



# ARDO

## **Suction Pumps**

**MASTER 45**  
**SENATOR 30**

**SERVICE MANUAL**

# TABLE OF CONTENTS

<b>8. INTRODUCTION</b>	
Safety .....	3
Responsibility .....	4
Guarantee .....	4
Service .....	5
<b>9. TECHNICAL DESCRIPTION AND DIAGRAMS</b>	
Mechanical Layout .....	5
Electrical Layout .....	7
Wiring Diagram/Block Diagram .....	8
<b>10. MAINTENANCE</b>	
General Maintenance .....	9
Maintenance Works for Technical Personnel .....	9
<b>11. SERVICING AND REPAIRS</b>	
Troubleshooting .....	10
Accessories/Spare Parts .....	11
Replacing Spare Parts .....	17
Cylinder.....	17
Belt Drive .....	18
Wearing Parts .....	18
<b>12. TECHNICAL INFORMATION</b>	
Specifications .....	18
Transport and Storage .....	19
Disposal after Service Life .....	19

**Please also follow the enclosed  
OPERATING INSTRUCTIONS (*chapter 1-7*)!**

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## 8. INTRODUCTION

### Safety

The suction pumps are designed and constructed according to the safety regulations of IEC 601-1, the EMC standard IEC 60601-1-2 and EN 10079-1. For the user's and the patient's safety as well as to prevent equipment damage, please observe these safety rules:



#### **Safety Rules**

- The suction pumps **MASTER/SENATOR** may only be installed and operated by competent personnel.
- Use the suction pumps with the ARDO hydrophobic bacterial filter only.
- To ensure the proper venting of the pumps, the feet must be installed on the bottom of the pumps if used without trolley.
- Never start operating the suction pump when the housing is open (rotating parts – hazard of injury and electric shock).
- Capacitors may be charged even if device is without power. Discharge capacitors with discharge set!
- Check contact points of the housing for tears. If there are any tears, exchange housing.
- See that **MASTER/SENATOR** are set into operation according to *Chapter 4 - Installation* - in the operating instructions.
- Store the service manual in a safe place, so that it is available to the trained technical personnel at all times.



#### **General Safety Regulations**

- **Never use MASTER/SENATOR in the presence of ignitable gases as anesthetic agents. Explosion hazard!**
- **The suction pumps may only be opened by qualified technical personnel. Electric shock hazard!**
- **Always switch the suction pump off and disconnect from mains power before cleaning and opening. Electric shock hazard!**
- **Do not use solvents for cleaning. Otherwise the surface of the housing or the synthetic material parts may be damaged.**

## **Responsibility**

ARDO is only responsible for effects on safety, reliability and performance of the device, if:

- Installation, new adjustments, alterations or repairs and maintenance works are carried out by authorized persons.
- For repairs and replacements of spare parts use original parts by ARDO only.
- The electric installations of the respective room meet the requirements of the standards IEC 601 and MPG (*German Medicinal Products Act*), and if the devices are maintained and repaired according to this standard and to EN 10079-1.
- The pump is used in accordance with the operating instructions.

## **Guarantee**

The suction pumps **MASTER/SENATOR** have a guarantee period of 2 years.

**General Conditions** Ardo medical AG warrants for material and production faults of the manufactured products. The guarantee period can be taken from the respective operating instructions. Faulty material is replaced free of charge within the guarantee period, assumed the device was not used improperly. Wearing parts are excluded. For ensuring guarantee and faultless functioning of the device, the notes of the operating instructions have to be observed. Furthermore, only original spare parts by Ardo medical AG may be installed and/or used.

The right to guarantee is waived, when non-authorized persons interfere with the device or alterations not conforming to the standard IEC 601 and EN 10079-1 are carried out. There is no right to guarantee exceeding the described scope of guarantee, as liability to consequential damages etc.

**Maintenance** Read operating instructions *Chapter 5 - Maintenance and Care, Cleaning -*.

## Service

Please contact to the following addresses for service, maintenance or any questions about this product or any other product of Ardo medical AG:

<b>Switzerland</b>	Ardo medical AG Gewerbstrasse 19 CH-6314 Unterägeri Switzerland Tel. +41-(0)41 754 70 70 Fax +41-(0)41 754 70 71 info@ardo.ch www.ardo.ch
<b>Germany</b>	Ardo medical GmbH Argelsrieder Feld 10 D-82234 Oberpfaffenhofen Germany Tel. +49-(0)8153 / 40 66 00 Fax +49-(0)8153 / 40 66 01 info@ardomedical.de www.ardomedical.de
<b>International</b>	Authorized Importer

## 9. TECHNICAL DESCRIPTION AND DIAGRAMS

### Mechanical Layout

The ARDO suction pumps **MASTER/SENATOR** work according to the principle of a piston/cylinder system.

Both power units are based on a modular driving concept, equipped with 2 cylinder units.

**MASTER 45**                      2 cylinder power unit (approximately 300 rpm)

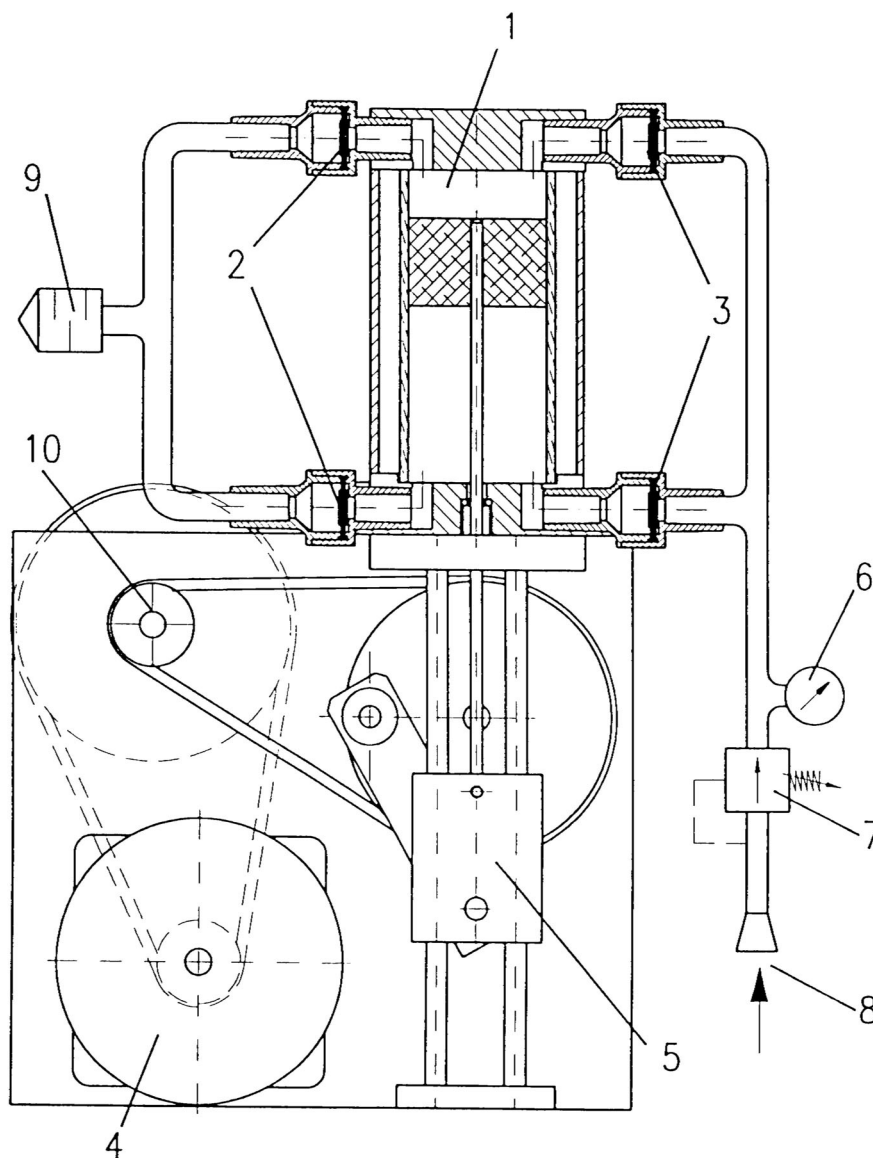
**SENATOR 30**                    2 cylinder power unit (approximately 220 rpm)

A two-stage belt transmission was developed for driving the cylinder units that may be used for both power units (**MASTER** and **SENATOR**).

Transmission reduction for the two power units can be adjusted with the two belt pulleys of the first reduction level (motor pinion + belt wheel = 1. level).

For both power units a bipolar capacitor motor with built-in temperature sensor is used. This protects the motor coil from heating to more than 125°C.

The piston is driven over a linear unit (slide). By using this system, the piston system is exposed to only minimal thrust forces, which ensures low wear and high service life. In **MASTER/SENATOR** the pistons work in angles of 90° to each other. This ensures a well-balanced run of the pump with low vibration levels.



- |                   |                              |
|-------------------|------------------------------|
| 1 Cylinder unit   | 6 Vacuum-meter               |
| 2 Discharge valve | 7 Vacuum regulator           |
| 3 Inlet valve     | 8 Vacuum connector           |
| 4 AC motor        | 9 Exhaust                    |
| 5 Linear drive    | 10 2-stage belt transmission |

## Electrical Layout

The driving motor is a bipolar capacitor motor and may be used for both power units (**MASTER** and **SENATOR**).

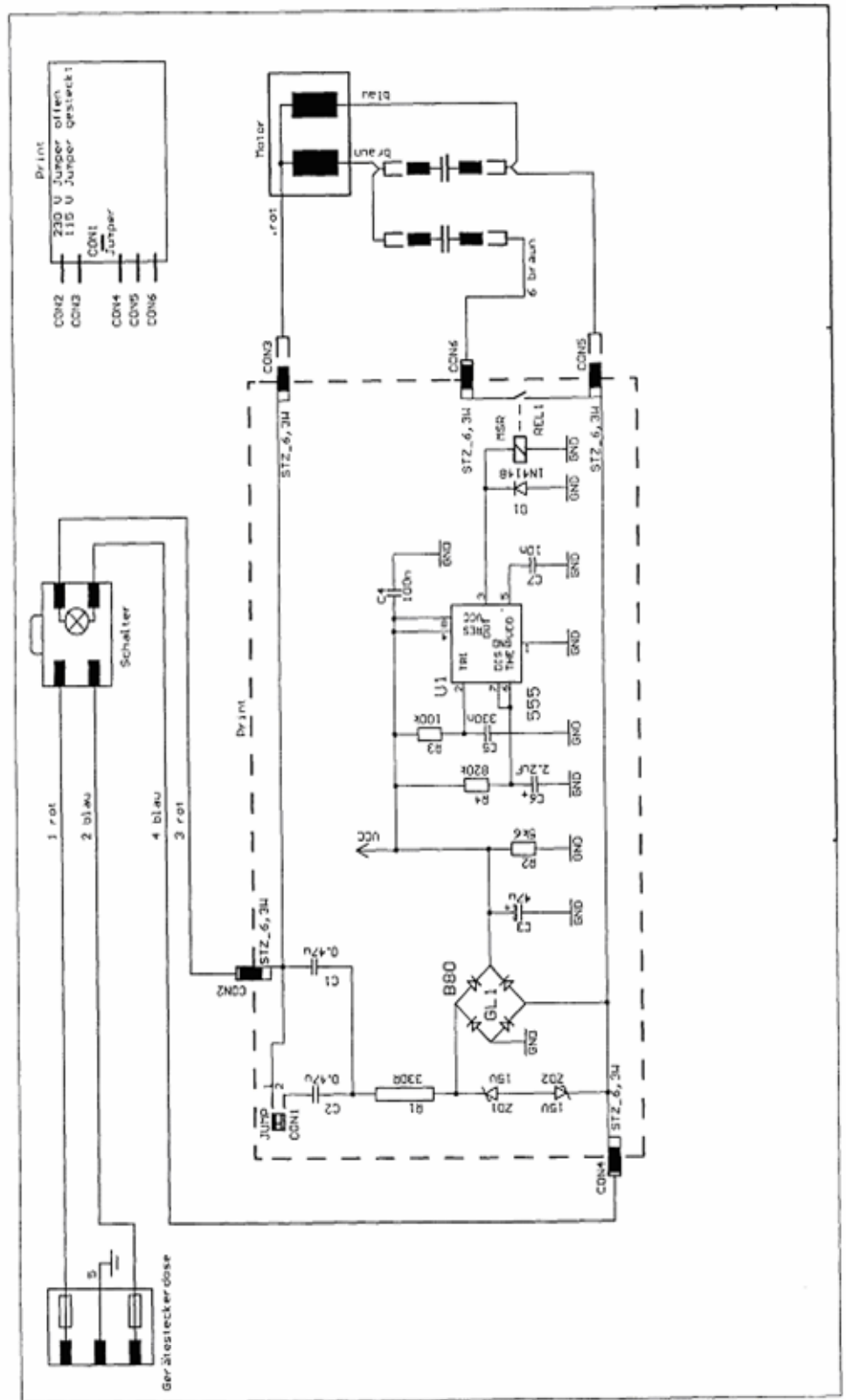
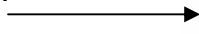
**MASTER** is equipped with a electronically controlled start-up circuit (Pushstart), so that the power unit starts also under difficult conditions (high vacuum with simultaneous mains undervoltage). This start-up circuit is also used in the **SENATOR** with 115V motor. This circuit increases the motor torque momentarily by parallel switching in a second start-up capacitor.

After approximately 3 seconds this second capacitor is switched off again, so that the motor is not overloaded during continuous operation.

This start-up circuit is activated each time the motor is powered up or mains power is interrupted.

# Wiring Diagram/Block Diagram grounded model

Circuit board "Pushstart"  
**MASTER 230V / 115 V**  
**SENATOR 115V**





# 10. MAINTENANCE

## General Maintenance

It is the user's obligation to perform a maintenance check at least once per year. If the manufacturer performs the maintenance check, a service confirmation is placed on the suction pump.



If you do not observe the procedures and cleaning instructions there is a danger of contamination!

## Maintenance Works for Technical Personnel

**General Maintenance** Maintenance works include the following tests:

- Checking of vacuum level, liter performance, function of vacuum regulator
- Leak test
- Check of tubing
- Safety check (electrical and mechanical parts)

### **Checking of**

Vacuum level, liter performance, function of vacuum regulator:

There are no specifications for these checks.

The permitted tolerances are:

- vacuum level  $\pm 5\%$
- liter performance  $\pm 15\%$

### **Leak Test**

- Connect 1 liter or 2 liter suction jar
- Pinch off the patient tubing
- Switch pump on and turn vacuum regulator to maximum vacuum level
- When maximum vacuum level of approximately 85kPa has been reached, switch pump off and observe vacuum meter. After 1 minute, vacuum level should not have decreased more than 10kPa, otherwise complete sealing is not guaranteed.

### **Check of Tubing**

- Check tubings on cleanness\* and damages.  
\*If an overflow has occurred, pack suction pump in a synthetic material bag and dispose of, after clarification with the customer.

### **Safety Check**

Electrical and mechanical parts

- Check power connection on damages. Check moving power unit parts on abrasion or damage (cylinder system, ventilator).
- According to IEC 601 and EN 10079-1, the measuring of the leakage current (using the safety tester) has to be carried out after maintenance or service works.

**Access to power unit** The device must be disconnected from mains power



**before opening the housing!**

- Dismount fitting rail
- On each side, unscrew two Phillips screws
- Unscrew another two Phillips screws on the bottom side of the device
- Pull back housing backplane
- The power unit can now be accessed



**Caution! Capacitors may be charged even if device is without power. Discharge capacitors with discharge set!**

## 11. SERVICING AND REPAIRS

For repairs and replacements of spare parts use original parts by ARDO only. The item numbers can be found in the Accessories/Spare Parts list. Technical documentations from ARDO including diagrams, descriptions and adjustment instructions are available to authorized personnel.

### Troubleshooting

<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
Green signal lamp on the ON/OFF switch is not illuminated after activation	<ul style="list-style-type: none"> <li>- Power plug does not sit properly in the socket</li> <li>- No power supply</li> </ul>	<ul style="list-style-type: none"> <li>- Check connection in wall socket</li> <li>- Check power supply (main fuse)</li> <li>- Check device fuse</li> </ul>
Signal lamp is illuminated, but device is not working or does not start up	<ul style="list-style-type: none"> <li>- Power unit overheated</li> <li>- Faulty electronics</li> </ul>	<ul style="list-style-type: none"> <li>- Check ventilation inlets on bottom and handle side for free airflow</li> <li>- Overheat protection may respond, if the device is poorly ventilated</li> <li>- Replace Pushstart</li> <li>- Motor defect</li> <li>- Replace Capacitor</li> </ul>
Poor or no suction capacity or not enough vacuum	<ul style="list-style-type: none"> <li>- Leak in vacuum system</li> <li>- Defective cylinder system</li> <li>- Missing or defect o-ring on plug nipple or filter housing</li> </ul>	<ul style="list-style-type: none"> <li>- Check internal tubing connections and replace if necessary</li> <li>- Replace retention valves (mind correct placing of blocking side)</li> <li>- Replace complete cylinder unit if necessary</li> <li>- Replace o-ring</li> </ul>

## Accessories/Spare Parts

<b>Product</b>	<b>Item No.</b>
- Hydrophobic bacterial filter	50.00.05
- 1 liter suction jar, TPX, graduated	50.00.50
- 2 liter suction jar, TPX, graduated	50.00.51
- 3 liter suction jar, polysulfone, graduated	50.00.52
- 5 liter suction jar, polysulfone, graduated	50.00.53
- Lid with handle and mechanical overflow safety device, for suction tubing ND 8 mm	50.00.08
- Lid with handle and mechanical overflow safety device, for suction tubing ND NW 12.7 mm	50.00.10
- Connection tubing with 2 angled coupling connectors, 0.5 m	50.00.01
- Seal for lid	99.00.544
- Coupling connector, angled, ND 8 mm, green	50.00.85
- Coupling connector, angled, ND 8 mm, transparent	50.00.86
- Coupling connector, angled, ND 12.7 mm, transparent	50.00.87
- O-Ring in silicone Ø 8.1 mm, white	99.00.303
- O-Ring in silicone Ø 14 mm, white	51.00.17
- Silicone tubing, transparent, Ø 7/13 mm, sterilisable, per meter	50.00.47
- Silicone tubing, transparent, Ø 12.7/18 mm, sterilisable, per meter	50.00.46
- Retainer for float	50.00.83
- Float	50.00.84

## Overview on Spare Parts shown on pages 13-16

### MASTER 45 (230V/115V)

Pos.	Item No.	Product
1	32.00.02	Housing <b>MASTER</b>
10	32.00.12	Power unit <b>MASTER</b> 230V
10	32.00.24	Power unit <b>MASTER</b> 115V
15	32.00.16	Capacitor set 230V <b>MASTER</b> (3.5 $\mu$ F /400V and 6 $\mu$ F /400V)
15a	32.00.17	Capacitor set 115V <b>MASTER/SENATOR</b> (14 $\mu$ F /250V and 18 $\mu$ F /250V)
17	32.00.06	Circuit board "Pushstart" ( <b>SENATOR</b> only for 115V)

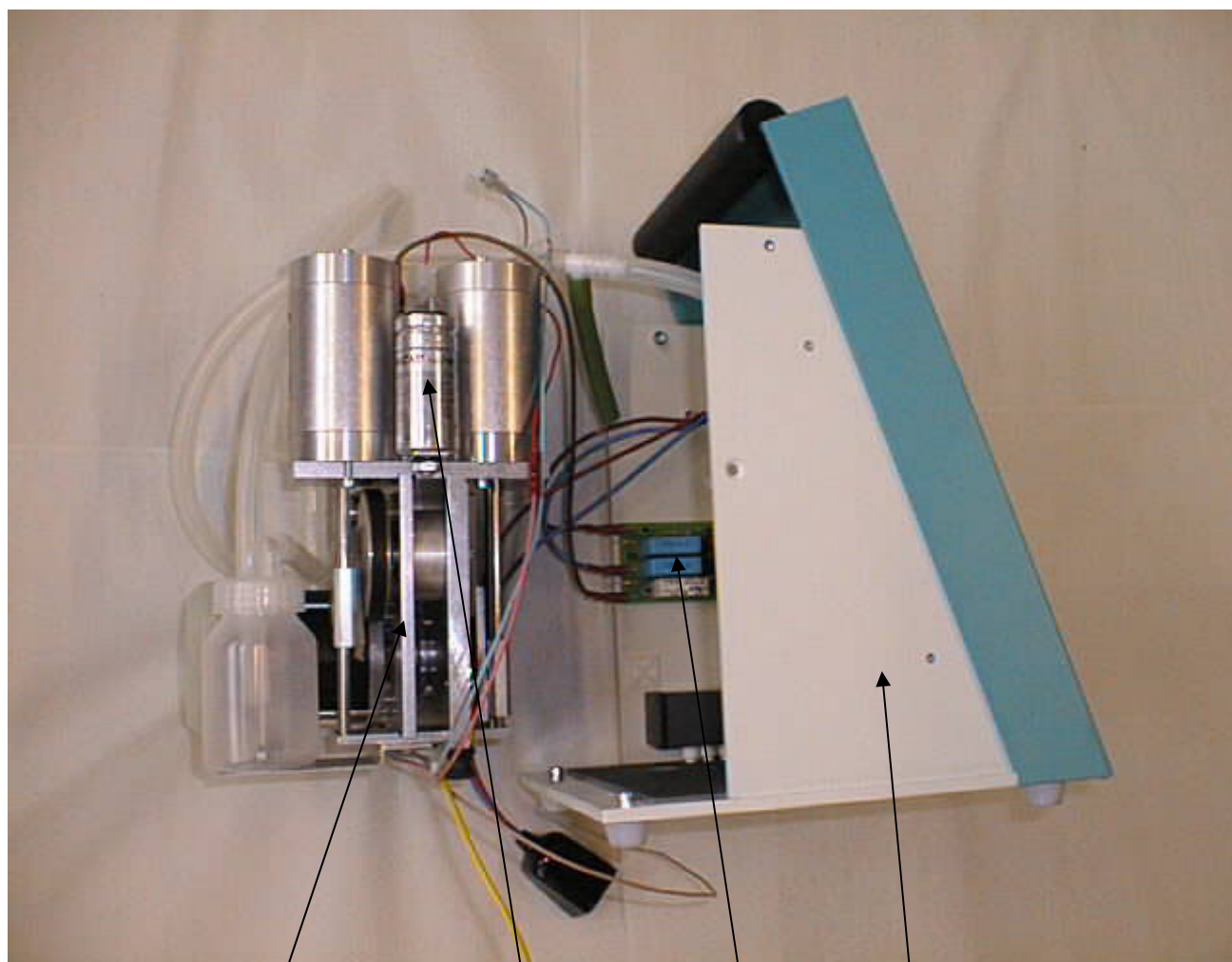
### SENATOR 30 (230V/115V)

Pos.	Item No.	Product
1	32.00.18	Housing <b>SENATOR</b>
10	32.00.19	Power unit <b>SENATOR</b> 230V
10	32.00.23	Power unit <b>SENATOR</b> 115V
14	32.00.20	Capacitor 230V / 3.5 $\mu$ F/400V
15a	32.00.17	Capacitor set 115V <b>MASTER/SENATOR</b> (14 $\mu$ F /250V and 18 $\mu$ F /250V)

### MASTER 45 and SENATOR 30 (230V/115V)

Pos.	Item No.	Product
#	32.00.03	Main socket complete
#	32.00.04	Fuse T630mA (230V)            10 pcs
#	32.00.25	Fuse T1.6A (115V)            10 pcs
4	99.00.693	Power switch
5	32.00.07	Vacuum-meter
6	32.00.08	Pneumatics set
7	32.00.09	Rubber shock-absorber set
8	32.00.10	Vacuum regulator complete
#	32.00.11	Valve set 8 pcs
11	32.00.13	Slide block 1
12	32.00.14	Slide block 2
13	32.00.15	Cylinder
17	32.00.06	Circuit board "Pushstart" ( <b>SENATOR</b> only for 115V)
#	32.00.21	Turn knob with pointer
#	32.00.01	Unit bases
#	99.00.328	Shipping packaging complete
#	32.00.22	Ground-compensate set
#	=	not shown in the pictures

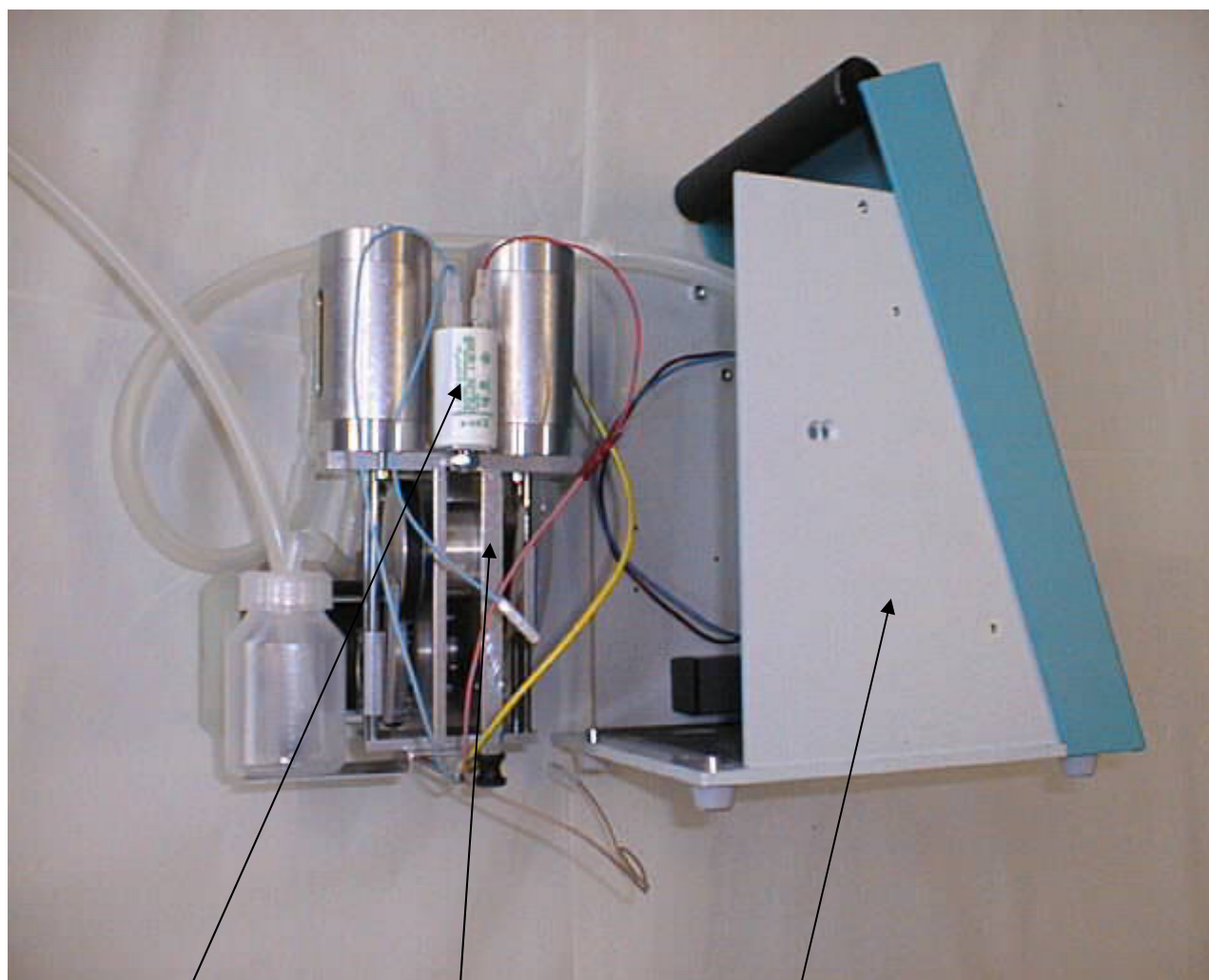
## MASTER 45 (230V/115V)



Pos. 10      Pos. 15 (15a)      Pos. 17      Pos. 1

<b>Pos.</b>	<b>Item No.</b>	<b>Product</b>
1	32.00.02	Housing <b>MASTER</b>
10	32.00.12	Power unit <b>MASTER</b> 230V
10	32.00.24	Power unit <b>MASTER</b> 115V
15	32.00.16	Capacitor set 230V <b>MASTER</b> (3.5 $\mu$ F /400V and 6 $\mu$ F /400V)
15a	32.00.17	Capacitor set 115V <b>MASTER/SENATOR</b> (14 $\mu$ F /250V and 18 $\mu$ F /250V)
17	32.00.06	Circuit board "Pushstart" ( <b>SENATOR</b> only for 115V)

## SENATOR 30 (230V/115V)



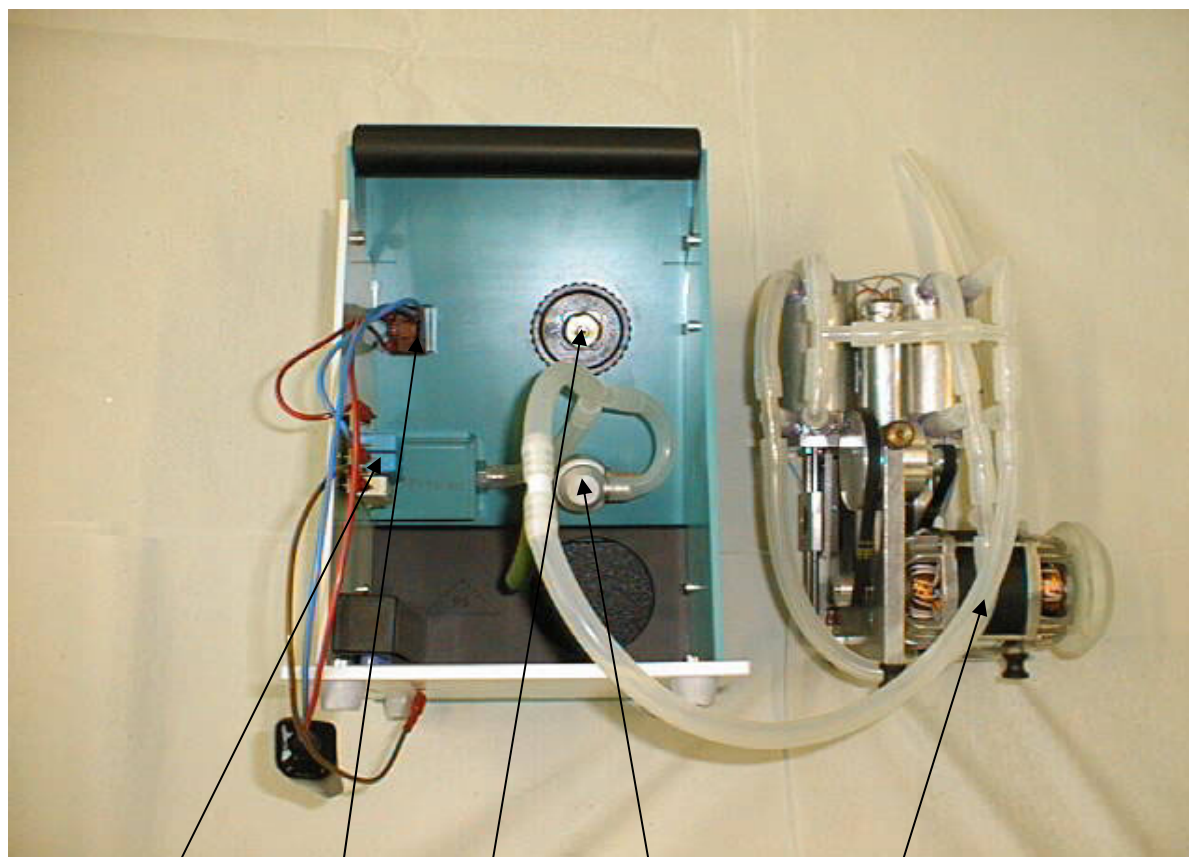
Pos. 14 (15a)

Pos. 10

Pos. 1

Pos.	Item No.	Product
1	32.00.18	Housing SENATOR
10	32.00.19	Power unit SENATOR 230V
10	32.00.23	Power unit SENATOR 115V
14	32.00.20	Capacitor 230V / 3.5 $\mu$ F/400V
15a	32.00.17	Capacitor set 115V MASTER/SENATOR (14 $\mu$ F /250V and 18 $\mu$ F /250V)

## Tubing MASTER 45 / SENATOR 30



Pos. 17

Pos. 4

Pos. 5

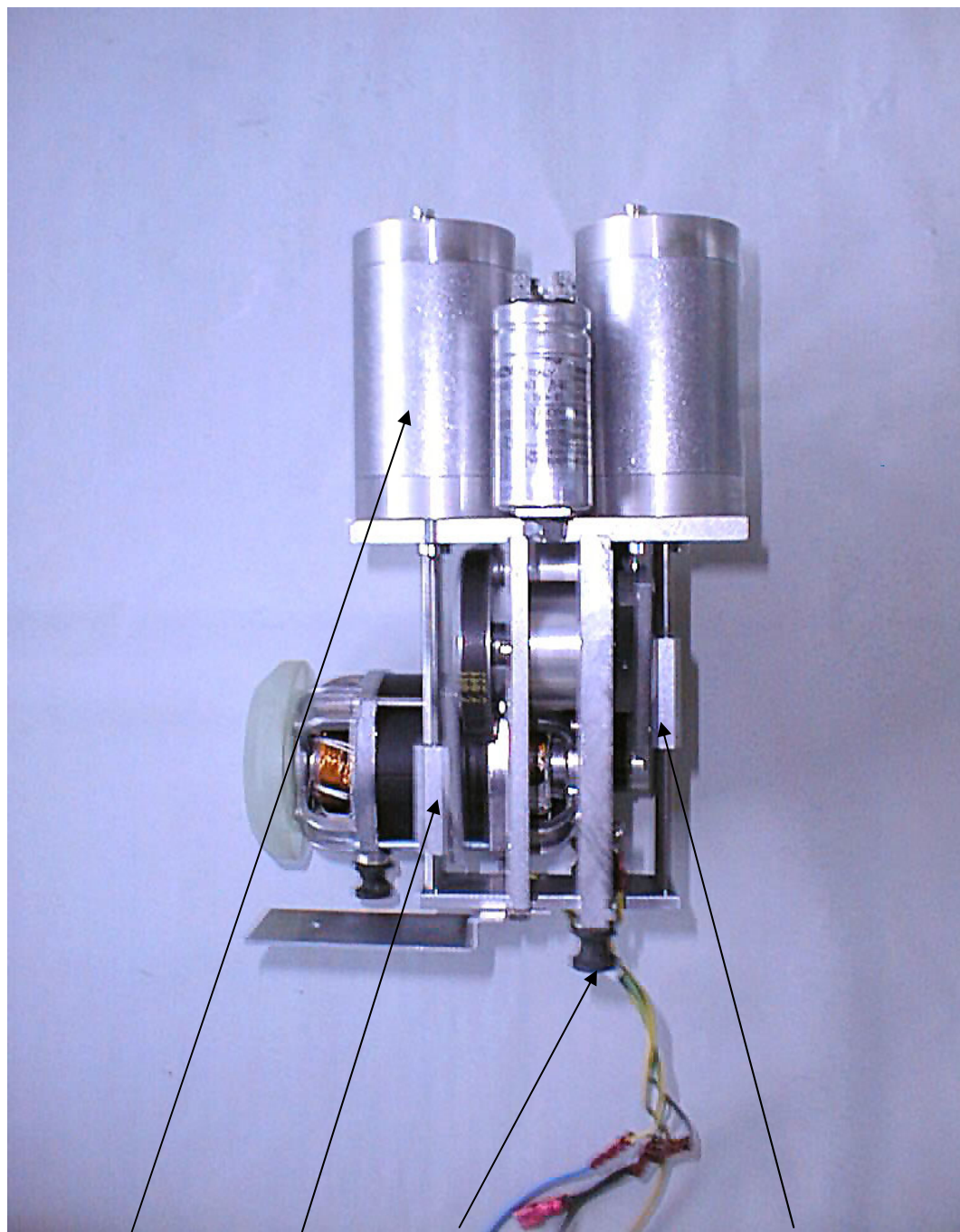
Pos. 8

Pos. 6

<b>Pos.</b>	<b>Item No.</b>	<b>Product</b>
4	99.00.693	Power switch
5	32.00.07	Vacuum-meter
6	32.00.08	Pneumatics set
8	32.00.10	Vacuum regulator complete
17	32.00.06	Circuit board "Pushstart" ( <b>SENATOR</b> only for 115V)



## Power unit MASTER 45 / SENATOR 30



Pos. 13

Pos. 11

Pos. 7

Pos. 12

<b>Pos.</b>	<b>Item No.</b>	<b>Product</b>
7	32.00.09	Rubber shock-absorber set
11	32.00.13	Slide block 1, complete
12	32.00.14	Slide block 2
13	32.00.15	Cylinder, complete



## Replacing Spare Parts



Always disconnect the suction pumps **MASTER/SENATOR** from mains power before opening.

Only technical personnel may replace components or repair the suction pumps **MASTER/SENATOR**. Due to reasons of functional safety and testing, replacement is limited to mechanical parts and individual electrical components. When using foreign parts or carrying out non-authorized works on the suction pump, we refer to operating instructions *Chapter 6 - Guarantee* -. Replacing components shall be carried out according to the specification, the processes and/or the photographic illustrations. If difficulties arise, please contact the manufacturer Ardo medical AG.

## Cylinder

### **Dismantling**

Initial position; power unit tray is dismantled from the housing

- Loosen the two fixing screws on the cylinder base
- Loosen mounting of the piston rods on the slide
- Slide complete cylinder with piston rod up and out

### **Assembly**

- Place cylinder from above on the cylinder holder
- Insert a 0.3 mm feeler gauge between cylinder holder and cylinder
- Set slide to the lower dead center
- Pull piston rod all the way down (do not damage mechanically!)
- Fix on slide with Allen screw
- Pull out feeler gauge and adjust cylinder
- Tighten both Allen screws on the cylinder foot

Assembly of the second cylinder is done analogously.



**CAUTION!** Glass cylinders and graphite pistons must never be exchanged or combined with another cylinder. These two components are specially designed for alignment.

### **Valves**

If device is contaminated or vacuum performance is poor, check valves on cleanness and damage.

- The valves are fixed in place by a two-component epoxy adhesive (araldite)

## Belt Drive

The belts must be checked annually for extensive wear.

## Wearing Parts

Ardo medical AG recommends to check the following wearing parts annually and replace them if necessary:

- Inlet and outlet valves on the cylinder
- Mechanical drive
- All tubing connections
- Rubber cushions of the power unit

## 12. TECHNICAL INFORMATION

### Specifications

#### Suction Pump MASTER 45

MASTER 45 suction pump 230 Volt, 50/60 Hz  
MASTER 45 suction pump 115 Volt, 60Hz

#### Suction Pump SENATOR 30

SENATOR 30 suction pump 230 Volt, 50/60Hz  
SENATOR 30 suction pump 115 Volt, 60Hz

SENATOR 30 double protection on request

- Dimensions without trolley: 345 x 245 x 282 mm
- Dimensions with trolley: 1000 x 470 x 680 mm
- Weight without trolley: 7,4 kg
- Weight with trolley: 21 kg
- Protection class grounded: Class I (with ground safety wire)
- Protection level: BF  
Drip-proof IPX1
- Double protection SENATOR 230V: Class II
- Protection level: BF  
Drip-proof IPX1
- Classification acc. to MDD93/42: Class 2a
- Rated voltage: 230/115 Volt AC +/- 15%
- Rated current: 50/60Hz
- Power consumption  
230V → 100W/0.45A  
115V → 100W/1.00A
- Fuse:  
230V → T630mA  
115V → T1.6A
- Suction capacity: MASTER 45 → 45 l/min.  
SENATOR 30 → 30 l/min.
- Vacuum range: 10 to 85kPa  
75 to 640mmHg

- Conformity:  
to the standard MDD 93/42 EEC  
of 14.7.1993 concerning medical devices  
EN 60601-1, EN60601-1-2, EN 10079-1
- UL 2601-1 (115V)

CE 0123



## Transport and Storage

**MASTER/SENATOR** shall be transported and stored in the original packaging only.  
We recommend a separate storage, protected from UV, heat and dust.

### **Transport and storage up to 15 weeks**

For transport and storage periods up to 15 weeks, the following storage conditions are valid:

- Temperature: -25°C to +70°C
- Relative humidity: 10% to 75%
- Air pressure: 500hPa to 1060hPa

### **Transport and storage for more than 15 weeks**

After this period, the operating condition values are valid:

- Temperature: +10°C to +40°C
- Relative humidity: 30% to 75%
- Air pressure: 700hPa to 1060hPa

## Disposal after Service Life

For disposal of a disused **MASTER/SENATOR**, the decontaminated suction pump may be sent back to the manufacturer or, after disinfection, separated into materials (metals, synthetics) and disposed of environment-friendly by an electronics recycling company. After decontamination, there are no special or increased risks.

### Manufacturer:

Ardo medical AG  
Gewerbstrasse 19  
CH-6314 Unterägeri  
Switzerland