3 mL/min at 18 rpm; with 6.1826.320 standard pump tubing.
Material of pump tubings	recommended: Tygon Long Flex Life

7.13 Metrohm CO_2 suppressor (MCS)

Material	fluoropolymer
Resistance to solvents	No restriction (apart from PFC)
Vacuum	
Working range	Microprocessor-controlled / stabilized
Build-up time after start	< 30 s
Capillary volume	400 µL
Recommended flow range	0.1…1.0 mL

7.14 Conductivity measuring system

Type	▪ Microprocessor-controlled Digital Signal Processing (DSP technology) ▪ Intelligent detector with 6 reference chromatograms
Measuring range	0…15000 µS/cm single range
Noise	< 0.1 nS at 1 µS/cm
Deviations from the linearity	< 1 % for conductivity values greater than 1…16 µS/cm (typical for analyses with sequential suppression)
Drift	< 0.2 nS/cm per hour
Measuring rate	10 measurements per second for optimum results without filtering
Resolution	0.0047 nS/cm
Baseline	Noise < 0.2 nS/cm typical for sequential suppression
Conductivity detector	
Cell volume	0.8 µL
Cell constant	▪ Individual calibration data saved in the detector ▪ adjustable range: 13.0…21.0 /cm
Electrodes	Ring-shaped electrodes made from stainless steel
Materials in contact with eluent	Chemically inert PCTFE
Maximum operating pressure	5.0 MPa (50 bar)

Cell temperature	20…50 °C in increments of 5 °C
Temperature stability	< 0.001 °C
Temperature compensation	0…5 %/K adjustable, default 2.3 %/K
Heating up time	< 30 minutes (40 °C)

7.15 Mains connection

Required voltage	100…240 V ± 10 % (auto-sensing)
Required frequency	50…60 Hz ± 3 (auto-sensing)
Power consumption	▪ 65 W for typical analysis application ▪ 25 W standby (detector to 40 °C)
Power supply unit	▪ Up to 300 W maximum, electronically monitored ▪ internal fuse 3.15 A

7.16 Interfaces

USB

Input	1 USB upstream, type B (for connection to the PC)
Output	2 USB downstream, type A

MSB 2 MSB Mini Din 8-pin (female) (for Dosino, stirrer, remote lines, ...)

Caution

When connecting an instrument to the MSB connector you **must** switch off the 850 Professional IC .

Detector	2 DSUB-15-pin high density (female)
Column recognition	3 (including 2 in the column thermostat *(see Chapter 3.15, page 49)*)
Leak sensor	1 jack plug
Further connections	▪ 1 DSUB 15-pin (female)

7.17 Safety specification

Design / Test

- EN/IEC/UL 61010-1
- CSA-C22.2 No. 61010-1
- Degree of protection IP20
- Protection class I

7.18 Electromagnetic compatibility (EMC)

Emission

- EN/IEC 61326-1
- EEN 55022 / CISPR 22
- EN/IEC 61000-6-3
- EN/IEC 61000-3-2
- EN/IEC 61000-3-3

Immunity

- EN/IEC 61326-1
- EN/IEC 61000-4-2
- EN/IEC 61000-4-3
- EN/IEC 61000-4-4
- EN/IEC 61000-4-5
- EN/IEC 61000-4-6
- EN/IEC 61000-4-8
- EN/IEC 61000-4-11
- EN/IEC 61000-4-14
- NAMUR: 2006

7.19 Weight

1.850.2220	33.1 kg (without accessories)
1.850.9010 (conductivity detector)	2.3 kg (with accessories)
Transport carriage (rollers and handle)	1.8 kg

8 Conformity and warranty

8.1 Declaration of Conformity

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity

850 Professional IC

The 850 Professional IC is an intelligent instrument for ion chromatography analysis.

This instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility

Emission:	EN/IEC 61326-1: 2006, EN 55011 / CISPR 11: 2003, EN/IEC 61000-6-3: 2006, EN/IEC 61000-3-2: 2006, EN/IEC 61000-3-3: 2005
Immunity:	EN/IEC 61326-1: 2006, EN/IEC 61000-6-1: 2007, EN/IEC 61000-4-2: 2001, EN/IEC 61000-4-3: 2006, EN/IEC 61000-4-4: 2004, EN/IEC 61000-4-5: 2001, EN/IEC 61000-4-6: 2001, EN/IEC 61000-4-8: 2001, EN/IEC 61000-4-11: 2004, EN/IEC 61000-4-14: 2004, NAMUR: 2004

Safety specifications

EN/IEC 61010-1: 2001, UL 61010-1: 2004,
CSA-C22.2 No. 61010-1: 2004, protection class I

It has also been certified by ElectroSuisse, a member of the International Certification Body (CB/IEC).

CE

This instrument meets the requirements of the CE mark as contained in the EU directives 2006/95/EC (LVD), 2004/108/EC (EMC). It fulfils the following specifications:

EN 61326-1	Electrical equipment for measurement, control and laboratory use – EMC requirements

EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use

This instrument meets the requirements of the ETL Listed Mark for the North American market. It conforms to the electrical safety standards UL 61010-1 and CSA-C22.2 No. 61010-1. This product is listed in Intertek's Directory of Listed Products.

Manufacturer Metrohm Ltd., CH-9101 Herisau/Switzerland

Metrohm Ltd. is holder of the SQS-certificate ISO 9001:2000 Quality management system for development, production and sales of instruments and accessories for ion analysis.

Herisau, 27 October, 2008

D. Strohm
Vice President, Head of R&D

Ch. Buchmann
Vice President, Head of Production
Responsible for Quality Assurance

8.2 Quality Management Principles

Metrohm Ltd. holds the ISO 9001:2000 Certificate, registration number 10872-02, issued by SQS (Swiss Association for Quality and Management Systems). Internal and external audits are carried out periodically to assure that the standards defined by Metrohm's QM Manual are maintained.

The steps involved in the design, manufacture and servicing of instruments are fully documented and the resulting reports are archived for ten years. The development of software for PCs and instruments is also duly documented and the documents and source codes are archived. Both remain the possession of Metrohm. A non-disclosure agreement may be asked to be provided by those requiring access to them.

The implementation of the ISO 9001:2000 quality management system is described in Metrohm's QM Manual, which comprises detailed instructions on the following fields of activity:

Instrument development

The organization of the instrument design, its planning and the intermediate controls are fully documented and traceable. Laboratory testing accompanies all phases of instrument development.

Software development

Software development occurs in terms of the software life cycle. Tests are performed to detect programming errors and to assess the program's functionality in a laboratory environment.

Components

All components used in the Metrohm instruments have to satisfy the quality standards that are defined and implemented for our products. Suppliers of components are audited by Metrohm as the need arises.

Manufacture

The measures put into practice in the production of our instruments guarantee a constant quality standard. Production planning and manufacturing procedures, maintenance of production means and testing of components, intermediate and finished products are prescribed.

Customer support and service

Customer support involves all phases of instrument acquisition and use by the customer, i.e. consulting to define the adequate equipment for the analytical problem at hand, delivery of the equipment, user manuals, training, after-sales service and processing of customer complaints. The Metrohm service organization is equipped to support customers in implementing standards such as GLP, GMP, ISO 900X, in performing Operational Qualification and Performance Verification of the system components or in carrying out the System Validation for the quantitative determination of a substance in a given matrix.

8.3 Warranty (guarantee)

Metrohm guarantees that the deliveries and services it provides are free from material, design or manufacturing errors. The warranty period is 36 months from the day of delivery; for day and night operation it is 18 months. The warranty remains valid on condition that the service is provided by an authorized Metrohm service organization.

Glass breakage is excluded from the warranty for electrodes and other glassware. The warranty for the accuracy corresponds to the technical specifications given in this manual. For components from third parties that make up a considerable part of our instrument, the manufacturer's warranty provisions apply. Warranty claims cannot be pursued if the Customer has not complied with the obligations to make payment on time.

During the warranty period Metrohm undertakes, at its own choice, to either repair at its own premises, free of charge, any instruments that can be shown to be faulty or to replace them. Transport costs are to the Customer's account.

Faults arising from circumstances that are not the responsibility of Metrohm, such as improper storage or improper use, etc. are expressly excluded from the warranty.

9 Accessories

Caution

Subject to change without notice!

9.1 Scope of delivery

2.850.2240 850 Professional IC – Anion – MSM-HC – MCS – Gradient

Qty.	Order no.	Description
1	1.850.2240	**850 Professional IC Anion – MSM-HC – MCS – Gradient**
1	6.2122.0x0	**Mains cable with C13 line socket IEC-60320-C13** Cable plug according to customer requirements. Switzerland: Type SEV 12 6.2122.020 Germany, …: Type CEE(7), VII 6.2122.040 USA, …: Type NEMA/ASA 6.2122.070
1	1.850.9010	**IC Detector MF**
2	6.1602.150	**Bottle neck attachment / GL 45 - 3 x UNF 10/32** For connecting capillary tubing 1/16 in. (=1.6 mm). Used for MSM auxiliary solutions and in inline dialysis. Material: Plastic
2	6.1602.160	**Eluent bottle attachment GL 45** For eluent bottles; with connections for drying tube and aspiration tubing. Opening ground joint: A-14/15

Qty.	Order no.	Description
2	6.1608.020	**Glass bottle / 1000 mL / GL 45**

Bottle for auxiliary solutions

Width (mm):	96
Height (mm):	223
Volume (mL):	1000

Qty.	Order no.	Description
2	6.1608.070	**Eluent bottle / 2 L / GL 45**

Material:	Clear glass
Height (mm):	262
Volume (mL):	2000

Qty.	Order no.	Description
2	6.1609.000	**Adsorbing tube, large and bent**

For filling with adsorber material.

Material:	Glass
Height (mm):	129
Inner diameter (mm):	32
SGJ size:	B-14/15

Qty.	Order no.	Description
1	6.1803.020	**PTFE capillary 0.97 mm i.d. / 5 m**

For all IC instruments

Material:	PTFE
Outer diameter (mm):	1.57
Inner diameter (mm):	0.97
Length (m):	5

Qty.	Order no.	Description
1	**6.1803.040**	**PTFE capillary 0.5 mm i.d. / 1 m**

Capillary for sample handling in IC.

Material:	PTFE
Outer diameter (inches):	1/16
Inner diameter (mm):	0.5
Length (m):	1

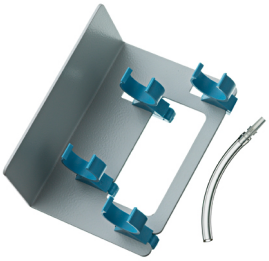
Qty.	Order no.	Description
1	**6.1807.010**	**Y-connector for tubing 6-9 mm i.d.**

Connector for waste tubing

Qty.	Order no.	Description
1	**6.1815.010**	**Spiral band 0.5 m**

For holding together different cables or tubing.

Length (m):	0.5

Qty.	Order no.	Description	
2	6.1816.020	**Silicone tubing 6 mm i.d., 1 m** For waste tubing. Material: Silicone rubber Outer diameter (mm): 9 Inner diameter (mm): 6 Length (m): 1	
2	6.1826.320	**Pump tubing LFL (orange/yellow), 3 stoppers** For suppressor solutions, acceptor solution in Inline Dialysis and for Inline Ultrafiltration	
2	6.2023.020	**Clip for SGJ 14/15** Clip for SGJ 14/16 Material: POM	
1	6.2057.080	**Adsorption cartridge holder (ProfIC)** Holder to install adsorption cartridges in Professional IC Instruments	

Qty.	Order no.	Description	
1	6.2151.020	**Cable USB A - USB B 1.8 m** USB connecting cable Length (m): 1.8	
1	6.2322.010	**PRIMUS multi anion standard solution: Promo**	
1	6.2617.010	**Tool for piston seal** For removing and assembling the piston seal for all standard pump heads	
2	6.2621.000	**Adjustable wrench** Max. opening: 20 mm. For IC instruments Length (mm): 150	
1	6.2621.030	**Hexagon key 4 mm** Length (mm): 73	

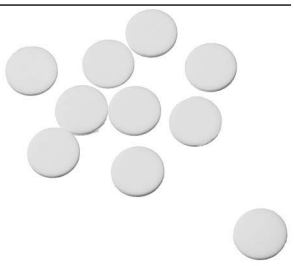
Qty.	Order no.	Description	
1	**6.2621.050**	**1/4 in. wrench** For 1/4 in. screws. For IC instruments Length (mm): 73	
1	**6.2621.080**	**Capillary cutter** For plastic capillaries. Used with IC instruments Length (mm): 118	
1	**6.2621.100**	**Hexagon key 3 mm** Hexagon key 3 mm for IC Sample Processors Length (mm): 73	

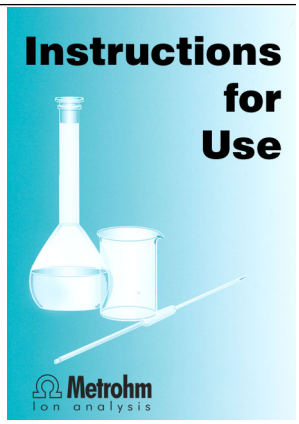
Qty.	Order no.	Description	
1	6.2626.000	**Drain nozzle (ProfIC)** Drain nozzle for Professional IC instruments, for mounting on front panel	
2	6.2739.000	**Wrench** For tightening connectors Length (mm): 68	
1	6.2743.080	**Stopper for overflow (ProfIC), 5 pieces** For Professional IC instruments	
1	6.2744.014	**Pressure screw 2x** With UNF 10/32 connection. For the connection of PEEK capillaries Material: PEEK Length (mm): 26	

Qty.	Order no.	Description	
2	6.2744.020	**Luer/UNF coupling** For IC instruments Material: PEEK Length (mm): 19	
1	6.2744.034	**Coupling nozzle - UNF 10/32, 2 pieces** Connection pressure screw and pump tubing. 2 pieces. For IC instruments with peristaltic pumps	
3	6.2744.040	**2 x UNF 10/32 coupling** For connecting 1/16 in. capillaries. For IC instruments Material: PEEK Length (mm): 24	

Qty.	Order no.	Description
3	6.2744.070	**Pressure screw short** Short version. With UNF 10/32 connection. 5 pieces. For the connection of PEEK capillaries Material: PEEK Length (mm): 21
2	6.2744.090	**Pressure screw long** Long version. With UNF 10/32 connection. 2 pieces. For the connection of PEEK capillaries (MCS and Sample degasser) Material: PEEK
2	6.2744.180	**Pump tubing connector with security lock and filter** For the connection of a pump tubing and a capillary with built-in filter Material: PEEK
2	6.2744.210	**Tubing adaptor for aspiration filter (ProfIC)** For Professional IC instruments

Qty.	Order no.	Description
2	6.2816.020	**Syringe 10 mL with Luer connection** For various applications in IC and VA Material: PP Length (mm): 102 Volume (mL): 10
1	6.2816.040	**Purging needle** With PTFE tubing and Luer connection. For syringes. For aspirating eluents.
2	6.2821.090	**Aspiration filter** Pore size 20 µm, set of 5 pieces. For 6.1834.000 Aspiration tubing and 6.1821.040 and 6.1821.050 Filter tubes. Material: PE Outer diameter (mm): 9.5 Length (mm): 35.5
2	6.2821.130	**Spare filter for inline filter** Spare filters for inline filter.



Qty.	Order no.	Description	
1	6.2837.000	**CO_2 adsorber cartridge** Adsorber cartridge for purifying the air.	
2	6.2837.010	**H_2O adsorption cartridge** To CO_2 Suppressor. Water adsorption cartridge for the aspirated air.	
1	8.850.8027EN	**Manual for 850 Professional IC, 2.850.2240 – Anion – MSM-HC – MCS – Gradient, English**	

9.2 Optional accessories

2.850.2240 850 Professional IC – Anion – MSM-HC – MCS – Gradient

Order no.	Description
6.2617.040	**Tool for piston seal, macro**
	For removing and assembling the piston seal for all macro pump heads
6.2741.040	**PE/PTFE piston seal, macro**
	For all macro pump heads
6.2824.130	**Macro pump head PEEK**
	Macro pump head for intelligente IC instruments, flow range 0.1...20 mL/min, maximum pressure 12.5 MPa. Material: PEEK (metal-free)

6.6059.112	**MagIC Net™ 1.1 Professional CD: 1 license**
	Professional PC program for controlling intelligent Professional IC systems, Compact IC instruments and their peripherals such as Professional Sample Processors, 800 Dosino, 771 Compact Interface, etc. The software permits control, data acquisition, evaluation and monitoring as well as report generation for ion chromatographic analyses. MagIC Net™ comprises the following features: graphic user interface for routine operations, extensive database programs, method development, configuration and manual system control, highly flexible user administration, efficient database operations, extensive data export functions, individually configurable report generator, control and monitoring of all system components and the chromatographic results. MagIC Net™ complies with FDA regulation 21 CFR part 11 as well as GLP. Dialog languages: German, English, French, Chinese, Korean, Japanese and more. 1 license.

6.6059.113	**MagIC Net™ 1.1 Multi CD: 3 licenses**
	Professional PC program for controlling intelligent Professional IC systems, Compact IC instruments and their peripherals such as Professional Sample Processors, 800 Dosino, 771 Compact Interface, etc. The software permits control, data acquisition, evaluation and monitoring as well as report generation for ion chromatographic analyses. MagIC Net™ comprises the following features: graphic user interface for routine operations, extensive database programs, method development, configuration and manual system control; highly flexible user administration, efficient database operations, extensive data export functions, individually configurable report generator, control and monitoring of all system components and the chromatographic results. MagIC Net™ complies with FDA regulation 21 CFR part 11 as well as GLP. Dialog languages: German, English,

Order no.	Description
	French, Chinese, Korean, Japanese and more. Client-Server version with 3 licenses.
6.9988.503	**Validation Documentation for 850 (English / German) – CD** 

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