DOC342.52.90756

QP 1680-TOC/TNb

User Manual

04/2022, Edition 3

Table of Contents

Section 1 Specifications

Specifications are subject to change without notice.

Specification	Details
Dimensions (W x H x D)	38 x 44 x 70 mm (15.0 x 17.4 x 27.6 in.)
Weight	29 to 32 kg (64.0 to 70.6 lb)
Pollution degree	2
Overvoltage category	II
Parameters	TOC, TNb
Sample oxidation	**QP 1680-TOC**: 680 °C (1256 °F) catalytic combustion **QP 1680-TOC/TNb; QP 1680-TNb**: 720 °C (1328 °F) catalytic combustion
Detection technique	TOC: Non-dispersive infrared detection (NDIR); TNb: Chemiluminescence
Temperature	Furnace temperature 1050 °C (1922 °F) maximum
Measuring range	0 to 30,000 mg/L
Detection limit	TC, TIC, NPOC: 50 µg/L; TNb: 20 µg/L
Repeteability	Until 10 mg/L: < 5%; More than 10 mg/L: < 2%
Analysis time[1]	**QP 1680-TOC; QP 1680-TNb:** 3 minutes **QP 1680-TOC/TNb:** 4 minutes
Sampler	Integrated sampler with 65 or 96 positions for liquid sample injection. Includes stirring device for each sample position.
Type of injection	Direct injection into the furnace or IC-port
Sample sparging	Standard—Included controllable sample sparging
Sample injection volume	5 to 800 µL (default: 100 µL)
Inorganic carbon removal	Automatic by addition of acid by sampler and sparging (not available in QP 1680-TNb)
Power requirements	**Analyzer:** 100-240 VAC ±10%, 50/60 Hz; 16 A (with safety ground); 750 W maximum **PC:** 100-240 VAC ±10%, 50/60 Hz; 16 A (with safety ground); 90 W maximum **Monitor:** 100-240 VAC ±10%, 50/60 Hz; 16 A (with safety ground); 100 W maximum
Operating temperature	20 to 30 °C (68 to 86 °F)
Storage temperature	-20 to 60 °C (-4 to 140 °F)
Relative humidity	20 to 80%, non-condensing
Altitude	2250 m (88,582 ft) maximum
Environmental conditions	Indoor use
Gas supply	Type: Oxygen or synthetic air; Quality: 99,998% minimum (4.8); Pressure: 3 to 10 bar (43.5 to 145 PSI)
Gas connection	1/8-inch Swagelok male connector for 1/8/-inch OD tubing[2]
Gas consumption	**QP 1680-TOC**: 150 mL/min[3] **QP 1680-TOC/TNb**: 200 mL/min [3] **QP 1680-TNb**: 200 mL/min **Ultra-pure water (UPW)** purging: 30 mL/min

[1] Analysis time does not include sample preparation.
[2] Supplied with the analyzer.
[3] The analyzer uses 300-350 mL/min more to remove NPOC.

Specification	Details
Certifications	CE, UKCA, certified to UL safety standards
Warranty	1 year (EU: 2 years)

1.1 PC specifications

A PC with TEIS2 software installed is necessary to operate the analyzer.

Table 1 Minimum PC specifications

Specification	Details
Operating system	Windows 7 or higher (Windows 8 not included)
Interfaces	Five USB ports 2.0 or higher for: • Analyzer • Service dongle • LIMS dongle • Mouse and keyboard
Processor	2 GHz 32-bit or 64-bit processor
Memory	1 GB
Hard drive	10 GB available disk space
Video card	Support for DirectX 9 graphics with 128 MB memory
Monitor	1280 x 1024 resolution; 22 inch.

In no event will the manufacturer be liable for damages resulting from any improper use of product or failure to comply with the instructions in the manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

2.1 Safety information

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is soley responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information

⚠DANGER

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

⚠WARNING

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

⚠CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates that the marked item can be hot and should not be touched without care.
	This symbol identifies the presence of a strong corrosive or other hazardous substance and a risk of chemical harm. Only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.

	This symbol indicates that the object is heavy.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

2.2 Intended use

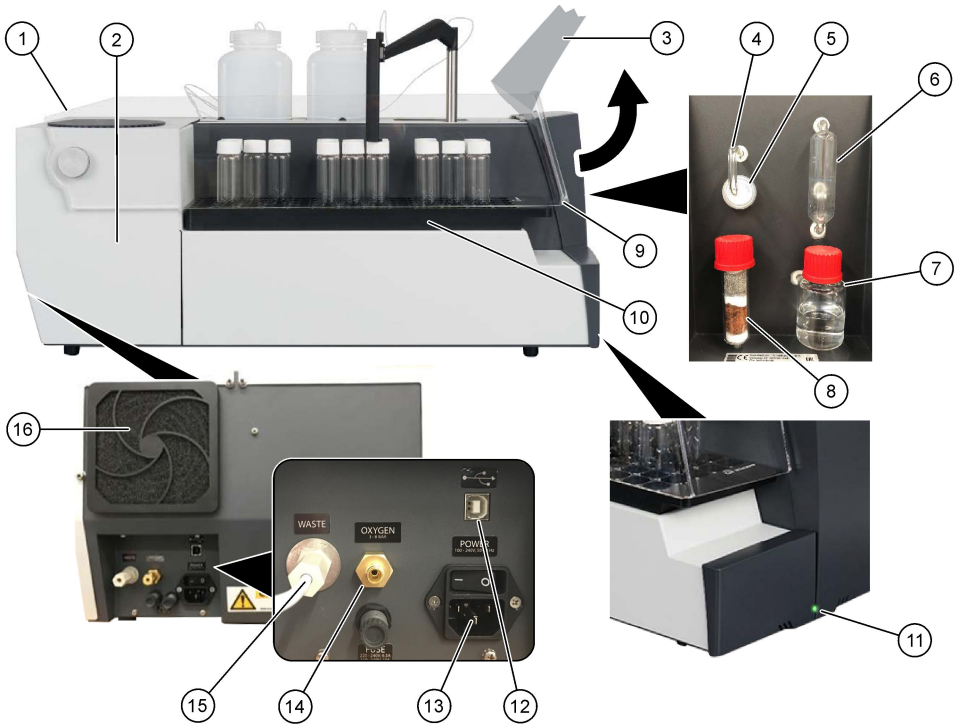
The QP 1680-TOC/TNb analyzer is intended for use by individuals who measure water quality parameters in the laboratory.

2.3 Product overview

The QP 1680-TOC/TNb analyzer measures non-purgeable organic carbon (NPOC) and total bound nitrogen (TNb) in aqueous samples. The analyzer also measures total carbon (TC), total inorganic carbon (TIC) and calculates total organic carbon (TOC).

The analyzer has an integrated sampler that analyzes carbon and nitrogen in different water matrices. The analyzer connects to a PC with the TE Instruments Software (TEIS2) for operation and automation. Refer to Figure 1 and Figure 2.

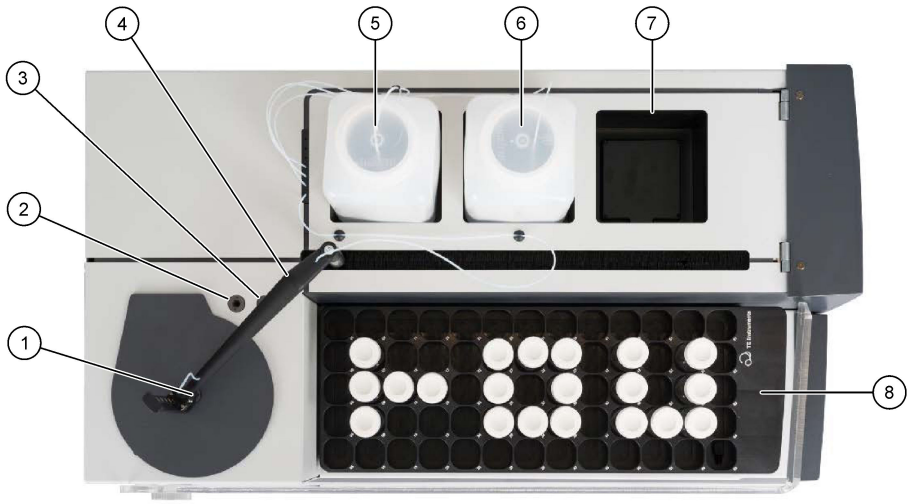
Figure 1 Product overview—Front and side views



1 QP 1680-TOC/TNb analyzer	**9** Safety cover
2 Furnace compartment	**10** Stirrer and sampler
3 Front cover	**11** LED indicator
4 Filter holder	**12** USB port type B
5 Particle filter, 5 µm	**13** Power supply connection an power switch
6 IC vessel	**14** 1/8" swagelock oxygen port
7 Humidifier	**15** Waste connection
8 Halogen scrubber	**16** Fan

LED color	Description
Green	The analyzer is prepared for use.
Yellow	The analyzer is not prepared for use. Some parameters are not within the measurement range.
Blue	The analyzer is in operation.
Red	The analyzer has no connection to the TEIS2 software.

Figure 2 Product overview—Top view

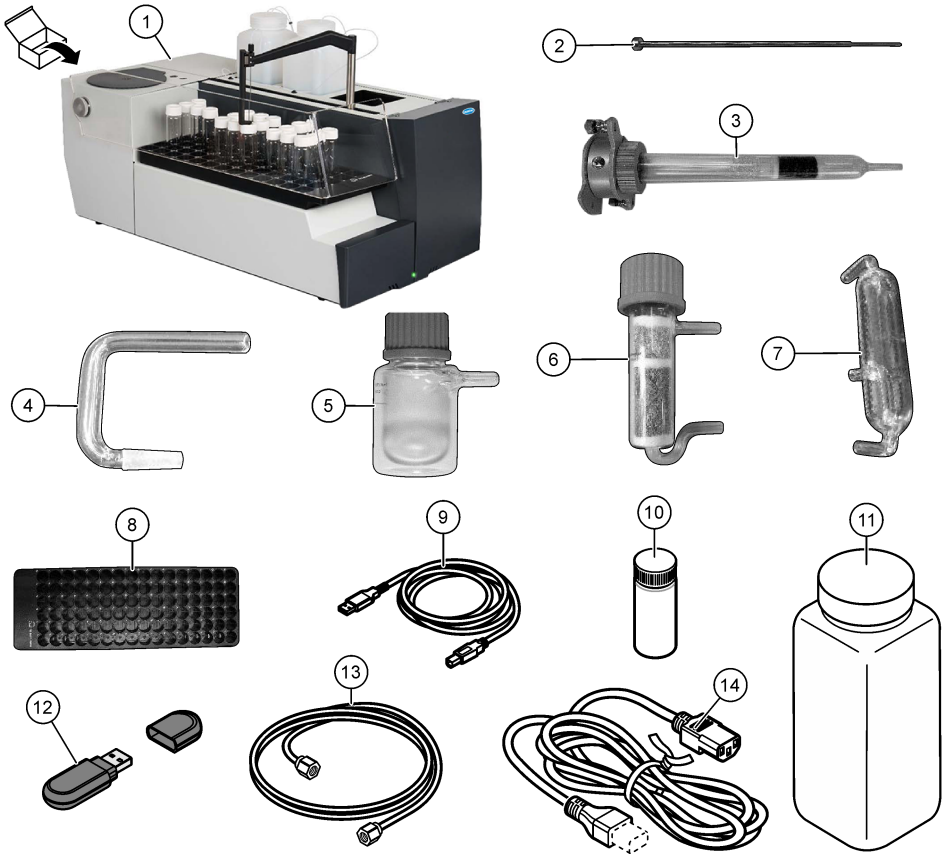


1 Furnace injection point	**5** Reagent container (ultra-pure water)
2 Waste port	**6** Reagent container (acid)
3 IC injection point	**7** Optional waste container
4 Sampler arm	**8** Vial tray, 65 or 96 samples

2.4 Product components

Make sure that all components have been received. Refer to Figure 3. If any items are missing or damaged, contact the manufacturer or a sales representative immediately.

Figure 3 Product components



1 Analyzer	**8** Sample tray
2 Sample introduction needle, stainless steel	**9** USB cable
3 Combustion tube	**10** 24-mL sample vials, glass (100x)
4 Filter holder	**11** 1-L containers (3x)
5 Humidifier assembly	**12** USB flash drive with TEIS2 software
6 Halogen scrubber	**13** PTFE blue-stripe tubing, 1/8-inch OD, 2 m (includes the nut and ferule)
7 IC vessel	**14** Power cord

Section 3 Installation

⚠ DANGER

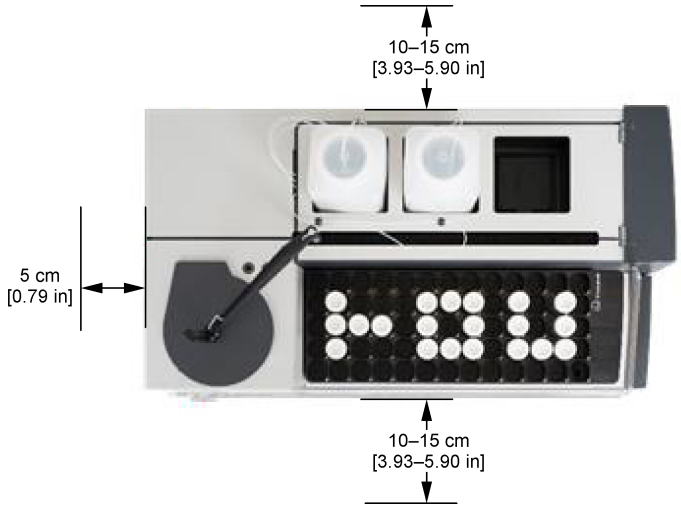
Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

3.1 Location requirements

Refer to Installation guidelines on page 11 for more location requirements.

- Keep a minimum 10 to 15 cm (3.93 to 5.90 inch) of clearance to the left and the right of the instrument. Refer to Figure 4.
- Keep a minimum clearance of 5 cm (0.79 inch) behind the instrument.
- Keep wires and tubing away from the furnace inlet and outlet.
- Make sure there is a sink or a waste bottle within 3 m (9.8 ft) of the instrument.

Figure 4 Installation clearances



3.2 Installation guidelines

⚠ WARNING

Fire hazard. This product is not designed for use with flammable liquids.

⚠ CAUTION

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

⚠ CAUTION

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

NOTICE

This instrument is sensitive to electromagnetic and electromechanical interference. These interferences may have an effect on the analysis performance of this instrument. Do not put this instrument near equipment that may cause interference.

Install the instrument:

- Indoors in a clean, dry, well-ventilated and temperature-controlled location
- In a location with a flat surface to prevent the unit from movement
- In a location with minimum mechanical vibrations and electronic noise
- In a location with no electromagnetic interferences from equipment such as transmitters, power switching, etc.
- In an environmental enclosure that supplies protection from precipitation and direct sunlight
- In a location where there is sufficient clearance to make plumbing and electrical connections
- In a location where the display is easily seen by the user
- In a location with a compatible waste container for the drain tube

3.3 Prepare the reagents and standards

⚠WARNING

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

- Wear protective clothing, safety glasses or face protections and rubber gloves.
- Prepare the reagents in a fume hood.
- Use only glass or PTFE labware.
- Make sure that all of the bottles vent to air after installation.
- Make sure that the applicable accident prevention regulations are observed.
- Dispose of substances correctly and in accordance with the applicable regulations.

For NPOC and IC analysis, a solution of strong acid (e.g., HCl 3 mol/L) is added with a capacity to transfer 300 ppm of IC from the sample vial (40 mL) into CO_2. Use 500 mL of acid solution to prepare approximately 750 NPOC samples. Adjust the acid concentration or amount of acid added based on the sample pH or buffering strength to get a sample pH less than 2. Make sure that the sample pH is less than 2 before the analysis.

Table 2 Reagents and standards

Chemical	Specification
Ultra-pure water (UPW)	Electrical conductivity at 25°C: 0.0555 µS/cm maximum; electrical resistivity at 25°C: 18 MΩ·cm minimum ***Note:*** *UPW is used to prepare standards or dillutions. 2.5 L of UPW is necessary for the analyzer installation.*
Phosphoric acid (H_3PO_4) 85% w/w[4]	Used to prepare the 9.33% phosphoric acid solution (1 mol/L) ***Note:*** *The recommended acid solution is phosphoric acid (H3PO4). As an alternative, other strong acids can be used.*
Phosphoric acid solution (H_3PO_4) (1 mol/L) 9.33% w/w	54.9 mL is used to prepare 500 mL of solution.
Hydrochloric acid (HCl) 36% w/w	Used to prepare the 10.4% hydrochloric acid solution.

[4] Concentration of the solution in terms of percentage composition. x% w/w solution equals X grams of solute dissolved in 100 grams of solution.

Table 2 Reagents and standards (continued)

Chemical	Specification
Hydrochloric acid solution (HCl) (3 mol/L) 10,4% w/w	144.7 mL is used to prepare 500 mL of solution.
Sulfuric acid (H_2SO_4) 96% w/w	Used to prepare the 13.5% sulfuric acid solution
Sulfuric acid solution (H_2SO_4) (1,5 mol/L) 13,5% w/w	70.3 mL is used to prepare 500 mL of solution.

3.3.1 Organic carbon (TC and NPOC)

TC and NPOC analysis use the same stock solution: Organic carbon.
The stock solution has a shelf life of 2 months when kept in the dark at 4 °C (39 °F).

Items to collect:

- Volumetric flask, glass, 1000 mL
- Pipette, glass, 1 mL
- Amber glass reagent bottle, 1 L (for solution storage)
- Ultra-pure water (UPW), 1 L
- Anhydrous potassium hydrogen phthalate ($C_8H_5KO_4$), 21.254 g

Prepare a 10,000-mg/L stock solution as follows:

1. Dry the anhydrous potassium hydrogen phthalate for two hours at 120 °C (248 °F).
2. Fill the volumetric flask with 500 mL of UPW.
3. Add 21.254 grams of anhydrous potassium hydrogen phthalate into the volumetric flask.

   Note: *Calculate the accurate concentration. weight and/or purity. An accurate quantity of 21.254 g in 1000 mL is necessary for a 10,000-mg/L stock solution.*
4. Carefully stir to dissolve the potassium hydrogen phthalate.
5. Fill to the mark with UPW and mix.
6. Pour the content of the flask into the reagent bottle. Put on a cap for storage

Use the stock solution to prepare the different **standards** based on the necessary calibration line.

Use the stock solution as a calibration standard of 10,000-mg/L. Use the solvent (UPW) as a blank. Always prepare the standards with the same batch of water for the blank. The blank is used more frequently. Prepare larger volumes of the blank.

Concentration (in mg/L)	Pipette (in mL)	Stock solution (in mg/L)	Volumetric flask (in mL)
1000	25	10,000	250
500	10	10,000	200
250	5	10,000	200
100	25	1000	250
50	10	1000	200
25	5	1000	200
10	25	100	250
5	10	100	200
2.5	5	100	200
1	25	10	250
0.5	10	10	200
0	-	-	250

3.3.2 Inorganic carbon (IC)

The stock solution has a shelf life of 6 months when kept in the dark at 4 °C (39 °F). Standards may have a shorter shelf life, especially when below 10 mg/L. The recommendation is to make new standards from the stock solution at 3-months intervals.

Items to collect:

- Volumetric flask, 1000 mL
- Amber glass reagent bottle, 1 L (for solution storage)
- Ultra-pure water (UPW), 1 L
- Anhydrous sodium carbonate (Na_2CO_3), 8.824 g

Prepare a 1000-mg/L stock solution as follows:

1. Dry the anhydrous sodium carbonate for two hours at 120 °C (248 °F).
2. Fill the volumetric flask with 500 mL of UPW.
3. Add 8.824 grams of anhydrous sodium carbonate into the volumetric flask.
   Note: *Calculate the accurate concentration. An accurate quantity of 8.824 gram in 1000 mL is necessary for a 1000-mg/L stock solution.*
4. Carefully stir to dissolve the potassium hydrogen phthalate.
5. Fill to the mark with UPW and mix.
6. Pour the content of the flask into the reagent bottle. Put a cap for storage

Use the stock solution to prepare the different standards based on the necessary calibration line.

Use the stock solution as a calibration standard of 1000 mg/L. Use the solvent (UPW) as a blank. Always prepare the standards with the same batch of water for the blank. The blank is used more frequently. Prepare larger volumes of the blank.

Concentration (in mg/L)	Pipette (in mL)	Stock solution (in mg/L)	Volumetric flask (in mL)
250	50	1000	200
100	25	1000	250
50	10	1000	200
25	5	1000	200
10	25	100	250
5	10	100	200
2.5	5	100	200
1	25	10	250
0.5	10	10	200
0	—	—	250

3.3.3 Total Nitrogen (TN)

The stock solution has a shelf life of 6 months when kept in the dark at 4 °C (39 °F).

Items to collect:

- Volumetric flask, 1000 mL
- Amber glass reagent bottle, 1 L (for solution storage)
- Ultra-pure water (UPW), 1 L
- Anhydrous ammonium sulfate (500 mg/L), 2.358 g
- Anhydrous potassium nitrate (500 mg/L), 3.608 g

Prepare a 1000-mg/L stock solution as follows:

1. Dry the anhydrous ammonium sulfate and the anhydrous potassium nitrate for two hours at 120 °C (248 °F).
2. Fill the volumetric flask with 500 mL of UPW.
3. Add 2.358 grams of anhydrous ammonium sulfate into the volumetric flask.

   Note: *Calculate the accurate concentration. An accurate quantity of 2.358 g in 1000 mL is necessary for a 1000-mg/L stock solution.*
4. Add 3.608 grams of anhydrous potassium nitrate into the volumetric flask.

   Note: *Calculate the accurate concentration. An accurate quantity of 3.608 g in 1000 mL is necessary for a 1000-mg/L stock solution.*
5. Carefully stir to dissolve the anhydrous ammonium sulfate and the anhydrous potassium nitrate.
6. Fill to the mark with UPW and mix.
7. Pour the content of the flask into the reagent bottle. Put a cap for storage.

Use the stock solution to prepare the different standards based on the necessary calibration line.

Use the stock solution as a calibration standard of 1000 mg/L. Use the solvent (UPW) as a blank. Always prepare the standards with the same batch of water for the blank. The blank is used more frequently. Prepare larger volumes of the blank.

Concentration (in mg/L)	Pipette (in mL)	Stock solution (in mg/L)	Volumetric flask (in mL)
250	50	1000	200
100	25	1000	250
50	10	1000	200
25	5	1000	200
10	25	100	250
5	10	100	200
2.5	5	100	200
1	25	10	250
0.5	10	10	200
0	—	—	250

3.4 Remove the transport locks

⚠WARNING

Personal injury hazard. Instruments or components are heavy. Use assistance to install or move.

NOTICE

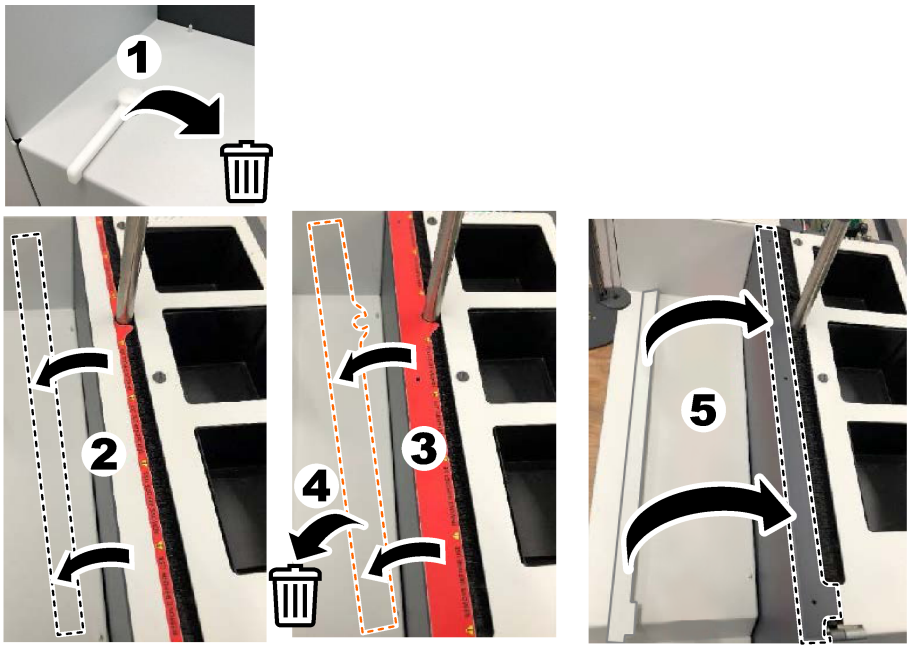
Use the bottom of the analyzer to lift the analyzer. Do not use the plastic covers or the sampler arm to lift the analyzer or damage to the analyzer can occur.

Remove the magnetic lock and transportation strips from the analyzer. Refer to Figure 5 and the steps that follow:

1. Remove the white stirrer lock.
2. Remove the white strip.
3. Remove the red warning strip..

4. Discard the red warning strip
5. Install the white strip again.

Figure 5 Remove the transport locks



3.5 Connect to carrier gas

⚠ DANGER

Fire and explosion hazard. Oil and grease can burn with explosive violence when there is oxygen. Make sure that all parts that are in contact with oxygen do not have grease or oil.

The instrument cannot operate without a carrier gas connection. An oxygen or synthetic air supply must be within 2 m (6.5 ft) of the rear of the analyzer. Use the supplied gas inlet tubing to connect oxygen or synthetic air. Refer to Specifications on page 3 for the gas supply specifications.

Connect the analyzer to a carrier gas as follows:

1. Open the gas air supply for some seconds to remove unwanted material.
2. Use a wrench to connect the supplied PTFE blue-stripe tubing to the gas supply and the Oxygen port. Refer to Figure 6.
3. Do not open the gas supply. Make sure that the carrier gas connection is leak tight.

Figure 6 Connect to carrier gas

3.6 Connect the waste tubing

The analyzer has a waste connector to discard the water after the analysis. Refer to Figure 7 and the steps that follow.

1. Use 4-mm OD tubing to connect the waste. The waste connector is a push-in connector. Push the tubing firmly into the waste connector.
2. Put the other end of the tubing in a sink or a waste container within 3 m (9.8 ft) of the analyzer.

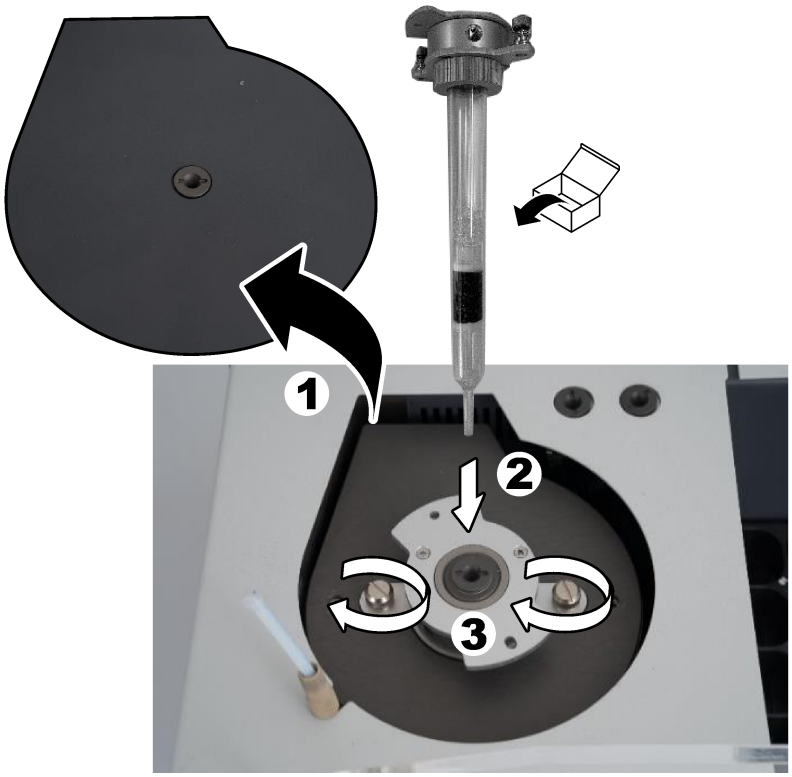
Figure 7 Connect the waste tubing

3.7 Assemble the combustion tube

Do not start the analyzer without the combustion tube installed. Refer to Figure 8and the steps that follow.

1. Remove the top cover of the furnace.
2. Put the combustion tube in the furnace.
3. Use the thumbscrews to attach the furnace tube.
4. Do not connect the gas line to the combustion tube.

Figure 8 Assemble the combustion tube



3.8 Assemble the sampler arm

1. Use the supplied 4-mm allen screw to attach the head of the sampler arm to the sampler.
2. Put the sample introduction needle into the guide of the sampler arm.

3.9 Connect the PC and power

⚠ DANGER
Electrical shock and fire hazards. Make sure that the supplied cord and non-locking plug meet the applicable country code requirements.

⚠ DANGER
Electrocution hazard. Protective Earth Ground (PE) connection is required.

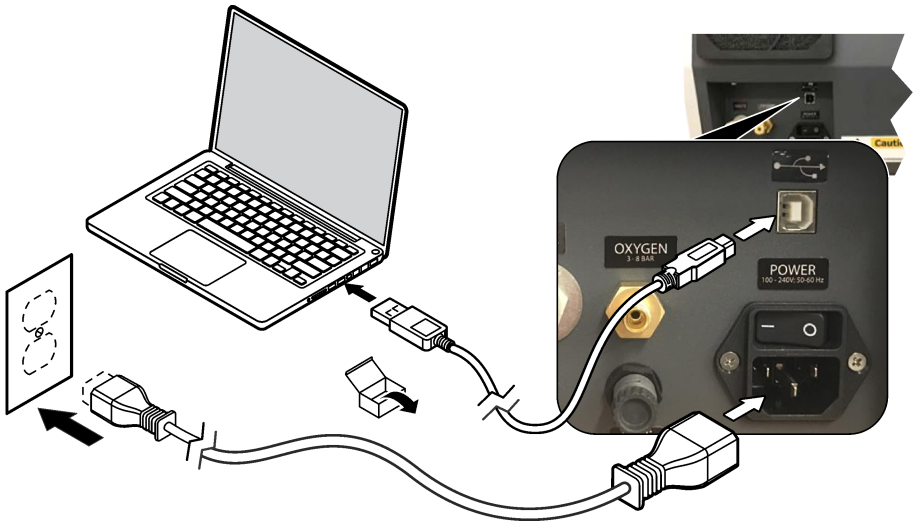
⚠ DANGER
Electrocution and fire hazard. Attach the power cord so that it cannot touch hot surfaces.

A PC with TEIS2 software installed is necessary to operate the analyzer.

1. Put the PC near to the analyzer. Make all of the necessary PC connections.
2. Use the supplied USB cable to connect the PC to the analyzer. Refer to Figure 9.

   Note: *Make sure that the USB cable is not parallel to a power cable or electrical noise interference on the connection can occur.*
3. Make sure that the power switch of the analyzer is set to OFF. Connect the supplied power cord to a grounded electrical outlet.

Figure 9 Connect the PC and power



3.10 Install the software

Note: *Do not start the TEIS2 software at this moment. Not loading the correct database will cause the instruments to malfunction.*

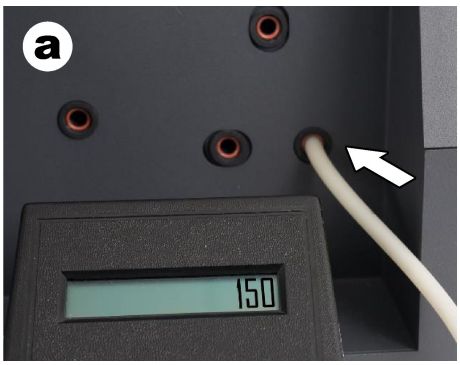
Use the supplied USB flash drive to install the TEIS2 software on the PC as follows.

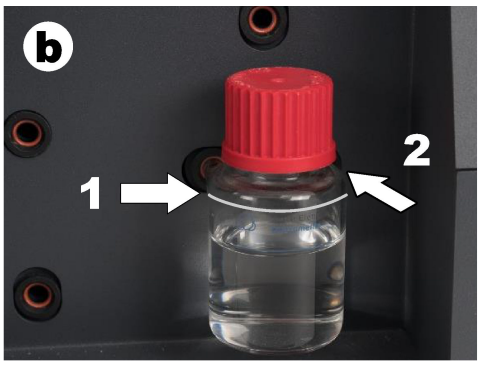
1. Connect the USB flash drive to the PC.
2. Go to USB > Software > 3rd part. Install two software programs:
   a. **AbdeRdr90_en-Us.exe**
   b. **vcredist_x86.exe** (internet version) or **dotNetFx40_Full_x86_x64.exe** (off-line version)
3. Go to USB > Software > TEIS > V2.x.x.
4. Install **Setup_TEIS2.msi**.
5. Open the TEIS2 software. "No database found" shows.
6. Click OK.
7. Select the database from the USB flash drive. Go to USB > Database > Backup 20XX.XXX > **TEIS_DATA.FDB**
8. Close the software and restart the PC.

Items to collect: flow meter

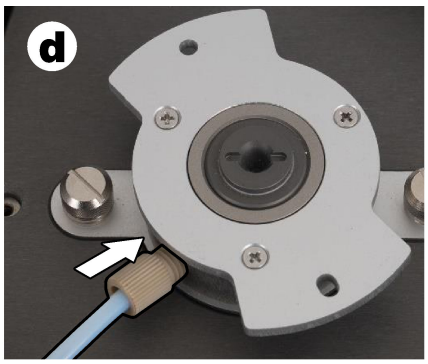
The first time the analyzer is used, do the steps that follow:

1. Set the PC to on.
2. Set the power switch of the analyzer to on.
3. Open the gas supply. Make sure that the gas pressure is less than 8 bar (116 PSI).
4. Start the TEIS2 software. Login with service engineer credentials.
5. Wait until all of the devices in the software show as connected.
6. Use the flow meter to examine the gas connections. Then, install the correct item.
   a. Connect a flow meter to the lower right connection of the humidifier. The flow must be 150 mL/min ± 5 %.
   b. Fill the humidifier with ultra-pure water. Carefully connect the humidifier.
      Note: *Make sure to push the humidifier in a straight line into the connector or damage to the connector can occur.*

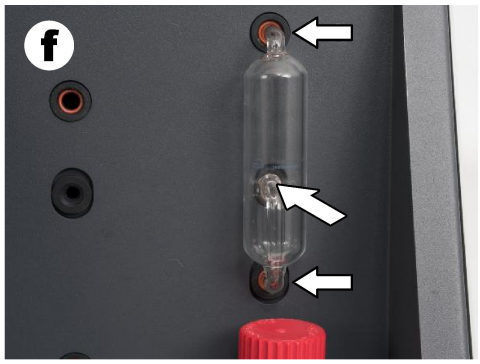




   c. Connect the flow meter to the carrier gas tubing in the top of the furnace. The flow must be 150 mL/min ± 5 %.
   d. Connect the carrier gas tubing at the top of the furnace. Install the top cover of the furnace.

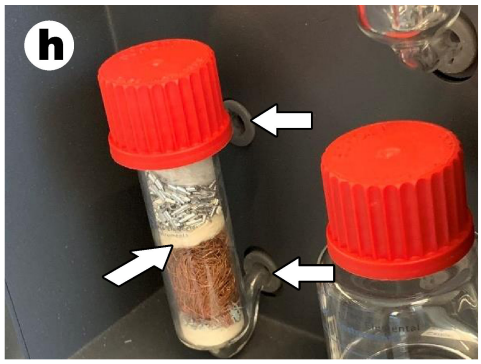


   e. Connect the flow meter to the middle connection of the IC vessel. The flow must be 150 mL/min ± 5 %.
   f. Carefully install the IC vessel. Apply pressure in the middle of the IC vessel.



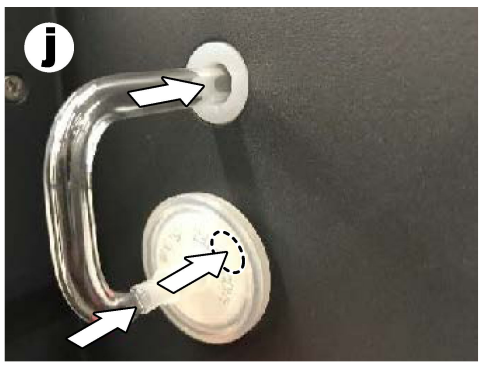
g. Connect the flow meter to the bottom connection of the halogen scrubber. The flow must be 150 mL/min ± 5 %.

h. Carefully install the halogen scrubber. Apply pressure in the middle of the halogen scrubber.



i. Connect the flow meter to the bottom connection of the filter. The flow must be 150 mL/min ± 5 %.

j. Install the filter holder with the particle filter.



7. In the TEIS2 software, open **Visual devices**.
   The **Total flow** box shows the total flow in mL/min. For analyzers without nitrogen detector, the flow must be 150 mL/min ± 5 %. For analyzers with nitrogen detector, the flow must be 200 mL/min ± 5 %.
8. Start the method "Test method: Send sampler to IC port to check system pressure".
   The analyzer sends the Sampler to the IC port to close the IC port inlet.
   The **Condenser** box shows the temperature of the condenser. When set at 1 °C, the value must be 1 °C ± 0.5 °C.

   The **Oxygen pressure** box shows the internal pressure of the oxygen or synthetic air. The value must be 1800 to 2300 mbar.
9. Remove the containers from the analyzer.
   In **Visual devices**, make sure that the values for the weigh unit cups are 0 g ± 10 g.

10. Install the containers filled with the applicable reagents in the weight units. Use the color label to identify the tubing for each container.
    - Weight unit 1: ultra pure water. Connect the two green tubes.
    - Weight unit 2: acid. Connect the red tube.
    - Weight unit 3: waste. Use 4-mm PTFE tubing for the waste. As an alternative, put the tube in a sink.
11. In **Visual devices**, examine the cooling and heating values.
    For analyzers with nitrogen detector, the cooling value must be 10 °C ± 5 %. The heater value must be 50 °C ± 5 %.
12. Examine the furnace temperature values.
    For analyzers without nitrogen detector, the value must be 680 °C ± 5 %. For analyzers with nitrogen detector, the value must be 720 °C ± 5 %.
13. Install the tray in the analyzer. Make sure that the tray shows in **Visual devices**.
14. Open and close the front cover. Make sure that the status of the front cover shows in **Visual devices**.

4.1 Examine the sampler tubing

Make sure to fix the sampler tubing with the tubing clamps. Make sure that the routing of the sampler tubing is correct. The tubing must let the sampler arm move freely.

Section 5 Operation

5.1 TEIS2 software

A PC with TEIS2 software installed[5] is necessary to operate the analyzer. Refer to Install the software on page 19.

The software is installed in the folder selected during the installation. The default installation folder is: C:\Program Files\TE Instruments\TEIS2

After installation, open and close the software one time to let the software make all of the necessary files and folders to keep the data. The default data folder is a hidden file: C:\ProgramData\TEIS2. The software makes the necessary files and folders based on the connected devices:

- Database
- DocManager
- Lims
- Logfiles
- Reports
- TableData

5.1.1 Login levels

When the TEIS2 software starts, the login window shows. There are different login levels to access different software functionality:

- **Analyst**—-Used for daily operation
- **Lab Manager**—Used when changes to methods are necessary
- **Lab Manager Plus**—For expert Lab Managers

Analyst and Lab Manager levels have no password by default. Lab manager plus is not available by default. A trained service engineer must enable the Lab Manager Plus level. Add password and user during the installation procedure. Manage the users and passwords in the **Users** menu.

Higher login levels, like Service Engineer, are only for factory-trained and certified representatives. Get the service level with a service dongle supplied by the manufacturer. Make sure that non-trained persons do not use higher login levels. Users without sufficient training that use higher login levels can cause damage to the analyzer or sampler and voids the warranty and liability.

5.1.2 Make a database backup

Make a backup of the database to prevent data loss and troubleshooting. Before a different database is copied on the PC, make a backup of the current database.

Make a database backup in the software as follows:
Note: *Lab manager login credentials are necessary to make a backup in the software.*

1. Select **Main menu**. Select **Database manager**.
2. Select **Backup**.
3. Select a location and filename.
4. Select **Save**.

As an alternative, make a database backup in windows as follows:

1. Find the database file **TEIS_Data.FDB** in the folder: C:\ProgramData\TEIS2\Database
2. Make a copy of the file.
   Note: *It is possible to make a copy of the file while the software is in operation.*

[5] The TEIS2 software is already installed and configured when the analyzer is supplied with a PC.

5.1.3 Make database sample groups

Databases can become large files that are not easy to manage and find data. Make a new database with only the selected sample groups to decrease the file size.

1. Select **Main menu**. Select **Database manager** .
2. Select **Create empty database**.
3. Select the sample groups to add. Then, click **Copy sample group**.
   The sample group shows in the new database on the right side of the screen.
4. Do steps 1 to 3 again for all of the necessary sample groups.

If necessary, make a copy of the database in windows. Refer to Make a database backup on page 25.

5.1.4 Software menu

The software menu gives access to the basic functions.

Note: ***Database manager*** *and* ***Users*** *options are only available when logged in as Lab manager.*

1. Select **Main menu** . Select one option.

Option	Description
Sample manager	Manages samples analysis. Makes sample groups, adds samples to a sample group, manages sample data and analysis results.
Configuration	Configures the connected devices and the software settings. Shows all of the connected devices. For each device, shows the status, controllers, actions and device settings.
System status	Shows the status of the analyzer, the connected modules and the signals.
Method manager	Removes, exports and edits methods.
Visual devices	Shows data of connected devices. Starts procedures on a selected device.
Database manager	Maintenance of the database. Makes a backup of the current database. Exports, imports or removes sample groups or a single sample.
Users	Adds, removes and edits users.
Help	Software help system

5.1.5 System status

Shows the analyzer condition, the connected modules and the signals. When all connected modules are green, the system is prepared to start the analysis of the samples.

1. Click the main menu icon. Select **System status.**
   The left side shows the modules. Refer to Figure 10.

- TOC heater/pressure device
- TOC flow plate
- TOC sampler
- Weight unit
- Syringe pump
- TN detector (QP 1680-TOC/TNb and QP 1680-TNb only)

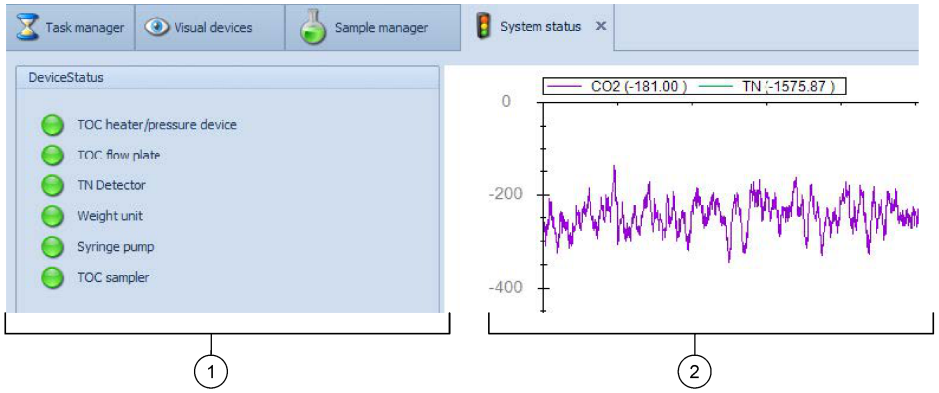
Note: *The sequence of the modules is not important and may change.*

A color code shows the module condition:

- Green: The module is ready.
- Yellow: Parameters are not within range
- Blue: The analyzer or one of the accessories is busy with a sample analysis or procedure.

The right side of Figure 10 shows a graph with the selected signals (default: CO_2 and TN).

Figure 10 System status



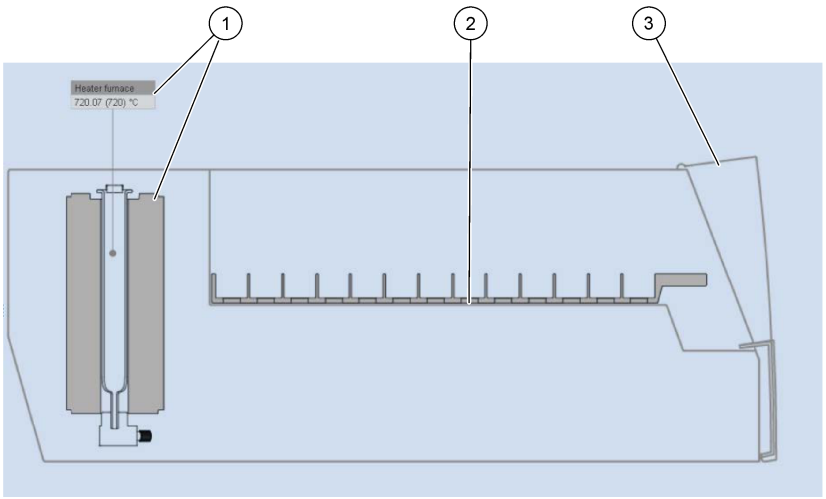
1 Device status	**2** Signals

5.1.6 Visual devices

Shows the **Furnace** and **Detector compartment**.

1. Click the main menu icon. Select **Visual devices**
   A list of the items shows.
2. Select **Furnace**.
   A side view of the analyzer shows. Refer to Figure 11.
3. Click on each element to see more data.

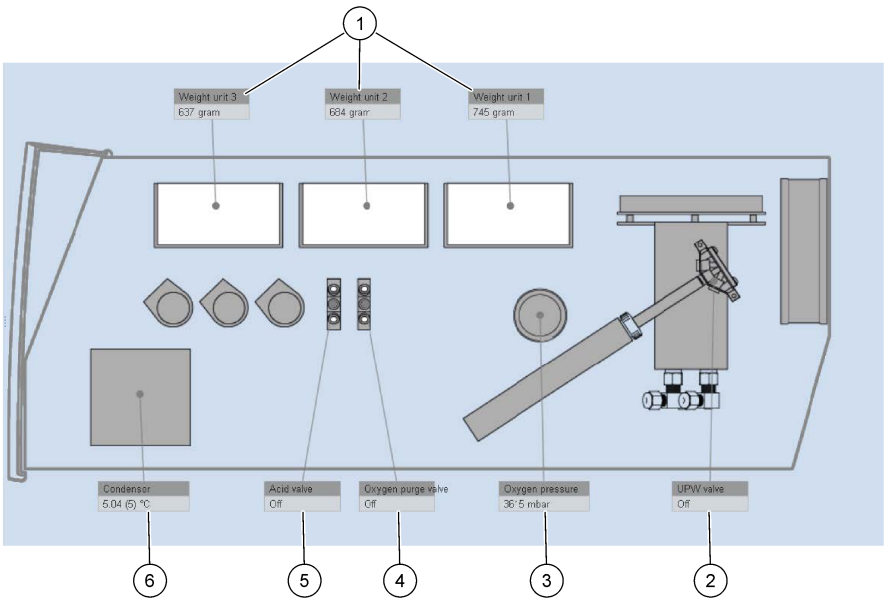
Figure 11 Furnace



1 Heater furnace—Shows the current furnace temperature and the set temperature (value in the brackets).	**3** Cover—Shows the cover closed or open. If the cover is not correctly closed, the analyzer does not operate.
2 Sample tray—Shows when the sample tray is correctly installed.	

4. Select **Detector compartment**.
   A top view of the analyzer shows. Refer to Figure 12.
5. Click on each element to see more data.

Figure 12 Detector compartment



1 Shows the quantity of liquid in the containers	**4** Oxygen purge valve—Off: The valve connects the syringe pump and sampler arm. On: The valve connects the sampler arm and oxygen for purging.
2 UPW valve—Off: The valve connects the syringe pump and sampler arm. On: The valve connects the sampler arm and UPW bottle.	**5** Acid valve—Off: The valve connects the syringe pump and sampler arm. On: The valve connects the syringe pump and the acid bottle.
3 Shows the input pressure of oxygen or synthetic air (default: 2000 mbar approximately)	**6** Condenser—Shows the current condenser temperature and the set temperature (value in the brackets).

5.1.7 Task manager

When the software starts, the **Task manager** shows. The **Task manager** is a task queue that does the tasks in the sequence listed in the table. Refer to Figure 13. Use the task manager window to insert and remove tasks, change the order of tasks and start and stop the Task manager.

When the **Task manager** is started, the software goes from top to bottom in the table and does the first task that shows "Pending" in the status column. Tasks that show as "Hold" are skipped. Completed tasks show as "Done".

Use the icons on the ribbon to select different tasks of the **Task manager**.

1. Use the Tasks tab to add tasks to the table. Select one option:

Option	Description
System method	Adds Startup, Standby or Shutdown tasks.
Create sample group	Adds new sample group tasks for analysis.
Tray configuration	Adds pre-defined configurations to do a dilution line for the sampler.

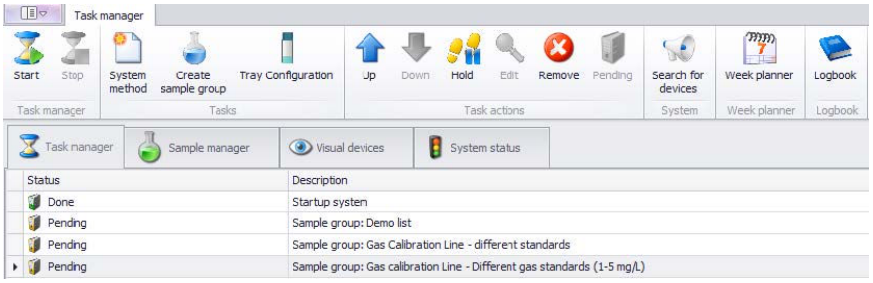
2. Use the Tasks actions tab to change the execution of a task selected in the table. Select one option:

Option	Description
Up / Down	Moves the selected task up or down in the table.
Hold / Pending	Toggles the selected task to hold (will not be executed) or pending (will be executed).
Remove	Removes the selected task from the table.
Pending	Toggles a task not correctly executed (listed as error) back to pending for execution again.

3. Push **Start** at the left top of the screen to start the Task manager.

   Note: *As an alternative, start or stop the* ***Task manager*** *on the status bar at the bottom of the software window.*

Figure 13 Task manager

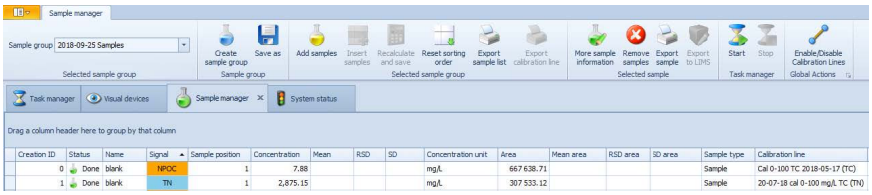


5.1.8 Sample manager

The **Sample manager** makes sample groups for analysis or calibration.

Note: *To show hidden columns in the* ***Sample manager*** *table, right-click on the table header and select the* ***Column Chooser****. The screen Customization opens and shows the columns. Select a column and drag it into the table. To hide columns, drag columns back into the Customization screen.*

1. Select **Main menu**. Select **Sample Manager**.
   The **Sample manager** tab shows. The sample table contains all sample data entered by the user and calculated by the software.



2. Select one option with icons of the ribbon.

Option	Description
Create sample group	Makes sample groups for analysis or calibration. Refer to Analyze samples on page 31.
Save as	Saves the selected sample group as a new sample group with a different name. The software keeps the sample configuration and removes the results from the new sample group. ***Note:*** *The software keeps the original sample group.*
Add samples	Adds samples to the selected sample group.
Insert samples	Adds a sample above the selected sample in the sample group.
Recalculate and save	Saves the changes made to the sample group. Also applicable for not analyzed samples (e.g., the method is changed before the analysis)
Start	Starts the task manager.

5.2 Start the analyzer

⚠CAUTION

Do not fill the humidifier higher than the mark or damage to the analyzer will occur.

Do the steps that follow to start the analyzer. Make sure that the analyzer is energized, the USB cable is connected to the PC and the gas supply is opened.

1. Make sure that the reagent containers are sufficiently filled with reagents or standards.
2. Examine the tubing of the containers. Make sure the tubing is in the correct position.
3. Examine the tubing of the sampler. Make sure that the tubing of the sampler is fixed in the tubing clamps.
4. Start the TEIS2 software.
5. Login with the correct credentials.

   When the software is started, the analyzer automatically connects to the software. The analyzer automatically does the Startup method. The software does the tasks that follow based on the recognized modules:

   - Opens the gas flow. The purge gas flow of the sampler is not included.
   - The furnace increases the temperature to the default setting.
   - The condenser decreases the temperature to 1 °C.
   - All valves of the sampler go to their default starting position.
   - The sampler moves to the waste port. Puts the needle in the waste. Removes the syringe content.
   - Sets the correct temperatures for the cooling (10 °C) and heating (50 °C) of the TN detector.
   - Sets the PMT for the TN detector.
   - Sets the Ozonator for TN detector on.

6. As an alternative, the user can manually do the Startup method.
   a. In the **Task manager** select **System method**.
   b. Select **Startup method** from the drop-down menu.
   c. Select **Add system method**.
   d. Select **Start**.

   The software does the Startup method and puts all the other tasks on hold.
7. Wait for the analyzer to complete the Startup method. At room temperature, the tasks will complete in approximately 45 minutes.

   The procedure is successful when all LEDs in System status window are green. The LED at the front of the analyzer is also green.
8. Fill the sampler lines with liquids as necessary.

   Note: *Make sure that the waste outlet is connected to a waste container or plumbed to a shrink.*

   a. In the **Task manager** select **System method**.
   b. Select **Fill tubing sampler with liquids** from the drop-down menu.
   c. Select **Add system method**.
   d. Select **Hold** for all other tasks.
   e. Select **Start**.
9. Fill the humidifier as necessary. Refer to Fill the humidifier on page 40.

5.3 Analyze samples

Before samples are analyzed, make sure that the analyzer is connected and prepared for operation. Examine the system condition and make sure that all of the connected devices are prepared. Refer to System status on page 26.

A sample group is necessary to analyze samples.

1. Select **Main menu**. Select **Sample Manager**.
2. Select **Create sample group**
3. Enter a name for the sample group. Use the drop-down button to add an optional prefix to the sample name. Select **OK**.

   There are three prefixes by default:

   - {dd-mm-yyyy}
   - {dd-mm-yyyy} Samples
   - {dd-mm-yyyy} Calibration line

   Note: *It is not possible to have two sample groups with the same name.*

   Note: *Go to **Configurations** > **Interface Settings** > **Sample Group Name** > **Selectable Prefixes** to edit the prefixes.*

   The Add / insert sample window shows. Refer to Figure 14.
4. Add the sample group data.

Option	Description
Sample group name	Shows the sample group name entered at step 3.
First sample position	Enters the tray position of the first sample vial of the sample group. As an alternative, go to step 5.

Option	Description
Number of samples	Selects the number of samples (vials in the tray) of the sample group. Samples must have a sequential numerical number.
Group type	Selects the sample group type: • Default—Sample analysis • Calibration—Calibration lines. Refer to Calibration lines on page 33.

5. As an alternative, select the first sample position of the sample group on the sample tray.

   The Sample tray shows the positions of the sample vials for the sample group. A color code shows the condition of the sample vials in the tray:

   - Clear (no color)—Free sample position
   - Yellow—Samples previously entered and not analyzed
   - Blue—Sample currently being analyzed
   - Purple—Samples currently being added to the sample group

6. Complete the Sample information table.

   Based on the number of samples selected in step 4, the software adds data to the Sample information table. Complete the sample data in the table.

Option	Description
Position	Sets the position of the sample on the sample tray
Name	Adds the sample name
Sample type	Sets the type of sample: • Blank—Used for automatic blank subtraction • Calibration—Used to make a calibration line • Reference —Used for yield determination • Sample—Standard sample line
Dilution	Adds a dilution factor if the sample was diluted.
Density	Applicable for the conversion of v/w or w/w
Analyst	Adds the user name
Comment	Adds comments

7. Set the sample parameters on the Sample analysis section (e.g., which method will be used and how many replicates).

   Note: *It is possible to select more than one method for one sample. The software will first add all the samples with first (top) method selected to the Sample group. Then, the software will add all samples for the second (next) method in the list to the Sample group, until all of the selected methods have been processed and all of the samples are added to the Sample group.*

   Note: *It is not possible to use any other method when a TOC method is selected.*

Option	Description
Enabled	Select to add the method to the sample.
Name	Shows the method name.
Replicates	Sets the number of replicates for each sample for the selected method.
Amount	Sets the amount of sample injection used for each analysis.
Amount unit	Shows the unit of the sample injection amount.
Conc. unit	Sets the concentration unit of the analyzed result.

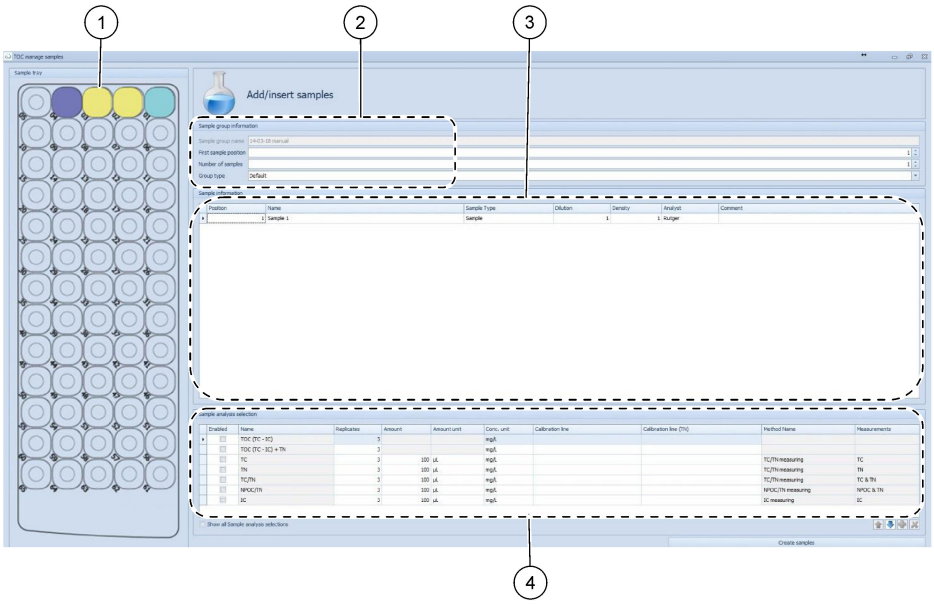
Option	Description
Calibration line	Shows the selected calibration line for the determination of the CO_2 detector.
Calibration line (TN)	Shows the selected calibration line for the determination of the TN detector.
Method name	Shows the selection of the analysis method.
Measurement	Shows the type of analysis.

8. Select **Create sample** to complete the sample group creation procedure. The software adds the sample group to the **Task manager**.
9. Start the **Task manager** to analyze the sample group.

   Note: *The sampler will not move if the front cover or the safety cover is open. A warning message shows if the cover is open.*

   The software calculates if there are sufficient reagents (UPW and acid) to complete all sample groups in the Task manager. If the amount of reagent is not sufficient, a message to fill the applicable reagent will show.

Figure 14 Add / Insert sample window



1 Sample tray	**3** Sample information
2 Sample group information	**4** Sample analysis selection

5.4 Calibration lines

The calibration line is a special sample group used to set up calibration for the analysis. It is necessary to add a calibration line for each analysis method to get correct and accurate results.

5.4.1 Manually add a calibration line

Do the steps that follow to add a calibration to the **Task manager** manually:

1. Select **Main menu**. Select **Sample Manager**.
2. Select **Create sample group**
3. Enter a name for the sample group.

   Note: *It is not possible to have two sample groups with the same name.*

The Add / insert sample window shows.

4. Select the **First sample position** on the Sample group information table or the sample tray.
5. Add a **Number of samples**.

   The number of samples is the number of standards that must be analyzed for the calibration line.
6. Select **Calibration** for the **Group type**.
7. Add "Standard" for the sample name in the name column of the Sample information table. Add the user name.

   Note: *Only add the name of the sample and the user. The software automatically adds concentrations when the samples are created. The dilution factor and density are usually 1 for all standards.*
8. On the Sample analysis section, set the calibration parameters.

   a. Select the method for the analysis in the **Enabled** column.

      Note: *When TOC (TC-IC) or TOC (TC-IC) + TN is selected, the TC and IC analysis are automatically selected. It is not possible to execute any other method when a TOC method is selected.*

      Note: *When the method TC/TN or NPOC/TN is selected, the standards must contain a known concentration of carbon as well as nitrogen.*

   b. Set the number of **Replicates**.

   c. Set the amount to be injected.

   d. Set the concentration unit.
9. Select **Create sample**.
   The Sample concentration screen shows.
10. Add the sample concentration for each standard (carbon and nitrogen signal).

    The entered theoretical concentration of the standard will automatically be added to the name.
11. Select **Save**.
    The calibration line is added to the **Task manager**.
12. Start the **Task manager**.

If a low calibration line below the 10 ppm is measured, measure the 0 in the calibration line as blank as an alternative to the calibration sample. The UPW or blank can degrade over time through environmental pollution. When the blank is measured, the daily change of the blank will be subtracted from the samples and the samples measured in the low range will be more accurate.

5.4.2 Single stock calibration wizard

In a calibration line, all of the standards are made separately and 100 µL is injected for each standard. A single stock calibration is a calibration line that is made from a single stock solution. The relative amount to the stock solution is injected to make the standard. For example, to analyze the 50-mg/L standard, 50 µL of the 100-mg/L stock and 50 µL of ultra-pure water are injected.

The Single stock calibration option makes a calibration line with a single stock solution. This option uses the internal syringe pump to make different quantities dilutions.

1. On the **Sample Manager** tab, use the dropdown button within the **Create Sample Group** button. Select **Single Stock Calibration**.

   Note: *Only available for QP 1680-TOC/TNb*

   The Element selection window shows.
2. Select the measuring method to calibrate.

   - TC—Total Carbon
   - NPOC—Non-Purgeable Organic Carbon

- IC—Inorganic carbon
- TN—Total Nitrogen (bound)
- TC / TN—TC and TN combination
- NPOC / TN—NPOC and TN combination

3. Select **Next**.
   The Calibration information window shows.
4. Complete the data in the Calibration information window.

Option	Description
Select the calibration range	Selects the calibration range. The expected stock solution is the highest concentration of that range (e.g., select 0-10 mg/L for a 10 mg/L stock solution). The actual concentration of the stock cannot change more than ±10% of the expected concentration.
Concentration of stock solution	Enters the actual concentration of the stock solution.
Position of stock solution	Enters the position of the stock solution. If the text box color changes to orange means that the entered position is in a sample group that is not measured.
Select method	Selects the correct method for the sample group.

5. Select **Next**.
   The Overview window shows.
6. Complete the data in the overview window.

Option	Description
Size	Selects the calibration points to set the dimension of the calibration. ***Note:*** *Calibration points are not configurable.*
Replicates	Enters the replicates for each standard.
Blank position	Enters the blank position on the tray. Enter 0 to not include the blank in the calibration line. If the text box color changes to orange means that the entered position is in a sample group that is not measured.
Overview table	Shows a preview of the sample group. The software calculates the necessary injection quantity and the actual concentration to make sure all real concentrations are correct.

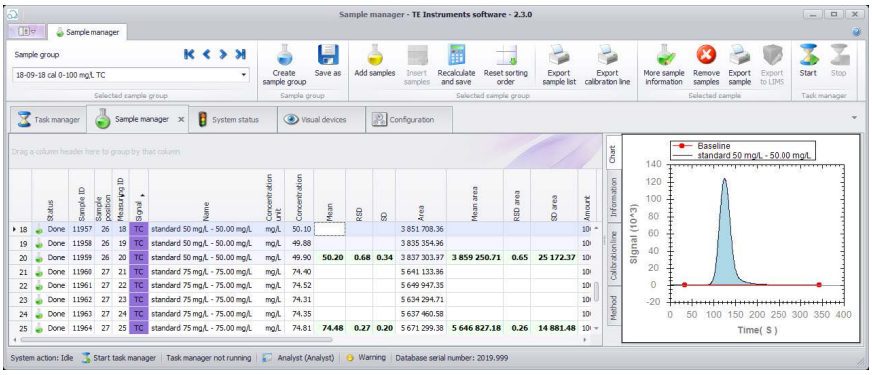
7. Select **Finish**.

5.5 See analysis results

After analysis, examine the graphs to see the analysis results.

1. Select **Main menu**. Select **Sample Manager**.
2. Select one sample.
3. If necessary, select the tab **Chart** on the right side of the **Sample manager**.
   Refer to Figure 15.

Figure 15 Sample manager



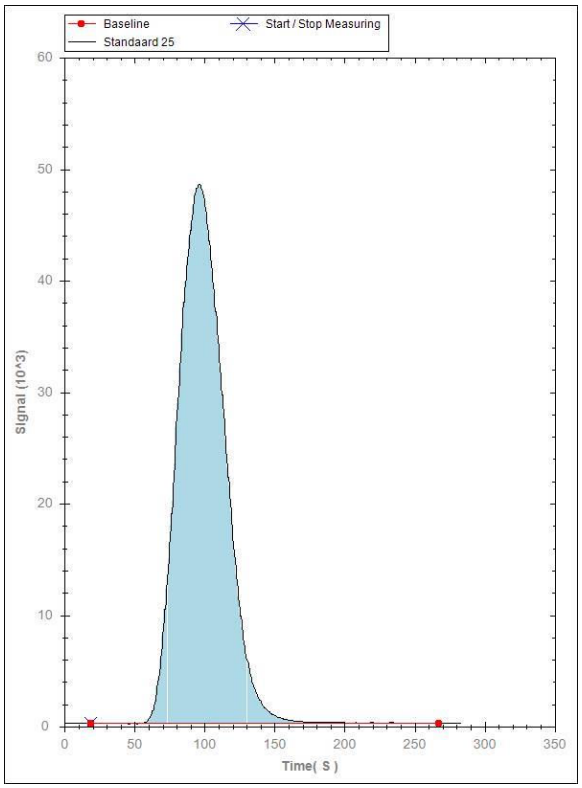
5.5.1 Change the integration

When the analysis is completed, the software integrates the sample automatically. A correctly integrated peak shows in the graph tab. The red integration baseline is horizontal and shows a start and stop at the same value.
Do the steps that follow to change the integration.

1. Move the red dots on the graph tab to change the integration.

   The left red dot shows the start of the integration. The right red dot shows the end of the integration. Refer to Figure 16.

Figure 16 Graph tab



2. Select **More sample information** to see more integration settings.

   Select one option from the drop-down menu.

Option	Description
Automatic	Draws the baseline automatically.

Option	Description
Change start/stop value	Changes the start and stop time of the integration.
Horizontal baseline	Draws a horizontal baseline from the start and stop time.
Freestyle	Selects points the graph to be the start and stop time, independently if the point is part of the sample graph.

3. Select **Update in sample table** to update the sample integration in the Sample manager.
4. Select **Recalculate and save** to update the calibration line.

   When the integration changes, it has one effect on the calculated result for samples. When the sample is used in a calibration line, the effect is on the calibration line.

   Note: *Changes in evaluation can be reversed.*

5.5.2 Select a different calibration line

Do the steps that follow to change the results based on a different calibration line.

1. Select one sample on the **Sample manager** table.
2. On the **Calibration line** column, select a different calibration line from the drop-down menu.
   The sample on the table shows a red color.
3. Select **Recalculate and save** to calculate the results based on the selected calibration line.

5.5.3 Automatic outlier detection

There are two types of outlier detection principles available in the software. **SD and RSD** and **Generalized Extreme Studentized Deviate** also known as generalized Grubb's test. The software can use the two principles to remove outliers from the sample results.

The software will define the outliers in a sample set based on the settings and can identify, remove and replace the results with new analysis. A sample set is defined as the samples that are included in the same calculation group.

Do the steps that follow to configure the automatic outlier detection:

1. Select **Main menu**. Select **Configuration** > **Interface Settings** > **Automatic Outlier Detection**.
2. Check **Replace Outliers** to let the software replace all samples marked as outliers.
3. On the **Detection type** drop-down menu, select one option

Option	Description
None	The outlier detection is disabled.

Option	Description
SD and RSD	Sets an absolute and relative threshold for each signal. Once the sample set is completed, the software will check if one of the thresholds has been met, whichever threshold is largest. The software will add a mark to the sample with the highest change toward the settings as fault and replace this analysis with a new one. This can be done to a maximum number of outliers. This principle can only find one outlier for each sample set. Configure the settings based on area counts: • SD Threshold—Maximum amount of area counts for Standard Deviation. • RSD Threshold (%)—Maximum percentage level for the Relative Standard Deviation. • Maximum No. Outliers—Sets the maximum number of outliers that can be marked as fault.
Generalized Extreme Studentized Deviate (ASTM D7915)	This principle is an iterative Grubbs method for the detection of outliers for a relatively small sample set. The principle makes a normal distribution for the sample set and only accepts the samples that are within the set significance level. After marking samples as fault, it will repeat this step until there are no more outliers or when the maximum number of outliers has been reached. This principle can find more than one outlier for each set. Configure the settings based on area counts: • Significance level (Alpha level ‘α’)—Sets the percentage of the normal distribution to reject. The percentage is a total value (e.g., if 10% is entered means that 5% on the left tail and 5% on the right tail will be rejected). • Maximum no. of outliers (%)—Sets the maximum number of outliers as a percentage of the total injections of the sample (e.g., if a sample has 10 injections and 40% is entered for the maximum number of outliers, the software will mark a maximum of 4 (10 * 40% = 4) injections as fault).

Section 6 Maintenance

⚠WARNING

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

⚠CAUTION

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

⚠CAUTION

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

6.1 Maintenance schedule

⚠WARNING

Multiple hazards. Only qualified personnel must repair and do maintenance tasks of compressed gas cylinders and accessories.

Table Table 3 shows the recommended schedule of maintenance tasks. Facility requirements and operating conditions may increase the frequency of some tasks.

Table 3 Maintenance schedule

Task	1 day	1 week	30 days	90 days	365 days
Examine for leaks and spills. Clean as necessary.	X				
Make sure that the tubing in the reagent containers touches the bottom of the container.		X			
Make sure that the waste container has sufficient capacity. Discard waste as necessary.		X			
Examine the level in the humidifier. Fill as necessary.		X			
Examine the injection needle for damage. Replace if damaged.		X			
Examine the movement of the sampler		X			
Clean the furnace injection port.		X			
Replace all UPW in the UPW reagent container.			X		
Replace the particle filter.			X		
Examine all tubing from the reagent containers for damage.			X		
Examine for dust at the air intake points of the analyzer. Replace the fan filter if necessary.			X		
Examine for leaks at the reagent containers. Replace the containers as necessary.			X		
Examine the O-ring of the furnace tube (red, top of the furnace tube)				X	
Examine the O-ring of the furnace injection port (black)				X	
Examine the halogen scrubber. Replace as necessary.				X	

Table 3 Maintenance schedule (continued)

Task	1 day	1 week	30 days	90 days	365 days
Replace the catalyst.				X	
Annual maintenance[6]					X

6.2 Clean spills

⚠CAUTION

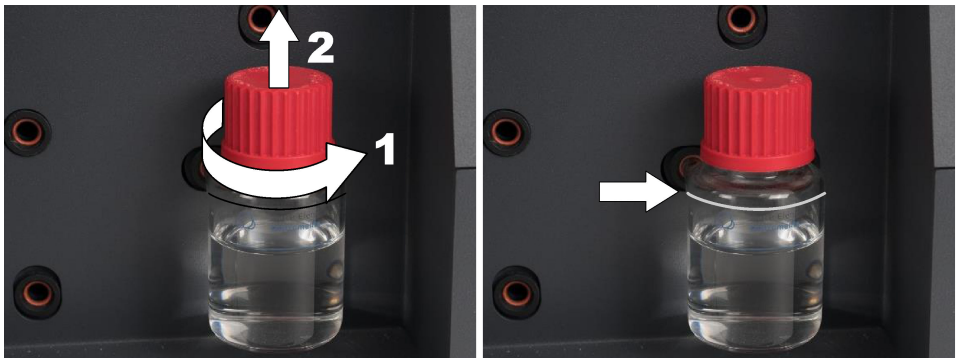
Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

1. Obey all facility safety protocols for spill control.
2. Discard the waste according to applicable regulations.

6.3 Fill the humidifier

Make sure that the humidifier is not empty. Examine the UPW level in the humidifier. Fill the humidifier as necessary.

1. Stop the Task manager.
2. Open the cover of the front compartment.
3. Do not remove the humidifier.
4. Remove the cap from the humidifier.
5. Add UPW to the humidifier to the mark.



6. Install the cap on the humidifier.
7. Wait a minimum of 5 minutes for the baseline to become stable.
   Note: *If the baseline is not stable, the analyzer will give incorrect results.*

6.4 Replace the sampler needle

⚠WARNING

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

Examine the injection needle for damage. Replace if damaged.

[6] An annual maintenance inspection by a factory-trained and certified service engineer is recommended. The annual maintenance includes important checks and part replacements to keep the analyzer in good condition.

Touch the needle with care. Some acid can stay in the needle or the outer surface of the needle.

1. Loosen the nut from the sampler arm.
2. Remove the needle from the sampler arm.


3. Put a new needle in the sampler arm.
4. Install the nut.


5. In the TEIS2 software, go to the **Task manager**. Select **System method**.
6. Select the method **Fill tubing sampler with liquids**.
7. Select **Add system method**.

   Make sure that the added method is the first task in the **Task manager** and that all of the other tasks are on hold.
8. Start the **Task manager**.

6.5 Clean or replace the furnace injection port

⚠CAUTION

Burn hazard. Turn off power and allow the instrument to cool before this procedure.

NOTICE

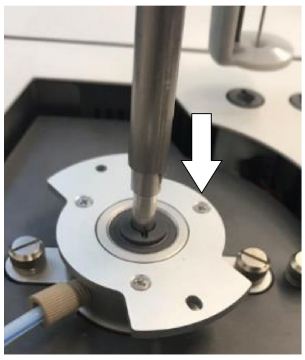
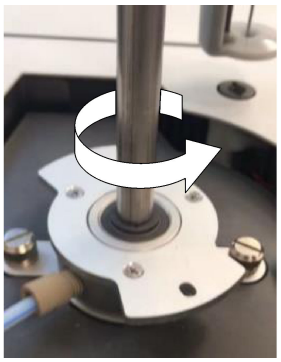
Do not use other liquids or solvents to clean the injection port, or damage to the instrument can occur.

Clean the furnace injection port weekly. Examine the injection port for damage. Replace the injection port if damaged.

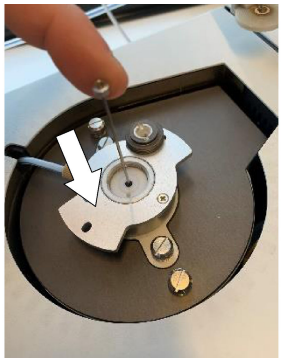
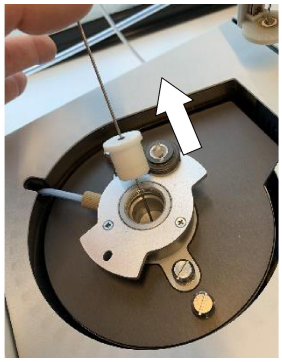
Items to collect:

- QP1680 Service tool
- Sampler needle
- Tissue
- Ultra-pure water

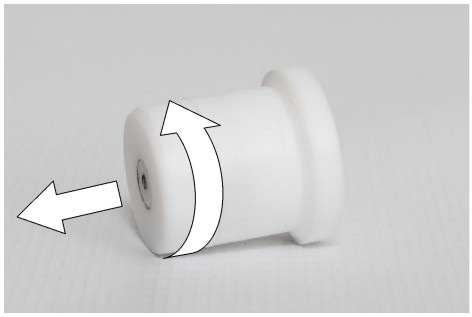
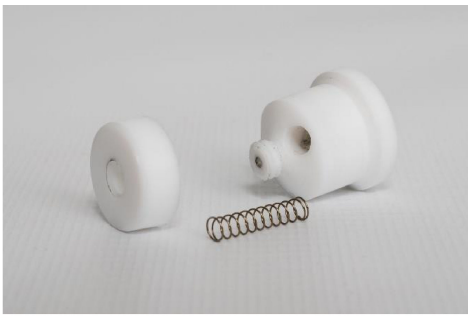
1. Remove the top cover of the furnace.
2. Use the service tool to disconnect the screwcap of the injection port.

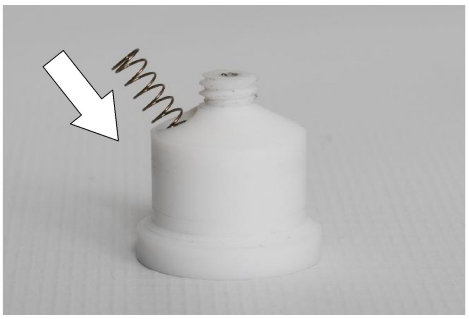

3. Use a sample needle to remove the injection port.

4. To replace the injection port, go to step 13. To clean the injection port, continue with step 5.
5. Carefully open the lower part. The spring and a ceramic ball can pop out when the injection port is opened.

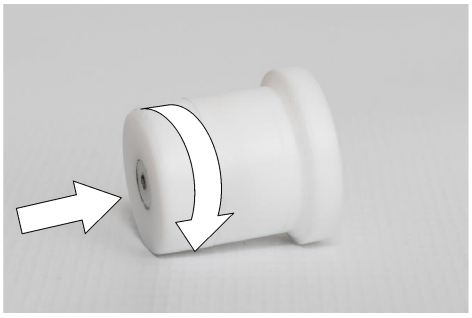



6. Remove the spring, the support part and the ceramic ball.
7. Clean all of the items with UPW.
8. Clean the inner side of the injection port with wet paper tissue.
9. Dry all of the parts.
10. Put the ceramic ball back into the hole.
11. Put the spring on top of the ceramic ball.

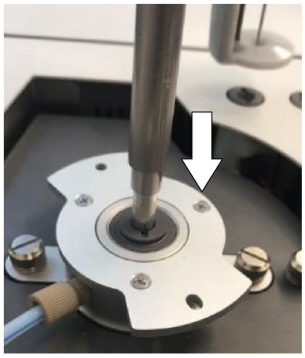


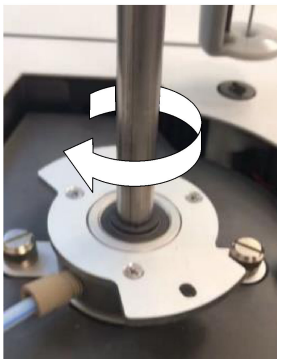
12. Install the lower part of the injection port.

    Make sure that the spring is fully pushed into position. If the spring is not correctly installed, the spring will cause the injection port to malfunction.



13. Install the new or cleaned injection port in the furnace. Use the service tool to attach the screwcap of the injection port.



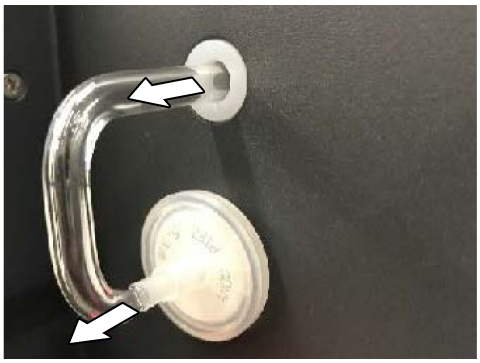


14. Install the furnace top cover.

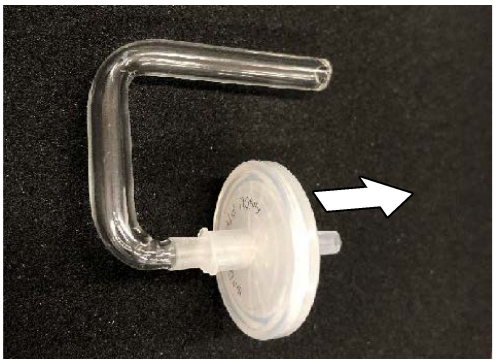
6.6 Replace the particle filter

The filter has a lifetime of 10,000 injections. Replace as necessary.

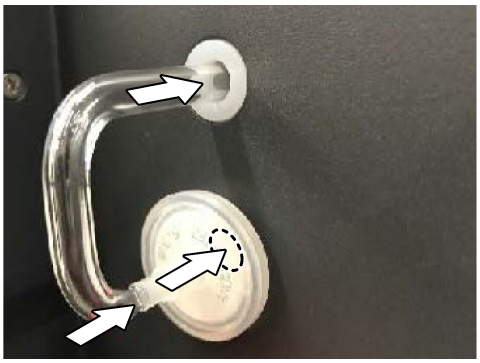
1. Stop the Task manager.
2. Open the front cover.
3. Remove the filter holder.



4. Open the holder and remove the particle filter.



5. Install the new particle filter on the holder.
6. Install the filter holder with the particle filter.



7. Close the front cover.
8. Wait 5 minutes to get a stable baseline.
9. Go to **Configuration** > **Counter center** and click the **Reset** button to reset the counter.

6.7 Remove the combustion tube

⚠CAUTION

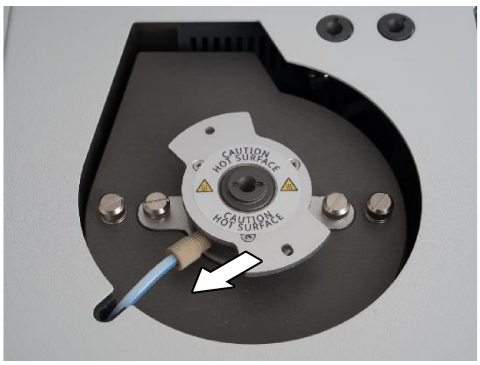
	Burn hazard. Turn off power and allow the instrument to cool before this procedure.

NOTICE

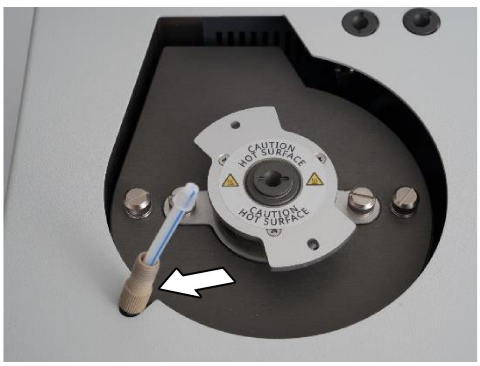
Do not start the analyzer without the combustion tube installed, or damage to the analyzer will occur.

1. Stop the analyzer. Refer to Stop the analyzer on page 58.
2. Wait a minimum of 30 minutes or until the furnace temperature is below 100 °C.
3. Remove the top cover of the furnace.

4. Disconnect the oxygen supply from the injection port.



5. Attach the oxygen line upwards into the service position.



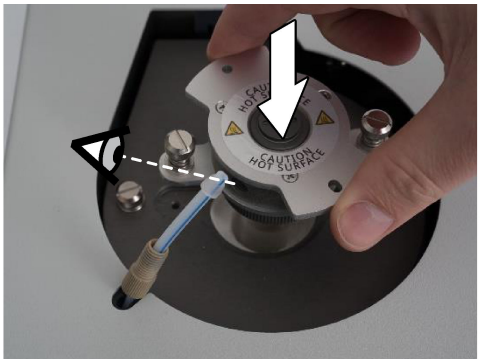
6. Loosen the two thumbscrews.

7. Remove the combustion tube.

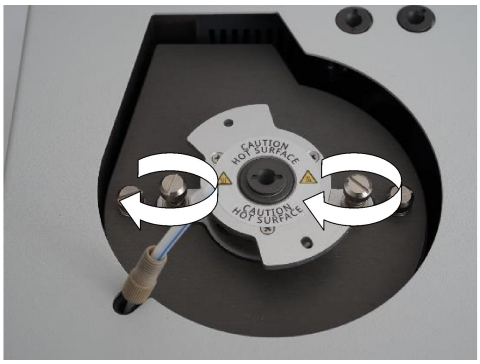
6.8 Install the combustion tube

1. Carefully put the combustion tube in the furnace. Look at the orientation of the furnace tube.

   The metal part of the furnace tube engages in the cut-out of the furnace. The oxygen inlet position must be on the correct side of the furnace.

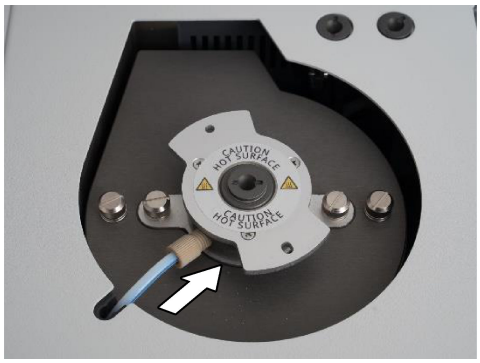


2. Use the thumbscrews to attach the furnace tube.



3. Connect the oxygen supply line to the injection port.

   Make sure that the ferrule is installed on the end of the oxygen tubing.



4. Install the top cover of the furnace.

5. Start the analyzer.

6.9 Remove the furnace

⚠DANGER

Electrocution hazard. Remove power from the instrument before this procedure is started.

⚠CAUTION

Burn hazard. Turn off power and allow the instrument to cool before this procedure.

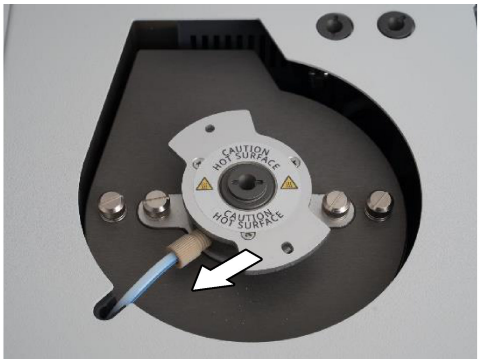
NOTICE

Do not start the analyzer without the combustion tube installed, or damage to the analyzer will occur.

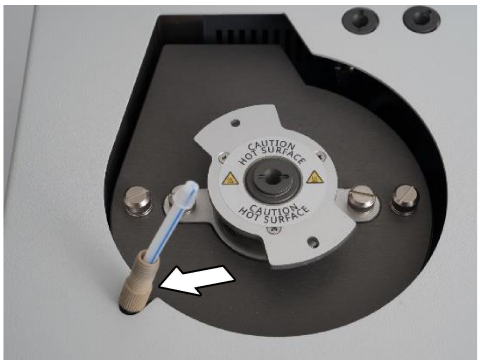
The furnace can be removed with the combustion tube installed.

1. Stop the analyzer. Refer to Stop the analyzer on page 58.
2. Wait a minimum of 30 minutes or until the furnace temperature is below 100 °C.
3. Remove the top cover of the furnace.

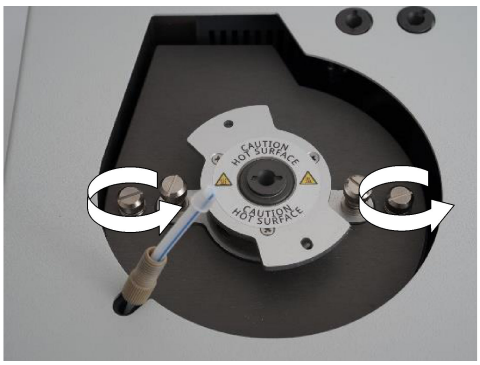
4. Disconnect the oxygen supply from the injection port.



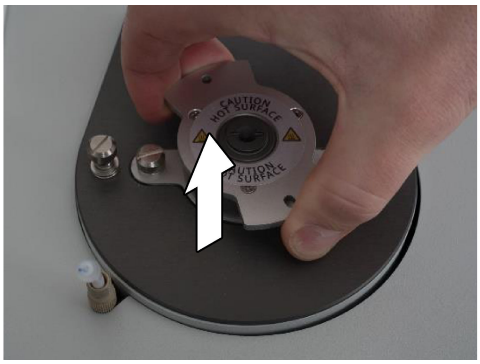
5. Click the oxygen line upwards into the service position.



6. Loosen the two thumbscrews of the furnace.



7. Remove the furnace with the combustion tube.



6.10 Install the furnace

DANGER

Electrocution hazard. Remove power from the instrument before this procedure is started.

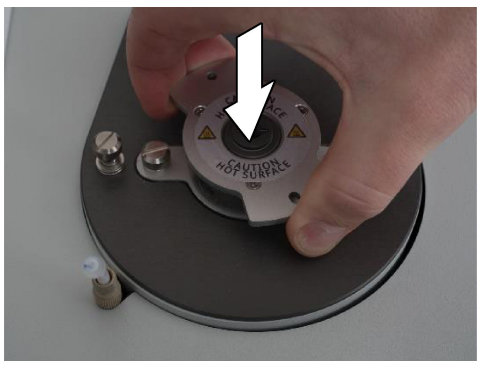
NOTICE

Do not start the analyzer without the combustion tube installed, or damage to the analyzer will occur.

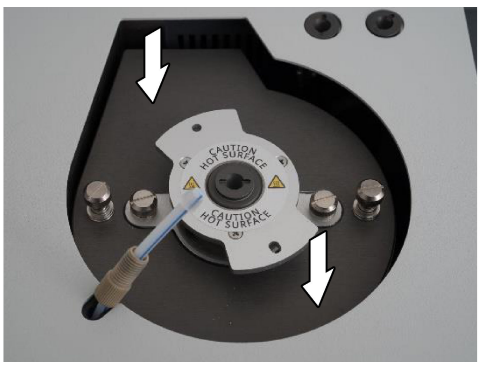
The furnace can be removed with the combustion tube installed.

1. Carefully install the furnace with the combustion tube.

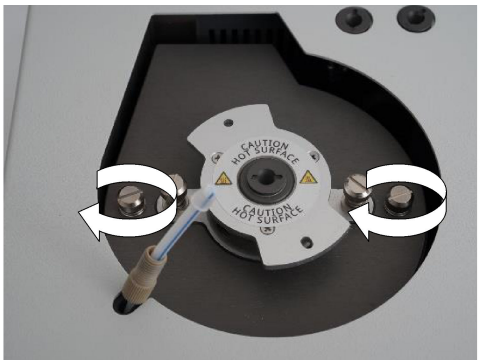
   Note: *As an alternative, install the combustion tube separately. Refer to* Install the combustion tube *on page 46.*



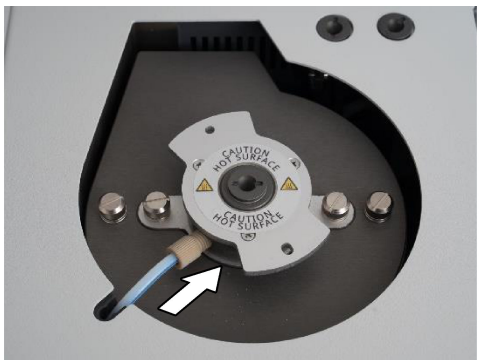
2. Push the furnace fully down.



3. Use the thumbscrews to attach the furnace.



4. Connect the oxygen supply line to the injection port.
   Make sure that the ferrule is installed on the end of the oxygen tubing.



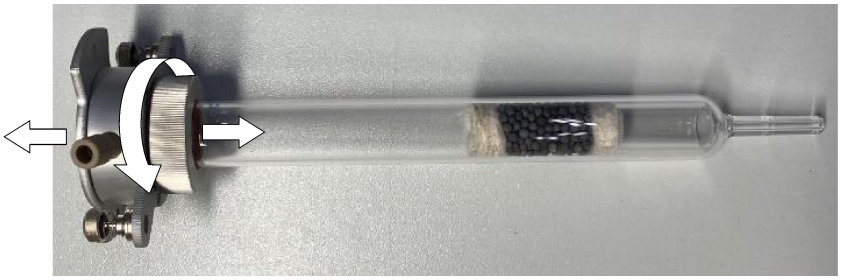
5. Install the top cover of the furnace.

6. Start the analyzer.

6.11 Replace the combustion tube

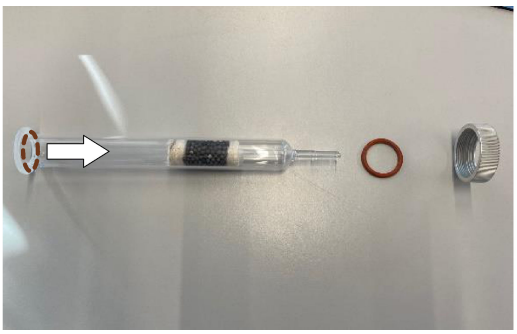
Do the steps that follow to fully replace the combustion tube.

1. Remove the combustion tube from the furnace. Refer to Remove the combustion tube on page 44.
2. Remove the tube nut to disconnect the quartz tube from the metal injection port.



3. Remove the tube nut from the quartz tube.

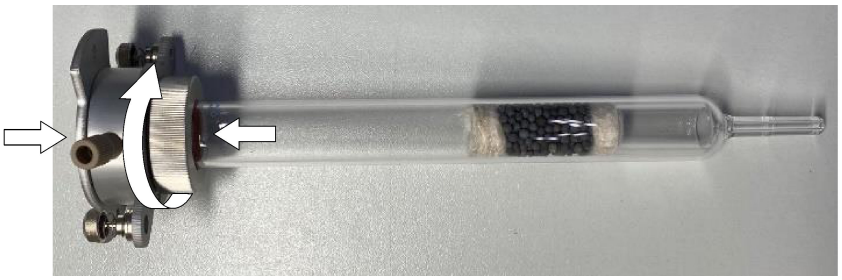
4. Remove the O-ring from the quartz tube.



5. Discard the combustion tube. Replace the combustion tube with a new one.
6. Put the O-ring on the combustion tube.

7. Put the nut on the combustion tube.

8. Connect the quartz tube to the metal injection port.



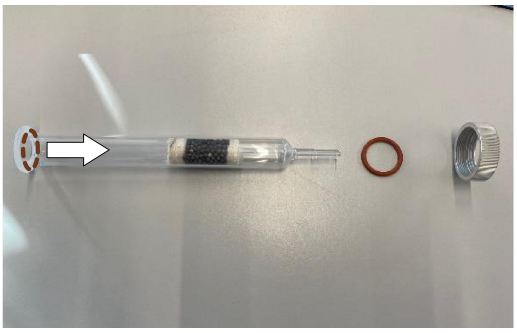
9. Install the combustion tube in the furnace. Refer to Install the combustion tube on page 46.

6.12 Replace the O-ring of the combustion tube

1. Remove the combustion tube from the furnace. Refer to Remove the combustion tube on page 44.
2. Remove the tube nut to disconnect the quartz tube from the metal injection port.

3. Remove the tube nut from the quartz tube.

4. Remove the O-ring from the quartz tube.



5. Discard the O-ring. Replace the O-ring with a new one.
6. Put the O-ring on the combustion tube.

7. Put the nut on the combustion tube.

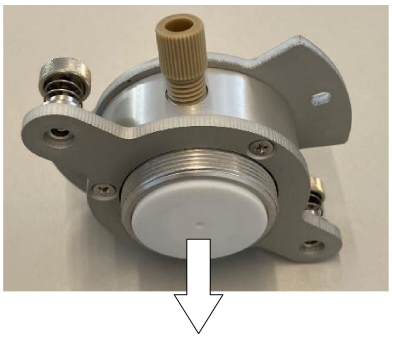
8. Connect the quartz tube to the metal injection port.

9. Install the combustion tube in the furnace. Refer to Install the combustion tube on page 46.

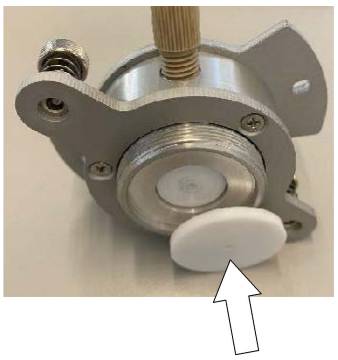
6.13 Replace the top seal of the combustion tube

1. Remove the combustion tube from the furnace. Refer to Remove the combustion tube on page 44.
2. Remove the tube nut to disconnect the quartz tube from the metal injection port.

3. Remove the PTFE disc from the metal injection port.



4. Put the new PTFE disc in the metal injection port.



5. Connect the quartz tube to the metal injection port.

6. Install the combustion tube in the furnace. Refer to Install the combustion tube on page 46.

6.14 Replace the catalyst

Do the steps that follow to replace the contents of the combustion tube.
Items to collect:

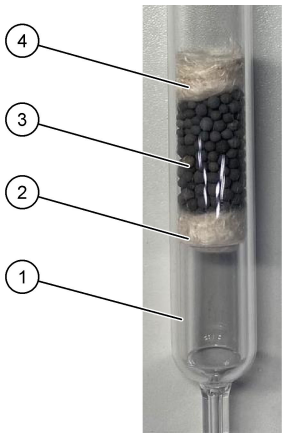
- Long tweezers
- TOC combustion tube filling kit

1. Remove the combustion tube from the furnace. Refer to Remove the combustion tube on page 44.
2. Remove the tube nut to disconnect the quartz tube from the metal injection port.

3. Remove the tube nut from the quartz tube.

4. Use the tweezers to fully remove the content of the combustion tube.
5. Use the tweezers to put the new catalyst items into the combustion tube. Refer to Figure 17.
    a. Install the combustion tube inlay.
    b. Add one ceramic wool slice.
    c. Add the TOC catalyst.
    d. Add one ceramic wool slice.

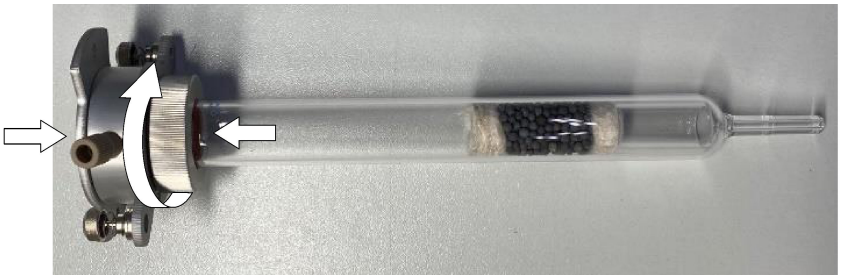
Figure 17 Combustion tube content



1 Tube inlay	**3** Catalyst
2 Ceramic wool	**4** Ceramic wool

6. Put the nut on the combustion tube.

7. Connect the quartz tube to the metal injection port.



8. Install the combustion tube in the furnace. Refer to Install the combustion tube on page 46.

6.15 Replace the O-ring of the furnace injection port

⚠ DANGER

Electrocution hazard. Remove power from the instrument before this procedure is started.

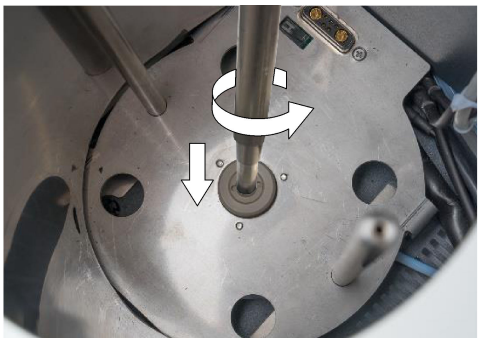
⚠ CAUTION

Burn hazard. Turn off power and allow the instrument to cool before this procedure.

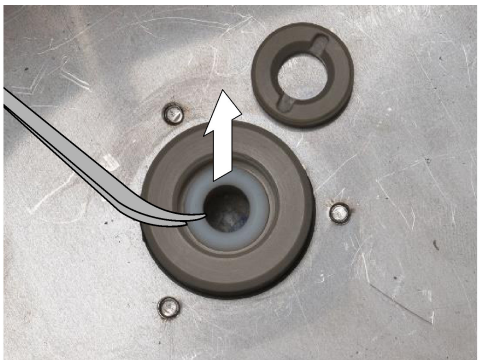
Items to collect:

- QP1680 Service tool
- Tweezers

1. Remove the furnace. Refer to Remove the furnace on page 47.
2. Use the service tool to disconnect the nut from the furnace exit.

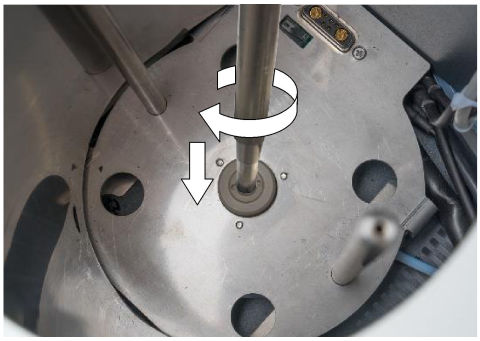


3. Use tweezers to remove the O-ring from the furnace exit.



4. Install the new O-ring.

5. Use the service tool to attach the nut to the furnace exit.



6. Install the furnace. Refer to Install the furnace on page 49.

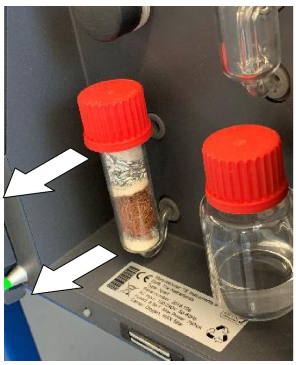
6.16 Fill or replace the halogen scrubber

⚠CAUTION

Personal injury hazard. Coper may have sharp edges and can cause puncture wounds. Wear personal protective equipment to prevent injury.

Replace the contents of the halogen scrubber at 3-months intervals. Replace the halogen scrubber if the halogen scrubber has damage.

1. Stop the **Task manager**.
2. Open the cover of the front compartment.
3. Carefully remove the halogen scrubber. Make sure to pull out straight or the glass can break.



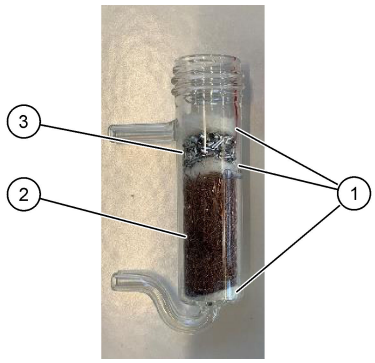
4. Remove the cap of the halogen scrubber.

5. Fully remove the contents of the halogen scrubber. Clean the inner side with a tissue.
6. Install the new content of the halogen scrubber. Refer to Figure 18. As an alternative, fully replace the halogen scrubber.

   Note: *The orientation of the slices is important. Make sure that slices are horizontal.*

   a. Put a ceramic wool slice at the bottom of the halogen scrubber.
   b. Put in the copper.
   c. Put in a second ceramic wool slice.
   d. Put in the aluminum.
   e. Put in a ceramic wool slice at the top.

Figure 18 Halogen scrubber content



1 Ceramic wool slice	**3** Aluminum
2 Copper	

7. Close the halogen scrubber with the screw cap.
8. Install the halogen scrubber.
9. Close the front cover.
10. Wait a minimum of 5 minutes for the baseline to become stable.
    Note: *If the baseline is not stable, the analyzer will give incorrect results.*

6.17 Replace the IC injection port

⚠WARNING

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

⚠CAUTION

Burn hazard. Turn off power and allow the instrument to cool before this procedure.

Carefully touch the IC injection port. Some acid can stay on the surface of the injection port.

Items to collect:

- QP1680 Sercive tool
- Sampler needle

1. Use the service tool to remove the screwcap of the IC injection port.
2. Use a sampler needle to remove the IC injection port.
3. Install the new IC injection port. Make sure to install the port in the correct orientation.
4. Use the service tool to install the screwcap of the IC injection port.

6.18 Stop the analyzer

Do the steps that follow to stop the analyzer for short periods (4 hours or more).

1. In the TEIS2 software, go to **Task manager** and select **System method**.
2. Select **Standby method**.
3. Click **Add system method**. The method shows in the **Task manager**.

4. Select **hold** for all other tasks in the task manager. Click **Start**.
5. Wait until the analyzer completes the Standby procedure.

6.19 Shutdown the analyzer

NOTICE

Do not set the analyzer to off until the shutdown procedure is complete and the furnace temperature has decreased to room temperature or damage to the analyzer will occur.

Do the steps that follow to prepare the analyzer to be stopped for a long period (more than 7 days):

1. In the TEIS2 software, go to **Task manager** and select **System method**.
2. Select **Shutdown method** from the list.
3. Click **Add system method**. The method shows in the **Task manager**.
4. Select **hold** for all other tasks in the task manager. Click **Start**.
5. Wait until the analyzer completes the shutdown procedure.
6. Set the analyzer to off.

6.20 Storage

Keep the analyzer and its accessories in the original packaging as much as possible. Make sure to obey the environmental conditions in Specifications on page 3.

Section 7 Troubleshooting

⚠WARNING

Burn hazard. The furnace gets extremely hot. Do not touch. The outer surface of the analyzer may become hot. Keep chemicals away from hot surfaces.

Make sure to set the analyzer to off. Let the analyzer temperature decrease to room temperature before a disassembling operation.

Problem	Possible cause	Solution
Leakage or loss of flow	There is a problem in the furnace injection point.	Add a drop of UPW on top of the furnace injection point. If there are air bubbles, remove and fully clean the injection port. As an alternative, replace the injection port.
	There is a problem in IC injection point.	• Add a drop of UPW on top of the IC injection point. If there are air bubbles, use a spray bottle to put some UPW into the IC injection point. • If the IC injection point continues to push the UPW out, the condenser has a possible blockage. Set the condenser temperature to 20 °C (68 °F). Wait 30 minutes. Use the spray bottle to put some UPW into the IC injection point. The flow should come back to the standard value. Contact technical support.
	There is a problem in particle filter.	The analysis can form CuCl, which is a tiny powder that can cause a blockage in the filter. The blockage can increase the pressure, which can cause the measured flow to be lower than expected. Use compressed air to clean the particle filter. Replace the particle filter.
	There is a leak after the furnace tube is assembled.	The O-ring that seals the bottom of the furnace tube can expand or shrink during furnace operation. Remove the complete furnace and use a flathead screwdriver to tighten the O-ring.
No air bubbles in the reagent bottle UPW	The system startup does not work.	Make sure that the system starts up correctly. If the startup is unsuccessful, the oxygen valves can be damaged. Contact technical support to replace the oxygen valves.
Area counts too high	There is a problem in the needle or needle sleeve.	• Examine the needle and the needle sleeve for damage. • Make sure that the sleeve starts at 21 mm from the bottom of the needle. Replace the needle if necessary.
	There is a problem in the particle filter or a leak in the system. The pH value of the acid is incorrect.	• Examine the particle filter. Replace the particle filter if necessary. • Make sure that the pH value of the acid is less than 2. • Compare the current flow of the instrument to the flow of the samples in the calibration line used to calculate the current samples. The flow has an effect on the area measured from a sample. A lower flow gives a higher area count and vice versa.
High area counts and large RSD for blanks	The tubes of the TN-detector are defective.	The tube has some tarnish. Contact technical support.
NPOC results too high	In TC measurements, the high temperature can cause IC collection in the furnace. When NPOC is measured after TC, the collected IC will break free and have an effect on the area counts.	Make sure to measure two NPOC blanks to prevent defective NPOC measurements.

Problem	Possible cause	Solution
Double peaks for TN measurement	The ceramic wool layer in the top of the furnace tube is defective.	Replace the furnace tube.
High and low area counts within a sample	There is a problem in the O-ring of the furnace exit.	Replace the O-ring and analyze 15 blanks.
	There is a problem in the furnace tube.	A very small tear in the furnace tube can cause a leak. Replace the furnace tube and analyze 15 blanks.
	The halogen scrubber is not assembled correctly.	Remove the halogen scrubber and install it again.
Halogen scrubber should be replaced within days	The tubing of the condenser is not assembled correctly. There is liquid in the detector chambers.	Examine the tubing. Identify if the particle filter is moist. If the filter is wet, identify if the CO2 detector is moist. Clean the CO2 detector as necessary.
System shows “Leakage below IC/Waste port”	There is a problem in the IC/waste port.	• Replace the sensor. • Remove the sensor below the leakage container. Rinse the sensor with ethanol and then with ultra pure water. Remove all possible liquids from the sensor. Install the sensor again. ***Note:*** *Make sure to install the sensor below the threshold before assembling the analyzer.*
Memory effect	The furnace tube is dirty.	Remove the furnace tube. Wait until the furnace tube temperature decreases to ambient temperature. Rinse the quartz and the catalyst separately with ultra pure water. Assemble and install the furnace tube in the analyzer. Startup the furnace heat.
IC vessel filled with liquid	The IC pump is defective.	Contact technical support.

Section 8 Consumables and replacement parts

⚠WARNING

Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer.

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Replacement parts

Description	Quantity	Item no.
Needle guide, opale coated	1	PRT518100C
Sampler needle, stainless steel	1	DRW518800
Furnace injection port	1	PRT512600
Ceramic ball for furnace injection port, 4 mm	5	PRT518300
O-ring for injection and IC port	5	PRT522500
IC Injection bush	1	DRW515800
Spring for furnace injection port	5	PRT518400
Cotton swabs	25	TOOLS0301
Combustion tube replacement, includes injection head	1	PRT514900
Quartz combustion tube, with catalyst refill kit	1	CON501100
Catalyst refill kit	1	CON500700
Top seal of combustion tube	1	DRW518600
O-ring for combustion tube, silicone, 22 x 3 mm	5	PRT517000
O-ring for furnace exit, PTFE, 6.02 x 2.62 mm	5	PRT517100
Ceramic wool slice, 20 mm	62	TEI000084
Combustion tube, quart glass only	1	PRT516500
Catalyst	5 g	CON500600
Quartz inlay for combustion tube	1	PRT552500
Humidifier kit	1	PRT508800
IC vessel, glass part	1	PRT518000
Halogen scrubber kit, includes content	1	PRT508900
Refill content for halogen scrubber	1	CON500200
Filter, 5 µm, disposable	10	PRT516100
Filter holder for 5-µm filter	1	PRT511500
Fuse, ceramic, 6.3 A 240 VAC, anti-surge T, 5 x 20 mm	10	PRT518200
Filter for fan guard, 120 mm	5	PRT552650
Interface cable, mini USB A to B, 1 m (3 ft)	1	PRT105300
Leak tray for reagent bottles	1	PRT505300
Reagent container with screw cap, UPW	1	PRT513600
Reagent container with screw cap, acid	1	PRT513700
Reagent container with screw cap, waste	1	PRT513800

Accessories

Description	Item no.
Tray for 24 mL glass vial, 96 positions	PRT508450
Tray for 40 mL glass vial, 65 positions	PRT508400
Solids module	SYS503000
Solids module kit, starter pacakge	KIT503000
Ash Finger for solids module (3x)	CON510200
O-ring for combustion tube head , PTFE, 21.89 x 2.62 mm Xpert (5x)	PRT510100
O-ring for combustion tube, silicone, 22 x 3 mm (5x)	PRT517000
TIN weighing pan, 10x10 mm (100x)	DRW552200
Tweezers, for sample cups	PRT101900
Tweezer, 250 mm	PRT525300
Halogen kit scrubber kit, includes: content and TOC solids	PRT508950
Halogen scrubber glass part. TOC solids	GLS500450
Halogen scrubber content, TOC solids	CON500200

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