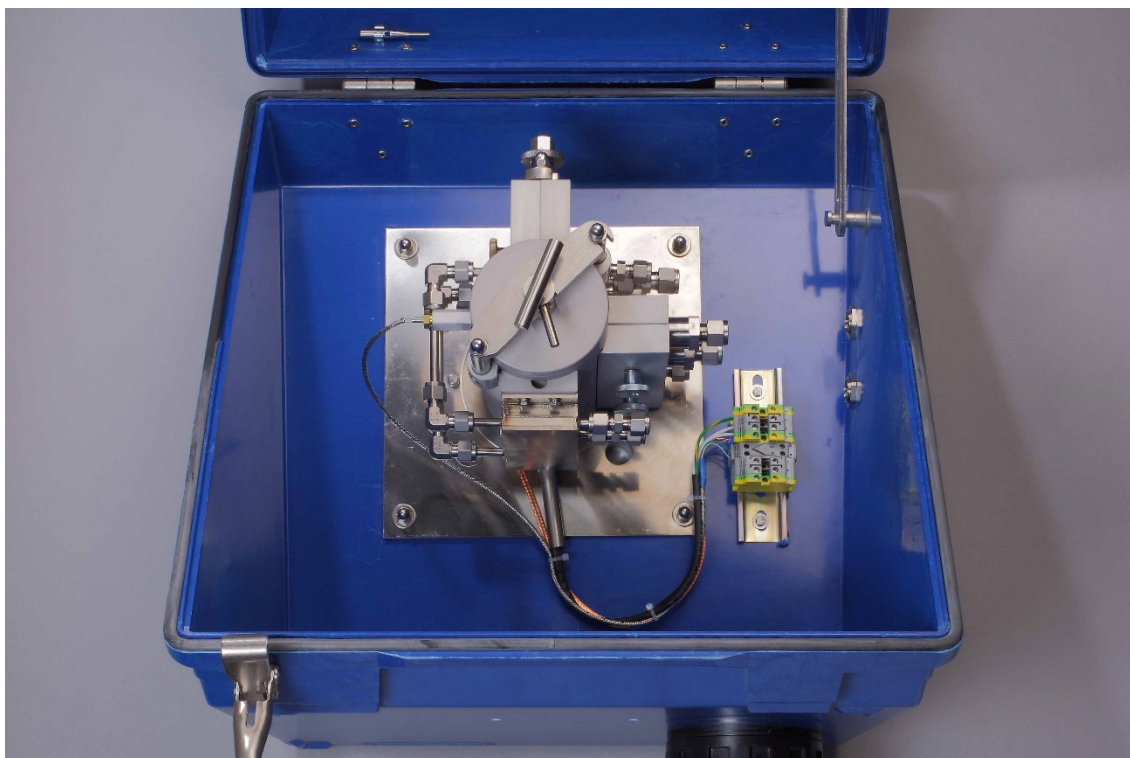


Gas sample probe Series SP[®]

SP2006-H/DIL..., SP2006-H280/DIL...

Instruction Manual
Version 1.00.02



**Dear customer,**

Thank you for buying our product. In this instruction manual you will find all necessary information about this M&C product. The information in the instruction manual is fast and easy to find, so you can start using your M&C product right after you have read the manual.

If you have any question regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor. You will find all the addresses in the appendix of this manual.

For additional information about our products and our company, please go to M&C's website www.mc-techgroup.com. There you will find the data sheets and manuals of all our products in German and English.

This Operating Manual does not claim completeness and may be subject to technical modifications.

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SP® is a registered trade mark.

Version: 1.00.02

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1 GENERAL INFORMATION

The product described in this manual has been built and tested in our production facility.

All M&C products are packed to be shipped safely. To ensure the safe operation and to maintain the safe condition, all instructions and regulations stated in this manual need to be followed. This manual includes all information regarding proper transportation, storage, installation, operation and maintenance of this product by qualified personnel.

Please follow all instructions and warnings closely.

Please read this manual carefully before commissioning and operating the device. If you have any questions regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor.

2 DECLARATION OF CONFORMITY



The product described in this operating manual complies with the following EU directives:

EMV-Instruction

The requirements of the EU directive 2014/30/EU “Electromagnetic compatibility” are met.

Low Voltage Directive

The requirement of the EU directive 2014/35/EU “Low Voltage Directive” are met.
The compliance with this EU directive has been examined according to DIN EN 61010.

Declaration of conformity

The EU Declaration of conformity can be downloaded from the **M&C** homepage or directly requested from **M&C**.

3 SAFETY INSTRUCTIONS

Follow these safety directions and instructions regarding installation, commissioning and operation of this equipment:

Read this operating manual before starting up and use of the equipment. The information and warnings given in this operating manual must be heeded.

Any work on electrical equipment is only to be carried out by trained specialists as per the regulations currently in force.

Attention must be paid to the requirements of VDE 0100 (IEC 364) when setting high-power electrical units with nominal voltages of up to 1000 V, together with the associated standards and stipulations.

Check the details on the type plate to ensure that the equipment is connected to the correct mains voltage.

Protection against touching dangerously high electrical voltages:

Before opening the equipment, it must be switched off and hold no voltages. This also applies to any external control circuits that are connected.

The device is only to be used within the permitted range of temperatures and pressures.

Check that the location is weather-protected. It should not be subject to either direct rain or moisture.

The gas sample probes version SP2006-H.. must not be used in hazardous areas.

Installation, maintenance, monitoring and any repairs may only be done by authorized personnel with respect to the relevant stipulations.

4 WARRANTY

In case of a device failure, please contact immediately M&C or your M&C authorized distributor.

We have a warranty period of 12 months from the delivery date. The warranty covers only appropriately used products and does not cover the consumable parts. Please find the complete warranty conditions in our terms and conditions.

The warranty includes a free-of-charge repair in our production facility or the free replacement of the device. If you return a device to M&C, please be sure that it is properly packaged and shipped with protective packaging. The repaired or replaced device will be shipped free of delivery charges to the point of use.

5 USED TERMS AND SIGNAL INDICATIONS



Danger

This means that death, severe physical injuries and/or important material damages **will occur** in case the respective safety measures are not fulfilled.



Warning

This means that death, severe physical injuries and/or important material damages **may occur** in case the respective safety measures are not fulfilled.



Caution

This means that minor physical injuries **may occur** in case the respective safety measures are not fulfilled.

Caution

Without the warning triangle means that a material damage may occur in case the respective safety measures are not met.

Attention

This means that an unintentional situation or an unintentional status may occur in case the respective note is not respected.



Note

These are important information about the product or parts of the operating manual which require user's attention.

Qualified personnel

These are persons with necessary qualification who are familiar with installation, use and maintenance of the product.



Hot surface!

Contact may cause burn! Do not touch!



High voltages!

Protect yourself and others against damages which might be caused by high voltages.



Corrosive!

These substances destroy living tissue and equipment upon contact. Do not breathe vapors; avoid contact with skin and eyes.



Wear protective gloves!

Working with chemicals, sharpe objects or extremly high temperatures requires wearing protective gloves.

6 INTRODUCTION

The **M&C** gas sample probes type **SP2006-H..** are based on the patented probe **SP2000-H** and are used for continuous gas sampling and dilution.

6.1 SERIAL NUMBER

The type plates are to be found where the electrical connection box is placed.



Note

Please indicate the serial number of the equipment in case of any question and when ordering spare parts.

7 APPLICATION

The electrically heated **M&C** dilution probe is applicable for such processes, where the measuring procedure or the handling of the process gas requires the dilution of the sample respectively the component to be measured. Typical applications are the use with toxic gases, the moisture measurement, and the emission measurement in flue gases.

The **M&C** dilution probe **SP2006-H/DIL...** is based on the well tested **M&C** gas sample probe **SP2000-H**. This enables the user to adapt the probe to nearly every application, using for example special filter techniques or special materials.

8 TECHNICAL DATA

Series SP	Version gas sample dilution probe SP2006-H/DIL ...
Insitu sample tubes and pre filters optional on request	See leaflet 2.14; 2.15, 2.17
Dilution rates with the critical orifices "a" - "g" ³⁾	a = 500, b = 200, c = 100, d = 50, e = 30*, f = 20, g = 10 : 1
Sample flow rate depending on the critical orifices "a" - "g"	a = 1.4, b = 2.7, c = 5.5, d = 11, e = 19*, f = 28, g = 55 l/h ¹⁾
Possibility to adapt the dilution factor	With dilution gas pressure-adjustment -5 % to +30 % ²⁾
Dilution gas flow rate with injector version I or II	I: 480 – 600 NI/h, optional for higher dilution rates II: 1800-3000 NI/h
Dilution gas pressure on inlet of pressure controller	Min. 4.5 bar g, max. 16 bar g
Bypass injector /B: gas pressure-gas flow rate-sample gas flow rate	At approx. 2 bar g - injector gas approx. 300 l/h - sample gas approx. 150 l/h
Process pressure	0.9 up to 2 bar abs.
Fault caused by process temperature variations	Operation independent from process temperature
Fault caused by process low or over pressure	No fault as long as the differential pressure ΔP at the dilution unit is > 0.5 bar g and test gas is given to the probe under process conditions
Fault caused by atmospheric pressure variations	< 1 % with a variation of 50 mbar
Materials in contact with the sample gas	Stainless steel 316Ti, quartz glass, FKM, graphite
Weight	Approx. 30 kg [≈ 66.1 lbs]

*Standard, others to be indicated along with order, intermediate values possible.

1) approx. at 3 bar dilution gas behind pressure controller.

2) -5% not possible for orifice „g“.

3) with injector version I. Further technical data see leaflet SP2000, 2.1.

Please note: NI/h and NI/min refer to the German standard DIN 1343 and are based on these standard conditions: 0 °C [32 °F], 1013 mbar.

9 DILUTION PRINCIPLE

The functional principle of the dilution unit is based on ultrasonic flow through a critical orifice (see Fig. 1). The flow through the orifice is constant when the differential pressure via the orifice is higher than 500 mbar. For the atmospheric inlet pressure ($P_{IN} = 1020$ mbar), this means a pressure at the orifice outlet (P_{OUT}) of less than 520 mbar absolute.

The necessary vacuum at the orifice outlet is produced by an injector operated with dilution gas.

Depending on the critical orifice selected, dilution rates can be between 10:1 and 500:1. The table below gives an overview of the dilution factor and sample gas volume using the injector I (480 – 600 NI/h):

Orifice type	a	b	c	d	e	f	g
Dilution ratio*	500:1	200:1	100:1	50:1	30:1	20:1	10:1
Volume flow through the orifice [NI/h]	1.4	2.7	5.5	11	19	28	55

* with Injector II 50:1 to 2000:1

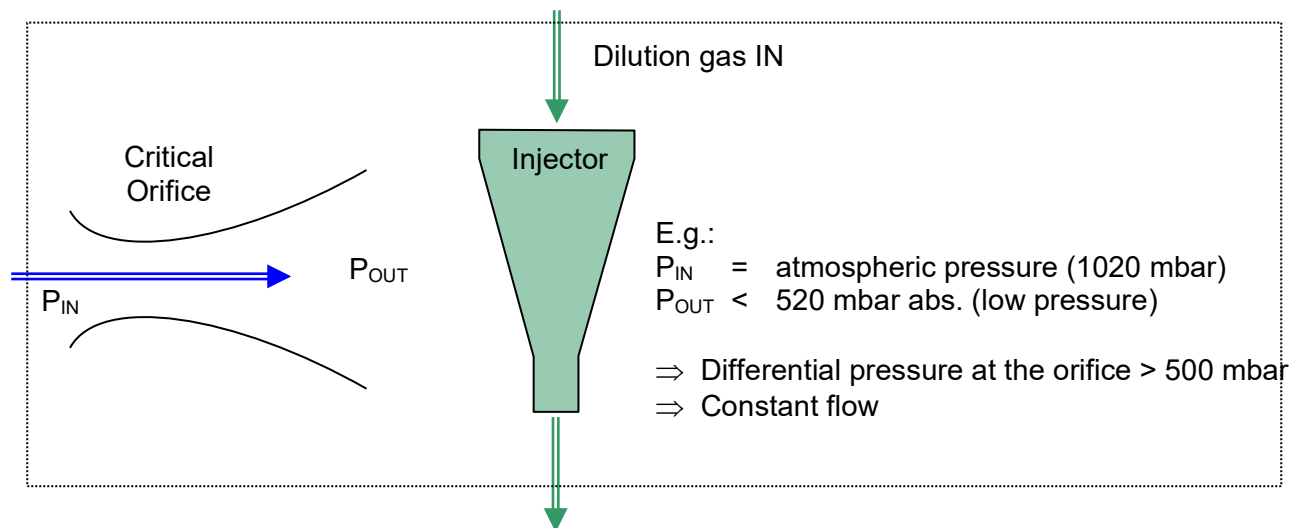


Figure 1 Dilution principle

10 DESCRIPTION

The dilution unit including the critical orifice is mounted directly at the probe body and therefore heated up with the probe to a stable temperature. The incorporated pre-heater heats up the dilution gas to the probe temperature. Both steps avoid that sample gas decreases under the dewpoint. Calibration gas enters the probe via an integrated connection.

The probe can be heated up to 180 °C [356 °F] or 280 °C [536 °F]. As an option a heated manual operated 2 way ball valve is available. It is integrated in the sample gas inlet and shuts off the probe head from the process, for example during the change of the filter element. Additionally the option 'blow back in front of ball valve' via the probe flange is available.

Through an optional high flow rate check valve **/BB**, which is fixed to the internal probe area, blow back of the filter housing area and the insitu probe tube will be done. Through the optional high flow rate check valve **/BB/F**, which is fixed to the filter housing wall, blow back of the incorporated ceramic filter will be done incl. the filter area and the insitu probe tube. The optional isolation valve **/I** shuts off the sample outlet from the internal filter area.

To optimize the blow back, an incorporated accumulator tank with a volume of two liters is available as option. To drive this tank an optional air actuated or solenoid valve is offered.

The necessary dilution gas pressure can be adjusted by the precision pressure controller with pressure gauge. A vacuum pressure gauge indicates the function of the dilution system.

The pressure controller and pressure gauges, necessary for the dilution function, have to be ordered separately. The external control unit **-S** is equipped with an additional shut-off ball valve and a flowmeter to adjust the test gas quantity. The set **-S1** includes an additional pressure controller for the option bypass injector **-B** or **-BR**.

The dilution probe realises with injector I dilution rates in a range of 10:1 to 500:1 (with injector II 50:1 – 2000:1). A high dilution rate causes a low sample flow from the process. With under pressure conditions the response time can be minimised using the optional heated bypass injector **-B** which is integrated directly upstream the dilution unit. It is available with recirculation into the process **-BR** as well.

The construction of the probe guarantees an operation which is independent from the process temperature and is easy to maintain as well.

10.1 OPTIONS AND VARIATIONS

The following list shows the probe types and options available. The diversity of options and the modular design of the **M&C** gas sample probes ensure optimum probe selection to suit the particular process and ambient conditions.

Part No.	Type	M&C gas sample dilution probe SP2000H/DIL with orifice "e" for dilution ratio 30 : 1 standard
	SP2006-H/DIL	Dilution probe 180 °C [356 °F] without ball valve upstream of the filter element
	SP2006-H280/DIL	Dilution probe 280 °C [536 °F] without ball valve upstream of the filter element
	SP2006-H/DIL-VA	Dilution probe 180 °C [356 °F] with heated manual operated ball valve upstream of the filter element
	SP2006-H/DIL-B	Dilution probe SP2000H/DIL with bypass injector and bypass gas to the vent
	SP2006-H/DIL-BR	Dilution probe SP2000H/DIL with bypass injector and bypass recirculation
	SP2006-H/DIL-BBF	Dilution probe SP2000H/DIL-VA with bypass injector and bypass gas to vent
	SP2006-H/DIL-BB	Dilution probe SP2000H/DIL-VA with bypass-needle valve and bypass gas to vent
	SP2006-H/DIL-I	Option: 1 pressure controller, 2 gauges, mounting set incl. connector set for dilution probe
	SP2006H/DIL-VA-MS1	Option: 2 pressure controllers, 3 gauges, mounting set incl. connector set for dilution probe with bypass
20S4423(a)	SP2006-H/DIL-B/2x/FRP	Gas sample dilution probe SP2006-H/DIL-B/2x/FRP with bypass-injector without gas recirculation With external ceramic filter type S-2K150, filter porosity: 2 µm, with electrically heated external filter 0-180°C [32-356 °F] without temp.-controller without thermostat, with PT100, build in a diagonal FRP-housing Power: 230 V/50 Hz, (a=115 V/60 Hz) 800 W. mounting flange: 3" 150lbs with thread G 3/4" i Sample gas OUT: tube 8 mm Material: SS316, ceramic, Viton®. # Dilution ratio to be indicated with the order.
20S4424(a)	SP2006-H/DIL-BR/2x/FRP	Gas sample dilution probe SP2006-H/DIL-BR/2x/FRP with bypass-injector and gas recirculation. With external ceramic filter type S-2K150, filter porosity: 2µm, with electrically heated external filter 0-180°C [32-356 °F] without temp.-controller without thermostat, with PT100, build in a diagonal FRP-housing Power: 230 V/50 Hz, 800 W. Mounting flange: 3" 150 lbs with thread G3/4"i. Sample gas OUT: tube 8mm Material: SS316, ceramic, Viton®. # Dilution ratio to be indicated with the order.
20S9401	SP2006/KVB 4"	Extra charge for probe series SP2006 with 4" 150 lbs flange 12 o'clock position, with welded mounting screws, long version KVB-execution Material: SS316.
20S9403	SP2006/703FRP	Extra charge for probe series SP2006. Support for mounting the external housing of the temperature controller on the FRP housing of the probe.
20S9408	SP2006/BB	Extra charge for probe type SP2006/BB with backflush valve and integrated filter Opening pressure: 0.7 bar. With storage buffer 0.75 l and pneumatic toggle valve for

		Blowback Connection: tube 3/8". Material: SS316, Viton®.
20S4250	SP2000H/DIL-S	Option: control panel with 1 pressure controller, 2 gauges, flowmeter, 2 ball valves
20S4260	SP2000H/DIL-S1	Option: control panel with 2 pressure controllers, 3 gauges, flowmeter, 2 ball valves

Viton® is a registered trademark for fluoropolymer elastomer by DuPont Performance Elastomers, USA.

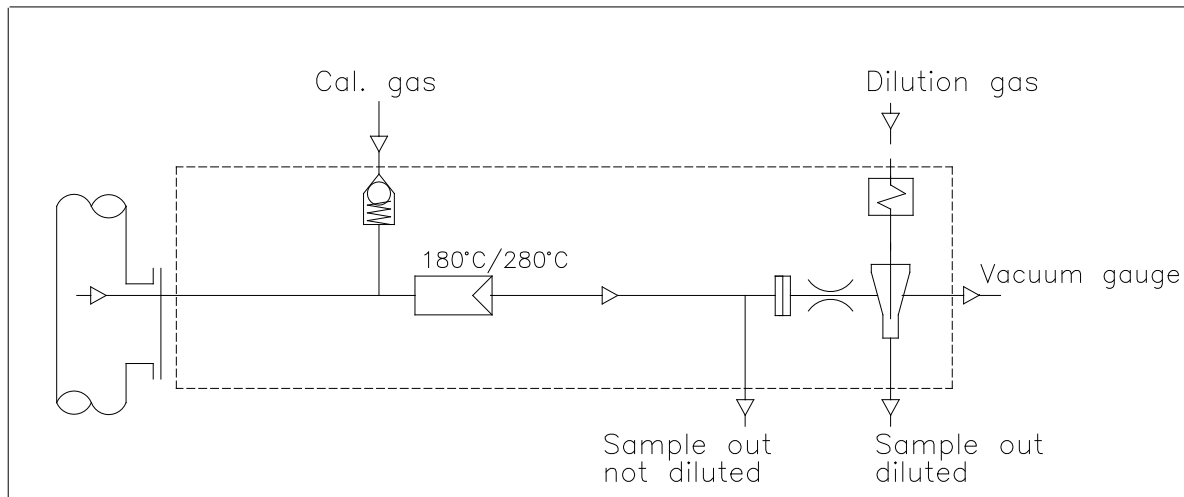


Figure 2 SP2006-H/DIL and SP2006-H280/DIL

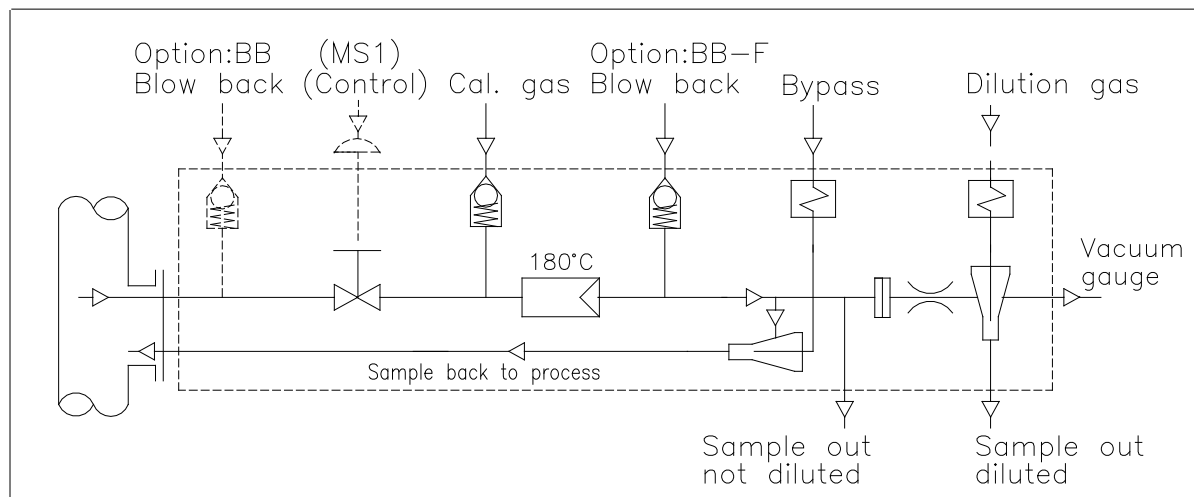


Figure 3 SP2006-H/DIL-BR-VA (-MS1)

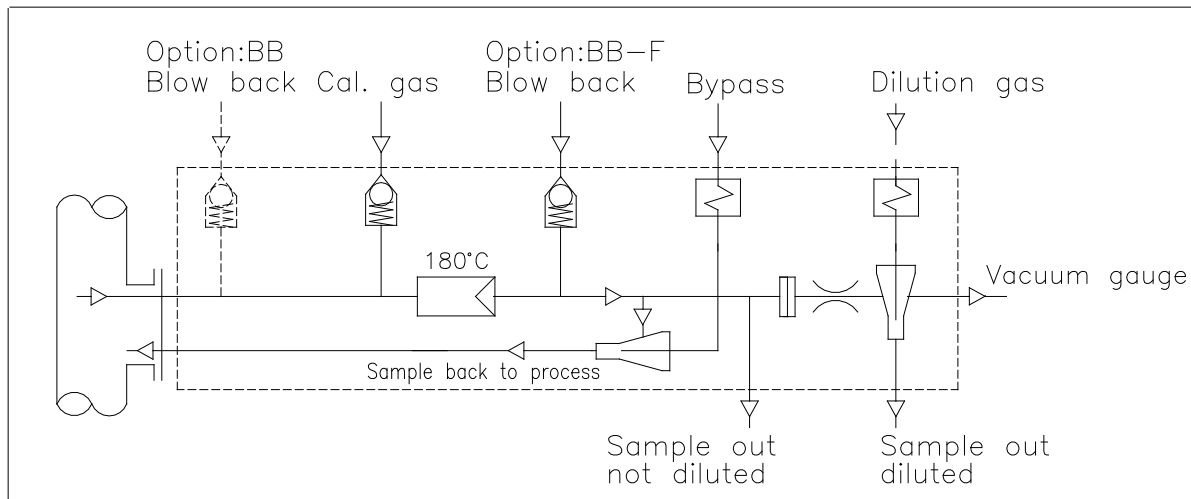


Figure 4 SP2006-H/DIL-BR

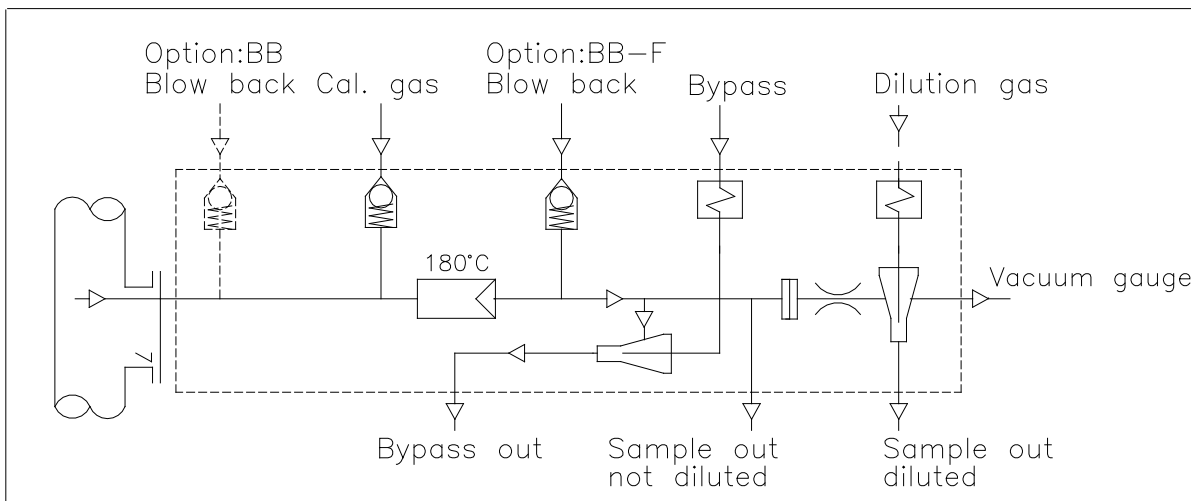


Figure 5 SP2006-H/DIL-B

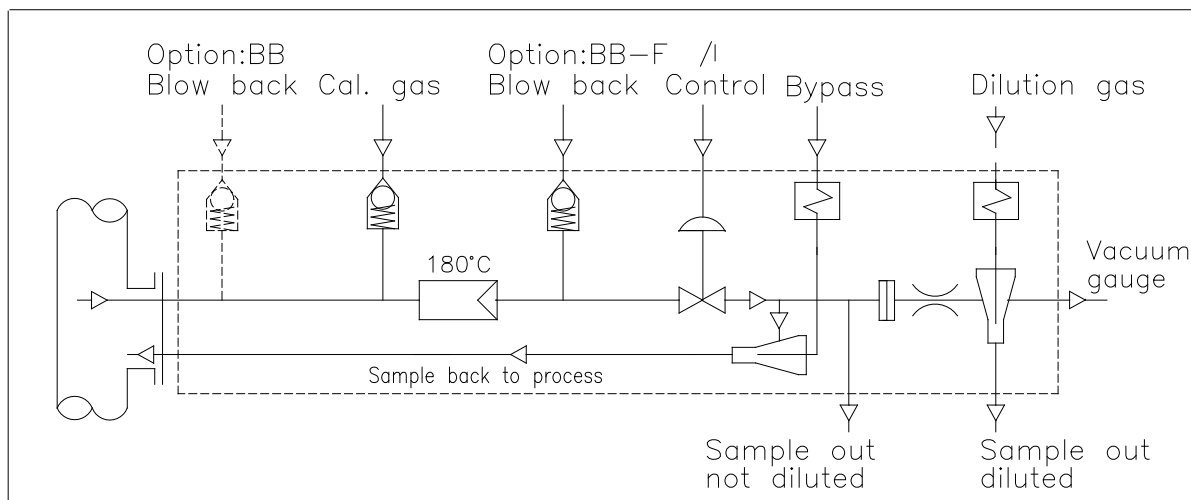


Figure 6 SP2006-H/DIL-BR-I

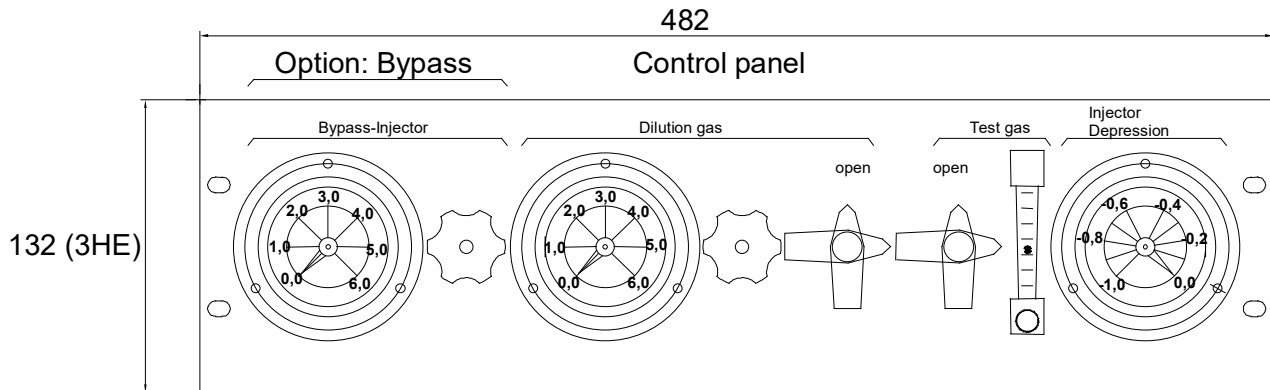


Figure 7 Control panel -S or -S1

11 RECEIPT OF GOODS AND STORAGE

Please remove the gas sample probe carefully from the packaging. Check the scope of the delivery specified on the delivery note. Please make sure that you have received all items stated on the delivery note. Please check the unit for any transport damages after receipt and report any complaints to the transport company immediately.



Note

The probe must be stored in a weather-protected and frost-proof area !

12 INSTALLATION AND DIMENSIONS

During installation, the descriptions for accident prevention and safety instructions for mounting and operation have to be heeded.

Please strictly observe the notifications of chapter 3 „Safety Instructions“.

Furthermore, consider the following:

- Select the optimum sampling point according to the prescriptions actually valid and coordinate with the responsible persons.
- Place the sampling point in such a way that sufficient space for mounting and dismounting of the probe is available. Also consider the insertion length of the sample tube.
- Take care of easy access to the probe in order to enable you to execute any maintenance work necessary in future without problem.
- The bleeder connection must be prepared so that the temperature of the connection piece remains above the acid dew point in order to avoid problems due to corrosion and obstruction.
- In case the temperature in the area of the connection piece is $> 60\text{ }^{\circ}\text{C}$ [$140\text{ }^{\circ}\text{F}$] due to radiant heat, you have to mount a device of sheet steel in order to reflect the radiant heat.
- The mounting flange of the connection piece should be connected with size 3" 150 lbs. Should you desire other dimensions, we can provide you suitable adapter intermediate flanges as option. The minimum flange size or connection piece diameter respectively is determined by the sample tube diameter or pre-filter diameter you apply.
- We recommend mounting the probe horizontally with an angle of inclination of 10° to the process.

**Note**

Before mounting the probe, you have to check its suitability on the basis of the given operating parameters (see type plate).

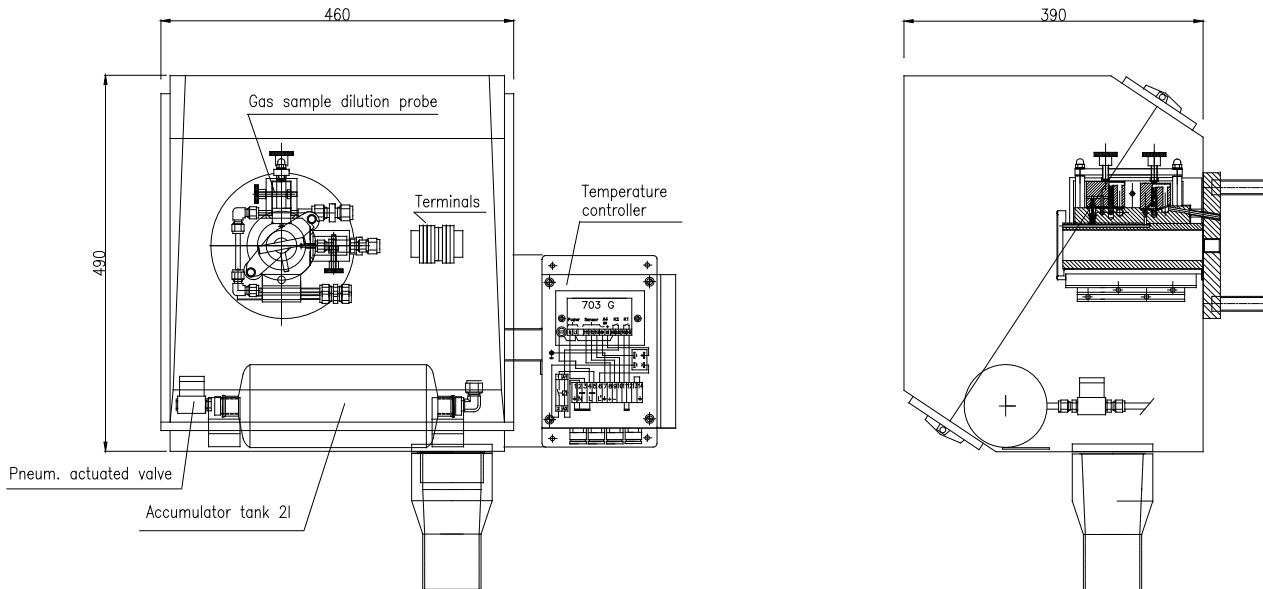


Figure 8 Construction and dimensions of the SP2006-H...

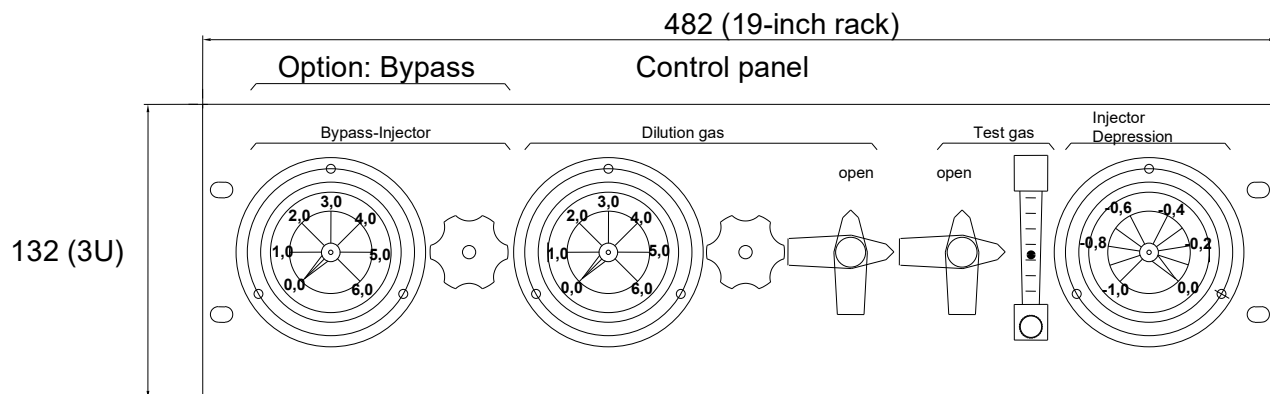


Figure 9 Dimensions control panel -S or -S1

13 MOUNTING

The **M&C** probes **SP2006-H..** are designed for stationary use and provide a long service life and a minimum of maintenance work under the premise of professional selection of the sampling point and professional mounting.

13.1 INSTALLATION INFORMATION

The safety rules and regulations for the prevention of accidents must be observed during installation and also subsequent operation. The information in chapter 3 “Safety Instructions” must be observed.

The following also applies:

- Select the optimum sampling point according to the generally applicable directives or coordinate with the responsible departments.



Note

The dilution probe must be checked for its suitability for use with the available operating parameters prior to installation (see type plate).

13.2 MOUNTING OF THE PREFILTER RESPECTIVELY THE SAMPLE TUBE

The pre-filter or sample tube is mounted together with a suitable sealing by screwing into the G 3/4" thread of the probe flange.

13.3 MOUNTING OF THE PROBE

- Put the flange sealing on the bleeder connection.
- Fit the mounting piece and the probe flange by means of the attached screws and/or screw nuts.



Note

It is recommended to mount the probe with its sample gas outlet showing downwards (not necessary for perfect function).

Further it is recommended to mount the probe with a slight descending gradient downwards so that possible deposited drops may flow back into the process.

13.4 CHECKING THE FILTER ELEMENT

The filter housing cover is dismantled as follows:

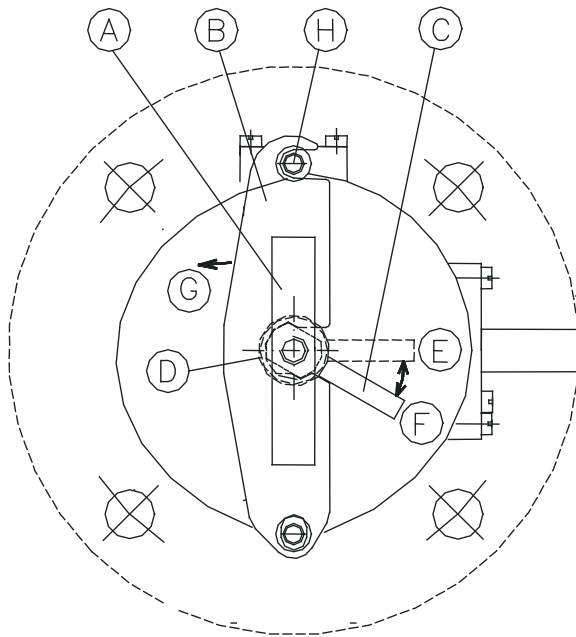


Figure 10 Schematic drawing of the filter housing cover

- Turn the toggle handle **A** approximately one rotation to the left side so that the cover is lifted;
- Put the handle **C** into position **E**;
- Turn the clamp clip **B** to the left side (direction **G**);
- Pull out the filter housing cover with the toggle handle **A**.

The photos shall illustrate the above mentioned steps.

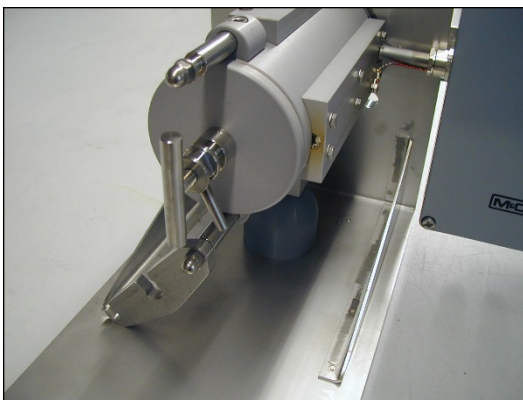
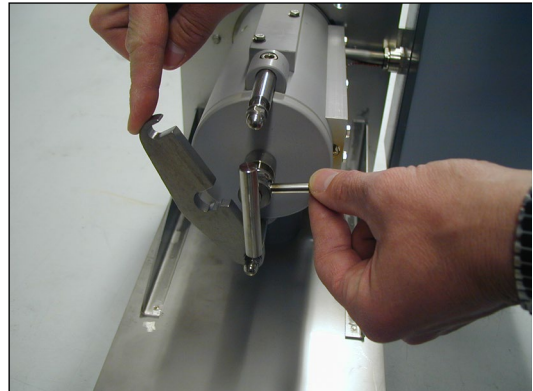


Figure 11 Dismounting of the filter housing cover

Now, the filter element is visible.

- Check on the filter pressing screw whether the filter element is screwed on tightly.
- Push the cover with filter element into the probe again.
- Turn the clamp clip **B** to the right side and bring the ring bolt **D** into position **E** by using the handle **C** so that the clamp clip locks into place of the ring bolt **D** and the threaded bolt **H**. For this purpose, you may push in or pull out a little the filter housing cover by means of the straining screw **A**; afterwards, turn the handle **C** into position **F** and screw the toggle handle **A** hand-tight by turning to the right.

14 INSTALLATION

The **M&C** dilution probes **SP2006-H..** are designed for stationary use. With correct selection of the sample point and proper installation, they will work for many years with a minimum of maintenance required.

14.1 CONNECTION OF THE SUPPLY AND SAMPLE LINES

All pneumatic lines have to be inserted through the CES cable entry, size 5, with an operative range of 36 – 70 mm. It is located in the bottom of the FRP-housing. After insertion and connection of all lines the CES cable entry can be shrunk by an air heater.



Note

Increases of pressure due to use of long sample gas lines at the outlet may have a great influence on the measuring result. For this reason, we recommend the following nominal widths and lengths for the sample lines in dependence on the type of injector:

Injector type I:

Ø_i 1/4" max. 50 m

Ø_i 3/8" max. 150 m

Injector type II:

Ø_i 8 mm max. 15 m

Ø_i 10 mm max. 40 m

Ø_i 12 mm max. 80 m

The connections for the supply and sample lines are as follows:

Connection	Dimension
Testgas In	Tube 1/4"
Dilution gas In	Tube 1/4"
Low pressure manometer	Tube 1/4"
Sample gas Out (diluted)	Tube 3/8"
Bypass gas In	Tube 1/4"
Bypass gas Out (diluted)	Tube 1/4"
Sample gas Out (undiluted)	Tube 1/4"
Blow back In	Tube 3/8"

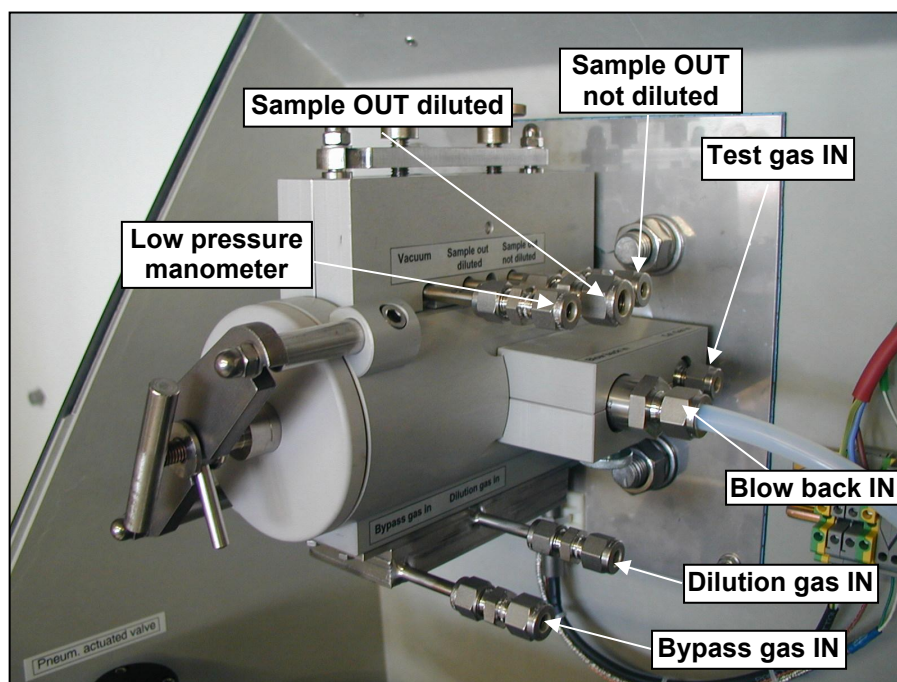


Figure 12 Connection of supply and sample lines

14.2 CONNECTION OF SAMPLE LINES

All connections for the sample lines are tube connectors out of stainless steel suitable for connection of stainless steel tubes or hose pipes with dimension 1/4". Only the outlet of the diluted sample gas and the blow back inlet is dimensioned for stainless steel tube or flexible tube of 3/8".



Note

**When connecting hose pipes to stainless steel fittings, a supporting sleeve must always be used.
The connection must be checked for tightness.**



Note

In dependence on the water vapor content respectively the dew point of the sample gas it is necessary to connect a heated sample line at the undiluted sample gas outlet.

For connection of the sample lines, tube connectors with dimension 1/4" or 3/8" are available. Please act as follows:

- Open the diagonal FRP-housing
- Mount the hose pipe or tube to the respective fitting (see drawings in the annex)
- Close the diagonal FRP-housing

14.3 CONNECTION OF DILUTION GAS, BYPASS GAS OR BLOW BACK

For connection of the supply lines, tube connectors with dimension 1/4" and 3/8" are available. Please act as follows:

- Open the diagonal FRP-housing
- Mount the hose pipe or tube to the respective fitting (see drawings in the annex)
- Close the diagonal FRP-housing

When using the 19"-control panels **–S** or **–S1**, corresponding marked connectors for the supply gases are provided at the rear of the unit.

14.4 CONNECTION OF CALIBRATION GAS

For all versions, a tube connector 1/4" is available for connection of the calibration gas.

- Open the diagonal FRP-housing
- Mount the hose pipe or tube to the respective fitting (see drawings in the annex)
- Close the diagonal FRP-housing

When using the 19-inch control panels **–S** or **–S1**, corresponding marked connectors for the supply gases are provided at the rear of the unit.

14.5 CONNECTION OF THE VACUUM GAUGE



Note

When using the 19-inch control panels –S or –S1, the connection of the vacuum gauge is possible. Otherwise the connection is closed by a blind cap.

For all versions, a tube connector 1/4" is available for connection of the vacuum gauge.

- Open the diagonal FRP-housing
- Mount the hose pipe or tube to the respective fitting (see drawings in the annex)
- Close the diagonal FRP-housing

At the 19-inch control panels –S or –S1 corresponding marked connectors for the vacuum gauge are provided at the rear of the unit.

14.6 ELECTRICAL CONNECTION

The temperature setting of the dilution probe **SP2006-H...** is made on the electronic controller e.g. 70304G.



Warning

The incorrect mains voltage can destroy the unit. Check the type plate for the correct voltage prior to connection!

The dilution probe must be mounted in such a way that touching the live parts is excluded!

In any case, we recommend the use of temperature resistant cables!

The alarm contact for low temperature must be controlled!

In case of a low temperature alarm (failure of heating or sensor) the dilution gas or bypass gas supply must be interrupted to avoid serious damage of the dilution probe. We recommend to switch the low temperature alarm on to external solenoid valves that provide the above mentioned function!



Note

For the erection of power installations with nominal voltages of up to 1000 V, the requirements of VDE 0100 and its associated standards and specifications must be observed.

A mains switch must be provided externally.

The supply circuit of the unit must be equipped with a fuse with the correct rating (over current protection); the electrical details see technical data.

- Remove cover of the controller 70304G.
- Insert the mains cable (min. 3 x 1.5 mm²) through the cable gland and connect to the appropriate terminals (1 = ground, 2 = N, 4 = L).
- Insert the signal cable (low temperature alarm) through the cable gland and connect to the appropriate terminals 11 and 12 (contact position T_u shows alarm event).
- Screw cover back in place.

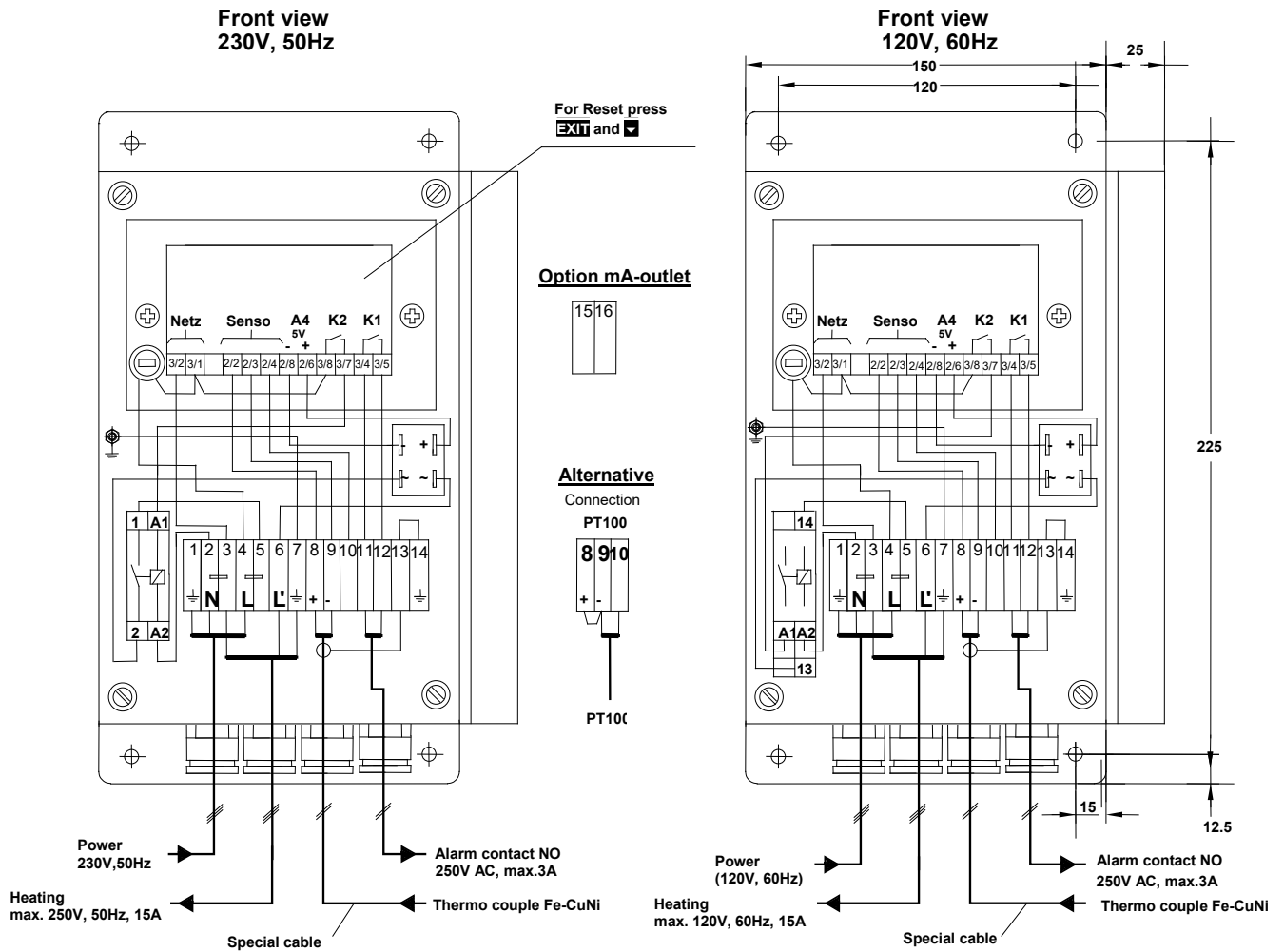


Figure 13 Electrical connection for SP2006-H.. at the 70304G



Note

We recommend the use of temperature resistant cables!

15 INITIAL STARTING

Prior to initial use, system and process-specific safety measures must be observed.

The relevant safety requirements and procedures for the medium to be sampled must be heeded.



Warning

The supply of gas to the injectors is only allowed when the heated dilution probe has reached its operating temperature (see technical data).



Prior to initial use, make sure that the mains voltage corresponds to the voltage indicated on the type plate!



Do not touch the surface of the heated dilution probe during operation. Due to its high surface temperatures, it may cause burns. Protective gloves must be worn and the dilution unit must be protected against unauthorised access!



The following step-by-step procedure is recommended:

- If possible, separate the dilution probe from the sample point, eg. above the ball valve.
- Check the set temperature on the installed temperature controller (see manual of the 70304G temperature controller).
- Switch on the mains voltage.



Note

The total heating time is about 2 hours. After about 1 hour, the lower threshold value (30°C below set value) is exceeded.

- Open the valve for the dilution gas. Set the precision pressure reducer to the pressure specified on the enclosed injector data sheet (see figure 13).



Note

For safety reasons, the low pressure gauge must show a low pressure of > -0.6 bar. With a low pressure of < -0.6 bar, the critical orifice will not function properly. If the necessary low pressure will not be reached, the dilution gas supply pressure must be increased.

The following table shows an extract from an injector data sheet.

Injektortyp Injector type	Injektor-Nr. Injector No.	Für Verdünnungssystem-Nr. For dilution system No./.....	Type	SP2006-H/DIL
Betriebsdruck Operating pressure [bar]	Durchfluss Flow [l/h]	Unterdruck ohne kritische Düse Vacuum without critical orifice [bar]		Unterdruck mit kritischer Düse Vacuum with critical orifice 5.1 l/h [bar]		
2.4	415	-0.62		-0.61		
2.6	435	-0.65		-0.64		
2.8	460	-0.68		-0.67		
3.0	490	-0.80		-0.77		
3.2	510	-0.79		-0.77		
3.4	535	-0.79		-0.77		
3.6	560	-0.78		-0.76		
3.8	585	-0.77		-0.76		
4.0	605	-0.77		-0.75		
Überprüfung des Verdünnungsfaktors Check of the dilution ratio			Messgasdruck atmosphärisch Sample gas pressure atmospheric			
Kritische Düse Critical nozzle	Verd.gas Dilution gas	Verdünnungsgasdruck Dilution gas pressure		Messgas Sample	Verdünnung Dilution	Messwert d. verd. Gases Meas. value of the dil. gas
5.1 l/h	100 % N ₂	3.2 bar		100% O ₂	100:1	1.0 % O ₂

Figure 14 Extract from an injector data sheet

- For the operation of an installed bypass injector, the necessary pressure must be set on the pressure regulator (see figure 14).



Note

The attached bypass injector table shows the suction flows at corresponding bypass gas pressures for two different process pressures, 1 bar and 0.9 bar absolute (see figure 14).

Bypassgas / Bypass gas		Prozessgas/Sample gas	
Betriebsdruck Operating pressure [bar]	Durchfluss Flow [l/h]	Ansaugvolumenstrom bei 1 bar abs. Suction flow at 1 bar abs. [l/h]	Ansaugvolumenstrom bei 0.9 bar abs. Suction flow at 0.9 bar abs. [l/h]
0.5	110	45	-
1.0	155	115	-
1.5	190	200	65
2.0	235	250	135
2.5	270	300	200
3.0	310	350	250
3.5	355	370	270
4.0	395	390	305
4.5	430	425	350

Figure 15 Suction flow at 0.9 or 1 bar abs. in dependence on the bypass gas pressure



Warning

In the event of low temperature (failure of the heating) the supply of dilution gas must be interrupted!

15.1 CALIBRATION

A calibration of the downstream analyser system or checking the dilution factor must always be effected under operating conditions.

Above the test gas valve, an appropriate test gas can be feeded.



Note

**The test gas pressure has to be higher than 0.7 bar, because the pressure control valve has an opening pressure of 0.7 bar.
When using the control panel, the respective ball valve for the test gas supply has to be opened and the flow rate to be set on the flow-meter.**

The procedure for calibration or checking the dilution ratio is as follows:

- Supply test gas of a concentration you know.
- Check the dilution ratio on the downstream analyser and, if necessary, correct the pressure on the pressure regulator of the dilution gas.

Test gas feeding without bypass injector

In order to assure that sufficient test gas is available, the test gas quantity should be at least threefold of the flow quantity passing through the critical orifice (see injector data sheet).

Test gas feeding with bypass injector

The test gas quantity must be approximately 10 % above the quantity of the volume flow passing through the bypass (see figure 14) and the critical orifice (see figure 13).

16 CLOSING DOWN

Before closing down, i.e. switching off the heating, the probe should be purged with inert gas or air in order to avoid condensation of aggressive components from the sample gas.

17 MAINTENANCE AND REPAIR

Before carrying out any maintenance and repair work, the specific installation and process safety measures are to be observed.



Warning

Aggressive condensate is possible. Wear protective glasses and appropriate protecting clothes !



Attention must be paid when touching the probe surface during operation. Due to the high surface temperatures, you may suffer from burnings. Protective gloves have to be worn, and the probe must be protected absolutely against unauthorized access!



Before carrying out any maintenance work on electrical equipment, the mains voltage must be switched off on all poles. The same is valid for eventually connected alarm and control circuits!



We cannot give any recommendation regarding maintenance cycles. This must be determined specifically depending on the process conditions.

The principal maintenance work of the probe is changing the filter element and control of the sealings.



Note

When carrying out any maintenance or repair work, the probe does not need to be dismantled.

17.1 CHANGE OF THE FILTER ELEMENT AND THE SEALINGS



Warning

Please ensure that no contaminations that are bad for one's health remain on the probe before carrying out any maintenance or repair work. An appropriate measure is to flush the probe with inert gas.

Before changing the filter element, the gas feeding must be stopped!

The following steps are recommended when changing the filter element or the sealings:

- Remove the protection cap after having opened the bent-lever closures;
- Dismount the filter housing lid according to 13.4;
- Screw out the filter pressing screw, check the filter element and exchange it if necessary;
- Check the filter element sealings and exchange them if necessary;
- Check the O-rings inside the lid and exchange them if necessary;
- Clean the filter chamber;
- Mount again the filter housing lid in reverse order and put it into the filter head;
- Bolt the filter housing lid according to 13.4;

- Put on again the protection cover.



Note

Pay attention that after putting in the filter housing lid the strap bolt (see fig.16) is screwed down hand-tight in cold condition and that it is tightened again after the operating temperature is reached.

17.2 DISASSEMBLY OF THE DILUTION AND BYPASS BLOCK

For disassembling of the dilution and the bypass block, the heating should be switched off so that the probe can cool down.

Figure 16 shows the dilution and bypass block.

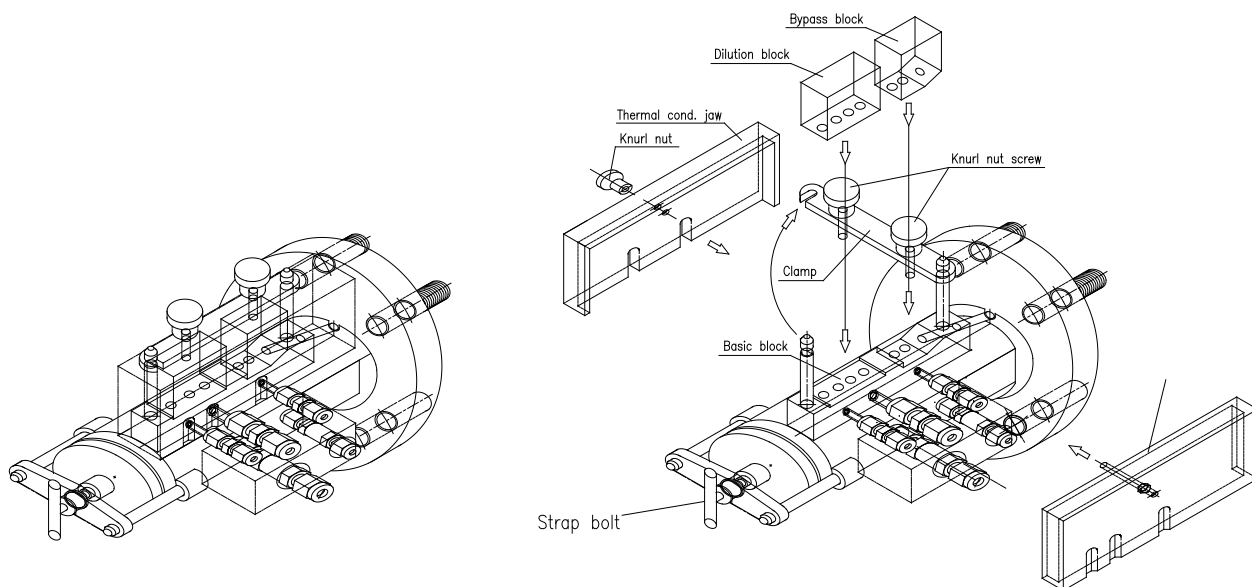
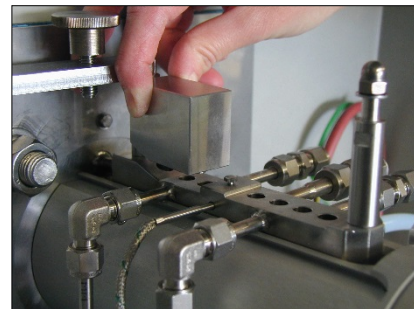
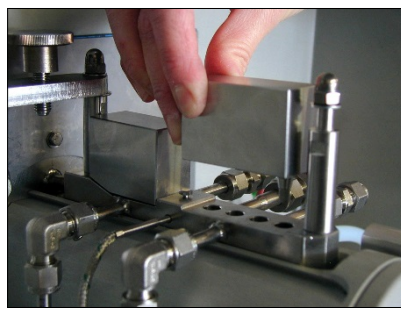
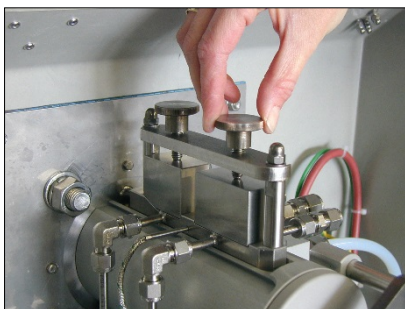


Figure 16 Drawing of the dilution and bypass block

We recommend to proceed according to the following steps:

- Open the lid of the glass fiber reinforced plastic housing
- Open the knurl nut screw at the side and remove the thermal conducting jaws
- Loosen the knurl nut screws on the top and turn the clamp to the side
- Now it is possible to remove the dilution and/or the bypass block



17.3 CLEANING OF THE CRITICAL ORIFICE, THE EDUCTOR AND CHECKING OR CHANGING OF THE O-RINGS

Caution Do not clean the critical orifice and the eductor mechanically.
Cleaning should be effected in an ultrasonic bath!

Figure 17 shows the position of the orifice, the eductor and the O-ring seals in the dilution block

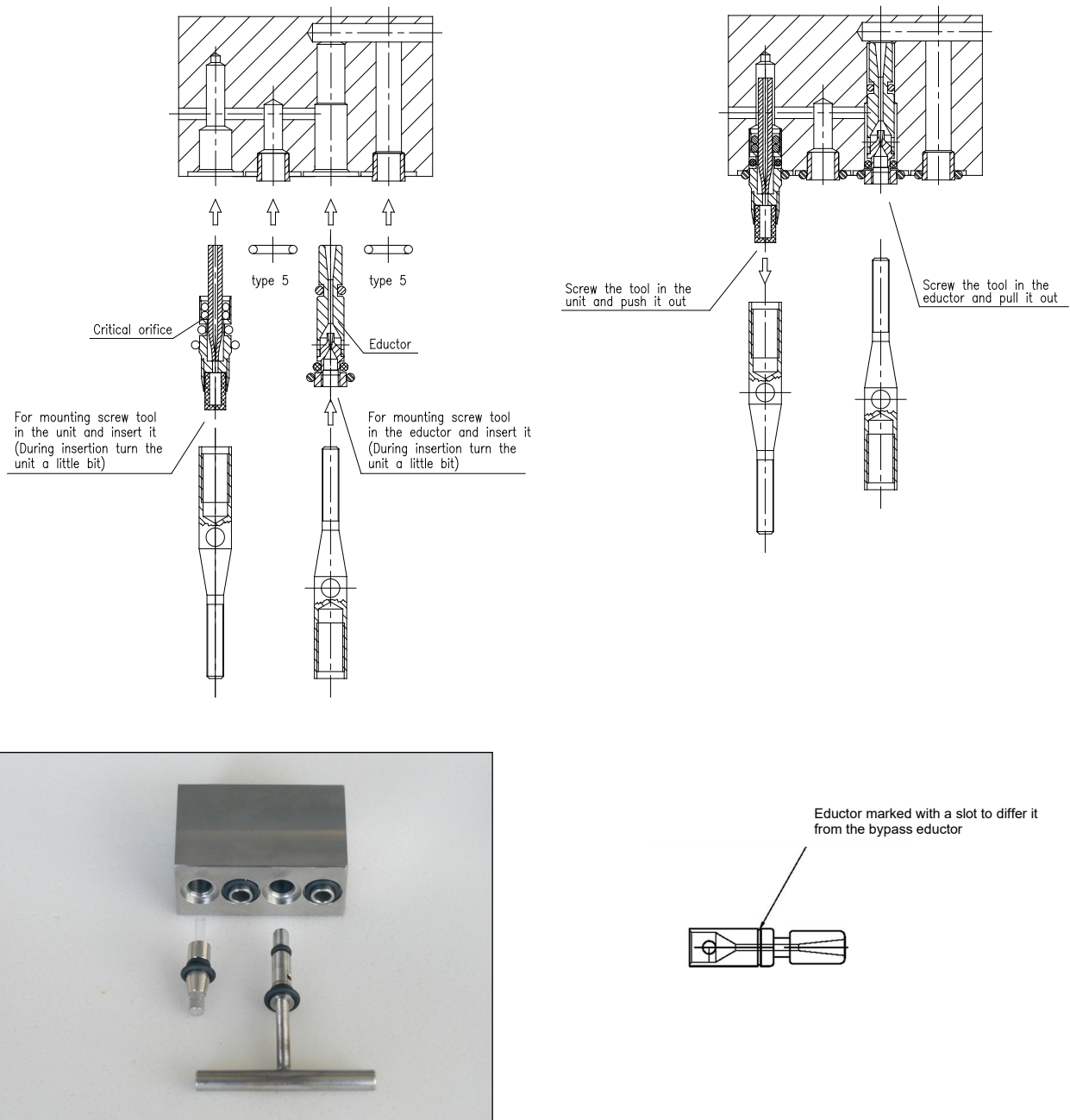


Figure 17 Dilution block with critical orifice, eductor, O-ring seals and tool

Figure 18 shows the position of the eductor and the O-ring seals in the bypass block

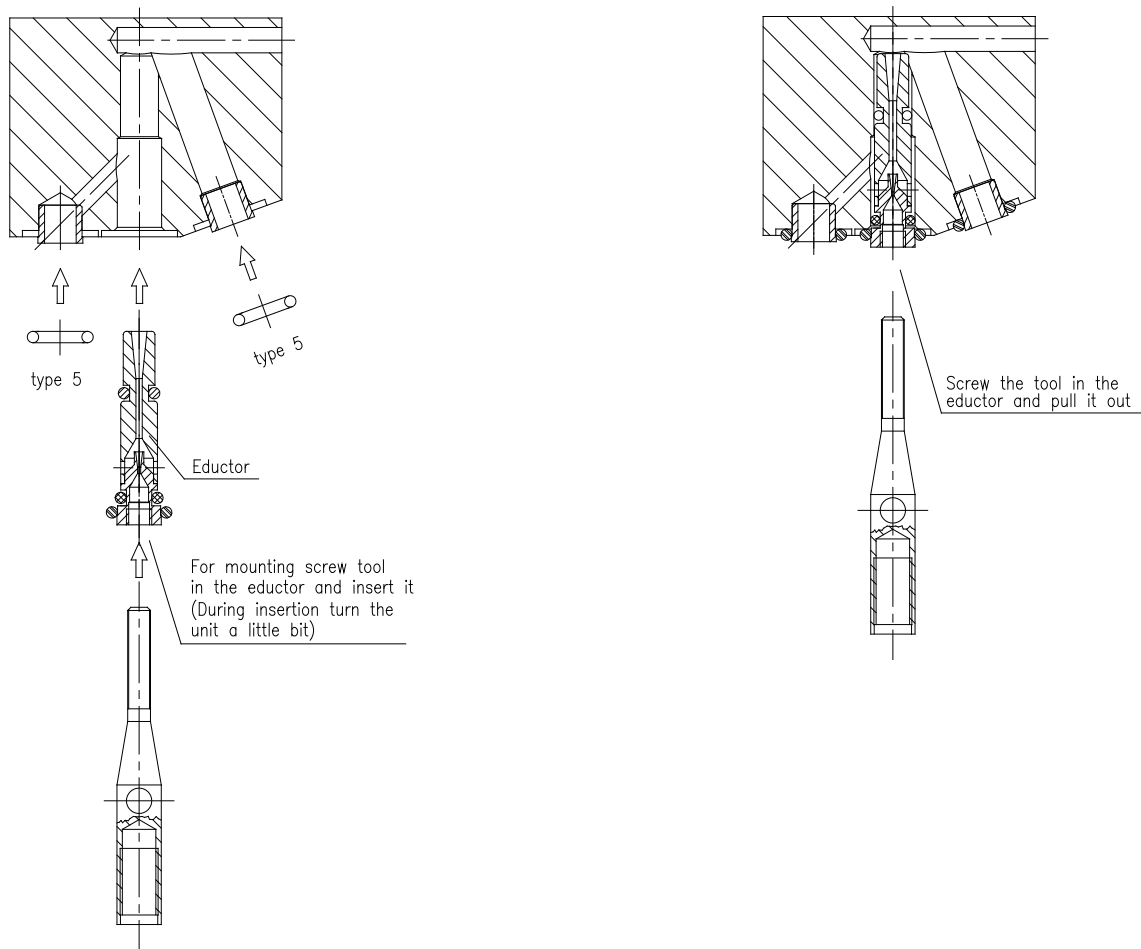


Figure 18 Bypass block with eductor and O-ring seals

Please proceed as follows:

- Use the delivered special tool to remove the critical orifice and/or the eductor from the block as described in figure 16 or 17
- Clean the orifice and/or the eductor in an ultra sonic bath
- Check the o-rings and change them if necessary (see figure 18 and 19)
- Push the critical orifice and eductor with its nozzle seat and o-ring carefully back into the block by using the special tool as described in figure 16 or 17

Now, the dilution unit can be reassembled in reverse order.

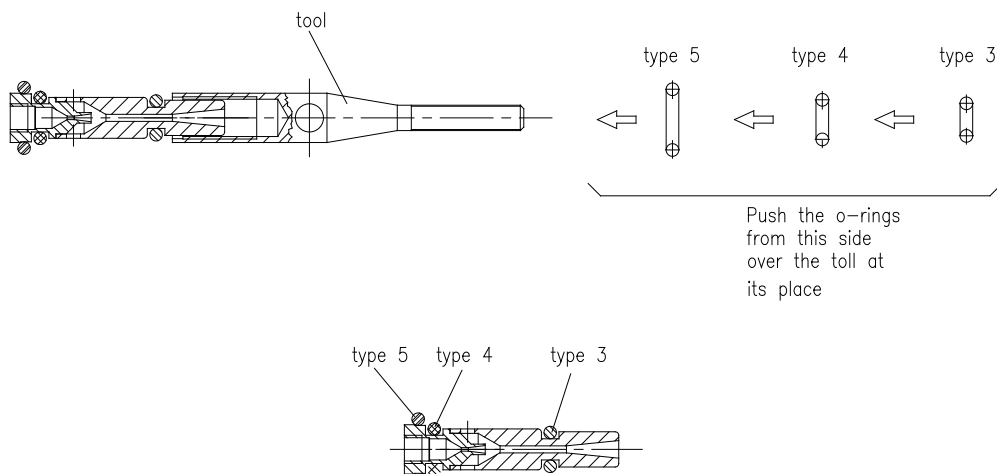


Figure 19 Eductor and o-rings

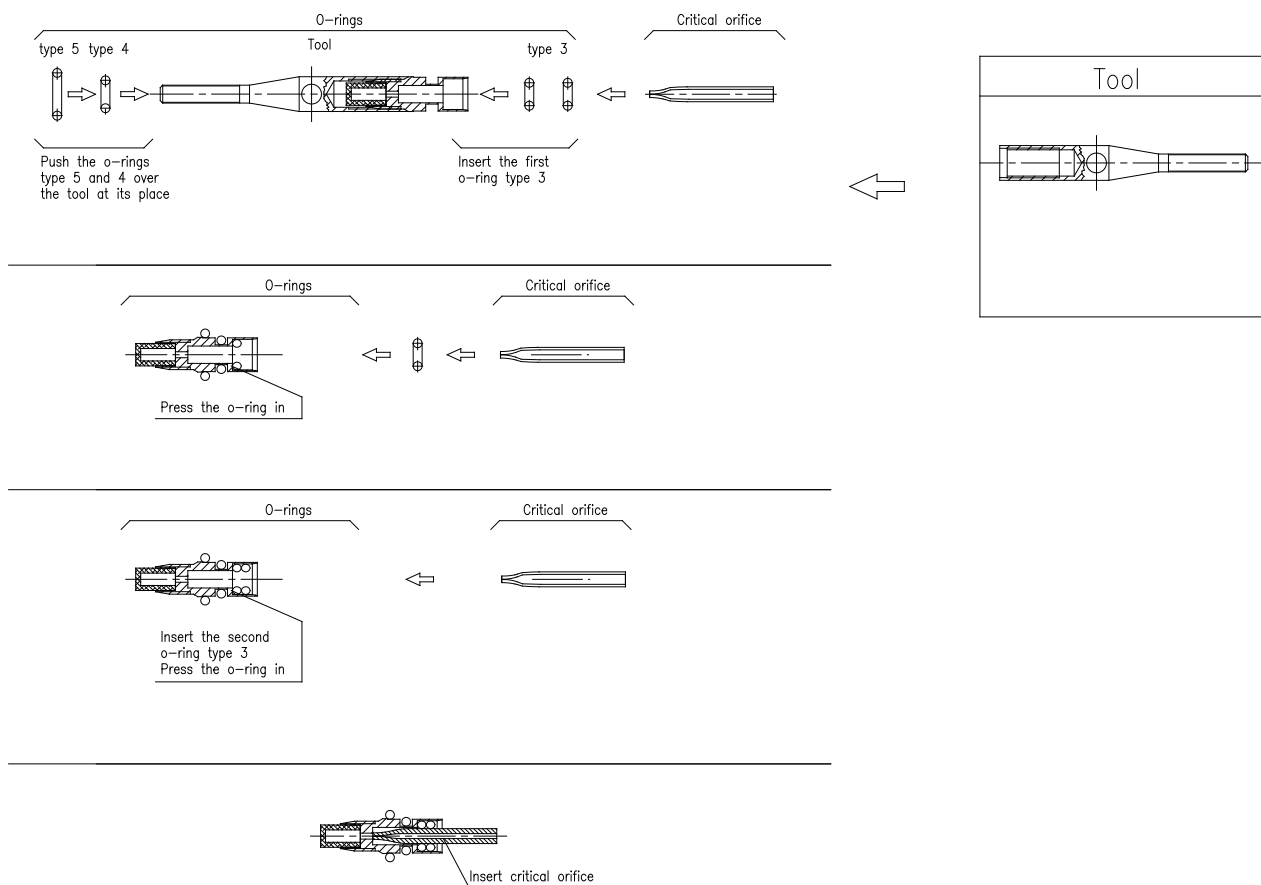


Figure 20 Critical orifice and o-rings

18 SPARE PARTS LIST

Wear, tear and replacement part requirements depend on the specific operating conditions. The following table shows an extract of the recommended spare parts for probe of type **SP2006-H..** .

Recommended spare parts	
Part No.	Description
90S0020	Spare filter element S-2K150, ceramic, 2 µm, 150 mm
90F0125	Spare filter element S-0,1GF150, glass fiber, 0.1 µm, 150 mm
93S0045	Gasket (30) for filter element. Material: Viton®
93S0051	Adaptor for probe filter element S-0,1GF150, Material PTFE.
93S0020	O-ring (39) for SP2000, SP2006-H... and CLF, Material: Viton®.
93S0025	O-ring (55) for SP2000 and SP2006-H... Material: Viton®.
90S2077	Flange gasket DN65 PN6B (67). Material: Novapress®
93S2350	Flange gasket 3" ANSI
93S0015	Spare heating cartridge HLP, 230 V 800 W
93S0017	Spare heating cartridge HLP, 115 V 800 W
93S0018	Heat conducting paste for putting in the heating cartridge
93S0059	Spare PT100 SP2000-H, SP2006-H...
93S0061	Spare thermoelement NiCr-Ni for SP..
93S0083	Clamp clip NEW 04/04 SP2000, SP2006_H...
93S0085	Press-Screw M8 for filter housing lid SP2000-H.., SP2006-H..
93S2125	Clamp LK 115 for filter housing lid SP2000-H.., SP2006-H..
93S0065	Mounting clip 1 1/4" for heated sample line and SP2000-H, SP2006-H.
93S1985	Filter housing lid compl. for SP2000-H, SP2006-H... with Viton® o-ring, filter holder and press screw
93S2084	Filter screw M6 for SP2000-H.., SP2006-H.., 1.4571.
93S0090	Finger screw M6 for SP2000/2006 connection protection.
93S4401	Eductor complete unit SP2006-H/DIL incl. O-rings and sample outlet tube
93S4406	Dilution unit for SP2006-H/DIL 180/280 °C empty, without any Inserts Material SS316
93S4411	Eductor complete unit SP2006-H/B incl. O-rings and sample outlet tube
93S4416	Bypass unit SP2006H/DIL 180/280 °C empty, without any inserts Material SS316
93S4420	Dilution unit complete for SP2006-H/DIL. DIL-ratio to be specified with the order.
93S4425	Bypass-unit complete for SP2006-H/DIL-BR.

19 ANNEX

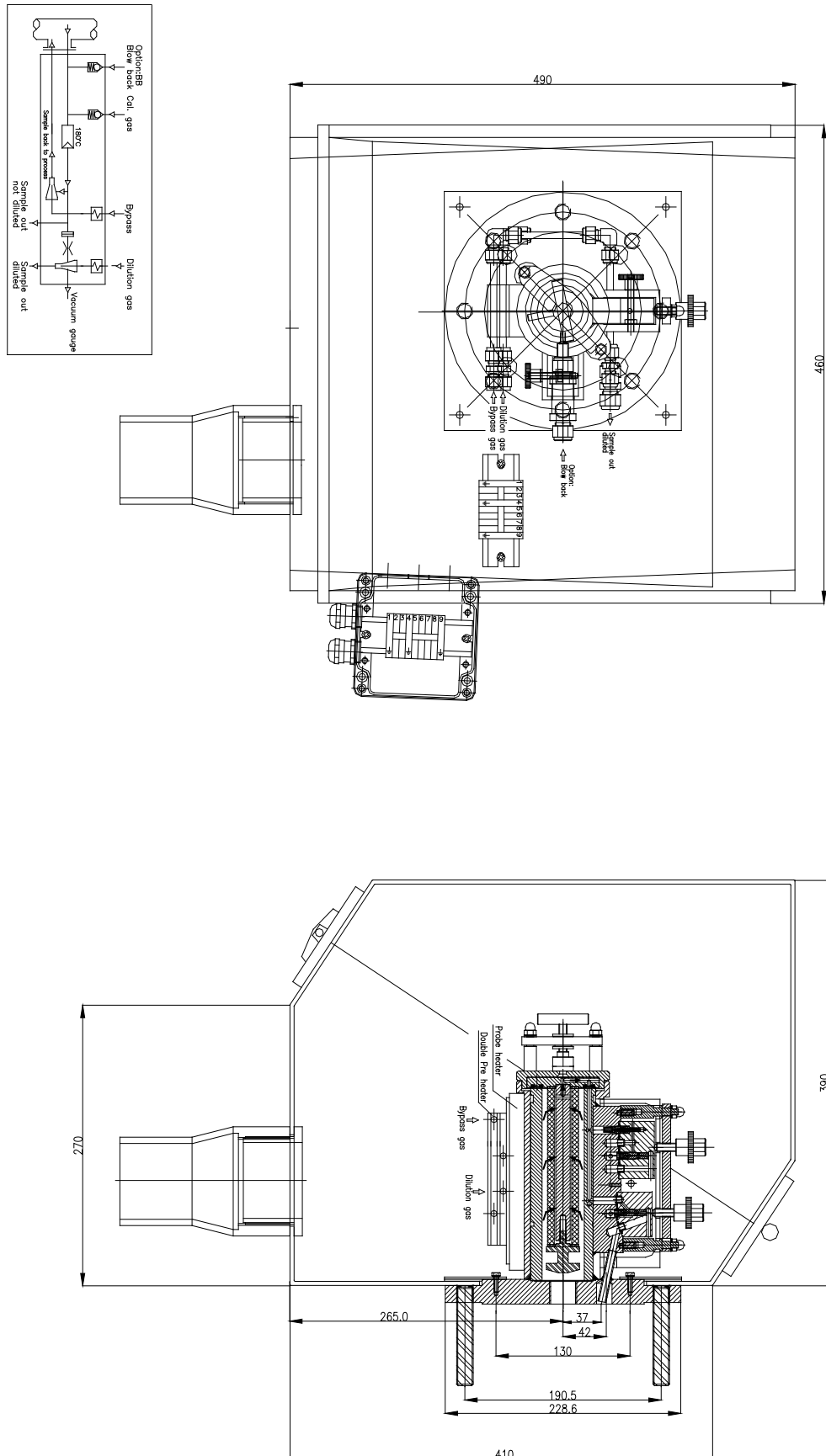
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Drawing SP2006-H/DIL-BR-BB-2x-K-12 o'clock position No. :	2290-1.01.1
Drawing SP2006-H/DIL-BR-BB-2x-K-703G-12 o'clock position No. :	2290-1.01.0
Drawing SP2006-H/DIL-BR No. :	SP2006a70/08.06



Additional product information may be seen and downloaded under:

www.mc-techgroup.com

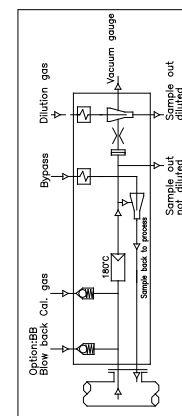
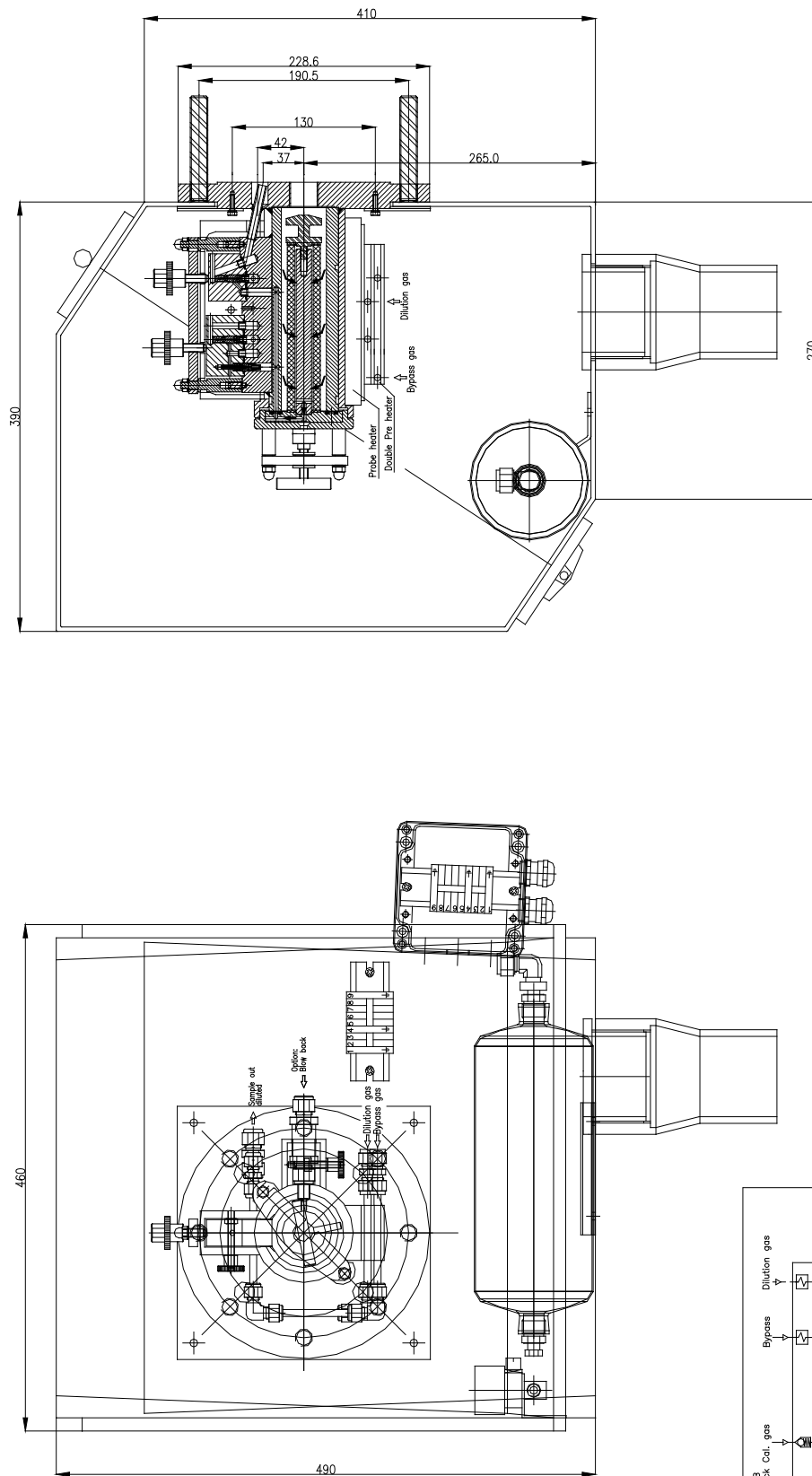
Gas sample dilution probe SP 2006-H/DIL/BR/BB/2x/K/1.2 o'clock position



* standard
Dimensions in mm

Subject to technical modifications

Drawing No: 2290-1.01.2/28.08.06

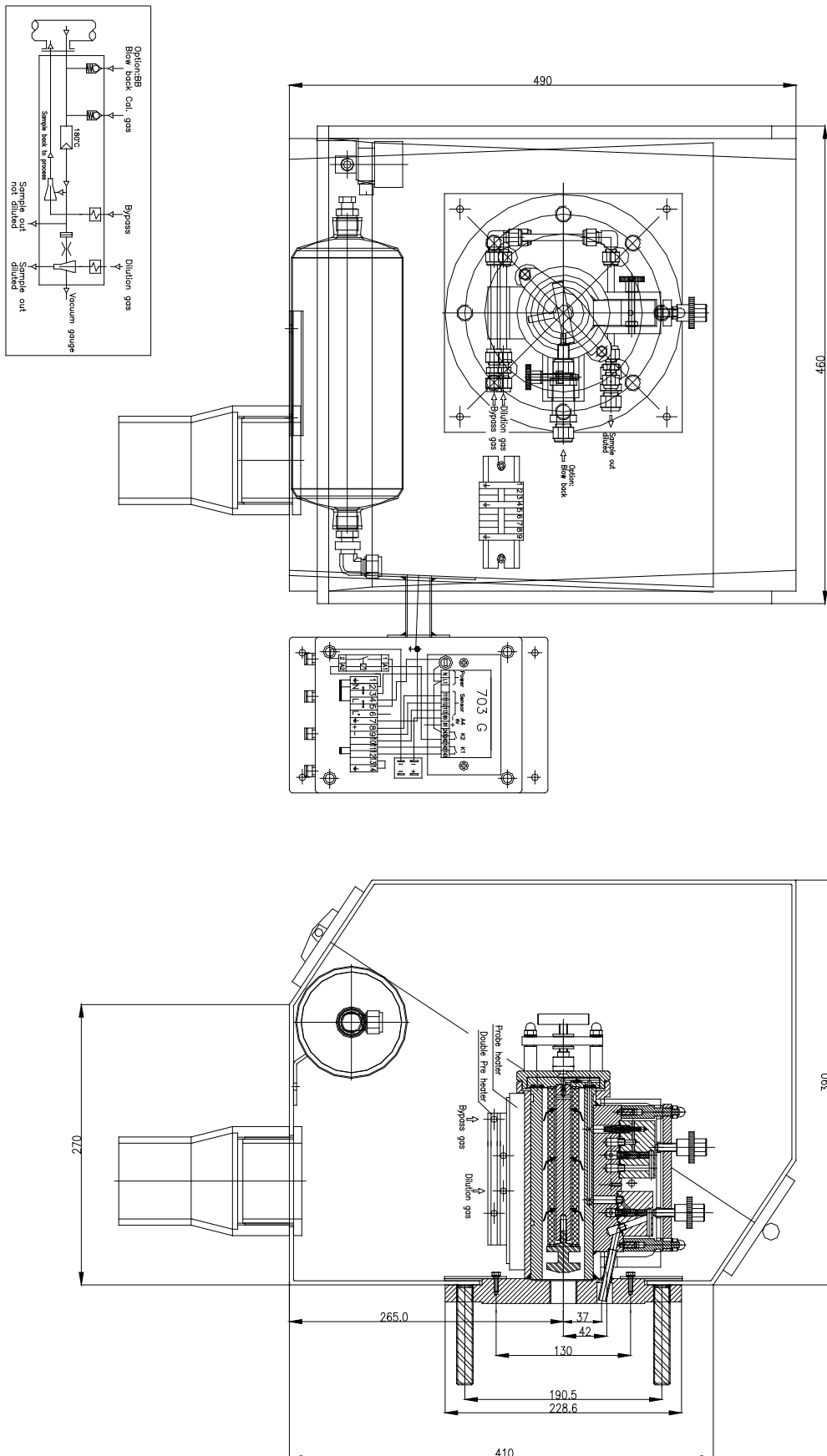


* standard
Dimensions in mm

Subject to technical modifications

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Gas sample dilution probe SP 2006-H/DIL/BR/BB/2x/K/703G/12 o'clock position

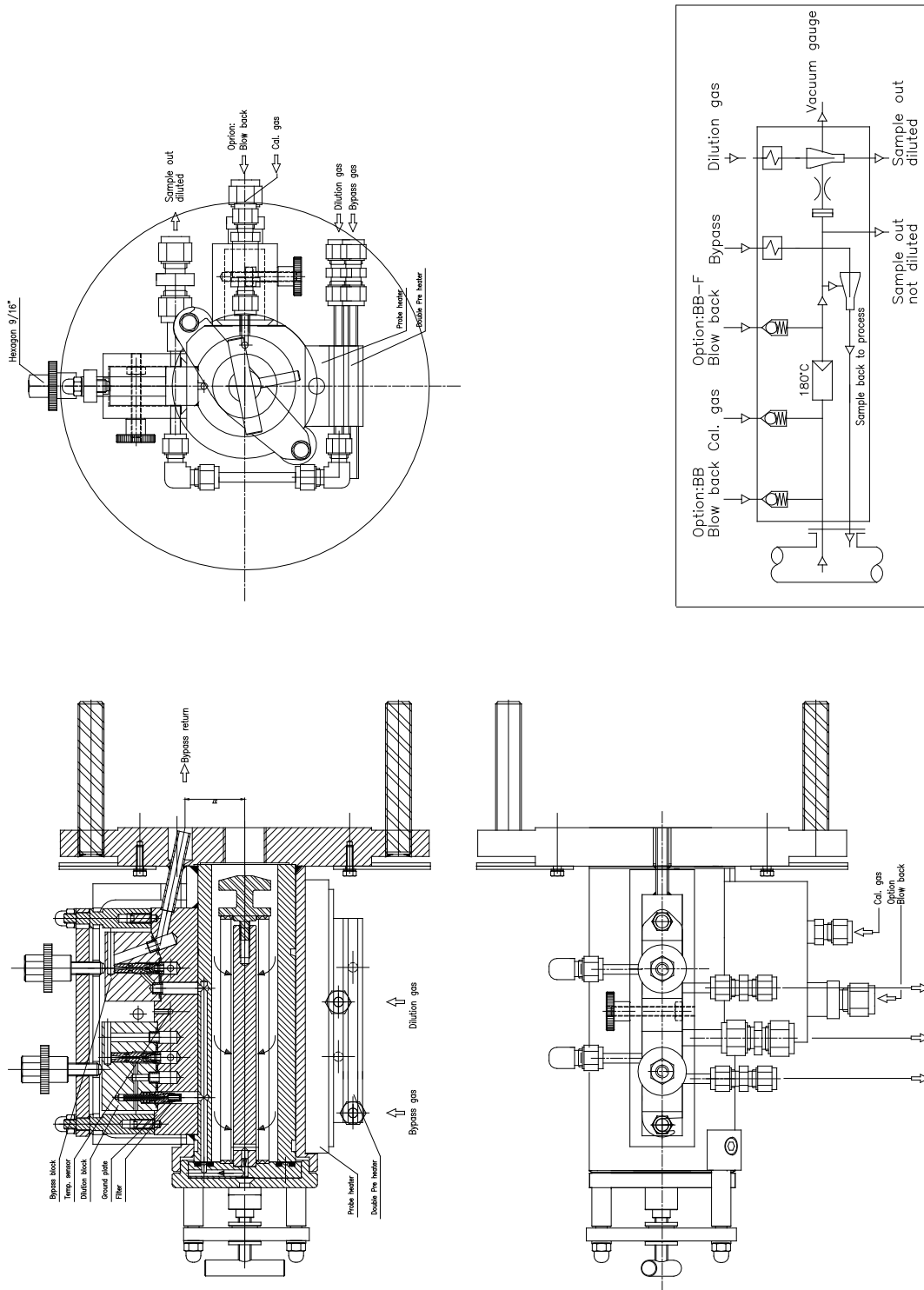


* standard
Dimensions in mm

Subject to technical modifications

Drawing No: 2290-1.01.0/10.08.06

Gas sample dilution probe SP2006-H/DIL/BR, with option BB or BB-F (Details)



Drawing no.: SP2006a70/08.06