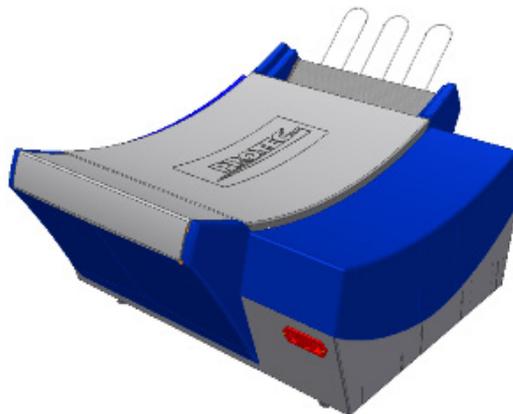


ECOMAX[™]

Film Processor Operation Manual



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Machine No.:

Type:

Installation Date:

Status:

Subject to change

August 2007/1.2

EU-Declaration of Conformity

PROTEC® declares, that the product

Description: ECOMAX™
Machine type: X-Ray-Film Processor
Model no. 1186-x-0000
 x is a number between 1 and 9

conforms to the following harmonized standards:

Safety: IEC 61010-1:2001; DIN 1988 T4:12/1988; UL 3101-1; CSA 22.2-1010-1
EMC: EN 61326:1997 + A1:1998; EN 61000-3-2:1995 + A1/A2:1998 + A14:2000;
 EN 61000-3-3:1995

according to the regulations of:

- the Medical Device Directive 93/42/EEC “Class 1”,
- the Low Voltage Directive 73/23/EEC and the
- EMC Directive 89/336/EG

Supplementary guidelines:

- DIMDI: DE / 0000042967
- WEEE: DE 55471807

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Information on Liability

This manual has been checked for correctness. The instructions and specifications were correct at the time it was published. Future models may have modifications without prior notice.

PROTEC® does not take responsibility for damage caused directly or indirectly by error, omission or non-conformity of the manual.

Introduction

The ECOMAX™ processor is a compact, automatic table-top processor. Due to the precision roller transport system, sheet films can be processed. The film materials are developed, fixed, rinsed and dried. The ECOMAX™ has been fitted with an automatic film-registration and a Stand-by mode. The developing solutions are temperature-regulated, circulated and automatically replenished.

These Operating Instructions contain important instructions for installation, operation and servicing of the machine. Please read the provided information carefully to ensure reliable and satisfactory operation of your ECOMAX™.

Intended Use

The X-ray film processor **ECOMAX**[™] is intended exclusively for the purpose describe in the introduction above.

X-ray film processors (MDD class I) are employed in “medical” applications (medical products directive) and “non-medical” applications (electrical appliances and EMC directives).

Intended use includes observing the operating instructions, the installation instructions and adherence to the safety notes.

Any application differing from intended use voids the guarantee by **PROTEC**[®].

The owner of the machine will be liable for damages resulting from unintended use or faulty application.

Intended use includes adherence to all statutory regulations concerning occupational safety and radiation protection applicable at the operating site.

Technical Specifications

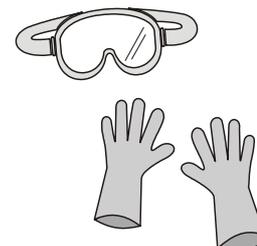
Film transport:	Continuous roller transport system
Film formats:	In general: sheet films up to max. 35.8 cm (14.1") width; Smallest film format 10x10 cm (4x4 ").
Processing capacity:	74 films 24x30 cm (10x12 ") per hour (standard model, feed film crosswise)
Process time:	Standard 100 s
Linear speed:	Standard 37 cm/min. (14.5 in/min)
Developer time:	Standard 29 s
Tank capacities:	Developer, fixer 2.3 litres each (0.51 gal) and water tank 2.1 litres (0.46 gal)
Circulation system:	Developer and fixer are continuously circulated by a circulation pump
Replenishment:	Automatic replenishment by film detection, in relation to film length
Developer temperature:	Ex works set to 32 °C (89.6 °F) In exceptional cases can be set by a technician
Fixer temperature:	Adjusted to developer temperature by heat exchanger.
Water connection:	Permissible water pressure 2 - 10 bar (29 - 145 psi), permissible water temperature 5 - 30 °C (41 - 86 °F).
Water consumption:	1.0 litres per minute (0.26 gal/min) when processing.
Drain capacity:	7 litres per minute (1.85 gal/min).
Noise level:	Less than 60 dB(A).
Heat emission:	Operation: 0.1 kJ/s, Development: 1.1 kJ/s
Environmental conditions:	1) Temperature 18 - 40 °C (51.6 - 104 °F), ventilated room, room temperature should be lower than set bath temperature. 2) Relative humidity lower than 80% up to 31 °C (80 °F), linearly decreasing to 50% at 40°C (104°F) 3) Height above sea level less than 2000 m (6666 ft.) 4) Indoor use
Pollution degree:	2
System protection:	IP 20

Electrical connections:	<p>Electrical specifications are indicated on the model nameplate.</p> <p>Type 1186-1-0000: 230 V±10%, 5.8 A, 50 Hz.</p> <p>Type 1186-2-0000: 230 V±10%, 5.8 A, 60 Hz.</p> <p>unit conforms to IEC 1010 (EN 61010, VDE 0411) overvoltage category II</p> <p>Type 1186-3-0000: 110 / 120 V~ ±10%, 12 A, 60 Hz, Type 1186-6-0000 110 / 120 V~ ±10%, 12 A, 50 Hz unit conforms to UL 3101 and CSA 22.2-1010 overvoltage category II</p>
Power consumption:	<p>Operation: 0.12 kWh</p> <p>Development: 0.9 kWh</p>
Weight (unit):	<p>Empty 26.5kg (58.3 lbs)</p> <p>Filled 34 kg (74.8 lbs)</p>
Dimensions (LxWxH):	88x66x42 cm (34.7x26.4x17.0 ")
Floor space required:	0.58 m ² (6.2 sqft)

Safety Instructions

To ensure the safe operation of this processor, installation and use should always conform to the instructions contained in this manual.

The developer and fixer chemicals used in the processor should be handled according to the manufacturers instructions. In general: Undiluted chemicals are caustic. For this reason, chemicals should be handled very carefully. Avoid contact with skin, always wear protective clothing, gloves and glasses when handling the chemicals - for example, when mixing and refilling. Also when taking the racks out for cleaning or servicing. If chemicals have come in your eyes, rinse the eyes immediately with cold, running water for approximately 15 minutes and contact a medical doctor afterwards. Inhalation of chemicals can be dangerous to your health and should be avoided. For this reason, always ensure that the room in which the processor is installed is adequately ventilated.



Environmental regulations regarding the storage and disposal of waste chemicals should be obtained from the local water authorities and complied with.



Before opening the unit, switch off the unit and unplug it from the electrical socket. Service and repairs must be performed by trained service technicians only. Use only manufacturer's replacement parts.



Installation

1. Requirements for installation

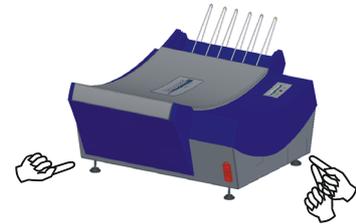
- a. Fresh water connection: Shut-off tap, thread with 3/4" outside diameter (washing machine connection), Water pressure 2 - 10 bar (29 - 145 psi).
- b. Drainage connection: Plastic tube - inner diameter 50 mm (2") or larger. A ventilated syphon which serves as odour preventor should be included in the planning. The drainage tubes should be installed with a decline of minimum 5 %.
Local Water Authorities regulations should be complied with.
- c. Electrical connection: Fused wall socket with earth connection according to electrical data (see technical specifications, [page 7](#)). It is also required to install an earth-leakage switch (with 25 A / 30 mA nominal error current).



Electrical connections should be carried out according to regulations by an electrician.

2. Transport

Due to the weight and dimensions of the film processor **ECOMAX™** should always be carried by two persons. To do so, hold the machine on the sides of the bottom pan (see figure). While putting the machine down, watch the position of the levelling feet to prevent damaging these.



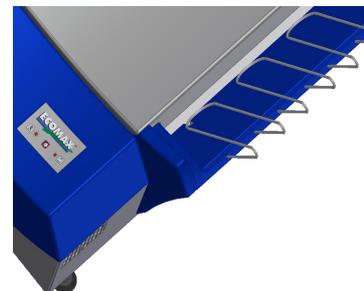
3. Set-Up

Unpack the Processor. Remove light protection cover and machine cover, remove roller racks, begin with the developer roller rack (red).

Remove the brackets for film output from the packaging and press them into the openings on the rear of the film output until they snap into place. Be sure the long side of the bracket points inward and touches the film output on top (see figure).

Table-top installation

In the event that the processor is to be installed on a work top or table, the four adjustable feet should be screwed on.



Attention!
Machine should not be installed on table-top without adjustable feet. The ventilation openings under the machine must not be blocked, as this can cause overheating.

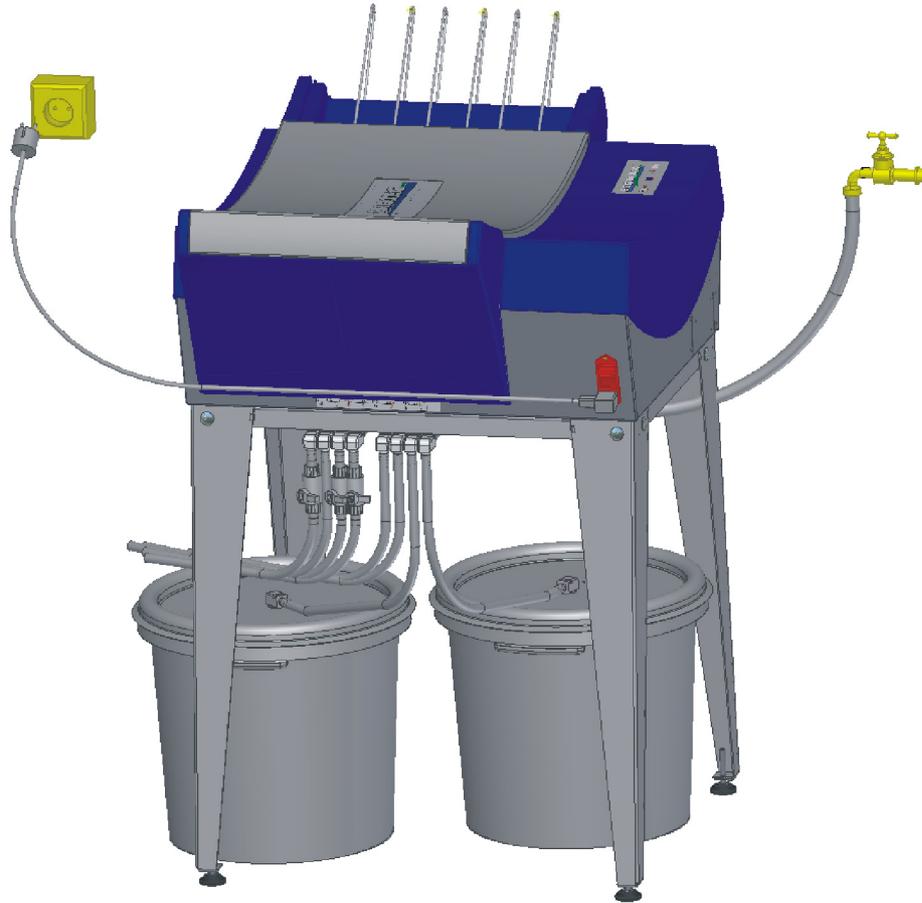
Unit with Worktable

If the unit is set up on a worktable (optional accessory), the unit should be screwed to the worktable. Mount the unit as outlined in the manual (included with the worktable).

Finally the processor needs to be levelled:

Place spirit level across the walls of the baths and adjust the levelling feet accordingly (on the unit itself or on the worktable). Reinstall the roller racks in the unit and lock them; begin with the dryer roller rack.

4. Connecting the processor



Water connection: Connect the water hose which comes out from the processor's back to the fresh water supply.

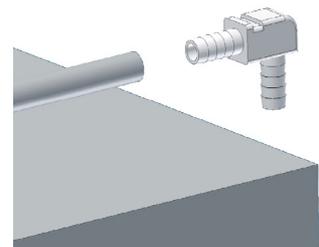
All other hoses (see diagram [page 10](#)): First cut off the pre-installed hoses at the film processor so that the angle stubs protrude somewhat beyond the edge of the table (see figure). Connect the enclosed hoses at the front of the machine according to the colour system. Put hose clip (enclosed in accessory bag) over hose end, before attaching to connection. Warm up hose end (with hot water or lighter) and push onto the respective connection. Finally push clip over hose and connection.

Cut hoses to required length. Then integrate the stop cocks into the three drainage hoses in such a position, that they are easy to reach.

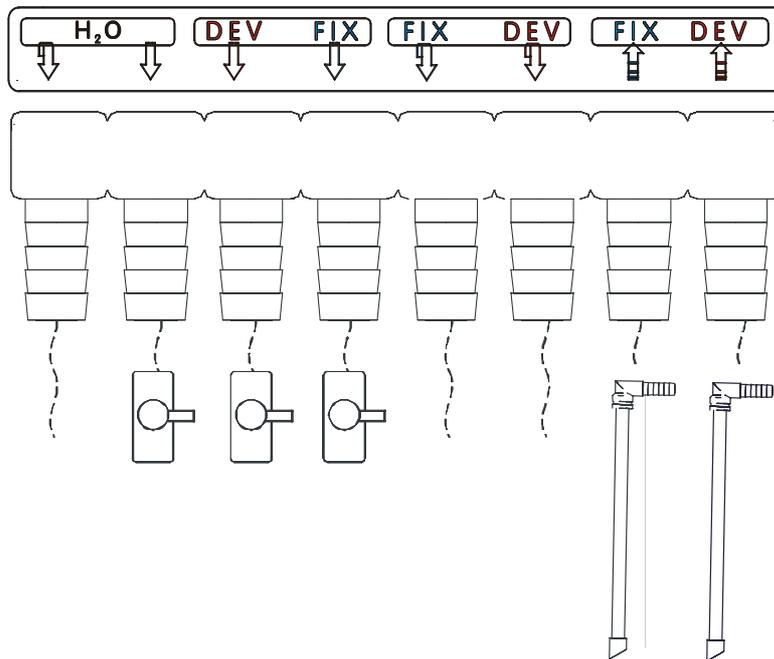
Using the hose clips, connect the suction pipes to the ends of the hoses for the replenishment tanks. Feed the suction pipes through the cover opening into the respective replenishment tanks and snap them in to place.

The overflow and drainage hoses from the developer and fixer should be guided into their respective collecting containers.

The overflow and the drainage of the water can either be guided into the drainage syphon or into respective collection containers.



Hose Connections



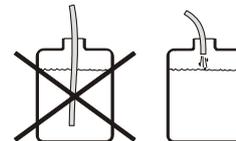
Pay attention to the correct colour connections:

Developer:	red;		Replenishment
Fixer:	blue;		Overflow
Water:	clear		Outlet



Danger of Overflow!

Use the included cable ties (accessory bag) to secure the hoses. Fix all hose ends which lead into the syphon or collecting container, so that they do not drop into the liquid.



Very important:

The hose piping should be straight (without the hoses going up and down) with a constant decline. The hoses should be as short as possible and without bends and kinks. This is very important for the water overflow hose. Bad water overflow piping work may cause the machine to overflow!



Inform yourself of the local water board regulations regarding drainage. These regulations may differ from information in this manual, but they should be complied with.



If the machine is installed table-top, ensure that the table is stable enough and does not wobble.



Initial Operation

1. Test run



Important!
Processor should not be run dry!

- a. Close the three drainage stop cocks and fill the tanks and replenishment containers with water. Open water inflow tap. Connect electrical socket and switch the machine on. Water now flows into water tank. The circulation pump activates, however the hosing of the machine must be ventilated.
- b. Ventilation of the replenishment pump:
Switch the machine off again. Open the stop cocks of the developer and fixer for five seconds and switch machine on again. Repeat this procedure until no more air bubbles are visible in the developer and fixer baths and until the circulation pump runs quietly.
- c. Ventilation of the circulation pump:
If air is in the circulation pump, a loud running noise can be heard. Switch the machine off again. Open the stop cocks of the developer and fixer for five seconds and switch machine on again. Repeat this procedure until no more air bubbles are visible in the developer and fixer baths and until the circulation pump runs quietly.
- d. Check all hose connections for leakage. Switch machine off and drain water out.

2. Filling the Processor with Chemicals

Prepare chemicals inside the replenishment containers according to manufacturers instructions.

Filling the processor manually

By using a suitable container, pour chemicals into the respective tanks. First the fixer and then the developer. Caution: when filling, be sure that chemicals do not splash from one bath into another. When fixer solution is mixed with developer solution, the developer chemical is destroyed.

Snap each suction pipe into the respective cover of its replenishment container and close it carefully. Place containers under processor.



Important!
The machine should not be switched on in dry condition (no water/chemicals filled in), since the circulation pumps would otherwise run dry and be damaged.

Automatic filling of the unit / manual replenishment:

- a. The chemicals containers need to be filled manually with at least 0.5 litres of fresh chemicals, to ensure the pumps will not run dry.
- b. Switch the machine off.
- c. Keep the film detection switch pressed when switching the machine on again.
- d. Release the film detection switch. The replenishment pump will now run for 9 minutes or until the machine is switched off again. This function can also be used for manual replenishment.



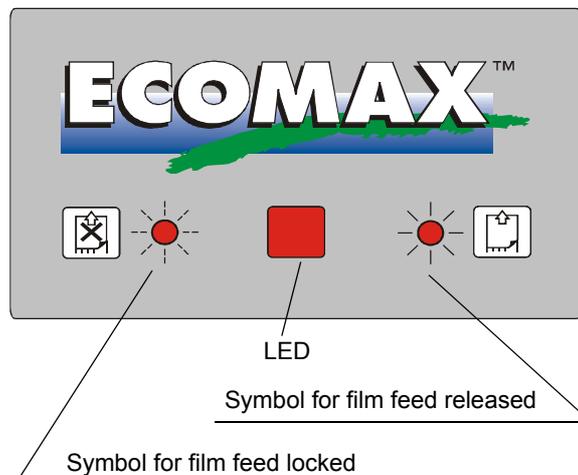
Warning, hot surface!

Operation

Short Overview and Front Panel Pad

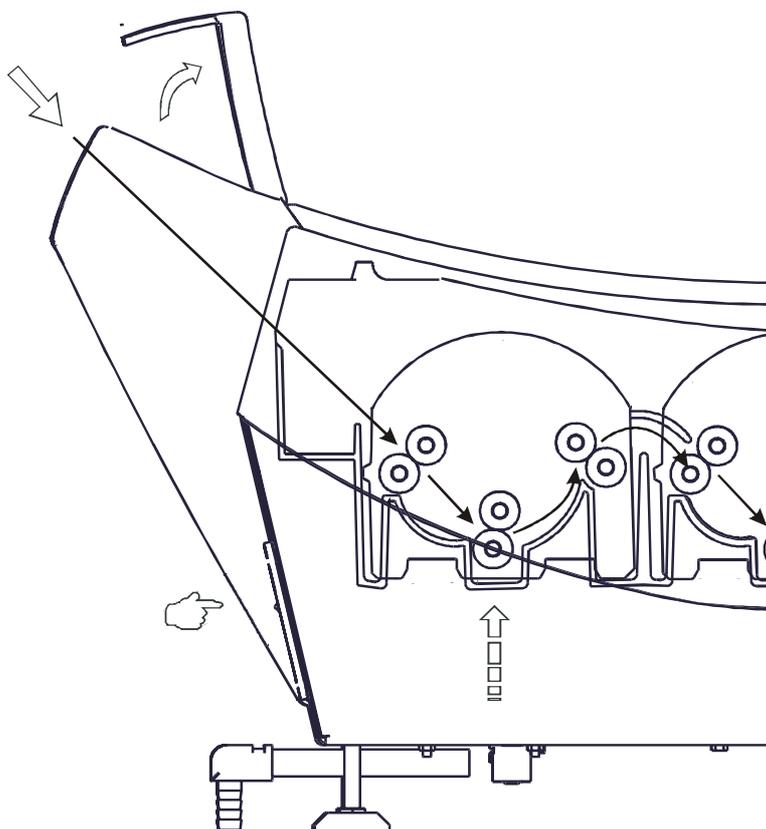
Functions

- Feeding film**
 Before feeding the next film wait until the LED stops flashing, but is continuously on. An acoustic signal additionally indicates that the next film can be inserted.
- Power (ready to operate)**
 The LED is on as long as the unit is on.
- Warming up**
 During warm-up the LED flashes; before feeding the next film wait until the LED stops flashing, but is continuously on. The end of the warm-up phase is indicated by an acoustic signal. If you try to insert a film during warm-up, an interval sound will occur permanently.
- Bath heating failure**
 If the developer temperature is not reached within 30 minutes, the LED starts flashing rapidly and an interval sound occurs permanently.



Important!

Safety function stops film transportation when cover is removed. Therefore keep cover placed on the machine when processing films.



Before use...

1. Close water-drainage stop cock.
2. Open water tap.
3. Switch processor on.
4. Check liquid level in replenishment and drainage collecting containers.
5. Wait until the developer temperature is reached. The LED stops flashing when the heat-up phase is completed.
6. Run cleaning films through processor.

Working procedure

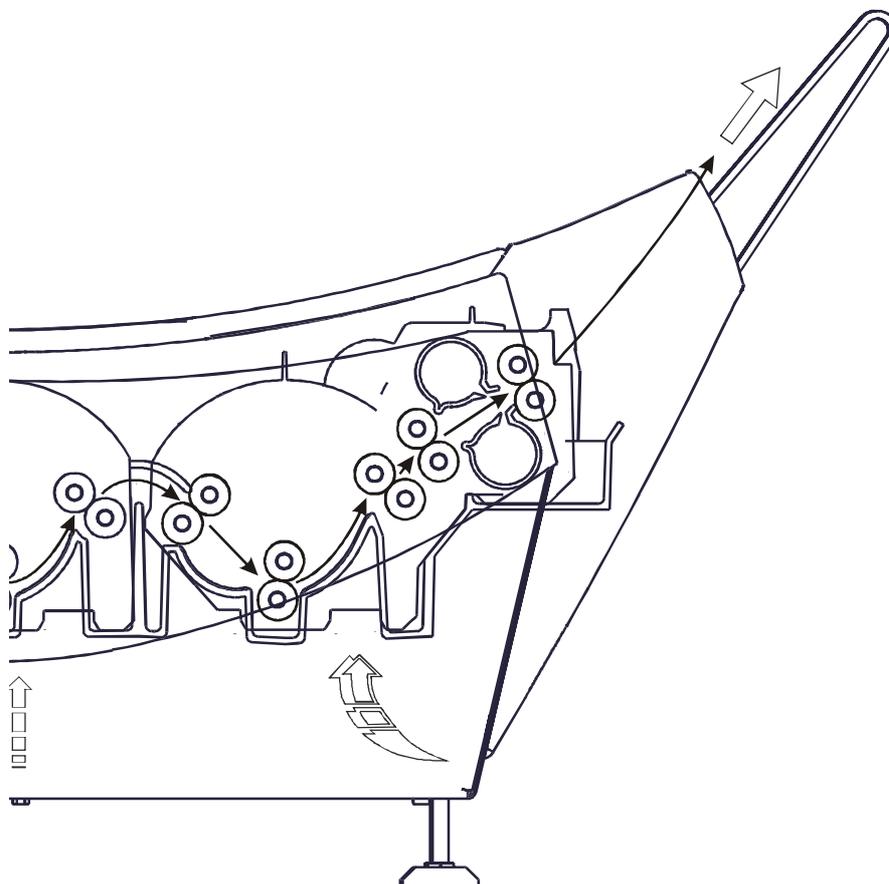
7. Processing films:
Open light protection cover. Important: Put film first on *left* side of infeed tray and then feed in. During processing films please watch the "Feeding film" LED. If it flashes, wait until it stops before feeding the next film; the LED must be continuously on and an acoustic signal must indicate that it is okay to feed a film.

After work...

8. Switch the unit off.
9. Close water tap.
10. Open water-drainage stop cock and drain water out of the machine.

Stand-by mode

When no film is being processed, the machine switches to Stand-by. The chemicals remain at a constant temperature. The film feed, the replenishment pumps and the water supply are switched on briefly at regular intervals, to prevent crystallisation of chemicals on the transport rollers and oxidation of the chemicals. A film can be inserted at any time.



Do not place any object on the processor.

Switching on the machine

The processor is switched on at the main switch (front right). The developer bath will be heated up. The LED flashes during the warm-up phase and no X-ray film must be inserted into the machine during this time. When the machine is ready, a acoustic signal is heard and the LED is on continuously.

Display “Infeeding film”

If films are fed into the processor without gap one after another, then this may cause a film jam. The “Feeding film” LED flashes as long as a film is fed. Once the film has been fed completely the LED is on continuously. Additionally an acoustic signal indicates that the next film can be inserted.



Both chemicals pumps - for fixer and developer - are driven in parallel by only one motor and therefore always run simultaneously. The regeneration volumes for developer and fixer thus are identical.

Anti-crystallisation function

During the stand-by mode, the film transport, the dryer ventilation, the dryer heating and the water inflow are activated every 20 minutes for a period of 20 seconds. This prevents the build-up of crystals on the rollers.

Anti-Oxidisation Function

Also during the stand-by, the developer chemicals are subject to change which causes their deterioration. By means of the time replenishment, a replenishment cycle is activated after 60 minutes without replenishment. The pump runs for 10 seconds. With this function, the quality of the developer chemicals are maintained even when standing idle for long periods.

Automatic replenishment

Depending on the processed amount of films the chemicals are replenished automatically. This is done by pumping chemicals from the replenishment containers. The surface area of the film processed is calculated on the basis of the film detection switch at the film feed. For every 40 seconds that the film detection switch is activated, a regeneration cycle of 13 seconds is started; thus a volume of fresh chemicals is introduced that is adequate for the film length processed. This corresponds to a regeneration rate of 600 ml pro m² of film at a film width of 35 cm. The chart below shows the replenishment rate in ml per m² film surface in relation to film width and setting of the pump.

REPLENISHMENT RATE				
Setting of the replenishment pump*				
100 % (85 %)**				
75 % (62 %)				
Setting of the replenishment time by the controller				
Film width	13 s	10 s	13 s	10 s
35 cm	600 ml/m ²	470 ml/m ²	450 ml/m ²	350 ml/m ²
24 cm	870 ml/m ²	690 ml/m ²	650 ml/m ²	520 ml/m ²
18 cm	1150 ml/m ²	920 ml/m ²	875 ml/m ²	690 ml/m ²

*Setting at 50 Hz current resp. settings at 60 Hz current are in brackets

**Standard setting

Care

Daily Care

Before use...

- Remove dirt and dust from film-infeed with soft cloth.
- Run 2 - 3 cleaner films through the processor to remove all accumulated dirt and dust from the rollers.
- Check the liquid level in the replenishment containers and if necessary refill.
- Leave light protection cover open when no film is in the processor. This avoids condensation on infeed.

After use...

- When work has been completed at the end of the day, drain water out of the machine. This avoids the growth of algae in the water.



Attention: Do not allow liquids to enter the interior of the unit. Liquids may cause damage to the processor.

Weekly Care

The developer chemicals cause residue buildup in the machine. This residue has a negative effect on the developing process of the film material. For this reason the processor should be regularly cleaned. Proceed as follows:

1. Switch the machine off, lift of light protection cover and cover.
2. Loosen the securing latches of the roller racks (red, blue and beige) on the drive shaft.
3. Remove the roller-racks. First remove the developer rack (red). Then remove the fixer (blue) and dryer (black) racks one after the other. The roller racks of the developer and the water bath can be removed and inserted easier if you tilt them a little.
4. Rinse all racks thoroughly under warm running water and then leave to drain off. Use a soft sponge (do not use scouring-pad, as this would scratch the rollers!) and remove the pollution from the rollers.
5. Replace the racks: Red = Developer, Blue = Fixer. Black = rinsing/dryer. Begin with the dryer, proceed with the fixer and last insert the developer rack. Ensure that the racks are properly placed and do not forget to lock the drive shafts.
6. Re-install machine cover and light protection cover; be sure these are properly placed; check that the machine cover actuates the cover switch.
7. Clean processor outer shell with damp cloth. Do not use aggressive cleaners or solvents.



Important notes:

When removing the rinsing / drying roller-rack, ensure that no water gets into the film dryer air channel.

For removal, the rinsing / drying roller-rack must first be turned toward the film output, then it can be lifted out.

Thorough Cleaning

Every three months (maybe earlier) a thorough cleaning is necessary, depending on the quantity of films processed. Tank cleaners are available for developer and water baths. The fixer bath is cleaned with water. When preparing chemical tank cleaners, follow manufacturer's instructions explicitly.

How to proceed:

1. Switch the machine off and empty all tanks by opening the stop cocks.
2. Remove light protection cover and machine cover and wait until the tanks are drained completely; then close the stop cocks again. Now fill the fixer-tank with water. Prepare cleaner solutions for developer and water baths and fill into respective tanks.
3. Remove suction pipes from the replenishment containers and place them in a water filled bucket. Attention: Do not add chemical cleaners here!
4. Install the machine cover and switch the machine on.
5. Start film transportation and keep it running for 10 to 20 minutes. After the heat-up phase, place a film in the feed so that it activates the film switch but will not be pulled into the processor. During the operation with water, the installed roller racks will be cleaned.
6. Important: After completion of tank cleaning, the tank should be rinsed thoroughly with clean water. To do this, fill the machine with fresh water twice and each time, let the machine run for a 10 minute period. Empty the tanks and re-close the stop cocks.
7. Remove the service cover. Take out the roller-racks and rinse them thoroughly with running water. Remove remaining dirt from the rollers by using a sponge and clean thoroughly. Doing this, the rollers can be turned by turning the drive shaft. Reinstall the roller-racks in the machine.
8. Refill the tanks with respective chemicals. Replace the suction pipes into the replenishment containers. In certain circumstances the circulation system must be ventilated: see [page 11](#), item 1c.
9. For quality check, process test films.

Before you go on holiday...

or if your processor will not be in use for longer than two weeks, all the chemicals have to be drained from the tanks. In case you don't want to do a complete tank cleaning at once, then fill the tanks after emptying, with water.



Attention: Do not use alcohol containing solvents to clean the machine!



The colour changes in the baths is normal; it is caused by the properties of the chemicals!

Maintenance / Disposal

Maintenance Protocol

Installation

Name:	Machine type:	Serial number:
Technician:	Training:	by:
Telephone:	Date:	Guarantee until:

Parameters Set

Developer temp.:	Dryer temp.:	Cycle time:
Dev. reg. volume:	Dev. reg. volume:	Anti-oxidation:
Developer:	Fixer:	Film type:
Changed by:	Date:	

Developer temp.:	Dryer temp.:	Cycle time:
Dev. reg. volume:	Dev. reg. volume:	Anti-oxidation:
Developer:	Fixer:	Film type:
Changed by:	Date:	

Developer temp.:	Dryer temp.:	Cycle time:
Dev. reg. volume:	Dev. reg. volume:	Anti-oxidation:
Developer:	Fixer:	Film type:
Changed by:	Date:	

Maintenance work performed (see [page 19](#))

Maintenance work performed				
Date:	Date:	Date:	Date:	Date:
Name:	Name:	Name:	Name:	Name:
next maintenance:				

Maintenance work performed				
Date:	Date:	Date:	Date:	Date:
Name:	Name:	Name:	Name:	Name:
next maintenance:				

Maintenance work performed				
Date:	Date:	Date:	Date:	Date:
Name:	Name:	Name:	Name:	Name:
next maintenance:				

**Attention:**

Never start the machine up unless it is filled with liquid!

Recommended Maintenance Work:

1. Functional check
film intake / film transport / replenishment / bath heating / dryer heating / water supply
2. Cleaning
 - 2.1. Switch off machine, remove cover
 - 2.2. Empty all three tanks
 - 2.3. Close drain cocks and fill tanks with water
 - 2.4. Install cover, switch machine on
 - 2.5. Fill two additional containers with water, place the suction pipes in these containers and activate the film intake until the replenishing system is filled with water
 - 2.6. Switch machine on for a few minutes
 - 2.7. Switch machine off
 - 2.8. Empty all tanks
 - 2.9. Prepare tank cleaning agent for developer and water tank according to manufacturer's instructions

**Attention:**

Do not use chlorine containing cleaning agents!

- 2.10. Fill developer and water tank with tank cleaning agent (**do not use the replenishment pumps to do so**)
- 2.11. Fill fixer tank with water
- 2.12. Place suction pipes into empty tanks
- 2.13. Install cover, switch machine on
- 2.14. Wait until the operating temperature is reached, (observe information concerning temperature, time, cleaning procedure contained in the datasheet of the tank cleaning agent)
- 2.15. Activate the transport (activate film intake)
- 2.16. After approx. 15 minutes (observe information concerning temperature, time, cleaning procedure contained in the datasheet of the tank cleaning agent) switch film transport off
- 2.17. Remove cover, neutralise developer tank (observe information concerning temperature, time, cleaning procedure contained in the datasheet of the tank cleaning agent)
- 2.18. Switch machine off
- 2.19. Empty all three tanks
- 2.20. Fill machine with water and switch it on
- 2.21. Put suction pipes into vessels with water
- 2.22. Activate the film intake until the replenishing system is filled with water
- 2.23. Check all pumps for tightness
- 2.24. Switch machine off
- 2.25. Drain tanks
- 2.26. Fill tanks 3/4 with water
- 2.27. Switch machine on
- 2.28. Activate film transport for a few minutes
- 2.29. Switch machine off and drain all three tanks
- 2.30. Repeat item 2.20 to 2.29 if required (observe information e. g. regarding temperature, time and cleaning procedure outlined in tank cleaner datasheet)

- 2.31. Remove roller racks from the machine and remove dirt under flowing water using a soft rag or sponge
- 2.32. Remove residual dirt particles from the tanks
- 2.33. Clean all toothed gear wheels, axles, bearings and rollers, check them for damage (replace if required)
- 2.34. Clean inlet plate using a soft rag
- 2.35. Align roller racks and re-insert them in machine
- 2.36. Fill machine with chemicals
- 2.37. Switch machine on
- 2.38. Feed cleaning film (approx. 4 pieces)
- 2.39. Check function as described under item 1.
- 2.40. Perform sensitometric test



Be sure to dispose properly of used machines.

Used machines contain valuable materials that should be recycled and turned over for proper treatment. Please be sure to turn used machines over to approved recycling centers.

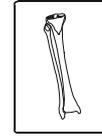
Problems and Solutions

Advice on Film Defects

Your processor has been constructed for long term use. However, if irregularities occur, you will find help to locate the problem below. Please check the listed points, before calling your service-technician.

Films do not have enough density

- Bath temperature is too low.
- Developing time too short.
- Exposure time is too short.
- Replenishment rate of developer too low.
- Developer chemicals are exhausted or too strong diluted: Renew.
- Fixer solution has been mixed into developer: Renew. Clean and rinse bath well before refilling.
- Circulation is broken down.



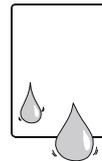
Too high a density

- Bath temperature too high.
- Developing time too long.
- Exposure time is too long.
- Replenishment rate of developer too high.
- Developer chemicals are too high diluted: Renew.
- After renewing chemicals: Starter is missing.
- Circulation is broken down.



Films will not dry

- If warm air comes out of the air channel in the dryer, chemicals and film type should be checked.
- Fixer solution is exhausted or diluted.



Film has a yellow-green surface

- Not fixed correctly. Check the film type and fixer chemistry.
- Fixer solution is exhausted or diluted. Replenishment rate of fixer is too low.

Scratches, pressure marks, dirt on film

- Prior to processing films, run cleaner films through the processor.
- Pressure marks caused by careless handling, finger nails etc.
- Rollers are polluted. Clean tanks and roller racks.



Cloudy film

- Level in developer is too low.
- First guide bar of fixer rack is dirty (condensate or crystals). Clean roller-racks.
- Developer is old or circulation not working.
- Try processing films by infeeding them with emulsion side up.



Advice on Machine Errors

Unit does not switch on

- Ensure that electrical plug is firmly inserted into socket.
- Ensure that electrical socket has power supply by testing with an appliance (e.g. tablelight).



Film is not drawn in

- Place cover correctly on machine, ensuring that the cover switch on the right rear side is activated.

Machine does not start automatically

- Film switch left side at the infeed has not been pressed down. Feed in the film to activate the switch.

Developer temperature too low

- Developer heating is defective
- Capillary tube controller is defective or its adjustment is faulty - call service technician

Replenishment pump does not pump

- Check whether the replenishment containers are full and that the end of the suction pipe is positioned under the liquid level.
- Check whether there is air in the replenishment hoses. If this is the case, check the hose connections.

Rinsing water does not flow

- Open water inflow tap.
- The water pressure in the water supply system is too low: Minimum pressure 2 bar (29 psi).

Water tank overflows

- Water drainage hose (overflow) is bent. The hose end should be positioned above the drainage level in the syphon (see diagram on [page 10](#)).
- Check water drain opening in the tank and the hose for blockage and residues. The drainage hoses should have a constant fall.

The film does not transport correctly

- Film is fed in and gets caught in the machine: Check the positioning of the racks in the machine and make sure that the latches on the drive shaft are closed.



Important notes:

Ensure correct seating of roller racks; keep the lock closed at all times.

Don't operate processor with empty replenishment tanks.

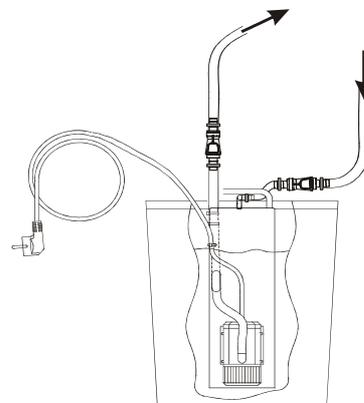
After a long machine shut down check bath level and refill if necessary.

Accessories

Water circulation system

For use of the film processor machine without permanent water supply connection

The water circulation system is a simple but effective accessory for installation sites that do not offer permanent water supply connection. It is comprised of a water reservoir with integrated circulation pump and hoses with stop cocks. Due to the separate power supply connection the water circulation system is immediately ready to operate. The proven circulation pump supplies the water from the reservoir to the water bath of the machine. From there the water flows back to the water reservoir via the overflow. A closed circuit results.



Technical Specifications

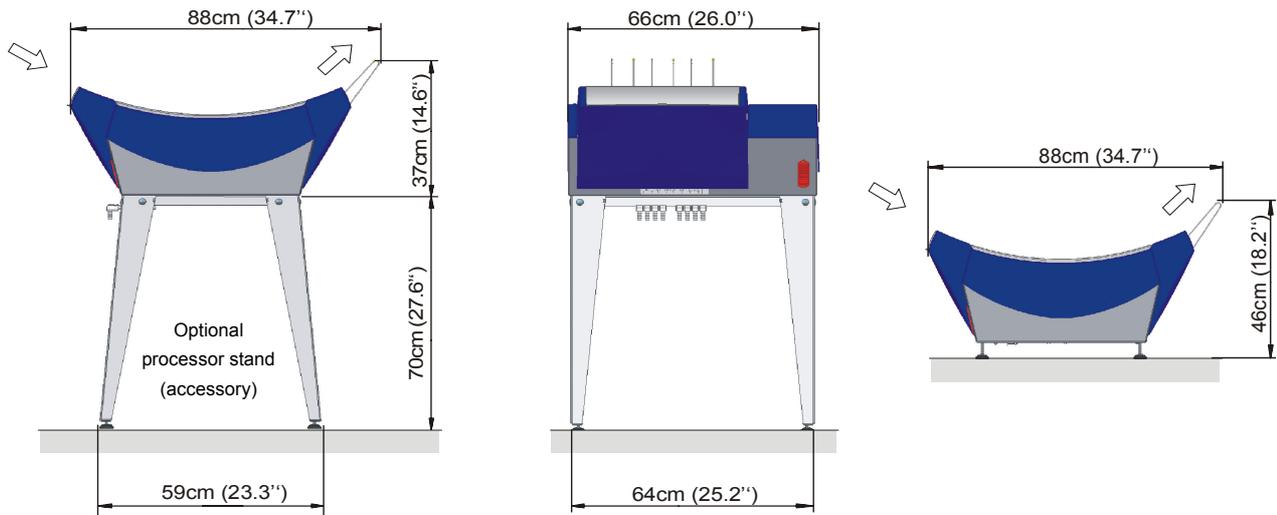
Tank volume:	25 litres
Circulation system:	Water is circulated by a rotary pump installed between water reservoir and water bath
Noise level:	Less than 58 dB(A)
Pump volume:	60 l/h
Max. pumping height:	1000 mm
Water connection:	No supply connection required
Environmental conditions:	Room temperature, 18-40°C
Electrical connections:	220 V/50 Hz or 220 V/60 Hz 110-120 V/60 Hz
Power consumption:	10 W
Weight:	5 kg empty, 30 kg filled
Floor space required:	0.03 m ²

Service Manual

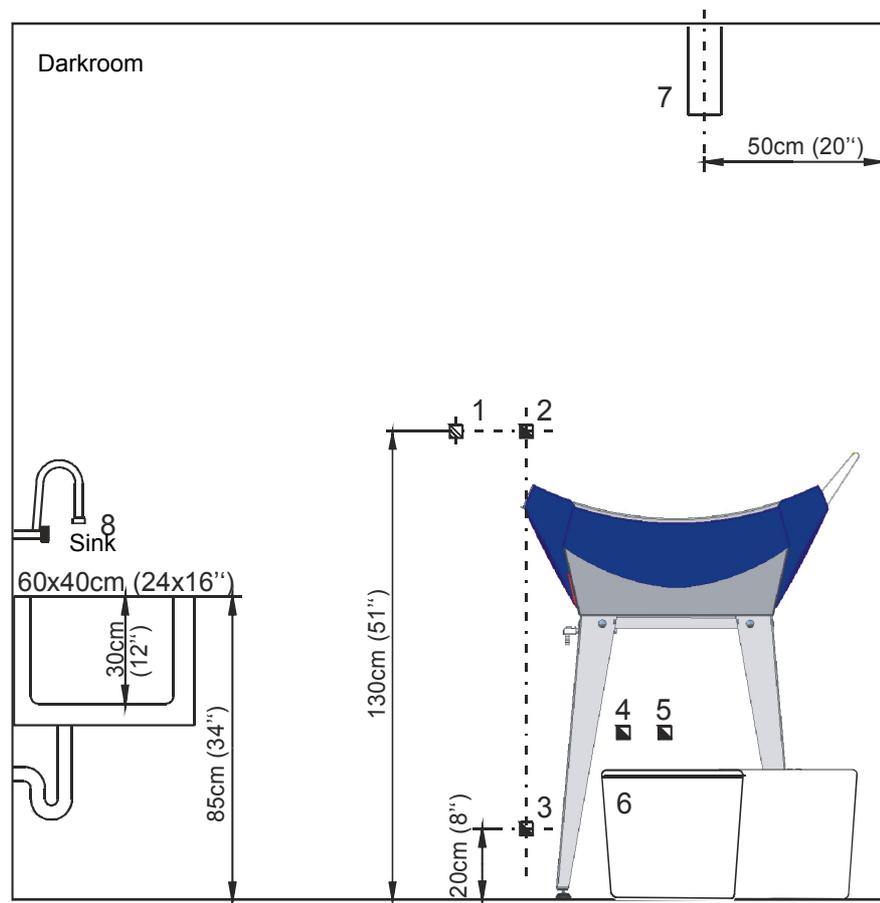
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Installation Data



1. Wall socket 220-240 V, 16 A or 110 V, 15 A (depending on machine model). Power supply should be equipped with earth-leakage breaker, 25 A / 30 mA nominal fault current. In addition, a power control switch can be installed.
2. Fresh water connection 3/4" with stop cock, permissible pressure 2-10 bar, water temperature 5-25 °C.
3. Drainage plastic pipe PVC \dot{y} 50 mm (2") incl. syphon.
4. Drainage or collecting containers for used developer.
5. Drainage or collecting containers for used fixer.
6. Storage location for replenishment tanks: Below machine or externally.
7. Ventilation of darkroom is required.
8. Sink with freshwater and flexible hose. Inner dimensions minimum (LxWxH) 60x40x30 cm (24x16x12").



Measures and positions are recommendations

Trouble Shooting

Summary

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1 Algae

1.1 Excessive algae growth in water tank

- Algae growth inside the water tank is not only annoying, it causes increased cleaning work and leaves residues on the films. If algae growth becomes excessive, corrective measures must be taken:
- When work has been completed at the end of the day, drain water out of the machine.
- Clean dryer-water rack regularly. Use soft sponge and soap to remove residue from the rollers.
- Install a particle filter system in the fresh water supply for the processor.
- If water tank overflows due to algae growth blocking the overflow hose, then the overflow hose can directly be connected to the connection at the water tank inside the machine.
- If no other solutions can be found, use of anti-algae agents can result in improvement (automatic dispensers work the best). However, it is known that cleaning agents containing chlorine may corrode rubber rollers and high-grade steel in the tank area (check before use).

2 General

2.1 Unit does not switch on

- Ensure that the power socket conducts power.
- Check machine fuse in main switch.
- While power switch is on, check the following components: Voltage on contact of main switch - if no voltage: - change main switch. Check input voltage at electronics. If the voltage is normal, exchange the electronics. if no voltage: check the cable wiring harness.



Do only use original PROTEC® fuses with gilded caps as replacement part. They are optimized for use with PROTEC processors.

3 Drive

3.1 Film transport not running

- When placing processor cover on, the cover switch should be activated, re-adjust if necessary.
- Cover switch does not switch when activated: Replace.
- Check drive motor: If voltage can be detected on motor, then motor is defective.
- Check screwing of chain wheel on motor- and driveshaft.

3.2 Machine does not start automatically

- With the unit switched on, insert a film in the feed. If the LED begins to flash, the film detection switch is okay; if not, check the position of the actuator and replace the switch if required.
- Check the following parts: film detection switch, connecting cable for film detection switch, electronics module.
- Check the connecting cables between the electronics module and slots of the components (motor, dryer heating and solenoid valve). If the connections have no fault then the electronics module may be defective.

3.3 Machine doesn't stop automatically

- LED flashes continuously: Check positioning of the film switch actuator or replace the film detection switch.
- Check the following parts: connecting cable of film detection switch and electronics module.

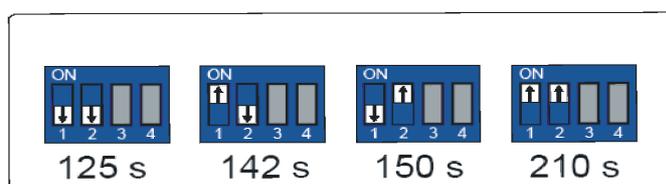
3.4 Film transport does not function, fan runs

- Check screwing of chain wheels and run of chain.

3.5 Machine stops before film comes out

The follow-up time is the part of the processing time that follows passing of the film detection switch. Activate the switch in the feed tray with a film and remove the film. Measure the time until the processor stops automatically.

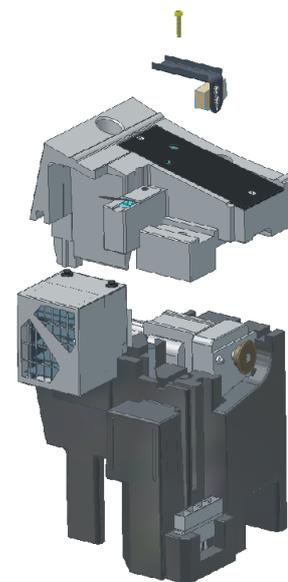
Change cycle time if necessary. The follow-up time can be set with a DIP switch on the controller. When the unit is restarted after a change of the setting, the new programming will be saved. The figure below illustrates the setting options:



3.6 Relation between processing time and developer temperature

The following chart demonstrates guiding values for the relation between developer temperature and processing time. Variations are possible depending on the various films and chemicals. Changing the transport speed see 3.7.

Total processing time	Developer temperature
100 s	32 °C - 34 °C
110 s	32 °C - 34 °C
117 s	32 °C - 34 °C
124 s	30 °C - 33 °C



3.7 Changing the transport speed

The processing speed can be changed by changing the gear wheels. The upper EPAC must be removed. First loosen the screw on the chain tensioner. After removing the drive motor and the drive shaft, the chain wheels can be replaced. Note that the follow-up time must be adjusted at the controller.

The following gear combinations are available:

220-240 V, 50 Hz versions 220-240 V, 60 Hz versions						110-120 V, 60 Hz versions					
t	Gm	Gs	DIP switch positions	Developer time (s)	Feed speed (cm/min)	t	Gm	Gs	DIP switch positions	Developer time (s)	Feed speed (in/min)
105	14	17	125	32,5	34,7	102	12	18	125	31,6	14,0
102	12	17	125	31,7	35,6	113	12	20	125	35,0	12,6
122	12	17	125	38,0	29,7	122	10	18	125	38,0	11,7
120	12	20	125	37,2	30,3	136	10	20	142	42,0	10,5
130	12	18	142	40,2	28,1	149	10	22	210	46,4	9,6
132	12	22	142	41	27,5						
144	12	20	150	44,7	25,2						
158	12	22	210	49,2	23,0						

t = Processing time in seconds
 Gm = Chain gear on motor shaft
 Gs = Chain gear on drive shaft

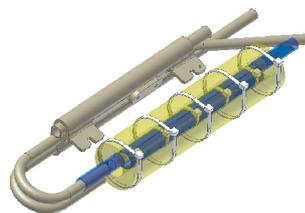
4 Chemicals Baths

4.1 No circulation in bath

- Circulation pump works but no circulation in bath: Air lock in heating and circulation system. Vent the pump (see page 11 item 1c).
- Particles in the pump chamber. The pump chamber can be opened easily by removing the four clips. When closing the pump, ensure that the rubber seal is positioned correctly and not damaged.
- Check connection of pump, circulation pump possibly defective.

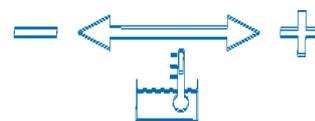
4.2 Developer temperature too high

- Check fastening of the temperature sensor of the temperature controller. It must be seated firmly on the tube, must have been installed with heat transfer grease, be covered by a silicone hose and be insulated with plastic foam.
- Temperature is set too high at the temperature controller: Set a lower temperature value by turning counterclockwise. (See “Calibration of developer temperature” on page 30.)
- If no error can be detected in the temperature sensor, the temperature controller is defective.



4.3 Developer temperature too low

- Check circulation pump. Air lock in the circulation pump: vent pump (see page 11). If no circulation can be detected: check wiring of circulation pump, pump possibly defective.
- Bath is not heated: check temperature safety switch on heat-exchanger. Check heating element: impedance across the element should reach approx. 66 W.
- Check temperature sensor (see 4.2).
- If no other error can be detected, the temperature controller may be defective.



4.4 Developer temperature too low, fixer temperature too high

- Air lock in the circulation pump: vent circulation (see page 11).

4.5 Calibration of developer temperature

Temperature fluctuations can be compensated for by the temperature controller. The controller is accessible from top. Remove the cover plate above the pumps. Adjustment of the controller is explained on the drive shaft next to it (see figure)

5 Film defects

5.1 Films will not dry

- No air comes out of air channel: check fastening of fan impeller, motor may be defective.
- Cold air comes out of air channel: check wiring of heating element in the air channel, heating element possibly defective.
- Hot air comes out of air channel, but the film is still not dried to satisfaction. Check chemicals and film type. If this leads to no solution then the transport speed of the machine can be reduced (see [Changing the transport speed, page 29](#)).

5.2 The film does not transport correctly

- Check the positioning of the racks in the machine and make sure that the latches are closed.
- Check the roller racks: rollers are correctly seated and do not have excessive clearance, rubber springs are correctly seated, all gear wheels are installed.
- Motor runs: the worm gear of the drive shaft should be secured with a split pin to avoid twisting. Check the screws and positioning of the chain and chain wheel.

5.3 Scratches, pressure marks, dirt on film

- Pressure marks caused due to polluted or damaged rollers. Check rollers for visible damage. Rubber rollers sometimes swell up. Replace defective rollers.

6 Replenishment

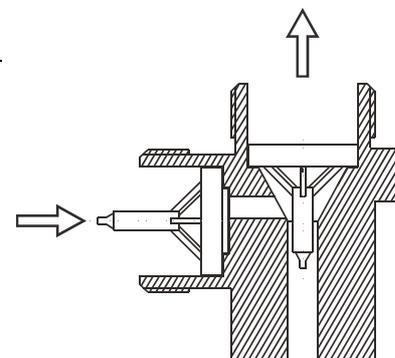
6.1 Replenishment pump does not work or works insufficiently

- Clean valves inside connection tube of pump.



Install valve-insert correctly: pay attention to flow direction!

- Check filter in the suction pipe (repl. container) and clean it if necessary.
- Replenishment pump sucks in air. Check hoses and connections.
- Check position of eccenter. Flow rate reads 240 ml/min at maximum eccenter position 100%.
- (60 Hz: 240 ml/min at 85 %)
- Measure the voltage between X3 and X4 directly after power-up of the unit or after the film detection switch has been actuated for 40 seconds. If no voltage can be measured, replace the power section.



6.2 Replenishment volume too high or too low

- The replenishment volume can be changed by altering the pump stroke or in the controller.

6.3 Adjusting the replenishment pump

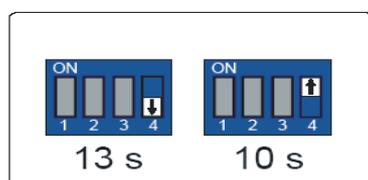
- To do this, the eccenter on the replenishment pump must be adjusted. Maximum pump capacity is 240 ml/min (100 %). For adjustment of the eccenter first open the socket hex screw on the large eccenter with the red mark. If the screw is not accessible, switch the machine on briefly. Switch the machine off as soon as the screw becomes accessible.
- Turn the eccenter so that the red mark will be at the desired position, then fasten the socket hex screw.



Do not set the eccenter below 75 %.

6.4 Setting the replenishment volume in the controller

The replenishment volume can be changed by altering the pump run time per cycle. To do so, set the DIP switch on the controller to either 10 s or 13 s (Compare figure). When the machine is restarted the new programming becomes active.



7 Dryer

7.1 Dryer fan does not run or runs with too slowly

- Check whether the threaded pin fastening the fan wheel to the rotor shaft of the motor has loosened.
- Check whether the motor is defective.

8 Water

8.1 Rinsing water does not flow

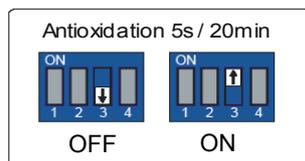
- The water pressure in the water supply system is too low: Minimum pressure 2 bar (29 psi).
- The valve opens, but no water flows through: the coarse filter on the intake end is blocked.
- Check the water supply hose in the machine.

8.2 Water tank overflows

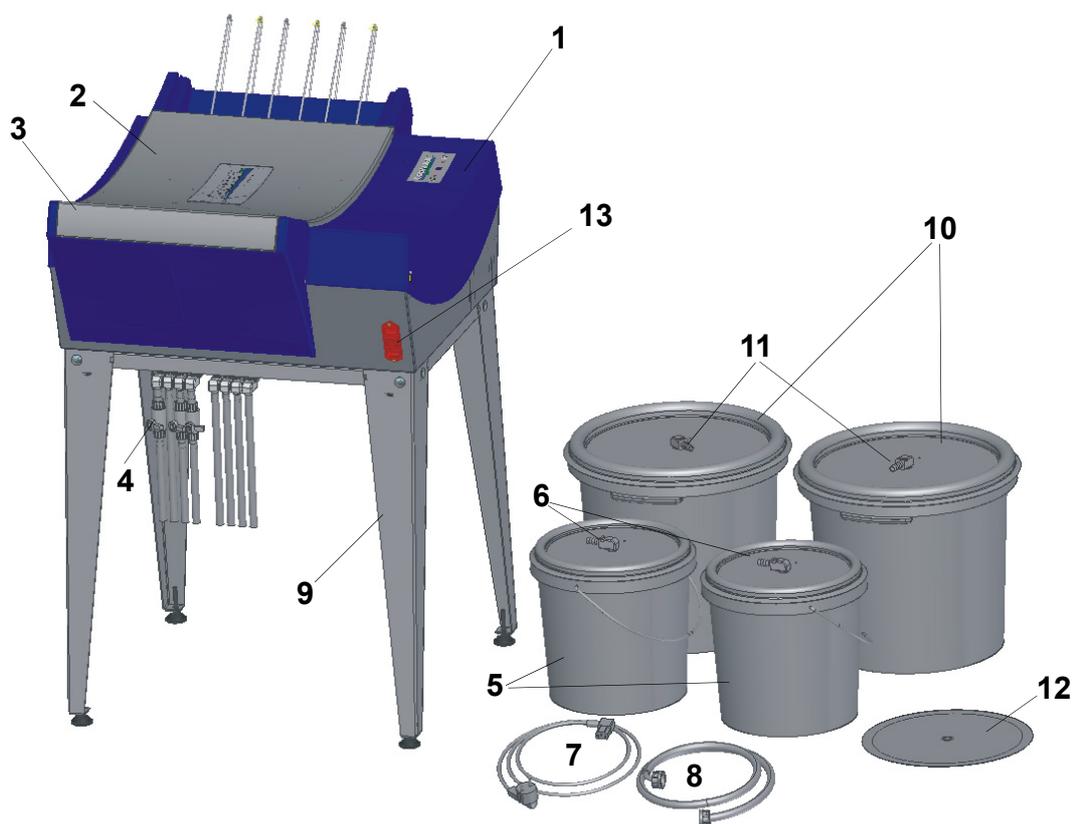
- The water drainage hose (overflow) should be laid out with constant descent. The hose end should be positioned above the drainage level in the syphon.
- Check water drain opening in the tank and the hose for blockage and residues.
- When extreme algae growth is registered, the overflow can be connected directly to the fitting of the water tank.

9 Shutting off time-controlled replenishment / anti-oxidation

The anti-oxidation function can be shut off at the controller. To do so, set the DIP switch on the controller as shown in the figure.

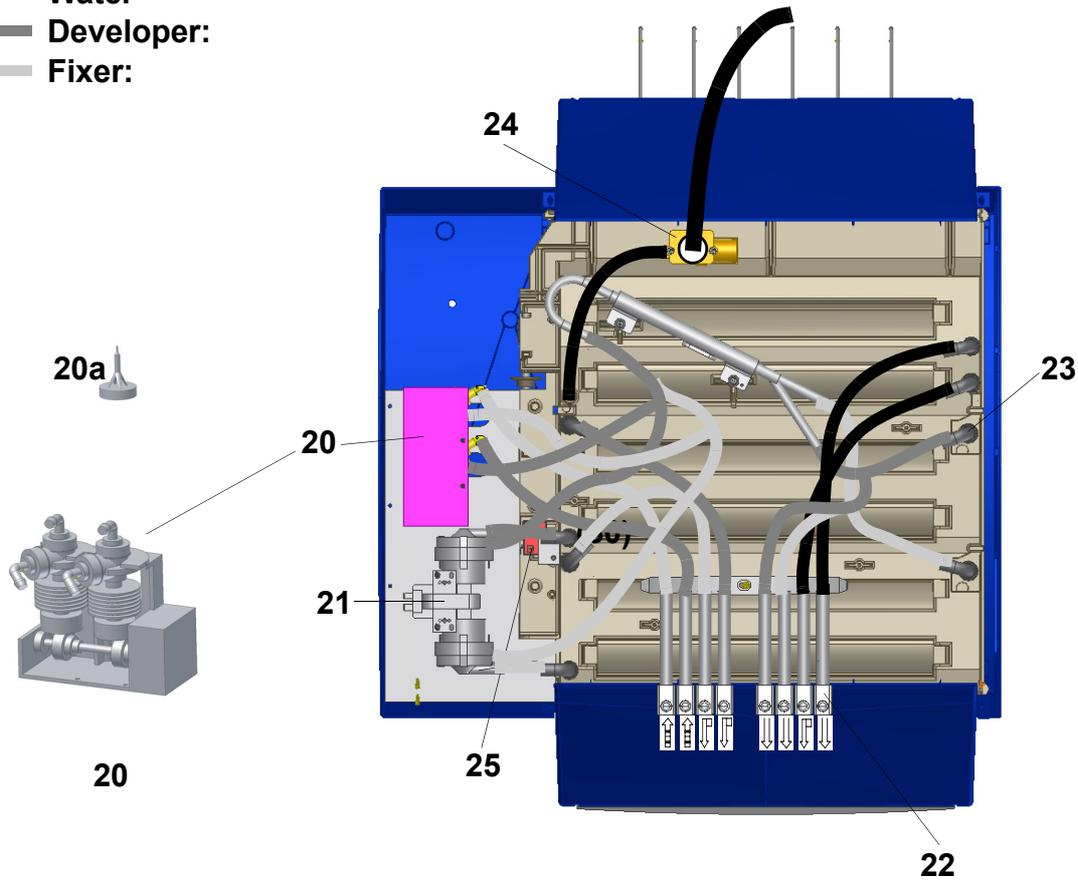


Spare Parts

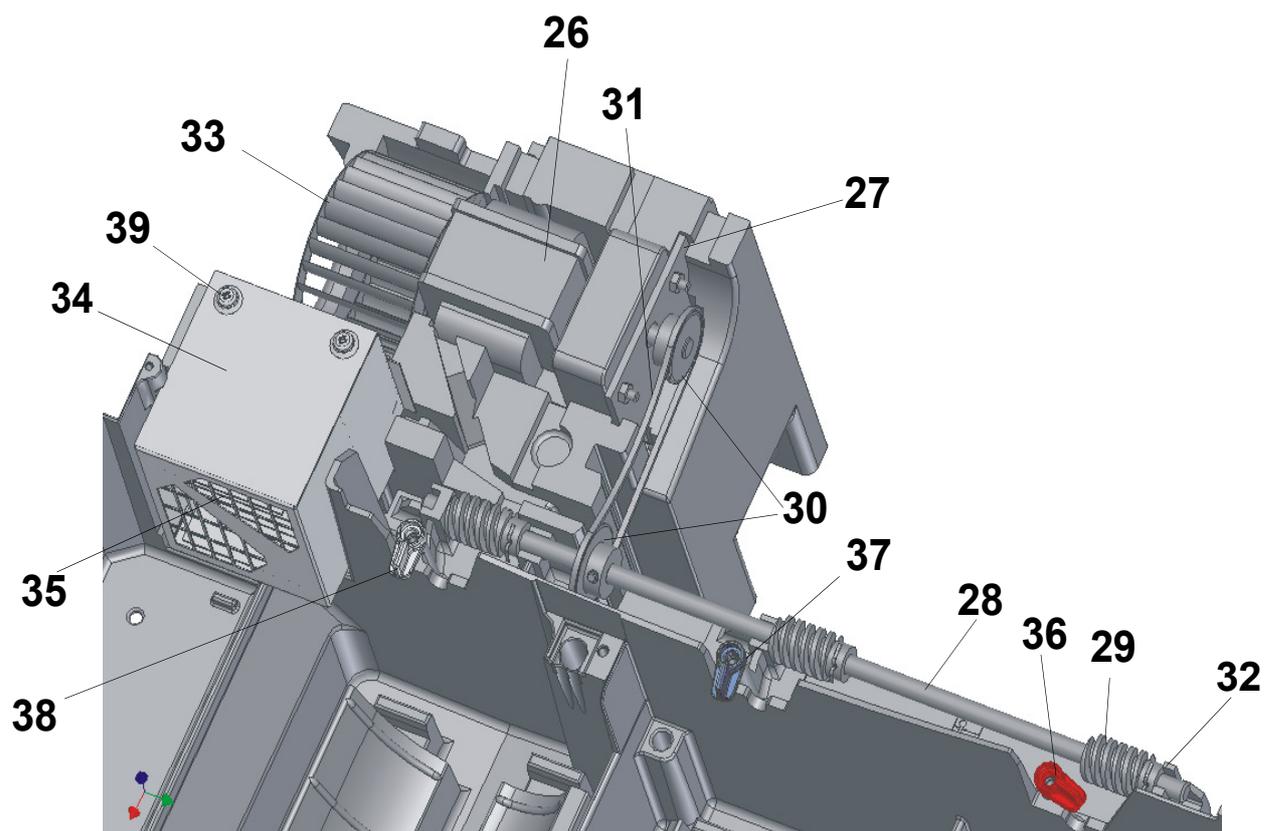


Pos.	Order No.	Description:
1	1186-0-0200	Service cover, complete
2	1186-0-0201	Cover
3	1186-0-3100	Light protection cover, complete
4	2006-0-0005	Ball-type stop cock 10 mm
5	1170-0-2000	Replenishment tank, 12 l dev.
	1170-0-2100	Replenishment tank, 12 l fix.
6	1170-0-1760	Suction pipe with filter for 12 l tank, round
7	2004-0-0003	Electrical power cable 220-240 V
	2004-0-0021	Electrical power cable 220-240 V
8	2018-0-0001	Water inlet tube
9	1286-0-0000	processor stand
10	1101-0-2000	Replenishment tank 25 l dev.
	1101-0-2100	Replenishment tank 25 l fix.
11	1101-0-1700	Suction pipe w. filter f. 25 l tank
12	1101-0-4100	Floating cover developer
13	1170-0-1400	Combined processor plug
14	2010-0-0010	Fusible, gold, T 10 A / 250 V UL
-	2018-0-0012	Hose 10 x 2 mm, celar, reinforced
-	2018-0-0009	Hose 10 x 2 mm, blue, reinforced
-	2018-0-0008	Hose 10 x 2 mm, red, reinforced
-	2018-0-0005	Hose 4 x 1 mm, green
-	2018-0-0003	Hose 9 x 2 mm, clear
-	2022-0-0004	Tube clamp
-	2022-0-0019	Wire tube clamp
-	1101-0-4600	Floating balls, 300 pcs.
-	1101-0-4800	Floating balls, 200 pcs.

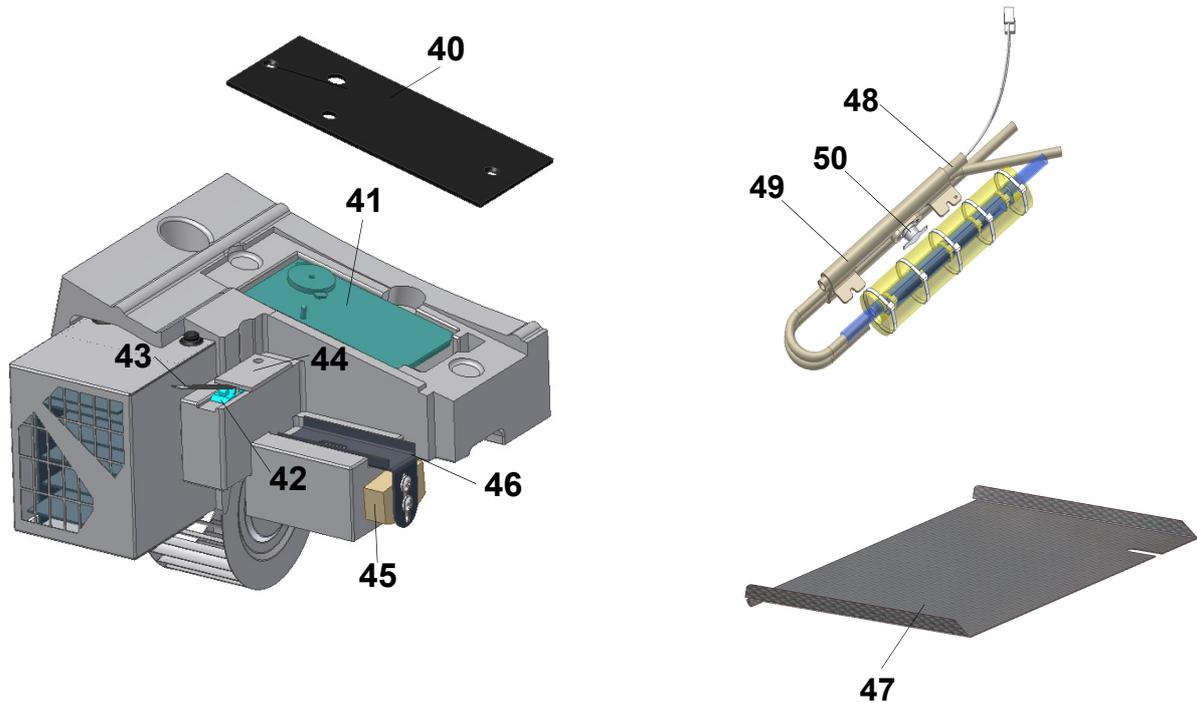
Water
 Developer:
 Fixer:



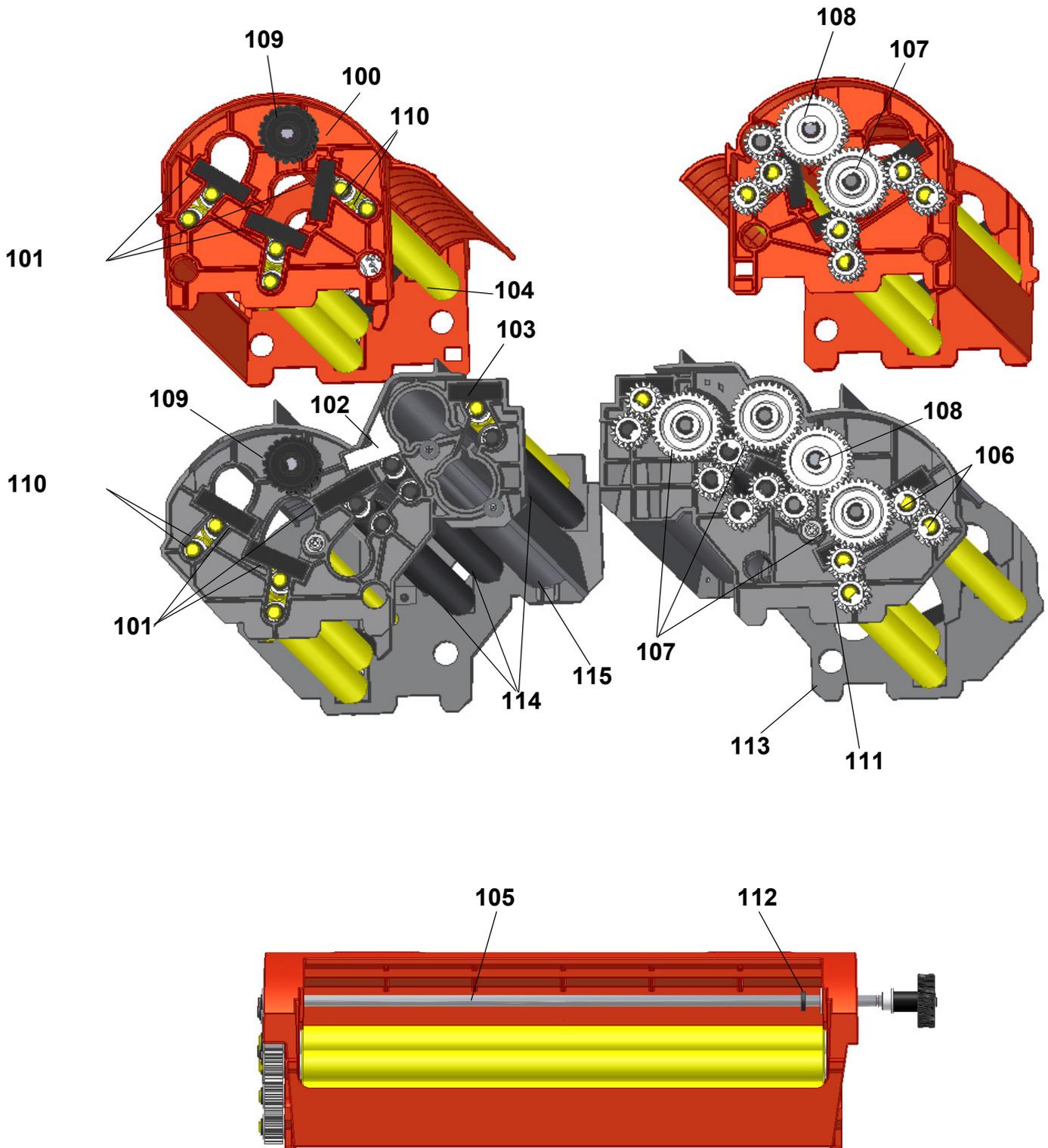
Pos.	Order No.	Description:
20	0202-1-0008	Replenishment pump 2KBA 220-240 V, 50/60 Hz
	0202-6-0008	Replenishment pump 2KBA 115 V, 50/60 Hz
20a	0002-1-0008	Conical valve for pos. 20
21	2002-1-0013	Circulation pump 220-240 V, 50/60 Hz
	2002-6-0013	Circulation pump 110 V, 50/60 Hz
22	1160-0-0702	Elbow fitting
23	1160-0-0710	Rubber hose stub
24	2006-5-0004	Solenoid valve 220-240 V, 50/60 Hz
	2006-6-0003	Solenoid valve 110 V
25	0186-0-2200	Temperature controller set
-	1186-0-1250	Wiring harness 230 V
-	1186-0-1251	Wiring harness 115 V



Pos.	Order No.	Description:
26	2001-0-0003	Main drive motor 220-240 V, 50 Hz
	2001-6-0003	Main drive motor 120 V, 50/60 Hz
27	1186-0-1101	Motor plate
28	1186-0-1501	Drive shaft worm-gear
29	1170-0-1503	Worm-gear
30	1186-0-1502	Chain wheel t=10
	1170-0-1506	Chain wheel t=12
	1170-0-1504	Chain wheel t=14
	1170-0-1505	Chain wheel t=16
	1170-0-1102	Chain wheel t=17
	1170-0-1507	Chain wheel t=18
	1186-0-1503	Chain wheel t=20
	1186-0-1504	Chain wheel t=22
31	2037-0-0003	Roller chain
32	3000-9-4013	Splint pin 2.0 x 20 mm, inox
33	2008-0-0001	Fan impeller TLR 85x52
34	1186-0-1302	Air channel
35	2003-5-0011	Heating element 230 V, 900 W
	2003-6-0011	Heating element 110 V, 900 W
36	1101-0-0146	Latch, red
37	1101-0-0141	Latch, blue
38	1101-0-0113	Latch, plain
39	2009-0-0019	Rivet

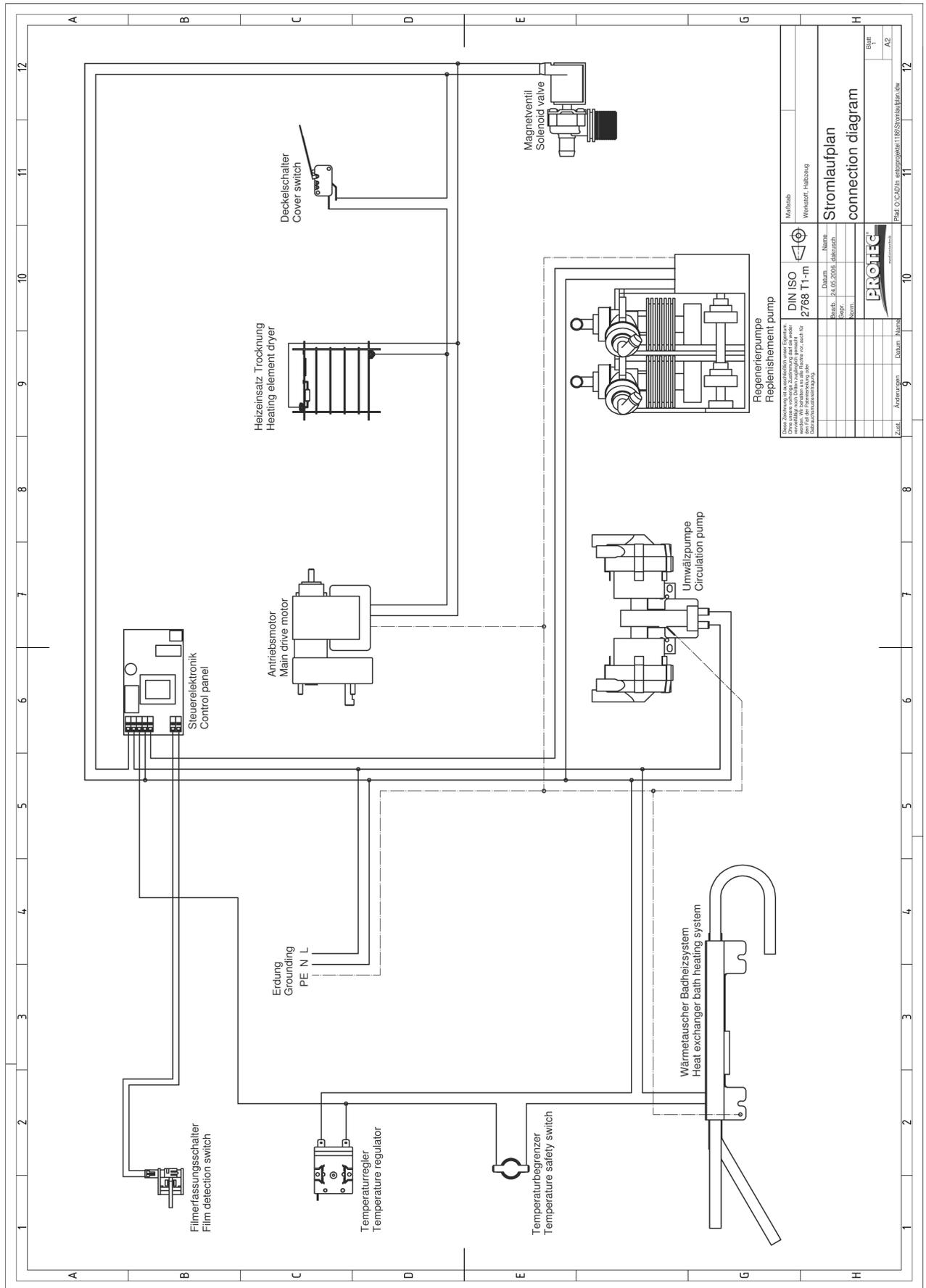


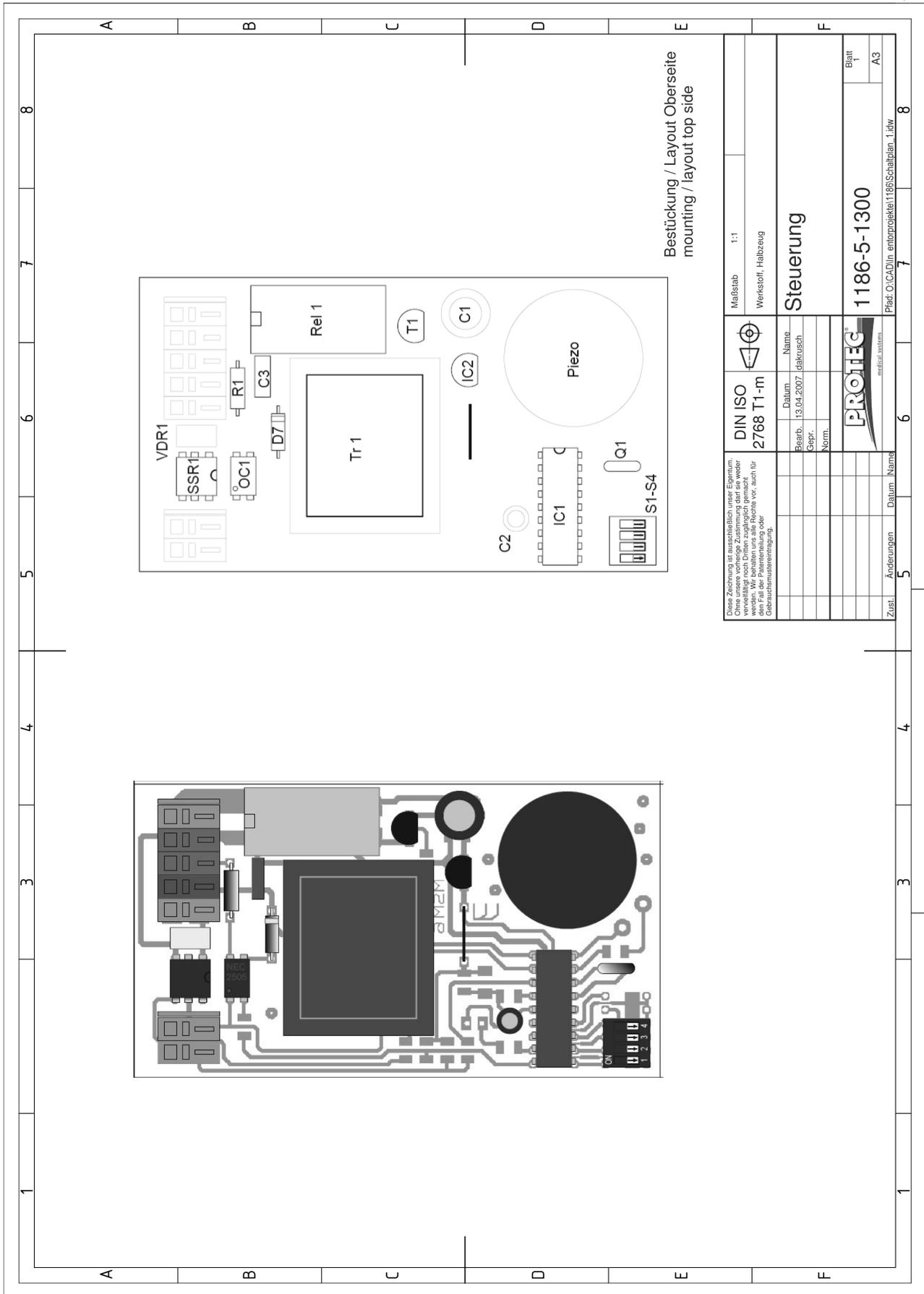
Pos.	Order No.	Description:
40	1186-0-1301	Controller cover plate
41	1186-5-1300	Controller 230 V
	1186-6-1300	Controller 110 V
42	2007-0-0001	Micro switch 83.161-6 N/O W3
43	2007-0-0010	Actuator for micro-switch
44	1186-0-0502	Inlet cover
45	1186-0-0701	Chain tensioner
46	1186-0-0702	Bracket for chain tensioner
47	1186-0-0802	Film feed tray
48	2003-5-0010	Heating element 230 V, 300 W
	2003-6-0002	Heating element 120 V, 400 W
49	1130-0-2101	Heat exchanger
50	2005-0-0005	Temperature limiter



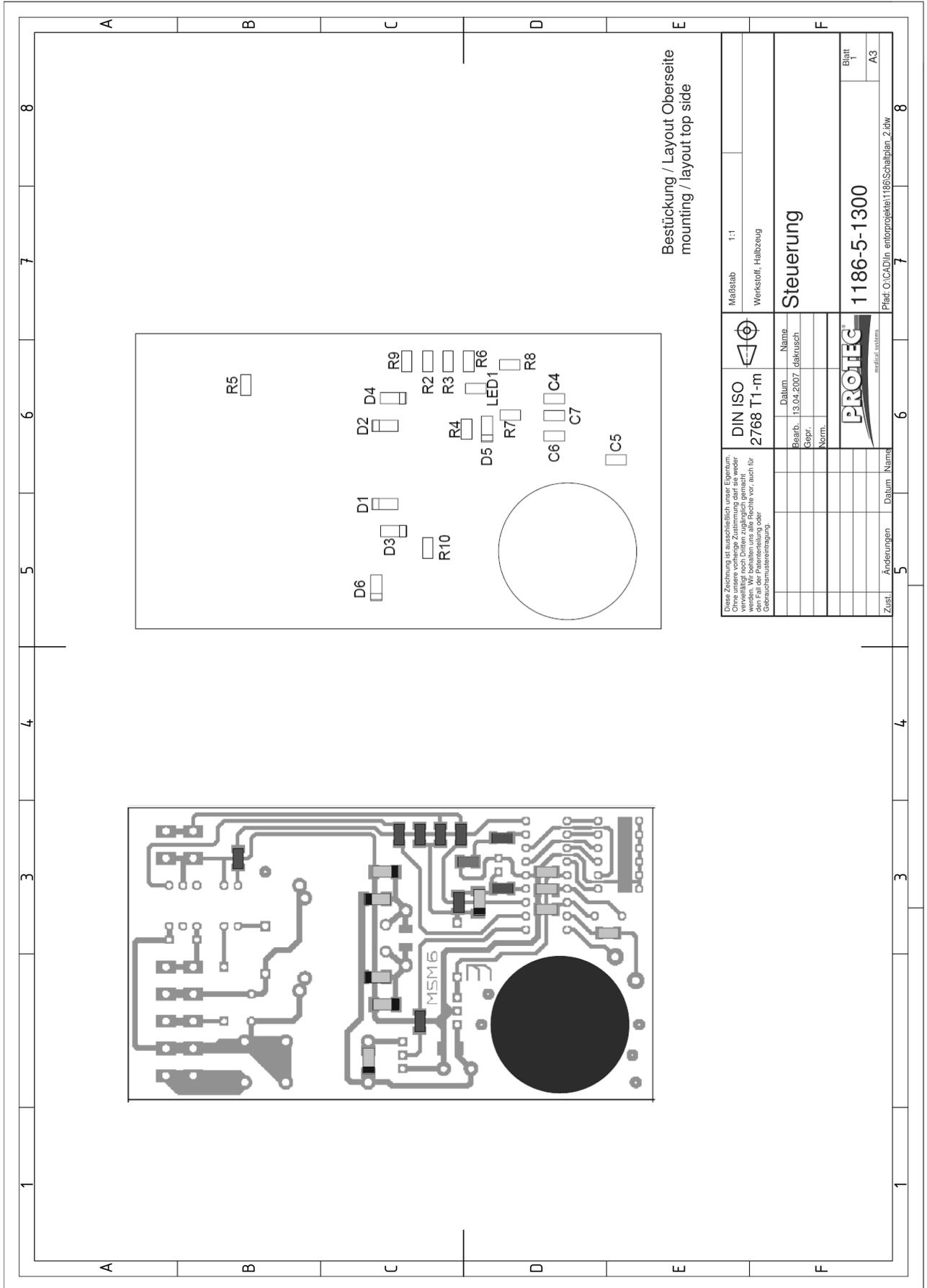
Standard roller racks

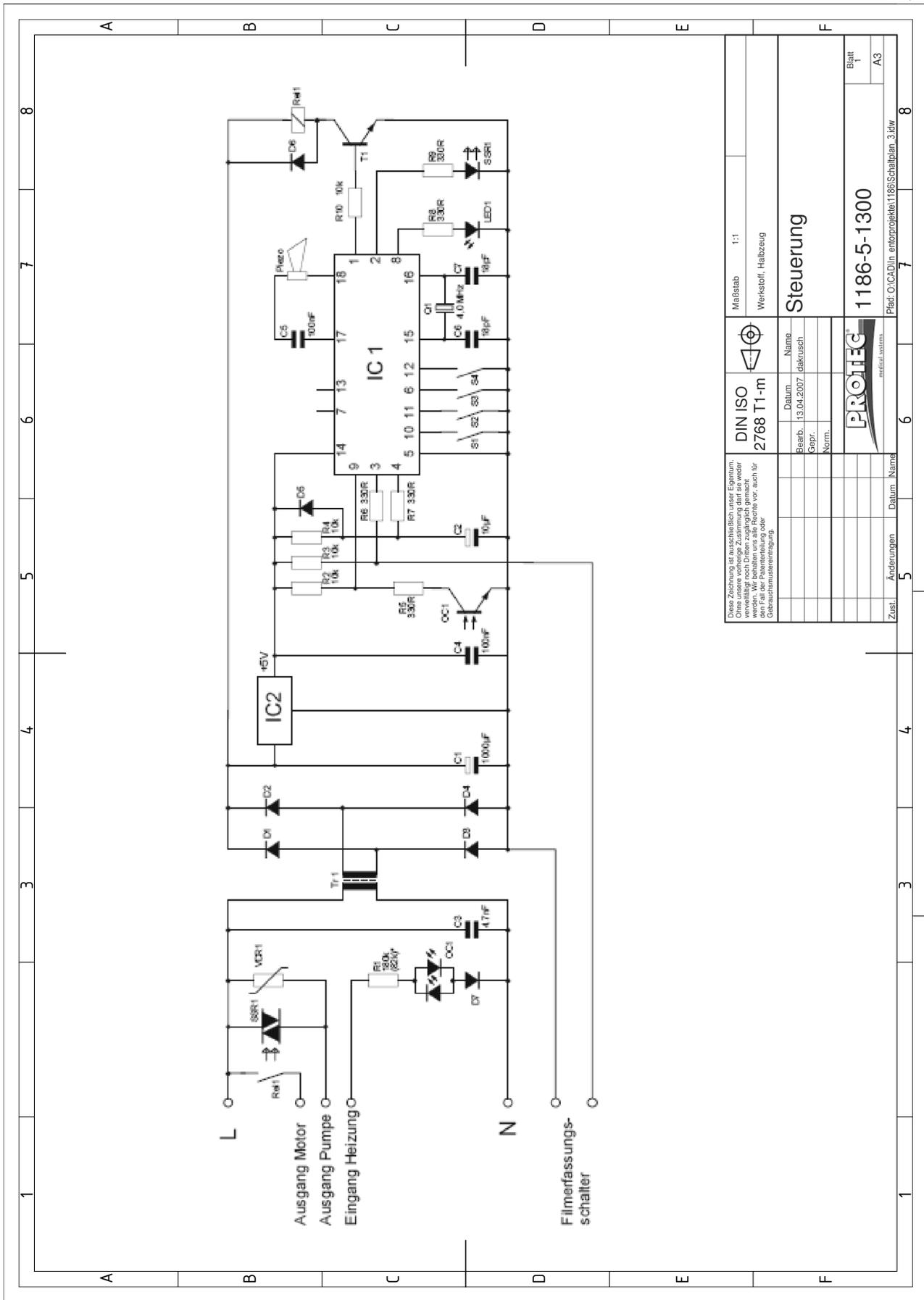
Pos.	Order No.	Description:
Standard Processor		
-	1186-0-0300	Roller rack, developer
-	1186-0-0400	Roller rack, fixer
-	1186-0-0600	Roller rack, dryer
100	0186-0-0303	Roller support, dev. with axles
	0186-0-0403	Roller support, fix. with axles
101	1186-0-0304	Rubber spring element, black 36.5 x 10 x 6
102	1186-0-0306	Rubber spring element, white
103	1186-0-0307	Rubber spring element, black 31 x 10 x 6
104	1140-0-0301	PU-roller 35 ground
105	1170-0-0310	Drive shaft rack
106	1101-0-0302	Gear t = 16, D-hole
107	1101-0-0304	Gear t = 32, round hole
108	1101-0-0303	Gear t = 32, D-hole
109	1170-0-0302	Worm wheel
110	1101-0-0305	Bearing bush
111	2014-0-0001	Circlip
112	2014-0-0003	Clamping ring
113	0186-0-0603	Roller support, dryer with axles
114	1140-0-0302	Rubber roller 35
115	1140-0-0605	Air jet (35)





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Bearb. 13.04.2007 Gepr. Name Norm.	Datum 13.04.2007 Name Hakrusch	Steuerung	
Zuzst. Änderungen. Datum. Name	Blatt 1 A3	1186-5-1300	
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DIN ISO 2768 T1-m		Maßstab 1:1	
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Datum 13.04.2007		Steuerung	
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Norm.		1186-5-1300	
Zustl.		Plat. C:CADIn_entprojekte\1186\Schaltplan_3.dwg	
Änderungen		7	
Datum		8	
Name		PROTEC	
Dateiname		medical.system	