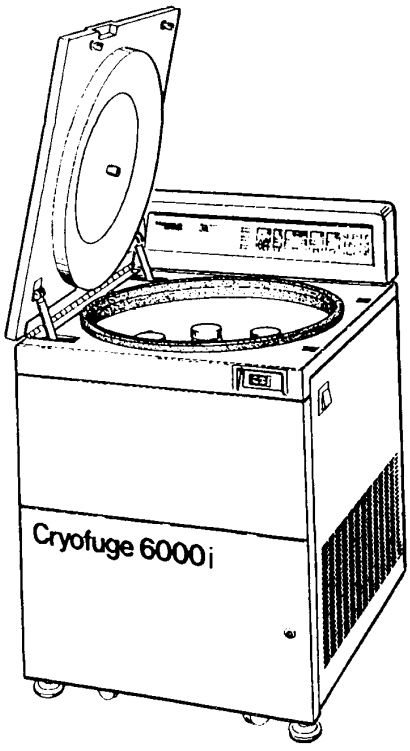
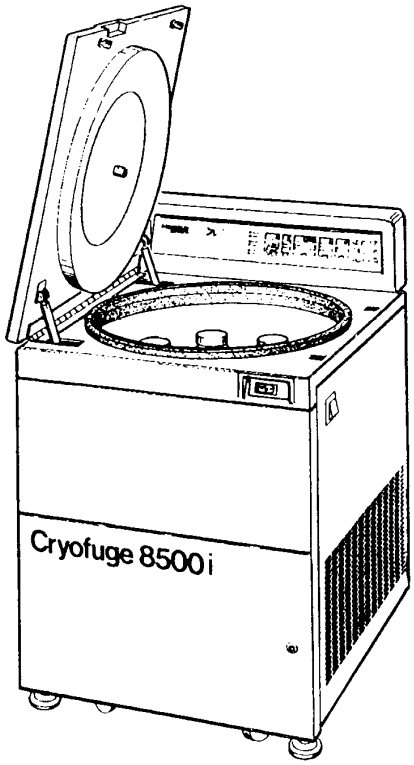
Heraeus

CRYOFUGE 6000i
CRYOFUGE 8500i

Operating Instructions





How to use these instructions

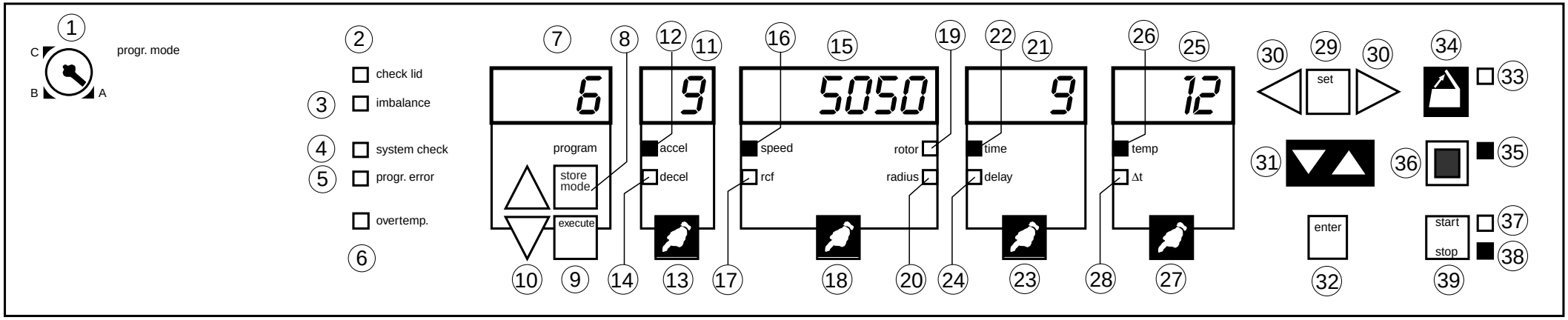
With the help of these operating instructions, familiarise yourself with your centrifuge and its accessories.

The operating instructions help you to avoid improper operation. Therefore always keep the instructions close to the centrifuge.

Operating instructions which are not accessible cannot prevent improper use and therefore injury or damage to property.

On the back of this page, you will find an illustration of the operating field with a compilation of the most important functions

Please open out



SEPACONTROL- Table of keys and displays

1. Key switch

Diagnosis display
2. Lid open
3. Imbalance
4. System check
5. Programming error
6. Excess temperature

Program field
7. Program display
8. Key to activate program memory
9. Key to end saving process
10. Direction keys for choosing program number

Functional fields
Curve field
11. Display of curve numbers
12. Reference LED: Acceleration curve
13. Selection key for acceleration and deceleration curve
14. Reference LED: Deceleration curve

4- function field
15. Display for multi-functional indication
16. Reference LED: Speed
17. Reference LED: RZB value
18. Selection key for speed, RZB, rotor/bucket or radius
19. Reference LED: Rotor/bucket type (order no.)
20. Reference LED: Radius

Time field
21. Time display
22. Reference LED: Running time
23. Selection key for running time or start delay
24. Reference LED: Start delay

Temperature field
25. Temperature display
26. Reference LED: Temperature display
27. Selection key for set temperature or excess temperature control
28. Reference LED: Excess temperature

Adjustment key field
29. Key for set value display and adjustment
30. Direction keys for pre-setting the display positi-ons
31. "+" and "-" keys for set value adjustment
32. Key for saving the adjusted set values

Control key field
33. Release LED to open the lid
34. Lid key
35. Release LED for "quick stop" (rapid deceleration)
36. "quick stop" key
37. Release LED to start ("start" function)
38. Release LED to decelerate ("stop" function)
39. Double function key to start or stop

Contents

Safety Measures and Hazards

Carefully read the operating instructions before starting up the centrifuge. This centrifuge must not be operated by persons who do not know how to operate it correctly.

- Avoid damage to the appliance or its accessories by operating errors!
- In the case of any malfunction precisely proceed according to the instructions (see Troubleshooting)!
- The rotor must be removed during transportation!
- Use only original spare parts!

CAUTION - DANGER!

To protect people and the environment observe the following safety measures:

- The CRYOFUGES are neither made inert nor protected against explosion. Therefore, do not use the centrifuge in environments where there is a risk of explosion.
- During centrifuging, the presence of persons or dangerous materials is prohibited within a 30 cm safety zone around the appliance!
- The centrifuging of radioactive, flammable, explosive materials or those which chemically react with each other with high energy, is prohibited unless suitable safety systems are used (e.g. protective chambers).
- During the centrifuging of toxins or pathogenic micro-organisms without suitable safety systems, it is prohibited to use vessels without (or with defective) BIO SEALS. The user is obliged to carry out suitable disinfecting measures, in case any dangerous materials have entered the appliance or any parts of it.
- **Under no circumstances manually open the lid when the rotor is still moving!**
- It is prohibited to program any rotor or bucket other than those inserted.

Exclude any improper operation, such as:

- Incorrectly installed centrifuge.
- Operation with casing or parts thereof removed.
- Operating the centrifuge after interference in mechanical or electrical components by non-authorised persons.
- Starting the centrifuge with a non-permitted rotor.
- Operating the centrifuge with partially empty bucket holders or incorrectly inserted buckets.
- Overloading the rotor – exceeding the maximum weight of the swing buckets (with load) permitted for a determined speed.
- Centrifugation of highly corroded substances, which can cause material damage and can decrease the mechanical strength of rotors and swivel vessels, without sufficient protective measures.
- Operating the centrifuge with rotors and buckets, which are already showing clear signs of corrosion or mechanical damage.
- Use of rotors and accessories, which are not expressly approved by KENDRO Laboratory Products with the exception of standard centrifuge vessels made of glass or plastic.

The manufacturer only accepts responsibility for the safety, reliability and performance of the appliance when:

- the appliance is used in accordance with the operating instructions, and
- assembly, extensions, new adjustments, modifications or repairs are carried out by persons authorised by the manufacturer, and the electrical installation of the affected area corresponds to the requirements of the IEC regulations, and the previously stated yearly tests in accordance with the regulations of the employers' insurance associations (in Germany: VBG 7z Article 15.1) have been carried out.

Description of Appliance

Classification

The CRYOFUGE 6000i and the CRYOFUGE 8500i are temperature controlled, microprocessor driven and programmable laboratory centrifuges for universal use in large laboratories, blood banks and other operations of the pharmaceutical and bio-technical industries. The CRYOFUGES are built as floor-standing appliances with frequency controlled and maintenance-free induction motors and are designed for a wide range of accessories. They belonged to group 3 according to the German Medical Appliance Ordinance (Med GV). In the framework of European harmonisation, the Med GV was replaced by the Medical Product Law (MPG).

Definition

The CRYOFUGES are surrounded by a stable and completely welded sheet steel housing. The rotors are driven directly by a frequency controlled, maintenance-free induction motor with high acceleration performance. This motor runs with little noise and vibration, even at high speeds, and has an extremely long life cycle. It is secured on the bed plate preventing vibrations and is sealed by a rubber flange towards the rotor chamber. In order to control the temperature, the appliances are equipped with compressor systems for environmentally friendly refrigerants.

The central processor monitors the sequencing, the speed measurement and control, the temperature measurement and control, the safety systems and the error messages of the centrifuge.

An additional microprocessor is responsible for the key and display functions and is also used for saving parameters. The practical SEPACONTROL system takes care of the operation and programming of the centrifuge.

Safety Equipment

Rotor chamber armouring

The high-grade steel rotor chamber is surrounded by a massive armoured boiler. This armouring is able to absorb the full rotation energy in the case of a rotor crash.

Lid lock

The centrifuge lid can only be opened when the rotor speed has dropped to < 10 rpm and the appliance is connected to the electricity supply. The centrifuge can only be started when the lid is correctly locked on both sides and the "OPEN" display disappears.

Thermal motor and electronic protection

In the case of the motor or the heat dissipater overheating, the power electronics is switched off, in order to protect the drive and the electronics against damage (error message "E-08").

Imbalance switch

The drive system is provided with an imbalance switch to protect against inadmissible imbalances. If the permitted imbalance is exceeded, the LED "imbalance" is alight, accompanied by an intermittent alarm, and the centrifuge automatically decelerates until it comes to a standstill.

Protection against excess temperature

The centrifuges have 2 different protection systems against excess temperature:

1. **Programmable protection against excess temperature** (ΔT function)
   Depending on the programmed set temperature, an increase in temperature (ΔT) of a minimum of 5 K can be set. If the display exceeds the value of temperature pre-selection plus ΔT when the rotor is turning, the excess temperature alarm is activated (LED "overtemp" is alight, the alarm signal is activated and the rotor is stopped).
   If no value is set for ΔT (display "- -"), the excess temperature alarm is activated when the temperature display exceeds 51°C.

2. Excess temperature protection sensor
   The excess temperature alarm is activated, when the temperature of the sensor located in the rotor chamber exceeds 70°C.

Lid emergency opening

CAUTION- DANGER!

Opening the lid while the rotor is moving is prohibited!

In the case of a power failure, the electrical unlocking of the lid does not work. To remove the specimen after the rotor has stopped, there is a manual opening device.

In this case, proceed as follows:

- Switch off and disconnect the centrifuge from the power supply.
- Ensure that the rotor is at a standstill (view window)!
- Unlock and open the front door with a square socket spanner.
- Pull down both pull cords on the right, the lid catch is mechanically unlocked.

Accessories

The centrifuge delivered also includes 2 metal rails for rolling the centrifuge down from the palette as well as an open jawed spanner (17 mm/19 mm) and a socket spanner (10 mm) for assembling and dismantling the rotor. Two further open jawed spanners (24 mm and 8 mm) are intended for fixing and securing the stand feet. The square socket spanner is used to open the front door.

Furthermore, 50 ml corrosion protection oil (order number 70009824) for maintaining the metallic rotor and bucket surfaces and a can of grease (order number 70006692) for lubricating the retaining bolts of the swing rotor are delivered with the centrifuge.

The documents include:

- The operating instructions
- A table for documenting all the parameters for 32 user programs.

Conformity with standards and regulations

The centrifuges are manufactured and tested in compliance with the following EU directives:

- *73/23/EEC,* Low voltage directive
- *89/336/EEC*, EMC directive
- *89/392/EEC*, Machinery directive

The following standards are applied:

- *DIN EN 61 010 Part 1*, Safety regulations for electrical measuring, control and laboratory appliances
  - Contamination level 2
  - Excess voltage category II
- *PR EN 61 010 Part 2-020*, Particular requirements of laboratory centrifuges
- *EN 50081 Part 1*, Electromagnetic compatibility (EMC), generic standard Interference transmission
- *EN 50082 Part 1*, EMC generic standard interference immunity
- *DIN 58 970 Part 1*, Laboratory centrifuges – terms, testing, marking

The compliance with the EU directives has been confirmed in a declaration of conformity.

The centrifuges bear the CE symbol.

For operators in Germany, the following regulations for the prevention of accidents apply.

- *UVV VBG 7z*, Centrifuges
- *UVV VBG 4*, Electrical installations and operating material
- *UVV VBG 20*, Refrigerating plants

The certification according to DIN ISO 9001 confirms that KENDRO Laboratory Products has an organisation which guarantees the compliance and implementation of the EU directives and standards.

Guarantee conditions

The guarantee begins on the day of delivery. Within the guarantee period, the centrifuge will be repaired or replaced free of charge if processing or material faults can be proved. The requirement for a claim under the guarantee is that

- The centrifuge is used as described in these operating instructions
- Assembly, extensions, settings, modifications or repairs are only carried out by persons authorised by KENDRO
- The required service and maintenance work has been regularly carried out.

Instructions for Rapid Start-up

Switching on the centrifuge

1. Switch on the machine's power switch on the front right and wait for the appliance identification display.
2. Wait for the yellow LED to the right of the lid symbol key to light up, press the key. After the lid unlocks, lift it by hand.
3. Check that the rotor is securely fixed and can be rotated fully!
4. All retaining bolts must be lubricated. Operation is only permitted when all 6 buckets are inserted and are of the same type!
5. The buckets must be symmetrically loaded!
6. Firmly close the lid but do not let it fall. The "Open" display disappears when the lid is correctly closed.

Programming the first operation

7. Entering the order number of the inserted buckets:
   Press the selection key with the hand symbol of the 4 function field until the "rotor" LED is alight and then press the "set" key for all setting processes.
   The last bucket order number entered will flash in the display and can now be changed by using the arrow keys (up, down). When the flashing and the inserted bucket numbers (engraved on all buckets) are the same, the setting can be completed by pressing the "enter" key, or other parameters can be entered one after the other (see 8. to 11.).

   WARNING!
   With the **swing rotor,** the order number of the **buckets currently inserted** must always be programmed, otherwise this could lead to the destruction of the appliance due to incorrectly entered speeds.
8. Setting the speed:
   Press the hand symbol key of the 4 function field until the "speed" LED is alight. The speed position last entered flashes and can be changed with the white direction arrows. The numerical value (rpm) can be entered using the arrow symbol keys (to enter the RZB value, see "SEPACONTROL programming").
9. Pre-setting the running time:
   Press the "hand" key of the "time/delay" field ("time" LED must light up), set as above using direction arrow and "up" or "down" keys.
10. Setting the temperature:
    Press the "hand" key of the "temp/ΔT" field ("temp" LED must light up), set as above under direction arrow and "up" or "down" keys.
11. Acceleration and deceleration curves can be set in a similar way in the "accel/decel" field or can be defined by the user.
12. Saving the values entered and starting up the centrifuge:
    Press the double function key "start/stop" within 2 minutes. After the programmed time has elapsed, centrifugation ends automatically. Press the "start/stop" or the quick stop symbol key to stop prematurely.

Preparing for the next run

13. Wait for release for the lid key (yellow LED is alight; rotor standing still). Press the lid symbol key, open the lid and check the state of the vessels before removing them.
14. Check vessels for damage, check the rotor and inserts for leaking fluids. If necessary, clean or disinfect (see also under "Service and Maintenance", page 39).

Further information can be found in the corresponding chapters!

Technical Information

Common performance features

Construction:	Welded sheet steel framework – floor-standing model with adjustable feet
Housing:	Enamelled sheet steel
Measurements (H x W x D):	(118 x 80 x 91)cm
Front panel:	Sturdy plastic housing for assembling the key and display elements, coated with an easy to clean protective film
Operation:	SEPACONTROL system
Drive:	Frequency controlled, maintenance free induction motor
Rotor chamber: size (Ø x H):	High grade steel (680x330)mm
Rotor:	6-place swing rotor with wind protection boiler and detachable hood
Lid opening:	Electromechanical unlocking using lid key with voltage supply
Lid closing:	Double locking when firmly closing the lid
Lid tumbler:	Double safety circuit (hard and software control)
Lid emergency opening:	Unlocking in the case of power failure using pull cords behind the front door
Starting/stopping:	Double function key (start release when the green LED is on, stop release when the red LED is on)
Start release:	Also during the deceleration phase
Quick stop:	At any time using a special key (also during the deceleration phase)
Imbalance stop	Automatically when exceeding the permitted imbalance
Ambient conditions	- Indoor use - Height up to 2000 m above sea level - Max. relative humidity 80 % up to 31°C; linearly decreasing, up to 50 % relative humidity at 40°C.
Permitted ambient temperature range:	4°C up to 40°C during operation, non-condensing -10°C up to 50°C during storage and shipping

Special information for Cryofuge 6000i / 8500i

Features	*CRYOFUGE 6000i*	*CRYOFUGE 8500i*
Max. speed (with buckets):	4240 rpm (no. 6694 / no. 8078 / no. 8165)	5050 rpm (no. 6694 / no. 8078 / no. 8165)
Min. speed:	300 rpm for all buckets	300 rpm for all buckets
Max. RZB value (with buckets):	6010 x g (no. 8165)	8525 x g (no. 8165)
Max. performance:	see “Type plate specifications“	
Max. capacity (with buckets):	6 x 1000 ml bottles or 12 x blood bag system	
Max. kinetic energy:	176 kNm	291 kNm
Noise level:	≤ 64 dB(A)	≤ 67 dB(A)
Weight (without rotor):	445 kg	445 kg

"SEPACONTROL" features

Program register:	For 32 complete parameter sets such as: • Acceleration and deceleration curves • Rotor or bucket or order no., speed, RZB value and radius • Centrifuging time and deceleration time • Temperature and ΔT control
Profile program:	For an individually definable user, acceleration and deceleration program with up to 10 profile sections (F1 - F0)
Program security :	Program and RAM memory can be protected against unauthorised access with a 3 level key switch
Data storage:	With NV-RAMs (non volatile random access memory) virtually unlimited
Diagnosis displays on LEDs for :	• Lid open (lid) • Imbalanced load (imbal.) • Malfunctions in the electrics (syst. check) • Programming error (prog. err.) • Excess temperature (overtemp.)
Digital parameter display fields:	• Program number • Acceleration or deceleration profile • Speed or RZB value or rotor/bucket order number or radius in centimetres • Centrifuging time or start delay • Temperature or difference between set and actual temperature
Acceleration:	Curves 1-9 can be pre-set
Deceleration:	Curves 1-9 and 0 = slow down without deceleration (cannot be reproduced) can be pre-set
Speed pre-setting:	In the range of 300 rpm up to max. bucket speed - adjustable in 10, 100 or 1000 rpm steps
RZB pre-setting:	From the minimum RZB value (relating to 300 rpm) up to the maximum RZB value - adjustable in 10, 100 or 1000 rpm steps
Rotor pre-setting:	Integer, sequenced according to increasing bucket order number
Radius pre-setting:	Dependant on the bucket, adjustable in 0.1cm steps
Time pre-setting: • "hld"-mode • h.min mode • h mode	 • Continuous operation (hold) • 1 minute up to 9 hours 59 minutes, adjustable in hours and minutes • 10 hours up to 99 hours, adjustable in 10 and 1 hour steps
Delay pre-setting: • "---" mode • h.min mode • h mode	 • without delay • 1 minute up to 9 hours 59 minutes, adjustable in hours and minutes • 10 hours up to 99 hours, adjustable in 10 and 1 hour steps
Temperature pre-setting:	-20°C up to 40°C, adjustable in l 1 or 10 K steps
Excess temperature control (• T):	"--"mode: no • T control 5 K • • T • (40°C - T_s) setting dependant on set value (T_s)

Transport and Installation

Transport and Storage

The centrifuge is securely fixed to a wooden board with 4 screws and steel straps and is packed in a carton made from corrugated cardboard. It is best to use a fork lift truck, as it grips under the palette so that the centrifuge can be transported and loaded in an up-right position. It must be ensured that the appliance is transported as dry and with as little dust and vibration as possible. The centrifuge must be stored in a dry and dust free room until its final installation on location.

WARNING!

Before transporting the centrifuge (in the case of a future move), the rotor must always be removed! Damage to the rotor and the centrifuge cannot be ruled out if these instructions are not followed.

Unpacking the CRYOFUGE

Before unpacking, ensure that the floor is stable and even. To roll the centrifuge down, a free area of at least 2m (appliance and rails) is required

First remove the surrounding carton. Then the centrifuge covered with corrugated cardboard is visible (Illustration 1).

View of the CRYOFUGE 6000i / 8500i after removing the outer cardboard casing

- Metal rail
- Strip (to be removed)
- Wooden lath for support

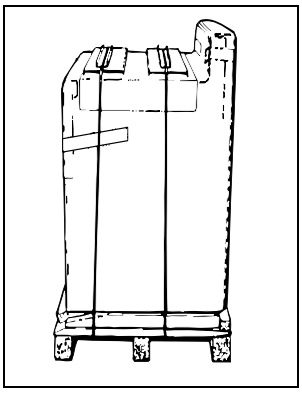


Illustration 1

After removing the steel straps, the 4 securing screws and transportation sleeves, the steel rails are removed and are fixed to the palette in front of the wheels using the supplied nails as shown in Illustration 2.

When doing this, ensure that the rails are parallel!

The wooden lath supplied must be pushed under both steel rails for support with the narrower side facing upwards.

Illustration 2: Lining up the metal rails so that they are parallel and securing them with the nails.

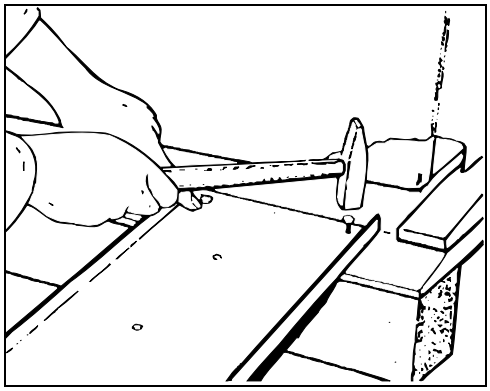


Illustration 2

Now, remove the stand feet (if attached) after screwing in the appropriate screws (Illustration 3 and 4).

Illustration 3: Removing the stand feet using a 24 mm open jawed spanner.

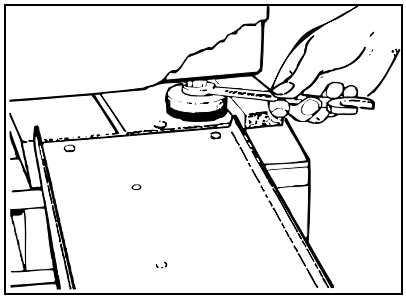


Illustration 3

Screw in the stud bolts and safety hooks up to the top, so that they do not get caught when the centrifuge is being rolled down.

Illustration 4: Removing the stand feet

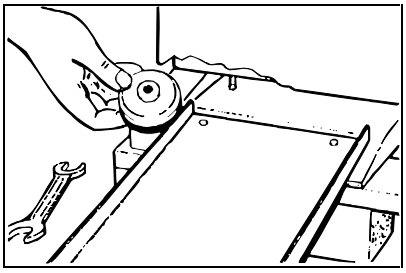


Illustration 4

When rolling the centrifuge (observe weight) down from the palette, at least 2 adults are required (see Illustration 5). In case of doubt, use a third person.

Once again ensure that the rollers run smoothly over the rails and check the steering rollers are facing the rear.

Illustration 5: Centrifuge being slowly rolled from the palette by 2 people

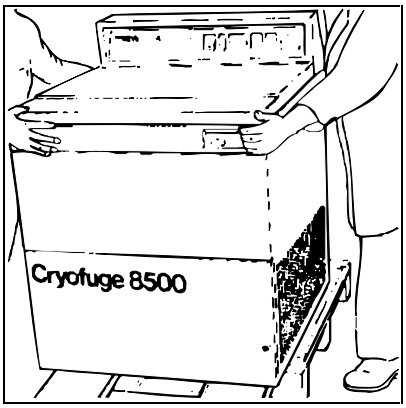


Illustration 5

After installation at the location, re-attach the stand feet.

Observe requirements of the place in which the centrifuge is to be installed!

Screw out the stud bolts, put the appliance feet underneath in the centre and align the centrifuge so that all feet are equally burdened (carry out the toppling test) and the transport rollers are approximately a hand's width from the floor.

Illustration 6: Re-attaching the stand feet

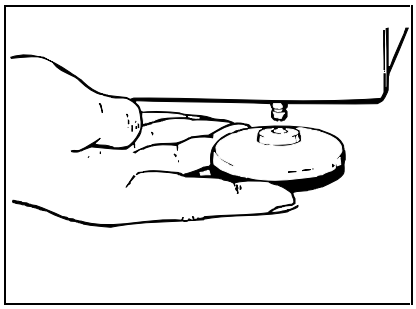


Illustration 6

The final assembly of the safety hooks takes place after unpacking and installing the rotor and subsequent levelling of the drive. (see "Installing the rotor").

Unpacking the Rotor

To avoid damage during transportation, the rotor is delivered in special packaging. The contents of the steel armoured carton on the wooden palette are wrapped in foam.

To unpack the contents, proceed as follows:

1. Cut and remove the steel straps using snips (Illustration 7).

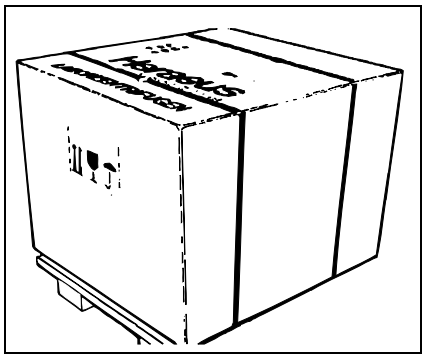


Illustration 7

2. Cut open the carton along the edges (Illustration 8).

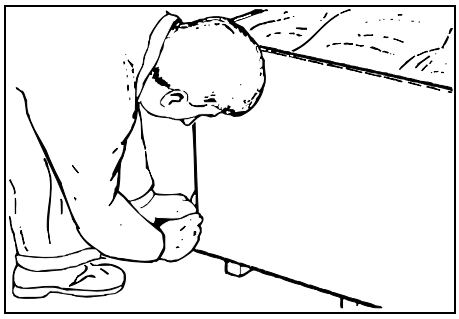


Illustration 8

3. Remove the foam padding and take out the buckets and other accessories (Illustration 9).

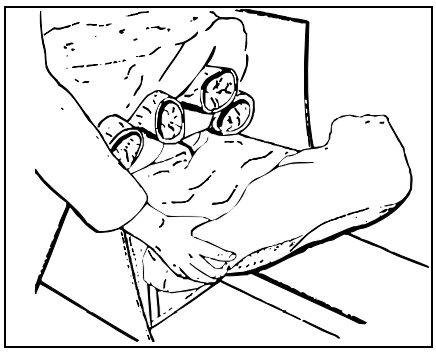


Illustration 9

4. Take the lid off the uncovered tubular frame and cut the steel straps using snips and remove them (Illustration 10).

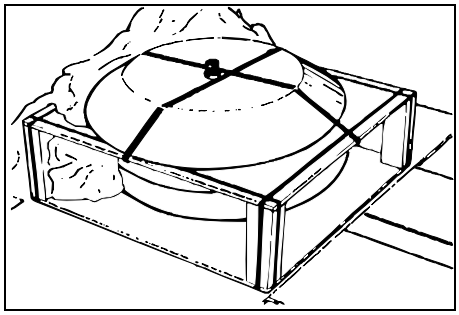


Illustration 10

5. Unscrew the nut from the central fastening screw. The supplied open jawed spanner size 17 can be used for this. Keep the nut and steel washer for subsequent transportation (Illustration 11).

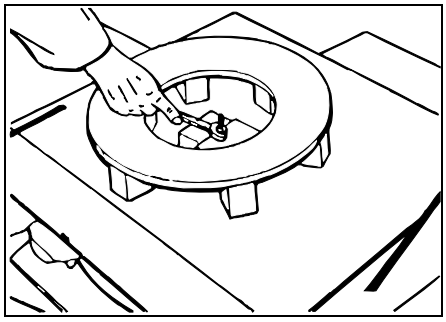


Illustration 11

6. After removing the upper piece of wood, the rotor is free. Remove the spacer, which prevents the central securing screw from rattling, from the flanged nut and keep it (Illustration 12).

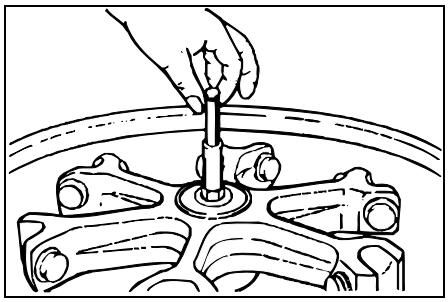


Illustration 12

7. The rotor weighs approx. 25 kg and is therefore best transported by two people, as shown in Illustration 13.

   WARNING!
   Under no circumstances hold the rotor by the wind boiler and try to transport it in this way! The wind protection boiler could bend, and then the rotor may no longer be able to rotate perfectly, if these instructions are not followed!

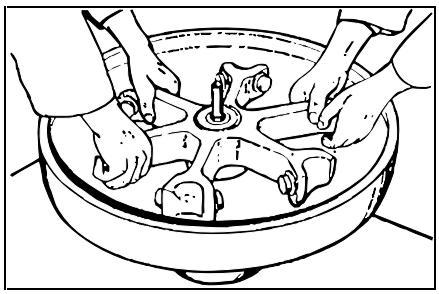


Illustration 13

8. Keep the packaging in case of subsequent transportation (bottom plate, top plate, 4 rectangular shaped wooden supports, 1 wooden palette, 1 nut (17 mm), 1 steel washer, 1 spacer, see Illustration 14).

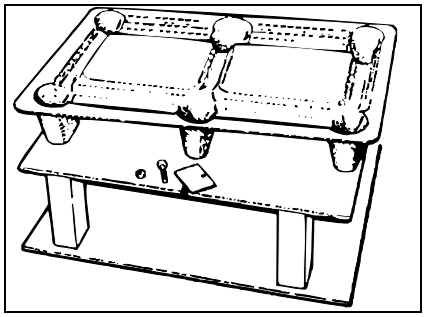


Illustration 14

Installation place

The rear side of the CRYOFUGE must be positioned at least 50 cm away from the wall and at least 30 cm away from the side. Therefore, a level, secure surface of at least 1.5 m² is required.

CAUTION!
The centrifuge must not be placed near to heat generators or radiators!

The **surface load of 1300 N/m²** requires a secure surface (concrete) and if necessary, a foundation.

WARNING!
The safety regulations require the marking of a danger area of 30 cm around the appliance, with the notice that during centrifuging, neither persons nor hazardous materials may be inside this area.

Connection requirements

Before the centrifuge is connected to the power supply, it must be ensured that:

1. The voltage specifications on the type plate are identical to the available supply voltage: 400 V / 50 Hz (3 phases + neutral conductor + earthed conductor)
2. The neutral conductor can be applied with 25 A (unsymmetrical phase loading)
3. For the connection a CEKON socket (32A-6h, 3L+N+PE) and for permanent connection, a three-pole isolating switch (3 x 63 A) is available.

CAUTION!
A permanent installation of the electrical wiring must only be carried out by a qualified electrician!

Start-up

Connect the plug to the required CEKON socket (32 A), or remove the plug and permanently install the cable.

Switch on the power switch on the front right.

All 7-segment displays and diodes light up for a short time to be tested (system check).

CAUTION!
The power switch must not be used to stop the centrifuge procedure (apart from in cases of emergency). To stop the centrifuge, use the QUICK STOP or STOP key!

Opening the lid

The centrifuge lid can only be opened when the yellow LED is lit up. This is only possible when the rotor is not rotating or has finished rotating and no error messages are shown.

CAUTION – DANGER!
The mechanical lid unlocking system, (emergency lid opening) must only be used in cases of emergency, e.g. if there is an interruption in the electricity supply.
You must wait until the drive has come to a complete stop!
(See instructions for safety equipment, page 6)

Installing and Removing the Rotor

CAUTION!
Before fitting the rotor, make sure that the rotor chamber is free of impurities (dust, splinters of glass, or similar). Condensed water or the remains of test liquids must be removed before centrifuging!

Handling the wind protection boiler rotor

WARNING!
The wind protection boiler rotor must only be carried by the steel cross and with the lid removed. Never transport the rotor carrying by the wind protection boiler!

Due to the weight of the rotor (approx. 25 kg) it should only be carried by 2 people. It must be ensured that the thin-walled aluminium boiler does not get dented or damaged in any way, which can lead for example to serious malfunctions during operation and damage to the centrifuge.

Installing the rotor

After positioning the rotor on the primary shaft, it is secured as follows:

1. Put the 10 mm socket spanner through the central rotor bore hole on the hexagon of the conical primary shaft.
2. Hold the rotor flanged nut in position with the 19 mm open jawed spanner.
3. Turn the primary shaft anticlockwise with the 10 mm socket spanner until it stops.
4. Tighten the flanged nut with the 19 mm open jawed spanner (in a clockwise direction), in the other hand holding the rotor by the rotor cross.
5. Position the box level centrally on the flanged nut and accurately level the drive using the feet.
6. Securely tighten the counter nuts of the stand feet and screw in the safety hooks to the feet using the size 8 open jawed spanner.

Lubricating the swing bearing bolts

CAUTION!
The retaining bolts of the swing rotor must always be lightly lubricated!

The swinging action of the buckets and the balance of the centrifuge are positively influenced by the lubrication film, particularly during acceleration and deceleration.

The friction surfaces should be lubricated with sliding grease on a daily basis, or at least after every 10 runs.

Before lubrication, the bolts and the retaining grooves of the swing buckets must be thoroughly cleaned using a dry cloth.

CAUTION!
Under no circumstances must organic solvents, alkaline cleaners or household cleaners containing scouring powder be used!

The suitable lubricant is available from KENDRO Laboratory Products, order number 70006692.

Molykote lubricants and lubricants containing graphite are not permitted!

Rotor hood

The wind protection boiler rotor no. 6606 is designed with a removable hood, in order to keep air friction and noise to a minimum and therefore to reach the specified maximum speeds (with the hood on). When loading the rotor, the hood should be inserted in the holder especially provided for this purpose on the inner side of the centrifuge lid (see illustration 15)

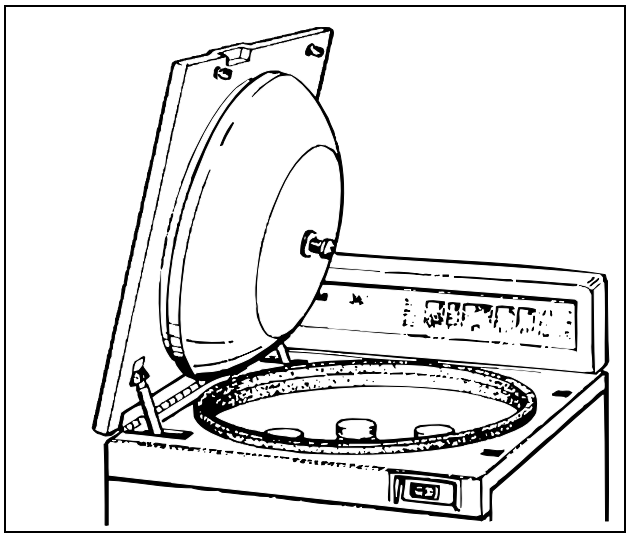


Illustration 15

WARNING!

1. If the wind protection boiler rotor is operated without the hood, (e.g. in the case of pre-cooling) the speed set must be reduced to 2000 rpm (no. 7719: to 1500 rpm)!
2. For the operation of the double blood bag buckets no. 7617 in an old rotor (delivered before 1993), a newly shaped hood must be used. The positive permit for bucket type no. 7617 must be visible on the top of the hood, if not the rotor must not be operated with the hood and only up to 2000 rpm without the hood.

The hood was newly designed after the introduction of the double blood bags (since 1993) and can be obtained afterwards under order no. 75007614.

Rotor removal

In order to remove the rotor from the primary shaft, proceed as follows:

1. Remove the hood and put it in a safe place (do not place it in the holding device during removal of the rotor).
2. Loosen the flanged nut with the 19 mm open jawed spanner in an anti-clockwise direction (see direction of arrow stamp), whilst securely holding the rotor by the cross arm.
3. After one turn, there is an additional rotational resistance which has to be overcome by a further lever pressure using the open jawed spanner.
4. Then, turn the primary shaft in a clockwise direction using the socket spanner until the rotor can be lifted out.
5. The rotor must be held by two people on two opposing cross arms and carefully lifted out of the rotor chamber.

Loading the Rotor

General instructions

CAUTION – WARNING!

In order to avoid damage to the centrifuge and accessories, the following instructions must be precisely followed!

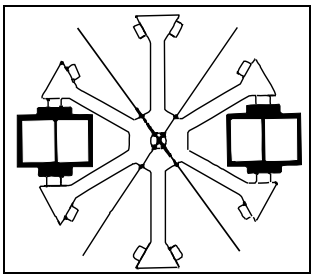


Illustration 16

Bucket positions

WARNING! Illustration 16 - prohibited!

Never start the centrifuge when not all of the carrying buckets are inserted!

For the swing rotor, all positions must be filled with buckets of the same type (same order number)!

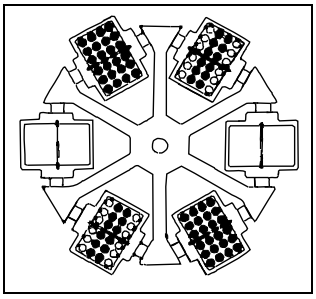


Illustration 17 – acceptable

Partial loading is possible (however all positions must be filled with buckets)

The buckets could have distinguishing characters for determining the varying weights.

Only buckets of the same weight class may be placed opposite each other!

Illustration 17

Symmetrical loading

The following illustrations show how vessels can be incorrectly or correctly placed in the rotor:

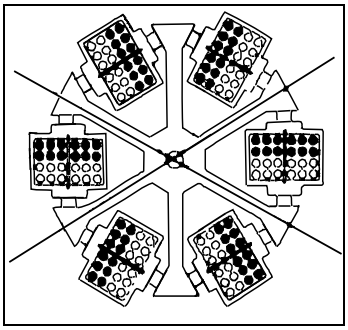


Illustration 18 – not acceptable!

The retaining bolts are unequally burdened.

Illustration 18

The vessels must be distributed within a bucket so that the load on the retaining bolts is equal!
For partial loading, see illustration 17 or illustration 20.

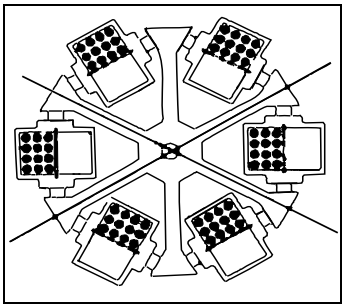


Illustration 19 – incorrect!

Imbalance due to unequal swinging of the buckets!

Illustration 19

The rotor must always be symmetrically loaded and vessels and inserts equally distributed.

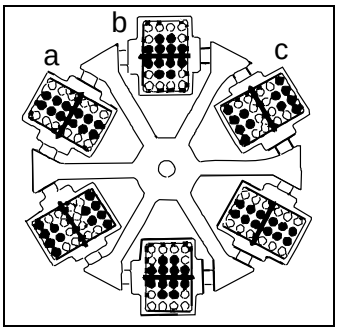


Illustration 20 correctly loaded

No imbalance because all vessels are symmetrically distributed.

Of all the variants shown (a, b, c), b is the best possible.

Illustration 20

Filling the vessels

Centrifuge vessels of up to approx. 30 mm diameter can be filled according to visual estimations (approx. 5 - 10 mm under the rim, depending on size).

With a larger quantity of the same vessels, small differences in weight between the individual vessels statistically even themselves out.

Permitted imbalance

In order to avoid imbalances, it is recommended to load opposite facing positions with adapters, multiple carriers, tubes, bottles etc of the same kind as well as filled to the same level.

Imbalance causes running noises and has negative effects on the drive system (premature wear of the motor bearing).

The permitted difference in total weight (or loading) of opposite facing buckets should not exceed 10 grams.

Blood bags should be weighed out to a maximum tolerance of 5 grams. The better the counterbalance, the better the running performance of the centrifuge: improvement in the separating quality, because the whirling up by oscillations of areas already separated can be avoided.

To establish the bucket weight, any laboratory scales, or even better, counterbalancing scales are suitable.

Maximum load

At high speeds, enormous centrifugal forces occur, which stress the arms and other rotor parts. Therefore, each rotor only has a limited strength and lifecycle.

HERAEUS rotors are designed so that they have a high reserve of strength even with maximum loads and speeds. However, the maximum values must not be exceeded, as otherwise the lifecycle of the rotor and buckets is considerably shortened.

The user is responsible that overloading of the rotor does not occur, by observing the maximum swing bucket weights.

The maximum load is reached when the filled liquid has a density of 1.2 g•cm^{-3} when using plastic buckets. In cases of higher densities or when using steel buckets, partial filling must be applied. The weight must not exceed the value that is reached with a complete filling of a liquid with the density of 1.2 g•cm^{-3}.

Alternatively, the maximum permitted speed n_{max} is to be reduced according to the following formula:

$$n_{perm} = n_{max} \times \sqrt{\frac{perm.\,total\ weight\ of\ the\ load\ for\ n_{max}}{increased\ total\ weight\ of\ the\ load}}$$

CAUTION!

For density values over 2.0 g•cm^{-3}, you should always contact KENDRO in Osterode!
You can reach the service department under the telephone number +49 5522 316 0.

Special Features for Working with Blood Bags

Inserting blood bags

Correct position of the blood bag

The flexibility of a blood bag can lead to difficulties during inserting in and removing from the centrifuge bucket/insert.

If the bucket is too narrow, the bags are difficult to insert. If the bucket is too wide, then the material can form creases and folds, can overstretch or tear.

Therefore the bag must sit firmly in the insert in order to avoid folding. "Nests" can form in the folds, i.e. cells can accumulate and evade the sedimentation process. This leads to poor results.

Furthermore, it must be ensured that the tube connections in which cells are also found, are standing upright. Then the cells can be separated and do not contaminate the plasma during the subsequent squeezing process.

The correct position of the blood bag is a condition for good separating results. It is guaranteed by selecting a suitable blood bag bucket and insert.

Arrangement of the bags in the centrifuge bucket

As in a double blood bag bucket different forces are present in the separating zones in both bags during the deceleration phase at low speed, this can lead to deviations in the separating results.

The larger the difference, the larger the distance between the bags in the bucket. Therefore it is recommended that the bags filled with blood be arranged in the double buckets in the centre opposite one another, and the satellite bags in the outer area.

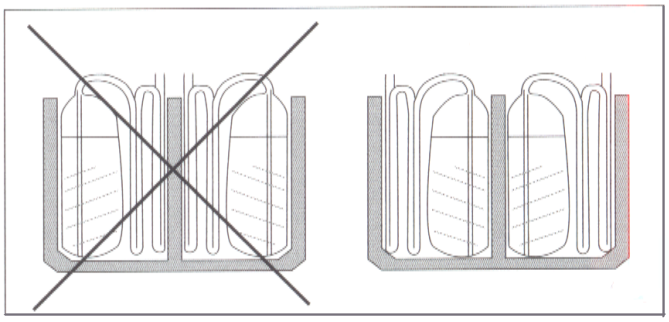


Illustration 21

Use of plastic inserts

In order to facilitate the transportation of blood bags before and after centrifuging, plastic inserts can be used. The bags are placed inside these inserts and placed directly in the blood bag buckets of the centrifuge.

After centrifuging, the inserts with the bags are removed. The bags can easily be removed from the inserts and inserted in the squeezing device.

Centrifuging blood bags

When centrifuging blood bags, the following must be ensured:

The balance of the centrifuge operation depends to a great extent on the distribution of weight in the opposing buckets.

The larger the difference in weight of the load, the stronger the oscillations of the appliance and as a result of this, the stronger the whirling up of already separated areas.

- Balance opposing buckets well
  (maximum tolerance 5 grams)
- Lay the tubes hanging from the bags downwards, so that they cannot be thrown around and torn during operation.

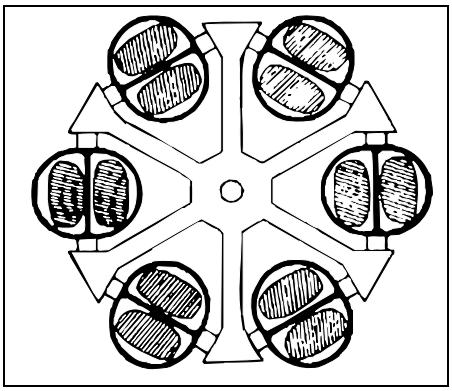


Illustration 22 **correct -** ideal load

- Avoid an uneven number of blood bags, because then the balance will need to be made up e.g. with water bags, which has the following disadvantage:

  Whilst the water bag has constantly the same mass distribution during the course of centrifugation, the erythrocytes in the blood bag slowly migrate to the periphery and displace the centre of gravity so that the system slowly becomes unbalanced.

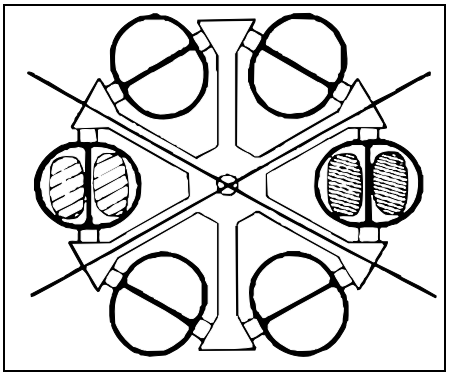


Illustration 23 **incorrect -** imbalanced operation

Double buckets must be basically equipped with 2 bags or bag systems, in order to avoid hanging crookedly. If, for example, only 2 bags are to be centrifuged, these should be inserted opposite one another in the inside of the buckets, and water bags should be placed in the outer positions (Illustration 24).

Blood bag 

Water bag 

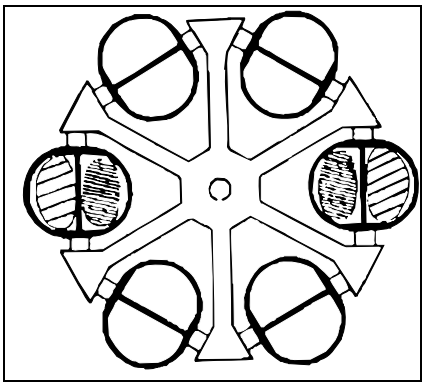


Illustration 24 **correct** – two-bag operation

Three water bags are required per blood bag (Illustration 25).

With multiple bags (double, triple or quadruple bags), the blood removing bag should be placed in the central area, next to the dividing wall.

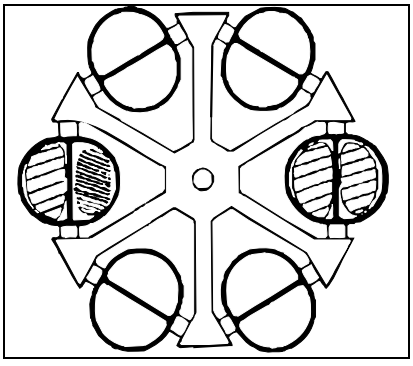


Illustration 25 **correct –** one-bag operation

"SEPACONTROL" Programming

"SEPACONTROL" is the brand name for the user interface of KENDRO Laboratory Products GmbH for programming, diagnosis, control and adjustment of operating functions.

The operating and display elements are, with the exception of the key switch, integrated in a touch-keypad with clear display of the user guidance in fields.

Design

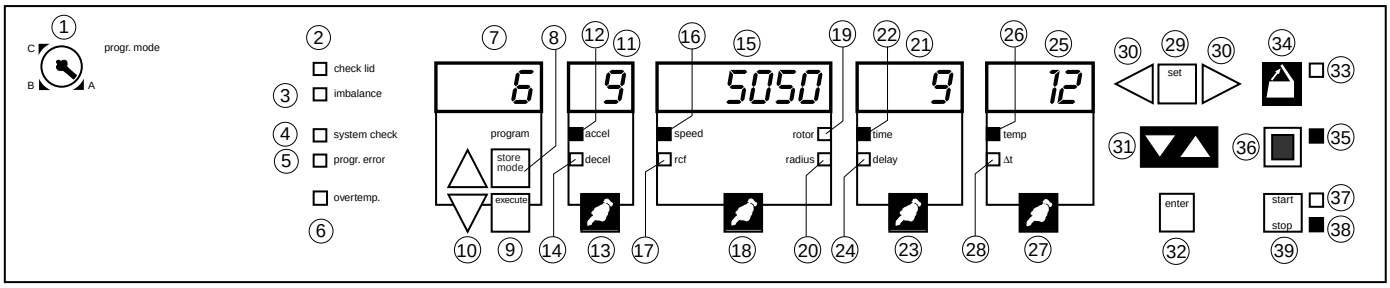


Illustration 26: SEPACONTROL key and display panel

1. Key switch

Diagnosis displays
2. Lid open
3. Imbalance
4. System check
5. Programming error
6. Excess temperature

Program field
7. Program display
8. Key to activate program memory
9. Key to end saving process
10. Direction keys for choosing program number

Functional fields
Curve field
11. Display of curve numbers
12. Reference LED: Acceleration curve
13. Selection key for acceleration and deceleration curve
14. Reference LED: Deceleration curve

Four-function field
15. Display for multi-functional displays
16. Reference LED: Speed
17. Reference LED: RZB value
18. Selection key for speed, RZB, rotor/bucket or radius
19. Reference LED: Rotor/bucket type (order no.)
20. Reference LED: Radius

Time field
21. Time display
22. Reference LED: Running time
23. Selection key for running time or start delay
24. Reference LED: Start delay

Temperature field
25. Temperature display
26. Reference LED: Temperature display
27. Selection key for set temperature or excess temperature control
28. Reference LED: Excess temperature

Adjustment key field
29. Key for set value display and adjustment
30. Direction keys for pre-setting the display positions
31. "+" and "-" keys for set value adjustment
32. Key for saving the adjusted set values

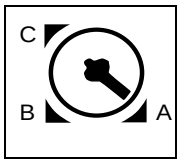
Control key field
33. Release LED to open the lid
34. Lid key
35. Release LED for "quick stop" (rapid deceleration)
36. "quick stop" key
37. Release LED to start ("start" function)
38. Release LED to decelerate ("stop" function)
39. Double function key to start or stop

Memory variants

1. Program memory area for up to 33 different user programs (including profile program). Each of these user programs can be loaded into the RAM memory at the beginning of the centrifuging process.
2. The RAM memory contains the current centrifugation program and is particularly suitable for constantly changing working conditions (e.g. during optimisation experiments).

Key switch

The position of the key switch influences the operating mode of SEPACONTROL.



Position A: Unlimited use
The user can use or adjust all the programs.

Position B: Program memory is secured against adjustments.
The current centrifugation program in the RAM memory can be adjusted.

Position C: Program and RAM memories are secured against adjustments.
All parameters set are blocked, but the current centrifugation program can still be run as often as necessary with the control keys.
All actual values can be displayed using the various "select" keys, and all set values using the "set" key.

The key can be removed in any position.

Display (set and actual values)

The display fields show either only actual or only set values.

Set values are indicated by a flashing cursor position.

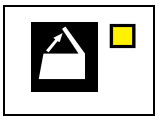
Sequential control

The control of the centrifuge is possible in any position of the key switch.

The release of the control key functions is indicated by the current standby LED on the right next to the key.

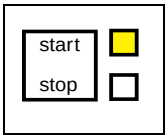
Opening the lid

Only when the centrifuge is switched on and the rotor is not turning any more and no error message is shown, can the lid be opened using the lid symbol key (yellow LED is alight). When the lid is open, the text "OPEN" is displayed in the multi-functional field. The start function is now blocked.



Starting

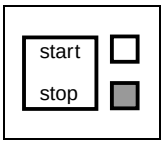
When the start release takes place (green LED is alight), centrifugation can be initiated using the "start/stop" key. After the start, the lid symbol key is blocked (yellow LED is off).



Stopping

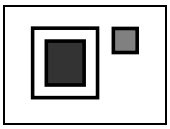
After each start the stop release (red LED is alight) is immediately activated. By pressing the "start/stop" key, centrifugation is terminated.

After each stop, the green LED is alight again. This means that the interrupted centrifuging process can be continued at any time (it is not necessary to wait until the rotor is at a standstill, in case it was unintentionally stopped).



Quick stop

Each centrifugation can also be stopped using the quick stop symbol key, when the red LED is alight. The "quick stop" function has been developed as the quickest form of deceleration.



Attention!
Pressing the quick stop key does not overwrite the programmed deceleration curve!

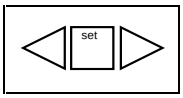
RAM memory operation

Key switch position

Adjusting set values is only possible in the key switch position A or B.

Calling up the setting mode (set value display)

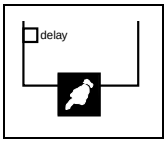
By pressing the "set" key or one of the two arrow keys, the set value mode is activated. The cursor flashes on the display position last chosen.



Calling up the setting function

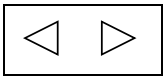
Press the hand symbol selection key of the corresponding function field once or several times if necessary, in order to display the set value to be changed.

The red LED marks the chosen functional parameter, and the set value last entered is shown.



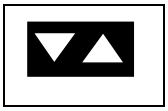
Calling up the setting position (decimal position)

Move the flashing cursor to the figure to be changed using the arrow keys. Positions which cannot be changed are skipped.



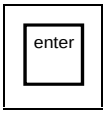
Entering the set value

With each touch on an one of the arrow keys, the displayed set value is increased or decreased.



Ending the setting - returning to actual value mode

To accept the entered display values as new set values, the "enter" key must be pressed. Otherwise, after 2 minutes (if the rotor is at a standstill) or 20 seconds (if the rotor is turning) the system will automatically switch back to the actual value mode without adopting the changes made.



Program memory operation

Creating and saving standard programs (position no. "01".... "32")

Key switch position

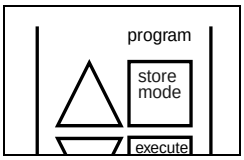
Changing programs is only possible in key switch position A.

CAUTION: The centrifugation process must not have been started!

Pre-setting a program number

With the directional program selection keys, the desired number from 01 to 32 or profile program (F1, F2,…) can be selected in single steps.

Activating programming

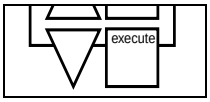


The pre-set program number can be displayed flashing by pressing the "store mode" key. This visually indicates that an adjustment of the program set values is possible.

Entering set values

The set values are to be entered as described under “RAM memory operation“.

Ending programming



The entered set value record can be stored at the chosen program memory position by pressing the "execute" key thereby ending the flashing phase.

Creating and saving a profile program (position "F", max. 10 levels)

The profile program enables the user to establish an individual program from acceleration and deceleration profiles as well as speed levels with a maximum of 10 different segments.

This additional program is available in the user memory in position 33 under display "F".

Key switch position

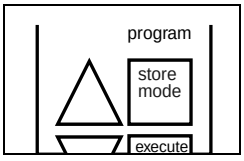
Changing profile programs is only possible in key switch position A.

CAUTION: The centrifugation process must not be started!

Pre-setting a program number

Call up the memory segment "F1" using the directional program selection keys.

Activating programming



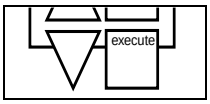
The memory segment "F1" is displayed flashing by pressing the "store mode" key.

Entering set values

In the segment "F1", all parameters of the complete centrifuging process must be set (bucket order number and set temperature cannot be changed in the following levels). With the "upward arrow" key, the values set are saved and the transition is made to "F2". For all the following segments ("F2" - "F0"), only the acceleration or deceleration curves, speed and time values can be set. For the last segment, the deceleration curve number (0-9) must be selected and the speed set to zero.

Attention!
After completion of a programmed time segment, the appliance will switch to the next profile segment independent of the speed value set. If all 10 available program segments are occupied, the appliance will decelerate using deceleration curve 9 after completion of segment 10.

Ending programming



The program set is stored in the profile program memory position by pressing the "execute" key thereby ending the flashing phase.

Examples of profile programs

Profile program A (24 min)

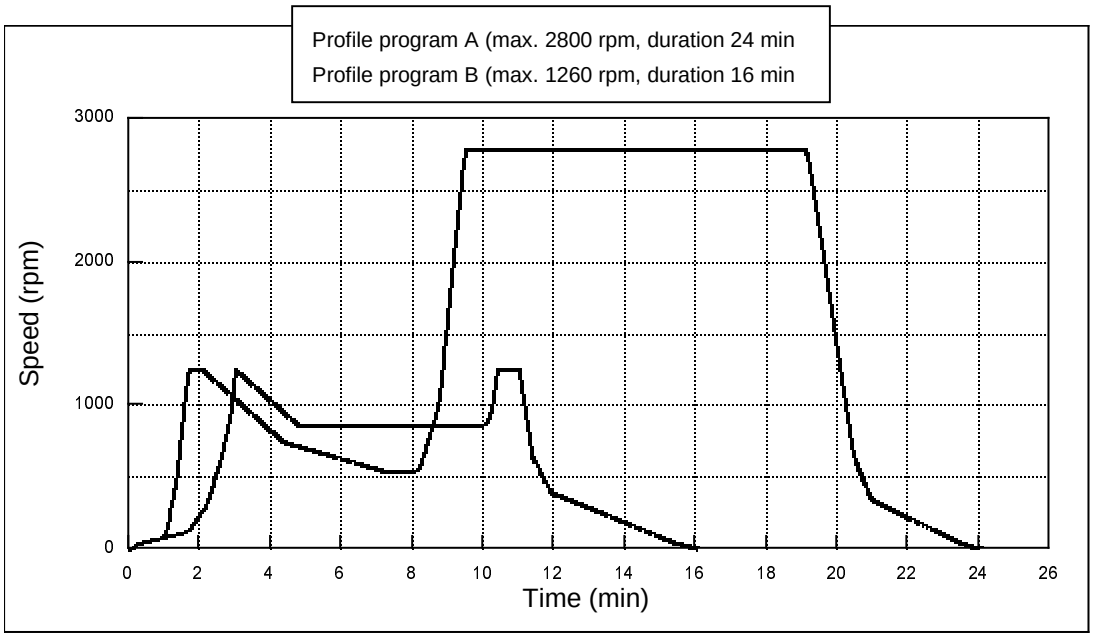
Program level	Acceleration curve	Deceleration curve	Speed (rpm)	Rotor bucket no.	Time (min)	Temp. (°C)
F1	6	9	1260	7617	1	20
F2	9	9	1260	As for F1	1	As for F1
F3	9	1	540	As for F1	6	As for F1
F4	8	9	2800	As for F1	11	As for F1
F5	9	6	0	As for F1	(5)*	As for F1
F6						
F7						
F8						
F9						
F0						

* results from the course of the curve independently of the pre-set time

Profile program B (16 min)

Program level	Acceleration curve	Deceleration curve	Speed (rpm)	Rotor bucket no.	Time (min)	Temp. (°C)
F1	5	9	1260	7617	3	20
F2	9	1	860	As for F1	7	As for F1
F3	1	9	1260	As for F1	1	As for F1
F4	9	5	0	As for F1	(5)*	As for F1
F5						
F6						
F7						
F8						
F9						
F0						

* results from the course of the curve independently of the pre-set time



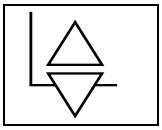
Operation with saved programs

Key switch position

Programs can be carried out in any key switch position. However, a program change is only possible in positions A and B.

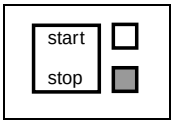
CAUTION: Program changes are not possible when the centrifuge is running!

Choosing a program



Choose the program with the desired set values using the direction keys and store in the RAM memory by pressing the "enter" key.

Storing programs and starting without pressing the "enter" key



By pressing on the "start" key within 2 minutes the content of the preset program memory position is copied in the RAM memory and immediately started. If the “start” key is not pressed, the chosen program is closed without being stored in the RAM memory.

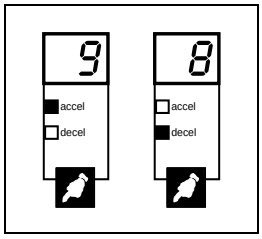
Modifying programs in the RAM memory

Choose the program that is to be changed as described. As described in "RAM memory operation" only set value parameters can be changed.

Attention:
Such a change is shown in the program field by "--". That means that the changes are only effective in the RAM memory. The program originally called up remains unchanged.

Additional setting information

Input in the curve field



The different curves for acceleration and deceleration are explained in more detail in the chapter "Acceleration and deceleration curves".

The acceleration curves can be adjusted from 1 to 9.

The deceleration curves can be adjusted from 0 to 9.

(Acceleration and deceleration effect increases from 1 to 9)

Deceleration curve 0 means non-decelerated slow-down, that means the braking curve is not defined.

Attention: If with the chosen curve 0 the set speed is reduced during the operation, the new set speed is driven with deceleration curve 1; the previously chosen curve 0 remains unaffected.

Input in the four-function field

1. Speed

   Input of the speed can take place in steps of 10, 100 or 1000 from 300 rpm up to the maximum speed of the inserted bucket.

2. RZB

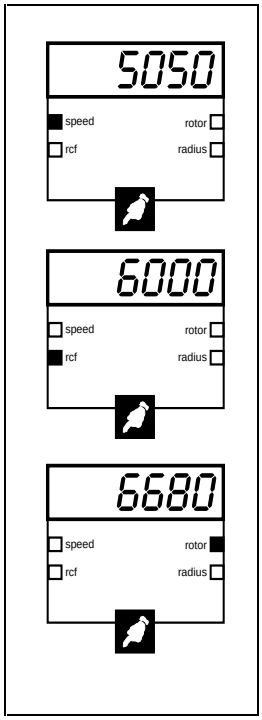
   The RZB set value can be entered in steps of 1, 10, 100 or 1000 from the equivalent of 300 rpm up to the maximum RZB value of the inserted bucket.

3. Rotor / bucket

   Pre-setting the bucket is only possible before the start of centrifugation. The rotor order numbers are saved in ascending order, and can only be entered as integers.

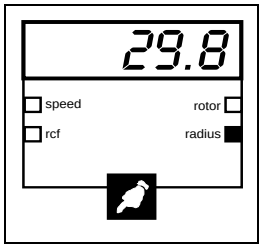
   CAUTION – DANGER!

   The order number (last 4 digits) of the inserted bucket must always be programmed, in order to avoid risk of accidents by possible errors in the programming of speeds (see rotor table)!



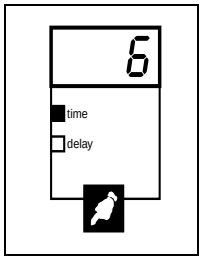
4. Radius

   Setting the radius is dependent on the bucket and can be carried out in steps of 1cm or 0.1 cm starting from the nominal radius (maximum value) until the smallest possible radius. The maximum and minimum radii of the buckets relate to the swung-out state during centrifuging.



Input in the time field

1. Running time



The running time can be pre-set for a particular timeframe or unlimited (hld = hold). After a set time has elapsed, centrifuging stops automatically.

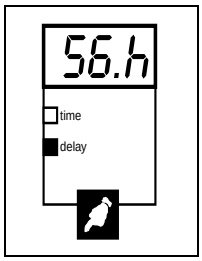
Time pre-setting in h.min mode:
- in hour, 10 minute or minute blocks up to 9.59 (9h 59 min).

The h-mode can be used for longer running times:
- ten hours or hour blocks from 10h to 99h.

Attention!

Running time is calculated from the start until the moment of deceleration, i.e. deceleration time is not included in the running time.

2. Start delay

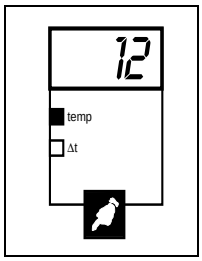


The start time point can be pre-planned up to 99 hours. It is entered and managed as described for the running time (see above).

With the start delay set, the timer is activated only after pressing the start key. In the four-function field, "delay" is also shown for the duration of the start delay. If no start delay is necessary, the setting "---" is displayed.

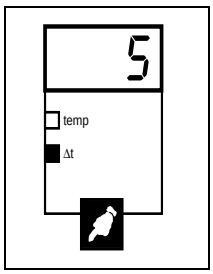
Input in the temperature field

1. Sample temperature



The set value of the sample temperature can be set in a range of –20°C to 40°C in 10K or 1K steps.

2. Excess temperature control



The ΔT function is designed for monitoring temperature sensitive samples.

5K (excess temperature) can be pre-set as the smallest ΔT range.

The maximum adjustable ΔT range depends on the programmed set temperature and is automatically limited by the microprocessor.

If no ΔT is pre-set, the display shows "--".

Attention!
Before activating the ΔT, the entered sample set value must be pre-heated in order to avoid false alarms.

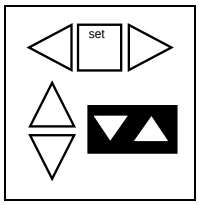
Special features

Rapid input

The following functions increase the input speed of SEPACONTROL.

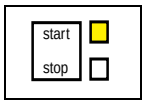
1. Sustained depression

   By constantly pressing on one of the arrow keys shown here, the microprocessor activates automatic relaying, which is immediately stopped when pressure is removed from the particular key.



2. Saving set values and immediately starting up

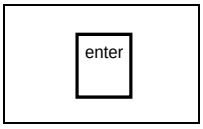
   For changes to set values with subsequent centrifugation, pressing the "start" key is sufficient. This way the "enter" and "start" functions are immediately carried out one after the other.



Acoustic signal transmitter

After the end of each centrifugation, a steady tone is produced, which can be switched off by quickly pressing any key.

This acoustic signal can be deactivated for all further centrifugations by pressing the "enter" key in the actual value mode. By pressing the key, "Alert off" is briefly displayed. This switching off can be undone by pressing "enter" again (display now: "Alert on") or by turning the appliance off and then on again.



Diagnosis displays

Possible malfunctions, which may occur in the appliance, or any particular operating errors are shown by red lights (LEDs) which have the following meaning:

LED	"lid"	Centrifuge lid not closed
LED	"imbalance"	Imbalance sensor triggered off
LED	"system check"	Malfunction of the centrifuge (see troubleshooting)
LED	"program error"	Operating error
LED	"overtemp."	Temperature limit exceeded

Acceleration and Deceleration Curves

The CRYOFUGES are equipped with 9 different acceleration and deceleration curves for optimum use of the different applications.

Design of the curves

The curves contain a smooth start-up and smooth slow-down phase and a phase with high acceleration. The resonance speeds determined by the laws of physics lie in the phase of high acceleration and high deceleration, so that they have no disturbing effects on samples and the motor system.

Choice of curves

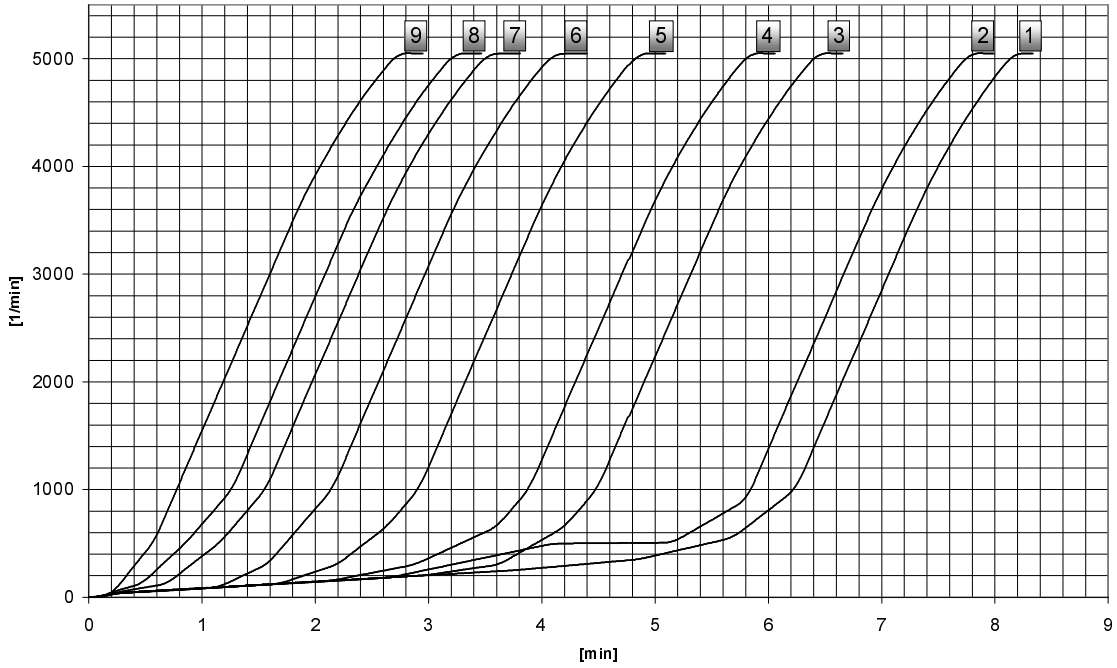
Curve No. 9 has the shortest acceleration or deceleration time, curve no. 1 has the longest acceleration or deceleration time. Deceleration curve 0 means non-decelerated slow-down, and can therefore not be reproduced.

The quickest deceleration can be carried out using the quick stop key, in which the rotor is brought to a standstill with the maximum brake force possible.

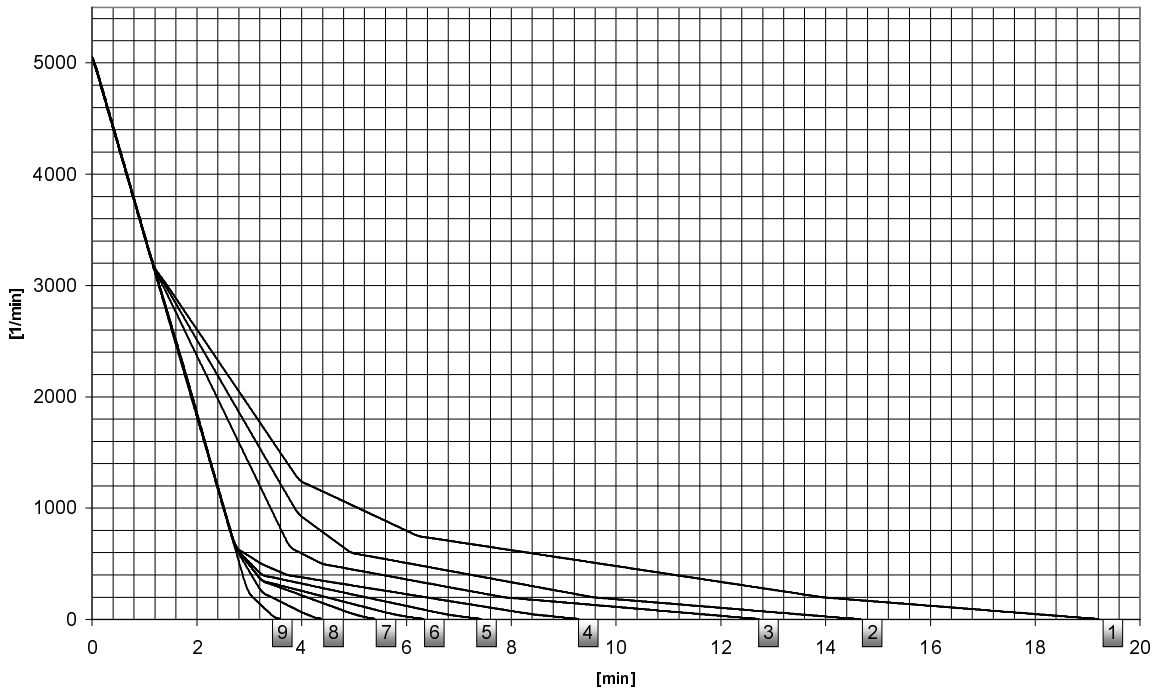
Whirl production on deceleration

With swing rotors the back-swing of the buckets starts at approx. 200 rpm. As a result, different accelerations effect the samples which could cause partial back-mixing. The whirling can be suppressed more effectively, the slower and more even the rotor comes to a standstill (e.g. deceleration curves 1 to 5).

Acceleration curves Cryofuge



Deceleration curves Cryofuge



Instructions for Temperature Control

In a steady state (thermal balance) the sample temperature is shown with an accuracy of ±2 K.

The minimum sample temperatures which can be achieved are dependent on the speed set and ambient temperature (see "Rotor/Bucket table" on page 47).

Attention!
The temperature control is only active when the lid is closed!

Pre-heating of rotor and bucket

The rotor and empty buckets should be pre-heated before centrifuging begins.

For this purpose, the following procedure is recommended:

1. Enter in the order number of the inserted bucket
2. Enter the required sample temperature
3. Set ΔT to "--"
4. Set speed to 2000 rpm - **WARNING!** For bucket no. 7719, n_{max}= 1500 rpm is the maximum speed!
5. Set running time to 30 min
6. Remove rotor hood and then press the "start" key.
   (The speed set may not exceed 2000 rpm, or 1500 rpm with bucket no. 7719)

Attention!
Removing the hood generally contributes to a quicker temperature compensation.

The pre-heating program has the advantage that it can be saved in a program memory position.

Maintenance and Service

The maintenance service for the centrifuge must be regularly carried out once a year by the authorised customer service.

For this purpose, KENDRO Laboratory Products offers inspection and service agreements. The inspection costs consist of a lump sum payment. Necessary repairs are carried out free of charge in the framework of the guarantee conditions. However, repairs outside the guarantee will be charged for.

In Germany, under the Industrial Accident Prevention Guidelines VBG 7z, annual inspection by a specialist is stipulated.

The test book stipulated by VBG 7z, in which all maintenance work by the customer service is to be entered, is delivered with the centrifuge. The test book must always be kept near the centrifuge (this only applies in Germany).

Maintenance work, carried out by you

To protect persons, the environment and materials, you are obliged to regularly clean the centrifuge and to disinfect when necessary.

CAUTION – WARNING!

Incorrect cleaning agents or disinfection procedures damage the centrifuge and its accessories!

For cleaning, use only the cleaning and disinfection procedures stated in these operating instructions.

Cleaning

Disconnect from the power supply before cleaning!

Maintaining the centrifuge generally means keeping the housing, the rotor chamber, the rotor and the accessories clean. This should be done at regular intervals, or whenever necessary. This is for hygienic reasons and also in order to prevent corrosion through adherent contamination.

CAUTION – WARNING!

Organic solvents corrode the lubrication of the motor bearing.

The primary shaft can get blocked.

During cleaning, no fluid, particularly no organic solvents, must come into contact with the primary shaft or the ball bearing.

For cleaning, only use cleaning agents approved by KENDRO Osterode:

- Caraform
- deconex 16 NT
- Extran MA 02 neutral
- RBS neutral

For all other cleaning agents, please consult the service department!

Non-observance can lead to damage to the appliance or its components.

Immediately after cleaning, the aluminium parts must be dried off or dried in a warm air cabinet (maximum temperature 50°C).

Rubbing the anodised aluminium parts regularly with corrosion protection oil (order no. 70009824) is required, thus extending the life cycle and minimising corrosion.

Disinfection

CAUTION – WARNING!
There could be infectious material caused by any breaks in the vessel or spillage in the centrifuge. Danger of infection on contact!

Observe the permitted filling volume!

In the case of contamination, immediately disinfect the rotor, rotor chamber, and if necessary, accessories (adapter).
Wear protective gloves!

If, during the centrifugation process, a leakage containing infectious material occurs at one of the centrifugation vessels, the centrifuge must be immediately disinfected. When doing this, please observe the following:

To decontaminate the rotor chamber and the rotor in the case of contamination, only use disinfectants approved by KENDRO, which are to be used according to the instructions for use of the product:

- Aldasan 2000
- Carlitt Spray
- Coldspore
- Gigasept FF
- HBV Pump-Spray
- Incidin Liquid Spray
- Incidur Spray
- Incidin plus
- Kohrsolin iD
- Lysetol FF
- Lysoform
- Lysoformin 3000
- Sagromed
- Sagrotan

For all other disinfectants, please consult the service department.

- The rotor and the accessories can be disinfected as follows. Observe the safety guidelines, which are valid when treating with infectious material.

1. Disconnect from the power supply (pull the mains plug).
2. Remove the centrifuge vessels and adapters and dispose of or disinfect them.
3. Treat the rotor and the rotor lid according to the instructions for the disinfectant (either submerse in solution or spray). The given time to take effect must be observed.
4. Afterwards, rinse the rotor and rotor lid well with water.
5. Dispose of the disinfectant solution according to current guidelines.
6. Afterwards, aluminium parts must be treated with corrosion protection oil (order number 70009824).

Attention!

To decontaminate and preserve blood bag buckets and plastic inserts, a rinsing machine with programs specially developed for this purpose can be used. (More information on request).

Condensation outlet

Condensation can form through humidity or not hermetically closed samples depending on the temperature in the rotor chamber. The liquid runs into a storage tank, which must be emptied regularly.

The condensation tank is easily accessible after opening the front panel of the appliance (after pulling out the tube, the tank can be removed from the mount).

CAUTION!
Condensation outlets, tubes and storage tanks, which could easily become a source of bacteria from spilt blood, serum or plasma, must be disinfected regularly, if sample material of this type is centrifuged regularly.

It is recommended that approx. 50-100 ml liquid disinfectant is always left in the condensation tank.

Autoclaving

Observe the permissibility of autoclaving!

CAUTION!
Rotor and carrying buckets must not be autoclaved.

The Centri-Lab inserts can be autoclaved at 121 °C.

Chemical additions to the steam are not permitted!

Broken glass

Centrifuge glasses have an increasing statistical break quota with increasing ‘g’ size.

CAUTION - WARNING!

Splinters of glass must be immediately and completely removed from the swing bucket / adapter and the rotor area, as they can scratch the surface area protection or become stuck in the retaining bolts of the swing bucket rotors and therefore hinder the buckets when swinging out.

Bearing lubrication

CAUTION – LUBRICATE SWINGING BEARING!

The retaining bolts of the swing buckets must always be lightly lubricated, to prevent jerky movements of the swing buckets! They should be lubricated regularly, at least after every 10 runs!

The bolts of the rotor and the retaining grooves of the swing buckets must be thoroughly cleaned with a dry cloth before lubrication. Under no circumstances are organic solutions, alkaline cleaning agents or cleaning agents containing scouring powder to be used.

Lubricants are among the accessories (order number 70006692)

Important information!
Molykote and graphite containing lubricants are not permitted!

DO NOT LUBRICATE THE MOTOR BEARINGS !
They are equipped with a lifetime lubricant.

CAUTION!
Ensure that no fluid, and in particular no organic solution enters the gaps of the motor shaft mouth, as this could wash the lubricant from the bearings.

The felt ring for sealing the bearing gap must be completely soaked with oil, to provide sufficient protection against any liquid that may leak.

Troubleshooting

Self-help measures

Fault report	Behaviour of the centrifuge	Possible causes and remedies
Setting position flashing after pressing the "set" key	Setting with "+/-" keys not possible, lid can be opened, start and stop O.K.	**Key switch position prevents programming.** Move the key switch from position C to A or B, if there is no reaction, request service.
Display remains dark	The drive stops. The rotor is slowing down without deceleration. The lid does not open	**The power supply is interrupted.** Is the power switch turned on? Check the voltage connection. If the voltage is O.K., inform your nearest customer service.
Displays break down for short periods	The drive suddenly stops. The rotor is slowing down with deceleration.	**The power supply was interrupted for a short time.** 1. Turn off the power switch. 2. Check that the power plug is correctly in the socket. 3. Start the centrifuge again.
Unusually loud running noises		**Press the quick stop symbol key.** When the appliance is at a standstill, look for obvious causes and if possible, eliminate. In other cases, request service.
Lid does not open	Pressing on “lid open“ key to no effect.	**Lid is not engaged properly or lid is distorted.** 1. Check that the appliance is connected to the power supply and that it is switched on (display’s lights are on). 2. If this has no effect, you can open the lid using the mechanical emergency unlocking (see page 6).
–	Loud running noises.	1. Stop the appliance. To do this, press the "quick stop" key, or in an emergency, unplug from the power supply. 2. Wait until the centrifuge is at a standstill. 3. Check if the rotor is correctly loaded. 4. Check to see if a broken vessel, a damaged rotor or a damaged motor is causing the noises. If you cannot recognise or eliminate the fault yourself, inform the customer service.
"imbalance" LED is alight, intermittent tone	The rotor is slowing down with deceleration.	**Imbalance switch triggered off.** 1. Open the appliance by pressing the "lid open“ key. 2. Check if the rotor is correctly loaded . 3. Check to see if a broken vessel or a damaged rotor has triggered off the imbalance switch.
Display showing "OPEN" although the lid is closed.	No start-up possible.	**The lid is not closed correctly.** Open the lid and repeat the locking process.

Fault report	Behaviour of the centrifuge	Possible causes and remedies
"check lid" LED is alight, intermittent tone	The drive stops. The rotor is slowing down without deceleration until it comes to a standstill.	**The lid has been opened manually during operation.** 1. Close the lid again using pressure. The appliance is slowing down without deceleration. 2. If you want to centrifuge further, you have to turn the appliance off and then on again.
"system check" LED is alight, E-00, intermittent tone	Motor is not starting.	**Motor or rotor blocked.** 1. Turn the appliance off and on again with the power switch. 2. Open the lid 3. Check if the rotor can turn freely. If you cannot eliminate the fault in this way, inform customer service.
"system check" LED is alight, E-02, intermittent tone	The rotor is slowing down without deceleration until it comes to a standstill. Appliance is not operable.	**Internal programm error in the memory.** Turn the appliance off and on again. If the fault continues, request customer service.
"system check" LED is alight, E-03, intermittent tone	The rotor is slowing down without deceleration until it comes to a standstill. Appliance is not operable.	**Defective speed detection.** Turn the appliance off and on again. If the fault continues, request customer service.
"system check" LED is alight, E-04, intermittent tone	The rotor is slowing down without deceleration until it comes to a standstill. Appliance is not operable.	**Temperature measuring malfunction** (sensor broken). Turn the appliance off and on again. If the fault continues, request customer service.
"system check" LED is alight, E-06, intermittent tone	The rotor is slowing down without deceleration until it comes to a standstill. Appliance is not operable.	**Communication error between keypad and CPU.** Turn the appliance off and on again. If the fault continues, request customer service.
"overtemp" LED is alight, intermittent tone	The rotor is decelerated to a standstill. The lid can be opened.	**Excess temperature in the boiler**. Display > 51°C or measured temperature > 70°C . – Clean cooling ribs on the rear of the appliance. (Cooling machine possibly defective.)
"system check" LED is alight, E-08, intermittent tone	The rotor is slowing down without deceleration until it comes to a standstill. Appliance is not operable.	**Excess voltage on frequency converter**. Voltage outside the tolerance. Deceleration resistance defective. If necessary, request customer service.

Fault report	Behaviour of the centrifuge	Possible causes and remedies
"system check" LED is alight, E-10, intermittent tone	During the self-test after switching on the centrifuge.	**NV-RAM; error in program memory.** Turn the appliance off and on again. If the fault continues, request customer service.
"system check" LED is alight, E-12, intermittent tone	The rotor is slowing down without deceleration until it comes to a standstill. Appliance is not operable.	**Temperature measurement malfunction.** Turn the appliance off and on again. If the fault continues, request customer service.
"system check" LED is alight, E-15, intermittent tone	The rotor is slowing down without deceleration until it comes to a standstill. Appliance is not operable.	**Incorrect checksum in NV-RAM.**
"system check" LED is alight, E-17, intermittent tone	Lid does not open.	**Lid is blocked or jammed.** Press the lid down once at the front in the centre and then press the “lid open“ key again. Otherwise, see “Mechanical emergency lid opening“ (page 6)
"system check" LED is alight, E-19, intermittent tone	During the self-test after switching on the centrifuge.	**Incorrect NV-RAM or keypad.**
"system check" LED is alight, E-22, intermittent tone	During the self-test after switching on the centrifuge.	**NV-RAM parameter does not fit the processor.**
"system check" LED is alight, E-23, intermittent tone	Appliance does not start or is slowing down without deceleration.	**Lack of cooling water;** **main contactor has returned to rest position or does not respond.** Failure of a mains phase, check the power fuses. Turn the appliance off and on again. If the fault continues, request customer service.
"system check" LED is alight, E-24, intermittent tone	During the self-test after switching on the centrifuge.	**NV-RAM 2 missing**.

When customer service is necessary

Should you ever need our customer service, please specify the order number and the serial number of your appliance. You can find this information on the type plate.

In the case of a permanent malfunction, note down all operational parameters such as:

- Bucket type inserted and type of loading
- Programmed bucket order number
- Acceleration and deceleration curves set
- Speed or RZB value set
- Time or - if applicable - time delay value set
- Temperature set value or - if applicable - excess temperature control value (ΔT) set

and the control processes such as:

- Start or stop phase
- "quick stop" key pressed
- Lid open or closed
- Key switch position
- Program memory or RAM memory operation

and describe malfunction signs as exactly as possible, such as:

- Illuminated or flashing diagnosis messages
- Non- intermittent or intermittent alarm tone
- Error messages in the display (note down "E_xx“ error no.)
- Unusual parameter displays: (speed, RZB, time, rotor, temperature)

and the malfunction behaviour:

- Unusual noises in when starting up, accelerating, controlling or decelerating
- Slowing down with or without deceleration etc.

before you inform the service.

Furthermore, details of the software version are helpful for the technician. You can see these numbers after every time you turn on the power. They appear one after the other and can be seen in the display panel in the speed and time fields.

For approx. 1 sec., 88 8 88888...appears in all displays.

Afterwards, the following appears in the display, each for approx. 2 sec.:

Software version keypad	__591	__2
Software version	__590	__6
NV-RAM version 1	_2571	__7
NV-RAM version 2	_2572	__2

The values in the time field show the state of development.

The current state of the cycle is the last piece of information shown.

Cycle counter	__235	_CY

The values given here are only examples!

Rotor/Bucket Table

Rotor + Bucket order number	Maximum capacity	Maximum speed	Maximum RZB value	Maximum radius	Max. permitted bucket weight	min. temp. at max. speed (room temp. 23°C)
[#]	[ml]	CRYOFUGE 6000i / 8500i [rpm]	CRYOFUGE 6000i / 8500i [xg]	[cm]	[g]	CRYOFUGE 6000I / 8500i [°C]
6606 + **6680**	6 x 2 x 650	4000	5310	29.7	3100	-4
6606 + **6694**	6 x 2 x 760	4240 / 5050	5770 / 8182	28.7	3700	-4 / +6
6606 + **6801**	6 x 2 x 750	4000	5170	28.9	3100	-4
6606 + **7617**[1)]	6 x 2 x 800	4000	5312	29.7	3570	-4
6606 + **7719**[2)]	6 x 2 x 150	**1500**	750	30.0	3100	-15
6606 + **8078**[3)]	6 x 2 x 150	4240 / 5050	4980 / 7070	24.8	2300	-4 / +6
6606 + **8165**[4)]	6 x 1000	4240 / 5050	6010 / 8525	29.9	2900	-4 / +6

1) Double blood bag bucket with counterbalancing insert.
CAUTION! For correct handling see bucket instructions for use!

2) Thrombocyte bucket - no longer available
WARNING! The maximum speed of 1500 rpm must never be exceeded!
For correct loading and handling the clamp, see bucket instructions for use!

3) Double rectangular bucket for using Centri-Lab inserts

4) Round bucket with hermetic cap
WARNING!
Hermetic impermeability is only guaranteed when centrifuge and accessories are in a perfect state!

Type Plate Data

Centrifuge	Order number	Voltage	Frequency	Power rating	Power consumption	Kinetic energy	Appliance fuses
CRYOFUGE 6000i	#7500 7520	400 V / 3N	50 Hz	17 A	4200 W	176 kNm	20 A + 6.3 A
CRYOFUGE 6000i	#7500 7521	230 V / 3N	50-60 Hz	21 A	4400 W	176 kNm	20 A + 6,3 A
CRYOFUGE 6000i	#7500 7526	230 V / 1N	50 Hz	19,5 A	3600 W[1)]	176 kNm	20 A + 6.3 A
CRYOFUGE 8500i	#7500 7550	400 V / 3N	50 Hz	24 A	5400 W	291 kNm	20 A + 6.3 A
CRYOFUGE 8500i	#7500 7551	230 V / 3N	50-60 Hz	26 A	6000 W	291 kNm	20 A + 6.3 A

CAUTION!

In cases of faults, the appliance fuses must only be replaced by an authorised service technician!

1) Single phase appliance with reduced refrigerating capacity (min. temperature at max. speed ≤ 4°C)

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Profile program A (24min)

Program level

Acceleration curve

Deceleration curve

Speed (rpm)

Rotor bucket no.

Time (min)

Temp. (°C)

As for F1

* results from the course of the curve independently of the pre-set time

Profile program B (16 min)

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