turns more than heads

Sigma 8KS

Sigma 8KS Clinic



Refrigerated centrifuge
from serial no. 162923

Operating manual

Original operating manual

Read this information carefully before using the centrifuge and retain it for future reference!

Revision history

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1 General information

1.1 Importance of the operating instructions

Familiarity with the operating instructions ensures the safe and trouble-free operation of the centrifuge. This manual is an integral part of the product.

The operating instructions and, in particular, the safety and hazard notes, must be observed by everyone working with this centrifuge.

- The operating instructions and any other applicable documents must be kept at the location of use of the centrifuge. Ensure that these documents are accessible at all times.
- Any changes, additions or updates received must be added to the operating manual.
- The operating instructions and any other applicable documents must be handed over to every subsequent operator of the centrifuge.

1.2 Further applicable documents

The following documents must be observed in addition to this instruction manual:

- Transport and installation instructions Sigma 8KS,
- Brochure Sigma 8KS,
- Cleaning and care leaflet,
- Quality certificate.

1.3 Representation conventions

The following symbols and typographic conventions are used throughout this document.

1.3.1 Warning notes

Warning symbols



This is the hazard symbol. It accompanies all hazard, warning and caution notes. It warns of possible injuries.

- Follow all of the measures marked with a hazard sign to avoid injuries and death.

Section-related warning notes

Warning of injury hazards that exist permanently or repeatedly during a sequence of actions.

DANGER

Description of a dangerous situation

Will lead to serious or fatal injuries if not avoided.

- Hazard prevention measures.

WARNING

Description of a dangerous situation

Can lead to serious or fatal injuries if not avoided.

- Hazard prevention measures.

CAUTION

Description of a dangerous situation

Can lead to minor or moderate injuries if not avoided.

- Hazard prevention measures.

ATTENTION

Description of damage to property and the environment

Used to indicate damage to property.

- Hazard prevention measures.

Integrated warning notes

Warning of injury hazards that exist when performing one or a few related steps within a sequence of actions.

DANGER – Type of danger. Instructions to avoid a dangerous situation that will lead to serious or fatal injuries.

WARNING – Type of danger. Instructions to avoid a dangerous situation that can lead to serious or fatal injuries.

CAUTION – Type of danger. Instructions to avoid a dangerous situation that can lead to minor or moderate injuries.

ATTENTION – Type of property damage. Instructions to avoid damage to property and the environment.

1.3.2 Typographic conventions

Instructions for a specific course of action

▶ Prerequisite.
1. Action (single step).
2. Action (single step).
   – Intermediate result.
3. Action (single step).
4. Action (single step).
   – Final result.

Lists

- Bullet point.
  – Subordinate point.

Notices

This symbol indicates a notice.

References

This symbol refers to separate applicable documents.

1.3.3 References to directions

Throughout this document, references to directions refer to the position from the perspective of the equipment user.

1.4 Warranty and liability

Our general terms and conditions apply. They have been handed over to the purchaser on the conclusion of the contract.

Warranty and liability claims are excluded if they are due to one or several of the following reasons:

- Improper use
- Non-compliance with the safety and hazard notes in the operating instructions and other applicable documents
- Improper set-up, connection, start-up, operation, transport or maintenance of the centrifuge
- Disasters caused by external influences or force majeure

1.5 Copyright

This document is solely intended for the operator and their personnel. It includes instructions and notes that must not be duplicated, distributed or communicated in any other way, neither in full nor in parts.

The copyright concerning this document remains with Sigma Laborzentrifugen GmbH.

Non-compliance may be prosecuted under criminal law.

1.6 Regulations, directives and standards

The applicable regulations, directives and standards are listed in the EC declaration of conformity in the appendix (see chapter 11.7 - "Declarations of conformity").

1.7 Scope of supply

The centrifuge comprises:

Quantity	Components	Possible versions	Part no.
1	Laboratory centrifuge Sigma 8KS	3 x 400 V, 60 Hz 3 x 400 V, 50 Hz 3 x 220 V, 60 Hz 3 x 400 V, 50 Hz, water cooling 3 x 400 V, 50 Hz, water cooling, GMP 3 x 400 V, 50 Hz, inert gas 3 x 400 V, 50 Hz, special cover 3 x 400 V, 50 Hz, water cooling, GMP, inert gas 3 x 480 V, 60 Hz, inert gas	10630 10631 10632 10633 91300 91301 91367 91583 190010
	Laboratory centrifuge , Sigma 8KS Clinic	3 x 400 V, 50 Hz	91594
1	square spanner, size 8 (door)		930114
1	open spanner, size 10/13 (height adjustment of the adjustable feet)		930015
1	open spanner, size 24 (lock nuts of the height adjustment)		930024
1	open spanner, angulate, size 17/19 (rotor)		26448
1	wrench, hex socket, size 4 (rotor)		930050
1	tube wrench (emergency release)		930110
1	holder for the rotor cover with hexagon socket head screw (M6x16) (see chapter 5.2 - "Cover holder")		28598 964216
1	hose connector for condensate drain (installed)		80415

Quantity	Components	Possible versions	Part no.
1	tube (30 g) heavy-duty grease for load-bearing bolts		71401
1	brochure		0612902

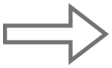
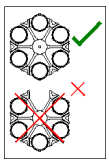
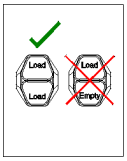
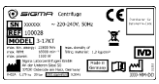
Table 1: Scope of supply

	Options	Description	Part no.
alternative	serial communication	interface for serial communication RS232 with option to connect a barcode scanner (without barcode scanner) (replaces interface for serial communication RS232, part no. 71442)	17948

Table 2: Configuration options

2 Safety

2.1 Marking of the centrifuge

Symbol	Description
	ON (mains power)
	OFF (mains power)
	General warning
	Hot surface
	Arrow indicating the direction of rotation (example)
	Information about the loading of the rotor
	Information about the loading of the buckets
	Name plate
	F-gases label
	Notice concerning the condensate drain

Symbol	Description
	CE mark in compliance with the directive 2006/42/EC
	Symbol indicating the need for the separate disposal of waste electrical and electronic equipment as per the directive 2012/19/EU
	Symbol indicating that compliance with the operating instructions is mandatory
	NRTL mark (USA and Canada only)
	RCM mark (Australia only)
	California Proposition 65 mark (USA only)
	China RoHS 2 mark (China only)

Table 3: Marking of the centrifuge

The markings on the centrifuge must not be covered, removed or altered, and they must be replaced if they become illegible.

The marking of the centrifuge varies depending on the version and country of destination.

2.2 Intended use

This chapter and its subchapters describe the centrifuge's intended area of application. Any use other than the one described here or any use going beyond this description is regarded as improper use. Sigma Laborzentrifugen GmbH cannot be held liable for any damage resulting from this.

The intended use also includes:

- Observation of all of the notes and instructions that are included in the operating manual,
- Compliance with the care, cleaning and repair instructions.

2.2.1 Centrifuge

Centrifuges are power-driven machines that use centrifugal force to separate mixtures with a maximum density of 1.2 g/cm^3 into their components. They are intended for this specific purpose only.

The centrifuge may only be operated by trained and authorised specialist personnel within closed spaces if the following conditions are fulfilled:

- The centrifuge has been properly set up and connected.
- The centrifuge is in a perfect technical state.
- Maintenance and service intervals are adhered to.
- The centrifuge is not located in an area with an explosion hazard.

2.2.2 Rotors, buckets, carriers and accessories

- The rotors, buckets, carriers and accessories have been produced by Sigma Laborzentrifugen GmbH and are authorised for use in this centrifuge.
- The maintenance intervals are adhered to.
- The service life specifications and, in particular, the specifications concerning the cycle limitations are complied with (see chapter 7.6.2 - "Maintaining the rotors, buckets, adapters and carriers").

2.2.3 Starting products

The centrifuge is intended for the centrifugation of solid substances as well as mixtures of liquids or solids. The substances to be centrifuged must fulfil the following requirements:

- The substances must not damage the material of the centrifuge, rotors or inserts nor impair its mechanical strength.
- Biological material may only be centrifuged in special, certified containment systems with a biological seal to prevent the release of the material.

2.3 Reasonably foreseeable misuse

There are applications where it is foreseeable that malfunctions, accidents or unsafe conditions may occur.

- Do not use the centrifuge in an area with an explosion hazard.
- Do not centrifuge explosive or flammable substances.
- Do not centrifuge substances that are prone to a high-energy chemical reaction.

2.4 Responsibility of the operator

The operator is the person who uses the centrifuge for commercial or economic purposes or lets a third party use it and who bears the legal product responsibility for the protection of personnel or third parties during operation.

Personnel

The operator is obliged:

- to comply with the specifications concerning the personnel (see chapter 2.5 - "Personnel qualification").
- to clearly define the areas of responsibility of the personnel concerning the operation, maintenance and care.
- to ensure that any personnel undergoing training as well as persons with physical, sensory or mental disabilities only work on the centrifuge under the supervision of an experienced person.
- to provide training for the tasks on the centrifuge, safety at the workplace and accident prevention.

Work environment

The operator is obliged:

- to perform a risk assessment concerning potential accidents in connection with the centrifuge and take design-related countermeasures, if necessary.
- to perform a risk assessment concerning the specific hazards with regard to the processing of the various products in the centrifuge (e.g. leakage of harmful substances, contaminated surfaces, fire hazard) and to take appropriate protective measures, if necessary.
- to perform compatibility tests of the substances to be processed in the centrifuge. Substances that damage the materials of the centrifuge, rotors or inserts or that weaken their mechanical strength must not be used.
- to provide standard operating procedures (SOPs) for the processing of the various products in the centrifuge.
- to check the safety-conscious work of the personnel in compliance with the operating instructions, other applicable documents and SOPs as well as with the relevant EU directives and the national laws concerning health and safety and the prevention of accidents at regular intervals (e.g. every month).
- to ensure that a sufficient quantity of suitable fire-extinguishing equipment is provided and ready for use.

Maintenance

The operator is obliged:

- to have the centrifuge checked by authorised specialist personnel at regular intervals to ensure its correct operation.
- to immediately stop using a damaged device and to have defective parts replaced without delay.
- to keep all safety and hazard notes on the centrifuge readable at all times and to replace them, if necessary.
- to check – at their own accord and at regular intervals – the number of cycles performed and the condition of the rotors and accessories.
- to comply with the inspection obligation as per the information FBRCI-025 of the German Berufsgenossenschaft Rohstoffe and chemische Industrie for centrifuges operated in Germany (see chapter 7.7 - "Inspection to be performed by the manufacturer").

2.5 Personnel qualification

Work on the centrifuge may only be performed by specialist personnel that have been authorised by the operator. Specialist personnel can identify and avoid hazards without assistance. Specialist personnel are familiar with the applicable statutory accident prevention regulations as well as the relevant standards and provisions.

The qualifications of the various groups of persons are defined as follows:

Operating personnel

The centrifuge may only be operated by personnel who, due to their training as clinical or medical laboratory technicians or due to comparable training, are able to perform the assigned tasks in a safe manner.

The tasks of the operating personnel include:

- the operation of the centrifuge
- the cleaning, decontamination and maintenance of the centrifuge
- the notification of the competent specialist in the event of malfunctions

Logistics personnel

Logistics personnel are in a position to perform their assigned tasks in a safe manner due to their training, experience and familiarity with the relevant regulations.

The tasks of the logistics personnel include:

- the transport and packaging of the centrifuge, rotors and accessories
- the placement and installation of the centrifuge

Qualified electricians, mechanical specialists and certified refrigeration specialists

Qualified electricians, mechanical specialists and certified refrigeration specialists are in a position to perform their assigned tasks in a safe manner due to their specialised training, experience and familiarity with the relevant regulations.

- The tasks of a **qualified electrician** include the repair and maintenance of the electrical system of the centrifuge.
- The tasks of a **mechanical specialist** include the repair and maintenance of the mechanical components of the centrifuge.
- The tasks of a **certified refrigeration specialist** include the repair and maintenance of the refrigeration system of the centrifuge.

2.6 Personal protective equipment

Personal protective equipment protects you from health and safety hazards at work.

The personnel must wear personal protective equipment when performing certain types of work on the centrifuge. This is pointed out in the respective sections of this manual. In addition, personal protective equipment may be required depending on the substances being centrifuged.

2.7 Remaining risks

The centrifuge was built in accordance with the state of the art and in compliance with the generally recognised safety rules. However, danger to life and limb of the user, or of third parties, or impairments of the centrifuge or other material assets cannot be completely excluded when the centrifuge is in use.



Read and comply with the following safety information prior to using the centrifuge!

2.7.1 Hazards due to electrical voltage

Danger to life caused by electric shock

There is a risk of electric shock when touching current-carrying components.

This may lead to ventricular fibrillation, cardiac arrest or respiratory paralysis.

- Only qualified electricians are authorised to perform work on the electrical system of the centrifuge for which the housing needs to be removed.
- Ensure that the mains voltage matches the voltage that is stated on the name plate of the centrifuge.
- Use the centrifuge only with an intact mains power cable. Damaged or faulty mains power cables must be replaced immediately.
- Ensure that no liquid penetrates the inside of the centrifuge. Spilled liquids or liquids that are used for cleaning can damage the electrical or mechanical components if they penetrate into the centrifuge.

Fire hazard due to electrical overload

Electrical overload due to defective components can cause a fire.

- Have the electrical system of the centrifuge checked by a qualified electrician at regular intervals or at least every 12 months.

2.7.2 Hazards due to mechanical force

Hazards caused by rotors, buckets, carriers and accessories

- Use the centrifuge and the accessories only in a perfect state. Stop using the centrifuge and the accessories immediately if they are damaged.
- In the event of rotor breakage resulting in a crash, there is a risk of injury from ejected parts or movement of the centrifuge. Cutting, impact or crushing injuries may occur.
- Do not move a running centrifuge. If a mobile centrifuge bench is used, lock the locking castors.
- Do not open the lid of a running centrifuge by way of the emergency lid release system.
- Comply with the specified service life of rotors, buckets, carriers and accessories.
- Use only rotors, buckets, carriers and accessories that have been manufactured and authorised for use with this centrifuge by the manufacturer.
- Ensure that the rotor is loaded in a rotationally symmetrical manner and that the weight is evenly distributed. Do not exceed the maximum permissible weight.
- Fasten the rotor correctly in place.
- Operate the rotor at the permissible speed.
- In case of swing-out rotors, ensure that the maximum permissible speed of the buckets is not exceeded.
- Comply with the specified maintenance and replacement intervals for the centrifuge, rotor, carriers and accessories.
- Only use spare parts that have been authorised by the manufacturer.

Hazards caused by the centrifuge lid

- In the event of defective lid stays, there is a risk of injury from the centrifuge lid. Crushing injuries may occur.
- Defective lid stays must be replaced immediately by specialist personnel.

2.7.3 Hazards due to hot surfaces

Risk of burns on hot surfaces inside the rotor chamber

After a centrifugation, the surfaces inside the rotor chamber and, in particular the motor shaft, can be hot.

There is a risk of burns when touching the surfaces.

- Wear suitable protective gloves.
- Do not touch the surfaces without good reason.

2.7.4 Hazards due to biological substances

Health hazard due to biological substances

The release of biological material can cause damage to health as well as cross-contamination.

- Set the centrifuge up in a room that fulfils the safety requirements for the respective biological substances (as per the directive 2000/54/EC).
- Wear personal protective equipment.
- Use special, certified containment systems with biological seals.
- Fill, close and open the rotors and buckets only at workstations that fulfil the safety requirements for the respective biological substances (as per the directive 2000/54/EC).
- The sealing ring of a rotor cover or bucket is made of NBR. Chemicals may damage the material and cause leaks. It is essential to comply with the information provided in the table of chemical resistance data (see chapter 11.6 - "Table of chemical resistance data").
- Observe any national regulations and the safety data sheets of the substances.

2.7.5 Hazards caused by the operating fluids

Hazards caused by the refrigerant

If refrigerant leaks from the centrifuge, harmful substances may be released. Contact with, or the aspiration of, the refrigerant can cause severe damage to health.

- Switch the centrifuge off and leave the affected area immediately.
- Ensure adequate ventilation.
- Have the centrifuge checked and repaired by a certified refrigeration specialist.

2.8 Safety devices and guards

The safety devices and guards are in compliance with the applicable national and international laws, rules and regulations concerning health and safety and the prevention of accidents.

- Check the safety devices and guards at regular intervals to ensure that they are operating correctly.
- Do not tamper with the safety devices and guards.

Mains power plug

Unplugging the mains power plug disconnects the centrifuge from the power supply.

Position: close to the centrifuge; accessible at all times

Mains power switch

The mains power switch disconnects the centrifuge from the power supply.

Position: left side of the centrifuge; accessible at all times

Protective earth conductor

A qualified electrician can test the protective conductor using an appropriate measuring device.

System for stopping the centrifuge due to an imbalance

If the centrifuge runs with an impermissible imbalance, the drive will be switched off. A visual and audible signal will be issued.

Position: user interface

System check

An internal system check monitors the data traffic and sensor signals for plausibility. The system performs continuous self-monitoring to detect faults. Error messages will be displayed in a dialogue box.

Position: user interface

Temperature monitoring system

If the temperature inside the rotor chamber exceeds +50°C, the drive will be switched off automatically. The centrifuge cannot be restarted until it has cooled down. A corresponding error message will be displayed.

Position: user interface

Rotor identification system

The rotor identification system automatically identifies the rotor and adapts the speed and relative centrifugal force (RCF) accordingly. If several buckets are authorised for use with the rotor in question, a dialogue box will show the permissible variants.

Position: user interface

3 Equipment description

3.1 Principle of centrifugation

Centrifugation is a process for separating heterogeneous mixtures of substances (suspensions, emulsions or gas mixtures) into their components. Rotating on a circular trajectory, the mixture of substances is subjected to centrifugal acceleration many times greater than the acceleration due to gravity.

Centrifuges harness inertia in the rotor chamber to separate substances. Due to their higher inertia, particles or media with a higher density migrate outwards, thereby displacing any components with a lower density which are forced towards the centre.

The centrifugal acceleration of an object in a centrifuge depends on the distance of the object from the axis of rotation and on the angular velocity. The larger the radius of the rotor chamber and the higher the speed are, the greater the centrifugal acceleration will be.

For detailed information about the various areas of application, see www.sigma-zentrifugen.de/en.html → [Applications].

3.2 Centrifuge overview



Fig. 1: General view

1 Lid
2 User interface



Fig. 2: Right side

3 Front door lock
4 Name plate



Fig. 3: Left side

5 Mains power switch
6 Condensate drain

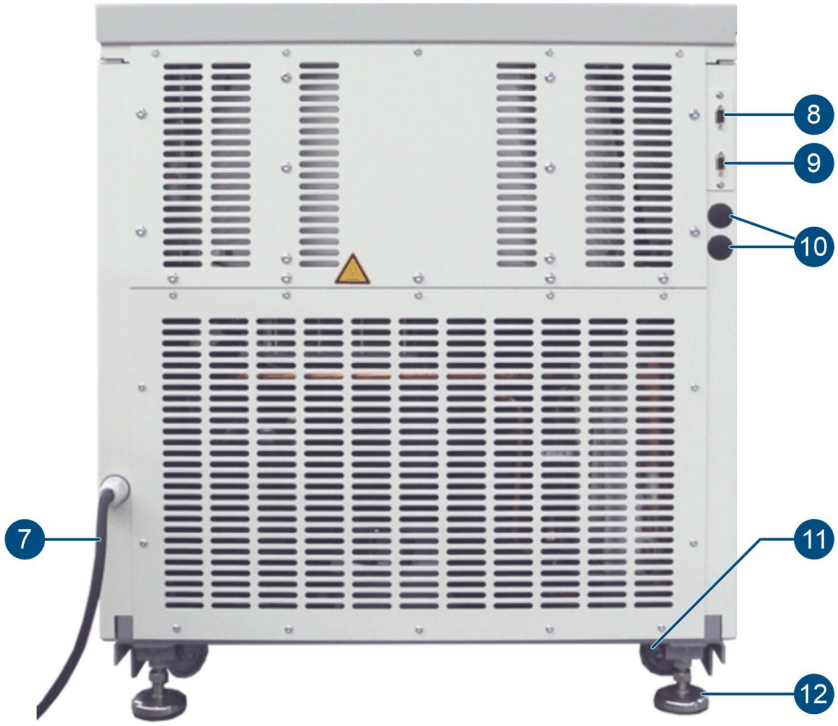


Fig. 4: Back of an air-cooled centrifuge

7 Mains power cable	10 Option: interfaces (see chapter 6.5.2.6 - "Options for data input and output")
8 Option: connection point for barcode scanners	11 Castor
9 RS232 interface	12 Foot



Fig. 5: Back of a water-cooled centrifuge

13 Cooling water connection points

3.3 F-gases label



Fig. 6: F-gases label in compliance with the implementation regulation (EU) 2024/2729

3.4 Name plate

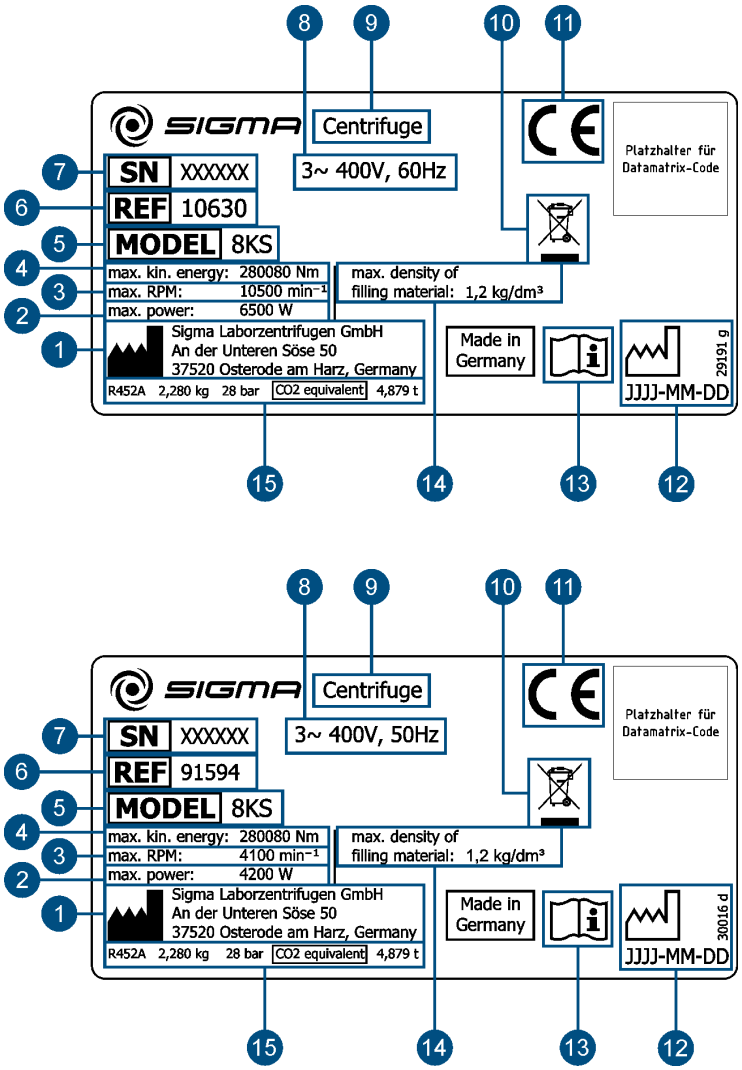


Fig. 7: Name plates (examples)

1	Manufacturer	10	Symbol for separate disposal
2	Power consumption	11	CE mark in compliance with the directive 2006/42/EC
3	Max. speed	12	Date of manufacture
4	Max. kinetic energy	13	Symbol indicating that compliance with the operating instructions is mandatory
5	Product name	14	Max. permissible density
6	Part number	15	Refrigerant data
7	Serial number		
8	Nominal voltage		
9	Product designation		

4 Packaging, transport and storage

4.1 Storing the centrifuge

The expected service life of 10 years can only be reached if all of the specified storage conditions are fulfilled.

- Store the centrifuge in its original packaging.
- Store the centrifuge in dry conditions as well as free from dust and mechanical load.
- Comply with the permissible storage temperature of -20°C to +60°C.

Storage

If the centrifuge needs to be stored for more than one year:

- Comply with the specified maintenance intervals; any necessary work must be performed immediately prior to use.
- Comply with the specified dates of expiry of the accessories (e.g. the limited usability of the plastic rotors). Replace any affected components.

4.2 Packaging and transporting the centrifuge

The centrifuge must be packaged and transported by authorised specialised personnel. All the necessary information is documented in a separate transport and installation manual.

- Ensure that any tasks concerning this field are only performed by authorised specialised personnel.

Comply with the information given in the separate transport and installation manual of the centrifuge.

5 Setup and connection

- The centrifuge must be set up and connected by authorised specialised personnel.

Comply with the information given in the separate transport and installation manual of the centrifuge.

5.1 Condensate drain

The condensate drain is used to drain off any condensate that forms inside the rotor chamber during centrifugation. It consists of a hose with a plastic valve and leads from the rotor chamber to the outlet on the left side of the centrifuge's front door (see chapter 3.2 - "Centrifuge overview").

Draining off the condensate

▶ The centrifuge is off and disconnected from the supply voltage.

1. Install the supplied hose connector.
2. Drain the condensate into a vessel that has been provided for this purpose.
3. Remove the hose connector by pressing the release button.
   – The condensate has been drained off.

5.2 Cover holder

The lid of the centrifuge is equipped with a cover holder for the cover of the swing-out rotor 11805 with a windshield when the centrifuge is loaded or unloaded.

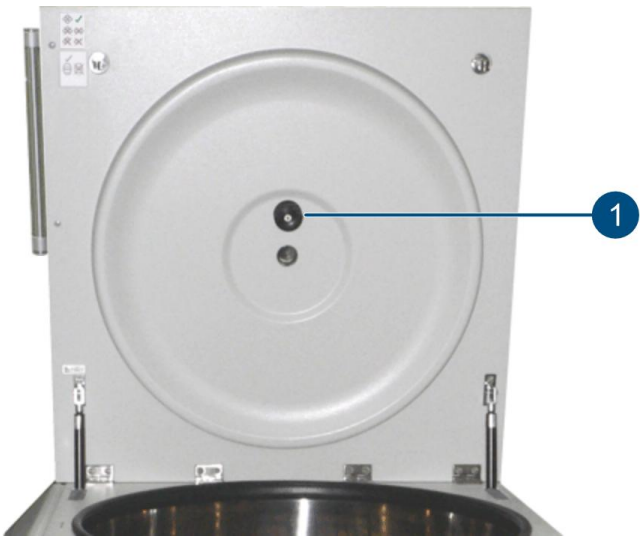


Fig. 8: Cover holder in the centrifuge lid

1 Cover holder

An additional cover holder can be installed on the right-hand side of the centrifuge. The required accessories are included in the scope of supply.

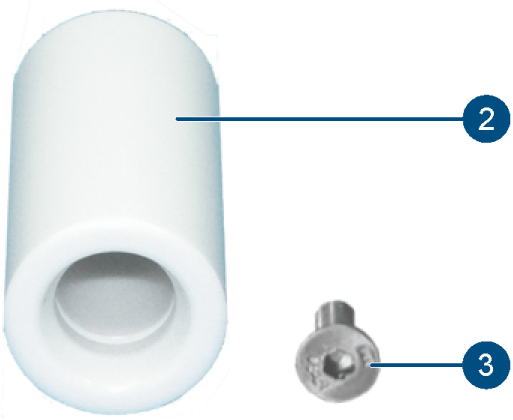


Fig. 9: Lateral cover holder and its fastening screw

2 Fastening screw
3 Cover holder

Installation of the lateral cover holder

The right-hand side of the centrifuge has two holes that are intended for installing the cover holder.

1. Push the fastening screw through the hole of the cover holder.
2. Install the cover holder in one of the holes by way of a size 4 hexagon key.

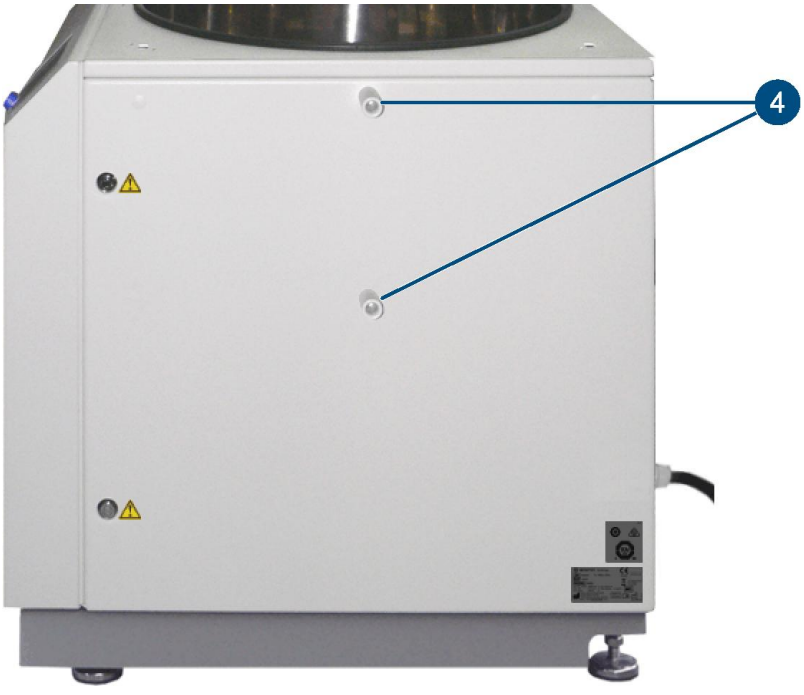


Fig. 10: Storage options for the windshield cover

4 Lateral cover holders

6 Operation

6.1 Safety



In an emergency, switch the centrifuge off immediately and disconnect the mains power plug!

6.2 Switching the centrifuge on and off

Power on

▶ The centrifuge has been properly set up and installed.

1. Press the mains power switch.
   – The display lights up. The centrifuge is ready for operation.

Power off

▶ The centrifuge is at a standstill.

1. Open the lid so that any potential moisture can escape.
2. Press the mains power switch.
   – The centrifuge is off.

6.3 Opening and closing the lid

Opening the lid

▶ The centrifuge is at a standstill.
▶ The lid button is illuminated.

1. Press the lid button.
   – The lid opens completely.

WARNING – Risk of injury caused by defective gas struts. The lid can fall down on its own, potentially crushing fingers or limbs. Have the gas struts checked regularly and replaced, if necessary.

Closing the lid

CAUTION – Risk of injury when closing the lid. Fingers or limbs may be crushed. Never reach between the lid and the housing.

1. Push the lid down until you hear both lid locks engage.
   – The lid is now closed correctly.

6.4 Using rotors, buckets, carriers and accessories

6.4.1 Preparing the accessories

Vessels

- ▶ The vessels have been authorised by Sigma Laborzentrifugen GmbH for use in this centrifuge.
- ▶ The information and instructions provided by the manufacturers of bags, bottles and tubes, and especially the information concerning the maximum permissible RCF value and temperature, are complied with.

1. Fill the vessels outside of the centrifuge.
2. Fill the vessels carefully and only up to the specified maximum fill level.
3. Seal the vessels.

ATTENTION – When using glass vessels, do not exceed 4,000 xg. The only exceptions are heavy-duty centrifuge vials, in which case the manufacturer's instructions apply.

Some vessels, e.g. centrifuge tubes, microtubes, culture tubes, PTFE tubes and, in particular, large-capacity vessels can be used in Sigma rotors, buckets and adapters at speeds higher than their breaking point.

Adapters

Adapters enable the use of vessels of different sizes in a rotor.

- ▶ The adapters have been produced by Sigma Laborzentrifugen GmbH and are authorised for use in this centrifuge.
- Load the adapters with the same number of vessels and the same weights.

6.4.2 Preparing and installing a rotor

WARNING

Hazard caused by insufficient fastening of the rotor

If a rotor is not properly fastened, it may detach itself from the shaft, thereby causing a crash.

- Prior to starting a centrifugation run, ensure that the rotor tie-down screw has been properly tightened.
- Loosen and tighten the rotor tie-down screw at regular intervals (depending on the frequency of use) to ensure a proper connection between the rotor holder and the motor shaft.

WARNING

Risk of toxic, pathogenic or radioactive contamination

Toxic, pathogenic or radioactive substances can cause contamination if they are not handled properly.

It may be necessary to clean and/or decontaminate the laboratory centrifuge, rotors and accessories for reasons of safety before they can be maintained, repaired or handed over.

- Disinfect and clean the centrifuge, rotors, buckets, carriers and accessories after a contamination.
- Comply with the relevant safety instructions concerning the handling of toxic, pathogenic or radioactive substances.
- Wear personal protective equipment.
- Document any measures taken (see chapter 8.5 - "Returning the centrifuge to the manufacturer" / Declaration of decontamination)

CAUTION

Hazard due to the improper loading of the rotor

Rotors with insufficiently balanced loads can lead to overload as a result of imbalance during operation.

- Always load the rotor in a rotationally symmetrical manner with even weight distribution.

The rotor installation and removal process is documented in a video.

Watch the video:
Rotor installation and removal

Rotor installation

▶ The rotor is clean and undamaged.

1. Open the centrifuge lid.
2. Carefully lower the rotor cross without any buckets perpendicularly from above onto the cone of the motor shaft (see the following illustration).

ATTENTION – If the rotor gets jammed or if it is lowered too quickly onto the fastening stud, the thread of the stud may be damaged. In this case, it is no longer possible to correctly secure the rotor in place.

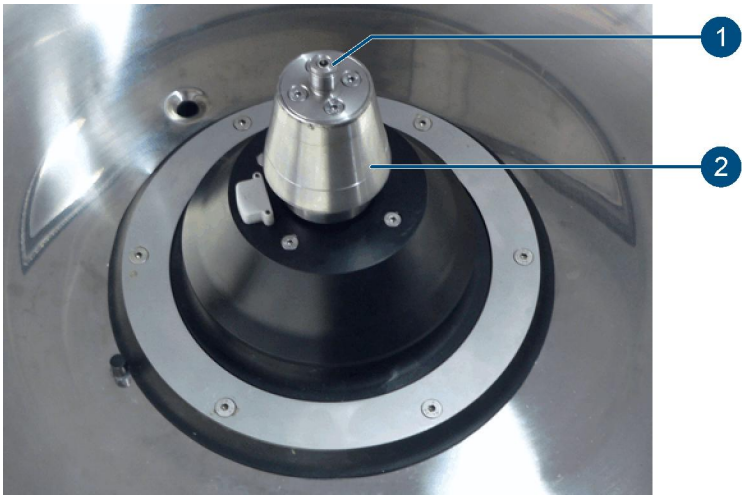


Fig. 11: Motor shaft with a cone

1 Fastening stud with a hexagon socket
2 Cone

3. Insert the supplied hexagon key into the hexagon socket of the fastening stud of the motor shaft and hold it in place with two fingers (two-finger-principle, see the following picture). At the same time, position the offset open-ended spanner AF 17/19 against the flat sides of the rotor hub and turn the hub anticlockwise until it is no longer possible to hold the hexagon key with two fingers.



Fig. 12: "Two-finger-principle" for holding the hexagon key

3 Hexagon key
4 Open-ended spanner

4. Release the hexagon key, hold the rotor with one hand and tighten it clockwise by way of the open-ended spanner (see the following illustration) and with a torque of 20 Nm.



Fig. 13: Fastening of the rotor (example)

– The rotor is correctly installed.

Loading and installing the buckets

1. Ensure that only buckets of the same set are used (see the set number on the buckets).
2. Place the filled sample vessels in the bucket or in the adapter in the bucket.
   – As a general rule, all of the compartments must be filled with buckets.
   – Load the rotationally symmetric compartments of the rotors with the same accessories and content.
   – When performing a centrifugation run at low capacity, distribute the sample vessels so that the load is rotationally symmetrical.

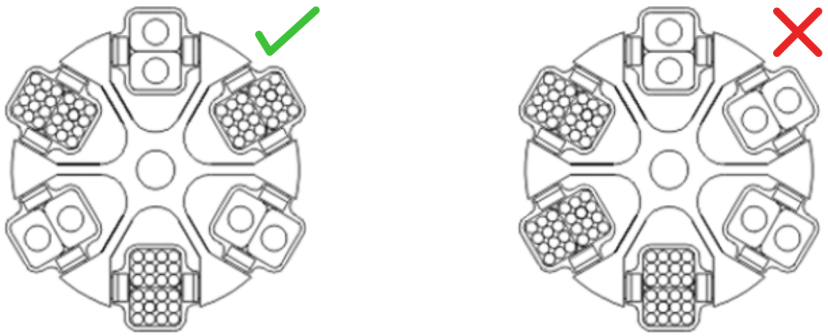


Fig. 14: Permissible and not permissible loading of vessels of different sizes (example)

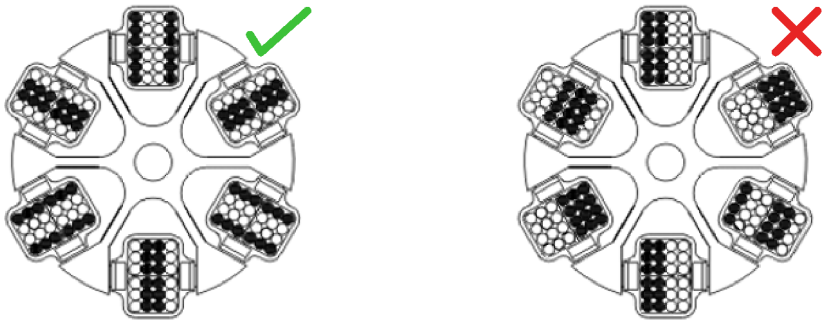


Fig. 15: Permissible and not permissible loading in case of low capacity (example)

3. Place the caps on the buckets and fasten them in place.
4. Ensure that the load-bearing bolts of the rotor cross are greased or equipped with the Sigma Comfort rotor coating.
5. Place all of the buckets in the rotor cross. If the buckets have numbers, place them in the corresponding compartments of the rotor (the compartments are numbered as well).
6. Close the centrifuge lid.

Comply with the instructions on the label in the centrifuge lid (see the following illustration)! The adhesive labels must be kept readable at all times. If necessary, they must be replaced.

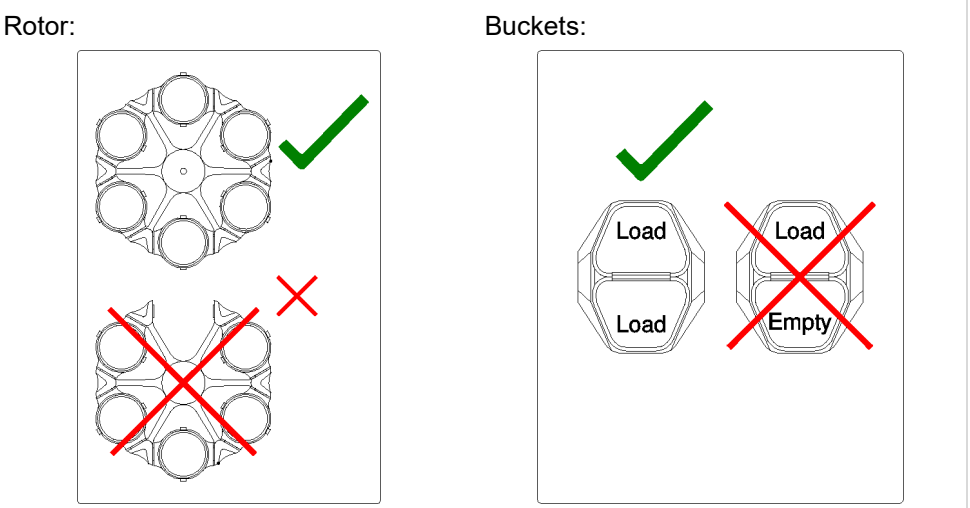


Fig. 16: Marking on the centrifuge

Installing the blood bag systems

1. Ensure that only buckets of the same set are used (see the set number on the buckets).
2. Position the blood bag adapters in the buckets.
3. Position the blood bags in the adapters.
   - Two opposite buckets must each be equipped with an adapter with two blood bags.
   - The weight of the opposite buckets, including the adapters, blood bag systems and content, must be the same. If there is an odd number of blood bags, a dummy weight must be used. Various taring weights are available for taring.
   - The bags must be placed in the opposite buckets in a symmetrical manner (see the illustration).
   - The main bag should be positioned towards the centre of both adapter chambers. The opposite bucket must then be loaded in a corresponding manner (see the illustration).
   - If smaller blood bags are used or if the bags are not completely full, adapters (e.g. part no. 17750) must be used for stabilisation. They prevent the bags from sliding together and causing an impermissible imbalance.

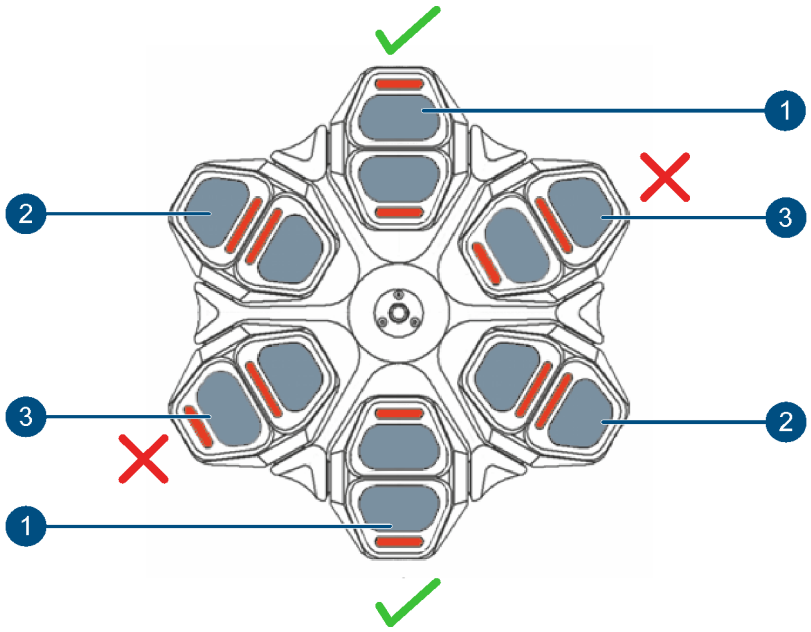


Fig. 17: Loading of blood bag systems

1 correct loading
2 possible loading
3 incorrect loading

Installing a rotor 11805 with a windshield

1. Open the centrifuge lid.

ATTENTION – The rotor weighs approximately 26.4 kg:

2. Have two people lift the rotor (without its windshield cover) by its rotor arms (see the following picture).



Fig. 18: Correct method for lifting the rotor 11805 with a windshield

3. Follow the instructions under "Rotor installation" (see hereinabove) to install and secure the rotor in place.
4. Follow the instructions under "Loading and installing the buckets" (see hereinabove) to load the rotor.
5. Lower the windshield cover perpendicularly onto the rotor. The stud on the inside of the cover must be inserted into the rotor hub.

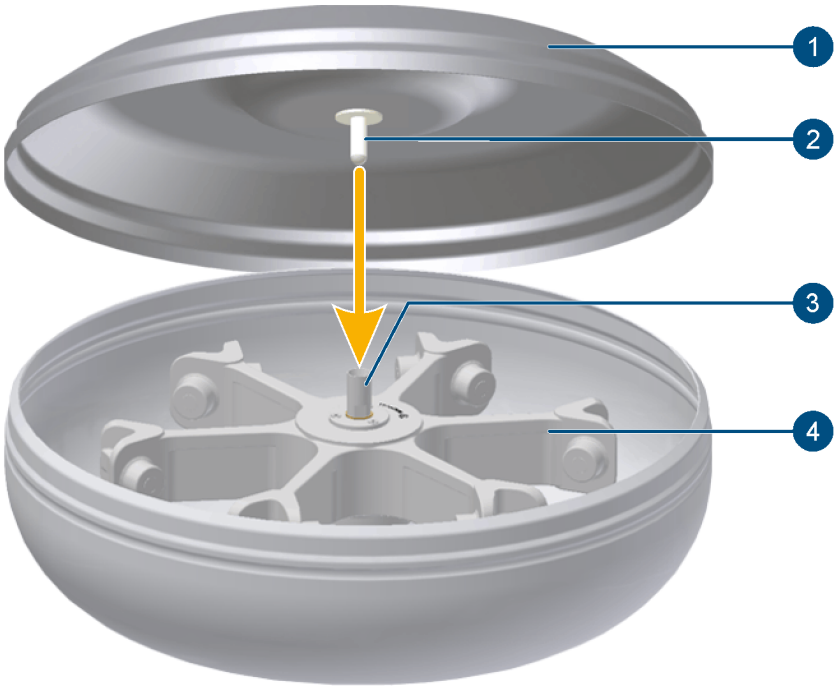


Fig. 19: Lowering the cover onto the windshield

1	Windshield cover	3	Rotor hub
2	Stud	4	Rotor 11805 with a windshield

6. Check whether the cover fits correctly.



Fig. 20: Checking the cover for correct fit

– The rotor 11805 with a windshield has been correctly installed.

Installing an angle rotor with a hermetic cover

▶ The rotor and cover, including all of the rubber seals, are clean and undamaged.
▶ The rubber seals have been slightly greased.

1. Insert the filled sample vessels into the holes of the angle rotor.
   – Load the rotationally symmetric compartments of the rotors with the same accessories and content.
   – When performing a centrifugation run at low capacity, distribute the sample vessels so that the load is rotationally symmetrical. Loading only one axis of the rotor is not permissible.

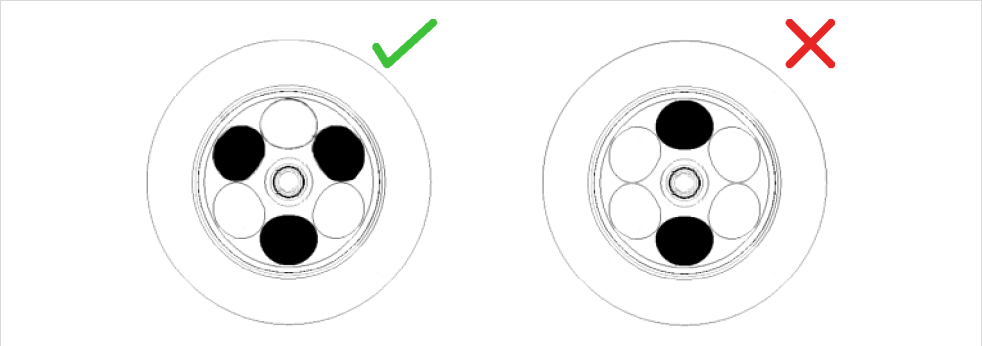


Fig. 21: Permissible and not permissible loading of angle rotors (example)

2. Screw the cover onto the rotor and tighten it clockwise by hand.

ATTENTION – The cover screw is solely intended for securing the cover on the rotor and not for fastening the rotor to the motor shaft.

3. Open the centrifuge lid.
4. Follow the instructions under "Rotor installation" (see hereinabove) to install and secure the rotor in place.
   – The angle rotor with a hermetic cover has been correctly installed.

6.4.3 Removing the rotor and accessories

WARNING

Risk of toxic, pathogenic or radioactive contamination when opening the vessels

During centrifugation, overpressure may build up in the vessels due to heat generated by air friction.

- This is why it must be ensured that there is no liquid in the cap/sealing area prior to opening the vessels.

CAUTION

Risk of burns on hot surfaces inside the rotor chamber

After a centrifugation, the surfaces inside the rotor chamber and, in particular the motor shaft, can be hot.

- Wear suitable protective gloves.
- Do not touch the surfaces without good reason.

The rotor installation and removal process is documented in a video.



Rotor removal

▶ The centrifuge is at a standstill and the lid is open.
▶ The buckets and sample vessels have been removed.

1. Remove the rotor in the reverse order of its installation.
   – Loosen the rotor by way of the open-ended spanner by turning it anticlockwise to such an extent that the rotor hub turns together with the rotor. While doing so, it may be necessary to overcome a certain resistance.
   – Thereafter, apply the hexagon key and turn it clockwise in line with the two-finger-principle until the rotor can be lifted upwards and out.
2. Using two people, lift the rotor out of the centrifuge and place it on a suitable surface.
   – The rotor has been removed.

Removing a rotor 11805 with a windshield

1. Remove the windshield cover.
2. Remove the buckets one at a time.
3. Remove the sample vessels carefully in order to prevent their contents from being mixed.
4. Remove the rotor in the reverse order of its installation (see hereinabove).
5. After every removal, check the windshield and its cover for signs of damage or deformation. Do not use any damaged parts. Replace them immediately.

Removing an angle rotor with a hermetic cover

1. Remove the rotor and cover in the reverse order of their installation (see hereinabove).
2. To release the cover, insert the supplied tool into the openings on top of the cover (see the following illustration) and open the cover by turning anticlockwise.



Fig. 22: Tool for releasing the cover (example)

3. Remove the sample vessels carefully in order to prevent their contents from being mixed.

6.5 User interface

6.5.1 Manual mode

6.5.1.1 Standard menu

The "Standard" menu is symbolised by the icon "🏠" on the menu bar and it is displayed a few seconds after the centrifuge has been switched on. In this menu, the parameters of a centrifugation run can be displayed and modified.

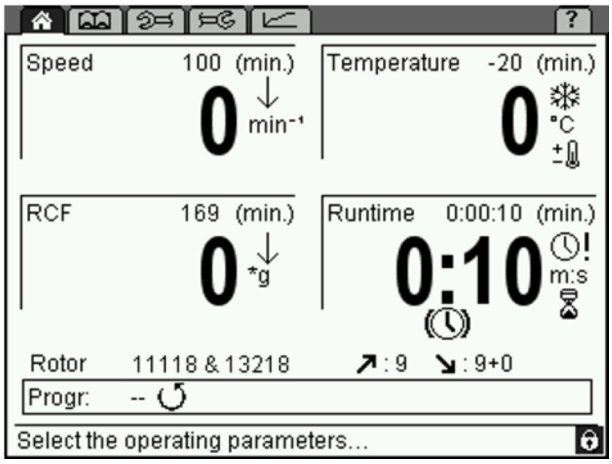


Fig. 23: Standard menu; here shown with all of the possible symbols

Speed

In the upper section of the field, the set speed of the centrifuge is displayed. The actual speed is displayed below this value. The values are stated in revolutions per minutes (min^{-1} = rpm) and they depend on the RCF values (see chapter 11.2 - "Speed, radius and relative centrifugal force (RCF)"). The maximum speed values depend on the rotor that is used.

Relative centrifugal force (RCF)

The relative centrifugal force is the acceleration that the sample is subjected to during the centrifugation run. The set value of this parameter is displayed in the upper section of this field with the actual value shown below. The values are stated in g (gravitational acceleration) and they depend on the speed values (see chapter 11.2 - "Speed, radius and relative centrifugal force (RCF)"). The maximum RCF values depend on the rotor that is used.

Temperature

The set temperature is displayed in the upper area, with the current sample temperature shown in the lower area. Temperatures between -20°C and +40°C can be preselected.

The centrifuge is designed for spinning samples in the available rotors in a temperature range from +4°C to 23°C. It does not have a heater, which is why temperatures above the rotor temperature depend on the air friction of the spinning rotor.

Runtime

The set runtime is displayed in the upper section of this field, with the remaining runtime shown below. The runtime is defined as the period from the start of the centrifuge to the beginning of the deceleration phase. The maximum value is 99 h 59 min 59 s.

In the "Setup" menu , it can be specified that the runtime is not to be started until the set speed is reached Further information can be found in chapter Setup menu on page 56.. In this case, the symbol "!" will be displayed in the runtime field.

Continuous run

During the continuous run, the runtime of the centrifuge is unlimited and must be stopped manually. The centrifuge accelerates during the continuous run until the set speed is reached.

1. Select the field "Runtime" and press the function knob.
   – The display flashes when it is activated.
2. Turn the function knob from the time 0:00:10 anticlockwise or from the time 99:59:59 clockwise.

– "Infinite" will be displayed.
– After the start of the centrifuge, the elapsed time will be displayed.

3. Deactivate the continuous run by pressing the stop button or by entering a specific runtime.

Short run

A short run can be started if no run is active.

1. Keep the start button pressed during the short run.
   – During the short run, the centrifuge accelerates with acceleration curve 9 (maximum acceleration) until the maximum speed of the rotor is reached.
   – The runtime is counted and in the speed field the message "Short run" flashes.
   – When the start button is released, the centrifuge decelerates with the maximum deceleration curve to a standstill.

The parameters speed, RCF, temperature and runtime can be changed during the centrifugation.

If the centrifuge is locked at level 2 or higher, a short run cannot be started.

Rotor: Rotor selection list

This field shows the rotor that is currently being used.

1. Select the field "Rotor" and confirm the selection.
   – A list with all of the possible rotors without buckets is displayed.
2. Select the desired rotor.
   – If an angle rotor is selected, additional information concerning this rotor will be displayed.
   – In the case of swing-out rotors, a list with all of the possible rotor/bucket combinations will be displayed. Select an item from the list so that the additional information concerning the combination will be displayed.
3. Press the function knob in order to accept the data.

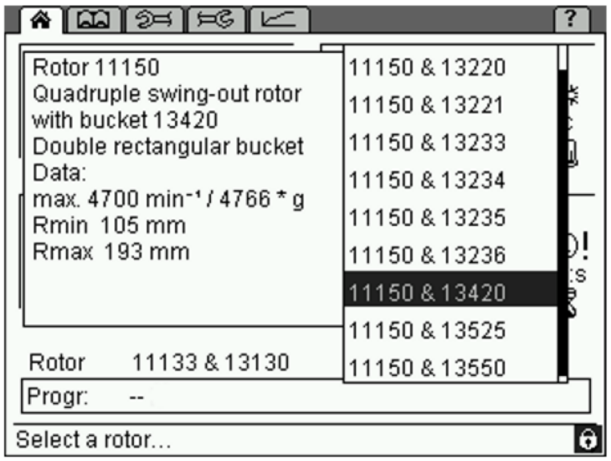


Fig. 24: Rotor selection list; here for a swing-out rotor

Automatic rotor identification

The centrifuge automatically identifies the rotor that is currently being used.

- If the system identifies a different rotor than the one that is set, and if there are no different buckets for this rotor, the rotor input will be adapted automatically. The system will not display a message.
- If the system identifies a different rotor than the one that is set, and if there are different rotor/bucket combinations for this rotor, the system will automatically identify the correct rotor and select the rotor/bucket combination with the lowest speed. The system will display a corresponding message so that the combination can be adapted manually.
- If the system cannot identify the rotor, a message will be displayed. The rotor cannot be used in the centrifuge.

This prevents the maximum permissible speed from being exceeded.

Acceleration

This function is used to select an acceleration curve. You can select a linear rise (curves 0-9) or a quadratic rise (curves 10-19). The acceleration curves 20-29 can be programmed as desired (see chapter 11.5 - "Acceleration and deceleration curves").

Deceleration (brake)

This function is used to select a curve that decelerates the centrifuge to a standstill. Deceleration curves are inverted images of the acceleration curves and are labelled with identical numbers. Deceleration curve no. 0 represents a brakeless deceleration.

Progr.: Program list

This field in the "Standard" menu shows the program that is currently loaded. When the field is selected, the program list is displayed (for information on how to work with the programs, please see chapter 6.5.2 - "Program mode").

The RAPID_TEMP quick cooling program (see below) cannot be deleted.

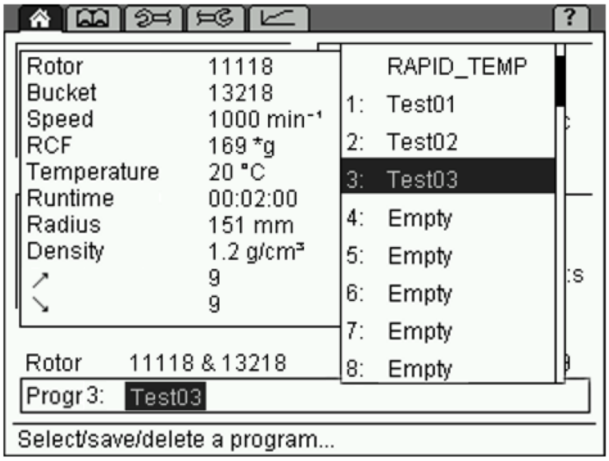


Fig. 25: Program list

Quick cooling program RAPID_TEMP

Precooling at a standstill may distort the measurement results and cause the increased wear of the mechanical components. This is why the centrifuge has a special program that precools the rotor chamber rapidly under defined conditions:

1. Select the option "Progr" in the "Standard" menu and confirm the selection. The program list will be displayed.
2. Select the quick cooling program RAPID_TEMP on the program list and confirm the selection. The display shows ⅓ of the maximum rotor speed and the corresponding RCF value. The deceleration and acceleration curves correspond to curve 9 and the runtime field indicates "infinite" (continuous run).

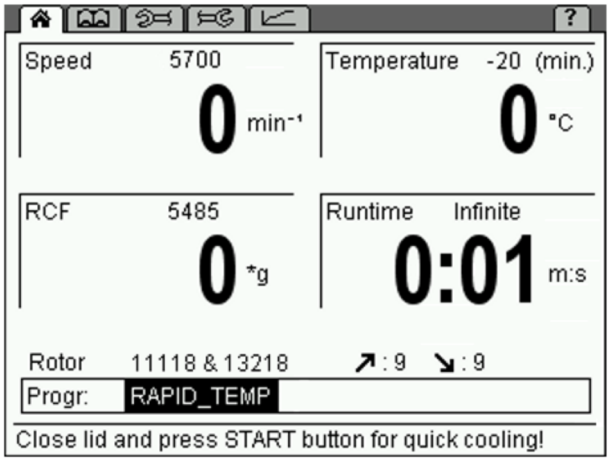


Fig. 26: Quick cooling program RAPID_TEMP

The quick cooling program can only be loaded if the actual temperature is higher than the set temperature.

1. Press the Start button in order to start the cooling run.
   – During the cooling run, the set temperature can be changed in the range below the actual temperature.
   – The current status of the program will be displayed on the status bar.

The quick cooling program will be stopped in the following cases:

- When the set value is reached. The quick cooling program stops with a sound signal (if this feature is activated), and the standstill cooling system will be activated.
- When the stop button is pressed. The quick cooling program will be stopped prematurely. No message will be issued when the set temperature is reached.
- When a parameter is changed (except for the temperature) or another input is made. The quick cooling program will be aborted. No message will be issued when the set temperature is reached.

After the stop, the previous program will be reloaded or the changed parameters will be adopted as the new settings.

- The automatic lid opening function is suppressed after a cooling run in order to prevent the material from reheating.
- The delta T temperature monitoring system (see chapter 6.5.1.3 - "Parameters menu"/ "Process") remains inactive as long as the quick cooling program is active.
- If the quick cooling program is used, the temperature of the unloaded aluminium bucket will be displayed. If samples, which have not been cooled beforehand, are placed into the buckets after a "RAPID_TEMP" run, the displayed temperature will deviate from the actual sample temperature.

Progress indicator

The progress indicator provides a quick overview of the remaining runtime of the running centrifugation run. For this purpose, a green progress bar and percentage value are displayed in the program field.

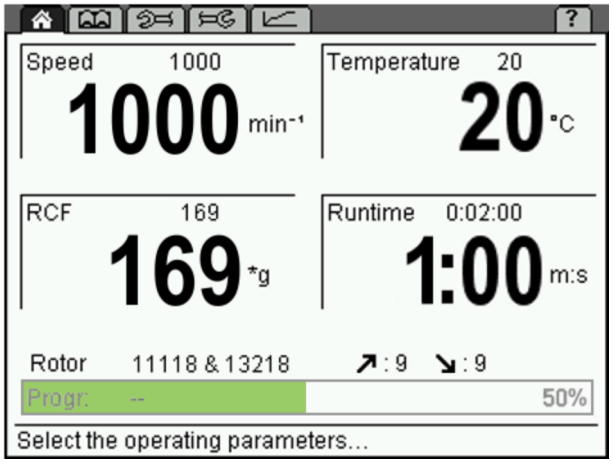


Fig. 27: Progress indicator during a centrifugation run

After the completion of the centrifugation run, the progress indicator remains at 100% until

- the lid is opened,
- a parameter is changed,
- a program is loaded, saved or deleted or
- a new centrifugation run is started.

6.5.1.2 Process library menu

The process library can be opened via the "🕮" symbol on the menu bar. It provides the user with an overview of all of the stored programs as processes.

The processes are listed with their name, RCF, runtime and temperature (exception: the RAPID_TEMP program will not be listed).

The order of the processes corresponds to their storage locations on the program list. Empty storage locations will not be displayed. If more than 11 programs have been stored, the user can scroll through the list.

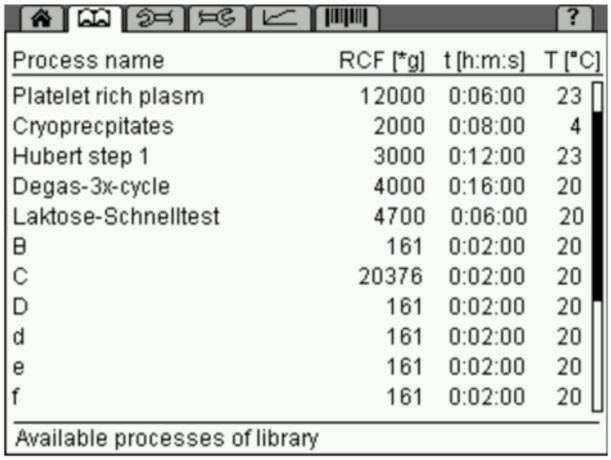


Fig. 28: Process library menu

Loading a process

1. In the process library, select the desired process by turning the function knob. Then, press the Start button.
2. Confirm the selection by pressing the function knob.
   – The process will be loaded and the "Standard" menu will be displayed.

Starting a process

1. In the process library, select the desired process by turning the function knob. Then, press the Start button.
2. Press the Start button.
   – The process will be loaded and started. The "Standard" menu will be displayed.

6.5.1.3 Parameters menu

The "Parameters" menu is symbolised by the "⚙" symbol on the menu bar. It is used to specify various conditions for the centrifugation. These conditions are used to monitor the process and to control access to the centrifuge.

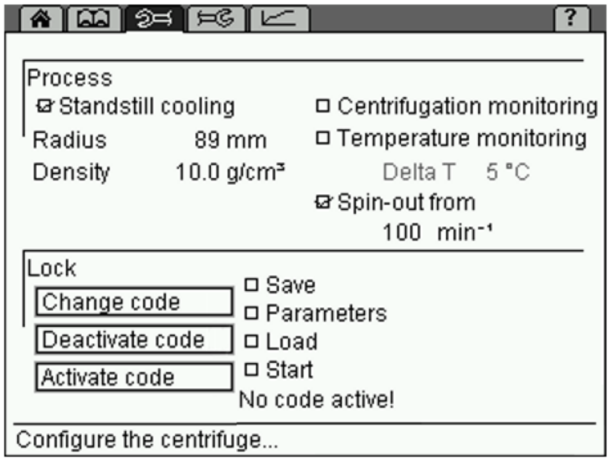


Fig. 29: Menu "Parameters"

Process

Standstill cooling

Depending on the substances that are to be centrifuged, it may make sense to precool the centrifuge prior to starting a centrifugation. The precooling prevents the samples with a specific temperature in the uncooled centrifuge from heating to an inadmissible temperature level.

If the standstill cooling function is activated, the precooling of the centrifuge will be started after it is switched on. In the runtime field, the symbol "❄" is displayed. The lid must be closed.

CAUTION – Unmoved air in the rotor chamber leads to an incorrect measuring and control behaviour, and it causes the compressor to freeze over. At temperatures below 0°C, aqueous liquids will freeze, thereby preventing sedimentation. Do not cool the rotor below 0°C at a standstill.

The centrifuge is equipped with the RAPID_TEMP program. This program is used to precool the rotor chamber quickly under the defined conditions.

Radius

The radius determines the values of the relative centrifugal force (RCF) that the sample is subjected to. Normally, the maximum RCF value is displayed. If the value is reduced manually, a downward facing arrow "↓" will be displayed in the RCF field.

Density

This setting is useful for glass vessels. If the density of the liquid to be centrifuged is higher than 1.2 g/cm³, the value must be adapted manually in order to prevent the glass vessel from breaking. This will reduce the maximum possible final speed. The reduction will be represented by a downward facing arrow "↓" in the speed field. Values between 1.2 and 10.0 g/cm³ are possible.

Centrifugation monitoring

The centrifugation monitoring function enables the continuous monitoring of the speed and runtime parameters during the centrifugation.

1. Activate the centrifugation monitoring function by clicking.

If the function is activated during a centrifugation run, the monitoring process will not be started until the start of the next centrifugation run.

The centrifugation monitoring function compares the speed values of the current run with the reference values that are stored in the control unit. After every run, it issues a corresponding message.

The runtime is considered faulty if the centrifugation run had to be stopped prematurely.

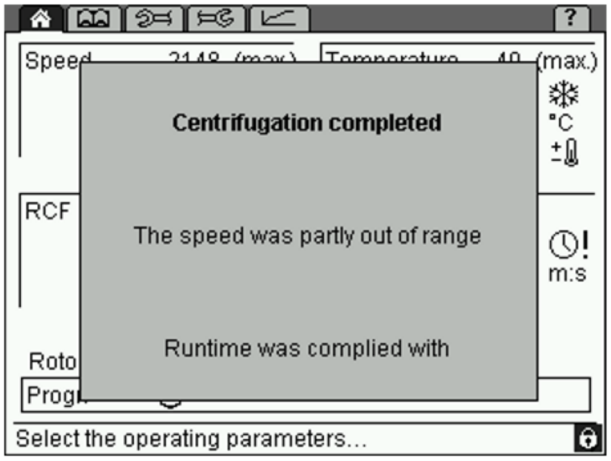


Fig. 30: Example of a centrifugation monitoring message

If the centrifugation monitoring system is used in combination with free acceleration or deceleration curves, unjustified error messages may result in certain cases.

Temperature monitoring system

The control system includes a temperature monitoring function. If the actual temperature difference with regard to the set value deviates from the set temperature difference, the centrifuge will stop and an error message will be issued.

1. Activate the temperature monitoring function by clicking.
2. Adjust the desired "Delta T" limit value in steps of 1°C or 1°F and confirm the setting.

If the temperature monitoring function is active, the symbol "" is displayed in the temperature field of the "Standard" menu.

In this case, the centrifuge can only be started if the current temperature is between the preset temperature in the "Standard" menu and the "Delta T" limit value.

If the temperature leaves this range during the centrifugation run, an error message will be displayed and the centrifuge will be decelerated to a complete standstill.

The delta T temperature monitoring system remains inactive as long as the quick cooling program is active.

Spin-out from…

If this function is active, the brake will be deactivated when the actual speed is below the set speed. As a result, the rotor will spin out in a brakeless manner.

A spin-out, in particular with heavy rotors and at high speeds, can take a lot of time (depending on the rotor and load, the speed will be reduced by approximately 0.5 to 1 min^{-1} (rpm per second)).

If the spin-out is active, "+0" is displayed next to the deceleration curve.

The spin-out can be interrupted by a quick stop or by restarting the centrifuge.

Lock

In order to prevent any unauthorised use of the centrifuge, the following functions can be locked:

- Saving of programs (level 01)
- Changing of parameters, short run (level 02)
- Loading of programs (level 03)
- Start button (level 04)

Locking a function

1. Select the function that needs to be locked. The lower levels will also be automatically selected (if, for example, the "Parameters" function is selected, the "Save" function will also be selected).
2. Select the button "Activate code".
3. Enter a four-digit code and confirm the entry.
   – The function has been disabled.
   – The symbol "" will be displayed on the status bar.
   – The locking level will be displayed.

If changes are made after a function has been locked, the system will ask for the code prior to executing the change.

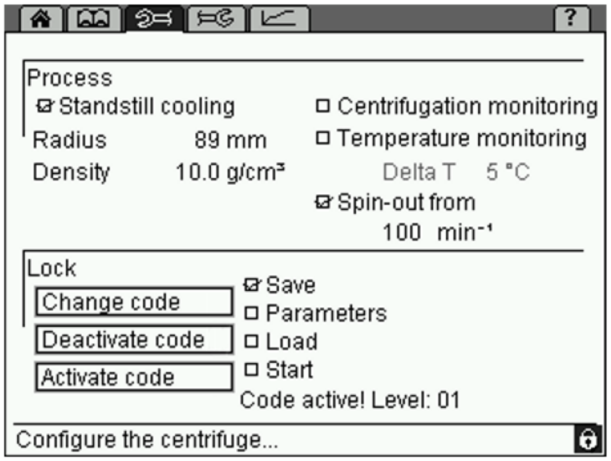


Fig. 31: "Parameters" menu with an active lock (level 01)

Unlocking a function

1. Select the button "Deactivate code".
2. Enter the code and confirm the entry.

The lock is now deactivated.

Changing the code

1. Select the button "Change code".
2. Enter the old code and confirm the entry.
3. Enter the new code.
4. For safety reasons, the code must be entered a second time.

The code is now changed.

6.5.1.4 Setup menu

The "Setup" menu is symbolised by the "⚙" symbol on the menu bar. It is used to perform basic settings concerning the control system of the centrifuge. It enables the optimum adaptation of the centrifuge to its specific area of application.

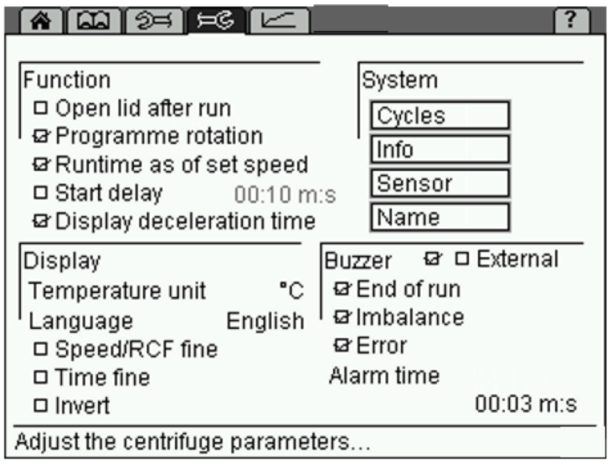


Fig. 32: Menu "Setup"

Function

Open lid after run

The automatic lid opening function ensures that the lid opens when the rotor has stopped.

CAUTION – When the lid is open, the cooling system is inactive. The samples may heat up.

Program rotation

See chapter 6.5.2.5 - "Automatic program rotation".

Runtime as of set speed

If this function is active, the runtime will not be measured until the set speed is reached. In the "Standard" menu, the symbol "⏲!" will be displayed in the runtime field.

The function "Runtime as of set speed" can be saved separately for every program in program mode. In this case, the symbol "⏲!" will be displayed under the runtime of the detailed program description.

Start delay

If the start delay function is active, the centrifuge will not start until the preset time has elapsed. The symbol "⏳" will be displayed in the runtime field.

Display deceleration time

In the activated mode, the deceleration time will be displayed instead of the runtime during and after the deceleration process. Below the time display, the symbol "" will be displayed. During a deceleration process, the symbol flashes. Once the deceleration is complete, it is displayed in a permanent manner.

Display

Temperature unit

The temperature can be displayed in °C (Celsius) or °F (Fahrenheit).

Language

The control system can be used in various language versions.

If a language is selected by mistake, it can be changed on any screen as follows:

1. Press and hold the stop button.
2. Turn the function knob one notch to the left and then one notch to the right.
3. Release the stop button.

   The "Language" window will be displayed.
4. Select the desired language.

Speed/RCF fine and Time fine

This menu item can be used to preselect the set speed in steps of 1 min^{-1} (instead of 100 min^{-1}), the RCF value in steps of 1 x g (instead of 10 x g), and the set time in steps of 1 min or 1 s (instead of 10 min or 10 s).

Regardless of the fine adjustment, the step size increases when the function knob is turned quickly.

Invert

If this function is activated, the display switches from the default setting with a bright background and dark writing to a dark background with bright writing.

System

Cycles

This field shows the number of cycles as well as the runtime of the rotor and buckets that are used.

The information engraved on the rotor or bucket regarding the service life is binding. The information provided by the control system is for informational purposes only and, thereby, non-binding.

Info

This item provides information on the software versions that are used in this centrifuge.

Sensor

The sensor mode is reserved for the service personnel.

Values can neither be entered nor changed in the "Cycles", "Info" or "Sensor" menus.

Name

In this field, an identification will be assigned to the centrifuge.

- The letters and characters can be entered when the cursor flashes in the text field. Turn the function knob in order to select a character and press it to confirm the selection. Then, press the knob again in order to enter the next character. Pressing the arrow button ← will delete the last character. The maximum number of characters is 19.
- When the name is complete, select the option "Accept" and confirm it.

Buzzer (signal)

With this function, a warning sound signal can be selected for

- the end of a centrifugation run,
- an imbalance message or
- an error message.

The duration of the warning signal can be specified.

External

This function is only available if the centrifuge is equipped with an option for the input and output of data (external signal, floating switch) (see chapter 6.5.2.6 - "Options for data input and output").

6.5.1.5 Curve menu

This menu is used to create and edit customised acceleration and deceleration curves (see chapter 11.5 - "Acceleration and deceleration curves"). It is symbolised by the "" symbol on the menu bar.

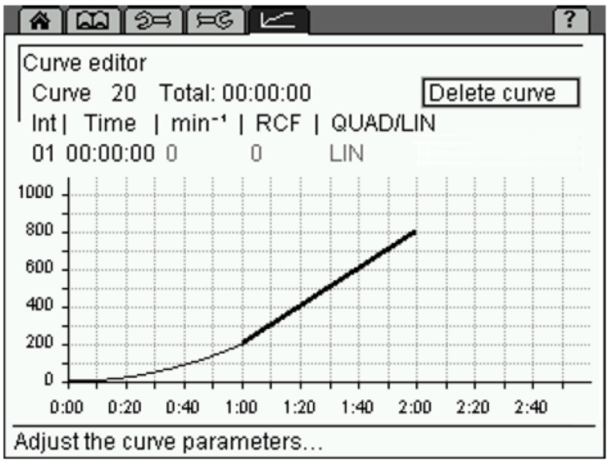


Fig. 33: Menu "Curve"

Creating or changing an acceleration curve

During a centrifugation run, curves can only be displayed. They cannot be changed or deleted.

1. Select the "Curve" menu.
   – The curve editor will be displayed.
2. Select a curve number between 20 and 29 in the input field "Curve". If the curve number is already used, the stored curve will be displayed.
3. The input field "Int" is used to specify the interval number of the process. Up to ten intervals can be entered for a curve.
4. Enter the interval time of the current interval into the input field "Time". While doing so, certain restrictions must be taken into consideration (see below).
5. Enter the desired acceleration under "min^{-1}" or "RCF". While doing so, certain restrictions must be taken into consideration (see below). The values are interdependent.
6. In the first interval, "QUAD/LIN" can be used to select a linear or quadratic rise. All of the other intervals are linear.

The field "Total" shows the total runtime of the process. The maximum total runtime of a curve depends on the slope of the curve and on the final speed of the rotor.

Only the last curve interval can be changed retroactively.

Restrictions

- Acceleration and deceleration curves can include intervals with a positive slope as well as intervals with a negative slope and also intervals with 0 slope.
- The slope of the curve intervals can be 1 min^{-1}/s minimum and 1,000 min^{-1}/s maximum.
- Quadratic curve intervals are only possible between 0 and 1,000 min^{-1} maximum. If a final speed > 1,000 min^{-1} is selected, this interval will automatically become linear above 1,000 min^{-1}.
- The possible runtime results from the maximum possible speed (depending on the rotor) and from the slope limitation.

Example 1: Start speed 0 min^{-1}, final speed 100 min^{-1}, runtime 1 h not possible, since the necessary slope is < 0.03 min^{-1}, which means that it is beyond the defined range.

Example 2: Start speed 0 min^{-1}, final speed 15,000 min^{-1}, runtime 10 s. not possible, since the necessary slope is 1,500 min^{-1}, which means that it is beyond the defined range.

6.5.1.6 Barcode menu

In order to connect a barcode scanner, the centrifuge must be equipped with a second RS232 interface and a corresponding circuit board.

If the centrifuge is equipped with the barcode scanner function, the symbol "▌▌▌" will be displayed on the menu bar. In order to use this function, a PC and a barcode scanner must be connected to the RS232 interface.

The "Barcode" menu shows all of the codes that are stored in the control system. Data structure 020 is displayed in the left-hand area of the screen, and data structure 001 is in the right-hand area. Free storage locations are symbolised by symbols without any code.

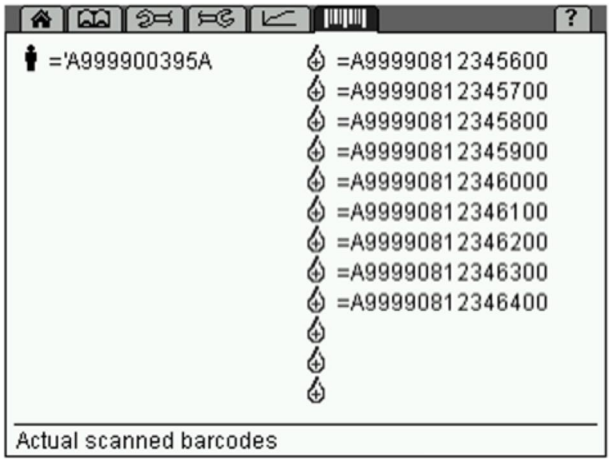


Fig. 34: Barcode menu

With the barcode scanner, the barcodes can be scanned directly at the centrifuge during the loading process. The centrifugation data can be enquired cyclically (automatically) by the PC. Once a centrifugation run is complete, the PC can detect this and save the result (centrifugation data with barcodes).

Barcode commands

Setting a barcode: "setbarcode"

Every code must be set separately. This is done automatically by way of the scanner. Barcodes will only be accepted under the following conditions:

- There is no active centrifugation run.
- There are not any barcodes stored in the system which have already been used for a centrifugation run.
- The barcode does not already exist.
- It is an ISBT 128 barcode with the data structure 001 (donation identification number) and there are fewer than 12 of these codes stored in the system.
- It is an ISBT 128 barcode with the data structure 020 (staff member identification number) and there are not any barcodes with this data structure stored in the system.

If the barcode is accepted, the data of the last centrifugation run will be automatically deleted and the "Barcode" menu will be displayed.

In the event of a mains power failure, all the codes that have been scanned in so far will be lost and must be scanned again.

Reading out the stored barcodes: "getbarcodes"

All of the codes will be output in one response. This leads to the following possible response formats:

- No codes are stored
  → syntax "Barcodes none\r\n"
- Only codes with the data structure 001 are stored
  → syntax "Barcodes abc, def,…\r\n" (abc, def,… = barcodes)
- Only codes with the data structure 020 are stored
  → syntax "Barcodes abc (staff)\r\n" (abc = barcode)
- Codes with the data structures 001 and 020 are stored
  → syntax: "Barcodes abc (staff), def,…\r\n" (abc, def,… = barcodes)

Deleting the stored barcodes: "deletebarcodes"

This command is used to delete all of the stored barcodes.
The "Barcode" menu will be updated.

This command will not be accepted unless the centrifuge is at a standstill.

Reading out the data of the last centrifugation run: "getlastrun"

The response to this command includes information about the parameters and status of the last centrifugation run.

If barcodes have been stored, they will also be output as follows:

- Syntax data structure 001:
  "Barcode;x;abc\r\n" (x = serial number starting at 1, abc = barcode)
- Syntax data structure 020:
  "Barcode;Staff Member ID;abc\r\n" (abc = barcode)

The enquiry can be performed at any time (before, during and after the centrifugation run). Depending on the time of the enquiry, some of the results may still be unknown.

6.5.1.7 Help menu

The Help function is symbolised by the "?" symbol on the menu bar. It provides a short description of the control elements of the selected option.

Activating and deactivating the Help function

1. Select the question mark on the menu bar and press the function knob.
2. Quit the Help function by selecting the question mark and by pressing the function knob again.

Parameters can still be changed when the help function is activated.

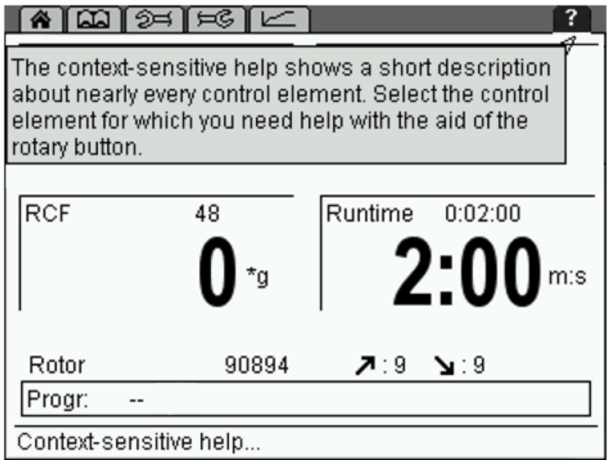


Fig. 35: Menu "Help"

6.5.1.8 Changing the contrast

To change the contrast:

1. Press and hold the Stop button and turn the function knob one notch to the left.
   – A dialog box will be displayed once the Stop button is released.
2. Adjust the contrast of the centrifuge display and confirm the change.

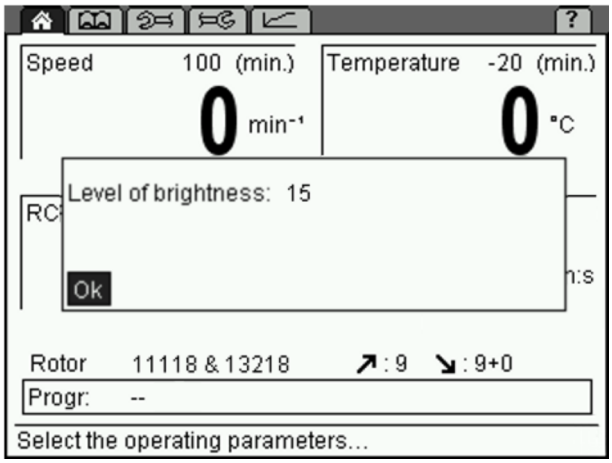


Fig. 36: Dialog box for changing the contrast

6.5.2 Program mode

A program contains all of the data that are required for a centrifuge run. Certain sedimentation results can be repeated under identical conditions.

Programs can be loaded, executed, edited and deleted when the centrifuge is at a standstill.

A maximum of 60 programs can be stored under the numbers 1-60. The program RAPID_TEMP does not occupy any storage location and cannot be deleted. It is used to bring the centrifuge to a specific temperature without any vessels.

"--" means that the values that are currently set are not a stored program.

The programs can be protected against unauthorised use, modification or deletion with the aid of a code (see chapter 6.5.1.3 - "Parameters menu").

Stored programs are listed in the "Process library" menu.

6.5.2.1 Saving a program

1. Enter the parameters that are to be included in the program.
2. Select the option "Progr" in the "Standard" menu and confirm the selection. The program list will be displayed.
3. Select a storage location from the program list.
4. Save the program under the desired name. The letters and characters can be entered when the cursor flashes in the text field.
   – Turn the function knob in order to select a letter and press it to confirm the selection. Then, the next character can be selected.
   – Pressing the arrow button ← will delete the last character.
5. When the program name is complete, select "OK" and confirm it.
   – The program will be saved and the "Standard" menu will be displayed.

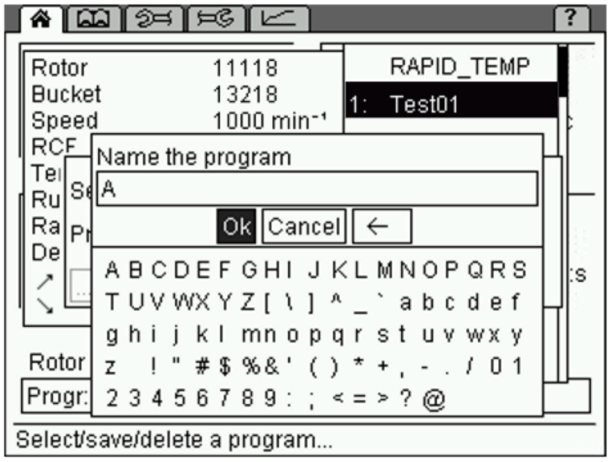


Fig. 37: Assignment of a program name prior to saving the program

6.5.2.2 Loading a program

1. Select the option "Progr" from the "Standard" menu and confirm the selection by pressing the function knob.
   – The program list will be displayed.
2. Select the desired program from the list and confirm the selection by pressing the function knob

   Or:
3. Open the process library, select the desired program and confirm the selection by pressing the function knob.
   – The program will be loaded and the "Standard" menu will be displayed.

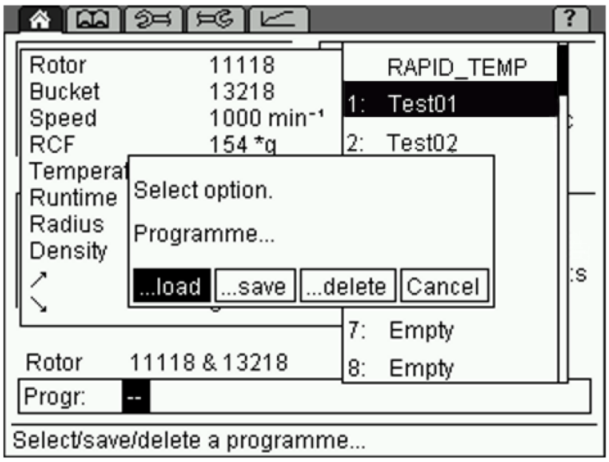


Fig. 38: Loading a program

6.5.2.3 Executing a program

1. Select the option "Progr" from the "Standard" menu and confirm the selection by pressing the function knob.
   – The program list will be displayed.
2. Select the desired program from the list and confirm the selection by pressing the function knob.
3. Press the Start button.

Or:

4. Open the process library, select the desired program and press the Start button.
   – The program will be executed and the "Standard" menu will be displayed.

6.5.2.4 Deleting a program

1. Select the option "Progr" in the "Standard" menu and confirm the selection.
   – The program list will be displayed.
2. Select the program that is to be deleted.
3. Select the option "Delete" and confirm it.
   – The program will be deleted and the "Standard" menu will be displayed.

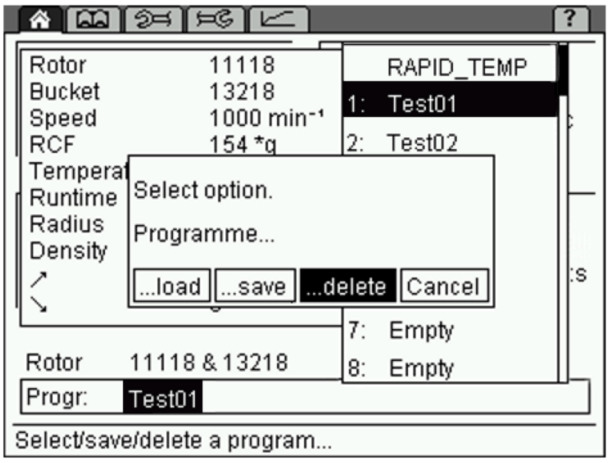


Fig. 39: Deleting a program

6.5.2.5 Automatic program rotation

With the automatic program rotation, several programs can be executed directly one after the other.

1. Activate the "Program rotation" function in the "Setup" menu.

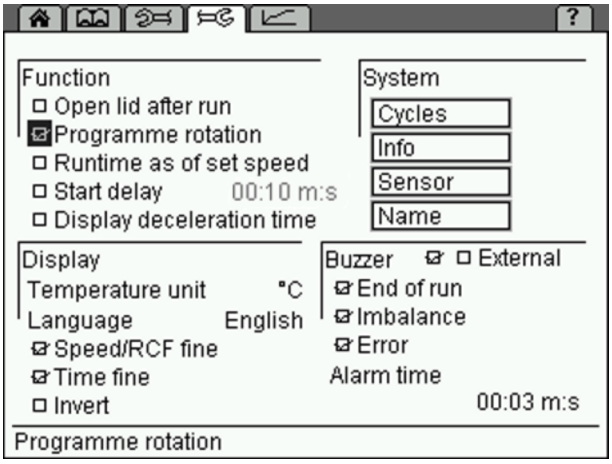


Fig. 40: Program rotation function

When a program is loaded while the program rotation function is active, this program will be used as the start program for the rotation. After the completion of the program, the next program on the program list will be loaded automatically. The

rotation continues up to the next empty storage location and then restarts from the beginning (see the following illustration).

Example 1: Loading of Sample4
Rotation: Sample4, Sample5, Sample6, Sample4,...

Example 2: Loading of Sample5
Rotation: Sample5, Sample6, Sample5,...

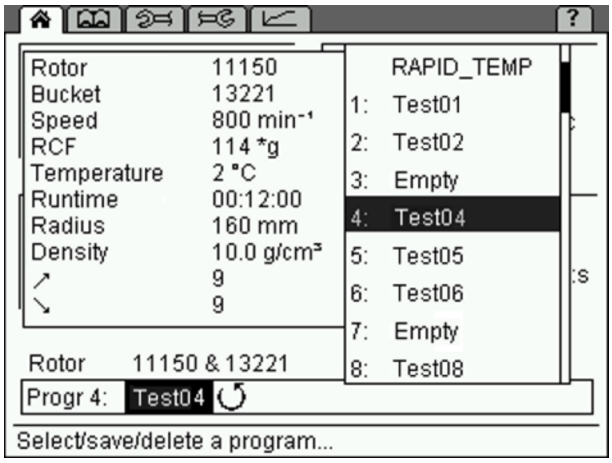


Fig. 41: Automatic program rotation

While the program rotation function is active, the arrow "↻" is displayed in the program line in the "Standard" menu.

6.5.2.6 Options for data input and output

- Serial interface (see chapter 6.5.3 - "Connecting a separate computer")
- External signal active DC 24 V, 0.5 A max. (part no. 17701)
- Floating switch AC 250 V max., 6 A (part no. 17702)
- Connection of a barcode scanner via a barcode expander board (see chapter 6.5.1.6 - "Barcode menu")

6.5.3 Connecting a separate computer

The back of the centrifuge has a serial interface (see chapter 3.2 - "Centrifuge overview")for connecting a computer.

1. Plug the connecting cable into the corresponding socket at the back of the centrifuge.
   – The centrifuge can now be controlled via the computer.

If the centrifuge is controlled via the computer, the display only acts as a screen for visualisation. Only the Stop button remains active at all times and can be used for stopping the centrifuge in an emergency.

7 Maintenance

7.1 Safety

DANGER

Risk of injury from electric shock or sharp-edged components when removing the housing panels

In the case of maintenance tasks requiring the removal of the housing panels, there is a risk of electric shock or mechanical injury.

- Maintenance tasks requiring the removal of the housing panels must only be carried out by authorised specialists.
- After the completion of maintenance tasks that involved the removal of the housing panels, a final standard-compliant check must be carried out by a qualified electrician.

WARNING

Risk of toxic, pathogenic or radioactive contamination

Toxic, pathogenic or radioactive substances can cause contamination if they are not handled properly.

It may be necessary to clean and/or decontaminate the laboratory centrifuge, rotors and accessories for reasons of safety before they can be maintained, repaired or handed over.

- Disinfect and clean the centrifuge, rotors, buckets, carriers and accessories after a contamination.
- Comply with the relevant safety instructions concerning the handling of toxic, pathogenic or radioactive substances.
- Wear personal protective equipment.
- Document any measures taken (see chapter 8.5 - "Returning the centrifuge to the manufacturer" / Declaration of decontamination)

7.2 General notes

The centrifuge and its accessories are subject to high mechanical stress. In order to withstand the continuous, extreme levels of stress within their area of application with high centrifugal force, the products are manufactured with the highest levels of precision. The service life of the centrifuge depends on its cleaning, maintenance, correct storage, frequency of use and other specific conditions of use. Diligent care and maintenance by the user will extend the service life of the products and prevent premature wear.

The centrifuge and accessories are made from different materials. Please check for any possible incompatibilities.

Prior to using cleaning agents and disinfectants other than those recommended, the user must consult with the manufacturer to ensure that they will not damage the centrifuge or its accessories.

For autoclaving, the long-term temperature resistance of the individual materials must be observed (see chapter 7.5 - "Autoclaving").

Protect the centrifuge and its accessories from intensive UV radiation (e.g. direct exposure to sunlight) and thermal stress (e.g. caused by heat generators).

Frequency of the required activities

Chapter	Activity	Frequency
	Cleaning	
chapter 7.3.1	Cleaning of the centrifuge	As required
chapter 7.3.2	Cleaning of the rotors and buckets	As required
chapter 7.3.3	Cleaning of the adapters and carriers	As required
	Disinfection	
chapter 7.4.1	Disinfection of the centrifuge	As required
chapter 7.4.2	Disinfection of the rotors and buckets	As required
chapter 7.4.3	Disinfection of the adapters and carriers	As required
	Maintenance	
chapter 7.6.1	Inspection of the centrifuge for signs of damage	Monthly
chapter 7.6.1	Greasing of the motor shaft	After cleaning
chapter 7.6.1.1	Check of the condenser for soiling	Monthly
chapter 7.6.1.1	Cleaning of the condenser	As required
chapter 7.6.2	Check of the rotors, buckets, adapters and carriers for signs of damage	Monthly
chapter 7.6.2	Greasing of the rotor tie-down screw	After cleaning
chapter 7.6.2	Greasing of the load-bearing bolts	As required/ after cleaning

Table 4: Table of the required activities and their frequency

7.3 Cleaning tasks

For cleaning the centrifuge and its accessories:

- Use soapy water or other water-soluble, mild cleaning agents with a pH value between 6 and 8.
- Clean the centrifuge by hand only.
- The water temperature must be < 40°C.
- Avoid corrosive and aggressive cleaning agents.
- Do not use any solvents.
- Do not use any agents with abrasive substances.

7.3.1 Cleaning the centrifuge

▶ The centrifuge is switched off and disconnected from the power supply.
▶ The lid is open.

1. Remove the rotor and buckets (see chapter 6.4.3 - "Removing the rotor and accessories").
2. Clean the housing and the rotor chamber with the specified cleaning agents and a soft, lint-free cloth.
3. Remove any cleaning agent residues completely with water and a soft, lint-free cloth.
4. After cleaning, dry the surfaces with a soft, lint-free and absorbent cloth.
   – The centrifuge has been cleaned.

7.3.2 Cleaning the rotors and buckets

▶ The rotors and buckets are located outside of the centrifuge.
▶ The covers have been removed from the rotors.
▶ Any existing carriers or adapters have been removed.

1. Remove the seals of the caps/covers, rotors or buckets from the groove with the aid of the seal removal tool (ref. no. 170360).
2. Remove any old grease and deposits from the load-bearing bolts of the swing-out rotors and from the grooves of the buckets.

ATTENTION – Rotors and buckets with an anodised coating must never be cleaned in a dishwasher. The dishwasher will remove the anodised coating of the rotors and buckets, thereby leading to cracks in areas under stress.

3. Clean the rotor, buckets and the associated seals with the specified cleaning agents and a soft, lint-free cloth.
4. To clean narrow holes, use a test tube brush with a wool tip and then rinse with water.
5. Remove any cleaning agent residues completely with water and a soft, lint-free cloth.
6. Dry the rotor, buckets and seals with a soft, lint-free and absorbent cloth or in a drying cabinet at 50°C maximum.
7. To dry the holes, let the rotor dry lying upside down on a surface.
   – Rotors and buckets have been cleaned.

ATTENTION – The chemical resistance of rotors, buckets and carriers made of plastic decreases at higher temperatures (e.g. during drying). See the table in chapter 11.6 - "Table of chemical resistance data".

7.3.3 Cleaning the adapters and carriers

▶ The adapters and carriers have been removed from the rotor or bucket.

1. Clean the adapters and carriers with the specified cleaning agents and a soft, lint-free cloth.
2. To clean narrow holes, use a test tube brush with a wool tip and then rinse the holes complete with water.
3. Remove any cleaning agent residues completely with water and a soft, lint-free cloth.
4. Dry the adapters with a soft, lint-free and absorbent cloth.
5. To dry the holes, let the adapter dry lying upside down on a surface.
   – The adapters and carriers have been cleaned.

ATTENTION – Adapters and carriers with an anodised coating must never be cleaned in a dishwasher. The dishwasher will remove the anodised coating of the adapters and carriers, thereby leading to cracks in areas under stress.

7.4 Disinfection

Prior to a disinfection, the cleaning steps described in chapter 7.3 - "Cleaning tasks" must be performed.

7.4.1 Disinfecting the centrifuge

- To disinfect the centrifuge (control panel, contact surfaces and rotor chamber), use an alcohol-based surface disinfectant with a concentration between 30% and 75% (e.g. Bacillol® AF).
- Disinfect the lid window and the display (acrylic glass), motor cover (silicone) and (screen-printed) labelling with a disinfectant that is suitable for the material (e.g. Bacillol® 30 sensitive tissues).
  Never use a surface disinfectant with a high alcohol concentration!
- Follow the manufacturer's instructions regarding the application time and concentration of the disinfectant.

▶ The centrifuge is off and disconnected from the power supply.
▶ The lid is open.
▶ There is no rotor inside the rotor chamber.
▶ The centrifuge has been cleaned as described in chapter 7.3.1 - "Cleaning the centrifuge".

1. Wipe down the housing and rotor chamber with the above-mentioned disinfectant and a soft, lint-free cloth.
2. Comply with the specified application time.
3. Let the disinfected surfaces dry completely.
   – The centrifuge has been disinfected.

7.4.2 Disinfecting the rotors and buckets

- To disinfect the rotors, buckets and their seals, use an alcohol-based surface disinfectant with a concentration between 30% and 75% (e.g. Bacillol® AF).
- Follow the manufacturer's instructions regarding the application time and concentration of the disinfectant.

▶ The rotors and buckets have been cleaned as described in chapter 7.3.2 - "Cleaning the rotors and buckets".

1. Wipe down the rotor, buckets and their seals with the above-mentioned disinfectant and a soft, lint-free cloth.
2. To disinfect narrow holes, fill them with the disinfectant without entrapping any air.
3. Ensure complete wetting.
4. Comply with the specified application time.
5. Let the disinfected rotors, buckets and seals dry completely.
   – The rotors and buckets have been disinfected.

7.4.3 Disinfecting the adapters and carriers

- To disinfect the adapters and carriers, use an alcohol-based surface disinfectant with a concentration between 30% and 75% (e.g. Bacillol® AF).
- Follow the manufacturer's instructions regarding the application time and concentration of the disinfectant.

▶ The adapters and carriers have been cleaned as described in chapter 7.3.3 - "Cleaning the adapters and carriers".

1. Wipe down the adapters and carriers with the above-mentioned disinfectant and a soft, lint-free cloth.
2. To disinfect narrow holes, fill them with the disinfectant without entrapping any air.
3. Ensure complete wetting.
4. Comply with the specified application time.
5. Let the disinfected adapters and carriers dry completely.
   – The adapters and carriers have been disinfected.

7.5 Autoclaving

The service life of the accessories depends on their frequency of use and on the autoclaving frequency.

▶ The caps have been removed from the vessels in order to prevent the vessels from being deformed.
▶ The seals have been removed from the caps/covers and buckets.

1. Position the accessories in the autoclave and run an autoclave cycle.
2. After each sterilisation, check the accessories for colour changes, structural changes or leaks and replace the affected parts immediately if any signs are detected.
3. After the autoclave run, reinstall the seals of the caps/covers and buckets (see chapter 7.3.2 - "Cleaning the rotors and buckets").

The specified autoclaving parameters exclusively refer to the material resistance and not to the degree of sterility.

Category	Name	Material abbreviation	121°C 20 minutes	Notes
Rotors and covers	Aluminium rotors	AL	yes	
	Polypropylene rotors	PP	no	
	Aluminium covers (without seals) for angle rotors	AL	yes	50 cycles max.
	Polycarbonate covers for angle rotors	PC	no	
	Polyallomer covers for angle rotors	PA	no	
	Polysulfone covers for angle rotors	PSU	yes	100 cycles max.
Buckets and caps	Aluminium buckets (without seals)	AL	yes	
	Polyamide buckets	PA	no	13035, 13296, 13299
	Polyphenylsulfone caps	PPSU	yes	100 cycles max.
	Polysulfone caps	PSU	yes	100 cycles max.
Adapters	Polyallomer racks	PA	no	
	Polyallomer racks	PC	no	
	Polyallomer racks	PP	no	
Vessels	Stainless steel vessels and bottles	--	yes	
	Glass vessels	--	yes	
	Polyethylene vessels	PE	no	
	Polyflor vessels	PF	yes	100 cycles max.
	Polycarbonate vessels	PC	no	
	Polypropylene copolymer vessels	PPCO	yes	20 cycles max.
	Polystyrene vessels	PS	no	
Additional equipment	Seals of the aluminium covers and buckets	NBR	yes	50 cycles max.
	Stainless steel taring weights for blood bag systems	--	yes	

Table 5: Autoclaving table

7.6 Maintenance tasks

7.6.1 Maintaining the centrifuge

The service life of the centrifuge depends on several factors, e.g. the type and frequency of use, the area of application and the performance of care, service and maintenance tasks.

▶ The centrifuge is off and disconnected from the power supply.
▶ There is no rotor inside the rotor chamber.

Post-centrifugation measures

- In the event of a contamination with toxic, pathogenic or radioactive substances, clean all of the internal surfaces immediately with a suitable decontamination agent depending on the type of contamination (see chapter 7.3 - "Cleaning tasks" and chapter 7.4 - "Disinfection").
- Liquids, such as water, solvents, acids and lyes, must be removed from the rotor chamber immediately using a cloth in order to prevent damage to the motor bearings.

Post-cleaning measures

- Grease the motor shaft and rotor tie-down screw slightly with a small amount of heavy-duty grease for load-bearing bolts and distribute the grease with a cloth so that it forms a thin layer.
- Rub talcum powder into the dry lid seal, if necessary.

Visual inspection

- Perform a visual inspection of the centrifuge at least monthly to detect the following signs of damage:
  - Cracks
  - Visible surface damage
  - Pressure marks
  - Signs of corrosion
  - Other changes
- Open the centrifuge lid completely and ensure that it remains in this position.

7.6.1.1 Cleaning the condenser

Refrigerated centrifuges with an air-cooled refrigeration system use a finned condenser to cool the refrigerant that is compressed by the refrigeration unit.

Dust and dirt on the condenser's ventilation opening impede cooling by the air flow and reduce the heat transfer, thereby compromising the performance of the refrigeration system.

- Check the condenser at least monthly for soiling and clean it whenever necessary.
- In case of dirt build-up on the condenser fins and tubes, contact the Sigma Service (see chapter 8.4 - "Service contact").

7.6.1.2 Removing broken glass

CAUTION

Risk of injury from broken glass

Broken glass in the rotor chamber can cause cuts.

- Broken glass must be removed immediately and completely.
- Wear personal protective equipment when removing the broken glass.

Potential problems caused by broken glass in the rotor chamber

- Broken glass damages the surface coating of the buckets, thereby causing corrosion.
- Broken glass in the adapters of the rotors and buckets causes more glass breakage.
- Broken glass in the swivel bearings of the load-bearing bolts prevents the buckets from swinging out evenly, thereby causing imbalance.
- Broken glass in the rotor chamber causes metallic abrasion due to the strong air circulation. The fine metal dust contaminates the rotor chamber, rotor and samples. At the same time, it also damages the surfaces of the rotor chamber, rotor, buckets, adapters, carriers and accessories.

Removing broken glass and metal dust from the rotor chamber

1. Apply a thick layer of petroleum jelly or similar to the upper third of the rotor chamber.
2. Switch the centrifuge on and let the rotor rotate for a few minutes at medium speed (approx. 2,000 min^{-1}). The broken glass and metal dust will be bound in the grease.
3. Remove the grease with a cloth.
4. Repeat this process until all the broken glass and metal dust has been removed.

7.6.2 Maintaining the rotors, buckets, adapters and carriers

Chemical reactions and pressure corrosion (a combination of alternating pressure and chemical reactions) can attack or destroy the structure of metals. Barely detectable cracks on the surface expand and weaken the material without leaving any clearly visible signs.

In the case of plastic materials, the resistance against chemicals decreases when the temperature increases (see the table in the chapter chapter 7.3.2 - "Cleaning the rotors and buckets")

Post-centrifugation measures

- Liquids, such as water, solvents, acids and lyes, must be removed immediately and completely from the rotor, buckets, adapters, carriers and plastic accessories with a cloth.

Post-cleaning measures

- Grease the rotor tie-down screw slightly with a small amount of heavy-duty grease for load-bearing bolts and distribute the grease with a cloth so that it forms a thin layer.
- When using aluminium buckets, slightly grease the load-bearing bolts of the rotors with a thin layer of grease for load-bearing bolts (see chapter 7.6.2.1 - "Maintaining the load-bearing bolts").

CAUTION – The load-bearing bolts must not be greased if plastic buckets are used.

Visual inspection

- The products must be checked regularly, at least monthly, for the following:
  - Cracks
  - Visible surface damage
  - Pressure marks
  - Signs of corrosion
  - Other changes
- Check the holes of rotors and multi-carriers.
- Damaged parts must be replaced immediately for your own safety.

If blood bag adapters are subjected to strong impacts (e.g. if they are dropped), the material may be damaged. Before any further use, their surface must be carefully checked for signs of damage, such as cracks.

Service life

Rotors and buckets have a limited service life.

Refer to the table indicating the service life of rotors and buckets (see chapter 11.4 - "Table indicating the service life of rotors and buckets")!

- The rotors and buckets must be put out of service after 10 years. Any use after this period may be permissible in individual cases after an inspection is performed by the manufacturer.
- For safety reasons, rotors must be scrapped after a maximum of 50,000 cycles.

- If different information regarding the service life is engraved on a rotor or bucket, this information applies accordingly:
  - A bucket with the engraving "max. cycles = 10,000" has a maximum service life of 10,000 cycles.
  - A bucket with the engraving "Exp. date 01/27" must be scrapped by January 2027 at the latest.
- If a specification concerning the maximum number of cycles and a specification concerning the service life (i.e. a specific date) are provided, the specification that occurs first shall apply.

The information engraved on the rotor or bucket regarding the service life is binding. The information provided by the control system is for informational purposes only and, thereby, non-binding.

Disposal of wear parts

When replacing wear parts, e.g. a cover or bucket seal, contamination of the material must be assumed.

1. Dispose of all wear parts in compliance with the special provisions of the waste disposal regulations.

7.6.2.1 Maintaining the load-bearing bolts

Only greased load-bearing bolts ensure a uniform swing-out of the buckets and, therefore, the smooth operation of the centrifuge. Load-bearing bolts that are insufficiently greased may cause the centrifuge to stop due to an imbalance.

1. Clean the load-bearing bolts and bucket groove in order to remove the old grease.
2. Apply a small amount of grease for load-bearing bolts to each of the load-bearing bolts of the rotor cross (see the following illustration).



Fig. 42: Applying the grease for load-bearing bolts

1 Sufficient quantity of grease for one bolt

3. Install a bucket and swing it manually back to its swing-out position in order to distribute the grease.
4. Repeat this process with all the other buckets.

7.7 Inspection to be performed by the manufacturer

Centrifuges used in Germany are subject to mandatory testing as per the information sheet of the German Berufsgenossenschaft Rohstoffe und chemische Industrie FBRCI-025 (November 2023). The test intervals must ensure that the centrifuge can be used safely between tests. The operator is responsible for specifying the test intervals.

When specifying the test intervals, the following time frames should not be exceeded:

- Every 1-2 years in operating condition
- Every 3-4 years in dismantled condition

We recommend the following:

- The motor damping elements (rubber parts of the motor suspension) should be replaced every 3 to 4 years or every 10,000 cycles.

Sigma Laborzentrifugen GmbH performs the inspection and maintenance of centrifuges as per FBRCI-025 and in accordance with the German DGUV regulation 3 (DGUV = German statutory accident insurance) (electrical systems and equipment) .

Maintenance contract

These services can be agreed as part of a maintenance contract.



8 Troubleshooting

8.1 Safety

DANGER

Risk of injury from electric shock or sharp-edged components when removing the housing panels

In the case of maintenance tasks requiring the removal of the housing panels, there is a risk of electric shock or mechanical injury.

- Maintenance tasks requiring the removal of the housing panels must only be carried out by authorised specialists.
- After the completion of maintenance tasks that involved the removal of the housing panels, a final standard-compliant check must be carried out by a qualified electrician.

WARNING

Risk of toxic, pathogenic or radioactive contamination

Toxic, pathogenic or radioactive substances can cause contamination if they are not handled properly.

It may be necessary to clean and/or decontaminate the laboratory centrifuge, rotors and accessories for reasons of safety before they can be maintained, repaired or handed over.

- Disinfect and clean the centrifuge, rotors, buckets, carriers and accessories after a contamination.
- Comply with the relevant safety instructions concerning the handling of toxic, pathogenic or radioactive substances.
- Wear personal protective equipment.
- Document any measures taken (see chapter 8.5 - "Returning the centrifuge to the manufacturer" / Declaration of decontamination)

8.2 Identifying and eliminating faults and malfunctions

When a fault occurs, a dialog box opens. If the sound signal is activated, it will be issued together with the error message.

Eliminating a fault

▶ A dialog box showing an error message is displayed.

1. Eliminate the source of the error (see chapter 8.2.1 - "Table of possible faults"and chapter 8.2.2 - "Table of error messages").
2. Acknowledge the error message by way of the lid button.

If an error message is acknowledged although the source of the error has not been eliminated, the dialogue box will be closed. The error message will not be cleared, but the centrifuge can be used.

3. Contact the service department if the recommended measures are not successful.

8.2.1 Table of possible faults

Error type	Possible cause	Measures
The display remains dark.	Mains power failure	• Check the on-site fuse.
	The mains power connector is not connected.	• Connect the mains power connector.
	Tripped fuses	• The fuses must be checked by a qualified electrician
	The mains power switch is switched off.	• Switch the centrifuge on.
The centrifuge cannot be started: The LED of the Start button does not light up.	Miscellaneous	• Switch the centrifuge off and back on. If the error occurs again, contact the Sigma service department.
The centrifuge cannot be started: The LED of the lid button flashes.	One lid lock has not closed properly.	• Open and close the lid. If the error occurs again, contact the Sigma service department.
The centrifuge decelerates during a centrifugation run.	Brief mains power failure	• Press the Start button to restart the centrifugation run.
	System error	• Switch the centrifuge off and back on. If the error occurs again, contact the Sigma service department.
The centrifuge decelerates during a centrifugation run and an imbalance message is displayed.	Uneven distribution of the load	• Eliminate the imbalance and restart the centrifuge. If the error occurs again, contact the Sigma service department.
	The centrifuge is tilted.	
	Malfunction of the drive	
	The centrifuge has been moved during a centrifugation run.	
	Ungreased load-bearing bolts	• Clean and grease the load-bearing bolts.
The lid cannot be opened.	The lid locks have not unlocked properly.	• Unlock the lid manually (see chapter 8.3 - "Opening the lid manually (emergency lid release)") and contact the Sigma service department.
	The lid seal is sticky.	• Clean the lid seal and apply some talcum powder.
The centrifuge does not reach the set temperature (refrigerated centrifuges).	Unsuitable location	• Adapt the conditions at the location of use or change the location (see the separate transport and installation instructions). If the error occurs again, contact the Sigma service department.

Error type	Possible cause	Measures
	Soiled condenser	• Clean the condenser. If the error occurs again, contact the Sigma service department.
	Insufficient refrigerant supply	• Contact the Sigma service department.
Insufficient sedimentation of the product	Insufficient fastening of the rotor	• Fasten the rotor correctly and restart the centrifugation.
	Defective sensor	• Contact the Sigma service department.
Hard running noise during centrifugation	Screws of the transport safety device are not removed	Remove screws of the transport safety device

Table 6: Table of possible faults

8.2.2 Table of error messages

Error type	Error no.	Measures	Notes
System error	1-9	• Let the rotor coast down. • Switch the centrifuge off and back on. • If the error occurs again: Contact the Sigma service department.	All errors cause the centrifuge to stop or to coast down to a stop.
Speed indicator error	10-19	• Let the rotor coast down. • Switch the centrifuge off and back on. • If the error occurs again: Contact the Sigma service department.	
Motor error	20-29	• Switch the centrifuge off. • Ensure sufficient ventilation.	
EEPROM error	30-39	• Let the rotor coast down. • Switch the centrifuge off and back on. • If the error occurs again: Contact the Sigma service department.	Errors 34, 35, 36 cause a stop; errors 37 and 38 cause a message.
Temperature error (refrigerated centrifuges only)	40-45	• Let the rotor coast down. • Switch the centrifuge off. • Let the centrifuge cool down. • Air-cooled centrifuges: Ensure better ventilation. • Water-cooled centrifuges: Ensure a sufficient water flow rate.	
Imbalance error	46-49	• Let the rotor coast down. • Switch the centrifuge off. • Eliminate the imbalance.	
Lid error	50-59	• Press the lid button. • Check whether there are any foreign objects in the opening for the lid hook. • Close the lid.	Errors 50 and 51 cause the centrifuge to stop.

Error type	Error no.	Measures	Notes
Process error	60-69	• Let the rotor coast down. • Switch the centrifuge off and back on.	60 "Power failure during the centrifugation run"; 61 "Stop after mains power ON"
Communication error	70-79	• Let the rotor coast down. • Switch the centrifuge off and back on.	
Parameter error	80-89	• Switch the centrifuge off. • Let the centrifuge cool down. • Air-cooled centrifuges: Ensure better ventilation. • Water-cooled centrifuges: Ensure a sufficient water flow rate.	Error 83 causes only a message.
Other errors	90-99	• Check the connections. • Water-cooled centrifuges: Ensure a sufficient water flow rate.	

Table 7: Table of error messages

8.3 Opening the lid manually (emergency lid release)

WARNING

Risk of injury due to a spinning rotor

If the emergency lid release is activated during a centrifugation run, the centrifuge will be switched off and then the rotor freely coasts to a standstill. There is a risk of injury due to the spinning rotor when reaching into the rotor chamber.

- Do not activate the emergency lid release until the rotor has come to a standstill.

In the event of a power supply failure, the centrifuge lid can be opened manually in order to withdraw the samples.

1. Switch the centrifuge off by way of the mains power switch and unplug the mains power plug.
2. Look through the window in the lid to verify that the rotor has come to a complete standstill.
3. Prise the plug out of the side panel (see the following illustration, item 1), e.g. by way of a screwdriver.

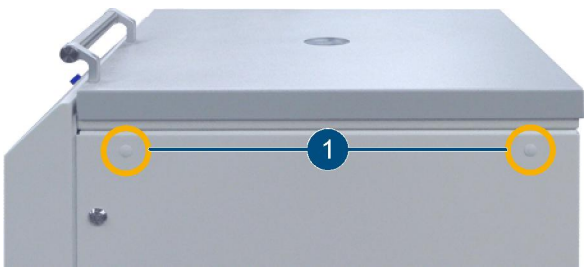


Fig. 43: Position of the opening for the emergency lid release

1 Plug

4. Push the supplied socket spanner (part no. 930 110) horizontally into the opening. The spanner will be guided through a funnel to the shaft of the lid lock motor.



Fig. 44: The emergency lid release spanner must be inserted horizontally

5. To unlock the motorised lid locks:
   – Unlock the left lid lock by turning anticlockwise.
   – Unlock the right lid lock by turning clockwise.
6. Remove the hexagon key and seal the opening with the plug.

8.4 Service contact

In Germany

Sigma Laborzentrifugen GmbH
An der Unteren Söse 50
37520 Osterode (Germany)
Telephone: +49 (0) 55 22 / 50 07-44 44
E-mail: support@sigma-zentrifugen.de

Outside of Germany

The contact data of our international sales and service partners can be found at www.sigma-zentrifugen.de/en.html → [Sales Partners]

Scan QR code
If you have any questions about this topic, kindly contact our service department:

8.5 Returning the centrifuge to the manufacturer

Complete and comprehensive information concerning the matter is required in order to ensure that all returns of centrifuges, rotors, buckets, adapters, carriers, accessories or spare parts are processed quickly and efficiently.

The necessary forms can be downloaded at www.sigma-zentrifugen.de/en.html →[Service] → [Overhaul and repair].

Completion of the declaration of decontamination

Due to the legal regulations for the protection of our employees and the environment, the manufacturer is obliged to document the harmlessness of all incoming goods.

- The form must be filled in completely as well as signed by authorised and specialised personnel.
- Affix the original document in a clearly visible manner to the outside of the packaging.

We will return the part/unit at your expense if no declaration of decontamination is provided.

Completion of the return declaration

Product-specific data are required to ensure that the return can be processed without delay.

- Enclose the completed return declaration, including a detailed error description, with the defective part/unit.
- Fill in a separate form for every defective part even if several parts are returned in one package.

We will return the part/unit at your expense if no error description is provided.

Cost estimate

Upon request, a cost estimate will be prepared prior to performing the repair.

If the cost estimate has still not been confirmed after 4 weeks, the part/unit will be returned at the customer’s expense.

Pick-up order

Upon request, we will commission a forwarding agent to collect the unit

- Complete the pick-up order and send it to support@sigma-zentrifugen.de

Returning a product

- Package the part/unit safely for transport, and in its original packaging, if possible. The original packaging can be supplied by the manufacturer for a fee.
- Return the product with the completed forms to
  Sigma Laborzentrifugen GmbH
  Service laboratory centrifuges
  An der Unteren Söse 50
  37520 Osterode
  Germany

If the part/unit is sent to the manufacturer in unsuitable packaging, it will be repackaged for return at your expense.

9 Disposal

9.1 Safety

Disposal regulations vary among the member states of the European Union.

- Comply with the national rules and regulations.

9.2 Disposal of the centrifuge



In accordance with the directive 2012/19/EU about waste electrical and electronic equipment (WEEE), Sigma centrifuges are marked with a symbol showing a crossed-out waste bin. It means:

- that the centrifuge was delivered after 13 August 2005.
- that the centrifuge must not be disposed of via the municipal waste system.

Products whose disposal is subject to the WEEE directive must be properly decontaminated and disposed of via a return scheme that ensures their proper collection, treatment, reuse or recycling.

Sigma Laborzentrifugen GmbH will take back appropriately labelled discarded units free of charge and ensure their proper disposal.

- Prior to returning the discarded unit, the operator must ensure that the unit has been decontaminated. A duly completed decontamination declaration must be enclosed (see chapter 8.5 - "Returning the centrifuge to the manufacturer").

9.3 Disposal of the packaging material

- Use the packaging for returning the centrifuge to the manufacturer.

Or:

- Dispose of the packaging separately by material type.

10 Technical data

Product data		
Manufacturer	Sigma Laborzentrifugen GmbH An der Unteren Söse 50 37520 Osterode (Germany)	
Product designation	Laboratory centrifuge	
Product name	Sigma 8KS	Sigma 8KS Clinic
Part numbers: – 3 x 400 V, 60 Hz – 3 x 400 V, 50 Hz – 3 x 220 V, 60 Hz – 3 x 400 V, 50 Hz, water cooling – 3 x 400 V, 50 Hz, water cooling, GMP – 3 x 400 V, 50 Hz, inert gas – 3 x 400 V, 50 Hz, special lid – 3 x 400 V, 50 Hz, water cooling, GMP, inert gas – 3 x 480 V, 60 Hz, inert gas	 10630 10631 10632 10633 91300 91301 91367 91583 190010	 91594

Table 8: Product data

Connection data		
Power supply	See the name plate	
Protection class	I	
IP code	20	
Power consumption (W) – at 3 x 400 V, 60 Hz: – at 3 x 400 V, 50 Hz: – at 3 x 220 V, 60 Hz: – at 3 x 480 V, 60 Hz:	Sigma 8KS 6,500 6,500 6,500 6,500	Sigma 8KS Clinic 6,500
Input fuse (AT) – at 3 x 400 V, 60 Hz: – at 3 x 400 V, 50 Hz: – at 3 x 220 V, 60 Hz: – at 3 x 480 V, 60 Hz:	Sigma 8KS 16.0 16.0 35.0 16.0	Sigma 8KS Clinic 16.0

Table 9: Connection data

Connection data of the water cooling system	
Water connector (inch)	2 x ¾
Inlet pressure (bar)	1.5 to 5.0
Min. flow rate (l/min) at max. power	5
Max. temperature at the water inlet (°C)	+20

Table 10: Connection data of the water cooling system

Performance parameters		
Speed	Sigma 8KS	Sigma 8KS Clinic
– Set speed (min^{-1})	100 ... 10 500	100 ... 4 100
– Display range (min^{-1})	0 ... 99 999	0 ... 99 999
– Resolution (min^{-1})	1	1
– Measuring accuracy (min^{-1}) at max. set speed	30	30
Max. capacity (ml)	12 000	9 000
Max. RCF (x g)	20 954	5 544
Max. kinetic energy (Nm)	280 080	280 080

Table 11: Performance parameters

Other parameters	
Time	
– Set time (m:s) or (h:m)	10 s ... 99 h 59 min, Short run, continuous run
– Display range (m:s) or (h:m)	00:00 ... 99:59
– Resolution (s)	1
– Measuring accuracy (‰)	1
Temperature	
– Display range (°C)	-20 ... +40
– Resolution (°C)	1
– Measuring accuracy (K)	1
Program storage locations	99

Table 12: Other parameters

Physical data	
Height (mm)	990
Height with open lid (mm)	1 690
Width (mm)	820
Depth (mm)	949
Weight without rotor (kg)	450

Table 13: Physical data

Sound pressure level	
Noise level (dB(A)) at maximum speed	73

Table 14: Sound pressure level

Operating fluids and quantities	
Refrigerant	R452A
Global warming potential (GWP)	2 140
Quantity (kg)	2.280
Max. permissible pressure (bar)	28
CO2 equivalent (t)	4.879

Table 15: Operating fluids and quantities

10.1 Ambient conditions

The information applies to an ambient temperature of +23°C and the rated voltage ±10%.

The minimum temperatures are ≤ +4°C and they depend on the rotor type, speed and ambient temperature.

Ambient conditions	
Use	Indoor
Altitude above sea level (m)	≤ 2 000
Pollution degree	2
Ambient temperature (°C)	+5 … 35
Humidity (%)	80 at +5°C to 31°C, linearly decreasing to 67 at +35°C

Table 16: Ambient conditions

11 Appendix

11.1 Rotor program

Sigma 8KS

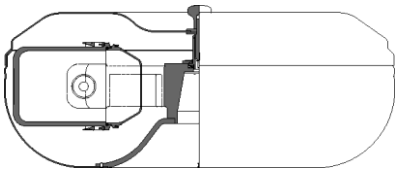
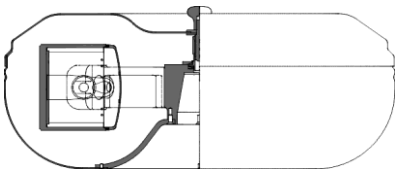
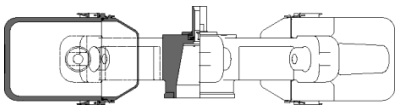
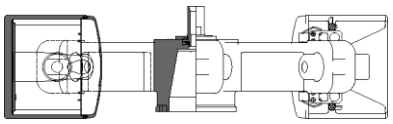
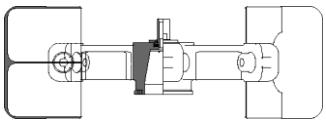
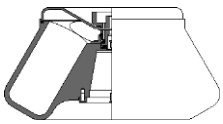
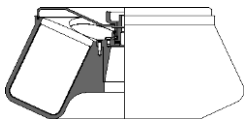
Product	Description	Ref. no.	Max. speed (min^{-1})	Max. RCF (x g)	Max. capacity
	Swing-out rotor for round buckets	11805 / 13850	5,000	8,578	6 x 1,500 ml
	Swing-out rotor for rectangular buckets	11805 / 13845	5,100	7,328	48 microwell plates or 144 x 15 ml
	Swing-out rotor for round buckets	11806 / 13850	3,700	4,515	6 x 1,500 ml
	Swing-out rotor for rectangular buckets	11806 / 13845	3,700	3,857	48 microwell plates or 144 x 15 ml
	Swing-out rotor for double buckets	11806 / 13855	3,300	3,579	12 x 1,000 ml
	Angle rotor	12505	10,500	20,461	6 x 500 ml
	Angle rotor	12510	7,000	11,285	6 x 1,000 ml

Table 17: Table of the available rotors for Sigma 8KS

Sigma 8KS Clinic

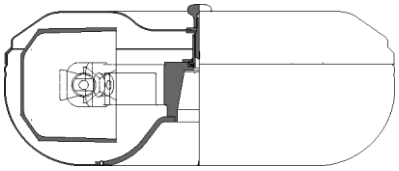
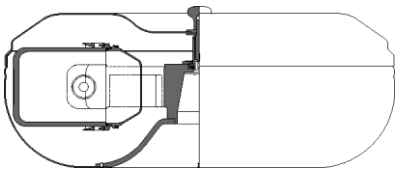
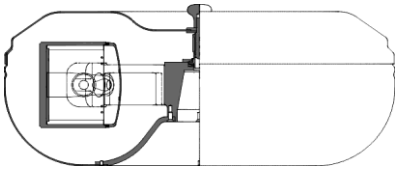
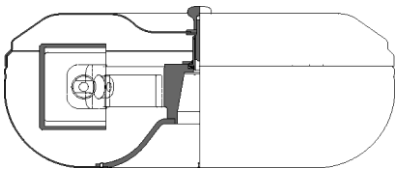
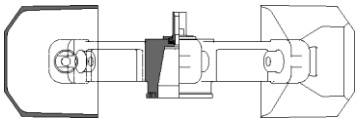
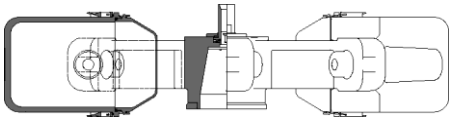
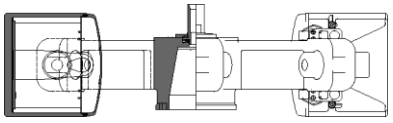
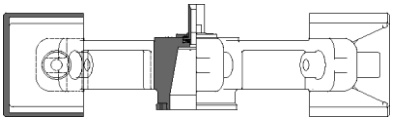
Product	Description	Ref. no.	Max. speed (min^{-1})	Max. RCF (x g)	Max. capacity
	Swing-out rotor for blood bag buckets	11805 / 13860	4,100	5,394	12 blood bag systems
	Swing-out rotor for round buckets	11805 / 13850	4,100	5,544	6 x 1,500 ml
	Swing-out rotor for rectangular buckets	11805 / 13845	4,100	4,736	48 microwell plates or 144 x 15 ml
	Swing-out rotor for carriers	11805 / 13890	4,100	4,755	6 rectangular carriers
	Swing-out rotor for blood bag buckets	11806 / 13860	4,100	4,393	12 blood bag systems
	Swing-out rotor for round buckets	11806 / 13850	4,100	4,515	6 x 1,500 ml
	Swing-out rotor for rectangular buckets	11806 / 13845	4,100	3,857	48 microwell plates or 144 x 15 ml
	Swing-out rotor for carriers	11806 / 13890	3,700	3,872	6 rectangular carriers

Table 18: Table of the available rotors for Sigma 8KS Clinic

11.2 Speed, radius and relative centrifugal force (RCF)

The acceleration g that the samples are subjected to can be increased by expanding the radius in the rotor chamber and by increasing the rotational speed. The three parameters are interdependent and linked with one another by the following formula:

Relative centrifugal force (RCF) = 11.18 x 10^{-6} x r x n^2

r = radius in cm

n = speed in min^{-1}

RCF is dimensionless

When two values are entered, the third is defined by the specified formula. If the speed or radius is changed thereafter, the resulting relative centrifugal force will be automatically recalculated by the centrifuge control system. If the RCF value is changed, the speed will be adapted accordingly using the specified radius.

11.3 Density

The laboratory centrifuge is suitable for the separation of substances of different densities in mixtures with a maximum density of 1.2 g/cm^3. All the information on the speed of rotors, buckets and accessories refers to liquids with a density corresponding to this specification. If the density of the liquid is higher than this value, the maximum permissible speed of the centrifuge must be reduced by way of the following formula:

$n = n_{max} \times \sqrt{(1{,}2/\rho)}$

ρ = density in g/cm^3

11.4 Table indicating the service life of rotors and buckets

- If no other information is provided, the rotor and buckets must be removed from service after 10 years. Any use after this period may be permissible in individual cases after an inspection is performed by the manufacturer. For safety reasons, rotors must be scrapped after 50.000 cycles.
- If a specification concerning the maximum number of cycles and a specification concerning the service life (i.e. a specific date) are provided, the specification that occurs first shall apply.

Rotor/bucket	Cycles	Service life ("Exp.Date")	suitable for centrifuge	Notes
12082		7 years	1-14, 1-14K	
12084		7 years	1-14, 1-14K	
12092		5 years	1-14, 1-14K	
12094		5 years	1-14, 1-14K	
12096		5 years	1-14, 1-14K	
12097		5 years	1-14, 1-14K	
12134		5 years	1-16, 1-16K	
12135		5 years	1-16, 1-16K	
12137		5 years	1-16, 1-16K	
91429		7 years	1-7	
13035			2-7	Do not grease the load-bearing bolts of the rotors
13296	35,000	5 years	2-7, 2-16KL, 2-16KHL	Do not grease the load-bearing bolts of the rotors
13299		5 years	2-7, 2-7 Cyto, 2-16KL, 2-16KHL, 3-30KS, 3-30KHS	Do not grease the load-bearing bolts of the rotors
13221	10,000		4-16S, 4-16KS, 4-16KHS, 6-16S, 6-16HS, 6-16KS, 6-16KHS	
9100	35,000		4-5KL, 4-16S, 4-16KS, 4-16KHS, 6-16S, 6-16HS, 6-16KS, 6-16KHS	
9366	15,000		4-5KL, 4-16S, 4-16KS, 4-16KHS, 6-16S, 6-16HS, 6-16KS, 6-16KHS	
13218	20,000		4-5KL, 4-16S, 4-16KS, 4-16KHS, 6-16S, 6-16HS, 6-16KS, 6-16KHS	
12600		7 years	6-16S, 6-16HS, 6-16KS, 6-16KHS	
13625	20,000		6-16S, 6-16HS, 6-16KS, 6-16KHS	
13635	25,000		6-16S, 6-16HS, 6-16KS, 6-16KHS	
13650	20,000		6-16S, 6-16HS, 6-16KS, 6-16KHS	

Rotor/bucket	Cycles	Service life ("Exp.Date")	suitable for centrifuge	Notes
13860	15,000	10 years	8KBS	
12505	30,000		8KS	
13845	20,000		8KS	
13850	10,000	10 years	8KS	
13890	25,000		8KS Clinic	
11805	15,000	10 years	8KS, 8KBS	
11806		10 years	8KS, 8KBS	

Table 19: Table indicating the service life of rotors and buckets

11.5 Acceleration and deceleration curves

The curves are numbered in relation to increasing acceleration (from right to left).

With curve 9, the centrifuge accelerates with maximum power. The time required to reach the set speed solely depends on the inertia of the rotor.

The deceleration curves are inverted images of the acceleration curves and are labelled with identical numbers. Curve 0 is an exception. It ensures a free coast-down.

Linear curves

Curve	Type	Gradient
0	Linear	4 [min^{-1}/s]
1	Linear	6 [min^{-1}/s]
2	Linear	8 [min^{-1}/s]
3	Linear	17 [min^{-1}/s]
4	Linear	25 [min^{-1}/s]
5	Linear	33 [min^{-1}/s]
6	Linear	50 [min^{-1}/s]
7	Linear	100 [min^{-1}/s]
8	Linear	200 [min^{-1}/s]
9	Linear	1,000 [min^{-1}/s]

Table 20: Table of the gradient of linear acceleration curves

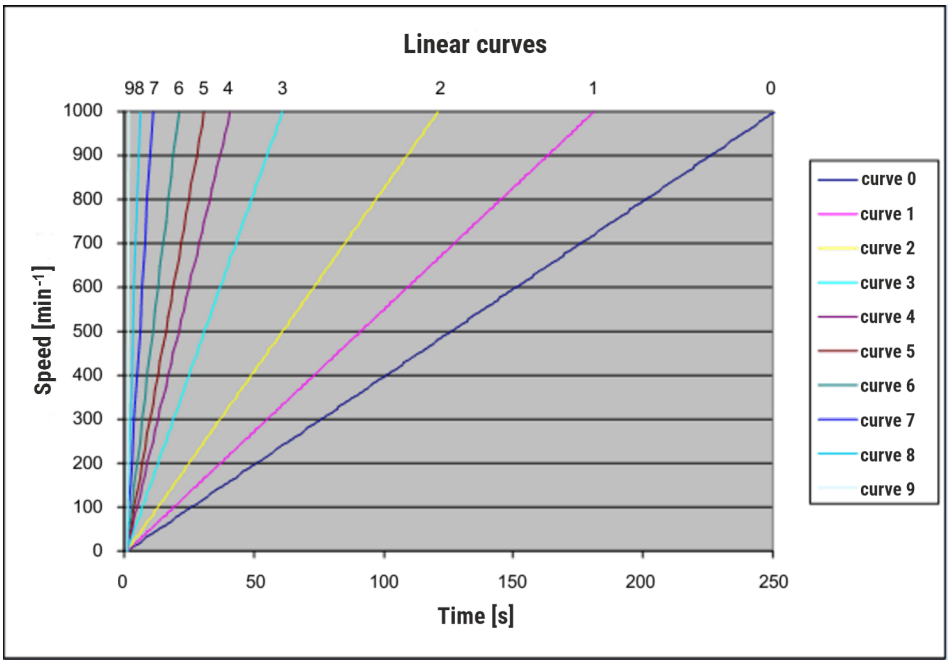


Fig. 45: Diagram of linear acceleration curves

Quadratic curves

Curve	Type	Time to 1,000 min^{-1}	Slope from 1,000 min^{-1}
10	Quadratic	500 [s]	4 [min^{-1}/s]
11	Quadratic	333 [s]	6 [min^{-1}/s]
12	Quadratic	250 [s]	8 [min^{-1}/s]
13	Quadratic	118 [s]	17 [min^{-1}/s]
14	Quadratic	80 [s]	25 [min^{-1}/s]
15	Quadratic	60 [s]	33 [min^{-1}/s]
16	Quadratic	40 [s]	50 [min^{-1}/s]
17	Quadratic	20 [s]	100 [min^{-1}/s]
18	Quadratic	10 [s]	200 [rpmmin^{-1}/s]
19	Quadratic	2 [s]	1,000 [min^{-1}/s]

Table 21: Table of the gradient of quadratic acceleration curves

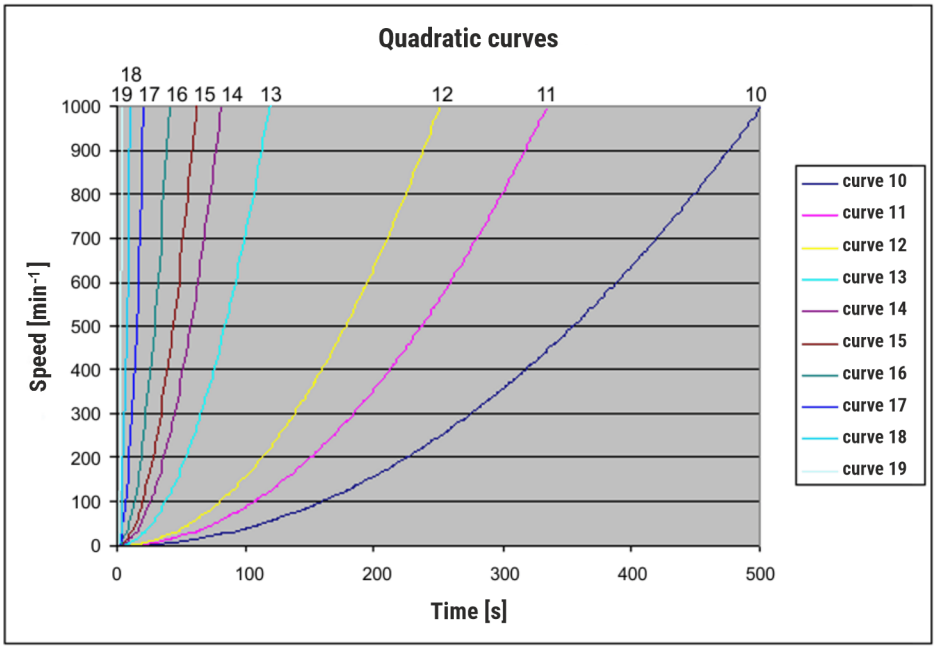


Fig. 46: Diagram of quadratic acceleration curves

11.6 Table of chemical resistance data

The information refers to the resistance at 20°C.

The information in the following tables applies to accessories with an anodised coating.

– no data 1 resistant 2 practically resistant 3 partially resistant 4 not resistant		Concentration	High-density polyethylene	Polyamide	Polycarbonate	Polyoxymethylene	Polypropylene	Polysulfone	Polyvinyl chloride, hard	Polyvinyl chloride, soft	Polytetrafluorethylene	Acrylonitrile butadiene caoutchouc	Aluminium
Medium	**Formula**	**[%]**	**HDPE**	**PA**	**PC**	**POM**	**PP**	**PSU**	**PVC**	**PVC**	**PTFE**	**NBR**	**AL**
Acetaldehyde	C_2H_4O	40	3	2	4	2	3	4	4	-	1	4	1
Acetamide	C_2H_5NO	saturated	1	1	4	1	1	4	4	-	1	-	1
Acetic acid	$C_2H_4O_2$	10	1	4	1	1	1	1	1	1	1	2	1
Acetic acid	$C_2H_4O_2$	90	1	4	4	4	1	3	1	4	1	-	1
Acetone	C_3H_6O	100	1	1	4	1	1	4	4	-	1	4	1
Acrylonitrile	C_3H_3N	100	1	1	4	3	3	4	4	4	1	4	1
Allyl alcohol	C_3H_6O	96	1	3	3	2	2	2	2	4	1	1	1
Aluminium chloride	$AlCl_3$	saturated	1	3	2	4	1	-	1	-	1	1	4
Aluminium sulphate	$Al_2(SO_4)_3$	10	1	1	1	3	1	1	1	1	1	1	1
Ammonium chloride	$(NH_4)Cl$	aqueous	1	1	1	2	1	1	1	1	1	1	3
Ammonium hydroxide	NH_3+H_2O	30	1	3	4	1	1	2	1	-	1	-	1
Aniline	C_6H_7N	100	1	3	4	1	2	4	4	4	1	4	1
Antimony trichloride	$SbCl_3$	90	1	4	1	4	1	-	1	-	1	-	4
Benzaldehyde	C_7H_6O	100	1	3	4	1	1	3	4	4	1	4	1
Benzene	C_6H_6	100	3	2	4	1	3	4	4	-	1	4	1
Boric acid	H_3BO_3	aqueous	1	3	1	2	1	-	-	-	1	1	1
Butyl acrylate	$C_7H_{12}O_2$	100	1	2	4	2	3	4	4	4	1	-	1
Butyl alcohol	$C_4H_{10}O$	100	1	1	2	1	1	2	2	4	1	1	1
Calcium chloride	$CaCl_2$	alcoholic	1	4	2	3	1	-	-	4	1	1	3
Carbon disulfide	CS_2	100	4	3	4	2	4	4	4	4	1	3	1

– no data 1 resistant 2 practically resistant 3 partially resistant 4 not resistant		Concentration	High-density polyethylene	Polyamide	Polycarbonate	Polyoxymethylene	Polypropylene	Polysulfone	Polyvinyl chloride, hard	Polyvinyl chloride, soft	Polytetrafluorethylene	Acrylonitrile butadiene caoutchouc	Aluminium
Medium	**Formula**	**[%]**	**HDPE**	**PA**	**PC**	**POM**	**PP**	**PSU**	**PVC**	**PVC**	**PTFE**	**NBR**	**AL**
Carbon tetrachloride (TETRA)	CCl_4	100	4	4	4	2	4	4	4	4	1	3	1
Chlorine	Cl_2	100	4	4	4	4	4	4	4	4	1	-	3
Chlorine water	$Cl_2 \times H_2O$		3	4	4	4	3	-	3	3	1	-	4
Chlorobenzene	C_6H_5Cl	100	3	4	4	1	3	4	4	4	1	4	1
Chloroform	$CHCl_3$	100	3	3	4	4	3	4	4	4	1	4	3
Chromic acid	CrO_3	10	1	4	2	4	1	4	1	-	1	4	1
Chromic potassium sulphate	$KCr(SO_4)_2 \times 12\ H_2O$	saturated	1	2	1	3	1	-	1	-	1	-	3
Citric acid	$C_6H_8O_7$	10	1	1	1	2	1	1	1	1	1	1	1
Citric acid	$C_6H_8O_7$	50	1	3	1	2	1	-	-	-	1	1	1
Copper sulphate	$CuSO_4 \times 5H_2O$	10	1	1	1	1	1	1	1	1	1	1	4
Cyclohexanol	$C_6H_{12}O$	100	1	1	3	1	1	1	1	4	1	2	1
Decane	$C_{10}H_{22}$	100	-	1	2	1	3	-	-	-	1	2	1
Diaminoethane	$C_2H_8N_2$	100	1	1	3	1	1	-	3	4	1	1	1
Diesel fuel	–	100	1	1	3	1	1	-	1	3	1	1	1
Dimethyl formamide (DMF)	C_3D_7NO	100	1	1	4	1	1	4	3	-	1	3	1
Dimethyl sulfoxide (DMSO)	C_2H_6SO	100	1	2	4	1	1	4	4	-	1	-	1
Dimethylaniline	$C_8H_{11}N$	100	-	3	4	2	4	-	-	-	1	-	1
Dioxane	$C_4H_8O_2$	100	2	1	4	1	3	2	3	4	1	3	1
Dipropylene glycol monomethyl ether	$C_4H_{10}O$	100	3	1	4	1	4	4	4	4	1	-	1
Ethanol	C_2H_6O	96	1	1	1	1	1	1	1	3	1	-	1
Ethyl acetate	$C_4H_8O_2$	100	1	1	4	1	1	4	4	4	1	4	1

– no data 1 resistant 2 practically resistant 3 partially resistant 4 not resistant		Concentration	High-density polyethylene	Polyamide	Polycarbonate	Polyoxymethylene	Polypropylene	Polysulfone	Polyvinyl chloride, hard	Polyvinyl chloride, soft	Polytetrafluorethylene	Acrylonitrile butadiene caoutchouc	Aluminium
Medium	**Formula**	**[%]**	**HDPE**	**PA**	**PC**	**POM**	**PP**	**PSU**	**PVC**	**PVC**	**PTFE**	**NBR**	**AL**
Ethylene chloride	$C_2H_4Cl_2$	100	3	3	4	1	3	4	4	4	1	-	1
Ferrous chloride	$FeCl_2$	saturated	1	3	1	3	1	1	1	1	1	-	4
Formaldehyde solution	CH_2O	30	1	3	1	1	1	-	-	-	1	2	1
Formic acid	CH_2O_2	100	1	4	3	4	1	3	3	1	1	2	1
Furfural	$C_5H_4O_2$	100	1	3	3	2	4	-	-	-	1	4	1
Gasoline	C_5H_{12} - $C_{12}H_{26}$	100	2	1	3	1	3	3	2	-	1	1	1
Glycerol	$C_3H_8O_3$	100	1	1	3	1	1	1	1	2	1	1	1
Heptane, n-	C_7H_{16}	100	2	1	1	1	2	1	2	4	1	1	1
Hexane, n-	C_6H_{14}	100	2	1	2	1	2	1	2	4	1	1	1
Hydrochloric acid	HCl	5	1	4	1	4	1	1	1	-	1	2	4
Hydrochloric acid	HCl	concentrated	1	4	4	4	1	1	2	3	1	4	4
Hydrogen peroxide	H_2O_2	3	1	3	1	1	1	1	1	-	1	3	3
Hydrogen peroxide	H_2O_2	30	1	4	1	4	1	1	1	-	1	3	3
Hydrogen sulphide	H_2S	10	1	1	1	1	1	1	1	3	1	3	1
Iodine, tincture of	I_2		1	4	3	1	1	-	4	4	1	1	1
Isopropyl alcohol	C_3H_8O	100	1	1	1	1	1	1	1	4	1	-	2
Lactic acid	$C_3H_6O_3$	3	1	3	1	2	1	1	2	-	1	1	1
Magnesium chloride	$MgCl_2$	10	1	1	1	1	1	1	1	1	1	1	1
Mercuric chloride	$HgCl_2$	10	1	4	1	3	1	1	1	1	1	1	4
Mercury	Hg	100	1	1	1	1	1	1	1	3	1	1	3
Methanol	CH_4O	100	1	2	4	1	1	3	1	3	1	2	1
Methyl acetate	$C_3H_6O_2$	100	1	1	4	2	1	-	4	4	1	-	1
Methyl benzene	C_7H_8O	100	3	4	4	1	4	4	2	-	1	4	1

– no data 1 resistant 2 practically resistant 3 partially resistant 4 not resistant		Concentration	High-density polyethylene	Polyamide	Polycarbonate	Polyoxymethylene	Polypropylene	Polysulfone	Polyvinyl chloride, hard	Polyvinyl chloride, soft	Polytetrafluorethylene	Acrylonitrile butadiene caoutchouc	Aluminium
Medium	**Formula**	**[%]**	**HDPE**	**PA**	**PC**	**POM**	**PP**	**PSU**	**PVC**	**PVC**	**PTFE**	**NBR**	**AL**
Methyl ethyl ketone (MEK)	C_4H_8O	100	1	1	4	1	1	4	4	4	1	4	1
Methylene chloride	CH_2Cl_2	100	4	3	4	3	3	4	4	4	1	-	1
Mineral oil	–	100	1	1	1	1	1	1	1	-	1	1	1
Nitric acid	HNO_3	10	1	4	1	4	1	1	1	-	1	4	3
Nitric acid	HNO_3	100	4	4	4	4	4	-	4	-	1	4	1
Nitrobenzene	$C_6H_5NO_2$	100	3	4	4	3	2	4	4	4	1	4	1
Oleic acid	$C_{18}H_{34}O_2$	100	1	1	1	2	1	-	1	-	1	3	1
Oxalic acid	$C_2H_2O_4$ x $2H_2O$	100	1	3	1	4	1	1	1	1	1	2	1
Ozone	O_3	100	3	4	1	4	3	1	1	-	1	4	2
Petroleum	–	100	1	1	3	1	1	1	1	3	1	1	1
Phenol	C_6H_6O	10	1	4	4	4	1	4	1	3	1	3	1
Phenol	C_6H_6O	100	2	4	4	4	1	3	4	3	1	3	1
Phosphoric acid	H_3PO_4	20	1	4	2	4	1	-	-	-	1	2	4
Phosphorus pentachloride	PCl_5	100	-	4	4	4	1	-	4	4	1	-	1
Potassium hydrogen carbonate	$CHKO_3$	saturated	1	1	2	1	1	-	-	-	1	-	4
Potassium hydroxide	KOH	30	1	1	4	3	1	1	1	1	1	-	4
Potassium hydroxide	KOH	50	1	1	4	3	1	1	1	1	1	-	4
Potassium nitrate	KNO_3	10	1	1	1	1	1		-	-	1	1	1
Potassium permanganate	$KMnO_4$	100	1	4	1	1	1	-	1	-	1	3	1
Pyridine	C_5H_5N	100	1	1	4	1	3	4	4	4	1	4	1
Resorcinol	$C_6H_6O_2$	5	1	4	2	3	1	4	2	-	1	-	2
Silver nitrate	$AgNO_3$	100	1	1	1	1	1	1	1	1	1	2	4

– no data 1 resistant 2 practically resistant 3 partially resistant 4 not resistant		Concentration	High-density polyethylene	Polyamide	Polycarbonate	Polyoxymethylene	Polypropylene	Polysulfone	Polyvinyl chloride, hard	Polyvinyl chloride, soft	Polytetrafluorethylene	Acrylonitrile butadiene caoutchouc	Aluminium
Medium	**Formula**	**[%]**	**HDPE**	**PA**	**PC**	**POM**	**PP**	**PSU**	**PVC**	**PVC**	**PTFE**	**NBR**	**AL**
Sodium bisulphite	$NaHSO_3$	10	1	1	2	4	1	-	-	-	1	1	1
Sodium carbonate	Na_2CO_3	10	1	1	1	1	1	-	-	-	1	-	3
Sodium chloride	NaCl	30	1	1	1	1	1	1	1	1	1	1	3
Sodium hydroxide	NaOH	30	1	1	4	1	1	1	1	1	1	2	4
Sodium hydroxide	NaOH	50	1	1	4	1	1	1	1	-	1	2	4
Sodium sulphate	Na_2SO_4	10	1	1	1	1	1	1	1	1	1	1	1
Styrene	C_8H_8	100	4	1	4	1	3	-	4	4	1	4	1
Sulphuric acid	H_2SO_4	6	1	4	1	4	1	1	1	-	1	2	3
Sulphuric acid	H_2SO_4	fuming	4	4	4	4	4	4	4	4	1	4	3
Tallow	–	100	1	1	1	1	1	1	1	1	1	1	1
Tetrahydrofuran (THF)	C_4H_8O	100	3	1	4	1	3	4	4	4	1	3	1
Tetrahydronaphthalene	$C_{10}H_{12}$	100	3	1	4	1	4	4	4	4	1	-	1
Thionyl chloride	Cl_2SO	100	4	4	4	2	4	4	4	4	1	-	3
Tin chloride	$SnCl_2$	10	1	4	2	2	1	-	-	-	1	1	4
Toluene	C_7H_8	100	3	1	4	1	3	4	4	4	1	4	1
Transformer oil	–	100	1	1	3	3	1	1	1	-	1	1	1
Trichloroethane	$C_2H_3Cl_3$	100	3	3	4	2	4	4	4	4	1	4	4
Urea	CH_4N_2O	10	1	1	1	1	1	-	-	-	1	1	1
Urine	–	100	1	1	1	1	1	-	1	1	1	-	2
Wax	–	100	-	1	1	-	1	-	-	-	1	-	1
Wines	–	100	1	1	1	2	1	1	1	1	1	-	4
Xylene	C_8H_{10}	100	3	1	4	1	4	4	4	4	1	4	1

Table 22: Table of chemical resistance data

11.7 Declarations of conformity

EC Declaration of Conformity

in accordance with the EC Machinery Directive 2006/42/EC, annex II, part 1, section A

Product designation	Laboratory centrifuge
Product name	Sigma 8KS, Sigma 8KS Clinic
Order number	10630, 10631, 10632, 10633, 91300, 91301, 91367, 91583, 31594, 190010
Manufacturer	Sigma Laborzentrifugen GmbH An der Unteren Söse 50 37520 Osterode Germany
Authorised representative for CE matters	Alexander Hörsting

The product named hereinabove was developed, designed, and manufactured in compliance with the relevant, fundamental safety and health requirements of the listed EC regulations, directives and norms.

In the event of modifications that were not authorised by the manufacturer or if the product is used in a manner that is not in line with the intended purpose, this declaration will be rendered void.

Regulations	Implementation Regulation for Regulation (EU) 2024/573 (F-gases Regulation)	(EU) 2024/2729
Directives	Machinery Directive	2006/42/EC
	Low Voltage Directive	2014/35/EU
	EMC Directive	2014/30/EU
	RoHS Directive	2011/65/EU
	Delegated RoHS Directive	(EU) 2015/863
Norms		EN 61010-2-020:2017 EN IEC 61010-2-011:2021 EN IEC 61326-1:2021

Osterode, 2025-11-04

Michael Sander

Dr. Michael Sander, Managing Director

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