Eco IC



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Eco IC 2.925.0020

Manual

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This documentation has been prepared with great care. However, errors can never be entirely ruled out. Please send comments regarding possible errors to the address above.

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1 Introduction

1 Introduction

1.1 Instrument description

The **Eco IC** is an intelligent, very compact ion chromatograph for education and routine analysis. The instrument is distinguished by:

- the **intelligence** of its components, which are able to monitor, optimize and document all functions.
- its compact design.
- its transparency. All components are easily accessible and located for simple visibility.
- its **safety**. Chemicals and electronics are separated.
- its environmental compatibility.
- its low noise emission.

The instrument is operated with the **MagIC Net Basic** software. It is connected to a PC on which MagIC Net is installed via a USB connection. The software detects the instrument automatically and checks its functional readiness. MagIC Net controls and monitors the instrument, evaluates the measured data and manages it in a database. The operation of MagIC Net is described in the "Tutorial for MagIC Net" as well as in the online help.

The instrument contains the following components:

High-pressure pump

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

Inline filter

Inline filters protect the separation column reliably from potential contamination from the eluent. The filter pads with 2 μ m pore size can be replaced quickly and easily. They remove particles from the solutions, such as bacteria and algae.

Injection valve

The injection valve connects the eluent path to the sample path. By a quick and precise switching of the valve, a quantity of sample solution defined by the size of the sample loop is injected and flushed to the separation column with the eluent.

1.2 Intended use

Metrohm Suppressor Module (MSM)

The chemical suppressor MSM consists of the suppressor drive, a rotor and, where applicable, an adapter. The suppressor drive gives you the flexibility to use different rotors according to the principle "one drive — many rotors". Suppression rotors with different capacities and construction or a rotor for sample preparation (SPM Rotor) are readily interchangeable with appropriate adapters as needed. The rotors are not included in the instrument's scope of delivery. The rotor required for the application and any adapter that is required must be ordered separately.

Peristaltic pump

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

Conductivity detector

The conductivity detector continuously measures the conductivity of the liquid passing through and outputs 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 separates different components according to their interactions with the column. Metrohm separation columns are equipped with a chip where their technical specifications and history (start-up, operating hours, injections etc) are stored.

1.2 Intended use

The **Eco IC** is used for the determination of anions or polar substances with chemical suppression using ion chromatography. It can also be used as needed for the determination of anions without chemical suppression or for cations.

This instrument is suitable for processing chemicals and flammable samples. Therefore, the use of the Eco IC requires the user to have basic knowledge and experience in handling toxic and caustic substances. Knowledge regarding the application of fire prevention measures prescribed for laboratories is also mandatory.

1 Introduction

1.3 Safety instructions

1.3.1 General notes on safety



WARNING

Operate this instrument only according to the information contained in this documentation.

This instrument 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.

1.3.2 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.

Supply voltage



WARNING

An incorrect supply voltage can damage the instrument.

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

1.3 Safety instructions

Protection against electrostatic charges



WARNING

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

Do not fail to pull the power cord out of the power socket before you set up or disconnect electrical plug connections at the rear of the instrument.

The device is to be operated only with the door closed.

1.3.3 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.

1.3.4 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. fume cupboard).
- Keep all sources of flame far from the workplace.
- Clean up spilled liquids and solids immediately.
- Follow the safety instructions of the chemical manufacturer.

1 Introduction

1.3.5 Recycling and disposal



Properly dispose of chemicals and of the product to reduce negative effects on the environment and public health. Local authorities, waste disposal companies or dealers provide more detailed information on disposal. Observe the WEEE EU directive (WEEE = Waste Electrical and Electronic Equipment) for the proper disposal of waste electronic equipment within the European Union.

1.4 Symbols and conventions

The following symbols and formatting may appear 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.		
Method	Dialog text, parameter in the software		
File ► New	Menu or menu item		
[Next]	Button or key		
	WARNING		
	This symbol draws attention to a possible life-threat- ening hazard or risk of injury.		
\wedge	WARNING		
7	This symbol draws attention to a possible hazard due to electrical current.		
	WARNING		
<u></u>	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.		
Ω	CAUTION		
	This symbol draws attention to possible damage to instruments or instrument parts.		



NOTE

This symbol highlights additional information and tips.

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2 Overview of the instrument

2 Overview of the instrument

2.1 Front

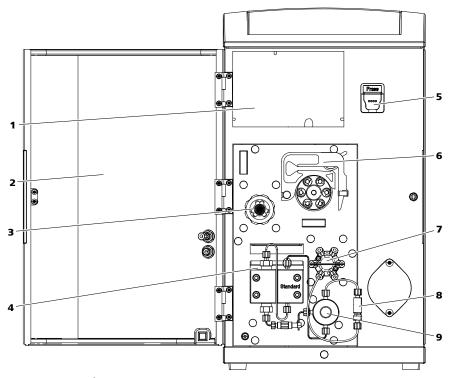


Figure 1 Eco IC front

1 Detector chamber

Offers space for an embedded detector.

3 Suppressor

Metrohm Suppressor Module (MSM) type.

5 Column holder

For hanging the separation column (iColumn). With column recognition.

7 Injection valve

9 Purge valve

2 Door

With Luer connector and capillary feed-through.

4 High-pressure pump

Pumps the eluent through the IC system.

6 Peristaltic pump

8 Inline filter

2.2 Rear

2.2 Rear

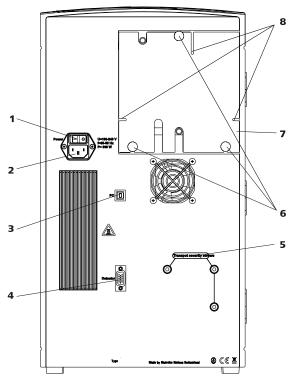


Figure 2 Eco IC rear

1	On/off switch	2	Power socket
3	PC connection socket	4	Detector connection socket
5	Transport locking screws	6	Knurled screws For fastening the removable back panel
7	Back panel Removable. Access to the detector chamber.	8	Capillary feed-throughs

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3 Installation

3.1 Initial installation



NOTE

Some of the capillaries are already connected when the instrument is delivered.

You still have to carry out the following steps:

Installing the Eco IC

1 Setting up the instrument

(see chapter 3.3, page 13).

2 Installations on the rear of the instrument

- Place the detector in the instrument and connect it (see chapter 3.13, page 41).
- Remove the transport locking screws (see chapter 3.5.1, page 16).
- Connect the drainage tubings (see chapter 3.5.2, page 17).

3 Inserting the rotor into the suppressor

Install the rotor and the connecting piece (see chapter 3.11, page 28).

4 Installing the eluent path

- Assemble the eluent aspiration tubing (6.1834.080) (3-1) and connect it with the eluent bottle (see chapter 3.7, page 20).
- Connect the column inlet capillary (6.1831.100) (3-2) and the capillary of the suppressor (3-3) labeled *in* to each other using a coupling (6.2744.040) and 2 short pressure screws (6.2744.070). The coupling is installed in the place of the separation column, which may only be installed after the initial start-up.
- Connect the capillary of the suppressor (3-4) labeled *out* and the detector inlet capillary (3-5) to each other using a coupling (6.2744.040) and 2 short pressure screws (6.2744.070).

3.1 Initial installation

5 Installing the sample path

If you do not use a Sample Processor:

• Guide the end of the sample aspiration capillary (3-**18**) out of the instrument to the sample vessel and fasten it there.

• Connect the end of the sample outlet capillary (3-19) from the inside to the Luer connector of the door (5-1) using the PEEK pressure screw (6.2744.070) (5-3). The sample can then be aspirated from outside with a syringe.

If you use a Sample Processor:

- Guide both capillary ends out of the instrument.
- Connect the sample aspiration capillary with the Sample Processor (see the manual for the Sample Processor).
- Guide the sample outlet capillary into a waste container and fasten it there.

6 Installing the peristaltic pump

(see chapter 3.12, page 36)

- Connect the capillary (6.1803.020) used as aspiration capillary for the regeneration solution (3-7) to the aspiration end of the pump tubing (6.1826.320) (3-15) using a tubing olive (6.2744.034) (3-14) and a short pressure screw (6.2744.070) (3-8). Guide the other end of the capillary out of the instrument, cut it to the required length and connect it to the bottle with the regeneration solution.
- Place the pump tubing in a tubing cartridge.
- Clamp the tubing cartridge into the peristaltic pump.

7 Connecting the suppressor

(see chapter 3.11, page 28)

- Connect the capillary labeled regenerant (3-9) with a pump tubing connection with filter and lock (6.2744.180) (3-16) and a short pressure screw (6.2744.070) (3-14) to the peristaltic pump at the outlet end of the pump tubing for the regeneration solution (3-8).
- Connect the capillary labeled rinsing solution (3-11) and the detector outlet capillary to each other using a coupling (6.2744.040) and 2 short pressure screws (6.2744.070).
- Connect the two capillaries of the suppressor labeled *waste reg.* and *waste rins*. with the waste collector (6.5336.000).

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8 Connecting the instrument

• Connect the instrument to the PC using a USB cable (6.2151.020) (see chapter 3.14, page 43).

• Connect the instrument to the power grid (see chapter 3.15, page 44).

9 Initial start-up

(see chapter 3.16, page 45)

- Switch on the PC and start MagIC Net.
- Switch on the instrument.
- Deaerate the high-pressure pump.
- Adjust the contact pressure of the peristaltic pump.
- Rinse the instrument without column(s).

10 Installing guard column and separation column

- Remove the coupling (6.2744.040) between the column inlet capillary and the eluent inlet capillary of the suppressor.
- Cut the column inlet capillary (6.1831.100) (3-2) to the required length with the capillary cutter (6.2621.080).
- Connect the guard column (recommended) (see chapter 3.17, page 47).
 - Connect the guard column to the end of the column inlet capillary as described in the leaflet supplied with the guard column.
 - Rinse the guard column for approx. 5 minutes.
- Connect the separation column (see chapter 3.18, page 49).
 - Connect the inlet of the separation column to the end of the column inlet capillary or to the guard column (if used) as described in the leaflet supplied with the separation column.
 - Rinse the separation column for approx. 10 minutes.
 - Connect the capillary of the suppressor labeled in to the outlet of the separation column using a pressure screw (6.2744.070).
- Hang the separation column with chip in the column holder of the instrument.

11 Conditioning the instrument

(see chapter 3.19, page 52).

3.2 Installation diagram

3.2 Installation diagram

The following installation diagram shows a schematic of the front of the instrument after installation is complete. Some of the capillaries are already installed when the instrument is delivered; these capillaries are not numbered in the diagram. Numbered capillaries have to be connected during installation.

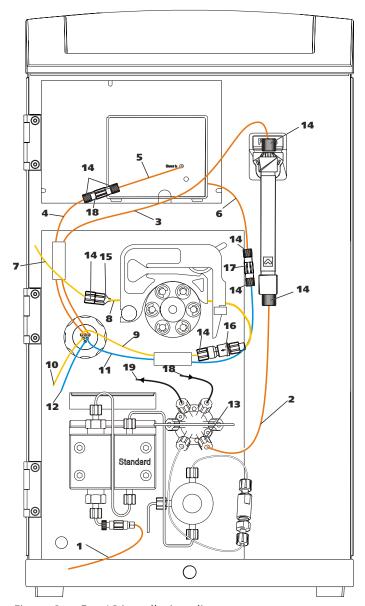


Figure 3 Eco IC installation diagram

1 Eluent aspiration tubing (6.1834.080)

2 PEEK capillary (6.1831.100) As column inlet capillary.

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3 Eluent inlet capillary of the suppressor Labeled *in*.

5 Detector inlet capillary

7 PTFE capillary (6.1803.020)

Section, used as regeneration solution aspiration capillary.

9 Regeneration solution inlet capillary of the suppressor

Labeled regenerant.

11 Rinsing solution inlet capillary of the suppressor

Labeled rinsing solution.

13 PEEK pressure screw (6.2744.014)

15 Tubing olive (6.2744.034)

For connecting capillaries to the aspiration side of the peristaltic pump.

17 Coupling (6.2744.040)

19 PTFE capillary (6.1803.040)

Sample outlet capillary.

4 Eluent outlet capillary of the suppressor

Labeled *out*.

6 Detector outlet capillary

8 Pump tubing (6.1826.320)

With orange/yellow stoppers, for the regeneration solution.

10 Regeneration solution outlet capillary of the suppressor

Labeled waste reg..

12 Rinsing solution outlet capillary of the suppressor

Labeled waste rins..

14 PEEK pressure screw, short (6.2744.070)

16 Pump tubing connection (6.2744.180)

With locking nut and filter, for connecting capillaries to the outlet side of the peristaltic pump.

18 PTFE capillary (6.1803.040)

Sample aspiration capillary.

3.3 Setting up the instrument

3.3.1 Packaging

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

3.3.2 Checks

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

3.3.3 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 and free of vibrations and which provides protection against corrosive atmosphere and contamination by chemicals.

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

3.4 Capillary connections in the IC system

Generally speaking, capillary connections between two components of an IC system are made up of one connection capillary and two pressure screws used to connect the capillary to the respective components.

Pressure screws

Three types of pressure screws are used in the IC system:

Number	Designation	Use
6.2744.010 / 6.2744.014	Pressure screw	On the injection valve
6.2744.070	Pressure screw, short	High-pressure pump, purge valve, inline filter, separation columns
6.2744.090	Pressure screw, long	MCS, sample degasser, 10- port valve

Pressure screws are tightened and loosened by hand. A tool is not needed.

Also see: *PEEK pressure screws 1x1* video on the Internet *http://ic-help.metrohm.com*.

Connection capillaries

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

PEEK capillaries (polyetheretherketone) PEEK capillaries are pressure-stable up to 400 bar (depending on the inner diameter), flexible, chemically inert and have an extremely smooth surface. They can be readily cut down to the desired length with the capillary cutter (6.2621.080).

Use:

- PEEK capillaries with an inner diameter of 0.25 mm (6.1831.010) for the entire high-pressure section.
- PEEK capillaries with an inner diameter of 0.5 mm (6.1831.180) for the sample path.

PTFE capillaries (poly(tetrafluoroethylene)) 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. They can be readily cut down to the desired length with the capillary cutter (6.2621.080).

Use:

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

PTFE capillaries with an inner diameter of 0.5 mm for sample processing and for the transfer of rinsing solutions (they are not necessarily included in the scope of delivery of the instrument).

Capillary connections



NOTE

Sprays of chemicals caused by capillaries slipping out

If you work with an increased system pressure (> 15 MPa), capillaries may slip out of the pressure screws. This can lead to sprays of chemicals.

To avoid this, we recommend

- degreasing the ends of the capillaries before installing them.
 Dampen a cloth with acetone and wipe off the ends of the capillaries before connecting them with the pressure screws.
- tightening the pressure screws firmly using a wrench (6.2739.000).

In order to achieve optimum analysis results, capillary connections in an IC system must be absolutely tight and free of dead volume. Dead volume occurs if two capillary ends connected to each other do not fit exactly, thus allowing liquid to escape. There are two possible causes for this:

- The capillary ends do not have exactly flat edges.
- The two capillary ends do not completely meet.

One prerequisite for dead-volume-free capillary connection is that both capillary ends are cut exactly flat. Therefore we recommend cutting PEEK capillaries only with a capillary cutter (6.2621.080).

Also see: *Cutting capillaries* video on the Internet *http://ic-help.metrohm.com*.

Creating dead-volume-free capillary connections

To create dead-volume-free capillary connections, proceed as follows:

- **1** Wipe off the end of the capillary with a cloth dampened with acetone.
- 2 Slide the pressure screw over the capillary. Ensure that the capillary protrudes 1 to 2 mm from the tip of the pressure screw.

3 Push the capillary into the connection or coupling as far as it will go and hold it there.

4 Only then start turning the pressure screw. Hold the capillary in the stop position while turning it shut.

Colored sleeves for PEEK capillaries

The enclosed set of varicolored sleeves for PEEK capillaries (6.2251.000) serves to easily differentiate the various flows of liquid in the system through color coding. Each capillary conveying a given liquid (e.g. eluent) can be marked with sleeves of the same color.

- 1 Slide a colored sleeve of a selected color over a capillary and move it to an easily visible position.
- Heat the colored sleeve, e.g. with a hairdryer.

 The colored sleeve shrinks and adapts to the shape of the capillary.



NOTE

In order to arrange capillaries more clearly, they can be bundled with the spiral band (6.1815.010).

3.5 Installation on the rear of the instrument

3.5.1 Transport locking screws

To avoid damage to the high-pressure pump drive during transport, the pump is secured with transport locking screws. These are located at the rear of the instrument and labeled with **Transport security screws** (2-5).

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

Accessories

For this step you need:

• 4 mm hex key (6.2621.030)

Removing the transport locking screws

1 Remove all of the transport locking screws with the hex key.

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Store the transport locking screws in a safe place. Reinsert the transport locking screws each time you transport the instrument a significant distance.



WARNING

The pump may be damaged if you transport the instrument without inserting the transport locking screws.

3.5.2 Installing the drainage tubing

Liquid that leaks in the bottle holder or in the detector chamber is conveyed via the drainage tubing into the waste container.

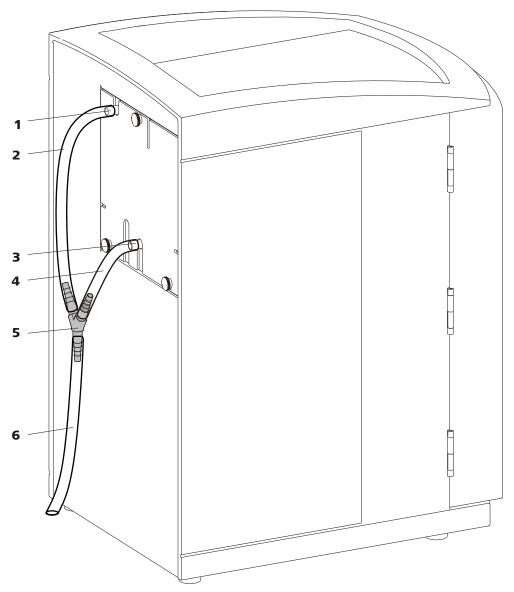


Figure 4 Drainage tubing

1 Drainage tubing connection

For draining leaked liquid from the bottle holder.

3 Drainage tubing connection

For draining leaked liquid from the detector chamber.

5 Y connector (6.1807.010)

For connecting the two drainage tubings (4-2) and (4-4).

2 Silicone tubing (6.1816.020)

Section. For draining leaked liquid from the bottle holder.

4 Silicone tubing (6.1816.020)

Section. For draining leaked liquid from the detector chamber.

6 Silicone tubing (6.1816.020)

Section. Conveys the leaked liquid to the waste container.

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Installing the drainage tubing

Proceed as follows to replace the drainage tubing:

- Connect the drainage tubing (4-2) to the drainage tubing connection (4-1) and shorten it to the required length.
- 2 Connect the drainage tubing (4-4) to the drainage tubing connection (4-3) and shorten it to the required length.
- **3** Connect the drainage tubing (4-2) and the drainage tubing (4-4) to each other using the Y connector (4-5).
- **4** Connect the drainage tubing (4-6) to the Y connector (4-5). Guide the other end into a waste container.

3.6 Capillary and cable feed-throughs

Several openings have been integrated for feeding through capillaries and cables. These can be found at the door (5-4), and at the rear panel (2-8).

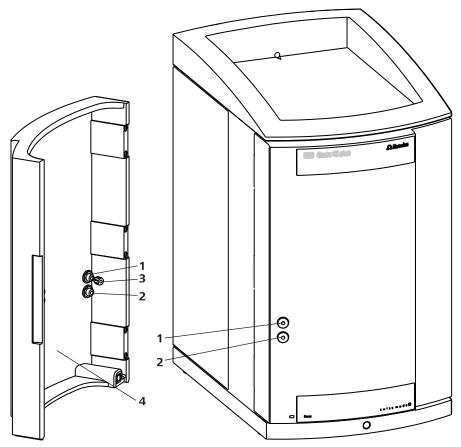


Figure 5 Capillary feed-throughs on the door

- **1 Luer connector**For connecting a (6.2816.020) syringe. For manual sample feeding.
- **3** PEEK pressure screw (6.2744.070)
- 2 Capillary feed-through

4 Door

3.7 Connecting the eluent bottle

The eluent is aspirated out of the eluent bottle via the eluent aspiration tubing . The eluent aspiration tubing is installed on the entry to the high-pressure pump.

The tubing must be fed out of the instrument through a suitable opening before the loose end can be connected to the eluent bottle.

Accessories

For this step, you need the following accessories:

- Eluent bottle (6.1608.070)
- The *eluent bottle cap GL 45* accessory set (6.1602.160)

 This accessory set contains the bottle cap, an M6 tubing nipple, an M8 tubing nipple, two O-rings and an M6 and M8 threaded stopper.

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- The tubing adapter for aspiration filter accessory set (6.2744.210)
 This accessory set contains a filter holder, a clamping screw and tubing weighting.
- An aspiration filter (6.2821.090)
- The adsorber tube (6.1609.000)
- The SGJ clip (6.2023.020)

Connecting the eluent aspiration tubing

1 Installing the eluent bottle cap (6.1602.160)

- Start by pushing the M8 tubing nipple onto the loose end of the eluent aspiration tubing, followed by the O-ring.
- Push the loose end of the eluent aspiration tubing through the
 M8 opening of the bottle cap and screw it on for the time being.

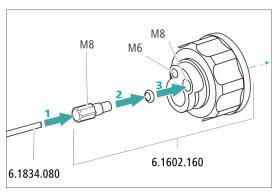


Figure 6 Installing the eluent bottle cap

2 Mounting the tubing adapter

Install the parts of the *tubing adapter for aspiration filter* (6.2744.210) accessory set:

- Start by pushing the tubing weighting onto the loose end of the eluent aspiration tubing.
- Then push the clamping screw onto the loose end of the eluent aspiration tubing.
- Lastly, push the filter holder onto the loose end of the eluent aspiration tubing and screw it onto the tubing nipple.
 The end of the tubing should extend approximately 1 cm.

3 Pre-rinsing the aspiration filter



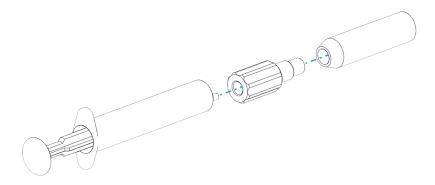
NOTE

Always wear gloves when handling the aspiration filter.

In order to avoid air bubbles after the installation of the aspiration filter, we recommend pre-rinsing the aspiration filter with ultrapure water or eluent.

For pre-rinsing, you will need the adapter Luer inner, M6 outer (6.02744.050), a syringe and a vessel with ultrapure water or eluent.

- Screw the adapter to the aspiration filter.
- Insert the syringe into the adapter.



- Immerse the aspiration filter tin a vessel with ultrapure water or
- Fill the syringe completely with ultrapure water or eluent 3 times and then empty it again each time.

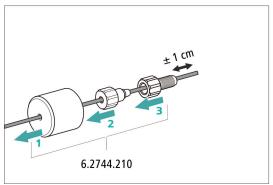
4 Mounting the aspiration filter



NOTE

Always wear gloves when handling the aspiration filter.

- Place the loose end of the eluent aspiration tubing into the aspiration filter.
 - The end of the tubing should reach approximately to the center of the aspiration filter.
- Tighten the aspiration filter to the filter holder.



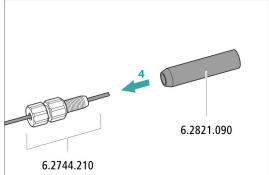
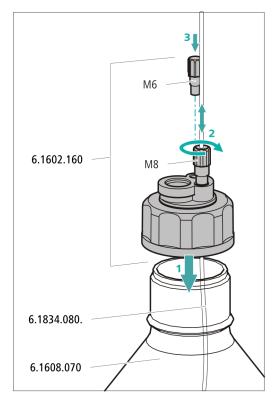


Figure 7 Installing the tubing weighting and aspiration filter

5 Installing the eluent bottle cap on the eluent bottle

- Insert the eluent aspiration tubing into the eluent bottle (6.1608.070).
- Tighten the bottle cap on the eluent bottle.
- Adjust the length of the eluent aspiration tubing so that the aspiration filter is at the bottom of the eluent bottle. Then fix it in place using the M8 tubing nipple.
- Seal the M6 opening on the bottle cap with the M6 threaded stopper from the accessory set.



6 Mounting the adsorber tube

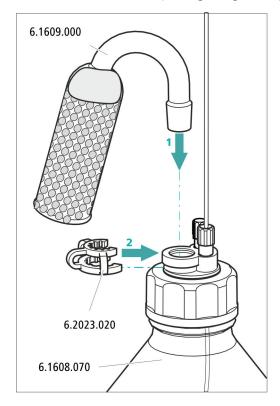


NOTE

Depending on the eluent used, the adsorber tube (6.1609.000) must be filled differently:

 For alkaline eluents or eluents with a low buffer capacity: first a little cotton, then with CO₂ adsorber material.

- For all other eluents: only with cotton.
- Remove the plastic cover from the large opening of the adsorber tube. Fill the adsorber tube and close it again using the plastic cover.
- Insert the adsorber tube into the bottle cap's large opening. Fasten it to the bottle cap using the ground-joint clip (6.2023.020).



3.8 Installing the high-pressure pump

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

The high-pressure pump consists of:

- The pump head, which pumps the eluent through the system.
- The purge valve used for bleeding the pump head.

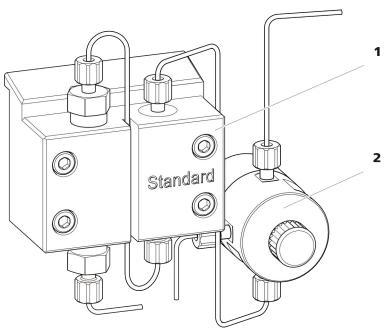


Figure 8 High-pressure pump with purge valve

1 Pump head 2 Purge valve

3.9 Installing an inline filter

Inline filters protect the separation column reliably from potential contamination from the eluent. The small filter pads with 2 μ m pore size can be replaced quickly and easily. They remove particles from the solutions.

An inline filter (6.2821.120) is installed between the purge valve and the injection valve as protection against particles.

3.10 Injection valve

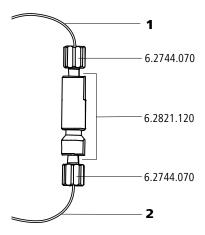


Figure 9 Inline filter

1 Inlet capillary
Connected to the purge valve.

2 Outlet capillary
Connected with the injection valve.

The inline filter is completely connected. No installation work is required.

3.10 Injection valve

The injection valve connects the eluent path to the sample path. By a quick and precise switching of the valve a defined quantity of sample solution is injected and flushed to the separation column with the eluent.

The quantity of sample solution injected is determined by:

- the volume of the sample loop or
- by an 800 Dosino when the Metrohm intelligent Partial Loop Injection Technique (MiPT) is used.

The choice of sample loop depends on the application. The following sample loops are normally used:

Table 1 Which sample loop do I need?

Application	Sample loop
Cation determination	10 μL
Anion determination with suppression	10 μL
Anion determination without suppression	100 μL
MiPT	250 μL

The injection valve is completely connected. No installation work is required.

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Optional: Exchanging the sample loop

The sample loop can be replaced to match the application (see table 1, page 26).



NOTE

Only use PEEK pressure screws (6.2744.010) to connect capillaries and the sample loop to the injection valve.

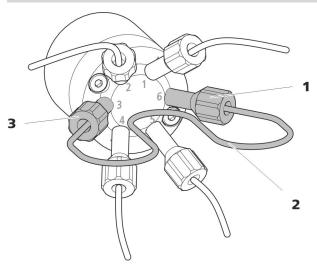


Figure 10 Exchanging the sample loop

1 Pressure screw Fastened to Port 6.

2 Sample loop

3 Pressure screw Fastened to Port 3.

Exchanging the sample loop



NOTE

Observe a dead-volume-free installation of the sample loop (see "Creating dead-volume-free capillary connections", page 15).

1 Removing the existing sample loop

- Loosen the pressure screws (6.2744.010) at Port 3 and Port 6.
- Remove the sample loop.

2 Installing a new sample loop

• Fasten one end of the sample loop to Port 3 using a PEEK pressure screw (6.2744.010).

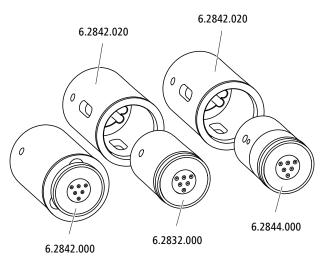
 Use the second PEEK pressure screw (6.2744.010) to fasten the other end of the sample loop to Port 6.

3.11 Metrohm Suppressor Module (MSM)

The suppressor drive of the Eco IC can hold various rotors. The large rotors, such as the MSM-HC Rotor A (6.2842.000) can be inserted directly.

The small rotors, such as the MSM Rotor A (6.2832.000) and the MSM-LC Rotor A (6.2844.000), must first be fitted into the adapter (6.2842.020), which can then be inserted into the suppressor housing.

A connecting piece (6.2835.010) is used for all rotors for connecting the Metrohm Suppressor Module (MSM) to the IC system.





NOTE

The instruments are supplied without rotor and without adapter.

The suitable rotor and the adapter, if required, must be ordered separately.

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3.11.1 Inserting the rotors

Accessories

For this step, you need the following accessories:

 For suppression: MSM Rotor A (6.2832.000) or MSM-HC Rotor A (6.2842.000) or MSM-LC Rotor A (6.2844.000)

Optional: Adapter (6.2842.020)Connecting piece (6.2835.010)

The large rotor can be inserted directly into the rotor housing.

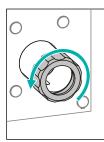


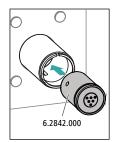
CAUTION

The rotor may be destroyed during start-up if not inserted correctly.

Therefore, follow the following instructions exactly.

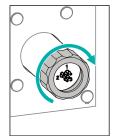
Inserting large rotors











1 Removing the union nut

Loosen the union nut and remove it.

2 Inserting the rotor

- Clean the sealing surface of the rotor with ethanol using a lint-free cloth.
- Insert the rotor into the suppressor drive so that the tubing connections on the rear of the rotor fit into the corresponding recesses inside the suppressor drive and one of the three holes of the rotor is visible from below in the slot of the suppressor drive.



NOTE

The rotor's sealing surface is located approx. 4 mm deep inside the suppressor drive if the rotor is inserted correctly.

If this is not the case, then the rotor must be moved into the correct position using careful turning. If the rotor cannot be turned or removed, it can be moved into the correct position from below by means of a pointed object (e.g. a screwdriver).

3 Inserting the connecting piece

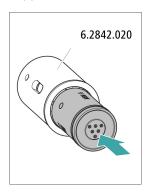
- Clean the sealing surface of the connecting piece with ethanol using a lint-free cloth.
- Insert the connecting piece into the suppressor drive so that connector 1 is on top and the three pins of the connecting piece fit into the corresponding recesses on the suppressor drive.

4 Attaching the union nut

Tighten the union nut on the thread of the suppressor drive by hand (do not use any tools).

Inserting small rotors

You need the adapter (6.2842.020) in order to insert a small rotor into the suppressor drive.





1 Inserting the rotor into the adapter



CAUTION

An incorrectly inserted rotor may be **destroyed** during start-up.

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 Clean the sealing surface of the rotor with ethanol using a lintfree cloth.

 Insert the rotor into the adapter so that the tubing connections on the rear of the rotor fit into the corresponding recesses inside the adapter and one of the three holes of the rotor is visible in the slot of the adapter.

2 Inserting the adapter

Insert the adapter into the suppressor drive just like a large rotor (see "Inserting large rotors", page 29).

3.11.2 Connecting the Metrohm Suppressor Module (MSM)

The three entries and exits of the suppressor units, numbered 1, 2 and 3 on the connecting piece, each have two permanently installed PTFE capillaries.

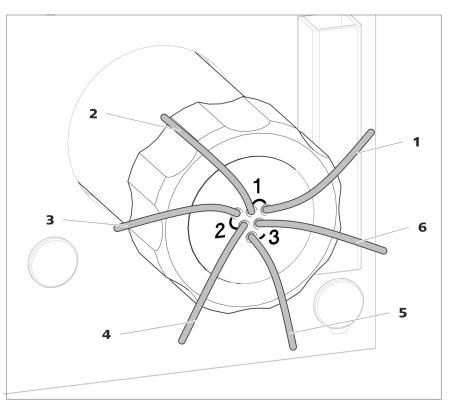


Figure 11 Metrohm Suppressor Module (MSM) – Connection capillaries

1 out
Outlet capillary for the eluent.

2 in Inlet capillary for the eluent.

3 regenerant

Inlet capillary for the regeneration solution.

5 waste rins.

Outlet capillary for the rinsing solution; to the waste container.

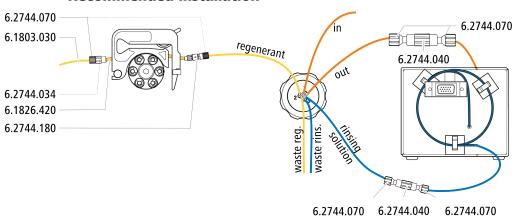
4 waste reg.

Outlet capillary for the regeneration solution; to the waste container.

6 rinsing solution

Inlet capillary for the rinsing solution.

Recommended installation

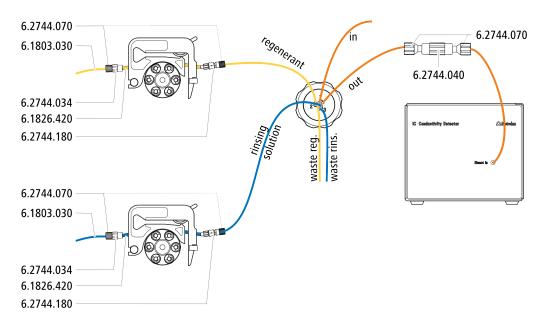


Alternative installation

For the alternative installation, a second tubing cartridge (6.2755.000) is required that must be ordered separately with the following accessories:

- Tubing cartridge (6.2755.000)
- Coupling olive/UNF 10/32 2x (6.2744.034)
- Pump tubing connection with locking nut and filter (6.2744.180)
- Pump tubing PharMed® (orange/yellow) 3 stoppers (6.1826.420)
- Glass bottle / 1000 mL / GL 45 (6.1608.020)
- Bottle cap / GL 45 3 × UNF 10/32 (6.1602.150)
- PTFE capillary, 0.5 mm inner diameter / 3 m (6.1803.030)

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3.11.2.1 Installing the eluent path

The eluent path is connected with the capillaries in and out.

- Connect the capillary labeled *in* to the outlet of the separation column using a short pressure screw (6.2744.070).
- Connect the capillary labeled *out* to the detector inlet capillary using one coupling (6.2744.040) and two pressure screws (6.2744.070) (see manual of the conductivity detector).

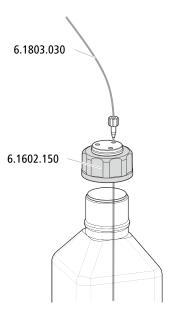
3.11.2.2 Installing bottles with auxiliary solutions

Accessories

To connect the bottles of the auxiliary solutions, you will need the following accessories:

Bottle with regeneration solution
 Bottle cap / GL 45 - 3 × UNF 10/32 (6.1602.150)
 PTFE capillary, 0.5 mm inner diameter / 3 m (6.1803.030)

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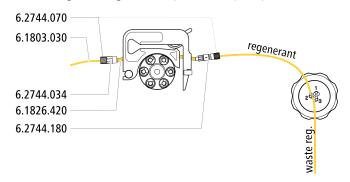
3.11.2.3 Connecting the regeneration solution

The regeneration solution is connected to the regenerant capillary.

Connecting the regeneration solution to the peristaltic pump

For this step, you need the following accessories:

- Accessory kit: Flex/Vario: ChS (6.5000.030)
- Pump tubing (6.1826.420)
- Tubing olive with filter and locking nut (6.2744.180)
- Tubing olive (6.2744.034)
- Tubing cartridge of the peristaltic pump



- Prepare a tubing cartridge of the peristaltic pump for the regeneration solution (see chapter 3.12.1, page 36).
- **2** Connect the capillary labeled *regenerant* to the outlet of the pump tubing using a pressure screw (6.2744.070).
- **3** Connect the PTFE capillary from the regeneration solution bottle to the inlet of the pump tubing.

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3.11.2.4 Connecting the rinsing solution

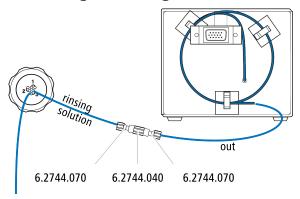
Various possibilities exist for rinsing the Metrohm Suppressor Module:

Rinsing solution via STREAM (recommended)
 Use the eluent from the conductivity detector as rinsing solution.

Rinsing solution via peristaltic pump
 Prepare the rinsing solution in a separate bottle and convey it with the peristaltic pump.

The rinsing solution is connected to the *rinsing solution* capillary.

Connecting the rinsing solution inlet with STREAM



1 Connect the detector outlet capillary of the conductivity detector and the capillary labeled *rinsing solution* to each other using a coupling (6.2744.040) and two pressure screws (6.2744.070).



NOTE

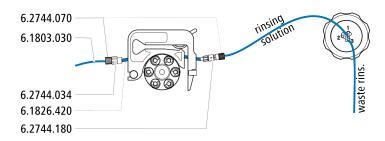
The detector outlet capillary must not be shortened.

Connecting the rinsing solution inlet to the peristaltic pump

For this step, you need the following accessories: (not contained in its entirety in the standard accessories):

- Pump tubing (6.1826.420)
- Tubing olive with filter and locking nut (6.2744.180)
- Tubing olive (6.2744.034)
- Tubing cartridge (6.2755.000)
- 2 short pressure screws (6.2744.070)
- PTFE capillary (6.1803.030) (connected with the bottle with the rinsing solution)

3.12 Peristaltic pump



- Prepare a tubing cartridge of the peristaltic pump for the regeneration solution (see chapter 3.12.1, page 36).
- **2** Connect the capillary labeled *rinsing solution* to the outlet of the pump tubing using a pressure screw (6.2744.070).
- Connect the PTFE capillary from the rinsing solution bottle to the inlet of the pump tubing.

3.12 Peristaltic pump

3.12.1 Installing the peristaltic pump

Installing the pump tubing

Pump tubing can differ in terms of material, diameter and thus flow rate. Different pump tubing is used depending on the application.

Table 2 Pump tubings

Order num- ber	Name	Material	Inner diame- ter	Use
6.1826.310	Pump tubing LFL (orange/ green), 3 stoppers	PVC (Tygon [®])	0.38 mm	Pump tubing for bromate deter- mination using the triiodide method.
6.1826.320	Pump tubing LFL (orange/ yellow), 3 stoppers	PVC (Tygon [®])	0.48 mm	For acceptor solutions for Inline Dialysis and for Inline Ultrafiltra- tion.
6.1826.330	Pump tubing LFL (orange/ white), 3 stoppers	PVC (Tygon®)	0.64 mm	No special applications.
6.1826.340	Pump tubing LFL (black/ black), 3 stoppers	PVC (Tygon®)	0.76 mm	For sample solution in Inline Dialysis.
6.1826.360	Pump tubing LFL (white/ white), 3 stoppers	PVC (Tygon®)	1.02 mm	For sample transfer.
6.1826.380	Pump tubing LFL (gray/ gray), 3 stoppers	PVC (Tygon®)	1.25 mm	For Inline Dilution.

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Order num- ber	Name	Material	Inner diame- ter	Use
6.1826.390	Pump tubing LFL (yellow/ yellow), 3 stoppers	PVC (Tygon®)	1.37 mm	For sample solution in Inline Ultrafiltration.
6.1826.420	Pump tubing PharMed [®] (orange/yellow), 3 stoppers	Ismaprene	0.51 mm	For suppressor solutions.

Selecting the pump tubing and adapter

- Select pump tubing suitable for the application (see table 2, page 36).
- 2 Select an adapter suitable for the pump tubing. The adapters are included with the pump tubing connection with locking nut and filter (6.2744.180).

Table 3 Pump tubing and suitable adapters

Pump tubing	Adapter
6.1826.310 (orange/green)	
6.1826.320 (orange/yellow)	
6.1826.330 (orange/white)	
6.1826.340 (black/black)	
6.1826.360 (white/white)	
6.1826.380 (gray/gray)	
6.1826.390 (yellow/yellow)	
6.1826.420 (orange/yellow)	

Installing the pump tubing

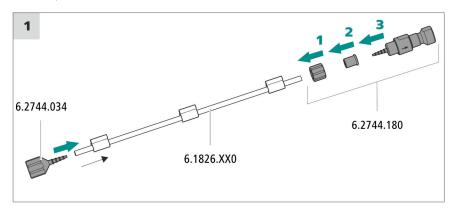
For this step, you need the following accessories:

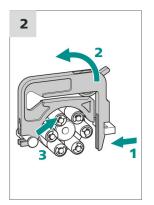
- Tubing cartridge (6.2755.000)
- Pump tubing (6.1826.XXX)
- Coupling olive/UNF 10/32 (6.2744.034)

3.12 Peristaltic pump

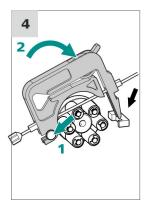
Pump tubing connection with locking nut and filter (6.2744.180):
 Includes a locknut, 3 adapters and a tubing olive with filter holder.

• 2 × pressure screw, short (6.2744.070)









1 Connecting the pump tubing

- Attach the coupling olive/UNF 10/32 (6.2744.034) to the pump tubing entry. Push the end of the pump tubing over at least the second notch of the olive so that the pump tubing is firmly in place.
- Assemble the pump tubing connection with locking nut and filter (6.2744.180) at the pump tubing exit:
 - Push the locknut onto the pump tubing.
 - Push the appropriate adapter onto the pump tubing.
 - Place the tubing olive with the filter holder into the pump tubing so that the pump tubing is firmly in place; push the end of the pump tubing over at least the second notch of the olive.
 - Tighten it using the union nut.

2 Removing the tubing cartridge

- Press in the tubing cartridge's snap-action lever.
- Tilt the tubing cartridge upwards.
- Unhook the tubing cartridge from the mounting bolt.

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3 Inserting the pump tubing

 Press the tubing cartridge's contact pressure lever down all the way.

Place the pump tubing in the tubing cartridge. Fit the tubing cartridge between two stoppers. The stoppers must snap into the corresponding holder of the tubing cartridge.

4 Inserting the tubing cartridge

• Hang the tubing cartridge in the mounting bolt and press it in the cartridge holder until you hear the snap-action lever snap in.

Setting the flow rate

The flow rate of the peristaltic pump depends on many factors:

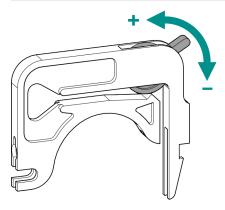
- The inner diameter of the pump tubing
- The rotational speed of the drive
- The contact pressure of the tubing cartridge



NOTE

Pieces of pump tubing are consumables. The service life of the pump tubing depends on the contact pressure, among other factors.

Setting the contact pressure correctly



- 1 Fully loosen the contact pressure lever , i.e. press it all the way down.
 - In the software, activate the drive of the peristaltic pump with the desired speed.
 - Raise the contact pressure lever one step at a time until liquid flows.

3.12 Peristaltic pump

• When liquid starts flowing, raise the contact pressure lever by an additional two ratchet increments.

The contact pressure is now set optimally.

3.12.2 Mode of operation for 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 based on the principle of displacement. The pump tubing is clamped between the rollers (12-5) and the tubing cartridge (12-2). During operation, the peristaltic pump drive rotates the roller hub (12-6), so that the rollers (12-5) advance the liquid in the pump tubing.

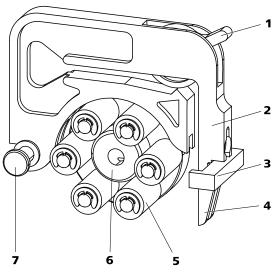


Figure 12 Peristaltic pump

1	Contact pressure lever	2	Tubing cartridge (6.2755.000)
3	Cartridge holder	4	Snap-action lever
5	Rollers	6	Roller hub
7	Mounting bolt		

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3.13 Conductivity detector

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

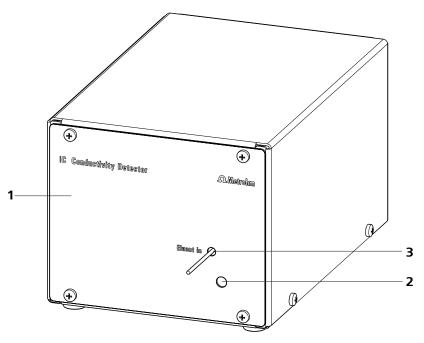


Figure 13 Front of conductivity detector

1 IC detector 2.850.9010

2 Opening for temperature sensor

3 Detector input capillary Permanently installed.

3.13 Conductivity detector

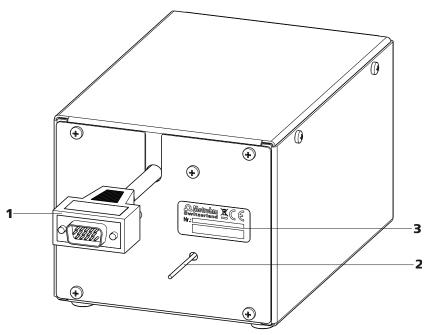


Figure 14 Rear of conductivity detector

- **1 Detector cable** With installed plug.
- **Type plate**With serial number.

2 Detector output capillary Permanently installed.



NOTE

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

Connecting the detector input capillary to the suppressor

Connect the detector input capillary (15-1) and the capillary of the MSM labeled *out* (15-2) to each other using a coupling (6.2744.040) (15-3) and two short pressure screws (6.2744.070) (15-4).

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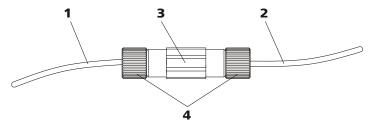


Figure 15 Connection detector-MSM

1 Detector input capillary

2 MSM output capillary Labeled *out*.

3 Coupling (6.2744.040)

4 Pressure screws, short (6.2744.070)

3.14 Connecting the instrument to a computer



NOTE

If the instrument is connected to the computer, then it must be switched off.

Accessories

For this step, you need the following accessories:

USB connecting cable (6.2151.020)

Connecting the USB cable

- 1 Insert the USB cable into the computer connection socket on the rear of the instrument labeled *PC*.
- 2 Insert the other end into a USB port on the computer.

3.15 Connecting the instrument to the power grid



WARNING

Electric shock from electrical potential

Risk of injury by touching live components or through moisture on live parts.

- Never open the housing of the instrument while the power cord is still connected.
- Protect live parts (e.g. power supply unit, power cord, connection sockets) against moisture.
- Unplug the power plug immediately if you suspect that moisture has gotten inside the instrument.
- Only personnel who have been issued Metrohm qualifications may perform service and repair work on electrical and electronic parts.

Connecting the power cord

Accessories

Power cord with the following specifications:

- Length: max. 2 m
- Number of cores: 3, with protective conductor
- Instrument plug: IEC 60320 type C13
- Conductor cross-section 3x min. 0.75 mm² / 18 AWG
- Power plug:
 - according to customer requirement (6.2122.XX0)
 - min. 10 A



NOTE

Do not use a not permitted power cord!

1 Plugging in the power cord

- Plug the power cord into the instrument's power socket.
- Connect the power cord to the power grid.

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3.16 Initial start-up

Even before the guard column and separation column are installed, the entire system must be completely rinsed with eluent for the first time.

Rinsing the IC system



CAUTION

The separation column and the guard column are not permitted to be installed at the time of the initial start-up.

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

1 Preparing the software

- Start the **MagIC Net** computer program.
- Open the Equilibration tab in MagIC Net: Workplace ➤ Run ➤ Equilibration.
- Import (or create) a suitable method.
 Also see: MagIC Net Tutorial and online help.

2 Preparing the instrument

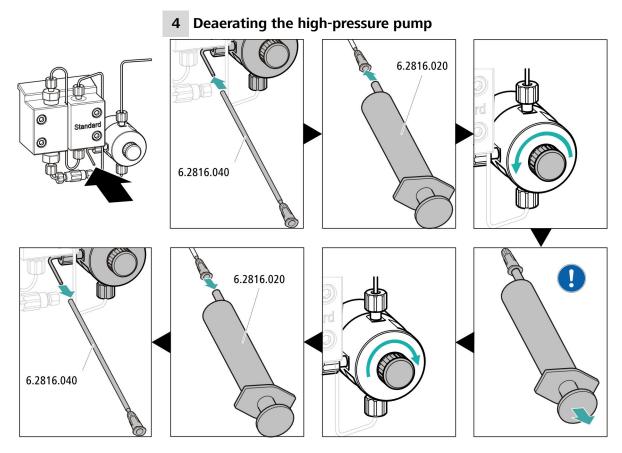
- Ensure that the eluent aspiration tubing is immersed in the eluent and that there is enough eluent in the eluent bottle.
- Switch on the instrument.

MagIC Net detects the instrument and all of its modules.

3 Starting equilibration

Start the equilibration in MagIC Net: Workplace ➤ Run ➤ Equilibration ➤ Start HW.

3.16 Initial start-up



- Push the end of the purge needle (6.2816.040) over the end of the purge capillary on the purge valve.
- Insert the syringe (6.2816.020) in the Luer connector of the purge needle.
- Open the purge valve using the rotary knob (approx. ½ turn).
- Switch on the high-pressure pump in MagIC Net.
- Use the syringe to aspirate eluent until there are no more air bubbles in the eluent aspiration tubing.
- Switch off the high-pressure pump in MagIC Net.
- Seal the purge valve using the rotary knob.
- Remove the syringe from the purge needle.
- Pull the purge needle out of the purge capillary.

5 Rinsing the instrument without columns

Rinse the instrument (without columns) with eluent for 10 minutes.

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3.17 Connecting and rinsing the guard column

Guard columns protect separation columns and significantly increase their service life. The guard columns available from Metrohm are either actual guard columns or guard column cartridges used together with a cartridge holder. The process of installing a guard column cartridge into the corresponding holder is described in the guard column leaflet.



NOTE

Metrohm recommends always working with guard columns. They protect the separation columns and can be replaced regularly as needed.



NOTE

Information regarding which guard column is suitable for your separation column can be found in the **Metrohm Column Program** (which is available from your Metrohm representative), the column leaflet and the the product information at http://www.metrohm.com (Ion Chromatography product area), or it can be obtained directly from your representative.



CAUTION

New guard columns are filled with a solution and sealed with stoppers or caps on both sides.

Before inserting the guard column, ensure that this solution can be mixed with the eluent being used (follow the information provided by the manufacturer).



NOTE

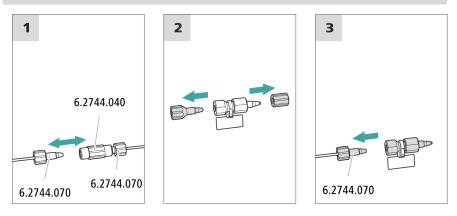
The guard column may not be connected until after the instrument has already been put into operation once (see chapter 3.16, page 45). The guard column and the separation column have to be replaced by a coupling (6.2744.040) until then.

Accessories

For this step, you need the following accessories:

• Guard column (suitable for separation column)

Connecting the guard column



1 Removing the coupling

Remove the coupling (6.2744.040) installed between the column inlet capillary and the column outlet capillary for the initial start-up.

2 Preparing the guard column

• Remove the stoppers or the stopper and the sealing cap from the guard column.

3 Connecting the guard column



CAUTION

When inserting the guard column, ensure that it is inserted correctly based on the marked flow direction (if specified).

- Fasten the inlet of the guard column to the column inlet capillary using a short pressure screw (6.2744.070).
- If the guard column is connected to the separation column using a connection capillary, fasten this connection capillary to the guard column outlet with a pressure screw.

Rinsing the guard column

1 Rinsing the guard column

• Place a beaker under the guard column's outlet.

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- Start manual control in MagIC Net and select the high-pressure pump: Manual ➤ Manual control ➤ Pump
 - Flow: in accordance with column leaflet
 - On
- Rinse the guard column with eluent for approx. 5 minutes.
- Stop the high-pressure pump in the manual control in MagIC Net again: Off.

3.18 Connecting the separation column

The smart separation column (iColumn) is the heart of ion chromatographic analysis. It separates the different components according to their interactions with the column. Metrohm separation columns are equipped with a chip where their technical specifications and history (start-up, operating hours, injections etc) are stored.



NOTE

Information regarding which separation column is suitable for your application can be found in the **Metrohm Column Program**, the product information for the separation column or it can be obtained through your representative.

You can find product information for your separation column at http://www.metrohm.com in the Ion Chromatography product area.

A test chromatogram accompanies every column. The column leaflet can be found online at http://www.metrohm.com with the corresponding article. Detailed information on special IC applications can be found in the corresponding **Application Bulletins** or **Application Notes**. You can find these online at http://www.metrohm.com in the Applications area or request them from your responsible Metrohm representative free of charge.



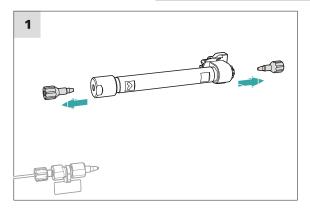
CAUTION

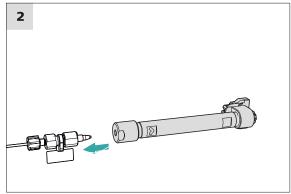
New separation columns are filled with a solution and sealed with stoppers on both sides. Before inserting the column, ensure that this solution can be mixed with the eluent being used (follow the information provided by the manufacturer).

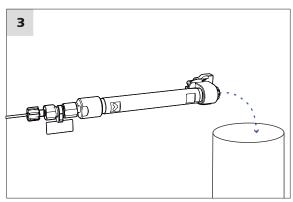


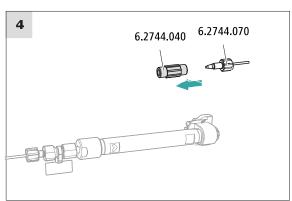
NOTE

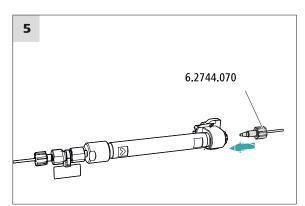
Connect the separation column only after the initial start-up of the instrument. Until that point, insert a coupling (6.2744.040) instead of the guard column and separation column.

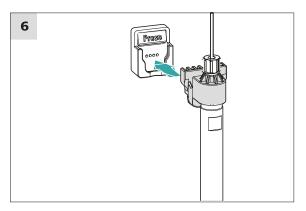












Connecting the separation column

1 Removing the stoppers

• Remove the stoppers from the separation column.

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2 Installing the inlet of the separation column



CAUTION

When inserting the column, ensure that it is inserted correctly based on the marked flow direction.

There are 3 possibilities:

- Attach the column inlet directly onto the guard column or,
- if the guard column is connected to the separation column using a connection capillary: Connect the column inlet to the guard column outlet capillary using a PEEK pressure screw (6.2744.070) or,
- if no guard column is used (not recommended): Connect the column inlet capillary to the inlet of the separation column using a short pressure screw (6.2744.070).

3 Rinsing the separation column

- Place a beaker under the outlet of the separation column.
- Start manual control in MagIC Net and select the high-pressure pump: Manual ➤ Manual control ➤ Pump
 - Flow: Increase gradually up to the flow rate recommended in the column leaflet.
 - On
- Rinse the separation column with eluent for approx. 10 minutes.
- Stop the high-pressure pump in the manual control in MagIC Net again: Off.

4 Removing the coupling

Remove the coupling (6.2744.040) from the column outlet capillary.

5 Installing the outlet of the separation column

• Fasten the column outlet capillary to the column outlet using a short PEEK pressure screw (6.2744.070).

6 Inserting the separation column

• Insert the separation column with the chip into the column holder until you hear it snap in place.

The separation column is now detected by MagIC Net.

3.19 Conditioning

3.19 Conditioning

In the following cases, the system must be conditioned with eluent until a stable baseline has been reached:

- After installation
- After each time the instrument is switched on
- After each eluent change



NOTE

The conditioning time can lengthen considerably if the composition of the eluent is modified.

Conditioning the system

1 Preparing the software



CAUTION

Ensure that the configured flow rate is not higher than the flow rate permitted for the corresponding column (refer to the column leaflet and chip data record).

- Start the **MagIC Net** computer program.
- Open the Equilibration tab in MagIC Net: Workplace ➤ Run ➤ Equilibration.
- Select (or create) a suitable method.
 Also see: MagIC Net Tutorial and online help.

2 Preparing the instrument

- Ensure that the column is inserted correctly in accordance with the flow direction marked on the sticker (arrow has to 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 Starting equilibration

Start the equilibration in MagIC Net: Workplace ➤ Run ➤ Equilibration ➤ Start HW.

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• Visually inspect whether all capillaries and their connections from the high-pressure pump to the detector are leak-tight. If eluent is leaking out anywhere, tighten the corresponding pressure screw further, or loosen the pressure screw, check the end of the capillary and shorten it using the capillary cutter if necessary and retighten the pressure screw.

4 Conditioning the system

Continue rinsing the system with eluent until the desired stability level for the baseline has been attained .

The instrument is now ready for measuring samples.

4.1 IC system

4 Operation and maintenance

4.1 IC system

4.1.1 Operation

In order to avoid disruptive temperature influences, protect the analysis system, including the eluent bottle, from direct sunlight.

4.1.2 Care

The instrument requires appropriate care. Excess contamination of the instrument results in malfunctions and a reduction in the service life of the sturdy mechanical and electronic components.

The instrument must be cleaned immediately if chemicals or solvents are spilled on it. In particular, the plug connections (particularly the power plug) must be protected against contamination.



CAUTION

The instrument has been designed so that liquid is largely prevented from being able to get inside the instrument. However, unplug the power plug immediately if you suspect that corrosive media have gotten inside the instrument. This is the only way to prevent extreme damage to the instrument electronics. Notify Metrohm Service.



WARNING

Electric shock caused by live parts

Never open the housing of the instrument.

Only trained personnel are permitted to open the housing of the instrument.

4.1.3 Maintenance by Metrohm Service

Maintenance of the instrument is best carried out as part of an annual service performed by specialist personnel from Metrohm. A shorter maintenance interval is recommended if you frequently work with caustic and corrosive chemicals. Metrohm Service offers every form of technical advice for maintenance and service of all Metrohm instruments.

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4.1.4 Shutting down and recommissioning

If the instrument is no longer used for a prolonged period, remove the guard column and the separation column. Rinse the IC system until it is salt-free with a mixture of methanol and ultrapure water (1:4). This prevents eluent salts from crystallizing and then causing damage. This prevents eluent salts from crystallizing and then causing consequential damage.

Rinsing the IC system to be free of salts

- In the software, stop the hardware and wait until the pressure in the high-pressure pump has been released.
- Remove the guard column and the separation column from the eluent path. Connect the connection capillaries directly with each other using a coupling (6.2744.040).
- **3** Rinse the IC system for 15 minutes with methanol/ultrapure water mixture (1:4).
- 4 In the software, switch the Metrohm Suppressor Module (MSM) twice during the rinsing process at five-minute intervals in each case (STEP command).
- Rinse the pump tubing of the peristaltic pump used for pumping the regeneration solution with water for 15 minutes at level 1. Finish by releasing the contact pressure at the peristaltic pump.

Putting the IC system back into operation

- 1 Check that a coupling (6.2744.040) is installed in place of the guard column and the separation column.
- **2** Rinse the IC system with freshly prepared eluent for 15 minutes.
- Remove the coupling and install the guard column and the separation column (see Chapter 3.17, page 47 and Chapter 3.18, page 49).

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4.2 Capillary connections

4.2 Capillary connections

All capillary connections between the injection valve, the separation column and the detector must be as short as possible, have a low dead volume and be completely leak-tight.

The PEEK capillary downstream of the detector must be free of blockages.

Use only PEEK capillaries with an inner diameter of 0.25 mm between the high-pressure pump and the detector (high-pressure section).

4.3 Door



CAUTION

Never use the door as a handle.

4.4 Handling the eluent

Careful handling of the eluent ensures stable analysis results. Keep the following general measures in mind when handling the eluent:

- The supply bottle with the eluent must be connected as indicated in *chapter 3.7, page 20*. This is particularly important for eluents with volatile solvents (e.g. acetone).
- Avoid condensation in the eluent bottle. Drop formation can change the concentration ratio in the eluent.
- In the case of very sensitive measurements, we recommend that the eluent be stirred constantly with a magnetic stirrer (e. g. the 2.801.0010 with 6.2070.000).
- To protect the IC system from foreign particles, we recommend aspirating the eluent via an aspiration filter (see chapter 3.7, page 20)
 (6.2821.090). This aspiration filter must be replaced as soon as it turns yellow but at least every 3 months.

4.4.1 Manufacturing eluent

Chemicals used for manufacturing eluents must have a purity grade of at least "p.a.". They may be diluted only by using ultrapure water (resistance $> 18.2 \text{ M}\Omega^*\text{cm}$). (These specifications apply generally for all reagents used in ion chromatography.)

Newly manufactured eluents always need to be microfiltered (0.45 μm filter).

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The composition of the eluent plays a critical role in chromatographic analysis:

Concentration An increase in the concentration generally leads

to shorter retention times and faster separation, but also to a higher background conductivity sig-

nal.

pH pH changes lead to shifts in dissociation equili-

bria and thus to changes in retention times.

Organic solvents Adding organic solvents (e.g. methanol, acetone

or acetonitrile) to a watery eluent generally

speeds up lipophilic ions.

4.4.2 Changing the eluent

Ensure that no precipitates can form when changing the eluent. Immediately successive solutions must be miscible. If the system must be rinsed with organic solvents, several solvents with rising or falling lipophilicity must be used.



NOTE

To change the eluent, remove the guard column and the separation column. Connect the capillaries using a coupling (6.2744.040) and two pressure screws (6.2744.070).

4.5 Notes on operating the high-pressure pump



CAUTION

The pump head is filled ex works with methanol/ultrapure water. Ensure that the eluent used is miscible with this solvent.

Keep the following recommendations in mind in order to protect the highpressure pump from damage as much as possible during operation:

• To protect the high-pressure pump from **foreign particles**, we recommend filtering the eluent through a filter with a pore size of 0.45 μm and aspirating it via an aspiration filter (6.2821.090).

Ensure that no precipitates can form when changing the eluent. Salt crystals between the piston and seal cause abrasive particles that can find their way into the eluent. These particles lead to contaminated valves, an increase in pressure and, in extreme cases, scratched pistons and thus to leakages in the high-pressure pump. Immediately successive solutions must always be miscible. If the system must be rinsed with organic solvents, use several solvents with rising or falling lipophilicity.

• In order to protect the pump seals, ensure that the pump is never 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.

4.6 Servicing the high-pressure pump



NOTE

You can find a video sequence for this task in the *Multimedia Guide IC Maintenance* or on the Internet at *http://ic-help.metrohm.com/*.

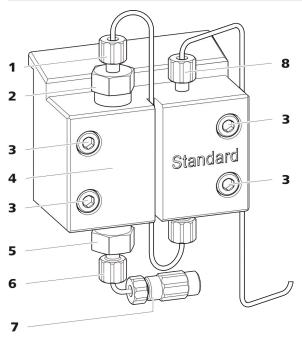


Figure 16 High-pressure pump – Parts

- 1 Pressure screw, short (6.2744.070) Fastened to the outlet valve holder.
- 3 Fastening screw

- 2 Outlet valve holder
- 4 Pump head

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5 Inlet valve holder

7 Eluent aspiration tubing connectorConsists of a coupling with a pressure screw.

- **6** Pressure screw, short (6.2744.070) Fastened to the inlet valve holder.
- 8 Pressure screw, short (6.2744.070)
 Fastened to the pump output.

Maintenance interval

The following parts of the high-pressure pump must be serviced at least once per year:

- Inlet valve (6.2824.170)
- Outlet valve (6.2824.160)
- Piston seal (6.2741.020)
- Zirconium oxide piston (6.2824.070)

Maintenance tasks can also be carried out if the following problems occur:

Unstable baseline (pulsations, flow fluctuations)



CAUTION

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

Recommended procedure

We recommend the following procedure for the maintenance of the pump head:

- 1. Service the inlet valve and the outlet valve.
- 2. Remove the pump head.
- 3. Service both pistons, one after the other.
 - a. Remove piston.
 - b. Dismantle the piston.
 - c. Replace the piston seal.
 - d. Replace the zirconium oxide piston.
 - e. Assemble the piston.
 - f. Insert the piston.
- 4. Reinstall the pump head.

You can find brief video sequences on the following maintenance steps on the Internet at http://ic-help.metrohm.com/.

Servicing the outlet valve and inlet valve

Accessories

For this step, you need the following accessories:

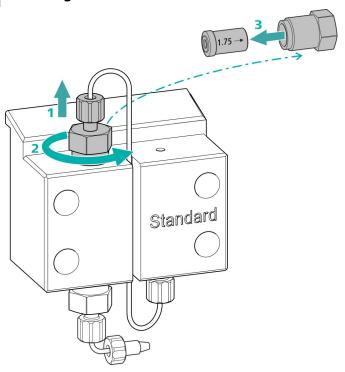
Adjustable wrench (6.2621.000)

Cleaning the outlet valve

Spare parts

If the outlet valve cannot be cleaned, you will need a new outlet valve (6.2824.160) for this step.

1 Removing the outlet valve



- Unscrew the connection capillary to the auxiliary piston from the outlet valve holder (16-2) (1).
- Start by loosening the outlet valve holder with the adjustable wrench and then unscrew it by hand (2) and remove it.
- Remove the outlet valve from the outlet valve holder (3).

2 Cleaning the outlet valve

■ Start by rinsing the outlet valve in the direction of eluent flow using a wash bottle filled with ultrapure water, RBSTM solution or acetone. (The direction of eluent flow is marked on the valve by an arrow.)

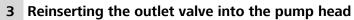
The rinsing solution must come out at the valve outlet. If no more solution comes out, then the valve is blocked.

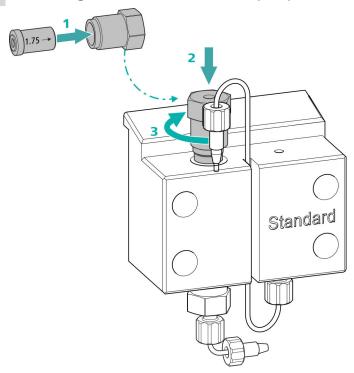
■ Rinse the outlet valve in the direction opposite the eluent flow using a wash bottle filled with ultrapure water, RBSTM solution or acetone.

The rinsing solution may only come out at the valve outlet.

The outlet valve must be replaced if it is still clogged after cleaning.

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- Insert the outlet valve into the outlet valve holder (the seal must be visible) (1).
- Screw the outlet valve holder up into the pump head (2) and tighten it firmly by hand and then retighten it one additional 3/4 turn using the adjustable wrench (3).
- Tighten the connection capillary to the auxiliary piston back onto the outlet valve holder.

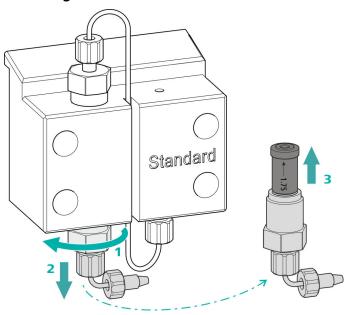
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Cleaning the inlet valve

Spare parts

If the inlet valve cannot be cleaned, you will need a new inlet valve (6.2824.170) for this step.

1 Removing the inlet valve



- Unscrew the connection capillary to the connection of the eluent aspiration tubing (16-**7**).
- Start by loosening the inlet valve holder with the adjustable wrench (1) and then unscrew it by hand (2) and remove it.
- Remove the inlet valve from the inlet valve holder (3).

2 Cleaning the inlet valve

■ Start by rinsing the inlet valve in the direction of eluent flow using a wash bottle filled with ultrapure water, RBSTM solution or acetone. (The direction of eluent flow is marked on the valve by an arrow.)

The rinsing solution must come out at the valve outlet. If no more solution comes out, then the valve is blocked.

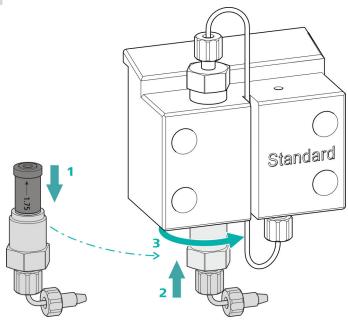
■ Rinse the inlet valve in the direction opposite the eluent flow using a wash bottle filled with ultrapure water, RBSTM solution or acetone.

The rinsing solution may only come out at the valve outlet.

The inlet valve must be replaced if it is still clogged after cleaning.

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3 Reinserting the inlet valve into the pump head



- Insert the inlet valve into the inlet valve holder (the seal must be visible) (1).
- Screw the inlet valve holder up into the pump head (2) and tighten it firmly by hand and then retighten it one additional 3/4 turn using the adjustable wrench (3).
- Refasten the connection capillary to the connection of the eluent aspiration tubing (16-**7**).

Removing the pump head

Accessories

For this step, you need the following accessories:

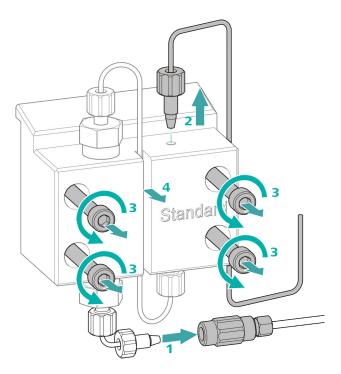
• 4 mm hex key (6.2621.030)

Removing the pump head

Prerequisites:

- Is the high-pressure pump switched off?
- Has the pressure been released?
- Is the instrument switched off?

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1 Release the coupling from the pressure screw and seal it with a stopper.

- 2 Unscrew and remove the pressure screw on the pump head's outlet (16-8).
- **3** Loosen and remove the four fastening screws (16-**3**) using the hex key.
- **4** Remove the pump head (16-**4**).

Servicing the piston

Carry out the following work on both pistons in turn.

Servicing a piston consists of the following tasks:

- 1. Replace the piston seal.
- 2. Clean or replace the zirconium oxide piston.
- 3. Reinstall the piston.

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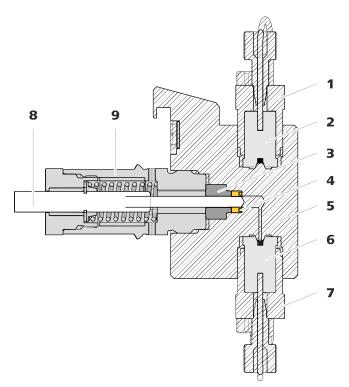


Figure 17 High-pressure pump – Cross-section

1	Outlet valve holder	2	Outlet valve (6.2824.160)
3	Backup ring	4	Piston seal (6.2741.020)
5	Pump head	6	Inlet valve (6.2824.170)
7	Inlet valve holder	8	Zirconium oxide piston (6.2824.070)
9	Piston cartridge		

Accessories

For this step, you need the following accessories:

- Adjustable wrench (6.2621.000)
- Tool for piston seals (6.2617.010) consisting of a tip (18-1) for removing the old piston seal and a sleeve (18-2) for inserting the new piston seal.

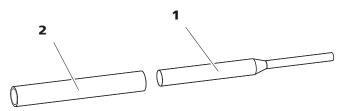


Figure 18 Tool for piston seal (6.2617.010)

1 Tip 2 Sleeve

Spare part

For this step, you need a new piston seal (6.2741.020).

Replacing the piston seal

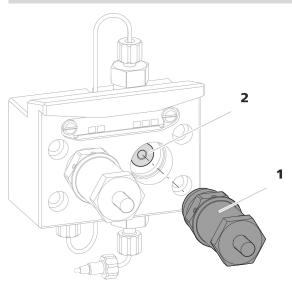


Figure 19 Removing the piston cartridge from the pump head

1 Piston cartridge

2 Backup ring

1 Removing the piston cartridge

Loosen the piston cartridge (19-1) using the adjustable wrench and then unscrew it from the pump head by hand. Set it aside.

2 Removing the backup ring

Shake the backup ring (19-2) out of the piston opening. Set it aside.

3 Removing the old piston seal



CAUTION

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



CAUTION

Avoid touching the sealing surface in the pump head with the tool!

Only screw the tip (18-1) of the tool for the piston seal far enough into the piston seal that the seal can be pulled out.

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4 Inserting the new piston seal into the tool

Insert the new piston seal into the recess of the sleeve (20-1) of the tool for piston seal. The sealing spring must be visible from the outside.

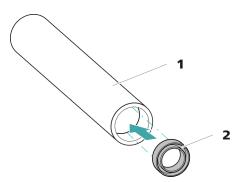


Figure 20 Inserting the piston seal into the tool

Tool for piston seal (6.2617.010)Sleeve for inserting the new piston seal.

2 Piston seal (6.2741.020)

5 Inserting the new piston seal into the pump head

Guide the sleeve (18-2) of the tool for the piston seal with inserted piston seal into the pump head. Press the seal into the pump head recess using the wide end of the tip (18-1) of the tool.

Cleaning or replacing the zirconium oxide piston

Prerequisites:

- The pump head has been removed (see "Removing the pump head", page 63).
- The piston cartridge is removed (see "Replacing the piston seal", page 66).

For this task, you need the following accessories:

Zirconium oxide piston (6.2824.070)

Adjustable wrench (6.2621.000) from the accessory kit: *Vario/Flex Basic* (6.5000.000).

1 Breaking down the piston cartridge



CAUTION

Inside the piston cartridge there is a taut spring that can launch out of the piston cartridge if the tension is released suddenly.

When opening the piston cartridge, counteract the pressure from the spring and carefully unscrew the cartridge.

- Loosen the piston cartridge's screw with an adjustable wrench and carefully unscrew the screw by hand while counteracting the pressure from the taut spring.
- Remove the zirconium oxide piston and place it on a paper towel.
- Remove the spring retainer, the spring and the inner plastic sleeve from the piston cartridge and lay them next to the piston.
- Place the backup ring you put aside with the remaining parts.

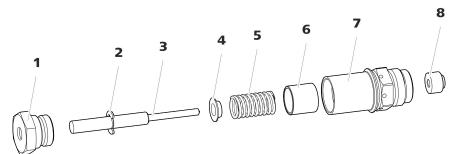


Figure 21 Parts of the piston cartridge

1 P	iston cartridge screw	2	Retaining washer
3 Z	irconium oxide piston (6.2824.070)	4	Spring retainer
5 S	pring (6.2824.060)	6	Inner plastic sleeve Protects from metallic abrasion.
7 P	iston cartridge	8	Backup ring

2 Cleaning the parts of the piston cartridge

 If the zirconium oxide piston has become contaminated due to abrasion or deposits, then clean it using a fine abrasive cleaning powder, rinse it using ultrapure water until it is free of particles and dry it.

The zirconium oxide piston must be replaced if it is heavily contaminated or scratched.

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• Rinse the other parts of the piston with ultrapure water and dry with a lint-free cloth.

3 Replacing the zirconium oxide piston

- Remove the retaining washer (21-2) from the old piston. If the retaining washer sits too tightly, use a pointed object to loosen the retaining washer.
- Assemble the retaining washer at the same point on the new piston.

4 Putting the piston cartridge together

- Insert the inner plastic sleeve, the spring and the 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 the screw and tighten it by hand.

Mounting the piston

1 Reinserting the backup ring

Clean the backup ring (17-3) wit ultrapure water and reinsert it.

2 Reinserting the piston cartridge

Screw the assembled piston cartridge back into the pump head and tighten, first by hand, then also using an adjustable wrench by approx. 15°.

Clean the second piston cartridge in the same way.

Mounting the pump head

Accessories

For this step, you need the following accessories:

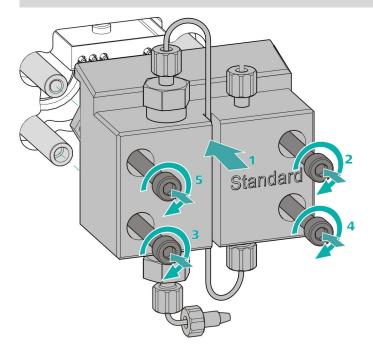
• 4 mm hex key (6.2621.030)

Mounting the pump head



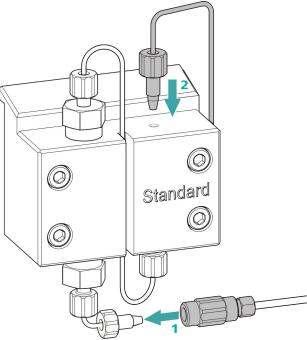
NOTE

The pump head cannot be mounted the wrong way, as it has fastening bolts with different bore hole depths, i.e., one fastening bolt is longer than all others. The bore hole with the greatest depth must therefore be aligned with the longest bolt.



- 1 Push the pump head onto the four fastening bolts (1).
 - Tighten the four fastening screws using the hex key (6.2621.030) alternating crosswise.





- **1** Remove the stopper from the coupling. Tighten the coupling to the pressure screw located on the pump head inlet capillary (1).
 - Reconnect the pump head outlet capillary to the pump head outlet (2).

4.7 Servicing the inline filter



NOTE

You can find a video sequence for this task in the *Multimedia Guide IC Maintenance* or on the Internet at http://ic-help.metrohm.com/.

Maintenance interval

The filter must be replaced at least every 3 months; it may need to be replaced more frequently, depending on the application.

Accessories

For this task, you need the following accessories:

- Two adjustable wrenches (6.2621.000) from the accessory kit: Vario/ Flex Basic (6.5000.000)
- Tweezers
- A new filter from the packaging (6.2821.130)

Removing the filter

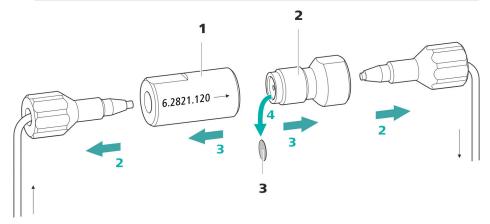


Figure 22 Inline filter – Removing the filter

1 Filter housing

Inline filter housing. Part of the accessories (6.2821.120).

3 Filter (6.2821.130)

Pack contains 10 pieces.

2 Filter screw

Screw for the inline filter. Part of the accessories (6.2821.120).

1 Shutting off the flow

Switch off the high-pressure pump in the software.

2 Removing the inline filter

Unscrew both pressure screws from the inline filter.

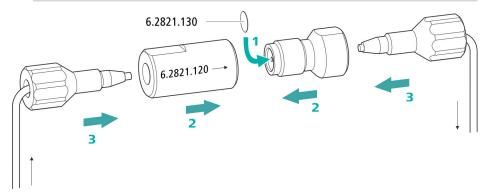
3 Unscrewing the filter screw

Use two adjustable wrenches (6.2621.000) to loosen the filter screw (22-**2**) from the filter housing (22-**1**) and unscrew it by hand.

4 Removing the filter

Remove the old filter (22-3) using tweezers.

Inserting a new filter



1 Inserting a new filter

Use tweezers to carefully place a new filter into the filter screw
 (22-2) so that it is flat and press it firmly into place with the rear
 of the tweezers.

2 Installing the filter screw

Screw the filter screw (22-2) back into the filter housing (22-1) and tighten by hand. Then use two adjustable wrenches (6.2621.000) to tighten it slightly.

3 Remounting the inline filter

Screw pressure screws back onto the inline filter.
 Take care to ensure that the flow direction matches that inscribed on the inline filter.

4 Rinsing the inline filter

- Dismantle the guard column (if present) and the separation column and replace with a coupling (6.2744.040).
- Rinse the instrument with eluent.
- Reinsert the columns after 10 minutes.

4.8 Injection valve

4.8 Injection valve

Maintenance on the injection valve is best performed by specialist personnel from Metrohm during annual service.

4.9 Metrohm Suppressor Module (MSM)

4.9.1 Notes for operating the Metrohm Suppressor Module (MSM)



NOTE

The suppressor units must never be regenerated in the same flow direction the eluent is pumped. Therefore, always mount the inlet and outlet capillaries according to the diagram outlined in *Chapter Connecting the Metrohm Suppressor Module (MSM)*, page 31.

The Metrohm Suppressor Module (MSM) consists of three suppressor units, which, in rotation, are (1.) used for suppression, (2.) regenerated with regeneration solution and (3.) rinsed with ultrapure water or with suppressed eluent. In order to record each new chromatogram under comparable conditions, work is normally performed with a freshly regenerated and rinsed suppressor unit.



CAUTION

The Metrohm Suppressor Module (MSM) must never be switched over if liquid is not flowing through it, since otherwise it may become jammed. If the Metrohm Suppressor Module (MSM) is in a dry state, it must be rinsed for at least five minutes before it may be switched over.



CAUTION

The Metrohm Suppressor Module (MSM) must be regenerated (see chapter 4.9.3.2, page 75), cleaned (see chapter 4.9.3.4, page 78) or replaced (see chapter 4.9.3.5, page 80) if the capacity of the Metrohm Suppressor Module (MSM) is reduced or if the backpressure is high.

4.9.2 Taking care of the suppressor housing



CAUTION

The transparent suppressor housing can become fogged.

The suppressor housing is made of PMMA (poly(methyl methacrylate)). It can become scratched and foggy if cleaned improperly. This can make viewing the rotor difficult or impossible.

- Do not use any scouring agents for cleaning.
- Do not use any solvents for cleaning.

4.9.3 Servicing the Metrohm Suppressor Module (MSM)

4.9.3.1 Parts of the Metrohm Suppressor Module (MSM)

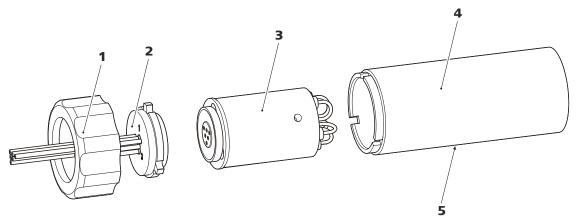


Figure 23 Parts of the Metrohm Suppressor Module (MSM)

1	Union nut	2	Connecting piece
3	Rotor	4	Housing
5	Slot in the housing		

4.9.3.2 Regenerating the anion suppression rotor

If the anion suppressor units are loaded with certain heavy metals (such as iron) or organic contamination for long periods, then the standard regeneration solution may no longer be able to completely remove them. This constantly reduces the capacity of the suppressor units, which results in reduced phosphate sensitivity in mild cases and a large increase in the baseline in severe cases.

If such capacity problems occur at one or more positions, all anion suppressor units must be regenerated with one of the following solutions:

Regeneration solutions

Contamination with heavy metals or elevated backpressure:
 1 mol/L H₂SO₄ + 0.1 mol/L oxalic acid

- Contamination with organic cationic complexing agents:
 0.1 mol/L H₂SO₄ / 0.1 mol/L oxalic acid / acetone 5%
- Heavy contamination with organic substances:
 0.2 mol/L H₂SO₄ / acetone ≥ 20%
- Contamination by certain environmental samples
 1 mol/L H₃PO₄



NOTE

If phosphoric acid has been used once as regeneration solution in an IC system, you will have to continue using phosphoric acid for regeneration. Regenerating it with sulfuric acid again can lead to problems in the baseline.



CAUTION

Pump tubing made of PVC must not be used for solutions containing organic solvents.

We recommend using the high-pressure pump for regeneration.

Regenerating the anion suppressor rotor

- 1 Disconnecting the Metrohm Suppressor Module (MSM) from the IC system
 - Disconnect the capillaries of the MSM labeled regenerant and rinsing solution from the IC system.

2 Regenerating the Metrohm Suppressor Module (MSM)

Regenerate the three suppressor units one after the other for approx. 15 minutes using one of the solutions mentioned above.

- Connect the capillary labeled **regenerant** to the outlet of the high-pressure pump using a coupling (6.2744.040).
- Set the flow of the high-pressure pump to 0.5 mL/min in the software.
- Connect the regeneration solution to the high-pressure pump.
- Switch on the high-pressure pump.
 If the pressure decreases during regeneration, slowly increase the flow of the pump to a maximum of 2 mL/min. When doing so, make sure that the pressure does not exceed 2 MPa!
- After approx. 15 minutes, switch off the high-pressure pump.

- In the software, use the **Step** command to switch to the next suppressor unit and regenerate it as described above.
- As soon as all three suppressor units have been regenerated, disconnect the capillary labeled **regenerant** from the coupling.

3 Rinsing the Metrohm Suppressor Module (MSM)

After regeneration, each of the three suppressor units must be rinsed with degassed ultrapure water for about 15 minutes.

- Connect the capillary labeled **rinsing solution** to the outlet of the high-pressure pump using a coupling (6.2744.040).
- Set the flow of the high-pressure pump to 0.5 mL/min in the software
- Connect the ultrapure water to the high-pressure pump.
- Switch on the high-pressure pump. If the pressure decreases during rinsing, slowly increase the flow of the pump to a maximum of 2 mL/min. When doing so, make sure that the pressure does not exceed 2 MPa!
- After approx. 15 minutes, switch off the high-pressure pump.
- In the software, use the **Step** command to switch to the next suppressor unit and rinse it as described above.
- As soon as all three suppressor units have been rinsed, disconnect the capillary labeled **rinsing solution** from the coupling.

4 Connecting the Metrohm Suppressor Module (MSM) to the IC system

- Reconnect the capillaries of the MSM labeled regenerant and rinsing solution to the IC system.
- Reconnect the entry and the exit of the high-pressure pump to the IC system.

4.9.3.3 Regenerating the cation suppression rotor

If the cation suppressor units are exposed to certain contaminations for prolonged periods, then these contaminations can no longer be removed completely with the standard regeneration solution. The performance of the suppressor units declines continuously, as indicated by a rise of the baseline or asymmetrical peaks.

If such problems occur at one or more positions, then treat all of the cation suppressor units as follows:

Regenerating the cation suppressor

1 Stopping the regeneration solution

Stop the regeneration solution feed.

2 Regenerating the first cation suppressor unit

Rinse the system with eluent until the suppressor unit is completely exhausted (indicated by a significant increase in conductivity). This can take up to 240 minutes under standard conditions.

3 Regenerating the second cation suppressor unit

In the software, use the **Step** command to switch to the next suppressor unit. Repeat step 2.

4 Regenerating the third cation suppressor unit

In the software, use the **Step** command to switch to the next suppressor unit. Repeat step 2.

5 Restoring the regeneration solution

As soon as all three suppressor units are completely exhausted, restore the regeneration solution feed.

6 Equilibrating the system

Equilibrate the system as usual (see chapter "Conditioning" in the manual for the ion chromatograph).

4.9.3.4 Cleaning the Metrohm Suppressor Module (MSM)

In the following cases, it may be necessary to clean the Metrohm Suppressor Module (MSM):

- Increased backpressure at the MSM's connection tubing.
- Irremediable blockage of the MSM (solutions can no longer be pumped through the MSM).
- Irremediable jamming of the MSM (MSM can no longer be switched over).

Cleaning the Metrohm Suppressor Module (MSM)

1 Disconnecting the Metrohm Suppressor Module (MSM) from the IC system

- Switch off the instrument.
- Disconnect all capillaries of the MSM from the IC system.

2 Dismantling the Metrohm Suppressor Module (MSM)

• Unscrew the union nut (23-1) from the housing (23-4).

- Pull the connecting piece (23-2) out of the housing together with the rotor (23-3).
 - If the rotor gets stuck in the housing, you can push it out as follows:
 - Put a pointed object into the slot in the housing and use it to push out the rotor.
- Loosen the connecting piece from the rotor with a turning movement.

3 Rinsing the capillaries

- Connect each of the six PTFE capillaries connected to the connecting piece (23-2) in sequential order to the high-pressure pump and pump ultrapure water through them.
- Check whether water comes out at the connecting piece.

If one of the capillaries remains blocked, the connecting piece (see "Replacing parts of the Metrohm Suppressor Module (MSM)", page 81) must be replaced (order number 6.2835.010).

4 Cleaning the rotor

• Clean the sealing surface of the rotor (23-3) with ethanol using a lint-free cloth.

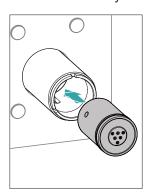
5 Inserting the rotor



CAUTION

The rotor may be destroyed during start-up if it is not inserted correctly.

For an overview of the rotors, see figure, page 28





• Insert the rotor (23-3) into the housing (23-4) in such a way that the tubing connections on the rear of the rotor fit into the corresponding recesses inside the housing and one of the three holes of the rotor is visible from below in the slot of the housing (23-5).



NOTE

The rotor's sealing surface is located approx. 4 mm deep inside the suppressor drive if the rotor is inserted correctly.

If this is not the case, then the rotor must be moved into the correct position using careful turning. If the rotor cannot be turned or removed, it can be moved into the correct position from below by means of a pointed object (e.g. a screwdriver).

6 Cleaning the connecting piece

• Clean the sealing surface of the connecting piece (23-2) with ethanol using a lint-free cloth.

7 Inserting the connecting piece

See also Chapter 3.11.1, page 29

- Insert the connecting piece (23-2) into the housing in such a way that connector 1 is on top and the three pins of the connecting piece fit into the corresponding recesses on the housing.
- Reattach the union nut (23-1) and tighten by hand (do not use a tool).

8 Connecting and conditioning the Metrohm Suppressor Module (MSM)

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

4.9.3.5 Replacing parts of the Metrohm Suppressor Module (MSM)

Parts of the Metrohm Suppressor Module (MSM) may need to be replaced in the following cases:

- Irremediable loss of suppressor capacity (reduced phosphate sensitivity and/or significant rise in the baseline).
- Irremediable blockage of the MSM (solutions can no longer be pumped through the MSM).

Both the rotor and the connecting piece can be replaced.

Replacing parts of the Metrohm Suppressor Module (MSM)

1 Disconnecting the Metrohm Suppressor Module (MSM) from the IC system

• Switch off the instrument.

• Disconnect all capillaries of the MSM from the IC system.

2 Dismantling the Metrohm Suppressor Module (MSM)

- Unscrew the union nut (23-1) from the housing (23-4).
- Pull the connecting piece (23-2) out of the housing together with the rotor (23-3).

If the rotor gets stuck in the housing, you can push it out as follows:

Put a pointed object into the slot in the housing and use it to push out the rotor.

Loosen the connecting piece from the rotor with a turning movement.

3 Cleaning the new rotor

• Clean the sealing surface of the new rotor (23-3) with ethanol using a lint-free cloth.

4 Inserting the new rotor



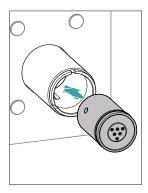
CAUTION

The rotor may be destroyed during start-up if it is not inserted correctly.



NOTE

The adapter (6.2842.020) (see "Inserting small rotors", page 30) is required in order to insert a small rotor into the suppressor drive.





• Insert the new rotor (23-3) into the housing (23-4) in such a way that the tubing connections on the rear of the rotor fit into the corresponding recesses inside the housing and one of the three holes of the rotor is visible from below in the slot of the housing (23-5).



NOTE

The rotor's sealing surface is located approx. 4 mm deep inside the suppressor drive if the rotor is inserted correctly.

If this is not the case, then the rotor must be moved into the correct position using careful turning. If the rotor cannot be turned or removed, it can be moved into the correct position from below by means of a pointed object (e.g. a screwdriver).

5 Cleaning the new connecting piece

• Clean the sealing surface of the new connecting piece (23-2) with ethanol using a lint-free cloth.

6 Inserting the new connecting piece

See also Chapter 3.11.1, Page 29

- Insert the connecting piece (23-2) into the housing in such a way that connector 1 is on top and the three pins of the connecting piece fit into the corresponding recesses on the housing.
- Reattach the union nut (23-1) and tighten by hand (do not use a tool).

7 Connecting and conditioning the Metrohm Suppressor Module (MSM)

- Reconnect all capillaries of the MSM to the IC system.
- Before switching the MSM over for the first time, rinse the three suppressor units with solution for five minutes.

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4.10 Peristaltic pump

4.10.1 Notes on operating the peristaltic pump

The flow rate of the peristaltic pump depends on the drive speed (set using the software), the contact pressure and, above all, the inner diameter of the pump tubing. Depending on the application, different pump tubing is used. Select pump tubing that best matches your application (see table 2, page 36).



CAUTION

The service life of the pump tubing primarily depends on the contact pressure.

If the peristaltic pump is switched off for long periods, lift up the tubing cartridges on the right side by releasing the snap-action levers. This ensures that the contact pressure will be maintained once it has been set.



CAUTION

The pump tubing (6.1826.xxx) is made of PVC or PP and therefore must not be used for rinsing with solutions containing organic solvents. In this case, use different pump tubing or use another pump for rinsing.

4.10.2 Servicing the peristaltic pump

4.10.2.1 Replacing the pump tubing

Pieces of pump tubing inserted into the peristaltic pump are consumables with a limited service life.

Pieces of pump tubing with 3 stoppers are tensioned in the tubing cartridge so that they end up positioned between two stoppers. This results in two possible positions for the tubing cartridge. Once the pump tubing exhibits significant signs of wear, it can be tensioned a second time in the other respective position.

Maintenance interval

Replace the pump tubing every 2 months.

Replace the pump tubing every 4 weeks if the peristaltic pump is being used continuously.

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4.10 Peristaltic pump

4.10.2.2 Replacing the filter

The filters inserted into the pump tubing connection with locking nut and filter (6.2744.180) must be replaced regularly.

Maintenance interval

We recommend replacing the filters (6.2821.130) (24-**2**) every three months. The filters may need to be replaced more frequently, depending on the application.

Accessories

For this step, you need the following accessories:

- 1 filter from the spare filter set (6.2821.130)
- 2 adjustable wrenches (6.2621.000)
- Tweezers

Replacing the filter

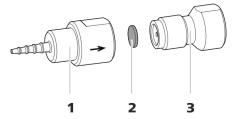


Figure 24 Pump tubing connection – Replacing the filter

1 Tubing olive

2 Filter (6.2821.130)
Pack contains 10 pieces.

3 Filter screw

1 Unscrewing the filter screw

• Unscrew the filter screw (24-3) from the tubing olive (24-1) using the two adjustable wrenches.

2 Replacing the filter

- Remove the old filter (24-2) using tweezers.
- Use tweezers to place the new filter (24-2) on the filter screw (24-3) so that it is flat and press it firmly into place with the rear of the tweezers.

3 Installing the filter screw

• Screw the filter screw (24-3) back into the tubing olive (24-1) and start by tightening it by hand. Finish tightening it using the two adjustable wrenches.

4.11 Servicing the detector

Follow the maintenance instructions in the the detector's manual.

4.12 Rinsing the sample path

Before a new sample is measured, the sample path must be rinsed with it long enough to prevent the measuring result from being falsified by the previous sample (sample carry-over).

The time required to rinse the sample path with the new sample is called the rinsing time. The rinsing time depends on the transfer time.

The transfer time corresponds to the time the sample needs to flow from the sample vessel to the end of the sample loop. The transfer time depends on the following factors:

- The pump capacity of the peristaltic pump or of the Dosino that is used for the sample transfer.
- The total capillary volume
- The volume of the gas removed from the sample by the sample degasser (if a sample degasser is present and connected)

The transfer time can be determined as follows:

Determining the transfer time

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 Unscrewing the sample loop

Unscrew the end of the sample loop.

3 Aspirating the sample and measuring the time

Aspirate a sample typical for the later application and use a stopwatch to measure the time the sample needs to go from the sample vessel to the end of the sample loop.

The time upon stopping the watch is the "transfer time".

4 Tightening the sample loop again

Tighten the sample loop again.

 4.13 Separation column

If the sample is injected automatically, the rinsing time must be at least three times the **transfer time**.

Checking the rinsing time

You can determine if the applied rinsing time is sufficient by measuring the sample carry-over directly. Proceed as follows to do this:

1 Preparing two samples

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

2 Determining "Sample A"

Allow "Sample A" to run through the sample path for the duration of the rinsing time; inject and then measure it.

3 Determining "Sample B"

Allow "Sample B" to run through the sample path for the duration of the rinsing time; inject and then measure it.

4 Calculating the sample carry-over

The sample carry-over corresponds to the ratio of the peak areas of the measurement from Sample B to the measurement from Sample A. The smaller this ratio, the smaller the amount of sample carry-over. This ratio can be changed by varying the rinsing time. This can be used to determine the required rinsing time for the application.

4.13 Separation column

4.13.1 Separating efficiency

The analysis quality that can be attained depends in a large part on the separating efficiency of the separation column being used. The separating efficiency of the selected separation column must be sufficient for the current analysis problems. If difficulties arise, start by checking the quality of the separation column in each case by recording a standard chromatogram.

You can find detailed information on the separation columns available from Metrohm in the leaflet provided along with your separation column, in the **Metrohm IC Column Program** (available from your Metrohm representative) or on the Internet at http://www.metrohm.com in the Ion Chromatography product area. You can find information on special IC applications in the corresponding "**Application Bulletins**" or "**Application Notes**", which are available on the Internet at http://

www.metrohm.com in the Applications area or free of charge upon request from your responsible Metrohm representative.

4.13.2 Protecting the separation column

We recommend using the following protective measures so that the separation column retains its separating efficiency for as long as possible:

- Microfilter both the sample and the eluent (0.45 μ m filter) and aspirate the eluent via the aspiration filter (6.2821.090) as well.
- Always use a guard column. 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 representative), the leaflet provided along with your separation column or the product information about the separation column at http://www.metrohm.com (Ion Chromatography product area), or it can be obtained directly from your representative.

4.13.3 Storing the separation column

Always store separation columns you do not need in a sealed and filled state according to the column manufacturer's specifications.

4.13.4 Regenerating the separation column

The separation column can be regenerated according to the column manufacturer's specifications if the separation characteristics of the column have deteriorated. You can find information on regenerating separation columns available from Metrohm on the leaflet provided with every column.



NOTE

Regeneration is intended as a last resort. It should not be carried out regularly.

 5.1

5 Troubleshooting

Problem	Cause	Remedy
	<u> </u>	
Marked drop in pressure.	 Leak in the system.	Check the capillary connections and seal leaks, if necessary (see chapter 3.4, page 14).
The baseline has a	The eluent path has a leak.	Check the eluent path and fix the leak.
large amount of noise.		If necessary, tighten the pressure screws using a wrench (6.2739.000).
	High-pressure pump – Contaminated pump valves.	Clean the pump valves (see chapter 4.6, page 58).
	The eluent path is blocked.	Check the eluent path and eliminate the blockage.
	Contaminations in the elu- ent	Check the quality of the chemicals and the water.
	High-pressure pump – Defective piston seals.	Replace the piston seals (see chapter 4.6, page 58).
The baseline is drifting.	Leak in the system.	Check all capillary connections and seal leaks, if necessary (see chapter 3.4, page 14).
	The organic solvent in the eluent is evaporating.	• Check the eluent bottle cap (see chapter 3.7, page 20).
		 Constantly stir the eluent.
The pressure in the system markedly	The inline filter (6.2821.120) is blocked.	Replace the filter (6.2821.130) .
increases.	The MSM is blocked.	• Regenerate the MSM (see chapter 4.9.3.2, page 75).
		Note: 6.2821.180 pump tubing connection with filter must be used.
	The conductivity detector is blocked.	Shorten the capillary ends by a few millimeters .

5 Troubleshooting

Problem	Cause	Remedy			
		 Rinse the detector opposite the normal flow direction . 			
	Guard column – Blocked.	Replace the guard column (see chapter 3.17, page 47).			
	Separation column — Blocked.	 Regenerate the separation column (see chapter 4.13.4, page 87). Replace the separation column (see "Connecting the separation column", page 50). 			
		Note: Samples should always be microfiltered .			
	Injection valve – blocked.	Have the valve cleaned (by a Metrohm service engineer).			
The retention times in the chromato-	Eluent - Incorrect concen- tration	Create eluent with correct concentration.			
gram have changed unexpectedly.	Separation column – Diminished separating effi- ciency.	 Regenerate the separation column (see chapter 4.13.4, page 87). Replace the separation column (see "Connecting the separation column", page 50). 			
	The eluent contains gas bubbles.	 Purge the high-pressure pump (see figure, page 46). 			
	– High-pressure pump – Defective.	Request Metrohm Service.			
Peak areas are lower than expected.	Sample – There is a leak in the sample path.	Find and fix the leak in the sample path.			
	Sample – The sample path is blocked.	Find and eliminate the blockage in the sample path.			
The peristaltic pump is pumping too little.	Peristaltic pump – Contact pressure too weak.	Correctly set the contact pressure (see "Setting the contact pressure correctly", page 39).			
	Peristaltic pump – Filter blocked.	Replace the filter (see "Replacing the filter", page 84).			
	Peristaltic pump – Pump tubing defective.	Replace the pump tubing (see chapter 4.10.2.1, page 83).			

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Problem	Cause	Remedy
Data of the separation column cannot be read.	Column chip dirty.	Clean the contact surfaces of the column chip with ethanol.
	Column chip is defective.	 Save column configuration in MagIC Net. Notify Metrohm Service.
Individual peaks are greater than expected.	Sample – Sample carry- over from previous meas- urements.	Check the rinsing time (see "Checking the rinsing time", page 86).
The background conductivity is too high.	The MSM is not connected.	Connect the MSM (see chapter 3.11, page 28).
mgn.	The incorrect eluent is being used.	Change the eluent (see chapter 4.4.2, page 57).
	MSM – No or insufficient flow of regeneration solution or rinsing solution.	Check the flow of the regeneration solution and of the rinsing solution .
The retention times are poorly reproducible.	The eluent path has a leak.	Check all of the connections along the eluent path and fix the leak.
cible.	The eluent path is blocked.	Check the eluent path and eliminate the blockage.
	The eluent contains gas bubbles.	 Deaerate the high-pressure pump (see chapter 3.16, page 45).
Chromatograms have poor resolution	Separation column – Diminished separating effi- ciency.	 Regenerate the separation column (see chapter 4.13.4, page 87). Replace the separation column (see "Connecting the separation column", page 50).
Conductivity detector is not recognized in the software	No connection to the detector.	 Check the cable connection (14-1). Switch the instrument off and (after 15 seconds) on again.
Extreme spread of the peaks in the chromatogram. Splitting (dual	Capillary connections – Dead volume in the sys- tem.	Check the capillary connections (see chapter 3.4, page 14) (use PEEK capillaries with an inner diameter of 0.25 mm between the injection valve and detector).
peaks)	Guard column – Dimin- ished efficiency.	Replace the guard column (see chapter 3.17, page 47).

5 Troubleshooting

Problem	Cause Remedy		
	Separation column – Dead volume at the column head.	 Install the separation column in the opposite flow direction (if the leaflet says this is permissible) and rinse into a beaker. Replace the separation column (see "Connecting the separation column", page 50). 	
Precision problems - the measured values are highly scattered.	Injection valve – Sample Ioop.	Check the installation of the sample loop (see "Optional: Exchanging the sample loop", page 27).	
	Injection valve – Defective.	Request Metrohm Service.	

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6.1 Reference conditions -----

Technical specifications

Reference conditions 6.1

The technical specifications listed in this chapter refer to the following ref-

erence conditions:

Ambient temp-

erature

+25 °C (±3 °C)

> 40 minutes in operation Device status

Ш

6.2 **Ambient conditions**

Operation

Nominal function +5 to +45 °C

range at max. 80% relative humidity, non-condensing

+5 to +45 °C Storage

at max. 80% relative humidity, non-condensing

Altitude / Pressure

range

max. 3,000 m.a.s.l. sea level / min. 700 mbar

Overvoltage cate-

gory

2 Pollution degree

Housing 6.3

Dimensions

Width 262 mm Height 468 mm Depth 362 mm

Base tray, housing

and cover plate material

94 V-0, CFC-free, coated

IP degree of pro-

IP 20

tection

Controls

Indicators LED for standby indicator On/off switch On the rear of the instrument

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Polyurethane hard foam (PUR) with flame retardation for fire class UL

6 Technical specifications

6.4 Weight

Weight 14.8 kg (without accessories)

6.5 High-pressure pump

Type

Serial dual-piston pump

Intelligent pump head recognition

Chemically inert

Metal-free pump heads

Materials in contact with the eluent: PEEK, ZrO₂, PTFE/PE

• Self-optimizing flow and pressure

Flow rate

Adjustable flow

0.001 - 20 mL/min

range

0.01 - 5 mL/min with standard PEEK pump head

Flow increment

1 μL/min

Reproducibility

< 0.1% deviation

of the eluent

flow

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 pulsa-

tion

< 1%

Safety shutdown

Function

Automatic shutdown upon reaching the pressure limits

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 becomes active two minutes after system start

• The pump is automatically shut down after three piston strokes below the minimum pressure limit

6.6 Injection valve

6.6 Injection valve

Actuator switch-

typ. 100 ms

ing time

Maximum operat-

35 MPa (350 bar)

ing pressure

Material PEEK

6.7 Metrohm Suppressor Module (MSM)

Resistance to sol-

No restriction

vents

Switching time typ. 100 ms

6.8 Peristaltic pump

Type 2-channel peristaltic pump

Shift direction Clockwise/counterclockwise

Rotational speed 0 - 42 rpm in 7 levels of 6 rpm each

Pumping charac-

teristics

0.3 mL/min at 18 rpm; with standard pump tubing (6.1826.420)

Pump tubing

material

Recommended: PharMed® (Ismaprene)

6.9 Detector

You can find the technical specifications for the detector in the manual for the detector.

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6 Technical specifications

6.10 Energy supply

Nominal voltage

100-240 V (± 10%)

range

Nominal frequency range 50-60 Hz (± 3%)

Power consump-

• 65 W for typical analysis application

tion

25 W standby (conductivity detector to 40 °C)

Power supply unit

• up to 300 W maximum, electronically monitored

• internal fuse 3.15 A

6.11 Interfaces

USB

Inlet 1 USB upstream, type B (for connecting to a computer)

Detector 1 15-pin high-density DSUB (female)

Column recogni-

tion

for an intelligent column

7 Accessories

Up-to-date information on the scope of delivery and optional accessories for your product can be found on the Internet. You can download this information using the article number as follows:

Downloading the accessories list

- **1** Enter https://www.metrohm.com/ into your Internet browser.
- 2 Enter the article number (e.g. **2.925.0020**) into the search field. The search result is displayed.
- Click on the product.

 Detailed information regarding the product is shown on various tabs.
- 4 On the **Included parts** tab, click on **Download the PDF**.

 The PDF file with the accessories data is created.



NOTE

Once you have received your new product, we recommend downloading the accessories list from the Internet, printing it out and keeping it together with the manual for reference purposes.

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