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Operation Manual Vacuum Pump V-700/710

BÜCHI SWITZERLAND

93091 en

Table of contents

Read this manual carefully before installing and running your system and note the safety precautions in chapter 2 in particular. Store the manual in the immediate vicinity of the instrument, so that it can be consulted at any time.

No technical modifications may be made to the instrument without the prior written agreement of Buchi. Unauthorized modifications may affect the system safety or result in accidents.

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If you need another language version of this manual, you can download it at www.buchi.com.

1 About this manual

This manual describes the vacuum pump V-700 and V-710 and provides all information required for its safe operation and to maintain it in good working order.
It is addressed in particular to laboratory personnel and operators.
Because of the technical similarities of the V-700 and V-710 most of the descriptions are based on the V-700.

NOTE
The symbols pertaining to safety (WARNINGS and ATTENTIONS) are explained in chapter 2.

1.1 Reference documents

For information on the Rotavapor R-210/215 and the Vacuum Controller V-850/855, please refer to the corresponding manuals available in English, German, French, Spanish and Italian:

- Rotavapor R-210/215, Operation Manual numbers 93076–93080
- Vacuum Controller, Operation Manual numbers 93081–93085

1.2 Trademarks

The following product names and any registered and unregistered trademarks mentioned in this manual are used for identification purposes only and remain the exclusive property of their respective owners:

- Rotavapor® is a registered trademark of Büchi Labortechnik AG
- Teflon® is a registered trademark of DuPont or its affiliates
- Kalrez® is a registered trademark of DuPont

1.3 Abbreviations

ETFE: Ethylene/Tetrafluoroethylene
PBT: Polybutylene Terephthalate
PEEK: Polyetheretherketone
PTFE: Polytetrafluoroethylene (Teflon)

2 Safety

This chapter points out the safety concept of the instrument and contains general rules of behavior and warnings from hazards concerning the use of the product.
The safety of users and personnel can only be ensured if these safety instructions and the safety-related warnings in the individual chapters are strictly observed and followed. Therefore, the manual must always be available to all persons performing the tasks described herein.

2.1 User qualification

The instrument may only be used by laboratory personnel and other persons who on account of training or professional experience have an overview of the dangers which can develop when operating the instrument.
Personnel without this training or persons who are currently being trained require careful instruction. The present Operation Manual serves as the basis for this.

2.2 Proper use

This instrument has been designed and built for laboratories. Its proper use is the evacuation of laboratory instruments. This is done by means of a PTFE diaphragm pump, with or without regulation through one or more vacuum controllers.

A PTFE diaphragm pump is mainly used for:

- Evacuation of distillation instruments, in particular rotary evaporators
- Vacuum filtrations
- Vacuum drying cabinets
- Drying ovens

2.3 Improper use

Applications not mentioned above are improper. Also, applications, which do not comply with the technical data, are considered improper. The operator bears the sole risk for any damages caused by such improper use.

ATTENTION
Danger of pump destruction or loss of pump performance:

- *Never use the pump for pumping liquids or solid particles.*

The following uses are expressly forbidden:

- Use of the instrument in rooms which require ex-protected instruments.
- Processing of samples which can explode or ignite due to a blow, friction, heat, or sparks (e.g. explosives, etc.).
- Use of the instrument for digestions (e.g. Kjeldahl).
- Use of the instrument to produce over-pressure (pressurize a system).
- Use of the instrument at an ambient temperature of > 40 °C.

2.4 Warning notices used in this manual

WARNING
Generally, the triangular warning symbol indicates the possibility of personal injury or even loss of life if the instructions are not followed.

WARNING
Hot surface.

WARNING
Electrical hazard.

WARNING
Biohazard.

ATTENTION
With the general "Read this" symbol, ATTENTIONs indicate the possibility of equipment damage, malfunctions or incorrect process results, if instructions are not followed.

NOTE
Useful tips for the easy operation of the instrument.

2.5 Product safety

The vacuum pump is designed and built in accordance with current state-of-the-art technology. Nevertheless, risks to users, property, and the environment can arise when the instrument is used carelessly or improperly.

The manufacturer has determined residual dangers emanating from the instrument

- if the instrument is operated by insufficiently trained personnel.
- if the instrument is not operated according to its proper use.

Appropriate warnings in this manual serve to make the user alert to these residual dangers.

2.6 General safety rules

Responsibility of the operator

The head of laboratory is responsible for training his personnel.
The operator shall inform the manufacturer without delay of any safety-related incidents which might occur during operation of the instrument. Legal regulations, such as local, state and federal laws applying to the instrument must be strictly followed.

Duty of maintenance and care

The operator is responsible for ensuring that the instrument is operated in proper condition only, and that maintenance, service, and repair jobs are performed with care and on schedule, and by authorized personnel only.

Spare parts to be used

Use only genuine consumables and genuine spare parts for maintenance to assure good system performance and reliability. Any modifications to the spare parts used are only allowed with the prior written permission of the manufacturer.

Modifications

Modifications to the instrument are only permitted after prior consultation with and with the written approval of the manufacturer. Modifications and upgrades shall only be carried out by an authorized Buchi technical engineer. The manufacturer will decline any claim resulting from unauthorized modifications.

3 Technical data

This chapter introduces the reader to the instrument specifications. It contains the scope of delivery, technical data, requirements and performance data.

3.1 Scope of delivery

Check the scope of delivery according to the order number.

NOTE

For detailed information on the listed products, see www.buchi.com or contact your local dealer.

3.1.1 Vacuum system

Order number:

0	7	**1**	x	x	x

Vacuum pump 1.8 m³/h < 10 mbar 100–240 V 50/60 Hz

Order number:

0	7	**2**	x	x	x

Vacuum pump 3.1 m³/h 2 mbar 100–240 V 50/60 Hz

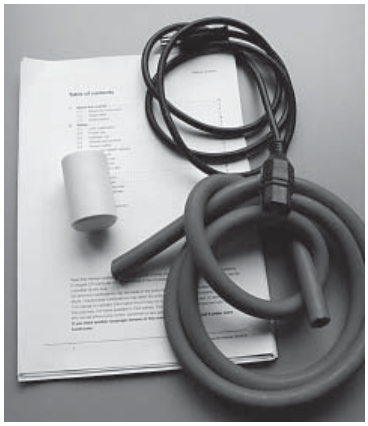


Table 3-1: Accessories Vacuum Pump V-700/710	
Product	Order number
Set hose connections (not on the picture)	041939
Vacuum hose 2 m	017622
Silencer	047090
Power cord	-
Type CH plug type 12 or PNE, 2.5 m	10010
Type Schuko	10016
Type GB	17835
Type AUS	17836
Type USA	10020
4 cable binders	-
Operation Manual:	
English	93091
German	93090
French	93092
Spanish	93093
Italian	93094

3.1.2 Vacuum Controller

Order number:

0	7	x	**1**	x	x

Manometer with needle valve

Order number:

0	7	x	**2**	x	x

Vacuum Controller V-850 100 V–240 V 50/60 Hz

Order number:

0	7	x	**3**	x	x

Vacuum Controller V-855 100 V–240 V 50/60 Hz

Order number:

0	7	x	**4**	x	x

EasyVac 100 V–240 V 50/60 Hz

Order number:

0	7	x	**5**	x	x

LabVac 100 V–240 V 50/60 Hz

3.1.3 Woulff bottle

Order number:

0	7	x	x	**1**	x

Woulff bottle

3.1.4 Condensation assembly

Order number:

0	7	x	x	x	1

Secondary condenser and insulation

Order number:

0	7	x	x	x	2

Cold trap

3.2 Technical data overview

Table 3-2: Technical data

	Vacuum Pump V-700	Vacuum Pump V-710
Dimensions (W x H x D)	180 x 276 x 209	177 x 297 x 378
Weight	5.3 kg	10.4 kg
Connection voltage	100–240 V / 50/60 Hz	100–240 V / 50/60 Hz
Power consumption	210 W	370 W
Environmental conditions	For indoor use only, altitude up to 2000 m, 5–40 °C, maximum relative humidity 80 % for temperatures up to 30 °C	
Ultimate vacuum (absolute)	< 10 mbar	2 mbar
Ultimate vacuum (with gas ballast)	24 mbar	8 mbar
Volume flow rate	1.8 m³/h	3.1 m³/h
Vacuum connection	GL-14	GL-14
Motor	brushles DC motor	brushles DC motor
Revolution speed	max. 1600 rpm min^{-1}	max. 1600 rpm min^{-1}
Sound level	40-52 dB dependent on operation mode	4-55 dB dependent on operation mode
Installation category	II	II
Pollution degree	2	2
Degree of protection	IP 34	IP 34

3.3 Materials used

Table 3-3: Materials used

Component	Material designation	Material code
Pump heads	Glass/PEEK	3.3
Housing	Aluminium	
Housing cover	PP	
Diaphragms	PTFE / rubber	
Valve plate	PEEK	
Valve head	PEEK	
Vacuum tubes	FEP	
Gasket rings, valves	Rubber	

3.4 Solvent table

Table 3-4: Solvent table

Solvent	Formula	Molar mass in g / mol	Evaporation energy in J / g	Boiling point at 1013 mbar	Density in g / cm3	Vacuum in mbar for boiling point at 40 °C
Acetone	CH_3H_6O	58.1	553	56	0.790	556
n-amylalcohol, n-pentanol	C_5H1_2O	88.1	595	37	0.814	11
Benzene	C_6H_6	78.1	548	80	0.877	236
n-butanol, tert. butanol	$C_4H_{10}O$	74.1	620	118	0.810	25
(2-methyl-2-propanol)	$C_4H_{10}O$	74.1	590	82	0.789	130
Chlorobenzene	C_6H_5Cl	112.6	377	132	1.106	36
Chloroform	$CHCl_3$	119.4	264	62	1.483	474
Cyclohexane	C_6H_{12}	84.0	389	81	0.779	235
Diethylether	$C_4H_{10}O$	74.0	389	35	0.714	atmospheric
1,2-dichloroethane	$C_2H_4Cl_2$	99.0	335	84	1.235	210
1,2-dichloroethylene (cis)	$C_2H_2Cl_2$	97.0	322	60	1.284	479
1,2-dichloroethylene (trans)	$C_2H_2Cl_2$	97.0	314	48	1.257	751
Diisopropyl ether	$C_6H_{14}O$	102.0	318	68	0.724	375
Dioxane	$C_4H_8O_2$	88.1	406	101	1.034	107
DMF (dimethyl-formamide)	C_3H_7NO	73.1		153	0.949	11
Acetic acid	$C_2H_4O_2$	60.0	695	118	1.049	44
Ethanol	C_2H_6O	46.0	879	79	0.789	175
Ethylacetate	$C_4H_8O_2$	88.1	394	77	0.900	240
Heptane	C_7H_{16}	100.2	373	98	0.684	120
Hexane	C_6H_{14}	86.2	368	69	0.660	335
Isopropylalcohol	C_3H_8O	60.1	699	82	0.786	137
Isoamylalcohol 3-methyl-1-butanol	$C_5H_{12}O$	88.1	595	129	0.809	14
Methylethylketone	C_4H_8O	72.1	473	80	0.805	243
Methanol	CH_4O	32.0	1227	65	0.791	337
Methylene chloride, dichloromethane	CH_2Cl_2	84.9	373	40	1.327	atmospheric
Pentane	C_5H_{12}	72.1	381	36	06.26	atmospheric
n-propylalcohol	C_3H_8O	60.1	787	97	0.804	67
Pentachloroethane	C_2HCl_5	202.3	201	162	1.680	13
1,1,2,2-tetra-chloroethane	$C_2H_2Cl_4$	167.9	247	146	1.595	35
Tetrachlorocarbon	CCl_4	153.8	226	77	1.594	271
1,1,1-trichloroethane	$C_2H_3Cl_3$	133.4	251	74	1.339	300
Tetra-chloro-ethylene	C_2Cl_4	165.8	234	121	1.623	53
THF (tetrahydrofurane)	C_4H_8O	72.1		67	0.889	357
Toluene	C_7H_8	92.2	427	111	0.867	77
Trichloroethylene	C_2HCl_3	131.3	264	87	1.464	183
Water	H_2O	18.0	2261	100	1.000	72
Xylene (mixture)	C_8H_{10}	106.2	389			25
o-xylene	C_8H_{10}	106.2		144	0.880	
m-xylene	C_8H_{10}	106.2		139	0.864	
p-xylene	C_8H_{10}	106.2		138	0.861	

4 Description of function

This chapter explains the basic principle of the instrument, shows how it is structured and gives a functional description of the assemblies and accessories.

4.1 Vacuum pump

4.1.1 Functional principle

The Vacuum Pump V-700/710 serves to evacuate laboratory instruments down to 10 mbar respectively 2 mbar pressure by means of a PTFE diaphragm pump. This pump is controlled by a variable speed and single stroke technology.
It can be either used as stand-alone instrument or it can be expanded to a complete vacuum system with optional accessories such as vacuum controllers and a secondary condenser.

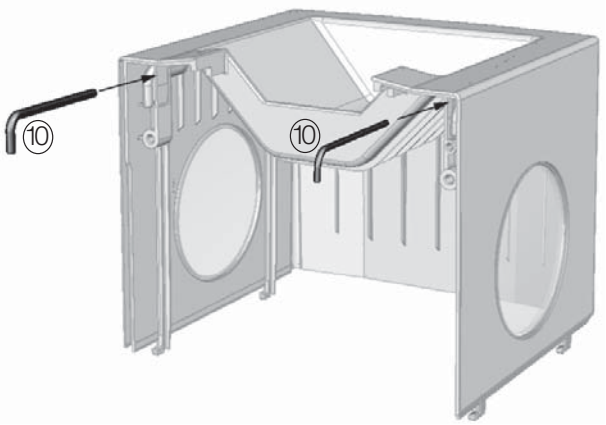
NOTE
During a stable vacuum control irregular pump motor operation might be audible when the pump is in the change over between speed control and Wankel operation. This is absolutely normal and does not indicate a technical malfunction.

4.1.2 Front view

① Mains switch On/Off
② Glass window for viewing and checking the membrane
③ Carrying handle

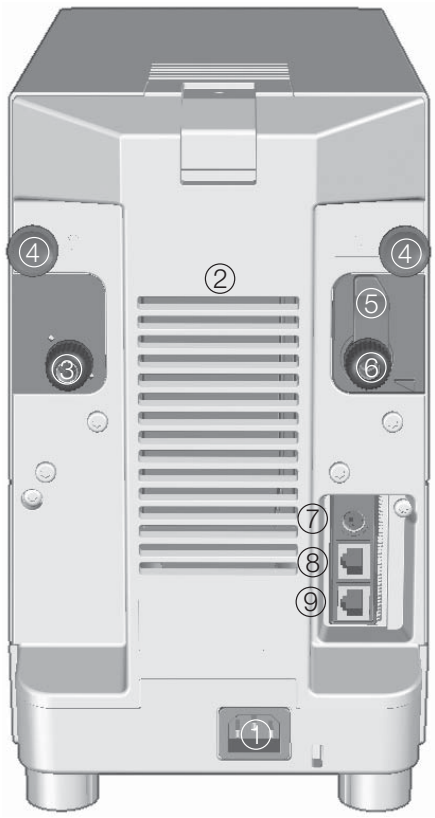
Fig. 4.1: Front view of the vacuum pump

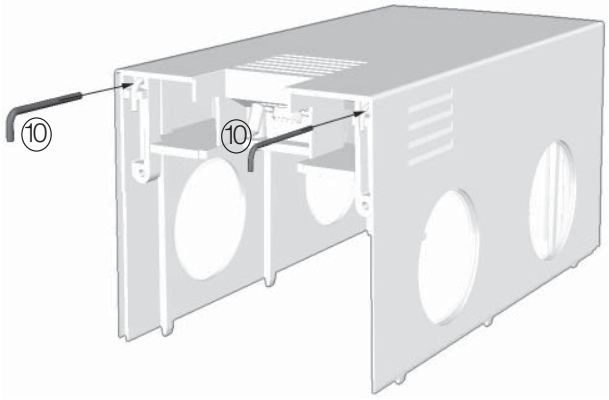
4.1.3 Rear view



① Power supply
② Fan for pump cooling
③ Pump outlet
④ Set screw for fixing the upper part
⑤ Gas ballast
⑥ Pump inlet
⑦ Mini-DIN connection (connection to V-800/805 or V-850/855 on/off mode)
⑧ RS 485 connection to V-85x, V-700/710 or R-210/215
⑨ RS 485 connection to V-85x, V-700/710 or R-210/215
⑩ Allen key in two different sizes

Fig. 4.2: Rear view of the V-700 with connections





① Power supply
② Fan for pump cooling
③ Pump outlet
④ Set screw for fixing the upper part
⑤ Gas ballast
⑥ Pump inlet
⑦ Mini-DIN connection (connection to V-800/805 or V-850/855 on/off mode)
⑧ RS 485 connection to V-85x, V-700/710 or R-210/215
⑨ RS 485 connection to V-85x, V-700/710 or R-210/215
⑩ Allen key in two different sizes

Fig. 4.3: Rear view of the V-710 with connections

4.1.4 Gas ballast

The gas ballast serves to aerate the system (membrane and valves) during pump operation, thus avoiding the collection of condensed solvent within the system.

NOTE

The end-vacuum is reduced to about 24 mbar when the gas ballast is open. The air stream due to the open gas ballast dries wet membranes, therefore close the gas ballast when the membranes are dry to reach a low end vacuum.

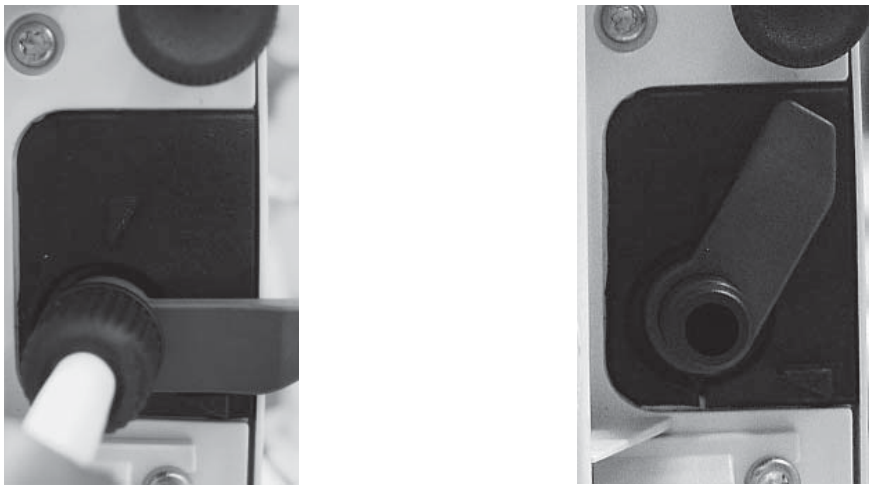
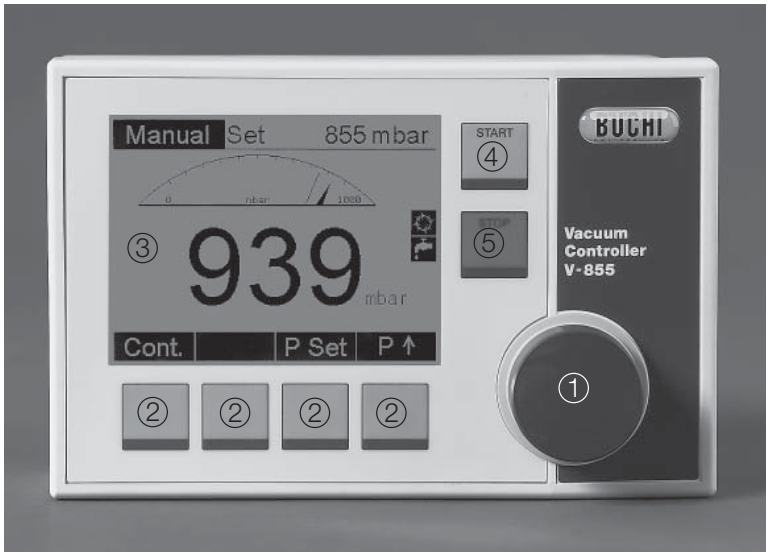


Fig. 4.4: Gas ballast shown open on the picture on the left and closed on the picture on the right

4.2 Vacuum Controller V-850/855

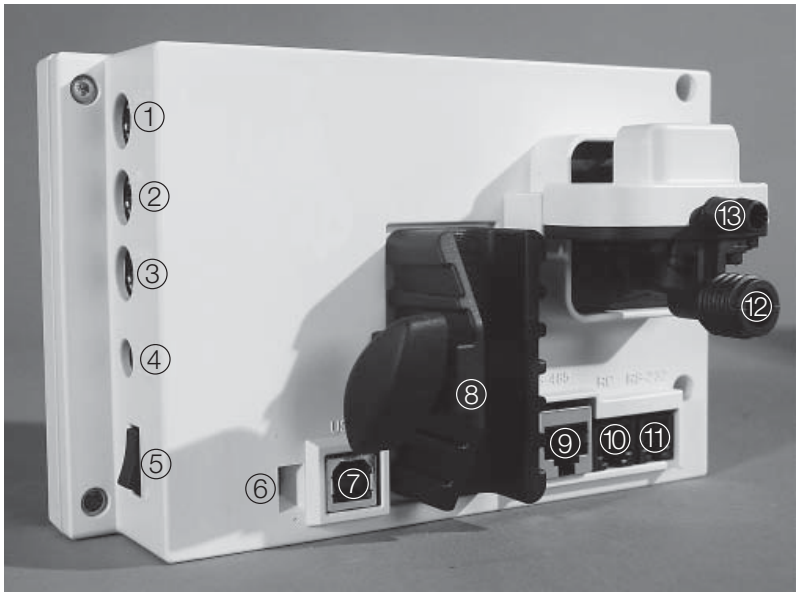
4.2.1 Control keys of Vacuum Controller V-850



① Selection knob
② Functional buttons
③ Display
④ START button
⑤ STOP button

Fig. 4.5: Overview of the vacuum controller

4.2.2 Rear connections of the vacuum controller



① Connection for Auto-distillation probe/switch box (AS/SB)
② Connection for cooling water valve (CW)
③ Connection for valve unit and vacuum valve (VALVE)
④ Power supply connection for stand alone mode 30 VDC
⑤ Mains switch On/Off
⑥ Service switch (upper position = Standard mode)
⑦ USB for data output
⑧ Fixation for support rod
⑨ RS 485 connection to V-700/710 or R-210/215
⑩ Remote control (RC 81)
⑪ RS 232 connection for Rotavapor (R-200/205/220/250)
⑫ Vacuum connection
⑬ Aeration valve and inert gas connection

Fig. 4.6: Connections of the controller

NOTE

For a detailed description of the vacuum controller, please refer to the corresponding Operation Manual.

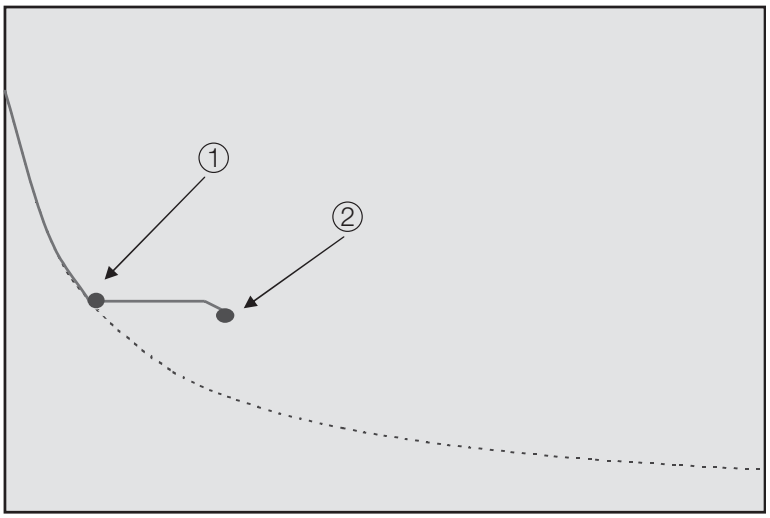
4.3 Vacuum Module V-801 EasyVac

The Vacuum Pump V-700/710 can be used for the automatic distillation of solvents together with the Vacuum Module V-801 Easy Vac. In which case the optimum pressure/vacuum setting for a distillation is automatically determined by a gradual reduction of the pressure.

Fig. 4.7: Pump with EasyVac module

4.3.1 Front view EasyVac

Fig. 4.8: Front view EasyVac



① Detection start of distillation ② Detection end of distillation

Fig. 4.9: Pressure course in EasyVac mode

① Start

By pressing the START button the pump starts evacuating the system until the solvent in the evaporating flask starts boiling. When the boiling point is reached the pump holds the reached vacuum level.

Continuous

By pressing the START button for more than 2 seconds, the pump enters the Continuous mode, where it operates constantly.

NOTE

EasyVac and the Autodistillation function are not recommended to be used in the standard LabVac mode due to pressure fluctuations (hysteresis). Therefore you have to run the LabVac system in the Continuous mode.

② Stop

When pressing the STOP button the pump stops and the system is aerated by means of the valve at the controller.

The LEDs indicate the operating state of the system:

③ LED ON/OFF

- Permanent light: The system is ready to operate
- LED flashes: The system is in the Continuous mode (the pump runs constantly)

④ LED PROCESS STATUS

- Permanent light: The system has reached the optimum vacuum for the distillation
- LED flashes: The system searches the optimum vacuum for the distillation

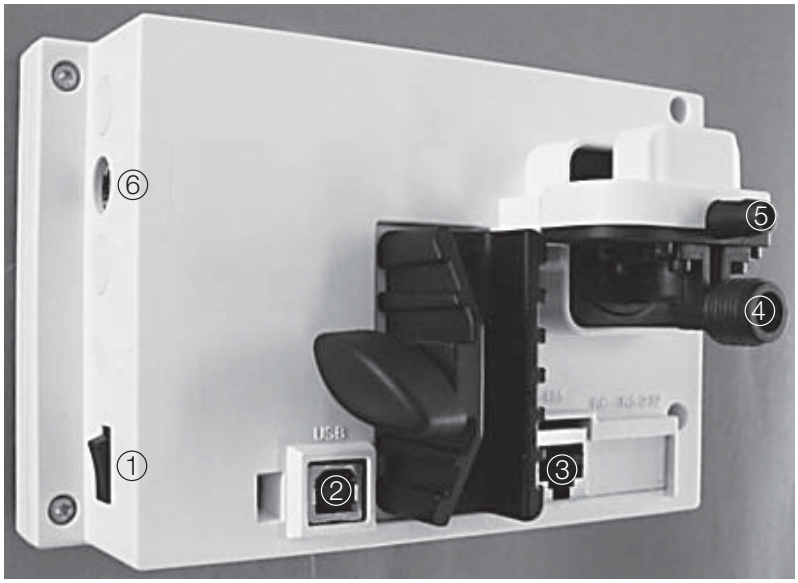
⑤ PRESSURE UP/DOWN

By means of these buttons, the pressure can be adjusted manually.

NOTE

In case EasyVac cannot find a starting point, the distillation start has to be searched for manually by means of the buttons PRESSURE UP/DOWN.

4.3.2 Back view EasyVac



① Mains switch On/Off
② USB for data output
③ RS 485 connection to V-700/710 or R-210/215
④ Vacuum connection to Woulff bottle
⑤ Ventilation valve and inert gas connection
⑥ Connection for cooling water valve (CW)

Fig. 4.10: Back view EasyVac

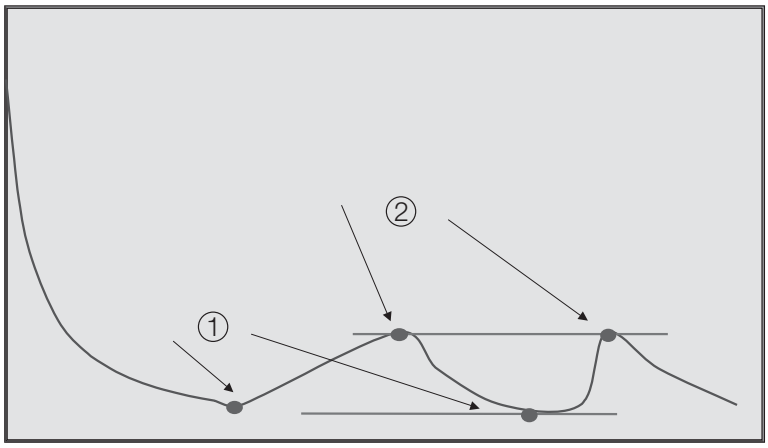
4.4 Vacuum Module V-802 Lab Vac

The Vacuum Pump V-700/710 can be used together with the Vacuum Module V-802 LabVac as a laboratory vacuum system.

Fig. 4.11: Front view LabVac

NOTE

The back view of the LabVac as the same as for the EasyVac, see Fig. 4.8.



① Pump not running ② Pump running

Fig. 4.12: Pressure course in LabVac mode

① Start

By pressing the START button the pump starts evacuating the system. When a constant vacuum is reached the pump stops. When the pressure rises over the hysteresis at 50 mbar the pump starts to operate again until a constant vacuum is reached.

Continuous

By pressing the START button for more than 2 seconds the pump enters the Continuous mode, where the pump runs constantly.

② Stop

When pressing the STOP button the pump stops and the system is aerated by means of the valve at the controller.

The LEDs indicate the operating state of the system:

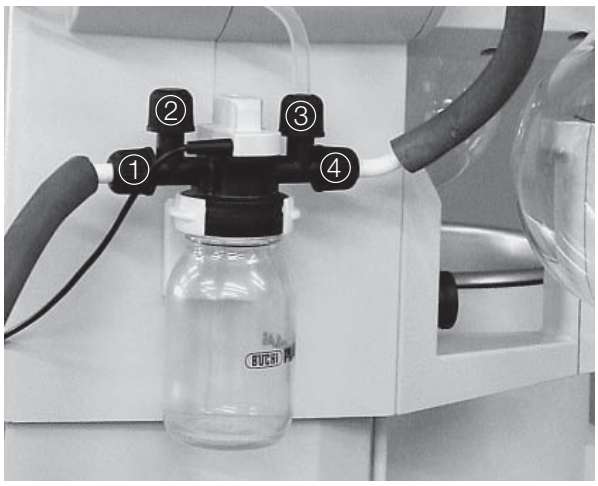
③ LED ON/OFF

- Permanent light: The system is ready to operate
- LED flashes: The system is in Continuous mode

④ LED PROCESS STATUS

- Permanent light: The system has reached the possible end-vacuum
- LED flashes: The system searches the constant end-vacuum

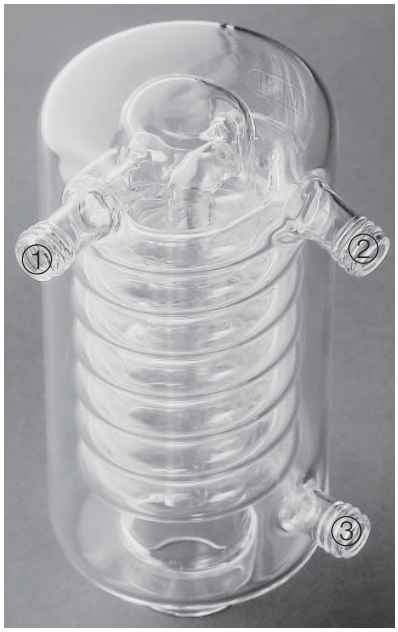
4.5 Vacuum connections to the valve unit or Woulff bottle



① Connection to vacuum pump
② Connection to an additional instrument
③ Connection to vacuum controller
④ Connection to Rotavapor

Fig. 4.13: Connections at the valve unit or Woulff bottle

4.6 Connections to the secondary condenser



① Outlet for exhaust gases
② Outlet for cooling water
③ Inlet for cooling water

Fig. 4.14: Connections to the secondary condenser with and without insulation

4.7 Connections at the cold trap

The inner vessel of the cold trap is filled with dry ice and acetone for operation.

① Vacuum connection

Fig. 4.15: Connections at the cold trap

5 Putting into operation

This chapter describes how the instrument is installed and gives instructions on initial startup.

NOTE
Inspect the instrument for damages during unpacking. If necessary, prepare a status report immediately to inform the postal company, railway company or transportation company.

Keep the original packaging for future transport.

5.1 Installation site

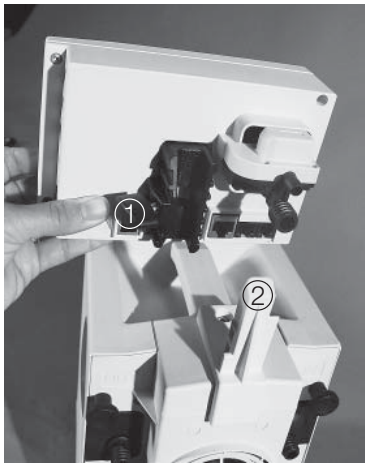
Place the instrument on a stable, horizontal plane and consider the maximum product dimensions. If the vacuum pump cannot be placed under a running hood, we recommend to use a secondary condenser or to lead the outlet of the pump into the running hood.

5.2 Vacuum controller

To install the vacuum controller, proceed as follows:

- Mount the holder of the vacuum controller with the screws to the upper bottom.

NOTE
You can use the allen key integrated in the top cover of the pump, see also Fig. 4.2.



- Fix the controller to the holder ② by means of the knurled screw ①.

Fig. 5.1: Connecting the controller to the vacuum pump

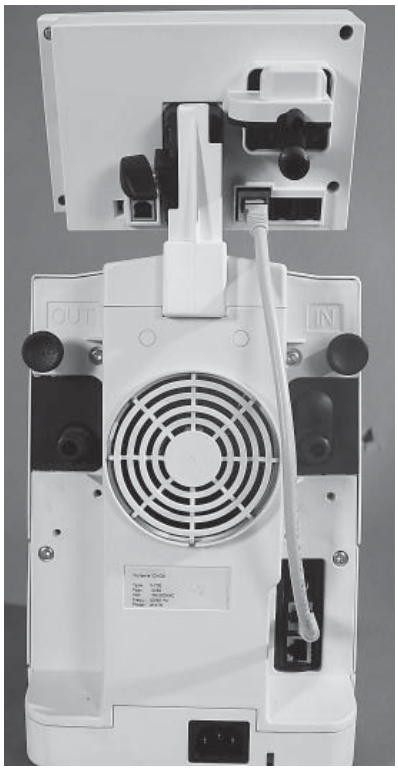
5.3 Electrical connections

ATTENTION

Make sure that the voltage on the socket corresponds to the voltage given on the type plate of the instrument.

Always connect the instrument to an earthed socket. External connections and extension cables must be provided with an earthed conductor lead (3-pole couplings, cable or plug equipment) as this lead cannot be interrupted, thus avoiding risks due to internal defects.

Make sure that no electric sparks form in the instrument or its sorroundings as they might damage the instrument.



- Connect the controller to the vacuum pump by means of the communication cable RS485.

Fig. 5.2: Connecting the controller to the vacuum pump

5.4 Silencer or secondary condenser

5.4.1 Secondary condenser

To install the secondary condenser, proceed as follows:

- Screw the corresponding holder to the pump.

NOTE

You can use the allen key integrated in the top cover of the pump, see also Fig. 4.2.

- Introduce the secondary condenser into the holder.

- Pull the GL-14 cap forward and screw it to the GL-14 thread of the pump outlet.

Fig. 5.3: Secondary condenser

5.4.2 Silencer

Fig. 5.4: Silencer

Screw the silencer, screw it to the clip GL-14 of the pump outlet or to the outlet of the secondary condenser.

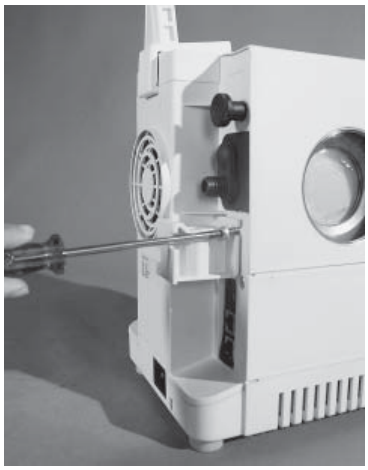
NOTE

Make sure to mount the silencer in such a way, that the marking on the silencer has the orientation as shown on the picture on the left. The orientation is vital to guarantee a correct functioning of the silencer.

Normally, the direction marking on the silencer is not colored.

5.5 Woulff bottle or valve unit

To install the Woulff bottle, proceed as follows:



- Screw the corresponding holder to the pump.

NOTE

You can use the allen key integrated in the top cover of the pump, see also Fig. 4.2.

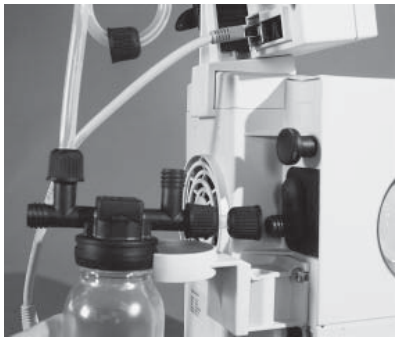


Fig. 5.5: Installing the Woulff bottle

- Introduce the Woulff bottle to the holder.
- Screw the GL-14 nut of the Woulff bottle to the GL-14 thread of the pump inlet. It may be necessary to pull the tube a little until it fits.

NOTE

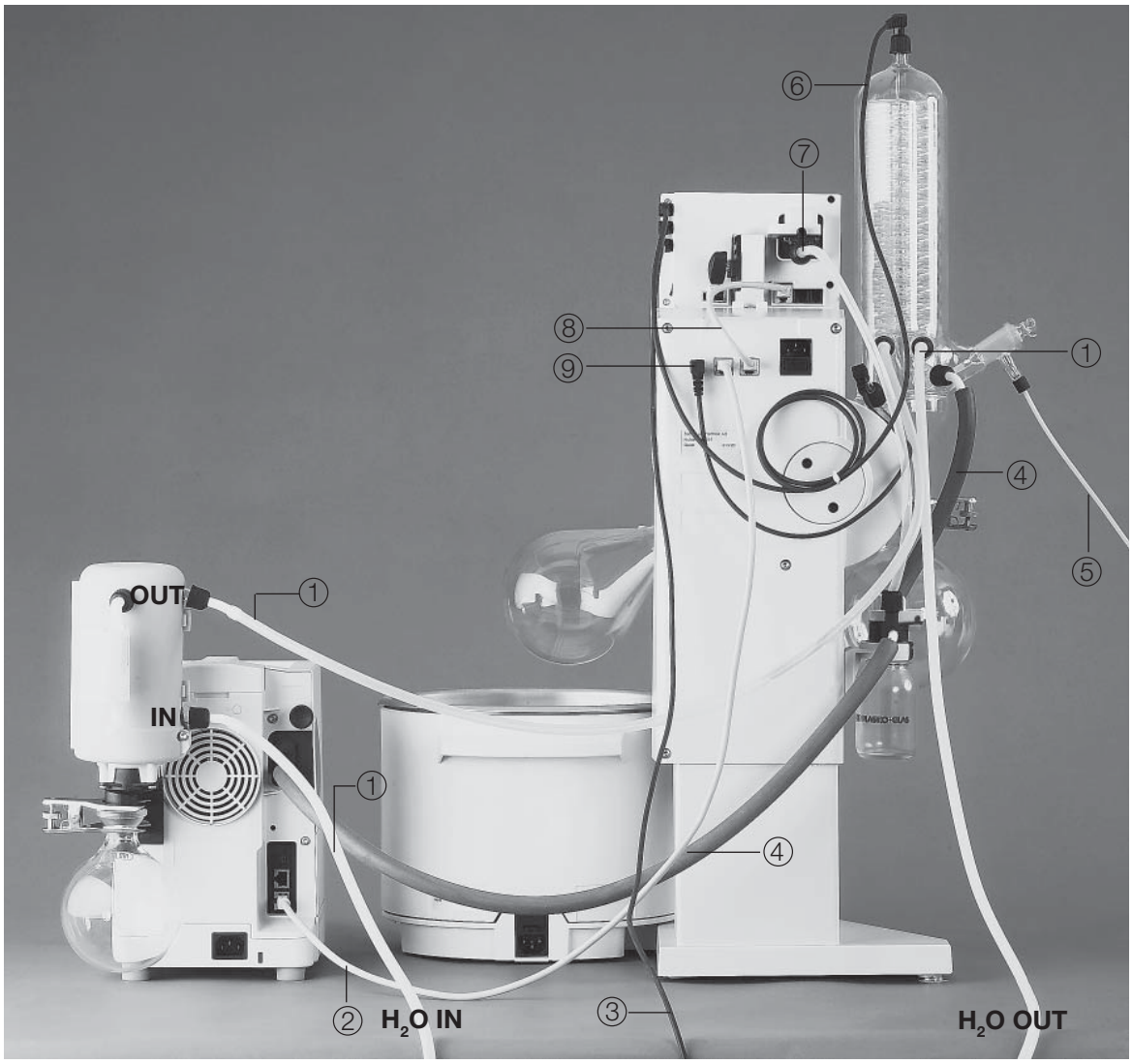
If no vacuum controller is connected, close the connections at the Woulff bottle, which are not in use, with screw caps.

5.6 Vacuum connection to the EasyVac and LabVac

Fig. 5.6: Vacuum connection to the Easy- and LabVac

① Vacuum connection EasyVac/LabVac
② Vacuum connection Woulff bottle / Rotavapor or other instrument

5.7 Complete system connection with one Rotavapor and one vacuum controller



① Cooling water connections
② Communication cable vacuum pump / Rotavapor
③ Communication cable vacuum controller / cooling water valve
④ Vacuum connection vacuum pump / Woulff bottle / glass assembly
⑤ PTFE tube for feeding the evaporating flask
⑥ Communication cable vacuum controller / Auto-distillation probe
⑦ Vacuum connection vacuum controller / Woulff bottle
⑧ Communication cable vacuum controller / Rotavapor
⑨ Communication cable Rotavapor (R-215) / vapor temperature sensor

Fig. 5.7: Complete system connection

Liquid connections: ①, ⑥
Communication cable connections: ②, ③, ⑤, ⑧, ⑨, ⑩
Vacuum connections: ④, ⑦

NOTE

The power supply for the controller is assured via the Rotavapor and the pump.

For a detail view of the connections at the valve unit see also Fig. 4.12.

5.8 System pump with two controllers on two Rotavapor

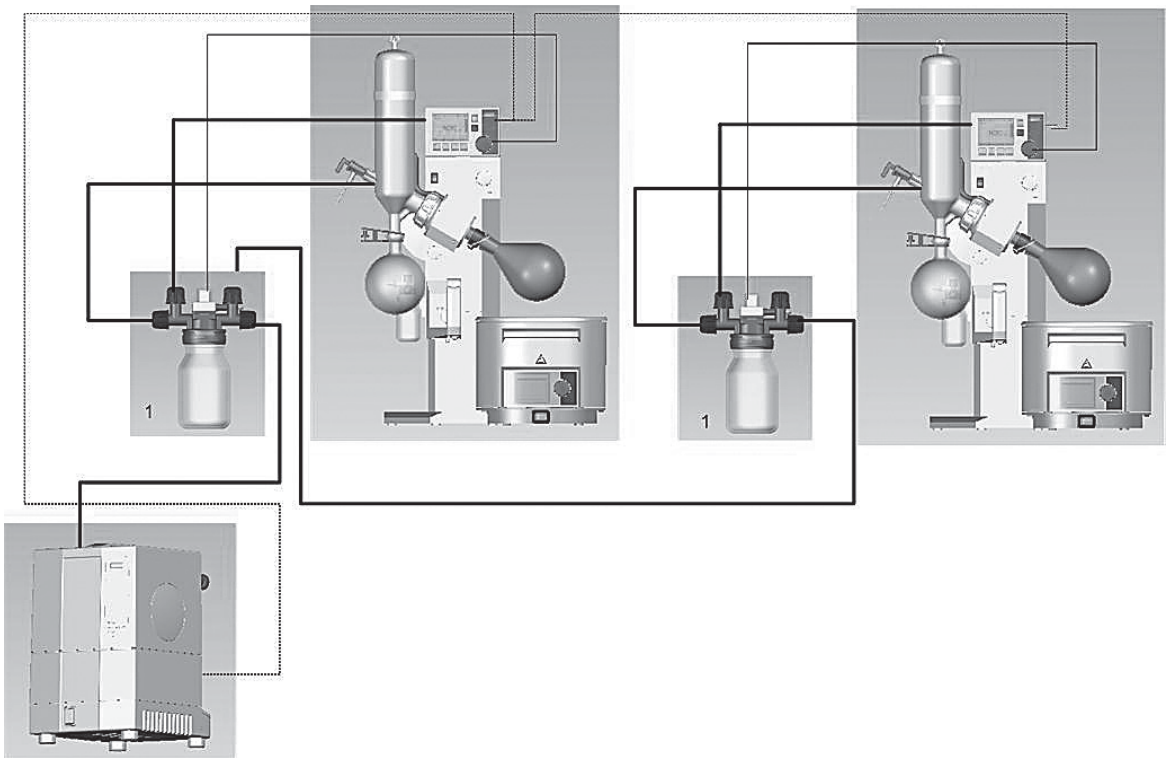


Fig. 5.8: Complete system connection with two Rotavapors

Legend:

1: Valve unit

Connections:

Thick line: Vacuum connections
Dotted line: Electrical connection vacuum controller (AS/SB) / vacuum controller (AS/SB) vacuum pump (switch box) with cable 38010
Thin line: Electrical connection valve unit / vacuum controller (VALVE)

6 Operation

This chapter explains the operating elements and possible operating modes. It gives instructions on how to operate the instrument properly and safely.

ATTENTION

Check the glassware for damages prior to each operation and use only glassware in perfect condition. Glassware with cracks, stars or other damages can break during operation.

6.1 Starting the pump

6.1.1 Pump without controller

After the pump is completely installed it is ready to operate, i.e. when the mains switch is pressed, the pump starts operating right away and starts evacuating until the end-vacuum (10 mbar).

6.1.2 Pump with controller

After the pump and the controller are completely installed, the system is ready to operate. When the mains switch is pressed, the pump is on standby and starts operating as soon as the controller is started. It then evacuates to the vacuum preset at the controller.

6.1.3 EasyVac

For a description of the EasyVac function, see chapter 4.3.

6.1.4 LabVac

For a description of the LabVac function, see chapter 4.4.

6.2 Selecting the distillation conditions

To achieve optimal distillation conditions, the distillation energy supplied by the heating bath must be removed by the condenser.

To ensure this, operate the instrument according to the following rule of thumb:

Cooling water: max. 20 °C Vapor: 40 °C Bath: 60 °C

How are these conditions achieved?:

- Set the bath temperature to 60 °C.
- Set the cooling water temperature not higher than 20 °C.
- Allow cooling water to flow through the condenser at approximately 40 – 50 l/h.
- Define the operating vacuum in such a way, that the boiling point of the solvent is 40 °C. The corresponding pressure can be seen from the Solvent Table in chapter 3.

Advantages associated with bath temperatures of 60 °C:

- The evaporating flask can be replaced without risk of burns.
- The evaporation rate of the water from the heating bath is low (low energy loss).
- The heating bath energy is used at a good degree of efficiency.

This rule can also be applied to lower bath temperatures, e.g.:

Cooling water: 0 °C Vapor: 20 °C Bath: 40 °C

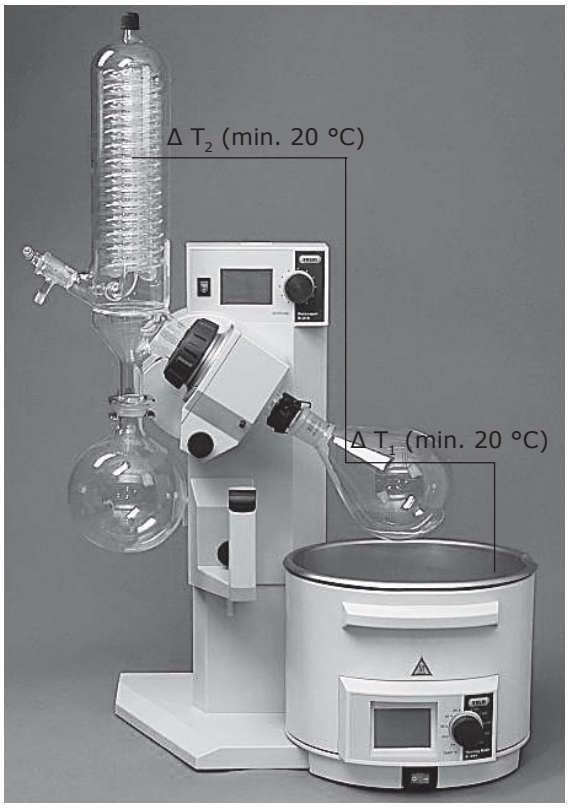


Fig. 6.1: 20-40-60 ° rule

6.3 Optimizing the distillation conditions

Depending on the solvent being distilled the distillation might have to be re-optimized. In the optimized case, the condenser should be steamed up to between 2/3 to 3/4, see figure below.

If this is not the case, there are two possibilities to optimize the distillation:

- When the heating bath has reached 60 °C slowly reduce the pressure. Thus, the boiling point of the solvent is reduced and ΔT_1 increases resulting in an increase of distillation capacity.
- When the heating bath has reached 60 °C increase the bath temperature. Thus ΔT_1 increases resulting in an increase of distillation capacity as well.

NOTE

When the bath temperature is increased, not all of the additional energy is used for distillation but a major part is discharged into the environment due to the increasing difference between heating bath and the ambient temperature.

Fig. 6.2: Optional condensation area of a condenser

7 Maintenance and repairs

This chapter gives instructions on all maintenance work to be performed in order to keep the instrument in good working condition. In addition to this, adjustment jobs the operator can carry out by himself/herself are explained.

WARNING

All maintenance and repair work requiring the opening or removal of instrument covers may only be carried out by trained personnel and with the tools provided for this purpose.

WARNING

Electrical hazard:

- *Prior to all maintenance work on the instrument switch off the power supply and remove all sources of flammable vapor.*

ATTENTION

Use only genuine consumables and genuine spare parts for maintenance and repair to assure good system performance and reliability. Any modifications to the spare parts used are only allowed with the prior written permission of the manufacturer.

7.1 Housing

Immediate maintenance

The housing is made of plastic. Remove any acid drops immediately from the housing with a moist cloth.

General maintenance

Check the housing for defects (controls, plugs) and clean it regularly with a moist cloth.

ATTENTION

Never use organic solutions (except for ethanol) as cleaning agents as these might damage the instrument.

7.2 Glass parts

Rinse the glass parts regularly with standard cleaning agents (e.g. mild soap solutions).
Afterwards examine them visually for splintered parts or cracks.

ATTENTION

Check the glassware for damages prior to each operation and use only glassware that is in perfect condition. Glassware with cracks, stars or other damages can break during operation.

7.3 Hoses and gaskets

Examine hoses and gaskets visually for cracks. If cracks have developed or if the tubes and gaskets have become brittle, replace them with suitable new ones.

7.4 Valve head

7.4.1 Cleaning

If the end vacuum of 10 mbar is not reached anymore and the rest of the system has no leakage, the problem is often caused by stuck valve plates.

To clean them, proceed as follows:

- Remove all connections to the pump and to the silencer.
- Switch the pump on.
- Inject a small amount of about approx. 10 ml of acetone at once into the inlet side of the pump and wait until the pump makes the same sound as before injecting solvent.

NOTE

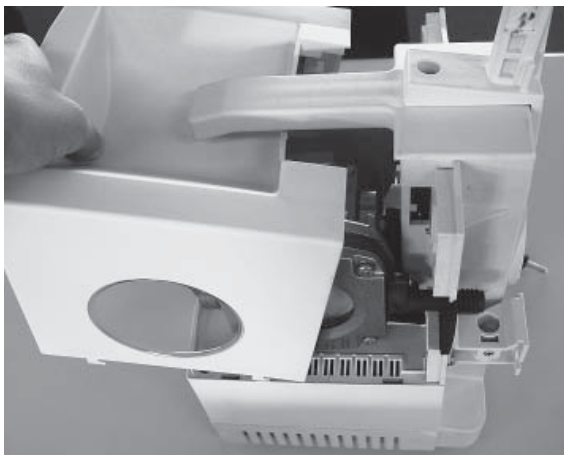
Use safety washing bottles to inject the acetone, as shown in Fig. 7.1.

- Repeat the injection step four to five times.
- Let the pump run for about 2 minutes and check whether the end-vacuum can be reached.
- If this is still not the case, repeat the cleaning procedure before going on with any disassembly work.

Fig. 7.1: Cleaning the valve head with acetone

7.4.2 Disassembly and reassembly of the pump head

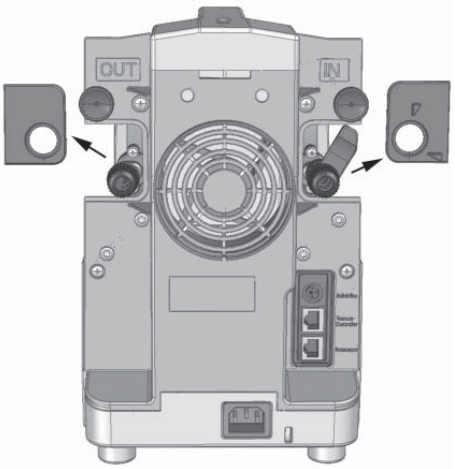
To disassemble the pump to replace the membrane and valves, proceed as follows:



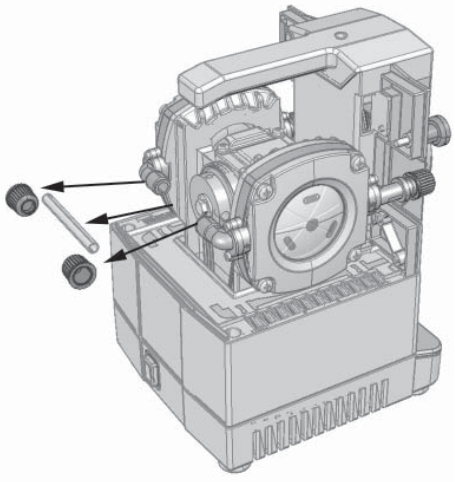
- Remove the two set screws for fixing the upper part (position 4 in Fig. 4.2) and pull the housing off.

NOTE

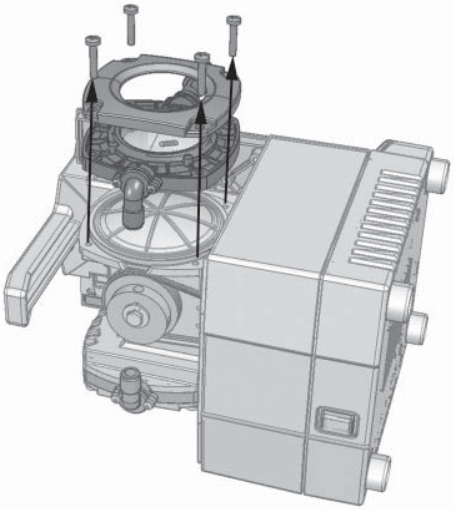
To replace only the valves you do not have to remove the metal cover and the pump head.



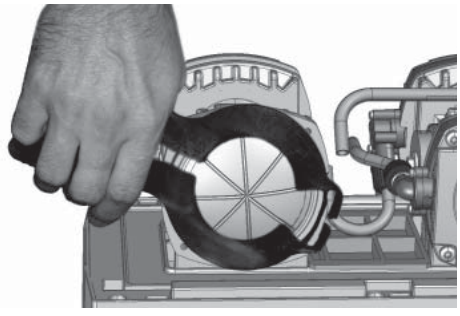
- Remove the two rubber parts at the valve in- and outlet.



- Loosen the black tube clips GL-14 between the pump heads.
- Turn the pump on its side.



- By means of the large key in the pump housing (for the position of the key, see Fig. 4.2) loosen the four screws at the glass/PEEK head.
- Remove the metal cover and the pump head.

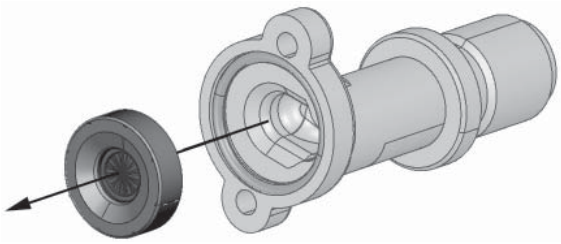


- Slightly lift up the membrane with both hands und unscrew it counterclockwise.

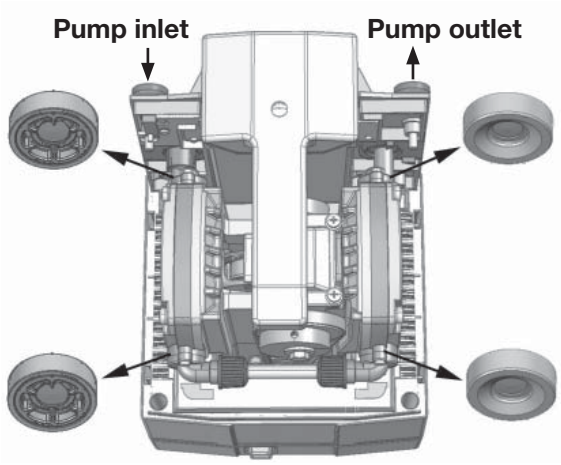
NOTE

Handle the diaphragm with care and make sure it is not damaged when removing and mounting it.

- In case the valve has to be replaced, loosen the two screws ① by means of the small key in the pump housing.



- Replace the valve (the picture on the left shows the replacement of the valve on the OUT side).



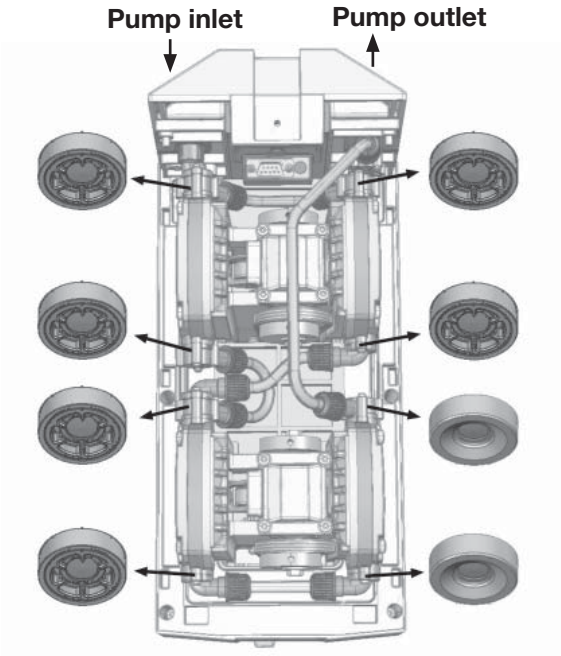
A description of how to mount the valve can be seen from the pump housing (the IN side is illustrated at the top of the picture on the left, the OUT side at the bottom).

NOTE

Normally, the illustration is not colored, this has just been done to make it visible on the picture.

NOTE

Consider the mounting direction of the valve as this is vital for the functioning of the pump. To check whether the mounting is correct, blow into the tube at the IN side. You should then feel the air coming out of the OUT side.



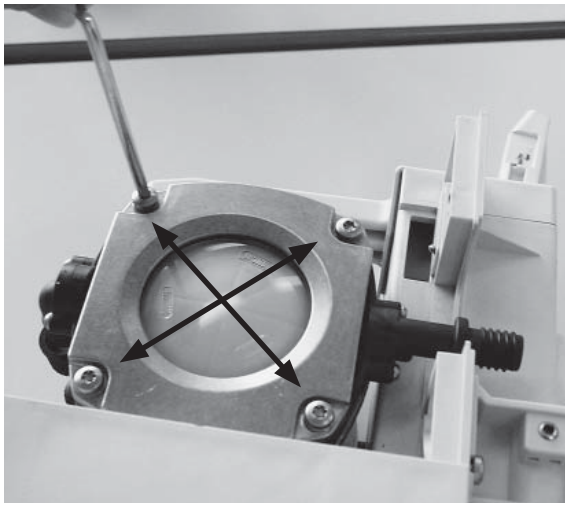


Fig. 7.2: Disassembling and reassembling the valve heads

- When all replacement work is done, reassemble the pump head in the reverse order.

NOTE

When remounting the valve head, fix the four screws slightly at first, and then tighten them crosswise (recommended torque 5.5 Nm).

7.5 Working with strong acids

ATTENTION

Always wear personal protective equipment such as protective eye goggles, protective clothing and gloves when operating the instruments with strong acids or bases.

In case you distill strong acids or bases, we recommend highly that you rinse the pump after the distillation process to increase the lifetime of the instrument.

To rinse the pump, proceed as follows:

- Suck 5–10 ml of water through the pump inlet and recollect it again directly behind the pump outlet.
- Check the pH value of the water leaving the pump and repeat the rinsing procedure until the value is between a pH of 3–9.
- Now dry the pump by sucking air through it for 2–3 minutes.

7.6 Customer service

Only authorised service personnel are allowed to perform repair work on the instrument. These persons have a comprehensive technical training and knowledge of possible dangers which might arise from the instrument.
Addresses of official Buchi customer service offices are given on the Buchi website under: www.buchi.com. If malfunctions occur on your instrument or you have technical questions or application problems, contact one of these offices.

The customer service offers the following:

- Spare part delivery
- Repairs
- Technical advice

8 Troubleshooting

This chapter helps to resume operation after a minor problem has occurred with the instrument. It lists possible occurrences, their probable cause and suggests how to remedy the problem.
The troubleshooting table below lists possible malfunctions and errors of the instrument. The operator is enabled to correct some of those problems or errors by him/herself. For this, appropriate corrective measures are listed in the column “Corrective measure”.
The elimination of more complicated malfunctions or errors is usually performed by a Buchi technical engineer who has access to the official service manuals. In this case, please refer to your local Buchi customer service agent.

8.1 Malfunctions and their remedy

Table 8-1: General malfunction and their remedy

Malfunction	Possible cause	Corrective measure
Instrument does not work	Mains switch off	Switch on mains switch
	Instrument is not connected to power supply	Check if mains connection is okay
	Instrument is not connected to power supply	Check mains connection
System is leaky or does not reach the end-vacuum	Tube clips have not been fixed correctly or are defective	Check tube clips
	Tubes are leaky (brittle)	Replace tubes
	Membrane and/or valves are contaminated	Clean or replace membrane and/or valves
Contact at the removable top cover is not closed	Top cover not perfectly mounted	Check the mounting of the top cover and refix it, if necessary

9 Shutdown, storage, transport and disposal

This chapter instructs how to shut down the instrument, how to pack it for storage or transport, and specifies the storage and shipping conditions.

9.1 Storage and transport

WARNING
Biohazard:

- *Remove all dangerous substances from the instrument and clean it thoroughly.*

Store and transport the instrument in its original packaging.

WARNING
Electrical hazard:

- *Always remove the plug connector at the socket first to avoid having energized cables lying about.*

9.2 Disposal

To dispose of the instrument in an environmentally friendly manner, a list of materials is given in chapter 3. This helps to ensure that the components are separated and recycled correctly. Make especially sure to dispose of the gas springs appropriately.
Please follow valid regional and local laws concerning disposal.

NOTE
When you send the instrument back to the manufacturer for repair work, please copy the health and safety clearance form on the following page, fill it in and enclose it in the instrument package.

9.3 Health and safety clearance form

Declaration concerning safety, potential hazards and safe disposal of waste, e.g. used oil.
Safety and health of our staff, laws and regulations regarding the handling of dangerous goods, occupational health and safety regulations, safety at work laws and regulations regarding safe disposal of waste, e.g. waste oil, require that for all pumps and other products this form must be send to our office duly completed and signed before any equipment is repaired or dispatched to our premises.
Products will not be accepted for any procedure and handling and repair / DKD calibration will not start before we have received this declaration.

a) Fax or post a **completed copy of this form** to us in advance. The declaration must arrive before the equipment. **Enclose a second, completed copy with the product.** If the product is contaminated you must notify the carrier **(GGVE, GGVS, RID, ADR)**.
b) Inevitably, the repair process will be delayed considerably, if this information is missing or this procedure is not obeyed. We hope for your understanding for these measures which are beyond our control and that you will assist us in expediting the repair procedure.
c) **Make sure that you know all about the substances which have been in contact with the equipment and that all questions have been answered correctly and in detail.**

1. Product (Model): .....

2. Serial No.: .....

3. List of substances in contact with the equipment or reaction products:

3.1 Chemical/substance name, chemical symbol:

a) .....
b) .....
c) .....
d) .....

3.2 Important information and precautions, e.g. danger classification

a) .....
b) .....
c) .....
d) .....

4. Declaration (please mark as applicable):

¤ **4.1 for non dangerous goods:**

We assure for the returned product that
- neither toxic, corrosive, bilogically active, explosive, radioactive nor contamination dangerous in any way has occurred.
- the product is free of dangerous substances.

The oil or residues of pumped media have been drained.

¤ **4.2 for dangerous goods:**

We assure for the returned product that
- all substances, toxic, corrosive, biologically active, explosive, radioactive or dangerous in any way which have pumped or been in contact with the product are listed in 3.1, that the information is complete and that we have not withheld any information.
- the product, in accordance with regulations, has been
¤ cleaned
¤ decontaminated
¤ sterilized

5. Way of transport / carrier:

.....

Day of dispatch to Büchi Labortechnik AG:

.....

We declare that the following measures - where applicable - have been taken:

- The oil has been drained from the product.

Important: Dispose of according to national regulations.

- The interior of the product has been cleaned.
- All inlet and outlet ports of the product have been sealed.
- The product has been properly packed, if necessary, please order an original packaging (costs will be charged) and marked as appropriate.
- The carrier has been informed about the hazardous nature of goods (if applicable).

Signature: .....

Name (print): .....

Job title (print): .....

Company's seal: .....

Date: .....

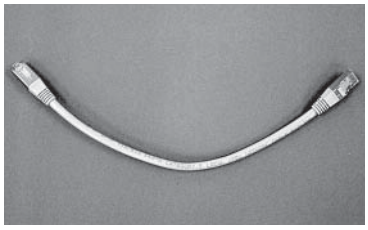
10 Spare parts and accessories

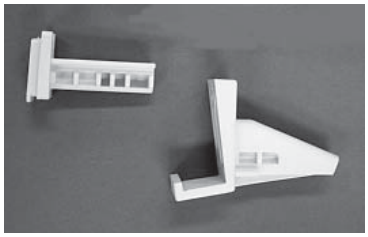
This chapter lists spare parts, accessories, and options including their ordering information.
Order the spare parts from Buchi. Always state the product designation and the part number when ordering spare parts.
Use only genuine Buchi consumables and genuine spare parts for maintenance and repair to assure good system performance and reliability. Any modifications to the spare parts used are only allowed with the prior written permission of the manufacturer.

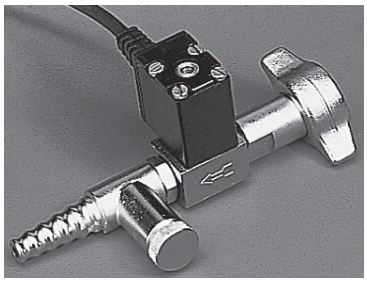
10.1 Spare parts

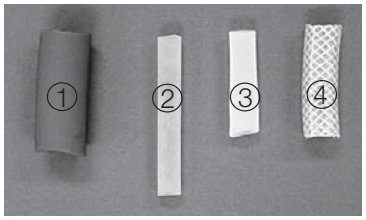
Table 10-1: Spare parts

Product	Order number
Secondary condenser complete, with receiving flask, 500 ml	47180
① Secondary condenser	47181
② Clip	03275
③ Receiving flask, 500 ml	00424
④ Insulating secondary condenser	47183
Secondary cold trap complete, with receiving flask, P+G coated	47190
Secondary cold trap, P+G coated	47191
Receiving flask, 500 ml, P+G coated	40774
Vacuum Module V-801 EasyVac	47202
Vacuum Module V-802 LabVac	47203
Manometer with needle valve complete (for manual vacuum control) including support for R-210/215, V-700/710 and V-850/855	47291









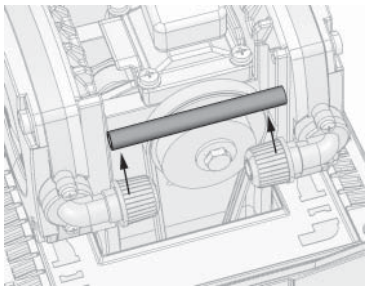
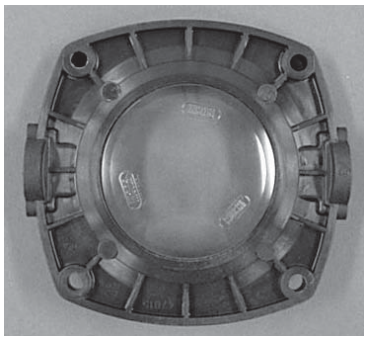
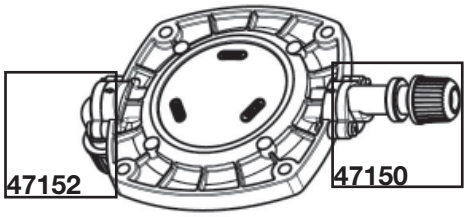
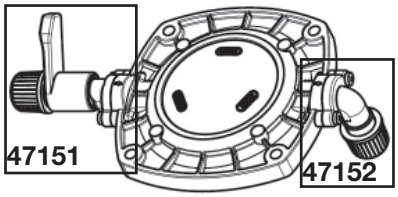


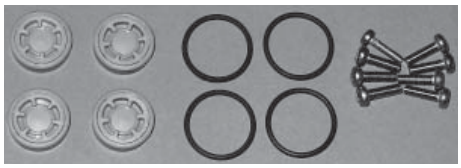
Table 10-1: Spare parts (cont.)

Product	Order number
Control cable between vacuum controller and Vacuum Pump RJ 45, 330 mm (speed control)	44288
Control cable for Vacuum Controller V-500/ V-1000, compatible with Vacuum Controller V-800/805	38010
Control cable between Rotavapor and Vacuum Pump RJ 45, 2000 mm (speed control)	44989
Support set for vacuum controller / manometer with needle valve for R-210/215, V-700/710	47280
Cooling water valve 24 V for Vacuum Controller V-800/805 and V-850/855	31356
Vacuum tube Ø 16/6 mm ①	17622
Cooling water tube silicone Ø 9/6 mm ②	04133
FEP hose, Ø 8.0 x 1.0 ③	27900
Nyflex tube Ø 14 x 8 ④	04113
Membrane complete including tongs	47153
FEP-tube	47066









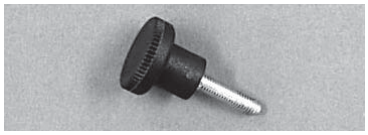


Table 10-1: Spare parts (cont.)

Product	Order number
Woulff bottle complete (with R-210/215 and V-700/710) for Vacuum Controller V-800/805 and V-850/855	47170
Woulff bottle glas part, P+G coated	47233
Holder for valve unit	47164
Pump head, 1 piece	47015
Outlet pump head complete, consisting of 1 pump head, outlet connector complete and angled connector complete	47009
Inlet pump head complete, consisting of 1 pump head, inlet connector complete and angled connector complete	47010
Outlet connector complete, including valve	47150
Inlet connector complete, including valve and gas ballast	47151
Angled connector complete, including valve	47152
Set of 4 valves, including O-rings and screws	47156
Silencer	47090
Knurled nut to fix the pump housing	46683

11 Declarations and requirements

11.1 FCC requirements (for USA and Canada)

English:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to both Part 15 of the FCC Rules and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.
This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Français:

Cet appareil a été testé et s'est avéré conforme aux limites prévues pour les appareils numériques de classe A et à la partie 15 des réglementations FCC ainsi qu'à la réglementation des interférences radio du Canadian Department of Communications. Ces limites sont destinées à fournir une protection adéquate contre les interférences néfastes lorsque l'appareil est utilisé dans un environnement commercial.
Cet appareil génère, utilise et peut irradier une énergie à fréquence radioélectrique, il est en outre susceptible d'engendrer des interférences avec les communications radio, s'il n'est pas installé et utilisé conformément aux instructions du mode d'emploi. L'utilisation de cet appareil dans les zones résidentielles peut causer des interférences néfastes, auquel cas l'exploitant sera amené à prendre les dispositions utiles pour palier aux interférences à ses propres frais.

11.2 Declaration of conformity

We BÜCHI Labortechnik AG
do hereby declare on our responsibility that the product:

Vacuum Pump V-700 / 710

which is the object of this certification, is in accordance with the following norms:

EN 61010-1:2001 (~ IEC 61010-1) Safety regulations for electrical measuring, control, regulation, and laboratory devices:
general requirements

EN 61326:2002 (~ IEC 61326) Electrical equipment for measurement, control, and laboratory use - EMC requirements

EN ISO 12100-1:2003 Safety of Machinery. Basic concepts, general principles for design - part 1 Basic terminology and methodology

EN ISO 12100:2:2003 Safety of Machinery. Basic concepts, general principles for design - part 2 Technical principles

In accordance with the regulations of the EU guidelines

73/23/EEC (electrical operating equipment/low-voltage guidelines)
89/336/EEC (electromagnetic compatibility)
89/392/EEC (machinery directive)

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