Ambient NOx monitor
APNA-370
Maintenance Manual

Preface

This manual describes the maintenance of the Ambient NOx monitor, APNA-370, to a person with necessary knowledge and skills.
Be sure to read this manual before using the product to ensure proper and safe operation of the instrument.
Also safely store the manual so it is readily available whenever necessary.

Product specifications and appearance, as well as the contents of this manual are subject to change without notice.

■ Warranty and Responsibility

The product delivered to you is covered by HORIBA's warranty for a period of one (1) year.
If any malfunction or damage attributable to HORIBA's responsibility should occur during this period, necessary repairs or replacement of parts shall be made free of charge by HORIBA.
The warranty does not cover the following:

- Any malfunction attributable to improper operation
- Any malfunction attributable to repair or modification by any party not authorized by HORIBA
- Any malfunction attributable to the use in an improper environment
- Any malfunction attributable to violation of the instructions in this manual
- Any malfunction attributable to operations in the manner not specified in this manual
- Any malfunction attributable to natural disasters, or accidents or mishaps not involving HORIBA
- Any deterioration in appearance attributable to corrosion, rust, and so on.
- Consumables and replacement of consumables
- Products of other companies

HORIBA shall not be liable for any damages resulting from any malfunctions of this product, any erasure of data, or any other uses of this product.

■ Trademarks

Generally, company names and brand names are either registered trademarks or trademarks of the respective companies.

Conformable Directive

This equipment conforms to the following directives and standards:

CE

Directives:	
The EMC Directives	89/336/EEC, in accordance with Article 10 (1) of the Directive
The Low Voltage Directive	73/23/EEC
Standards:	
[The EMC Directive]	EN61326: 1997+A1: 1998+A2: 2001 Emission: Class B Immunity Category: Industry
[The Low Voltage Directive]	EN61010-1: 2001

Installation Environment

- Installation Categories (Overvoltage Categories) II
- Pollution Degree 2

FCC Rules

■ Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provided reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

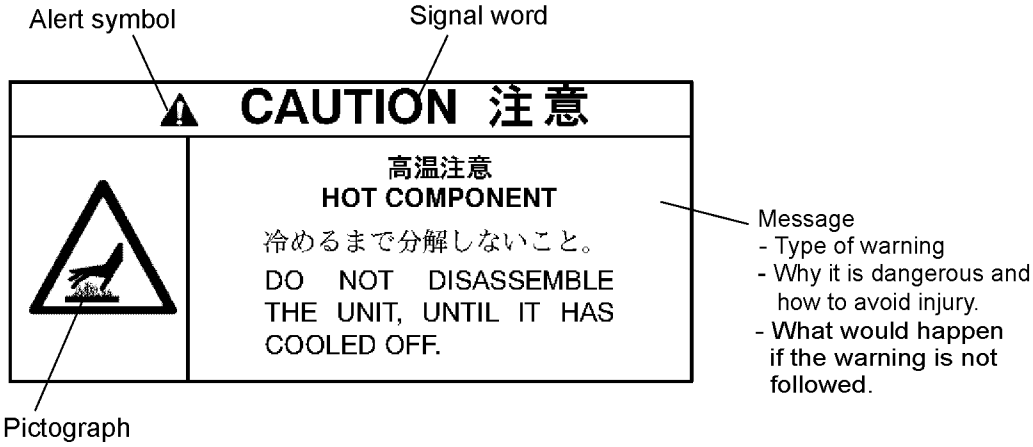
FCC label

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS : (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

Safety Policy

■ Warnings and Warning Labels

We arrange warning labels on our products, and describe notes and cautions in this manual.
Make sure to follow these instructions for your safety.



● **The meanings of the signal words are as follows**

- DANGER:
  This indicates a imminently hazardous situation which, if not avoided, could result in death or serious injury.

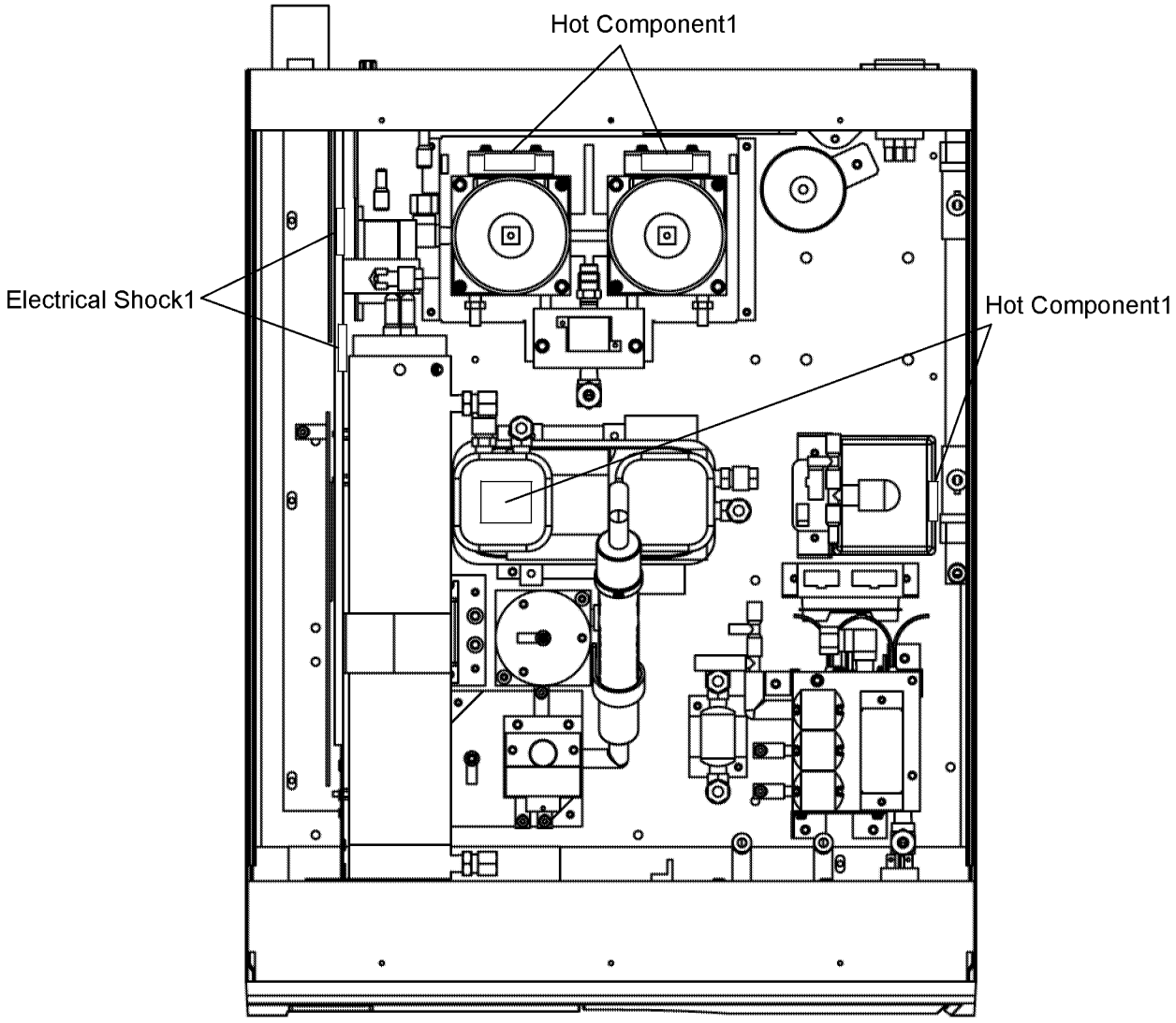
- WARNING:
  This indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

- CAUTION:
  This indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

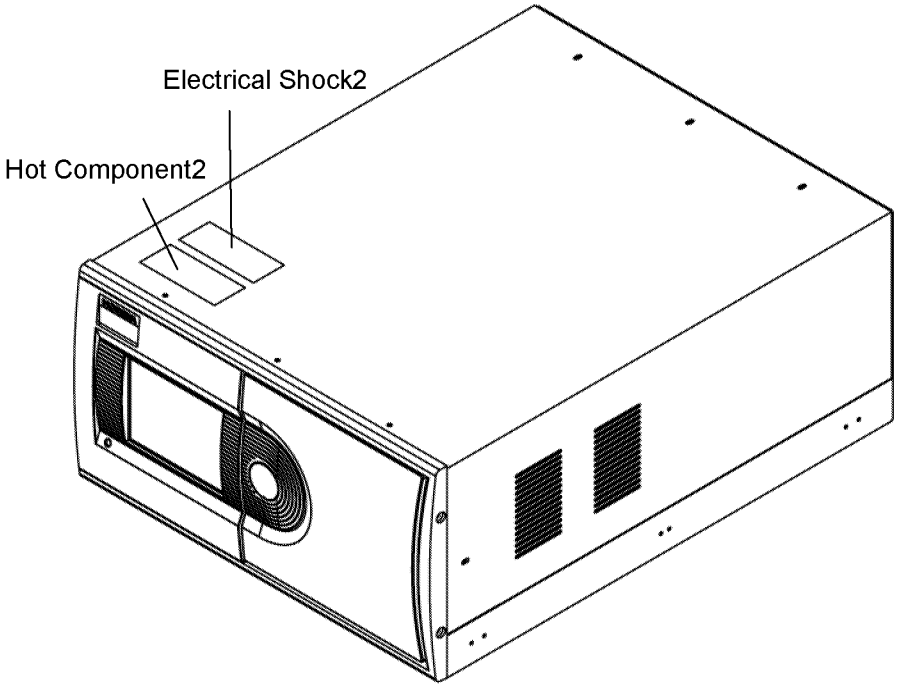
■ Labels and Location

● Label location

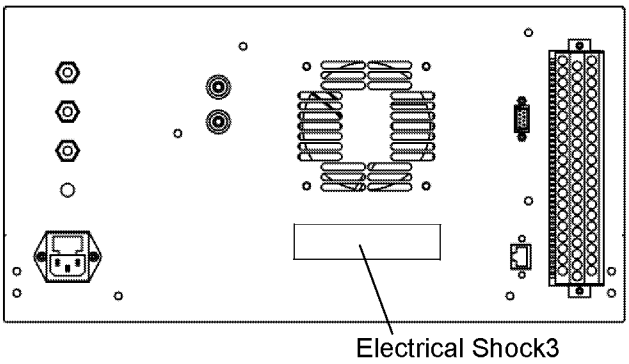
Inside



Top

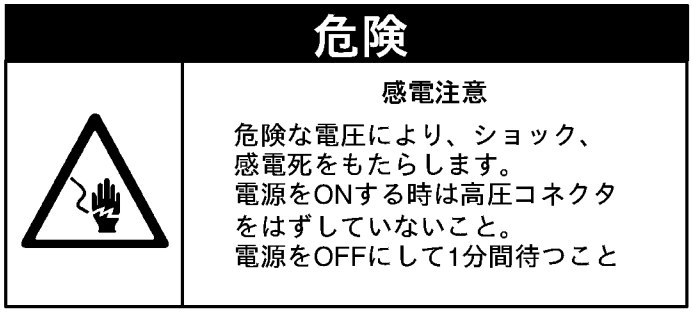


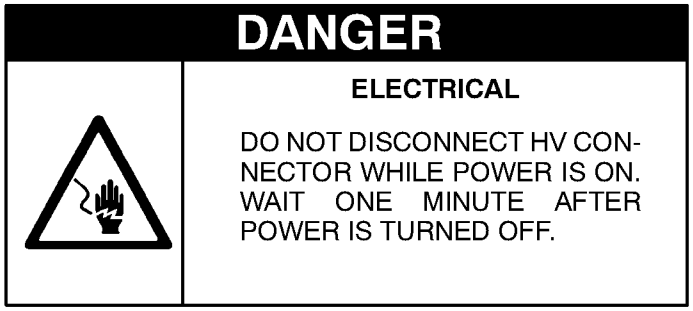
Rear



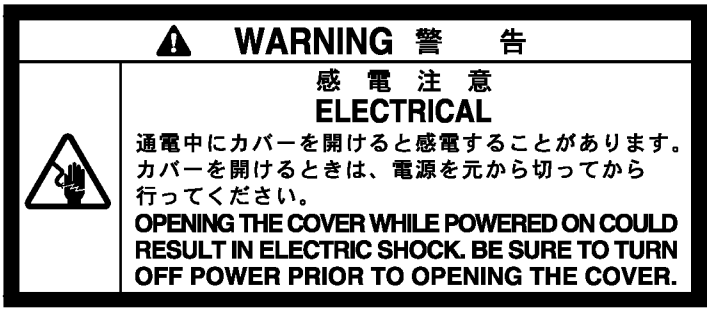
● **Labels**

Electrical Shock1

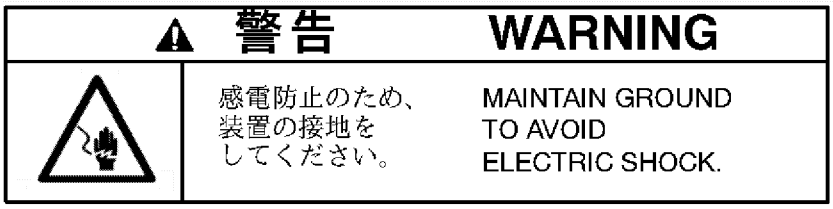




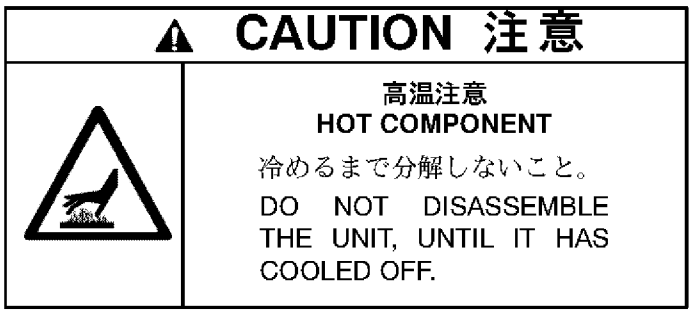
Electrical Shock2



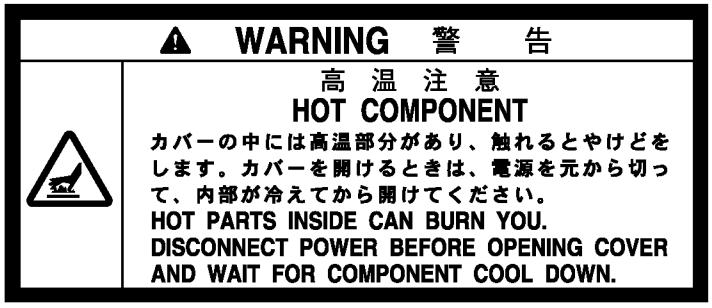
Electrical Shock3



Hot Component1



Hot Component2



■ Precautions

This instruction manual describes how to replace APNA-370 consumable parts.
The instrument inside is hot or high-voltage partly. Before opening the cover, make sure to plug off the main power cable and wait 1 hour or longer until the inside cools down.
For the safety, the works described in this book should be operated only by the service engineers who have the knowledge and skills necessary for APNA-370 maintenance.

■ Description in this manual

Notes and cautions are described in the following styles:

Note

Fix the diaphragm assembly securely, or it may cause the pump to malfunction.

Contents

1 List of Consumables and Replacement Parts

The following table shows the consumable and replacement parts of APNA-370.

Note

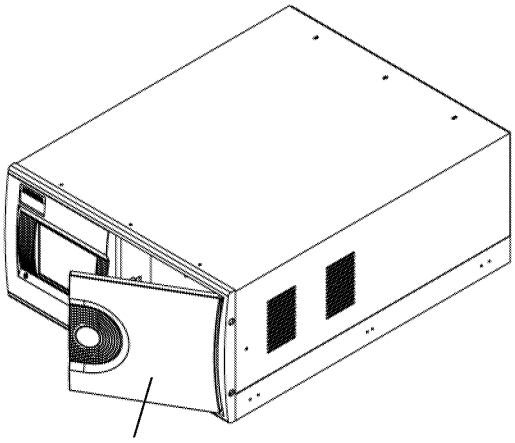
- **The replacement periods shown below are given as recommended and do not assure any performance. The replacement periods of consumables may become shorter depending upon the installation environment and operating conditions.**
- **In order to maintain the accuracy, it is recommended that periodical maintenance and checks be performed when consumables are replaced. For information on maintenance and checks, etc., contact us.**
- **Consumable or replacement parts no longer required should be disposed of as industrial waste.**
- **Perform zero and span calibration after parts replacement.**

Parts name	***Hour-meter***	***Interval***
Sample filter		2 weeks
Air filter 0,3µ		2 years
Catalyzer DO	DO-1	2 years
Pump diaphragm	P-1-D	2 years
Silica gel for Dryer Units	D-1	2 years
Catalyzer NO2-NO (ca.3ml)	COM-1	4 years
Gas Cleaner BAA		4 years
Dehumifier unit	PPD-1	If necessary
UV lamp with PTFE Liner	OGU	If necessary
Pump unit (double head)	P-1-B	If necessary
Solenoid valve (NOx-line)	SV-2	If necessary
Solenoid valve (NO-line)	SV-3	If necessary
Solenoid valve (Referenz-line)	SV-4	If necessary
Internal Zero NO2 Permeation		
Activated carbon		1 year
DFU filter		If necessary
Permeations tube NO2		If necessary
Internal Zero/NO Dilution		
Activated carbon		1 year

You have to clean the filter sponge from the cover.

2 Preparations

1. **Open the front panel door and turn OFF the power switch.**



When the front panel door is open

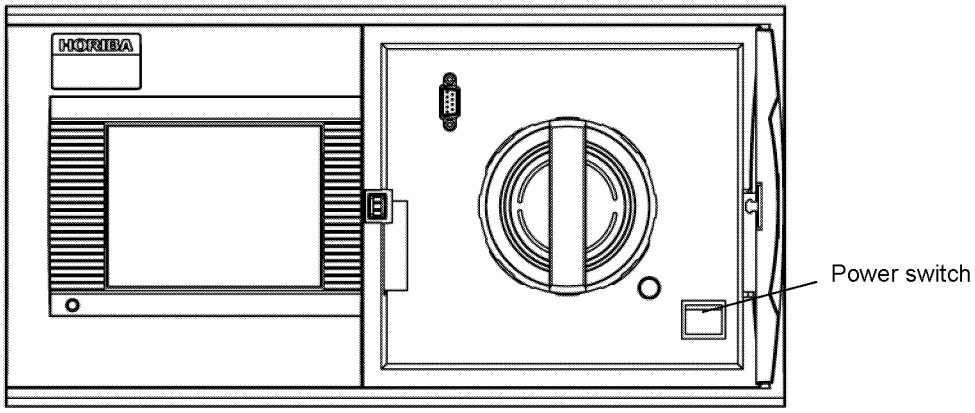


Fig. 1 Front panel

2. **Unplug the power cable from the rear panel.**

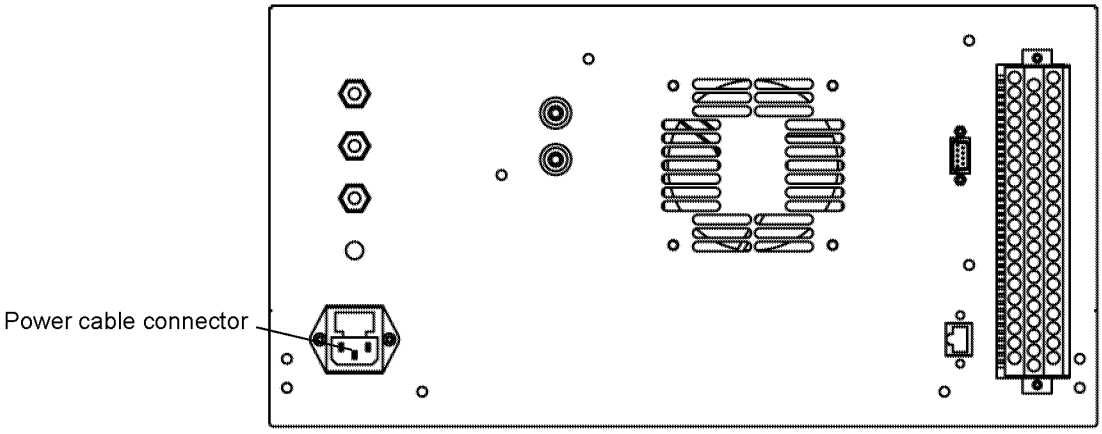


Fig. 2 Rear panel

3. Wait 1 hour or longer until the instrument cools down.
4. Remove the 8 screws (M3) on the cover (shown below) and open the cover.

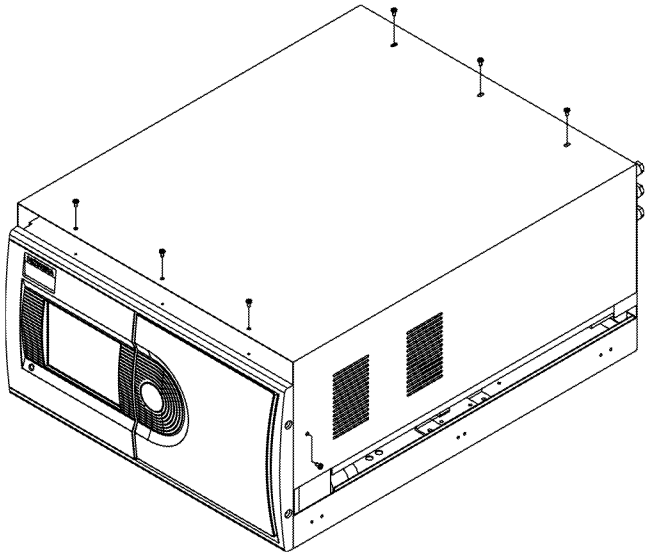


Fig. 3 Removing the cover

3 Component Arrangement

The following figure shows the component arrangement of APNA-370.

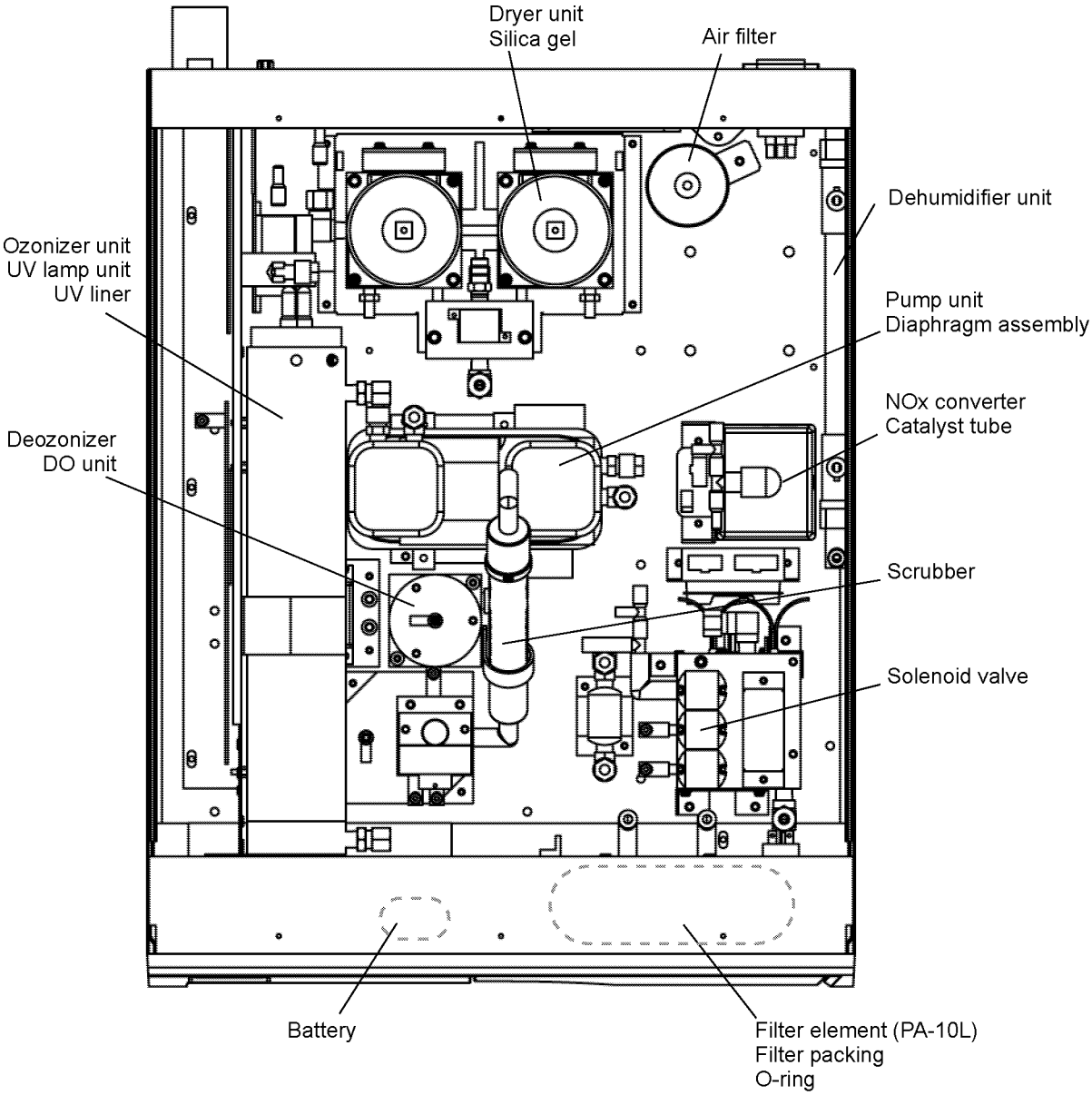


Fig. 4 Component arrangement

4 Parts Replacement

4.1 Filter element (PA-10L), filter packing, O-ring

The filter element (PA-10L) is used to purify sample gas and protect the analyzer.
If the filter element is used over a long period, the flow rate of the sample decreases.
And the filter packing or O-ring will be deteriorated with time, and it may cause troubles, such as insufficient sample flow rates.
We recommend that you replace the filter element (PA-10L), filter packing and O-ring periodically. This procedure is the same as mentioned in the APNA-370 operation manual.

Procedure

Note

Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2).

1. **Push the PUSH-marked area on the front panel door to open the door.**

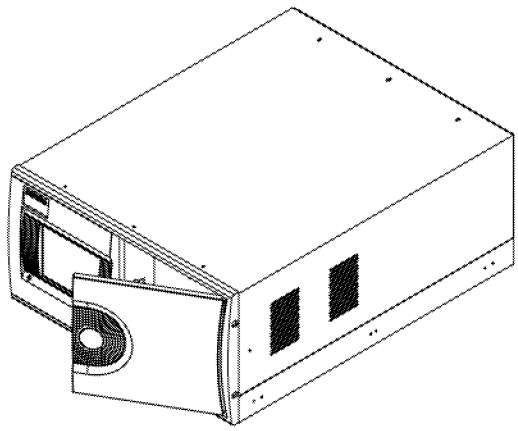
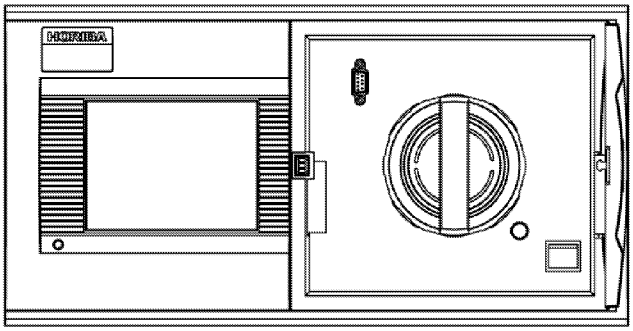


Fig. 5 Front panel door

2. **Turn the filter cover leftward and then pull it out.**
3. **Remove the filter packing.**

Front panel (with the door opened)



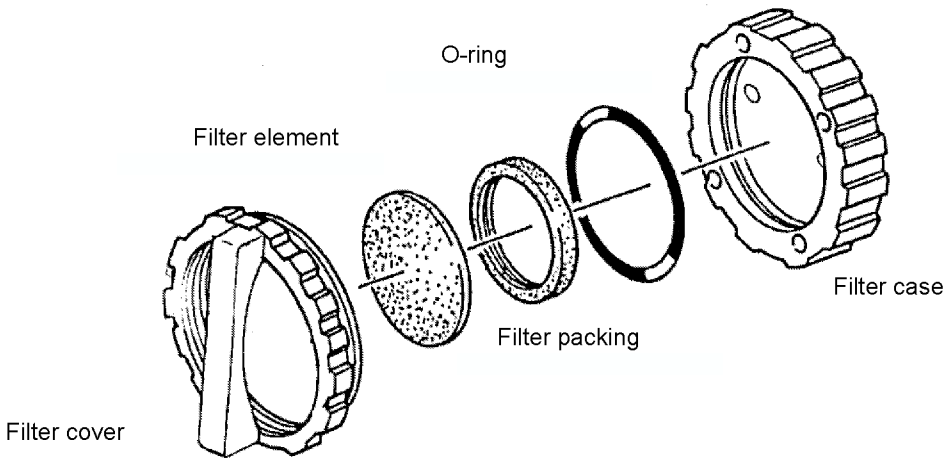


Fig. 6 Exploded view of filter element

4. **Replace the filter element, filter packing, or O-ring wiht new ones, and then put them back together.**
5. **Turn the filter cover rightward to install it.**
6. **Close the front panel door.**

4.2 Diaphragm assembly

The diaphragm or valve will be deteriorated with time, and it may cause troubles, such as insufficient flow rates.
We recommend that you replace the diaphragm and valve periodically.

Procedure

Note

The surface of the pump is very hot.
Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2) and wait until the pump cools down.

1. **Remove the 4 fixing screws on the each pump head.**
2. **Remove the diaphragm with the special wrench provided with the diaphragm assembly.**

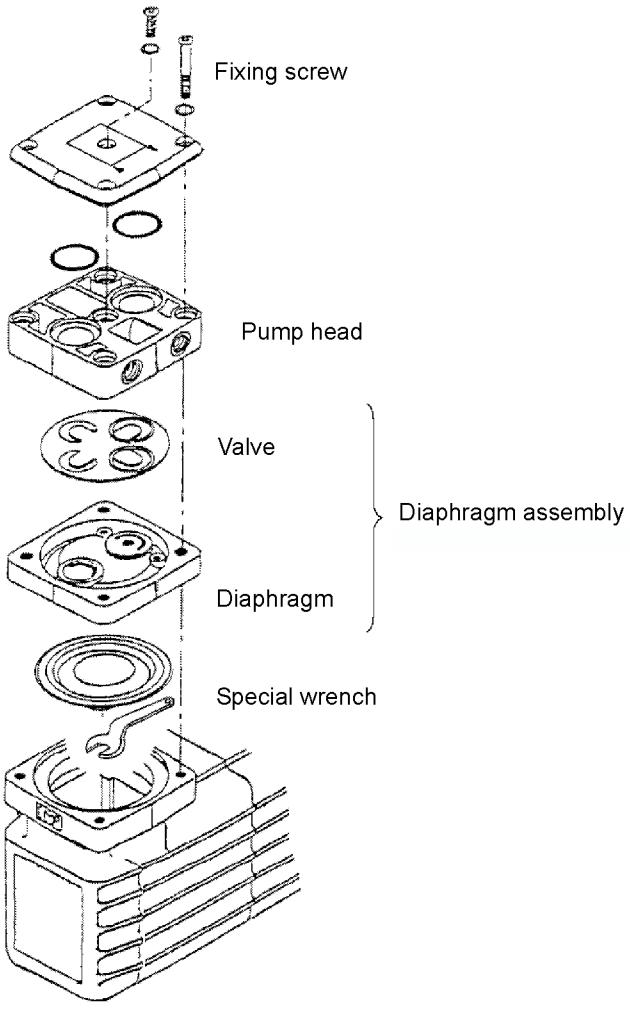


Fig. 7 Diaphragm

3. Replace the valve with new one.
4. Mount a new diaphragm and valve, and use the special wrench to fix it.

Note

Fix the diaphragm assembly securely, or it may cause the pump to malfunction.

5. Making sure that the directions of the valve and pump head are correct, put them back together.

4.3 DO unit

The built-in deozonizer is used to convert ozone, included in exhaust gas after measurement, into harmless gases.
The catalyst in the deozonizer will be deteriorated with time, and it may cause toxic ozone to be discharged. And the continued use of deteriorated catalyst hastens deterioration of the pump.
Replace the DO unit for the deozonizer, which includes a packing, filter element, and DO catalyst, periodically.

Note

If the installation location is in a traffic-congested area or tunnel, make the frequency of maintenance shorter because a catalyst may deteriorate quickly.

Procedure

Note

Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2).

1. **Unscrew the 3 fixing screws on the top of the deozonizer to remove the lid.**
2. **Remove the DO unit (packing, filter element, DO catalyst).**

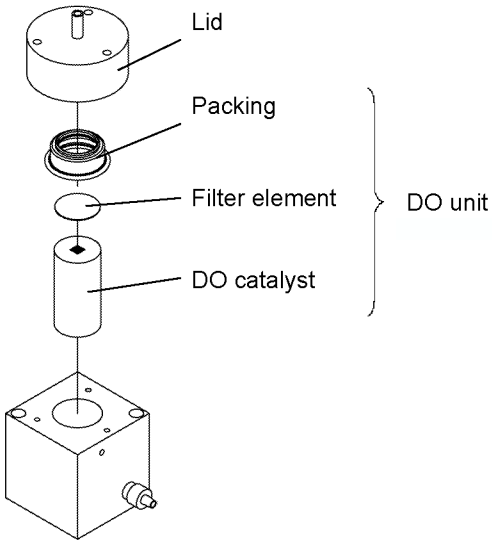


Fig. 8 Deozonizer

3. **Attach a new DO unit (packing, filter element, DO catalyst).**
4. **Put the lid back on and tighten the 3 fixing screws.**

4.4 UV lamp unit, UV liner

The built-in ozonizer is used to generate ozone gas.
The brightness of the UV lamp in the ozonizer will decrease with time, and it may cause ozone generation to be insufficient to meet demand.
We recommend that you replace the UV lamp unit and UV liner periodically.

Danger

High voltage

Care should be taken when handling the lamp.
The lighting circuit of the lamp is high-voltage. There is a danger of electric shock, or electrocution at worst.

Warning

DO NOT look directly at lighted lamp.
It may damage your eyes.

Procedure

Note

Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2).

1. **Remove the ozonizer piping and UV lamp connector.**
2. **Unscrew the screw on the fixing plate of the ozonizer and the screw that fixes the ozonizer.**
3. **Unscrew the screw A, which fixes the UV lamp, and pull out the UV lamp slowly from the ozonizer.**
4. **Remove the UV liner and O-ring from the ozonizer body inside.**

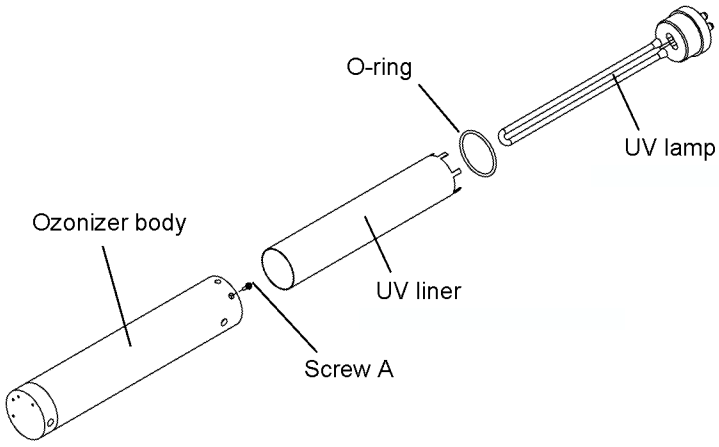


Fig. 9 UV unit

5. **Insert a new UV liner into the ozonizer body making sure that the direction is correct.**

6. If something is stuck in the O-ring groove, remove it with a clean, dry, and soft cloth. You can use put a drop of alcohol on the cloth to remove a persistent dirt.
7. Attach a new O-ring on the ozonizer inside.
8. Insert a new UV lamp and fix it with screw A.
9. Reassemble the ozonizer unit and reconnect the piping and connector in the reverse procedure.

Note

- Tighten the joints firmly.
- The lamp contains mercury. Take care not to damage the lamp and release the internal mercury.

4.5 Dehumidifier unit

The built-in dehumidifier is used to remove water from sample gas.
The unit will be deteriorated with time, and it may cause measurement errors.
We recommend that you replace the dehumidifier unit periodically.

Procedure

Note

Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2).

1. **Remove the piping (4 joints) from the dehumidifier unit.**
2. **Remove the joints on the both ends of the unit (see below).**
3. **The dehumidifier unit is fixed with O-rings.**
   Pull out the unit and replace it with a new one.

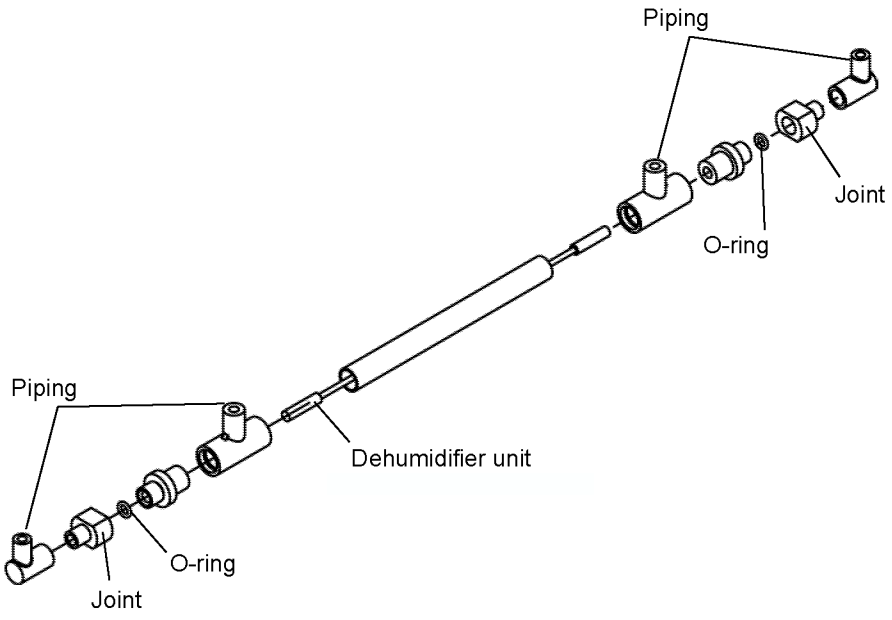


Fig. 10 Dehumidifier unit

4. **Reassemble the dehumidifier and reconnect the piping in the reverse procedure.**

Note

The dehumidifier is a flexible tube. Do not twist or strain it too tightly, or it may be damaged.

4.6 Catalyst tube

The performance of the catalyst in the NOx converter will degrade with time, and it may reduce converter efficiency to cause the NO_2 readings to be lower than actual values.
We recommend that you replace the Catalyst tube periodically.

Procedure

Note

The surface and inside of the catalyst unit in the NOx converter are hot.
Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2) and wait until APNA-370 cools down.

1. **Remove the wiring connector from the NOx converter, and release the hose clamps to remove the upper and lower rubber joints.**
2. **Unscrew the fixing screw of the catalyst unit.**
3. **Release the screw fixing the catalyst tube.**

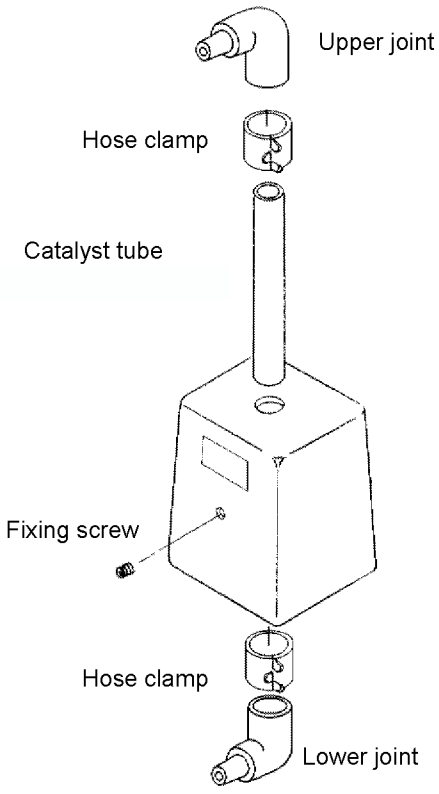


Fig. 11 NOx converter

4. **Pull out the catalyst tube, and replace it with a new one.**
5. **Tighten the fixing screw to fix the catalyst unit tightly.**
6. **Reassemble the NOx converter, and attach the upper and lower rubber joints, and connect the wiring connector in the reverse procedure.**

4.7 Air filter

The air filter is used to purify gas for ozonization, and protect the analyzer.
If the air filter is used over a long period, clogging of the filter will reduce pump performance or dryer unit efficiency and it may cause APNA-370 to malfunction at worst.
We recommend that you replace the air filter periodically.

Procedure

Note

Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2).

1. **Remove the piping.**
2. **Unscrew the screw fixing the air filter, and remove the air filter.**

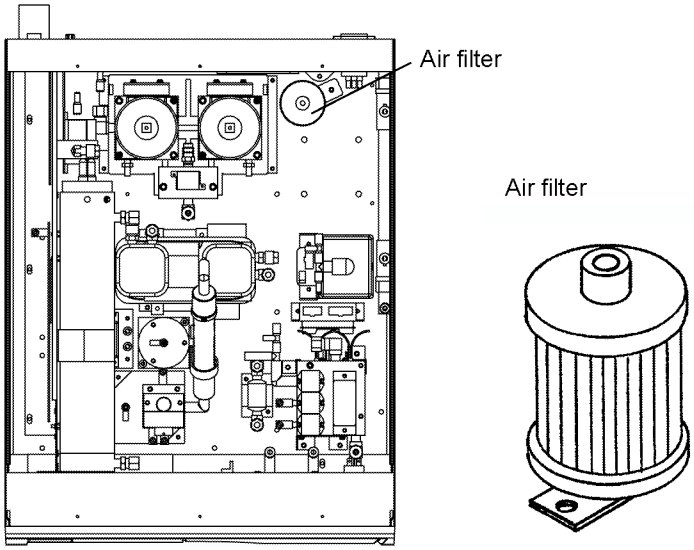


Fig. 12 Air filter

3. **Mount a new air filter in the reverse procedure.**

4.8 Scrubber

The built-up scrubber is used to protect the pump by removing impurities from exhaust gas, and to create purge gas for dehumidifier unit.
If the scrubber is used over a long period, the performance will degrade and it may cause interference to measurement to increase.
We recommend that you replace the scrubber periodically.

Procedure

Note

Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2).

1. **Remove the upper and lower joints of the scrubber.**
2. **Unscrew the screw fixing the scrubber.**

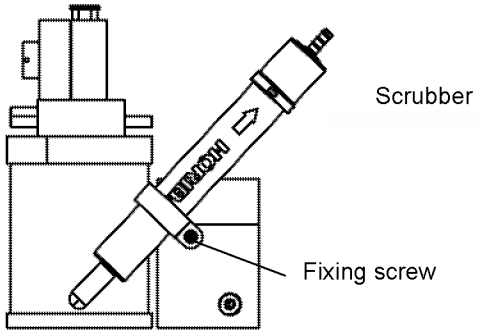


Fig. 13 Scrubber

3. **Replace the scrubber with a new one making sure that the direction is correct.**
4. **Reassemble the scrubber and reconnect the piping in the reverse procedure.**

4.9 Silica gel

If the dryer unit is used over a long period, the dehumidification performance of the silica gel in the dryer unit will degrade and it may ozone generation to change and interference to measurement to increase.
We recommend that you replace the silica gel periodically.

Procedure

Note

The surface of the dryer unit is hot.
Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2) and wait until the dryer unit cools down.

1. **Release the 2 screws of the dryer unit and remove the silica gel container from the base.**

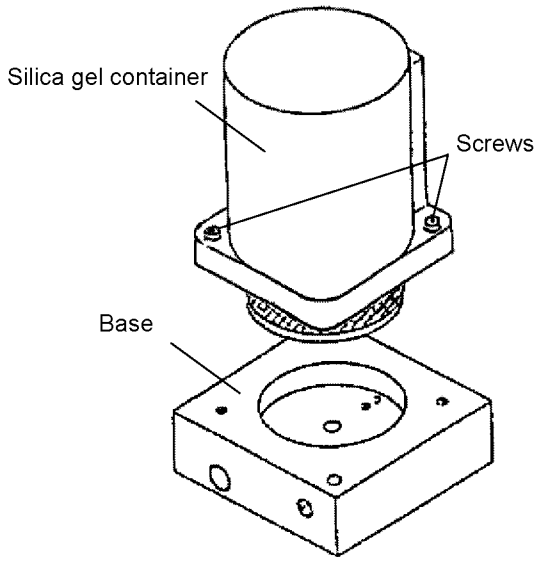


Fig. 14 Silica gel container

2. **Turn the container upside down, and then remove the large filter, large packing, small packing, and small filter.**

3. **Replace the silica gel inside the container with new one.**
   Pour silica gel into the outer container up to the highest projecting part, and into the inner container up to 1 or 2 mm lower than the top (see below).

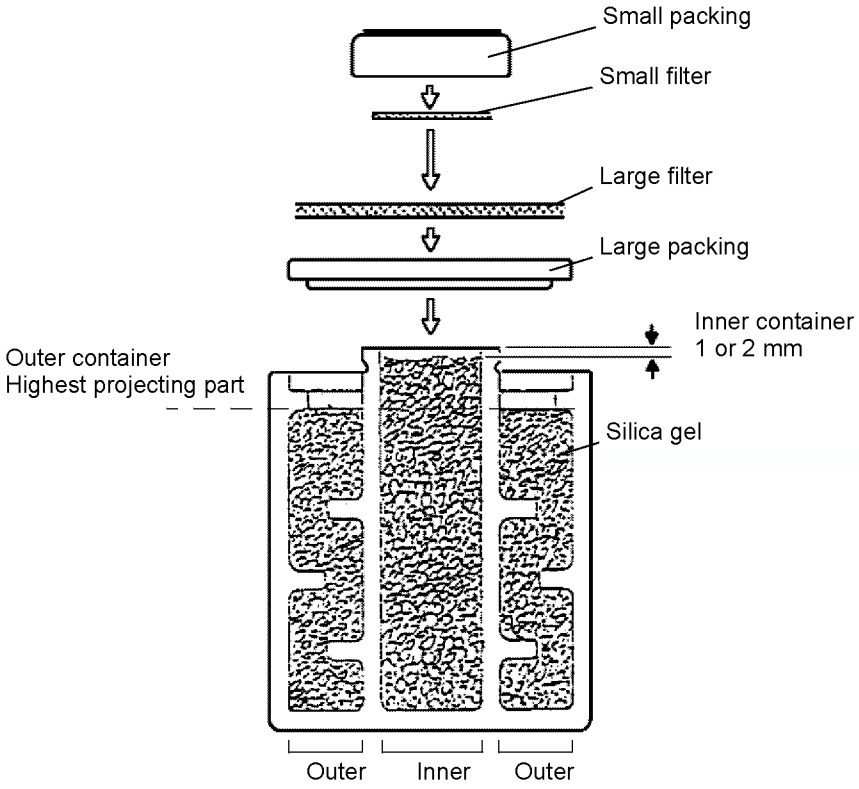


Fig. 15 Silica gel container (cross-sectional view)

4. **Insert the large filter into the large packing, and cover the outer container with them securely.**
5. **Insert the small filter into the small packing, and cover the inner container with them securely.**
6. **Fix the silica gel container to the base.**

4.10 Pump unit

The pumps will be deteriorated with time, and it may change sample flow rates.
We recommend that you replace the pumps periodically.

Procedure

Note

The surface of the pump is very hot.
Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2) and wait until the pump cools down.

1. **Disconnect the power connector of the pump.**
2. **Remove the joints attached to the pump.**
3. **Unscrew the 4 screws fixing the pump, and remove the pump.**
4. **Turn the upper part (A) of a new pump unit at a right angle, as shown below, and check the position marks (B) on the upper and lower parts of the pump head. If the direction is correct, the position marks meet each other.**

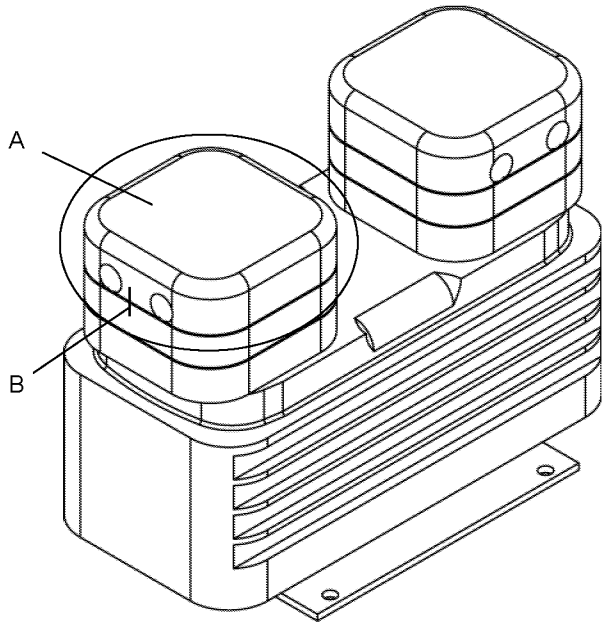


Fig. 16 Pump unit

5. **Mount a new pump unit in the reverse procedure.**

Note

When connecting the joints, make sure to use sealing tapes to wind them.

4.11 Solenoid valve

The built-in solenoid valves are used to switch gas lines to be introduced to the detector.
The solenoid valves will be deteriorated with time, and it may cause serious troubles affecting measured values, such as insufficient airtight, or malfunction.
We recommend that you replace the solenoid valves periodically.

Procedure

Note

Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2).

1. **There are 3 solenoid valves on the detector block. Disconnect the connector of the solenoid valve to be replaced.**
2. **Unscrew the fixing screw of the solenoid valve and remove the valve.**

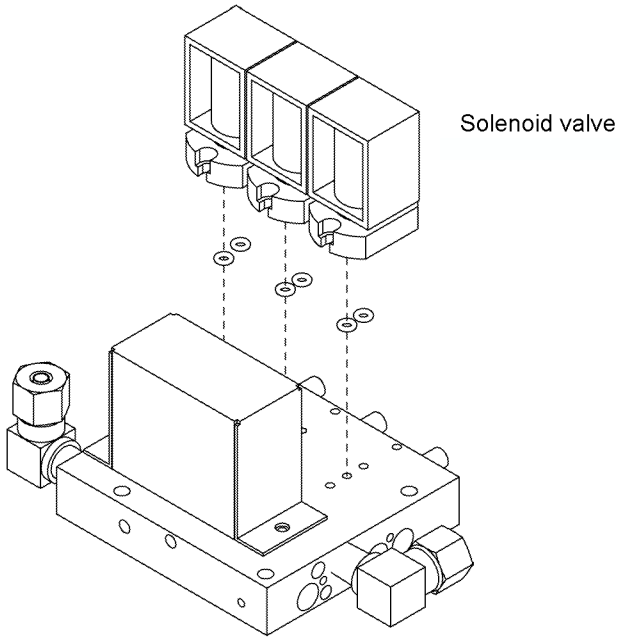


Fig. 17 Solenoid valves

3. **Mount a new valve and O-rings on the block, making sure that the valve direction is correct.**

4.12 Battery

The battery for clock/memory backup will be deteriorated with time, and the voltage will be lowered.

Procedure

Note

Before doing the procedure below, make sure to power OFF the instrument referring to " 2 Preparations " (page 2).

1. **The battery is attached on the printed board that is located on the front panel inside (see below). Replace the battery with a new one.**

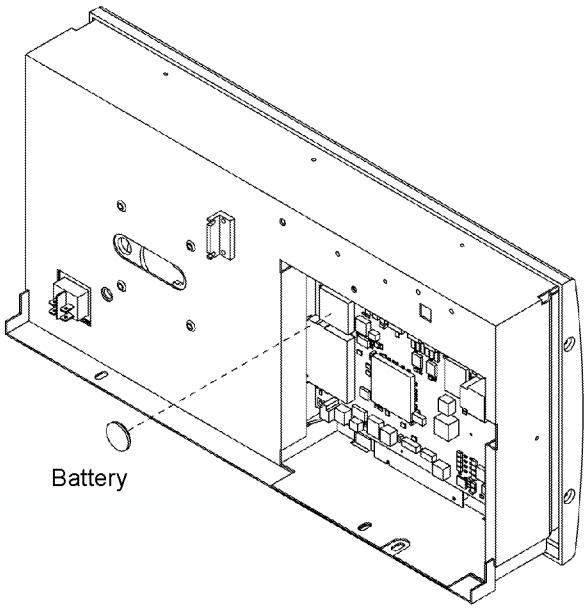


Fig. 18 Battery

2. **After powering ON the instrument, adjust the internal clock (see " 5.2 Readjusting the internal clock " (page 22)).**

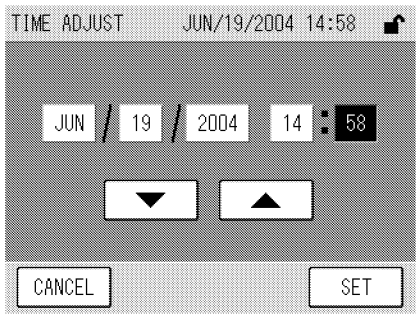


Fig. 19 TIME ADJUST screen

5 Operations after Part Replacement

5.1 Resetting the maintenance status

To use the maintenance status as an indication for the next replacement, reset the operation hours for the replaced parts on the MAINTENANCE STATUS screen.

1. **After powering ON the instrument, press the [MAINTENANCE STATUS] button on the MENU/MAINTENANCE screen. The MAINTENANCE STATUS screen will be displayed.**

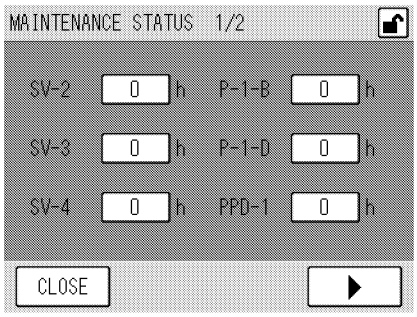


Fig. 20 MAINTENANCE STATUS screen

The operating hours of consumable parts are displayed.
For the symbols, see the flow sheet at the end of this document.
Use P-1-B for the pump itself and P-1-D for the pump diaphragm.

2. **Press the button of the operating hour to be changed (reset).**
   The MAINTENENCE STATUS screen for setting will be displayed.

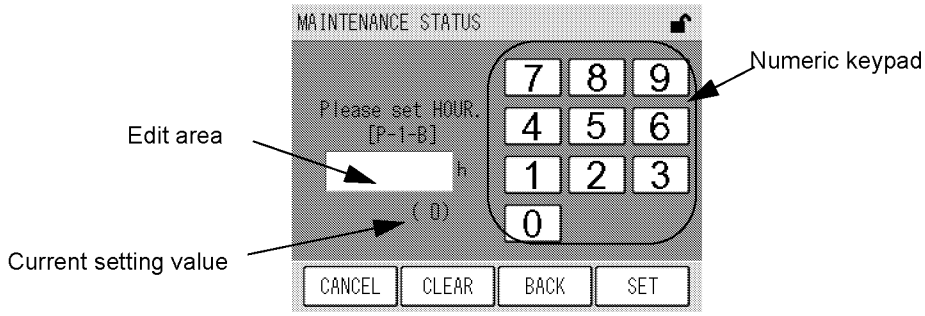


Fig. 21 MAINTENENCE STATUS screen for setting

Enter a value via the numeric keypad.
The keys allow you to perform the following operations.

[CANCEL]:	Returns to the MAINTENANCE STATUS screen without changing the time.
[CLEAR]:	Deletes the value entered in the edit area.
[BACK]:	Deletes the just entered figure (1-digit).
[SET]:	Returns to the MAINTENANCE STATUS screen with the time changed.

3. **Enter a desired value (0 for resetting) via the numeric keypad.**
4. **Press the [SET] key. The operating hours will be changed (reset) and the MAINTENENCE STATUS screen is displayed again.**
5. **Press the [CLOSE] key on the MAINTENANCE STATUS screen. The MENU/MAINTENANCE screen will be displayed again.**

5.2 Readjusting the internal clock

Readjust the internal clock after battery replacement.

1. **After powerinf ON the instrument, press the [TIME ADJUST] button on the MENU/ SETTING screen. The TIME ADJUST screen will be displayed.**

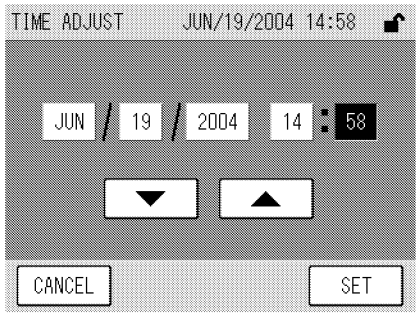


Fig. 22 TIME ADJUST screen

The current time setting is always displayed first, in a format of year, month, day, hour, and minute as respective buttons.
To change a value, press the corresponding button, and then press either of the following buttons to increase or decrease the value.

[▲]: Increases the value.
[▼]: Decreases the value.

The keys allow you to perform the following operations.

[CANCEL]: Returns to the MENU/SETTING screen without changing the settings.
[SET]: Returns to the MENU/SETTING screen with the settings changed.

2. **Press a value button to be changed to select the item, and adjust the current time with the [▲] and [▼] buttons.**
3. **Press the [SET] key. The current time setting will be changed and the MENU/SET-TING screen will be displayed again.**

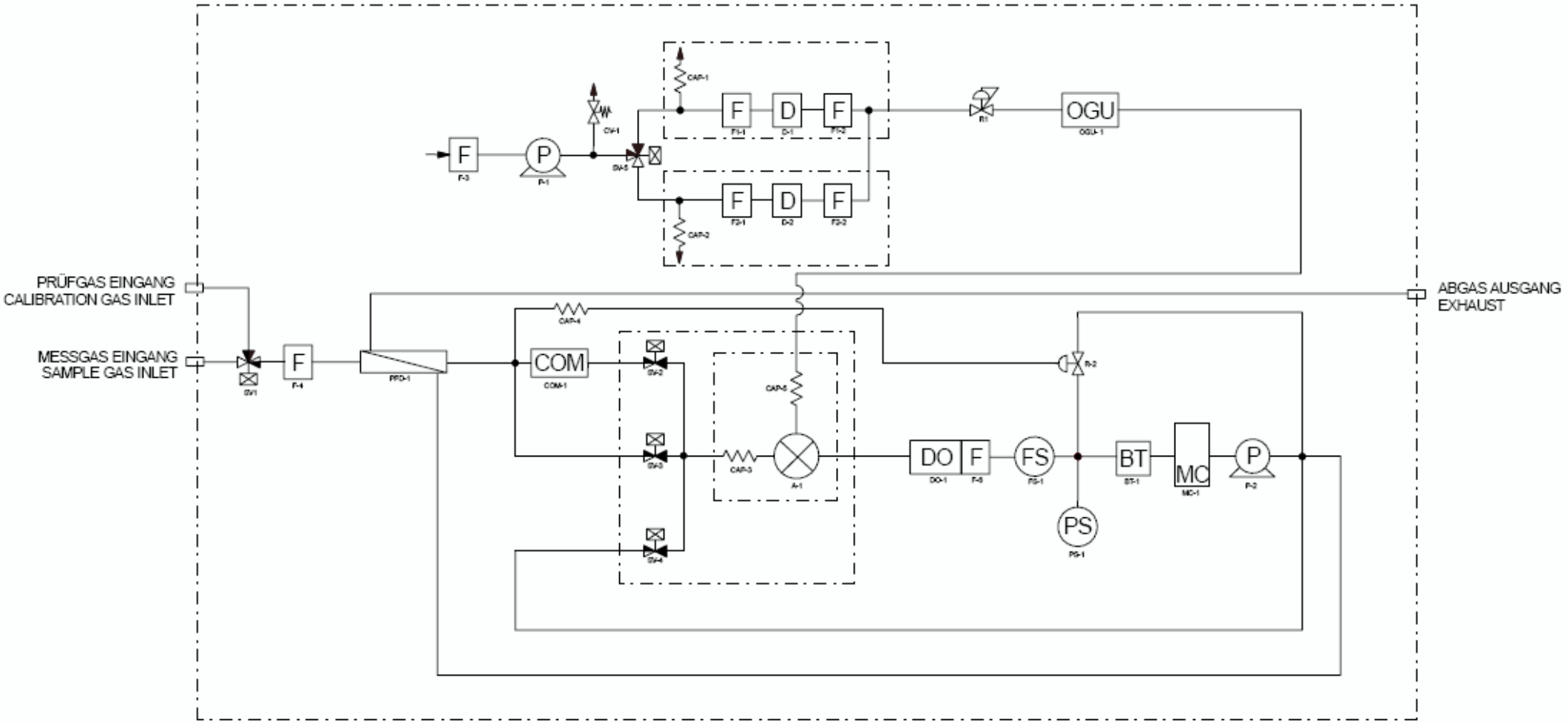
Note

- **If you press the [CANCEL] button before completing the setting, the time prior to the change will apply.**
- **The time cannot be set on a second basis. Pressing the [SET] key will automatically set the time to 00 second.**
- **If you change the time to any unrealistic date or time and press the [SET] key, the realistic date or time nearest to the set value will apply automatically.**
- **Pressing the [SET] key will delete the internal data (e.g., average) having the creation time later than the set time.**

Converter efficiency check

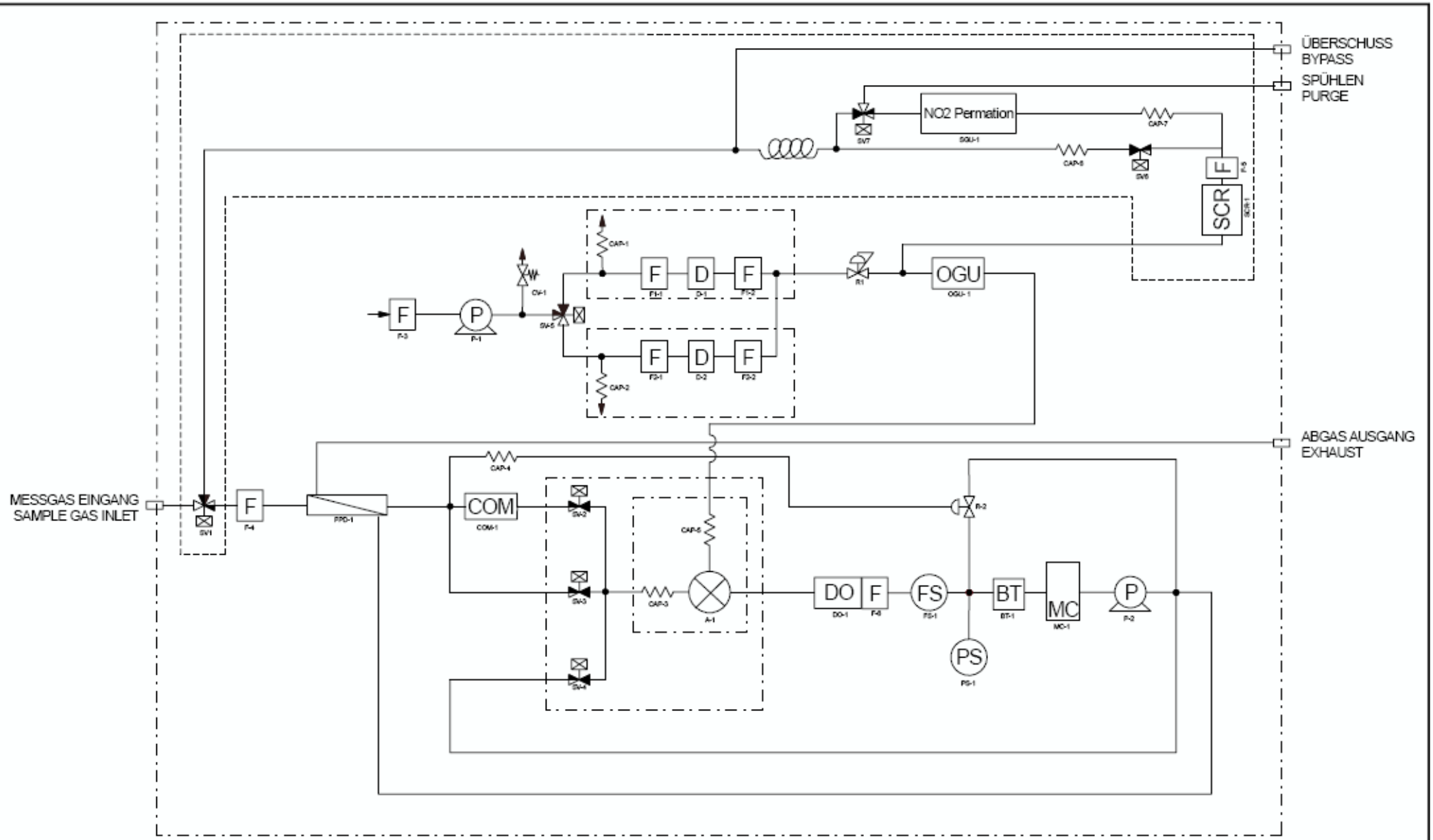
After maintenance of APNA you have to check and adjust the converter efficiency:

- Change to Supervisor Modus 8/9 FACTORY CALIBRATION
- Introduce zero gas and calibrate zero point
- Introduce NO span gas and calibrate span point
- Introduce GPT this means NO is converted to NO2 by using ozone
- If the measured value is stable, adjust the number of the EFFICIENCY until the NOx value is the same like before without GPT.



SV-1 = 3/2 Wegeventil Bürkert 127

APNA-370_STANDARD_MIT_MAGNETVENTIL_SV1 APNA-370_STANDARD_WITH_SOLENOID_VALVE_SV1	HORIBA	APNA - 370 GASLAUFPLAN FLOW SCHEMATIC	Ausgest. 4.4.2006 Bearb. J.Moser Format A4 Sprache D/E	Bl.-Nr. 1 / Anz. Bl. 1 Zeichnungsnummer 2.06.065.1

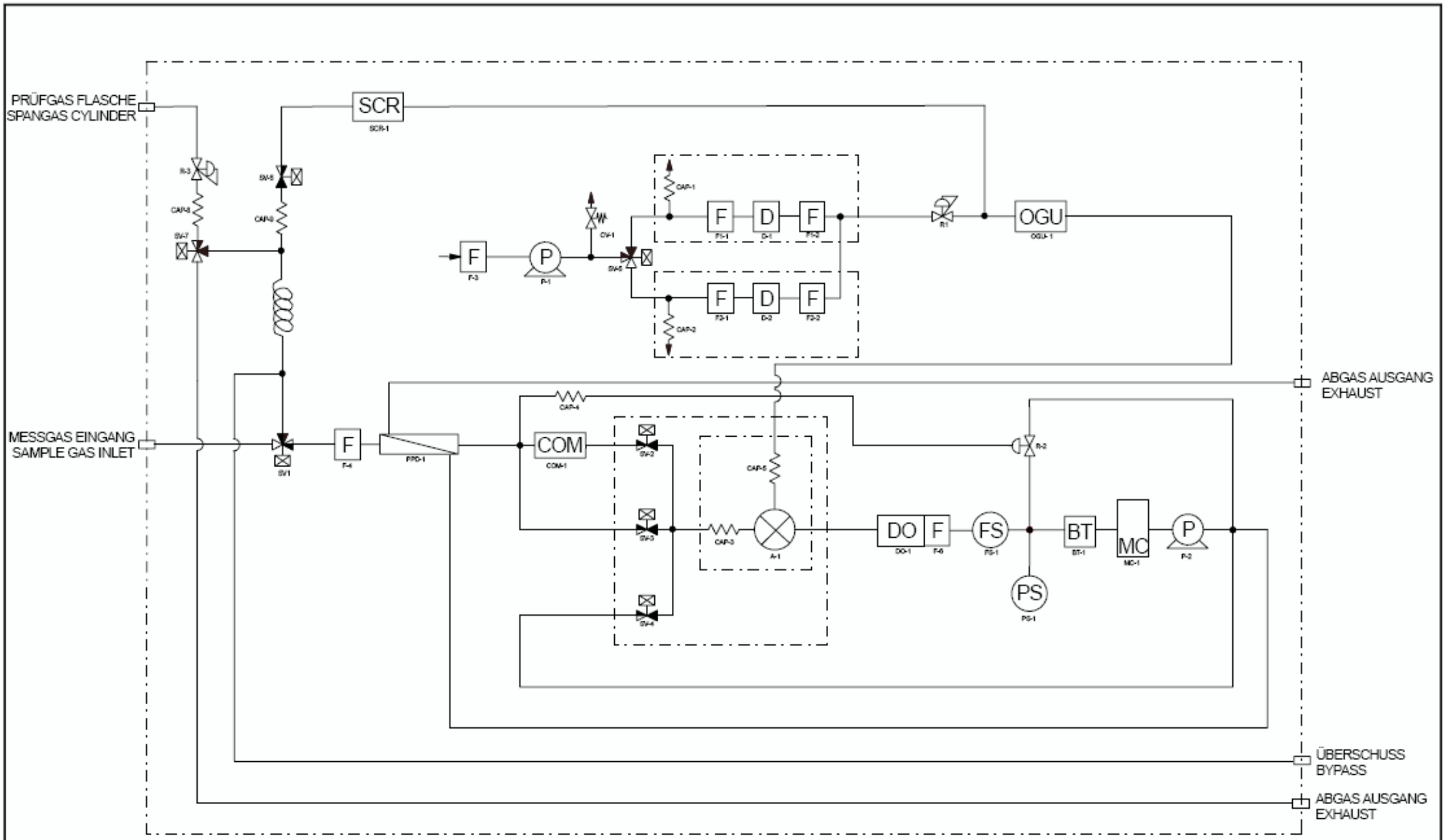


SV-1 = 3/2 Wegeventil Bürkert 127
SV-6 = 2/2 Wegeventil VDW21
SV-7 = 3/2 Wegeventil Bürkert 127

CAP-6 = Glasrohr Kapillare Ø0,6mm , L40mm
CAP-7 = Glasrohr Kapillare Ø0,3mm , L40mm
F-5 = DFU / BN-70 Filter

SCR-1 = Aktivkohle

APNA-370_INTERNER_NO2_PRÜFGASGENERATOR APNA-370_INTERNAL_NO2_SPANGASGENERATOR	HORIBA	APNA - 370 GASLAUFPLAN FLOW SCHEMATIC	Ausgest. 17.7.2006	Bl.-Nr. 1	Anz. Bl. 1
			Bearb. J.Moser		
			Format A4	Zeichnungsnummer: 2.06.083.1	
			Sprache D/E		



SV-1 = 3/2 Wegeventil Bürkert 127
SV-6 = 2/2 Wegeventil MV-11-1
SV-7 = 3/2 Wegeventil MV-14-1

R-3 = Druckregler UA13-S202-AV
CAP-8 = Kapillare SA-060-RJ
CAP-9 = Kapillare SA-152-QJ

SCR-1 = Aktivkohle

APNA-370_INTERN_NULLGAS_UND_NO_VERDÜNNUNG APNA-370_INTERNAL_ZEROGAS_AND_NO_DILUTION	HORIBA	APNA - 370 GASLAUFPLAN FLOW SCHEMATIC	Ausgest. 4.7.2006 Bearb. J.Moser Format A4 Sprache D/E	Bl.-Nr. 1 / Anz. Bl. 1 Zeichnungsnummer: 2.06.071.1