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Centrifuge

Centrifuge 5811 R

Original Operating Instructions

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1 About this manual

1.1 Version overview

Version	Change	Content approved
00	• Document created	2026-05-18

1.2 Notes on this manual

 The current version of this manual can be found on the website www.eppendorf.com/manuals. To obtain a different version of the manual, contact Eppendorf SE.

1. Read this manual completely before using the product.
2. Ensure that you have the manual available while using the product.

The dates in this manual correspond to the international date format as specified in the ISO 8601 standard. All dates are shown in the format YYYY-MM-DD or YYYY-MM.

This manual uses units of measurement and unit symbols in accordance with the International System of Units (SI) (see ISO 80000) and its derived and legally permissible units. For example, times are specified in hours [h], minutes [min], and seconds [s].

1.3 Warning notice structure



HAZARD LEVEL! Type of danger

- Source of danger
- Consequences of disregarding the danger
- Measures to avoid the danger

Symbol	Hazard level	Type of danger	Meaning
	DANGER	Personal injury	Will lead to severe injuries or death.
	WARNING	Personal injury	May lead to severe injuries or death.
	CAUTION	Personal injury	May lead to minor or moderate injuries.
	NOTICE	Material damage	May lead to material damage.

1.4 Graphics

Depiction	Meaning
1.	Work steps
2.	
•	Bullet point
<i>Text</i>	Display text
Key	Name for port, button, status lamp, or key
	Important information
	Tip

1.5 Other applicable documents

The following documents supplement this manual:

- Instructions for use of the rotors
- Instructions for use for aerosol-tight centrifugation
- VisioNize box operating manual

1.6 Certificates

Declarations of conformity, certificates, Safety Data Sheets etc. on the product can be found on the respective product page at www.eppendorf.com.

2 Safety

2.1 Intended use

The centrifuge is used for separating aqueous solutions and suspensions of different densities in approved sample tubes.

The centrifuge is intended for indoor use only. All country-specific safety requirements for operating electrical equipment in laboratories must be observed.

2.2 Residual risks when used as intended

If the product is not used as intended, the installed safety devices may not function correctly. To reduce the risk of personal injury and material damage and to avoid dangerous situations, please observe the general safety instructions.

2.2.1 Personal injury

2.2.1.1 Biological hazards

Pathogenic biological agents can harm your health and the environment.

- Observe the national regulations and the biosafety level of your laboratory.
- Wear suitable personal protective equipment.
- Observe the Safety Data Sheets and instructions for use for the accessories.
- For instructions regarding the handling of germs and biological material in risk group II or above, please refer to the "Laboratory Biosafety Manual" (source: World Health Organization, Laboratory Biosafety Manual, check the most current edition).

2.2.1.2 Explosion hazards

The use of explosive substances or substances with violent reactions may cause explosions to occur. Do not operate the device under the following conditions:

- In an explosive atmosphere
- In areas where work with explosive substances is carried out
- With explosive substances or substances with violent reactions
- With substances that may create an explosive atmosphere when reacting with other substances

The R290 refrigerant used in the device is flammable. If the refrigeration cycle is defective, the refrigerant may escape and form explosive mixtures with the ambient air.

- Observe the regulations that apply to your laboratory.
- Make sure there is a sufficient volume of air at the location.
- Ensure adequate ventilation of the device at the location.

2.2.1.3 Electrical hazards

Touching parts that carry high voltage can cause an electric shock. A life-threatening electric shock can cause cardiac arrhythmia, burns and respiratory paralysis.

- Only use earth/grounded sockets with a protective earth (PE) conductor.
- Ensure that a residual current circuit breaker is present and accessible.
- Ensure that the housing and mains/power cord are not damaged.
- In case of danger, disconnect the device from the mains/power line.
- Do not open or remove the housing.
- Compare the technical data of the mains/power cord and the mains/power plug with the technical data on the name plate, taking into account national laws and regulations. This also includes legally required test seals. Use only approved mains/power cords with plugs.
- Make sure that the mains/power plug and earth/grounded socket match and that the electrical PE conductors of the device and the building installation are securely connected to each other.
- Only clean and maintain the device when it is disconnected from the mains/power line.
- Have the device regularly checked for electrical safety in accordance with national requirements.

If liquids get inside the device, users may suffer an electric shock. A potentially fatal electric shock causes arrhythmia and respiratory paralysis or severe burns.

- Switch off the device and disconnect it from the mains before starting any cleaning or disinfection work.
- Do not connect the device to the mains/power line unless both the inside and outside of the device are completely dry.

2.2.1.4 Mechanical hazards

Defective gas springs on the centrifuge lid may cause the lid to slam shut. There is a risk of hand injury.

- Ensure the gas springs on the centrifuge lid are functioning correctly.
- Any defective gas springs must be replaced immediately.
- Have the gas springs replaced every two years by a service technician.

If you handle rotors incorrectly, the rotors may fall down and injure people.

- Hold rotors with both hands.
- Hold swing-bucket rotors at the rotor cross.

2.2.2 Material damage

2.2.2.1 Chemical hazards

Aggressive chemicals as well as aggressive cleaning agents and disinfectants can damage the material of the device, rotor and accessories. This may cause damage to the interior of the device during operation.

- Protect all components from aggressive chemicals.
- Clean and disinfect all components only with recommended cleaning agents and disinfectants.
- Clean the rotor, device and accessories immediately if they come into contact with aggressive chemicals.
- Check all components for material changes before each use.

- Take a damaged device out of operation.
- Replace a damaged rotor.
- Replace damaged accessories.

The use of organic solvents (e.g. Phenol, Chloroform) reduces the stability of plastic tubes. The tubes may become damaged.

- Please take note of the information provided by the manufacturer regarding the chemical resistance of the tubes.

2.2.2.2 Electrical hazards

Connecting the device to an incorrect mains/power supply will damage the device.

- Only connect the device to a mains/power supply that meets the requirements on the name plate.
- Only use earth/grounded sockets with a protective earth (PE) conductor.
- Compare the technical data of the mains/power cord and the mains/power plug with the technical data on the name plate, taking into account national laws and regulations. This also includes legally required test seals. Use only approved mains/power cords with plugs.
- Make sure that the mains/power plug and earth/grounded socket match and that the electrical PE conductors of the device and the building installation are securely connected to each other.

Condensate may form in the device due to transport of the device from a cool environment to a warmer environment and cause a short-circuit.

- Wait for at least 4 h after setting up the device. Connect the device to the mains/power line after this.

2.2.2.3 Mechanical hazards

If the device is switched on when tilted or directly after tilting, the compressor and refrigeration system may become damaged.

- Leave the device to stand in its normal position for at least 4 h before switching it on.
- Do not place the device upside down.

A damaged rotor or damaged accessories can be destroyed when used in the device.

- Check the rotor and accessories for visible damage and material changes before each use.
- Use only undamaged rotors and accessories.
- Use rotors and accessories only within their service life.

2.2.2.4 Incorrect handling

The use of accessories and spare parts other than those recommended by Eppendorf SE may impair the safety, functioning, and precision of the device. Eppendorf SE cannot be held liable or accept any liability for damage resulting from the use of accessories and spare parts other than those recommended.

- Only use the accessories and spare parts recommended by Eppendorf SE.
- Only use accessories and spare parts that are in perfect technical condition.

Incorrect handling of tubes may cause sample loss.

- Observe the manufacturer's instructions for tubes.
- For centrifugation, only use liquids with a maximum density of 1.2 g/mL.

Incorrect attachment of the rotors may damage the device, rotors and tubes.

- Only use recommended accessories and recommended tubes.
- Load the rotor symmetrically.
- Only load the rotor to its maximum load capacity.
- Insert the rotor properly. Tighten the rotor nut.
- Always grasp the rotor with both hands when moving it.
- Do not move the device during operation.
- Stop centrifugation immediately if there are any unusual noises.

High-energy radiation may lead to damage of the device.

- Do not use UV, beta or gamma rays, or any other high-energy forms of radiation for disinfection.
- Avoid storage in areas with strong UV radiation.

2.2.2.5 Sample loss

Incorrect handling of the buckets, tubes and adapters can lead to tube breakage and sample loss.

- Observe the manufacturer's instructions for tubes.
- Only use accessories appropriate for the tubes in the rotor.
- Use adapters to insert the tubes in the buckets.
- Remove the buckets before removing the rotor.
- Insert the rotor without buckets.

Incorrect handling of tubes may cause sample loss.

- Observe the manufacturer's instructions for tubes.
- For centrifugation, only use liquids with a maximum density of 1.2 g/mL.

If leaky vessels are used, sample loss may occur. Liquid may leak into the rotor chamber.

- Use only undamaged vessels
- Do not use deformed or brittle vessels.
- Only insert sealed vessels into the rotor.
- Clean up any spills immediately.

2.3 Application limits

Due to its design, the product is not suitable for use in a potentially explosive atmosphere.

The product may only be used in a safe environment, such as a ventilated laboratory or under a fume hood. Substances which may potentially contribute to an explosive atmosphere may not be used.

2.4 Target groups

This manual is intended for the following target groups, who have different qualifications and levels of knowledge.

Owner

The owner is any natural or legal person who operates or owns the device.

The owner provides the product and the necessary infrastructure. The owner has a special responsibility to ensure the safety of all persons working on the product.

User

The user operates the product and works with it. The user must be instructed in the use of the product. The user must have read and fully understood the manual.

Any tasks that go beyond operation may only be performed by the user if this is specified in this manual. The owner must explicitly assign these tasks to the user.

Technical personnel

The technical personnel supervises the building services and ensures the technical prerequisites for the operation of the product.

Authorized service technician

The authorized service technician is trained and certified by Eppendorf SE to service, maintain and repair the product.

2.5 Information for the owner

The owner must ensure the following:

- The product is in a safe operating condition.
- The safety devices are all available and functional.
- The product is serviced and cleaned according to the information in this manual.
- The product is disposed of in accordance with local regulations.
- All work on the product is carried out by users, technical personnel, or authorized service technicians who are suitably qualified.
- Personal protective equipment is available and is worn.
- The manual is available during the use of the product.
- The manual is part of the product. Use the following link to download the current version of the manual: <https://www.eppendorf.link/documents>. For a printed or older version of the manual for your product, please contact your Eppendorf partner.

2.6 Personal protective equipment

Personal protective equipment serves to ensure the safety and protection of the user when working with the product.

Personal protective equipment must comply with country-specific regulations and the regulations of the laboratory.

Cut-resistant gloves

The gloves provide protection against sharp-edged parts and splinters.

Laboratory gloves

The gloves provide protection against infectious liquids and pathogenic germs.

Laboratory protective clothing

The clothing protects against contamination and infection when working with pathogenic agents.

Protective gloves

Gloves for unpacking and packing the device

Safety boots

The boots protect the wearer against injury from heavy loads and improve grip on slippery floors.

Safety shoes

The shoes protect the wearer against injury from heavy loads and improve grip on slippery floors.

2.7 Information on product liability

The owner of the device will be held liable for personal and material damage in the following cases:

- The device is used outside of its intended use
- The device is not used in accordance with the operating manual
- Manipulation of safety devices
- The device has spare parts installed that are not authorized by Eppendorf SE
- The device is used with accessories or consumables that are not recommended by Eppendorf SE
- Cleaning agents are used that are not recommended by Eppendorf SE
- Chemicals are used that are not recommended by Eppendorf SE
- Shipment not in original packing or in improper substitute packing
- The device is maintained or repaired by persons not authorized by Eppendorf SE
- Unauthorized modifications

2.8 Information on the device

Symbol	Meaning	Location
	Observe the safety-relevant information in the operating manual.	Right side of the device
	Read the operating manual.	Right side of the device

Symbol	Meaning	Location
	Beware of electrical current	Rear of the device
	WARNING Risk of injuring your hands when closing the centrifuge lid.	Upper side of the device, under the device lid
	Fasten the rotor by tightening the rotor nut with the rotor key provided.	Upper side of the device, under the centrifuge lid
	QR code for device identification and serial number	Right side of the device

Information on rotors

Symbol	Meaning	Location
	Risk of damage to health when handling infectious liquids or pathogenic germs.	Rotor lid of aerosol-tight fixed-angle rotors Cap of aerosol-tight buckets

3 Product description

3.1 Features

The device has the following specific features:

- Suitable for use with heat-sensitive samples
- Cooling function with climate-friendly refrigerant
- Continuous cooling with the lid closed
- Capacity of 4 × 750 mL/ 4 × 4 MTP
- ECO shut-off
- Standby mode
- 35 program slots for user-defined settings
- 10 acceleration and deceleration ramps
- Automatic rotor detection with speed limit
- Automatic rotor imbalance detection
- Compatible with various rotors

The following consumables can be used with the device:

- Reaction vessels in sizes 0.2 mL – 5.0 mL
- PCR strips
- Microtainers
- Spin columns
- Cryogenic vessels
- Conical vessels in sizes 15 mL or 50 mL
- Bottles in sizes 175 mL – 750 mL
- Various vessels in sizes 3 mL – 120 mL
- Microplates
- PCR plates
- Deepwell plates
- Slides with CombiSlide adapter
- Cell-culture flasks

3.2 Product overview

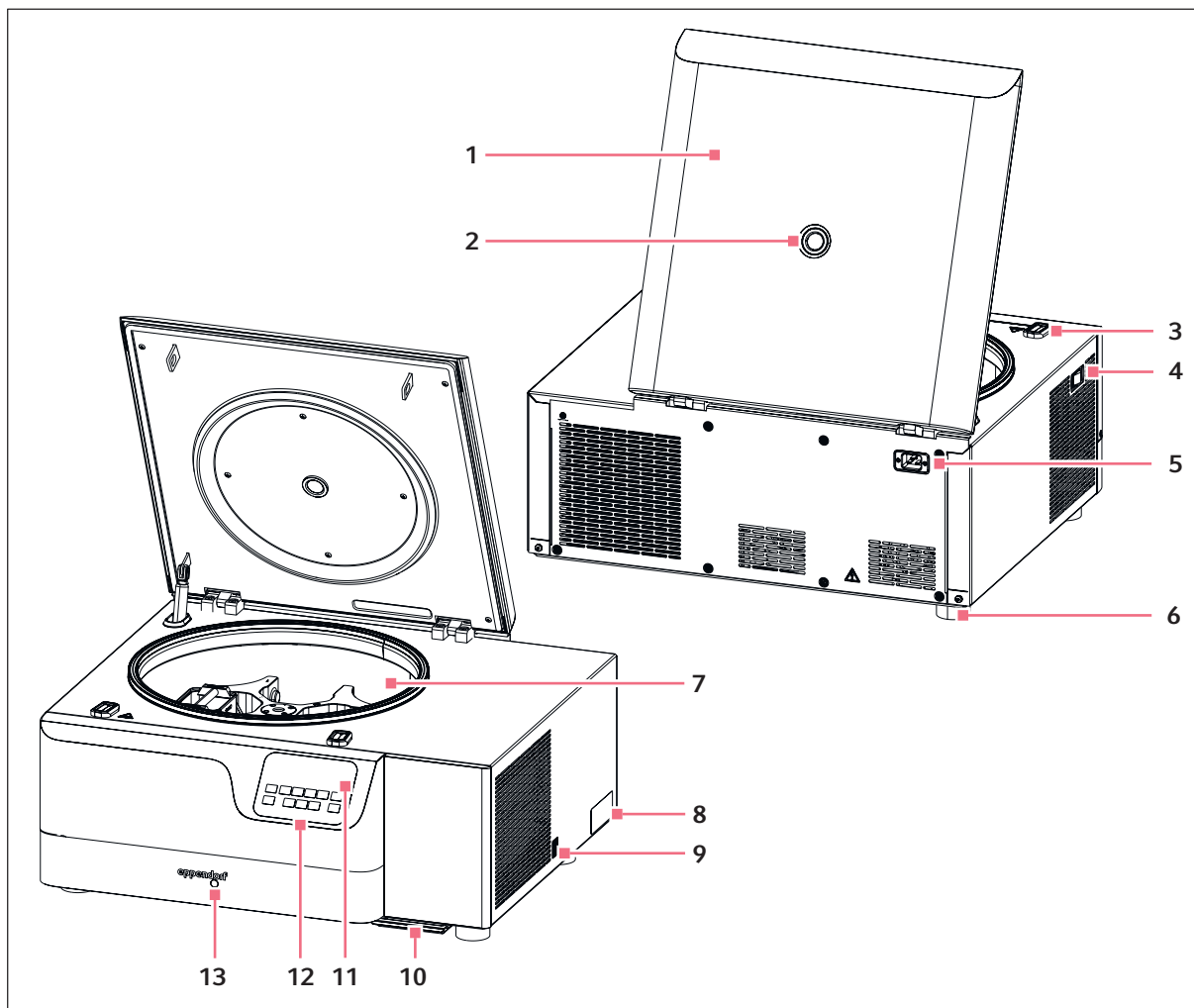


Fig. 3-1: Front and rear of the device

- | | |
|---------------------|---|
| 1 Centrifuge lid | 8 Name plate |
| 2 Monitoring glass | 9 QR code for device identification and serial number |
| 3 Lid latch | 10 Condensation water tray |
| 4 Power switch | 11 Display |
| 5 Power cord socket | 12 Control panel |
| 6 Device foot | 13 Emergency release |
| 7 Rotor bowl | |

3.3 Product components

Emergency release

Use the emergency release to open the centrifuge lid if it cannot be opened via the **open** key.

Monitoring glass

The monitoring glass is used for visual inspection for rotor stop and allows a speed check with a stroboscope.

Condensation water tray

The condensation water tray is used to collect the condensation water from the device.

Mains/power switch

The mains/power switch is used to switch the centrifuge on and off.

Control panel

The control panel is used to operate the display, the keys and the softkeys of the centrifuge.

Mains/power connection

The mains/power connection is the connection for the mains/power supply device provided.

3.4 Control panel

3.4.1 Overview of control panel

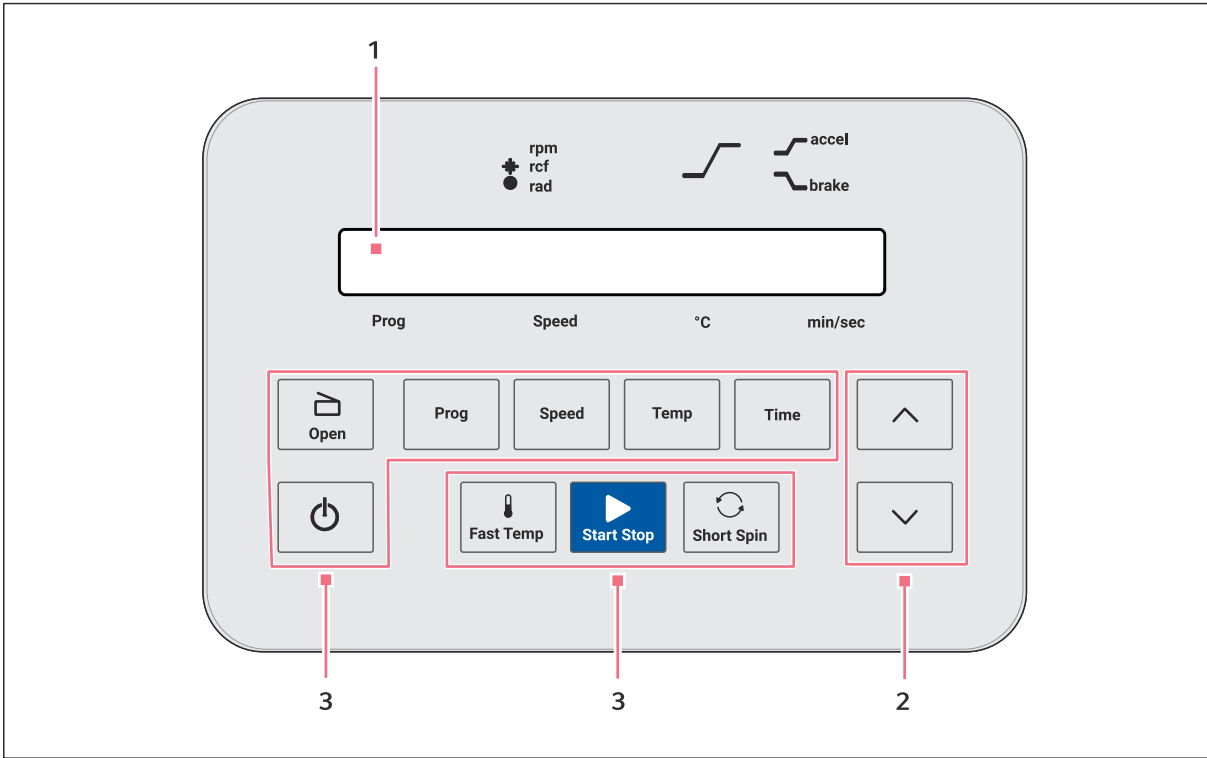


Fig. 3-2: Control panel

- 1 Display
- 2 Control keys
- 3 Softkeys

3.4.2 Operating controls

Operating control	Function
	Opens the centrifuge lid
	Starts and stops the centrifugation
	Activates and deactivates standby mode
	Performs centrifugation with Short Spin

Operating control	Function
 	Adjusts the value
	Tempers the rotor chamber
	Adjusts the speed of centrifugation
	Adjusts the centrifugation time
	Saves the program and loads without program name
	Sets the temperature

3.4.3 Key combinations

Function	Operating controls pressed	Information on the display
Setting parameters	<i>Speed, Time</i> or <i>Temp</i>  or 	- The selected parameter flashes. - The set value is displayed.
Setting acceleration and deceleration ramps	<i>Time</i> repeatedly  or  to select the ramp	: acceleration ramp 0 (long) ... 9 (short) : deceleration ramp 0 (long) ... 9 (short)
Signal tone on/off	<i>Speed</i> and <i>Time</i> simultaneously	<i>Alarm on/Alarm off</i>
Programming mode (only while the rotor is stationary)	- The parameter is selected $2 \times \text{Prog}$ - Save: <i>Prog</i> > s 2	- Parameter <i>P...</i>: the first free program number <i>OK</i>

3.4.4 Display

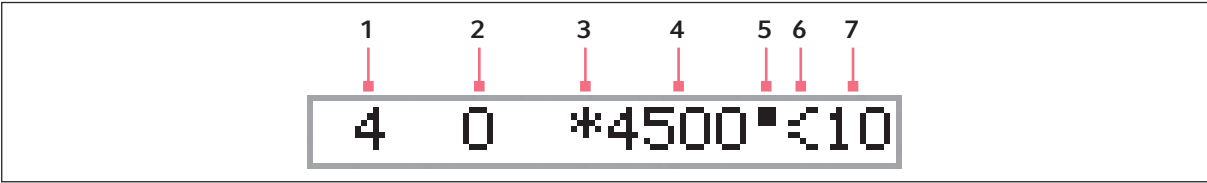


Fig. 3-3: Display of parameters

- | | | | |
|---|---|---|---|
| 1 | Set temperature when rotor is stationary and actual temperature during centrifugation | 5 | Operating mode status |
| 2 | Program number | 6 | Display for acceleration and deceleration ramps |
| 3 | Symbol for <i>g</i> -force (rcf) | 5 | Centrifugation time |
| 4 | <i>g</i> -force (rcf) or rotational speed (rpm) | | |

3.4.5 Symbols

Symbol	Description
	The timing for the run starts when 95 % of the nominal speed is reached.
	The timing for the run starts simultaneously with the centrifugation run.
	Status display: the symbol flashes during centrifugation.
	The <i>g</i> -force (rcf) is displayed.
	The radius can be manually adjusted.
	An acceleration ramp (0 to 9) has been set.
	A braking ramp (0 to 9) is adjusted.

3.5 Name plate

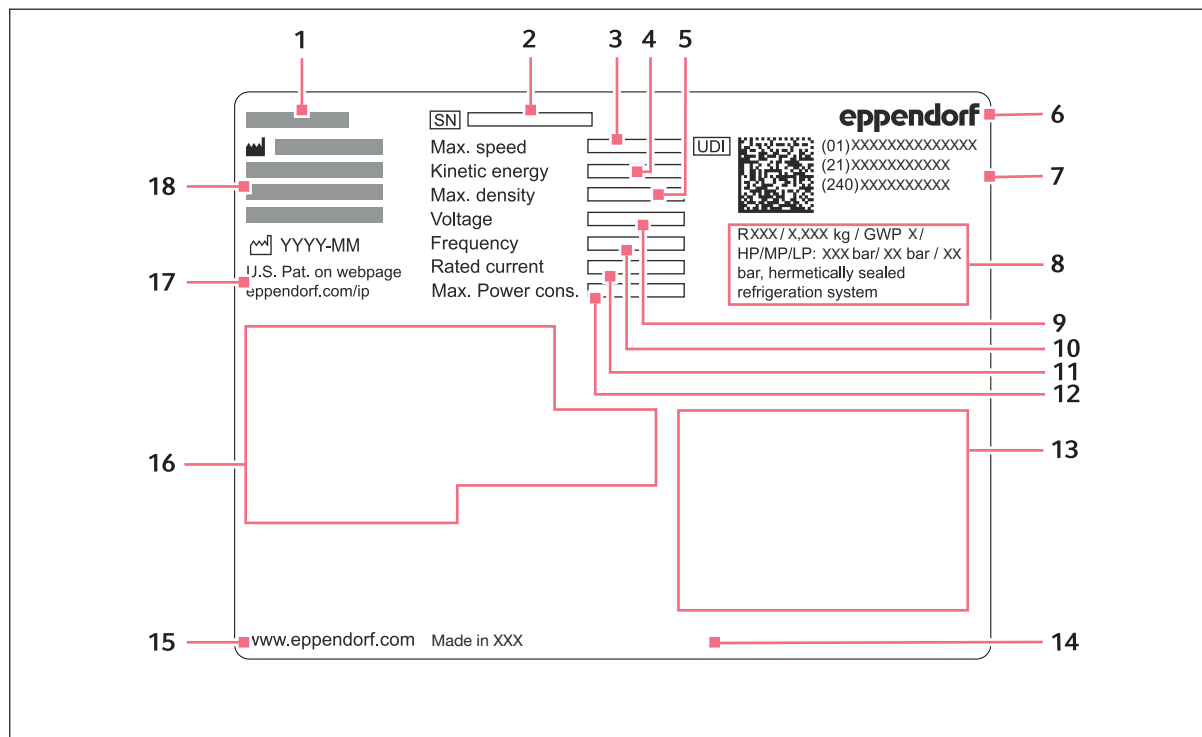


Fig. 3-4: Device identification for Eppendorf SE (example)

1	Product name	10	Rated frequency
2	Serial number	11	Rated current
3	Maximum speed	12	Maximum rated power
4	Maximum kinetic energy	13	Additional device data
5	Maximum density of material for centrifuging	14	Place of development
6	Manufacturer	15	Manufacturer's website
7	UDI code	16	Device-specific certification marks and symbols
8	Information on refrigerant/refrigeration system	17	Patent information
9	Rated voltage	18	Manufacturer's address

Certification and conformity marks and symbols (device-dependent)

Symbol	Meaning
	Serial number

Symbol	Meaning
	Manufacturer's name and address
	Date of manufacture
	Mark for unique device identification
	Mark for an in-vitro diagnostic device
	Mark indicating the conformity of waste electrical and electronic equipment with the DIN EN 50419 standard in accordance with Directive 2012/19/EU of the European Union
	Certification mark indicating compliance with EU-wide requirements for safety, health, and environmental protection
	Certification mark indicating that representative samples of the device have been tested by Underwriters Laboratories (UL) in accordance with US and Canadian safety standards
	Certification mark indicating that representative samples of the device have been tested by TÜV SÜD in accordance with US and Canadian safety standards
	Certification mark indicating electromagnetic compatibility in accordance with the regulations of the Federal Communications Commission (FCC, USA)
	Certification mark indicating that representative samples of the device have been tested by the Korean Agency for Technology and Standards (KATS) in accordance with South Korean safety standards
	Mark indicating environmentally sound service life in accordance with the SJ/T 11364 standard of the People's Republic of China
	Mark indicating conformity with the standards of the competent telecommunications authority in Australia

Product description

Centrifuge 5811 R
English (EN)

Symbol	Meaning
	Mark indicating conformity of medical devices with the technical regulations of the Eurasian Economic Union
	Mark indicating conformity with the regulations of the Eurasian Economic Union
	Mark indicating conformity for the UK Economic Area
	Note indicating that the pressure must be observed
	Note indicating that the operating manual must be observed
	Note indicating that the Original Operating Instructions must be observed
	Note indicating that safety-relevant information in the operating manual must be observed

3.6 Required accessories

3.6.1 Fixed-angle rotors

Every fixed-angle rotor has a specific rotor lid. The rotor designation on the rotor and the rotor lid are the same.

Non-aerosol-tight fixed-angle rotors

Identifying features:

- Rotor designation with "F"
- Black rotor lid screw
- Rotor lid without a sealing ring

Aerosol-tight fixed-angle rotors with Eppendorf QuickLock

Identifying features:

- Rotor identified by red ring
- Rotor designated with "FA"
- Red rotor lid screw

- Rotor lid label "aerosol-tight"
- Rotor lid with red sealing washer

3.6.2 Swing-bucket rotors

Every swing-bucket rotor has its own specific rotor bucket.

Identifying features:

- Rotor cross
- Various rotor buckets
- Rotor designated with "A or S"

4 Functional description

4.1 Centrifugation runs for refrigerated centrifuges

You can perform various centrifugation runs:

- Centrifugation with a time setting will stop after the set duration.
- Centrifugation without a time setting must be stopped manually.
- Centrifugation with Short Spin will be performed as long as you hold down the **Short Spin** key. No temperature can be selected during this function. The acceleration and deceleration time settings are not used.

4.2 Temperature control

Before centrifugation, a temperature control run (*FastTemp*) can be started without samples to cool the rotor chamber, the rotor, and the accessories.

During centrifugation, the rotor chamber is cooled to the set temperature.

After centrifugation, the rotor chamber is cooled to the ambient temperature at a maximum and 4 °C at a minimum, according to the cooling setting or without a time limit, with the centrifuge switched on and the lid closed. This temperature prevents:

- Formation of ice
- Condensation
- Freezing of the rotor chamber and samples

If the rotor is not rotating, the set temperature is reached more slowly.

If the centrifuge is in standby mode, the rotor chamber is not cooled.



In order to quickly cool the rotor chamber, rotor and adapter to the set temperature and thus execute a precisely tempered centrifugation run, start a temperature control run without samples using the FastTemp function. The rotational speed for the temperature control run is set by the device software.



The device does not have a heating function. Not every adjustable temperature can be achieved at every speed with every rotor.

Factors that may influence the highest and lowest achievable temperatures include:

- the rotor load
- the ambient temperature
- the speed of the rotor
- the number of previously completed centrifugation runs.

4.3 FastTemp function

The *FastTemp* function allows you to directly start a temperature control run without samples at rotor and temperature-specific rotational speed to quickly bring the rotor chamber, including the rotor, buckets, and adapters, to the set target temperature.

4.4 Overview of basic functions

Rotor detection

The rotor type is automatically detected at the start of a centrifugation run. The device limits the speed of the detected rotor to its maximum speed. There are two ways to trigger the rotor detection.

Imbalance detection

Due to the imbalance detection, the device detects if the rotor is loaded asymmetrically. The device stops the centrifugation and prevents damage to the device and rotor.

Programs

The centrifuge has 35 memory slots for programs.

For each program, you can set the following parameters:

- Centrifugation parameters
- Start of time measurement (*At set rpm* function)
- Acceleration and deceleration times
- Radius

You cannot overwrite saved programs. If you want to use an already assigned memory slot, you must first delete the program from that memory slot.

Signal tone

The signal tone sounds at the end of the temperature control run and at rotor stop after a centrifugation.

Standby mode

The device can be switched to standby mode.

Standby mode

- The **Standby** key  lights up red.

Ready for use

- The **Standby** key  lights up green.
- The centrifugation parameters are displayed.

You can switch between standby and operational mode at any time centrifugation is not taking place by pressing the **Standby** key.

ECO shut-off

When the *ECO shut-off* function is activated, the continuous cooling of the rotor chamber is automatically switched off after 8 hours. This prevents ice build-up in the rotor chamber and increased condensation inside the device.

When the *ECO shut-off* function is switched off, the rotor chamber is continuously cooled when the rotor is at a standstill.

5 Installation

5.1 Preparing installation

5.1.1 Checking connection requirements

All prerequisites must be met before the device can be installed and put into operation.

Checking the electrical connection

1. Check that the electrical connection meets the following conditions:

- The power connection corresponds to the specifications on the name plate.
- A power socket with a PE conductor is present.
- The power socket is always freely accessible.
- A residual current circuit breaker is present and accessible.

5.1.2 Checking the location



NOTICE! Disruption of the radio link

For devices with class A interference emission in accordance with EN IEC 61326-1/EN 55011:
The device cannot ensure adequate protection of radio reception in residential areas and domestic environments. The device may cause radio interference in residential or domestic environments.

- Do not use the device in residential or domestic environments.

All requirements must be met before the device can be installed and put into operation.

1. Check that the location meets the following conditions:
 - Ambient conditions as specified in the Technical Data chapter
 - Room volume (air volume at the location): 12 m³
 - Distance to other devices and walls: 50 cm
 - Distance between the rear of the device and other devices and walls: 30 cm
 - Resonance-free table with a level, flat work surface
 - Footprint suitable for the weight of the device
 - Good ventilation
 - No explosive environment
 - No hazardous materials allowed in the device's safety area
 - Access-controlled room
2. Check that the location is protected from the following:
 - Heat sources
 - Sparks
 - Open flames
 - Direct sunlight
 - UV radiation
 - Strong electromagnetic radiation

5.1.3 Checking the delivery and packing

1. Check whether the packages indicated on the delivery note match the packages actually delivered.
2. Check the packing for transport damage.
3. Report any visible damage to your Eppendorf partner.

5.1.4 Unpacking the device

Protective equipment:

- Protective gloves
- Safety shoes

Prerequisites:

- A lifting aid is available.
- The device is at its location.

1. Open the packing.
2. Remove the accessories from the packing.
3. To avoid excessive stress on the front of the device, attach the lifting aid to the sides of the device.
4. Lift the device out of the packing using a suitable lifting aid. Place the device at its point of use.
5. Remove the plastic cover from the device.
6. Retain the original packing for shipping and storage.

5.1.5 Checking the delivery condition

1. Check the device and accessories for visible damage.
2. Report any damage to your Eppendorf partner.

5.1.6 Checking the delivery package

1. Check that the supplied components match the specifications of the delivery package.
2. If any parts are missing, contact your Eppendorf partner.

Quantity	Description
1	Centrifuge as ordered
1	Rotor key
1	Power cord
1	Download instructions
1	Condensation water tray

5.2 Performing the installation

5.2.1 Setting up the device



Do not use the opening of the condensation water tray as a handle.

Protective equipment:

- Safety boots

Prerequisites:

- The location meets the requirements.
- Sufficient transport aids are available.

1. Place the device in its intended location with the help of another person.

5.2.2 Connecting the device to the power supply



Connect only one device per circuit.



DANGER! Electric shock

If the protective conductor connection is missing, you can receive an electric shock. An electric shock can cause heart injuries and respiratory paralysis.

- Ensure that the power plug and power socket are compatible and that the electrical PE conductors of the device and the building wiring are securely connected.

Prerequisites:

- The device is set up according to this manual.
- The device has been in place for at least 4 h.

1. Connect the power cord to the device.
2. Plug the power plug into the power socket.

5.2.3 Switching on the device

Prerequisites:

- The device has been set up and connected in accordance with this operating manual.

1. Switch on the device using the mains/power switch.

6 Operation

6.1 Preparing the device for the application

6.1.1 Selecting the rotor and accessories

1. Select the rotor, adapter, and vessels according to your application.
2. Use a rotor lid suitable for the fixed-angle rotor. Ensure that the rotor designation on the rotor and the rotor lid match.
3. Ensure that rotors, rotor lids, and accessories meet the following requirements:
 - Maximum service life not exceeded
 - Undamaged
 - No corrosion
 - No material changes
 - Undamaged and clean seals
 - Seals not protruding at any point
4. Ensure that the vessels meet the following requirements:
 - Approved by the manufacturer for this application
 - Chemically resistant to the sample
 - Designed for the intended load
 - Undamaged
 - Not deformed
 - Not brittle

6.1.2 Switching on the device

Prerequisites:

- The device has been set up and connected in accordance with this operating manual.

1. Switch on the device using the mains/power switch.

6.1.3 Opening the device lid



CAUTION! Crushing injuries to hands

If the device lid falls shut, this may cause hand injuries.

- Open the device lid fully to ensure that the device lid cannot slam shut.

1. Press the **open** key.

The centrifuge lid opens.

2. Open out the centrifuge lid as far as it will go.

6.1.4 Closing the device lid



CAUTION! Crushing injuries to hands

When closing the device lid, there is a risk of hand injury.

- Do not reach into the space between the device and lid.
- Do not reach into the locking mechanism of the device lid.

1. Press down the device lid until the lid latch catches and the lid is automatically pulled shut.

6.1.5 Replacing the rotor

6.1.5.1 Removing the rotor



NOTICE! Sample loss

Rotor F-35-48-17 can fall if handled incorrectly. This could cause the loss of sample.

- To remove the rotor safely, remove a sufficient amount of sleeves from the outer row of the rotor.
- Always use both hands to hold the rotor.

Tool:

- Rotor key
- Rotor key for rotor cross A-4-81 / S-4-104

Prerequisites:

- For swing-bucket rotors, the rotor buckets are removed from the rotor cross before removal.

1. Undo the rotor nut by turning the rotor key counterclockwise.
2. Lift the rotor vertically out of the device with both hands.

6.1.5.2 Inserting the rotor



NOTICE! Sample loss

Rotor F-35-48-17 can fall if handled incorrectly. This could cause the loss of sample.

- To remove the rotor safely, remove a sufficient amount of sleeves from the outer row of the rotor.
- Always use both hands to hold the rotor.

Inserting fixed-angle rotors

Tool:

- Rotor key
- Rotor key for rotor cross A-4-81 / S-4-104

Prerequisites:

- A usable rotor is available.
- The temperature of the rotor and motor shaft is in the range of 10 – 30 °C.

1. Place the rotor vertically on the motor shaft.
2. Tighten the rotor nut by turning the rotor key clockwise.

Inserting swing-bucket rotors

Tool:

- Rotor key
- Rotor key for rotor cross A-4-81 / S-4-104

1. Hold the rotor cross with both hands and place the rotor vertically on the motor shaft.
2. Place the rotor buckets into the rotor.
3. Tighten the rotor nut by turning the rotor key clockwise.

6.1.6 Triggering the rotor detection

Manually triggering rotor detection



CAUTION! Risk of hand injuries

Manually rotating a swing-bucket rotor may cause hand injuries from the rotor cross or the swinging buckets.

- Remove your hands from the rotor cross immediately after attaching the rotor.

Prerequisites:

- The device is ready for operation.
- The centrifuge lid is open.
- The rotor has been reinserted.
- The rotor nut has been tightened.

1. Turn the rotor counterclockwise using your hand.
2. Press the **start/stop** key.

Rotor detection is triggered.

In the display, the maximum permitted rotational speed appears for approx. 2 s.

If the device recognizes the rotor, it will check the nominal speed. If necessary, the nominal speed will be limited to the maximum speed of the rotor used.

Performing automatic rotor detection

Prerequisites:

- The device is ready for operation.
- The rotor has been reinserted.
- The rotor nut has been tightened.
- The centrifuge lid is closed.

1. Press and hold the **Short Spin** key until the maximum permitted rotational speed is shown.

If the maximum permitted rotational speed of the rotor is exceeded:

- The centrifuge stops after the rotor detection.

The following appears in the display:

- The error message *SPEED*.
- The new maximum permitted rotational speed.

2. Reset the nominal speed.
3. Press and hold the **Short Spin** key until the maximum permitted rotational speed is shown.

6.1.7 Opening the rotor lid

Opening the rotor lid with Eppendorf screw cap

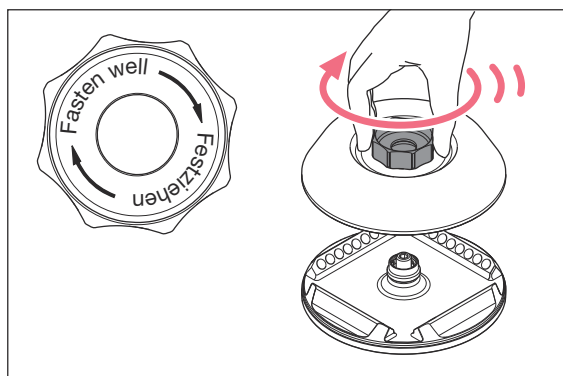
1. Turn the rotor key counterclockwise several times.
2. Remove the rotor lid.

Opening the rotor lid with Eppendorf QuickLock

1. Turn the rotor lid counterclockwise less than one turn.
2. Remove the rotor lid.

6.1.8 Closing the rotor lid

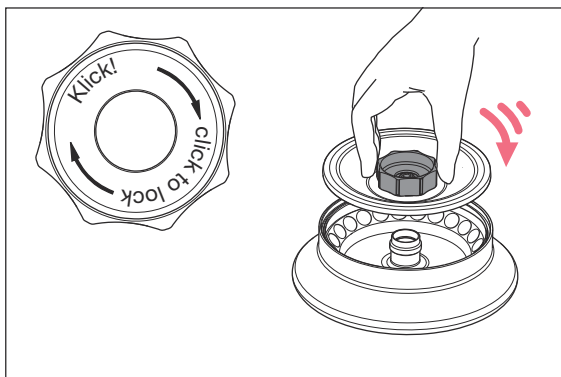
Closing the rotor lid with screw cap



1. Ensure that the rotor designation on the rotor and the rotor lid match.
2. Place the rotor lid on the rotor.
3. Tighten the rotor lid with the locking mechanism in a clockwise direction.

Closing the rotor lid with Eppendorf QuickLock

 The rotor is correctly locked into place once a click is heard.



1. Ensure that the rotor designation on the rotor and the rotor lid match.
2. Check whether the sealing ring is fitted correctly in the rotor lid.
3. Place the rotor lid on the rotor.
4. Rotate the locking mechanism in a clockwise direction as far as it will go and a clicking noise is heard.

6.1.9 Tempering the rotor chamber with FastTemp

Prerequisites:

- The rotor is correctly inserted and secured.
- Rotor bucket and adapter are correctly inserted in the swing-bucket rotors.
- Rotor lid is correctly assembled at all fixed-angle rotors.
- The centrifuge lid is closed.

1. Press the **temp** key.

The temperature will flash in the display.

2. Use the arrow keys to set the target temperature in the rotor chamber.

3. Press the **FastTemp** key.

- The temperature control run starts.
- The display shows *FastTemp*, the temperature set, and the current rotational speed.

4. Wait until the rotor chamber has reached the set temperature.

- If the rotor chamber is cooled to the set temperature, the temperature control run stops.
- A signal tone sounds when activated in the basic settings.
- When the temperature control run has finished, the set temperature is maintained in the rotor chamber. Regardless of the set temperature, the temperature will not fall below 4 °C during continuous cooling in order to prevent the formation of ice in the rotor chamber.



To abort the temperature control run, press the **start/stop** key.

6.1.10 Administration of programs

6.1.10.1 Saving a program



You cannot overwrite saved programs. If you want to use an already assigned program number, you must first delete the old program.

Prerequisites:

- The rotor is stationary.

1. Set the centrifugation parameters.
2. Set the functions in the advanced settings.
3. Press the **prog** key twice.

The first free program number *S Px...* appears on the display.

4. Use the arrow keys to select a program number.
5. Press and hold the **prog** key for 2 s.

The display shows *saved*. The current centrifugation parameters and the advanced settings have been saved.

6.1.10.2 Loading a program

Prerequisites:

- The rotor is stationary.

1. Press the **prog** key once.

The program number flashes on the display: *L Px...*

- *0*: Centrifugation parameters and settings from the last run
- *1...9, A...Z*: Saved programs

2. Use the arrow keys to select a program number.

3. Press the **start/stop** key.

- Closed centrifuge lid: Centrifugation starts with the selected program.
- Open centrifuge lid: Program loading is completed. The centrifugation parameters and settings of the last run are active again.



If you change the centrifugation parameters during a run with a program, the centrifuge switches to program *0*.

6.1.10.3 Deleting a program

Prerequisites:

- The rotor is stationary.
- The centrifuge lid is open.

1. Press the **prog** key once.

The program number flashes on the display: *L Px...*

- 0: Centrifugation parameters and settings from the last run
- 1...9, A...Z: Saved programs

2. Use the arrow keys to select a program number.

The program can be deleted within the next 10 s.

3. Press and hold the **start/stop** key for 2 s.

The display shows *deleted*.

The program has been deleted.

New centrifugation parameters and settings can be saved once again under the program number.

6.1.11 Preparing tubes



NOTICE! Damage to rotor, accessories and samples

If the maximum *g*-force is exceeded, the sample tubes may break and damage the device, accessories and samples.

- Observe the information provided by the tube manufacturer.
- Only use undamaged tubes.

Protective equipment:

- Laboratory protective clothing

Prerequisites:

- The tubes have been checked and are suitable for the centrifugation parameters.
- The adapters are suitable for the tubes.

1. Make sure the load does not exceed the permitted weight.

The permitted load weight specifications can be found on every rotor and in this operating manual in *Chapter 14 "Suitable rotors" on page 82*.

2. Make sure the filled tubes have the same weight.
3. Make sure the tube lids are closed.

6.1.12 Loading the rotor

Loading the fixed-angle rotor

i When using different tube types, the load weight in the rotor must be distributed symmetrically.



NOTICE! Sample loss

Open tube lids can break off during centrifugation.

- Before centrifugation, make sure that the tube lids are closed correctly.



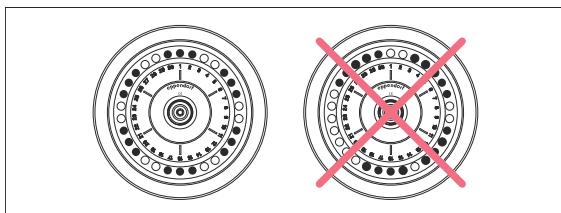
NOTICE! Damage to device

If rotor are loaded incorrectly, the rotor and the device may become damaged during centrifugation.

- Load the rotor symmetrically.
- Only load the rotor to its maximum load capacity.

Prerequisites:

- The tubes are filled.
- The filled tubes and adapters have the same weight.



1. Place the tubes in suitable adapters if necessary.
2. Insert tubes of the same weight in the rotor bores, correctly aligned and symmetrically.

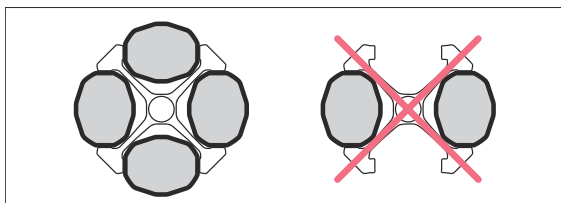
Loading the swing-bucket rotor

i The code number for the rotor bucket referring to the weight category is stamped into the groove on the rotor bucket.

Prerequisites:

- The grooves of the bucket are clean.
- The rotor buckets are equipped with suitable tubes, adapters, and plates.
- The pegs of the rotor cross are greased.
- The rotor buckets can swing freely at 90° with tubes or plates.
- The rotor buckets are evenly loaded.

- The maximum load per rotor bucket, adapter, tube, and plate is not exceeded.
- The filled tubes are of the same type and have the same weight.



1. Insert rotor buckets with the same code number opposite each other in the rotor cross.
All positions in the rotor cross are filled.
2. Correctly align the tubes or plates in the rotor buckets.
3. Make sure the rotor buckets can swing freely.



Swing-bucket rotors can be loaded with various types of rotor buckets, if they are intended for the rotor.

Mixed loading of a swing-bucket rotor



A swing-bucket rotor can be loaded with a mix of buckets and plate carriers if these are designed for use with the rotor.

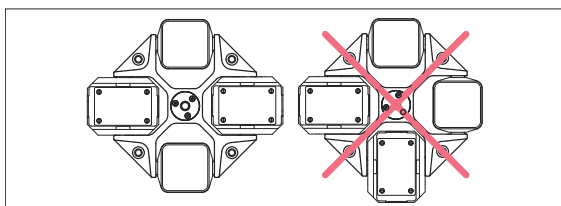


Fig. 6-1: Mixed loading of swing-bucket rotors



NOTICE! Rotor damage

If you load the A-4-62 rotor with a mix of rectangular and MTP buckets, the rotor will be damaged during centrifugation.

- Load the A-4-62 rotor with the same buckets in all positions.

1. Check how the buckets are loaded.

Rotor	Mixed loading
S-4×104	• 2 buckets for plates (open buckets or plate buckets) • 2 round buckets
A-4-81/A-4-81-MTP/Flex	• 2 buckets (MTP or DWP buckets) • 2 buckets for conical vessels • 2 rectangular buckets
A-4-44	• 2 rectangular buckets • 2 buckets for conical vessels

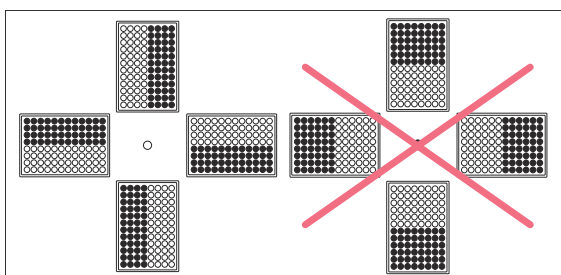
6.1.13 Using accessories

Loading plates

- i** During the run, the meniscuses will be standing at an angle in the outer tubes of the plates. This is caused by the centrifugal force and unavoidable.

Prerequisites

- The tubes are filled up to two-thirds full.
- The filled tubes are the same type and have the same weight.



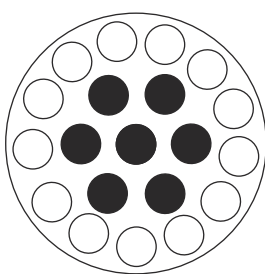
1. Insert tubes of the same weight in the plates, correctly aligned and symmetrically.

- i** For rotor A-4-81, insert the adapters into the rotor buckets so that the black sealing clamp points towards the Eppendorf logo on the bucket.

Equipping the buckets for rotor S-4x104 adapter with tubes longer than 119 mm

Prerequisites:

- The tubes are filled.
- The filled tubes are the same type and have the same weight.



1. Load the buckets in such a way that the bucket can swing freely.
2. Only load the inner bores of the adapter.

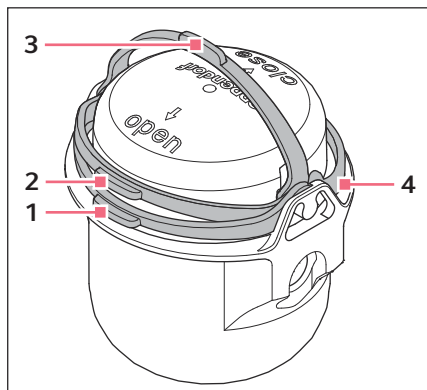
Sealing the bucket for Rotor S-4-104 with the cap



NOTICE! Damage to the bucket cap

If the bucket cap is positioned incorrectly, the sealing clamp of the cap may break when sealing the bucket.

- Make sure the bucket cap is correctly positioned on the bucket.



1. Fold the sealing clamp of the cap into the position **open** (1).
2. Place the cap on the bucket and press it down so that the sealing clamp lifts slightly (2).
3. In order to seal the caps aerosol-tight, fold the clamp beyond the locking tab to the **close** position (4) until it audibly engages.



To transport the bucket, fold the clamp into the carrying position (3).

6.2 Performing a centrifugation

6.2.1 Performing centrifugation with a time setting

Prerequisites:

- The rotor is installed.
- The rotor nut is tightened.
- The rotor is loaded.
- The rotor lid of the fixed-angle rotor is closed.
- The centrifuge lid is closed.
- The following settings have been made:
 - Start of time measurement
 - Acceleration and deceleration times
 - Radius of the rotor used
 - Cooling time after centrifugation

1. Press the **speed** key.

The rotational speed will flash on the display.

2. Use the arrow keys to set the nominal speed.

3. Press the **time** key.

The centrifugation time will flash on the display.

4. Use the arrow keys to set the centrifugation time.

5. Press the **temp** key.

The temperature will flash on the display.

6. Use the arrow keys to set the target temperature in the rotor chamber.

7. Start centrifugation using the **start/stop** key.

- The **open** key is no longer lit.
- The display shows:
 - The flashing symbol ■
 - The remaining centrifugation time
 - Actual values for temperature and rotational speed

8. Wait until the centrifugation time has elapsed.

- Centrifugation stops automatically.
- The rotor will brake to a standstill.
- The display shows the following during braking:
 - The centrifugation time flashing
 - The current temperature in the rotor chamber
 - The rotational speed with the value 0
 - The flashing symbol ■
- A signal tone will sound several times if it is enabled in the basic settings.
- The **open** key will flash blue.
- Once the rotor has stopped, the display shows the setpoints.

The rotor chamber is cooled for the set duration.

9. Open the centrifuge lid using the **open** key.

Cooling of the rotor chamber is complete.

10. Open the rotor lid.

11. Remove the samples.



- To switch the display between rotational speed, *g*-force, and radius, press the **speed** key. The following symbols appear on the display:
 - Rotational speed: No symbol
 - *g*-force: ✱
 - Radius: ⊙
- During centrifugation, you can display the following setpoints for 2.5 s:
 - Centrifugation time (**time**)
 - Temperature (**temp**)
 - Rotational speed (**speed**)
- During centrifugation, you can change the following values:
 - Centrifugation time
 - Temperature
 - Rotational speed
 - Radius
 - Acceleration time and deceleration time
- To stop centrifugation, press the **start/stop** key.

6.2.2 Performing centrifugation without a time setting

Prerequisites

- The rotor is installed.
- The rotor nut is tightened.
- The rotor is loaded.
- The rotor lid of the fixed-angle rotor is closed.
- The centrifuge lid is closed.
- The following settings have been made:
 - Start of time measurement
 - Acceleration and deceleration times
 - Radius of the rotor used

1. Press the **speed** key.

The rotational speed will flash on the display.

2. Use the arrow keys to set the nominal speed.

3. Press the **time** key.

The centrifugation time will flash on the display.

4. Use the arrow keys to set the centrifugation time to unlimited by setting the time to < 1 min or > 99 min.

The display shows *oo*.

5. Press the **temp** key.

6. Use the arrow keys to set the target temperature in the rotor chamber.

7. Start centrifugation with the **start/stop** key.

- The **open** key is no longer lit.
- The display shows:
 - The flashing symbol ■
 - The remaining centrifugation time. 99 will appear on the display if the centrifuge has been running for more than 99 min.
 - The current temperature.
 - The current rotational speed.

8. End centrifugation using the **start/stop** key.
 - The rotor will brake to a standstill.
 - The display shows the following during braking:
 - The centrifugation time flashing
 - The current temperature in the rotor chamber
 - The current rotational speed
 - The flashing symbol ■
 - A signal tone will sound several times if it is enabled in the basic settings.
 - The **open** key will flash blue.
 - Once the rotor has stopped, the display shows the setpoints.
9. Open the centrifuge lid using the **open** key.

Cooling of the rotor chamber is complete.
10. Remove the samples.



You can change the run time, temperature, and rotational speed during centrifugation.

6.2.3 Performing centrifugation with ShortSpin

Prerequisites:

- The rotor is installed.
- The rotor nut is tightened.
- The rotor is loaded.
- The centrifuge lid is open.

1. Press the **Short Spin** key.

The display shows one of the following two options:

- *Shortspin max*: ShortSpin centrifugation is performed at the maximum rotational speed.
- *Shortspin target*: ShortSpin centrifugation is performed at the set rotational speed.

2. To switch between the two options, press and hold the **Short Spin** key for more than 3 s seconds.

The selected option appears on the display for 2 s.

3. To set the rotational speed using the *Shortspin target* option, press the **speed** key.

The rotational speed will flash on the display.

4. Use the arrow keys to set the rotational speed.
5. Close the centrifuge lid.

6. To start ShortSpin centrifugation, press and hold the **Short Spin** key.

7. To stop centrifugation, release the **Short Spin** key.

The rotor will brake to a standstill.

The display shows the centrifugation time.

When the rotor stops, the device will open automatically.



While the rotor is braking, you can restart ShortSpin centrifugation two more times. To do this, press the **Short Spin** key.

6.2.4 Switching off the device

Prerequisites:

- The centrifugation run is finished.
- The device lid is open.

1. Switch off the device using the mains/power switch.

6.3 Advanced settings

6.3.1 Activating/deactivating the standby mode

Activating standby mode

Prerequisites:

- The device is ready for operation.

1. Press the  key.

- The display goes out.
- The standby key lights up red.

Deactivating standby mode

Prerequisites:

- The device is in standby mode.

1. Press the  key.

- The centrifugation parameters appear in the display.
- The standby key lights up green.

6.3.2 Activating and deactivating the signal tone

Activating the signal tone

Prerequisites:

- The rotor is at a standstill.
- The signal tone is deactivated.

1. Press and hold the **speed** and **time** keys for longer than 2 s.

The *Alarm on* message appears in the display.

Deactivating the signal tone

Prerequisites:

- The rotor is at a standstill.
- The signal tone is activated.

1. Press and hold the **speed** and **time** keys for longer than 2 s.

The *Alarm off* message appears in the display.

6.3.3 Setting the cooling time after centrifugation



The cooling time after centrifugation is set by default to 8 h.

Setting the cooling time to unlimited



NOTICE! Damage to the device

If the rotor chamber is cooled with no time limit after centrifugation, the service life of the compressor will be shortened.

- Set a cooling time limit after centrifugation.

Prerequisites:

- The centrifuge lid is open.

1. Press the **temp** and **prog** keys simultaneously.
2. *Standby 8h* appears in the display.
3. Press the **FastTemp** key.

Continuous operation for continuous cooling is activated.

Standby endless appears in the display.

Setting the cooling time to 8 h



If the device is not used for longer than the 8 h of continuous cooling, the continuous cooling switches off to help prevent the formation of ice in the rotor chamber and increased condensation in the device. The device changes to standby mode.

The centrifuge lid is open.

1. Press the **temp** and **prog** keys simultaneously.
2. *Standby endless* appears in the display.
3. Press the **FastTemp** key.

The 8 h continuous cooling is activated.

Standby 8h appears in the display.

6.3.4 Activating time measurement

Activating the time measurement without At set rpm

Prerequisites:

- The centrifuge lid is open.

1. Press and hold the **start/stop** key until the lower triangle in the  symbol starts flashing.

The time measurement and the centrifugation run start simultaneously.

Activating the time measurement with At set rpm

Prerequisites:

- The centrifuge lid is open.

1. Press and hold the **start/stop** key until the upper triangle in the  symbol starts flashing.

The time measurement starts once 95 % of the nominal speed has been reached.

6.3.5 Setting the ShortSpin centrifugation speed

Setting the maximum rotational speed

Prerequisites:

- The centrifuge lid is open.

1. Press and hold the **short** key.

The display shows:

- *Shortspin max*: The rotor accelerates to its maximum *g*-force (rcf)/rotational speed (rpm).
- *Shortspin target*: The rotor accelerates to the set *g*-force (rcf)/rotational speed (rpm).

Using the preset rotational speed

Prerequisites:

- The centrifuge lid is open.

1. Press and hold the **short** key for more than 3 min to switch between the *Shortspin max* and *Shortspin target* options.

The selected option appears on the display for 2 s and is then retained.

6.3.6 Setting the acceleration and deceleration times

Acceleration and deceleration times are set in levels from 0 to 9.

- Level 9: Shortest acceleration and deceleration times
- Level 0: Longest acceleration and deceleration times

 Level 9 is the factory default setting.

Setting the acceleration ramp

1. Press the **time** key until the  symbol appears on the display.
2. Use the arrow keys to select an acceleration ramp.

 The device displays the  and  symbols continuously only for levels 0 to 8.

Adjusting the braking ramp

1. Press and hold the **time** key until the  symbol appears in the display.
2. Use the arrow keys to select a braking ramp.

 The device will only permanently show the  and  symbols for the stages 0 to 8.

6.3.7 Adjusting the rotor radius

Conversion of the rotational speed to *g*-force is generally based on the maximum radius of the rotor used. If an adapter is used for the tubes, the radius value can be manually adjusted. The value for the radius of an adapter in a rotor can be found in the technical data of the rotor.

Prerequisites:

- The device recognizes the rotor.

1. Press and hold the **speed** key until the  symbol appears in the display.

The current radius flashes.

2. Use the arrow keys to set the new radius.

After 3 s, the changed *g*-force appears in the display.

If the rotor is stopped, the changed *g*-force will first appear in the display after 10 s.

6.3.8 Displaying the total run time of the device

Prerequisites:

- The rotor is at a standstill.

1. Simultaneously press the **time** and **prog** keys.

The total run time of the device is shown in hours in the display.

6.3.9 Exiting the service function

1. To exit a service function that was inadvertently called up, press both keys simultaneously.

7 Maintenance

7.1 Maintenance plan

Interval	Maintenance work
As required	🔗 Chapter 7.2.3 "Removing the sealing ring from the rotor lid" on page 52
	🔗 Chapter 7.2.4 "Inserting the sealing ring into the rotor lid" on page 53
	🔗 Chapter 7.3.1 "Cleaning a contaminated device" on page 54
	🔗 Chapter 7.3.2 "Cleaning the device after glass breakage" on page 54
	🔗 Chapter 7.3.3 "Cleaning a fixed-angle rotor when contaminated" on page 55
	🔗 Chapter 7.3.4 "Cleaning a fixed-angle rotor after tube breakage" on page 56
	🔗 Chapter 7.3.5 "Cleaning the swing-bucket rotor when contaminated" on page 56
	🔗 Chapter 7.3.6 "Cleaning the swing-bucket rotor after tube breakage" on page 57
	🔗 Chapter 7.3.7 "Cleaning the rotor lid" on page 58
	🔗 Chapter 7.3.8 "Cleaning accessories" on page 59
	🔗 Chapter 7.4.1 "Decontaminating the device" on page 59
	🔗 Chapter 7.4.2 "Autoclaving the rotor and accessories" on page 60
Before each use	🔗 Chapter 7.2.1 "Checking the device" on page 52
	🔗 Chapter 7.2.2 "Checking the rotor and accessories" on page 52
Weekly	🔗 Chapter 7.3.5 "Cleaning the swing-bucket rotor when contaminated" on page 56
50 autoclaving cycles	🔗 Chapter 7.2.3 "Removing the sealing ring from the rotor lid" on page 52
	🔗 Chapter 7.2.4 "Inserting the sealing ring into the rotor lid" on page 53
	🔗 Chapter 7.2.5 "Replacing the rotor S-4 × 104 sealing ring on caps" on page 53

7.2 Maintenance

Eppendorf SE recommends having your device inspected and maintained at regular intervals by trained and skilled personnel.

Eppendorf SE offers customized service solutions for preventive maintenance, qualification and calibration of your device. For information, offers and contact options, visit our website www.eppendorf.com/epservices.

Eppendorf SE recommends that the device and the associated rotors are serviced by an authorized service technician at least every 12 months. Please note the country-specific regulations.

7.2.1 Checking the device

1. Check the device, mains/power cord and motor shaft for visible damage.

If the device is damaged, take it out of operation.

Inform the authorized service technician.

2. Check the rotor chamber for:

- Corrosion

Inform the authorized service technician about any corrosion in the rotor chamber.

7.2.2 Checking the rotor and accessories

1. Check the rotors and accessories for damage.

Take damaged rotors and damaged accessories out of operation.

2. Check the service life of the rotors and the accessories.

Replace rotors and accessories that have exceeded their service life.

7.2.3 Removing the sealing ring from the rotor lid



The sealing ring of a rotor lid with Eppendorf QuickLock Pro closure cannot be replaced.

Tool:

- Paper clip

Material:

- Soap-based cleaning agent
- Cloth
- Water

1. Use the paperclip to pry the sealing ring out of the groove.
2. Remove the sealing ring.
3. Moisten the cloth with water and cleaning agent.
4. Clean the groove.

7.2.4 Inserting the sealing ring into the rotor lid

Material:

- Pivot grease

Prerequisites

- The sealing ring has been removed from the rotor lid.
- A new, undamaged sealing ring is available.

1. Apply a thin layer of pivot grease to the sealing ring.
2. Position the sealing ring on the groove.
3. Press the sealing ring into the groove, making sure it does not protrude from the sides.
4. Check that the sealing ring is correctly inserted.

7.2.5 Replacing the rotor S-4 × 104 sealing ring on caps



The cap is only sealed aerosol-tight when the sealing ring is positioned correctly.

Material:

- Distilled water
- Cloth

Prerequisites

- A new sealing ring is available.

1. Open the bucket and remove the cap from the bucket.
2. Lever the sealing ring out of the groove using the paper clip.
3. Position the new sealing ring on the groove.
4. Press the sealing ring into the groove.

The sealing ring fits perfectly into the groove and does not stick out at any point.

5. Place the cap on the bucket and close the bucket.
6. Check that the sealing ring is correctly inserted.

7.2.6 Documenting the service life

The service life of rotors, rotor lids and accessories may be limited. Information on how long you may use rotors, rotor lids and accessories can be found in the technical data.

1. Document the following data for rotors, rotor lids and accessories:
 - Date of initial setup
 - Number of centrifugation cycles
 - Number of autoclaving cycles

7.3 Cleaning

For any questions regarding cleaning and decontamination, or the cleaning agents used, please contact your local Eppendorf partner.

7.3.1 Cleaning a contaminated device

Protective equipment:

- Laboratory protective clothing

Material:

- Water
- Soap-based cleaning agent
- Cloth
- Brush
- Care product

Prerequisites:

- The device is disconnected from the power supply.
- The device lid is open.
- The rotor has been removed from the device.

1. Clean the ventilation gaps of the housing with a dry paintbrush or hand brush.
2. Wet the cloth with the cleaning agent.
3. Clean all accessible surfaces, including the power cord, with the damp cloth.
4. Clean all rubber seals with the damp cloth.
5. Clean the motor shaft with a dry cloth.
Do not grease the motor shaft.
6. Leave the device to dry with the lid open.
7. Rub the dry rubber seals with a lubricant, such as glycerol.

7.3.2 Cleaning the device after glass breakage



Micro glass particles collect in rubber parts, e.g. in the motor sleeve, seals and rubber mats, and have a sandblasting effect. Clean these parts and the inner parts of the device very carefully.



WARNING! Contamination

Biological substances leak from broken tubes. People who come into contact with these substances may suffer damage to their health.

- Wear your personal protective equipment.
- If necessary, carry out decontamination before cleaning.

Material:

- Water
- Cloth

Prerequisites:

- The device has been disconnected from the mains/power supply.
- The rotor and the accessories have been removed.

1. Remove all glass splinters.
2. Use damp cloths to clean the rotor chamber.
3. Leave the device to dry with the lid open.

7.3.3 Cleaning a fixed-angle rotor when contaminated



Clean the rotor by hand.

Do not submerge the rotor under water. When submerged, liquid will enter the rotor cavities.



Do not grease the rotor cone.

Protective equipment:

- Laboratory protective clothing

Material:

- Deionized water
- Soap-based cleaning agent
- Cloth
- Cleaning brush

Prerequisites:

- The rotor has been removed from the device.

1. Wet the cloth and cleaning brush with deionized water and cleaning agent.
2. Clean the rotor.
3. To remove cleaning agents from the rotor, wipe them off with deionized water.
4. Leave the rotor to dry.



Cleaning can cause the rotor to dry out in the sealing area. This can result in a sluggish rotor lid operation. If this is the case, lightly grease the seal with the supplied pivot grease.

7.3.4 Cleaning a fixed-angle rotor after tube breakage



Clean the rotor by hand.

Do not submerge the rotor under water. When submerged, liquid will enter the rotor cavities.



Very small glass particles can deposit in adapters and parts made of rubber, e.g., seals. Clean these parts very carefully.



WARNING! Contamination

Biological substances leak from broken tubes. People who come into contact with these substances may suffer damage to their health.

- Wear your personal protective equipment.
- If necessary, carry out decontamination before cleaning.

Protective equipment:

- Laboratory protective clothing
- Cut-resistant gloves

Material:

- Water
- Soap-based cleaning agent
- Cloth

1. Remove all glass splinters.
2. Remove the rotor and the accessories.
3. To remove any shards from tubes, clean the rotor, the rotor bores and the accessories with a damp cloth.
4. Replace the adapters to prevent any further damage.
5. Allow the rotor and the accessories to dry.



Cleaning can dry out the seal areas on the rotor. This can make the rotor lid difficult to operate. If this is the case, lightly grease the seal with the supplied pivot grease.

7.3.5 Cleaning the swing-bucket rotor when contaminated



Do not immerse the swing-bucket rotor in water.



Do not grease the rotor cone.

Protective equipment:

- Laboratory protective clothing

Material:

- Distilled water
- Soap-based cleaning agent
- Cloth
- Pivot grease

Prerequisites:

- The rotor has been removed from the device.
- The rotor has been decontaminated.

1. Remove the pivot grease from the rotor pivots.
2. Wet a cloth with water and cleaning agent.
3. Clean the rotor, including the rotor pivot, and the rotor buckets.
4. Rinse the rotor, including the rotor pivot, and rotor buckets with distilled water.
5. Place the rotor and rotor buckets on a cloth to dry.
6. Clean the rotor cone with a dry cloth.
7. Lightly grease the rotor pivots with pivot grease.

7.3.6 Cleaning the swing-bucket rotor after tube breakage



WARNING! Contamination

Biological substances leak from broken tubes. People who come into contact with these substances may suffer damage to their health.

- Wear your personal protective equipment.
- If necessary, carry out decontamination before cleaning.

Protective equipment:

- Laboratory protective clothing
- Cut-resistant gloves

Material:

- Deionized water
- Soap-based cleaning agent
- Cloth

1. Remove all tube fragments.
2. Remove the rotor from the device.
3. Thoroughly rinse the rotor and rotor buckets with water.
4. Clean the rotor and rotor buckets with a damp cloth.

5. Very small tube particles may be left in the parts made of rubber, e.g., seals. Clean these parts very carefully.
6. Replace any damaged seals.

7.3.7 Cleaning the rotor lid



Check the sealing washer of aerosol-tight rotor lids. Replace the sealing washer if required.

Protective equipment:

- Laboratory protective clothing

Material:

- Water
- Distilled water
- Soap-based cleaning agent
- Disinfectant with at least 70 % ethanol
- Cloth
- Pivot grease

1. Disinfect the rotor lid.
2. Wet a cloth with water and cleaning agent.
3. Remove the seal from the groove and clean it.
4. Clean the rotor lid, especially the groove.
5. Rinse the rotor lid with distilled water.
6. Place the seal in the groove of the rotor lid.
7. Place the rotor lid on a cloth to dry.
8. Lightly grease the lid thread of aerosol-tight rotor lids with pivot grease.

7.3.8 Cleaning accessories

Protective equipment:

- Laboratory protective clothing

Material:

- Water
- Distilled water
- Soap-based cleaning agent
- Cloth

Prerequisites:

- The accessories have been removed from the device.
- The accessories have been disinfected.

1. Moisten the cloth with water and cleaning agent.
2. Clean the accessories.
3. Rinse the accessories with purified water.
4. Place the accessories on a cloth to dry.

7.4 Decontamination

7.4.1 Decontaminating the device



DANGER! Electric shock

If you touch any parts which are under voltage, you may experience an electric shock. Electric shocks cause heart injury and respiratory paralysis.

- Switch off the device and disconnect the mains/power plug before commencing work on the device.



NOTICE! Component damage

If disinfectant gets inside the device, it can cause electronic components to corrode. This will impair the function of the device.

- Only spray disinfectant onto a cloth.

Protective equipment:

- Laboratory protective clothing
- Laboratory gloves

Material:

- Disinfectant with at least 70 % ethanol
- Deionized water
- Cloth

Prerequisites:

- The device has been disconnected from the mains/power supply.
- The device is defrosted.

1. Wet a cloth with disinfectant.
2. Wipe out the rotor chamber of the device with the cloth.
3. Allow the disinfectant to act.
4. Wipe off the disinfectant with deionized water.
5. Leave the device to dry with the lid open.

7.4.2 Autoclaving the rotor and accessories

The following are autoclavable:

- All rotors of the device, with the following exceptions:
 - Rotor cross A-4-81
 - Rotor cross S-4-72
 - Rotor cross S-4-104
- Adapters, with the following exceptions:
 - Easyclean adapter for rotor A-4-44



Replace the sealing rings of the aerosol-tight rotor lids and the caps of the aerosol-tight buckets after 50 autoclaving cycles.

Protective equipment:

- Laboratory protective clothing

1. Autoclave at 121 °C for 20 min.
2. Apply a thin layer of pivot grease to the pivots in the rotor lid closure.
3. Apply a thin layer of pivot grease to the lid thread of the aerosol-tight rotor lids.



The aerosol-tight rotor FA-45-30-11 can be autoclaved at 142 °C for 2 h to destroy prions.

- Replace the rotor lid after each autoclaving procedure.

7.5 Observe care instructions

1. Empty and clean the condensation water tray regularly, especially after spilling liquid into the rotor chamber.
2. Leave the centrifuge lid open when the device is not in use for longer periods of time.
3. Remove the condensation water from the rotor chamber.

8 Troubleshooting

8.1 General errors

Error description	Cause	Solution
The device does not start.	The centrifuge lid is open.	Close the centrifuge lid.
No display	Power outage	Check: • The laboratory power fuse
	The device is not receiving power.	Check: • The power cord
The display shows <i>Interrupt</i> after the centrifuge is switched on.	Power outage	Check: • The laboratory power fuse
	The excess current switch has tripped.	Reset the excess current switch.
The centrifuge lid will not open.	The rotor is rotating.	Wait until the rotor has come to a complete stop. Then open the centrifuge lid.
	The excess current switch has tripped.	Reset the excess current switch.
	Power outage	Check: • The laboratory power fuse. Open the centrifuge lid using the emergency release.
The gas spring no longer keeps the centrifuge lid open. The centrifuge lid closes on its own.	The gas spring is defective or older than 2 years.	Check: • The age and function of the gas spring Replace: • Have defective or worn-out gas springs replaced by service
The display shows <i>clean rotor</i> .	The rotor has reached 200 cycles	Stop centrifugation. Wait until the rotor has come to a complete stop. Clean the rotor chamber. Clean the rotor and the accessories.
There is black metal debris in the rotor chamber.	The vessels in the rotor are too long.	Clean the device. Use vessels that are compatible with the rotor.

Error description	Cause	Solution
There is black metal debris in the rotor chamber.	The permissible rotational speed of the vessels has been exceeded.	Clean the device. Use vessels approved for the required rotational speed.
The rotor is braking even though you are pressing the Short Spin key.	You have released the Short Spin key briefly at least twice. The drive's safety function has been activated.	Press and hold the Short Spin key.

If you are unable to resolve the error using the suggested measures, please contact your local Eppendorf partner. You can find the address on the Internet at www.eppendorf.com.

8.2 Software error messages

Error description	Cause	Solution
The display shows <i>no rotor</i> and centrifugation cannot be started.	No rotor is installed.	Install a rotor.
	The rotor is not detected by rotor detection.	If the device does not detect the rotor, use a different rotor. If further rotors are not detected, contact an authorized service technician.
	The drive is malfunctioning.	Switch off the device. Switch the device back on after 20 s.
<i>Press Open</i>	The centrifuge lid is not locked.	Press the open key. Close the centrifuge lid.
<i>Close lid</i>	The centrifuge lid is not properly closed.	Press the centrifuge lid firmly closed.
<i>Lid Lift</i>	The centrifuge lid does not open completely.	Open the rotor lid completely by hand.
<i>IMBAL</i> - The device shakes during acceleration and shuts down.	The rotor is loaded asymmetrically.	Stop centrifugation. Load the rotor symmetrically. Restart centrifugation.
<i>ROTOR</i> - The device shakes during acceleration and shuts down.	The rotor is not sufficiently tightened.	Stop centrifugation. Wait until the rotor has come to a complete stop. Tighten the rotor nut securely. Check the rotor cone and motor shaft for scoring and damage. Restart centrifugation.

Error description	Cause	Solution
<i>ROTOR</i> - The device shakes during acceleration and shuts down.	The centrifuge's base is unstable and the centrifuge has been bumped.	Place the centrifuge on a suitable laboratory bench.
<i>Wrong Speed</i> - The device shuts down.	The nominal speed is too high for the installed rotor.	Adjust the nominal speed for the installed rotor.
<i>change Rotor</i>	The rotor has reached its maximum shelf life.	Contact your local Eppendorf partner.
<i>Clear Memory</i>	The program memory is full.	Delete programs that are no longer needed.
<i>Interrupt</i>	Power outage during centrifugation.	Check: • The laboratory power fuse
	The excess current switch has tripped.	Reset the excess current switch.
<i>Error 1</i>	The rotational speed measurement system is malfunctioning.	Wait a maximum of 6 min. Check: • The error message on the display If the error message appears again: • Use a different rotor.
<i>Error 2</i>	The imbalance sensor is malfunctioning.	Restart centrifugation.
<i>Error 3</i>	The rotational speed measurement system is malfunctioning.	• Remove the rotor from the device. • Place the rotor vertically onto the motor shaft. • Tighten the rotor nut.
	The rotational speed measurement system is malfunctioning.	• Do not switch off the centrifuge. • Wait 12 min until the open key lights up. • Open the centrifuge lid.
<i>Error 4</i>	The lid latch sensor is malfunctioning.	• Switch off the device. • Switch the device back on after 20 s.
<i>Error 5</i>	The user attempted to open the centrifuge lid during centrifugation.	• Wait until the rotor has come to a complete stop. • Then open the centrifuge lid. • Close the centrifuge lid. • Restart centrifugation.

Error description	Cause	Solution
<i>Error 5</i>	The lid switch is defective.	• Wait until the rotor has come to a complete stop. • Then open the centrifuge lid. • Close the centrifuge lid. • Restart centrifugation.
<i>Error 6/overload</i>	The power supply voltage is too low.	Check the power supply voltage.
	The frequency converter is over-loaded.	Switch off the device. Let the device cool down for approx. 15 min. Restart centrifugation.
	The brake is defective	Switch off the device. Let the device cool down for approx. 15 min. Restart centrifugation.
<i>Error 8</i>	The rotor is not sufficiently tightened.	Stop centrifugation. Wait until the rotor has come to a complete stop. Tighten the rotor nut securely. Restart centrifugation.
<i>Error 9 – Error 25</i>	The electronics are malfunctioning.	• Switch off the device. • Switch the device back on after 20 s.

If you are unable to resolve the error using the suggested measures, please contact your Eppendorf partner. You can find the address on the Internet at www.eppendorf.com.

8.3 Software error messages for the refrigeration system

Error description	Cause	Solution
The actual temperature value is flashing on the display.	The difference between the actual temperature and set temperature is > 3 °C.	Wait until the set temperature is reached. Check: • The set temperature Switch off the device. Leave the device to cool for approx. 15 min. Ensure that air can circulate freely through the ventilation gaps.

Error description	Cause	Solution
The actual temperature value is flashing on the display.	The difference between the actual temperature and set temperature is $> 3\text{ }^{\circ}\text{C}$.	Remove any ice from the rotor chamber.
<i>overtemp</i> - The centrifuge shuts down with an audible warning.	The difference between the actual temperature and set temperature in the rotor chamber is $> 5\text{ }^{\circ}\text{C}$.	Check: • The set temperature Switch off the device. Leave the device to cool for approx. 15 min. Ensure that air can circulate freely through the ventilation gaps. Remove any ice from the rotor chamber.

If you are unable to resolve the error using the suggested measures, please contact your local Eppendorf partner. You can find the address on the Internet at www.eppendorf.com.

8.4 Resetting the excess current switch

Thermal excess current switches are mounted as fuses. Excess current switches switch OFF the switch when the overcurrent protection is triggered, however do not automatically switch it back on.

To switch the excess current switch back on, proceed as follows:

1. Switch off the centrifuge at the mains/power switch.
2. Wait at least 20 s.
3. Switch the centrifuge back on.

The excess current switch is reactivated and the centrifuge ready for operation.

8.5 Unlocking the device lid in an emergency



Only actuate the emergency release in the case of an emergency.



WARNING! Hand injury

If the emergency release of the lid is used, the rotor may continue to rotate. Reaching into the rotor chamber while the rotor is still rotating may cause hand injuries.

- Wait for the rotor to stop moving.
- Grasp the rotor or reach into the rotor chamber only after this.

Tool:

- Rotor key

Prerequisites:

- The device has been disconnected from the mains/power supply.
- The cover of the emergency release was removed with a screwdriver.

1. Wait for the rotor to stop.
2. Use the monitoring glass to check progress.
3. Guide the rotor key into the opening of the emergency release until resistance is met.
4. Press the rotor key against the resistance. At the same time, rotate the rotor key in the direction of the arrow.

The device lid is unlocked and jumps open slightly.

5. Open the device lid.
6. Remove the rotor key.

9 Shut down

9.1 Disconnecting the device from the mains/power supply

Prerequisites:

- The device is switched off.

1. Pull the mains/power plug from the socket.

10 Transport

10.1 Preparing the device for transport

Prerequisites:

- The device is out of operation.

1. Remove the rotor from the device.
2. Close the device lid.

10.2 Transporting the device



WARNING! Personal injury

The device is heavy. Improper lifting and moving of the device can lead to injury.

- At least two people are required to transport the device.
- Use a suitable transport aid to move the device.

Protective equipment:

- Safety boots

Material:

- Transport aid

Prerequisites:

- There is a sufficient number of people ready to help with transport.

1. Transport the device in an upright position. Use a transport aid for this, such as a mobile table.
2. Avoid shaking the device.

10.3 Sending in the device



Use the original packing or suitable and appropriate replacement packing. The device must be adequately protected by the packing during storage, transport and shipment. Eppendorf SE is not liable for damage caused by unsuitable or improper replacement packing.



WARNING! Contamination

Shipping or storing a contaminated device or contaminated accessories may lead to contamination of persons or cause damage to health.

- Decontaminate the device and accessories before shipping or putting them into storage.

Material:

- Packing

Prerequisites:

- The device has been taken out of service.
 - The device is decontaminated.
1. Download the decontamination certificate for goods returns from <https://www.eppendorf.link/decontamination/>.
 2. Complete the decontamination certificate.
 3. Pack the device.
 4. Attach the decontamination certificate securely to the outside of the packing for transport.
 5. Send in the device.

11 Storage

11.1 Storing accessories

1. Store rotors with the rotor lid open.
2. Do not store rotors, rotor lids and accessories in areas with strong UV radiation.

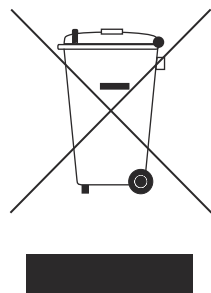
12 Disposal

12.1 Legal regulations

Electrical and electronic equipment in EU countries

Electrical and electronic equipment must be disposed of in EU member states in accordance with Directive 2012/19/EU. This directive has been implemented into national law by all EU member states.

Electrical and electronic equipment placed on the market after August 13, 2005, must be specially marked. According to the European standard EN 50419, the following symbol can be used for this marking:



Batteries and rechargeable batteries in EU countries

Batteries and rechargeable batteries must be disposed of in an environmentally sound manner in EU member states in accordance with Regulation (EU) 2023/1542. They must not be disposed of with household waste.

Consumers are required to dispose of used batteries and rechargeable batteries at an authorized collection point.

Table 1: Marking on batteries

Symbol	Meaning
	Battery must not be disposed of with household waste.
	Battery contains cadmium. Battery must not be disposed of with household waste.
	Battery contains mercury. Battery must not be disposed of with household waste.

Symbol	Meaning
	Battery contains lead. Battery must not be disposed of with household waste.

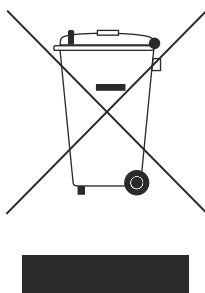
Non-EU countries

Non-EU countries have country-specific standards for the disposal of waste electrical and electronic equipment and the disposal of batteries and rechargeable batteries.

Notes on disposal of electrical and electronic equipment in the United Kingdom

In the United Kingdom, the disposal of electrical and electronic equipment is governed by national regulations which are based on national legislation from 2013, The Waste Electrical and Electronic Equipment Regulations 2013 (as amended), which apply to these devices.

According to these regulations, any electrical and electronic equipment that was put on the market after August 13, 2005 in the business-to-business sector – which applies to this product – must no longer be disposed of with household waste. They are marked with the following symbol to indicate this:



As the disposal regulations may differ from one country to another, please contact your supplier for more information.

12.2 Preparing for disposal

Preparing for disposal according to legal regulations

 For information on the legal regulations applicable in your country, contact your local authority and your Eppendorf partner.

 Dispose of non-decontaminated devices as hazardous waste.



WARNING! Fire or explosion

The device contains flammable refrigerant. If the refrigerant used comes into contact with sparks, it will ignite. Persons may be injured.

- Dispose of the device properly in accordance with national or local regulations.

1. Check which legal regulations apply to disposal in your country.
2. Choose a certified disposal company or contact your Eppendorf partner.

Removing batteries and rechargeable batteries

1. Check whether your device contains permanently installed batteries or rechargeable batteries.
2. Only remove the batteries and rechargeable batteries that are not permanently installed.
3. Dispose of the removed batteries and rechargeable batteries in accordance with the legal regulations of your country.

Creating a decontamination certificate

Prerequisites:

- The device has been decontaminated.
1. Download the decontamination certificate from the website
<https://www.eppendorf.link/decontamination/>.
 2. Complete the decontamination certificate.

12.3 Handing over the device to the disposal company

1. Inform the disposal company of any hazards posed by the device, e.g., locking devices, flammable substances.
2. Hand over the device and the decontamination certificate to the certified disposal company.

13 Technical data

13.1 Dimensions

Device

Width	700 mm
Height with lid closed	353 mm
Height with lid open	793 mm
Total depth	646 mm
Footprint depth	523 mm

Packing

Width	840 mm
Depth	770 mm
Height	520 mm

13.2 Weight

Device without rotor	89 kg
Device with packing	99 kg

Rotors and accessories

S-4-104	Rotor	5220 g
	Bucket	575 g
	DWP bucket	790 g
A-4-81	Rotor	5400 g
	Bucket	585 g
	Flex bucket	810 g
	Form bucket 7×50	880 g
A-4-62	Rotor	2900 g
	Bucket	460 g
	MTP bucket	730 g
S-4-72	Rotor	3100 g
	Bucket	290 g
A-4-44	Rotor	1600 g

	Bucket	290 g
	Form bucket	420 g
A-2-DWP-AT	Rotor	5250 g
	Bucket	970 g
A-2-DWP	Rotor	2000 g
	MTP bucket	630 g
F-34-6-38	Rotor	3220 g
FA-45-6-30	Rotor	3300 g
FA-45-48-11	Rotor	2400 g
FA-45-30-11	Rotor	1300 g
F-45-30-11	Rotor	900 g
FA-45-20-17	Rotor	2800 g
F-35-48-17	Rotor	2100 g
	Sleeve	30 g
F-45-48-PCR	Rotor	1000 g

13.3 Mains/power supply

Power connection	220 V – 230 V $\pm 10\%$, 50 Hz – 60 Hz 120 V $\pm 10\%$, 60 Hz
Current consumption	220 V – 230 V: 10 A 120 V: 12 A
Power consumption	220 V – 230 V: max. 1650 W 120 V: max. 1300 W
Electromagnetic compatibility Interference emission (radio interference)	• DIN EN 61326-1 – Class A • DIN EN 55011 – Class A • CFR 47 FCC Part 15 – Class A
Electromagnetic compatibility Noise immunity	The device meets the following requirements: • DIN EN 61326-1 Industrial electromagnetic environment
Overvoltage category	II
Pollution degree	2
Fuses	220 V – 230 V: Excess current switch 12 A 120 V: Excess current switch 15 A

13.4 Refrigerant

Refrigerant	R290 (90 g)
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13.5 Ambient conditions

Operation

Environment	For indoor use only
Room volume (air volume at the location)	12 m ³
Clearance to other devices and walls	50 cm
Clearance between the rear of the device and other devices and walls	30 cm
Ambient temperature	10 °C – 35 °C
Relative humidity	10 % – 75 %, non-condensing
Atmospheric pressure	79.5 kPa – 106 kPa
Use above sea level	2000 m max.

Transport

	General transport	Air freight
Air temperature	-25 °C – 60 °C	-20 °C – 55 °C
Relative humidity	10 % – 75 %	10 % – 75 %
Atmospheric pressure	30 kPa – 106 kPa	30 kPa – 106 kPa

Storage

	In transport packing	Without transport packing
Air temperature	-25 °C – 55 °C	-5 °C – 45 °C
Relative humidity	10 % – 75 %	10 % – 75 %
Atmospheric pressure	70 kPa – 106 kPa	70 kPa – 106 kPa

13.6 Noise level

The noise level was measured frontally in a sound measuring room with accuracy class 1 (DIN EN ISO 3745) at a distance of 1 m from the device and at lab bench height.

Rotor A-4-81 (4 x 500 mL)	Rotor A-4-44 (4 x 100 mL)	Rotor F-34-6-38 (6 x 85 mL)	Rotor S-4-104	Rotor FA-45-6-30
< 56 dB(A)	< 56 dB(A)	< 59 dB(A)	< 56 dB(A)	< 57 dB(A)

13.7 Influence of rotational speed on the temperature

Voltage	Rotor	Temperature at maximum rotational speed	Rotational speed required to maintain a temperature of 4 °C
220 V – 230 V	F-34-6-38	9 °C ±2 °C	11700 rpm
	FA-45-6-30	9 °C ±2 °C	11700 rpm
120 V	F-34-6-38	9 °C ±2 °C	11700 rpm
	FA-45-6-30	10 °C ±2 °C	11700 rpm
	A-2-DWP-AT	7 °C ±2 °C	4200 rpm

13.8 Acceleration and deceleration times



- Level 9: Shortest acceleration/deceleration time
- Level 0: Longest acceleration/deceleration time without brake

Table 2: Acceleration times

Rotor	Level									
	0	1	2	3	4	5	6	7	8	9
A-4-81	≤564 s	≤350 s	≤194 s	≤129 s	≤109 s	≤94 s	≤79 s	≤65 s	≤54 s	≤48 s
A-4-81-MTP/ Flex	≤564 s	≤349 s	≤192 s	≤127 s	≤107 s	≤92 s	≤76 s	≤61 s	≤49 s	≤40 s
A-4-62	≤564 s	≤349 s	≤193 s	≤128 s	≤108 s	≤93 s	≤76 s	≤62 s	≤46 s	≤37 s
A-4-62-MTP/ Flex	≤564 s	≤349 s	≤192 s	≤127 s	≤107 s	≤92 s	≤76 s	≤61 s	≤44 s	≤33 s
A-4-44	≤462 s	≤352 s	≤240 s	≤183 s	≤148 s	≤114 s	≤94 s	≤69 s	≤42 s	≤25 s
A-2-DWP-AT	≤629 s	≤392 s	≤218 s	≤144 s	≤121 s	≤104 s	≤87 s	≤71 s	≤60 s	≤52 s
A-2-DWP	≤443 s	≤262 s	≤179 s	≤118 s	≤90 s	≤73 s	≤61 s	≤44 s	≤25 s	≤16 s
FA-45-6-30	≤818 s	≤710 s	≤429 s	≤339 s	≤287 s	≤227 s	≤168 s	≤112 s	≤71 s	≤48 s
F-34-6-38	≤811 s	≤518 s	≤345 s	≤278 s	≤238 s	≤196 s	≤148 s	≤111 s	≤74 s	≤52 s
F-45-30-11	≤478 s	≤307 s	≤215 s	≤161 s	≤116 s	≤86 s	≤68 s	≤56 s	≤36 s	≤23 s
F-45-48-PCR	≤373 s	≤241 s	≤157 s	≤115 s	≤91 s	≤75 s	≤60 s	≤50 s	≤32 s	≤19 s

Rotor	Level									
	0	1	2	3	4	5	6	7	8	9
S-4-104	≤753 s	≤498 s	≤278 s	≤198 s	≤154 s	≤126 s	≤108 s	≤79 s	≤59 s	≤41 s
S-4-72	≤590 s	≤366 s	≤246 s	≤178 s	≤143 s	≤106 s	≤79 s	≤53 s	≤35 s	≤23 s
F-35-48-17	≤507 s	≤388 s	≤264 s	≤201 s	≤163 s	≤125 s	≤89 s	≤62 s	≤34 s	≤23 s
FA-45-48-11	≤658 s	≤417 s	≤310 s	≤237 s	≤196 s	≤150 s	≤114 s	≤74 s	≤41 s	≤28 s
FA-45-30-11	≤481 s	≤307 s	≤215 s	≤160 s	≤117 s	≤86 s	≤68 s	≤56 s	≤36 s	≤24 s
FA-45-20-17	≤882 s	≤563 s	≤375 s	≤303 s	≤259 s	≤213 s	≤161 s	≤119 s	≤60 s	≤38 s

Table 3: Deceleration times

Rotor	Level									
	0	1	2	3	4	5	6	7	8	9
A-4-81	≤1003 s	≤357 s	≤200 s	≤135 s	≤114 s	≤100 s	≤81 s	≤66 s	≤53 s	≤40 s
A-4-81-MTP/ Flex	≤1148 s	≤354 s	≤200 s	≤134 s	≤113 s	≤98 s	≤81 s	≤65 s	≤52 s	≤40 s
A-4-62	≤876 s	≤357 s	≤201 s	≤142 s	≤114 s	≤98 s	≤81 s	≤65 s	≤48 s	≤29 s
A-4-62-MTP/ Flex	≤969 s	≤357 s	≤198 s	≤133 s	≤114 s	≤98 s	≤80 s	≤63 s	≤48 s	≤33 s
A-4-44	≤541 s	≤361 s	≤248 s	≤190 s	≤157 s	≤121 s	≤99 s	≤74 s	≤44 s	≤24 s
A-2-DWP-AT	≤1169 s	≤401 s	≤225 s	≤149 s	≤127 s	≤110 s	≤90 s	≤73 s	≤61 s	≤44 s
A-2-DWP	≤531 s	≤268 s	≤186 s	≤125 s	≤96 s	≤76 s	≤64 s	≤47 s	≤26 s	≤16 s
FA-45-6-30	≤998 s	≤721 s	≤439 s	≤350 s	≤298 s	≤236 s	≤175 s	≤115 s	≤77 s	≤55 s
F-34-6-38	≤1252 s	≤521 s	≤352 s	≤288 s	≤244 s	≤202 s	≤155 s	≤115 s	≤77 s	≤57 s
F-45-30-11	≤433 s	≤303 s	≤215 s	≤162 s	≤117 s	≤85 s	≤69 s	≤56 s	≤36 s	≤22 s
F-45-48-PCR	≤262 s	≤231 s	≤153 s	≤115 s	≤92 s	≤75 s	≤59 s	≤50 s	≤32 s	≤19 s
S-4-104	≤1337 s	≤508 s	≤291 s	≤208 s	≤164 s	≤136 s	≤113 s	≤84 s	≤63 s	≤37 s
S-4-72	≤805 s	≤375 s	≤256 s	≤189 s	≤152 s	≤113 s	≤83 s	≤56 s	≤39 s	≤19 s
F-35-48-17	≤511 s	≤394 s	≤274 s	≤210 s	≤171 s	≤133 s	≤94 s	≤67 s	≤36 s	≤21 s
FA-45-48-11	≤763 s	≤416 s	≤314 s	≤245 s	≤202 s	≤153 s	≤118 s	≤76 s	≤40 s	≤28 s
FA-45-30-11	≤426 s	≤303 s	≤214 s	≤160 s	≤117 s	≤86 s	≤69 s	≤56 s	≤36 s	≤23 s
FA-45-20-17	≤838 s	≤567 s	≤383 s	≤313 s	≤266 s	≤219 s	≤169 s	≤124 s	≤61 s	≤40 s

13.9 Application parameters

Time	1 min – 99 min, infinite (∞)
Adjustable temperature	-9 °C – 40 °C
Rotational speed	100 rpm – 14000 rpm • 100 rpm – 1000 rpm: Adjustable in increments of 10 rpm • 1000 rpm – 5000 rpm: Adjustable in increments of 50 rpm • 5000 rpm – 14000 rpm: Adjustable in increments of 100 rpm
Relative centrifugal force	5 rcf – 20817 rcf • 5 rcf – 100 rcf: Adjustable in increments of 5 rcf • 100 rcf – 3000 rcf: Adjustable in increments of 50 rcf • 3000 rcf – 20817 rcf: Adjustable in increments of 100 rcf
Maximum load	4 × 750 mL
Maximum kinetic energy	22300 J
Permissible density for material for centrifuging	1.2 g/mL
Subject to testing in Germany	Yes

13.10 Service life

Service life	10 years
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13.11 Shelf life of rotors, rotor lids, and accessories

The maximum shelf life of rotors and accessories is specified in cycles and years. The number of cycles is decisive. If the number of cycles cannot be determined, the shelf life in years applies.

Each centrifugation run in which the rotor is accelerated and decelerated is counted as a cycle, regardless of the speed and duration of the centrifugation run.

Rotor	Shelf life from first use	
	In cycles	In years
A-2-DWP-AT	100000	15
A-2-DWP	34000	7
A-4-44	34000	7
A-4-62	40000	7

Rotor	Shelf life from first use	
	In cycles	In years
A-4-81	100000	15
F-34-6-38	75000	10
FA-45-6-30	100000	15
FA-45-48-11	100000	15
FA-45-20-17	100000	15
F-35-48-17	100000	15
S-4-72	100000	15
S-4-104	100000	15

Unless otherwise specified (centrifuge manual, number of cycles indicated on the rotor, instructions for use for the rotor), all other rotors and rotor lids can be used throughout the entire lifetime of the centrifuge if the following prerequisites are met:

- Proper use
- Recommended care
- Damage-free condition

Accessories	Shelf life from first use	
	In cycles	In years
Rotor lids made of polycarbonate (PC), polypropylene (PP), or polyetherimide (PEI)	–	3 years
Aerosol-tight rotor lids without replaceable seal	50 autoclaving cycles	–
QuickLock rotor lids	–	3 years
QuickLock rotor lid seals	50 autoclaving cycles	–
Caps made of PP, PC, PEI	50 autoclaving cycles	3 years
Adapter	–	1 year

The date of manufacture is stamped on rotors in the form *03/15* or *03/2015* (= March 2015). The date of manufacture is stamped in the form of a ⌚ clock on the inside of plastic rotor lids.

To ensure aerosol tightness, the following applies:

- Replace the seal on QuickLock rotor lids after 50 autoclaving cycles.
- Replace the seal on aerosol-tight rotor lids with replaceable seals (e.g., QuickLock rotor lids) after 50 autoclaving cycles.
- Replace aerosol-tight caps after 50 autoclaving cycles.

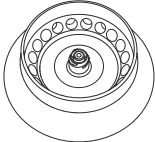
14 Suitable rotors

Centrifuges from Eppendorf SE can only be operated with rotors that are specifically designed for the device. All compatible rotors for the Centrifuge 5810 R are also compatible with the Centrifuge 5811 R.

Observe the manufacturer's specifications regarding the centrifugation stability of the sample vessels (maximum *g*-force).

14.1 Rotor FA-45-20-17

Aerosol-tight fixed-angle rotor for 20 reaction vessels

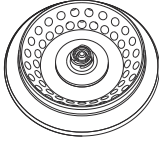
Rotor FA-45-20-17				
	Max. <i>g</i> -force:		20193 × <i>g</i>	
	Max. rotational speed:		13100 rpm	
	Max. weight in rotor (adapter, vessel, and contents):		20 × 9.5 g	

Vessel	Vessel Capacity Vessels per adapter/rotor	Adapter Order no. (International)	Bottom shape Diameter	Max. <i>g</i> -force Max. rotational speed Radius
	Reaction vessel 1.5 mL/2.0 mL 1/20	 5820 768 002	Open Ø 11 mm	18227 × <i>g</i> 13100 rpm 9.5 cm
	Reaction vessel 5 mL –/20	–	Conical Ø 17 mm	20913 × <i>g</i> 13100 rpm 10.9 cm
	HPLC vial 1/20	 5820 770 007	Open Ø 12 mm	17076 × <i>g</i> 13100 rpm 8.9 cm
	Cryogenic vessel 1.0 mL/2.0 mL 1/12	 5820 769 009	Flat Ø 13 mm	18802 × <i>g</i> 13100 rpm 9.8 cm

14.2 Rotor FA-45-48-11

Aerosol-tight fixed-angle rotor for 48 reaction vessels

Rotor FA-45-48-11

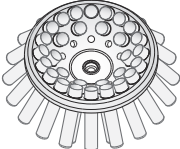
	Max. <i>g</i> -force of the outer row:	19083 × <i>g</i>
	Max. <i>g</i> -force of the inner row:	16816 × <i>g</i>
	Max. rotational speed:	13000 rpm
	Max. weight in rotor (adapter, vessel, and contents):	48 × 3.75 g

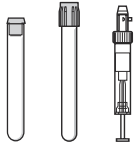
Vessel	Vessel Capacity Vessels per adapter/rotor	Adapter Order no. (International)	Bottom shape Diameter	Max. <i>g</i> -force of the outer row Max. <i>g</i> -force of the inner row Max. rotational speed Radius of the outer row Radius inner row
	Reaction vessel 1.5 mL/2.0 mL –/48	–	Round Ø 11 mm	19083 × <i>g</i> 16816 × <i>g</i> 13000 rpm 10.1 cm 8.9 cm
	PCR vessel 0.2 mL 1/48	 5425 715 005	Conical Ø 6 mm	15115 × <i>g</i> 12848 × <i>g</i> 13000 rpm 8 cm 6.8 cm
	Reaction vessel 0.4 mL 1/48	 5425 717 008	Conical Ø 6 mm	19083 × <i>g</i> 16816 × <i>g</i> 13000 rpm 10.1 cm 8.9 cm
	Reaction vessel 0.5 mL 1/48	 5425 716 001	Open Ø 8 mm	17005 × <i>g</i> 14737 × <i>g</i> 13000 rpm 9 cm

Vessel	Vessel	Adapter	Bottom shape	Max. g-force of the outer row
	Capacity		Diameter	Max. g-force of the inner row
	Vessels per adapter/rotor	Order no. (International)		Max. rotational speed
				Radius of the outer row
				Radius inner row
				7.8 cm
	Microtainer		Open	$19083 \times g$
	0.6 mL		$\varnothing$ 8 mm	$16816 \times g$
	1/48	5425 716 001		13000 rpm
				10.1 cm
				8.9 cm

14.3 Rotor F-35-48-17

Fixed-angle rotor with 48 steel sleeves for 48 reaction vessels

Rotor F-35-48-17	
	Max. g-force:
	$5005 \times g$
	Max. rotational speed:
	5500 rpm
	Max. load (adapter, vessel, and contents):
	48×56 g

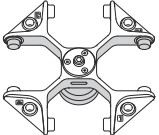
Vessel	Vessel	Adapter	Bottom shape	Max. g-force
	Capacity		Vessel diameter	Max. rotational speed
	Number per adapter/rotor	Order no. (International)	Max. vessel length	Radius
	Vessel		Flat	$5005 \times g$
	7.5 mL – 12 mL		$\varnothing$ 16 mm	5500 rpm
	1/48	5702 701 009	127 mm	14.8 cm

Vessel	Vessel Capacity	Adapter	Bottom shape	Max. <i>g</i> -force
	Number per adapter/rotor	Order no. (International)	Vessel diameter	Max. rotational speed
			Max. vessel length	Radius
	Conical vessel 15 mL 1/40	 5702 708 003	Conical Ø 17 mm 127 mm	5005 × <i>g</i> 5500 rpm 14.8 cm

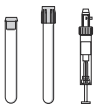
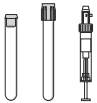
14.4 Rotor S-4-72

Swing-bucket rotor for 4 × 250 mL round bucket

Rotor S-4-72

	Max. <i>g</i> -force:	3234 × <i>g</i>
	Max. rotational speed:	4200 rpm
	Max. load per bucket (adapter, vessel, and contents):	450 g
250 mL round bucket		

Plate/vessel	Plate Capacity	Adapter	Bottom shape	Max. <i>g</i> -force
	Number per adapter/rotor	Order no. (International)	Vessel diameter	Max. rotational speed
			Max. vessel length	Radius
	Reaction vessel 1.5 mL/2.0 mL 23/104	 5804 794 001	Open Ø 11 mm 43 mm	3136 × <i>g</i> 4200 rpm 15.9 cm
	Reaction vessel 5 mL 8/32	 5804 793 005	Conical Ø 17 mm 60 mm	3215 × <i>g</i> 4200 rpm 16.3 cm

Plate/vessel	Plate Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. vessel length	Max. <i>g</i> -force Max. rotational speed Radius
	Vessel 4 mL – 8 mL 14/56	 5804 789 008	Round Ø 13 mm 115 mm	3136 × <i>g</i> 4200 rpm 15.7 cm
	Vessel 7.5 mL – 12 mL 13/52	 5804 791 002	Round Ø 16 mm 112 mm	3096 × <i>g</i> 4200 rpm 15.7 cm
	Vessel 9 mL 12/48	 5804 792 009	Round Ø 17.5 mm 113 mm	3116 × <i>g</i> 4200 rpm 15.8 cm
	Conical vessel 15 mL 8/32	 5804 783 000	Conical Ø 17 mm 120 mm	3234 × <i>g</i> 4200 rpm 16.4 cm
	Conical vessel 25 mL 4/16	  5804 784 006 5804 734 000	Conical Ø 29.8 mm 84.5 mm	2701 × <i>g</i> 4200 rpm 13.7 cm
	Conical vessel 25 mL 4/16	  5804 784 006 5804 733 004	Conical Ø 29.8 mm 91 mm	2524 × <i>g</i> 4200 rpm 12.8 cm
	Conical vessel 50 mL 4/16	 5804 784 006	Conical Ø 30 mm 120 mm	3234 × <i>g</i> 4200 rpm 16.4 cm

Plate/vessel	Plate Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. vessel length	Max. <i>g</i> -force Max. rotational speed Radius
	Conical vessel 50 mL 4/16	 5804 784 006	Conical Ø 30 mm 118 mm	3234 × <i>g</i> 4200 rpm 16.4 cm
	Conical vessel 50 mL 2/8	 5804 785 002	Conical Ø 29 mm 120 mm	2602 × <i>g</i> 3900 rpm 15.3 cm
	Centrifuge bottle – 1/4	 5804 787 005 Conical bottles require the adapter supplied by the manufacturer	Flat Ø 62 mm 130 mm	3155 × <i>g</i> 4200 rpm 16 cm

14.5 Rotor S-4-104 with aerosol-tight plate buckets

Swing-bucket rotor for 4 × plate bucket with aerosol-tight cap.

Always use the plate bucket together with the removal tool and the base element.

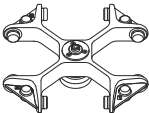
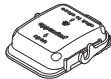
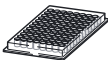
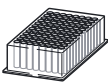
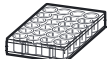
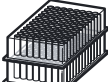
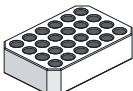
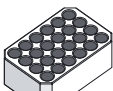
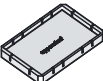
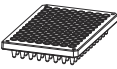
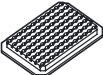
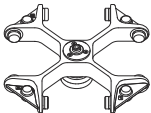
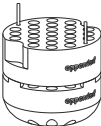
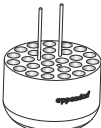
Rotor S-4-104			
		Max. <i>g</i> -force:	2568 × <i>g</i>
		Max. rotational speed:	3900 rpm
		Max. load per bucket (removal tool, base element, adapter, plate, and contents):	530 g
Plate bucket with aerosol-tight cap			

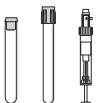
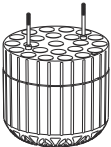
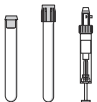
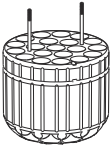
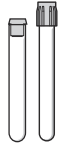
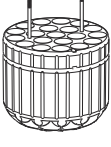
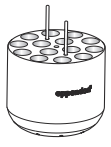
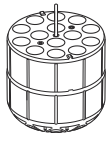
Plate	Plate Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. loading height	Max. <i>g</i> -force Max. rotational speed Radius
	Microplate 96/384 wells 4/16	–	Flat 47 mm/60 mm	2568 × <i>g</i> 3900 rpm 15.1 cm
	Deepwell plate 96 wells 1/4	–	Flat 47 mm/60 mm	2568 × <i>g</i> 3900 rpm 15.1 cm
	Cell-culture plate 2/8	–	Flat 47 mm/60 mm 60 mm	2568 × <i>g</i> 3900 rpm 15.1 cm
	Kit 1/4	–	Flat 47 mm/60 mm	2568 × <i>g</i> 3900 rpm 15.1 cm
	IsoRack 24 × 0.5 mL reaction vessels 1/4	 5825 708 008	Open Ø 6 mm 47 mm/60 mm	2449 × <i>g</i> 3900 rpm 14.4 cm
	IsoRack 24 × 1.5 mL reaction vessels 1/4	 5825 709 004	Open Ø 11 mm 47 mm/60 mm	2381 × <i>g</i> 3900 rpm 14.0 cm
	PCR plate 384 wells 1/4	 5825 713 001	Flat 47 mm/60 mm	2415 × <i>g</i> 3900 rpm 14.2 cm
	PCR plate 96 wells 1/2	 5825 711 009	Conical 47 mm/60 mm	2449 × <i>g</i> 3900 rpm 14.4 cm
Slide	CombiSlide 12 slides 12/48	 5825 706 005	Flat 47 mm/60 mm	1000 × <i>g</i> 2467 rpm 14.7 cm

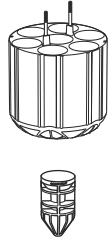
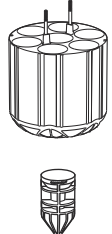
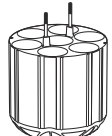
14.6 Rotor S-4-104 with aerosol-tight round buckets

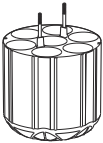
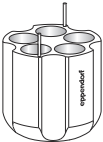
Swing-bucket rotor for 4 × 750 mL round buckets with aerosol-tight cap.

Rotor S-4-104				
	Max. <i>g</i> -force:		3214 × <i>g</i>	
	Max. rotational speed:		3900 rpm	
		Max. load per bucket (adapter, vessel, and contents):		1000 g
750 mL round bucket with aerosol-tight cap				

Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aer- osol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Reaction vessel 1.5 mL/2.0 mL 50/200	 5825 740 009	Open Ø 11 mm 39 mm	3162 × <i>g</i> 3900 rpm 18.6 cm
	Reaction vessel 5 mL 14/56	 5825 734 009 (without upper part)	Conical Ø 17 mm 60 mm	3197 × <i>g</i> 3900 rpm 18.8 cm
	Round-bottom vessel Ø 12 mm × 75 mm 27/108	 5825 747 003	Round Ø 12 mm 108 mm/115 mm	3078 × <i>g</i> 3900 rpm 18.1 cm

Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Vessel 4 mL – 8 mL 23/92	 5825 738 004	Round Ø 13 mm × 100 mm 107 mm/112 mm	3044 × <i>g</i> 3900 rpm 17.9 cm
	Vessel 7.5 mL – 16 mL 20/80	 5825 736 001	Round Ø 16 mm × 98 mm 114 mm/119 mm	3112 × <i>g</i> 3900 rpm 18.3 cm
	Vessel 8 mL – 16 mL 7/28 (load only inner bores)	 5825 736 001	Round Ø 16 mm 125 mm (do not use aerosol-tight cap)	3061 × <i>g</i> 3900 rpm 18 cm
	Vessel 9 mL 20/80	 5825 743 008	Round Ø 17.5 mm × 100 mm 106 mm/111 mm	3044 × <i>g</i> 3900 rpm 17.9 cm
	Round-bottom vessel Ø 14 mm 14/56	 5825 748 000	Round Ø 17.5 mm 112 mm/117 mm	3027 × <i>g</i> 3900 rpm 17.8 cm
	Conical vessel 15 mL 14/56	 5825 734 009	Conical Ø 17 mm × 104 mm 121 mm/125 mm	3197 × <i>g</i> 3900 rpm 18.8 cm

Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Conical vessel (skirted) 30 mL 8/32	 5825 755 006	Flat Ø 25 mm 106 mm/112 mm	2602 × <i>g</i> 3900 rpm 15.3 cm
	Conical vessel 25 mL 7/28	 5825 733 002 5820 734 000	Conical Ø 30 mm × 109 mm 78.5 mm/78.5 mm	2567 × <i>g</i> 3900 rpm 15.1 cm
	Conical vessel 25 mL 6/28	 5825 733 002 center bore cannot be used 5820 733 004	Conical Ø 30 mm × 109 mm 83 mm/83 mm	2737 × <i>g</i> 3900 rpm 16.1 cm
	Conical vessel 50 mL 7/28	 5825 733 002	Conical Ø 30 mm × 109 mm 116 mm/122 mm	3180 × <i>g</i> 3900 rpm 18.7 cm

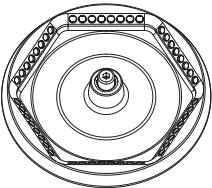
Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Conical vessel 50 mL 6/28	 5825 733 002 center bore cannot be used	Conical Ø 30 mm × 109 mm ~122 mm	3180 × <i>g</i> 3900 rpm 18.7 cm
	Conical vessel 50 mL 5/20	 5825 732 006	Conical Ø 30 mm × 104 mm 116 mm/120 mm	3027 × <i>g</i> 3900 rpm 17.8 cm
	Centrifuge bottle 175 mL – 250 mL 1/4	 5825 741 005 Conical bottles require the adapter supplied by the manufacturer	Flat Ø 62 mm × 129 mm 128.5 mm/145 mm	3146 × <i>g</i> 3900 rpm 18.5 cm
	Wide-neck bottle 750 mL 1/4	 5825 744 004	Flat Ø 102 mm × 132 mm 140 mm (do not use aerosol-tight cap)	3146 × <i>g</i> 3900 rpm 18.5 cm
	Corning centrifuge bottle		Conical	3180 × <i>g</i>

Vessel	Vessel Capacity	Adapter	Bottom shape	Max. <i>g</i> -force
			Vessel diameter	Max. rotational speed
		Order no. (International)	Max. length of vessel with/without aerosol-tight cap	Radius
	500 mL		Ø 96 mm × 132 mm	3900 rpm
	1/4	5825 745 000	147 mm (do not use aerosol-tight cap)	18.7 cm

14.7 Rotor F-45-48-5-PCR

Fixed-angle rotor for 48 PCR vessels.

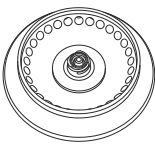
Rotor F-45-48-5-PCR

	Max. <i>g</i> -force:	15294 × <i>g</i>
	Max. rotational speed:	12000 rpm
	Max. weight in rotor (adapter, vessel, and contents):	6 × 3.5 g

Vessel	Vessel Capacity	Adapter	Bottom shape	Max. <i>g</i> -force
			Diameter	Max. rotational speed
		Order no. (International)		Radius
	0.2 mL -/48	-	Conical Ø 6 mm	15294 × <i>g</i> 12000 rpm 9.5 cm
	PCR strips 8 × 0.2 mL 5 × 0.2 mL -/6 × 8 -/6 × 5	-	Conical Ø 6 mm	15294 × <i>g</i> 12000 rpm 9.5 cm

14.8 Rotors FA-45-30-11 and F-45-30-11

Aerosol-tight fixed-angle rotor and fixed-angle rotor for 30 reaction vessels.

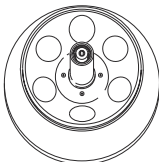
Rotors FA-45-30-11 and F-45-30-11				
	Max. <i>g</i> -force:		20817 × <i>g</i>	
	Max. rotational speed:		14000 rpm	
	Max. weight in rotor (adapter, vessel, and contents):		30 × 3.75 g	

Vessel	Vessel Capacity	Adapter	Bottom shape	Max. <i>g</i> -force
	Vessels per adapter/rotor	Order no. (International)	Diameter	Max. rotational speed
	Radius			
	Reaction vessel 1.5 mL/2.0 mL -/30	–	– Ø 11 mm	20817 × <i>g</i> 14000 rpm 9.5 cm
	PCR vessel 0.2 mL 1/30	 5425 715 005	Conical Ø 6 mm	16200 × <i>g</i> 14000 rpm 7.4 cm
	Reaction vessel 0.4 mL 1/30	 5425 717 008	Conical Ø 6 mm	20817 × <i>g</i> 14000 rpm 9.5 cm
	Reaction vessel 0.5 mL 1/30	 5425 716 001	Open Ø 8 mm	18400 × <i>g</i> 14000 rpm 8.4 cm
	Microtainer 0.6 mL/2 mL 1/30	 5425 716 001	Open Ø 8 mm	20817 × <i>g</i> 14000 rpm 9.5 cm

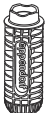
14.9 Rotor F-34-6-38

Fixed-angle rotor for 6 × 85 mL vessels

Rotor F-34-6-38

	Max. <i>g</i> -force	18514 × <i>g</i>
	Max. rotational speed	12000 rpm
	Max. load (adapter, vessel, and contents)	6 × 125 g

Vessel	Vessel Capacity Vessels per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. vessel length including vessel lid	Max. <i>g</i> -force Max. rotational speed Radius
	Reaction vessel 1.5 mL/2.0 mL 4/24	 5804 770 005	Round Ø 11 mm 43 mm	18200 × <i>g</i> 12000 rpm 11.3 cm
	Reaction vessel 5 mL 1/6	 5804 777 000	Conical Ø 17 mm –	16842 × <i>g</i> 12000 rpm 10.45 cm
	Blood collection vessel 2 mL – 5 mL 3/18	 5804 738 004	Round Ø 13 mm 80 mm	17065 × <i>g</i> 12000 rpm 10.6 cm
	Vessel 4 mL – 7 mL 3/18	 5804 739 000	Round Ø 13 mm 107 mm	18353 × <i>g</i> 12000 rpm 11.4 cm
	Vessel 7 mL – 15 mL 2/12	 5804 771 001	Round Ø 16 mm 112 mm	18000 × <i>g</i> 12000 rpm 11.2 cm

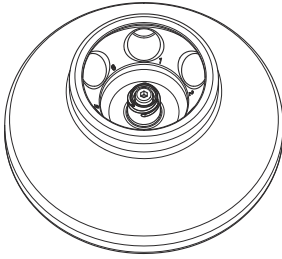
Vessel	Vessel Capacity Vessels per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. vessel length including vessel lid	Max. <i>g</i> -force Max. rotational speed Radius
	Conical vessel 15 mL 1/6	 5804 776 003	Conical Ø 17.5 mm 123 mm	$17200 \times g$ 12000 rpm 10.7 cm
	Vessel 15 mL – 18 mL 1/6	 5804 772 008	Round Ø 26 mm 123 mm	$17550 \times g$ 12000 rpm 10.9 cm
	Round-bottom vessel 20 mL – 30 mL 1/6	 5804 774 000	Round Ø 18 mm 123 mm	$17700 \times g$ 12000 rpm 11.0 cm
	Round-bottom vessel 50 mL 1/6	 5804 774 000	Round Ø 29 mm 123 mm	$18014 \times g$ 12000 rpm 11.2 cm
	Conical vessel 25 mL 1/6	  5804 775 007 5804 734 000	Conical Ø 30 mm 78.5 mm	$14070 \times g$ 12000 rpm 8.7 cm
	Conical vessel 50 mL 1/6	 5804 775 007	Conical Ø 30 mm 117 mm	$17387 \times g$ 12000 rpm 10.8 cm

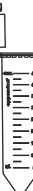
Vessel	Vessel Capacity	Adapter	Bottom shape	Max. <i>g</i> -force
	Vessels per adapter/rotor	Order no. (International)	Vessel diameter	Max. rotational speed
			Max. vessel length including vessel lid	Radius
	Conical vessel 50 mL 1/6	 5804 775 007	Conical Ø 30 mm 118 mm	17387 × <i>g</i> 12000 rpm 10.8 cm
	Round-bottom vessel 85 mL –/6	–	– Ø 38.2 mm 121 mm	18500 × <i>g</i> 12000 rpm 11.5 cm

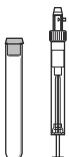
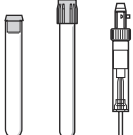
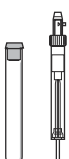
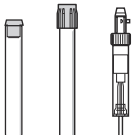
14.10 Rotor FA-45-6-30

Aerosol-tight fixed-angle rotor for 6 conical vessels.

 Corning® 50 mL PET Centrifuge Tubes are not suitable for rotor FA-45-6-30.
These tubes can get stuck in the bores after centrifugation.

Rotor FA-45-6-30		
	Max. <i>g</i> -force:	20133 × <i>g</i>
	Max. rotational speed:	12100 rpm
	Max. weight in rotor (adapter, vessel, and contents):	6 × 75 g

Vessel	Vessel Capacity Vessels per adapter/rotor	Adapter Order no. (International)	Bottom shape Diameter Max. vessel length including vessel lid	Max. <i>g</i> -force Max. rotational speed Radius
	Conical vessel 15 mL 1/6	 5820 717 009	Conical Ø 17 mm 125 mm	$19642 \times g$ 12100 rpm 12.0 cm
	Conical vessel 25 mL 1/6	 5820 734 000	Conical Ø 30 mm 85 mm	$15878 \times g$ 12100 rpm 9.7 cm
	Conical vessel 25 mL 1/6	 5820 733 000	Conical Ø 30 mm 94 mm	$17023 \times g$ 12100 rpm 10.4 cm
	Conical vessel 50 mL 1/6	— —	Conical Ø 30 mm 127 mm	$20133 \times g$ 12100 rpm 12.3 cm
	Conical vessel 50 mL 1/6	— —	Conical Ø 30 mm 122 mm	$20133 \times g$ 12100 rpm 12.3 cm
	Oak Ridge 10 mL 1/6	 5820 719 001	Round Ø 16 mm 119 mm with lid	$19642 \times g$ 12100 rpm 12.0 cm
	Oak Ridge 16 mL 1/6	 5820 720 000	Round Ø 18 mm 107 mm	$19642 \times g$ 12100 rpm 12.0 cm
	Oak Ridge 30 mL		Round Ø 26 mm	$17187 \times g$ 12100 rpm

Vessel	Vessel Capacity Vessels per adapter/rotor	Adapter Order no. (International)	Bottom shape Diameter Max. vessel length including vessel lid	Max. <i>g</i> -force Max. rotational speed Radius
	1/6	5820 721 006	104 mm	10.5 cm
	Oak Ridge 35 mL 1/6	 5820 722 000206	Conical Ø 29 mm 113 mm	18333 × <i>g</i> 12100 rpm 11.2 cm
	Reaction vessel 5 mL 1/6	 5820 730 005	Conical Ø 17 mm –	19806 × <i>g</i> 12100 rpm 12.1 cm
	Vessel 2.6 mL – 5 mL 1/6	 5820 726 008	Round Ø 13.5 mm –	19642 × <i>g</i> 12100 rpm 12.0 cm
	Vessel 4 mL – 8 mL 1/6	 5820 725 001	Round Ø 13.5 mm 119 mm	19642 × <i>g</i> 12100 rpm 12.0 cm
	Vessel 5.5 mL – 10 mL 1/6	 5820 728 000	Round Ø 16 mm –	19642 × <i>g</i> 12100 rpm 12.0 cm
	Vessel 7.5 mL – 12 mL 1/6	 5820 727 004	Round Ø 16 mm –	19642 × <i>g</i> 12100 rpm 12.0 cm
	Vessel 9 mL 1/6	 5820 729 007	Round Ø 17.5 mm Ø 112 mm	19642 × <i>g</i> 12100 rpm 12.0 cm

14.11 Rotor A-2-DWP

Swing-bucket rotor for 2 × Deepwell plate buckets.

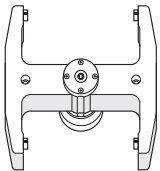
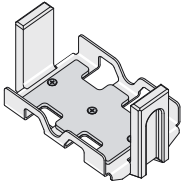
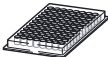
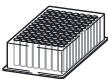
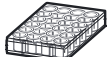
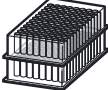
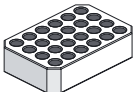
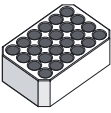
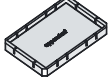
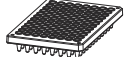
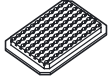
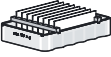
Rotor A-2-DWP				
	Max. <i>g</i> -force:		2250 × <i>g</i>	
	Max. rotational speed:		3700 rpm	
	Max. load per bucket (adapter, plate, and contents):		380 g	
Deepwell plate buckets				
Plate	Plate Capacity Number per adapter/rotor	Adapter Order no. (international)	Bottom shape Tube diameter Max. loading height	Max. <i>g</i> -force Max. rotational speed Radius
	Microplate 96/384 wells 5/10	–	Flat 89 mm	2250 × <i>g</i> 3700 rpm 14.7 cm
	Deepwell plate 96 wells 1/2	–	Flat 89 mm	2250 × <i>g</i> 3700 rpm 14.7 cm
	Cell-culture plate 4/8	–	Flat 89 mm	2250 × <i>g</i> 3700 rpm 14.7 cm
	Kit 1/2	–	Flat 89 mm	2250 × <i>g</i> 3700 rpm 14.7 cm
	IsoRack 24 × 0.5 mL reaction vessels 1/2	 5825 708 008	Open Ø 6 mm 89 mm	2050 × <i>g</i> 3700 rpm 13.8 cm

Plate	Plate Capacity Number per adapter/rotor	Adapter Order no. (international)	Bottom shape Tube diameter Max. loading height	Max. <i>g</i> -force Max. rotational speed Radius
	IsoRack 24 × 1.5 mL reaction vessels 1/2	 5825 709 004	Flat Ø 11 mm 89 mm	1990 × <i>g</i> 3700 rpm 13.3 cm
	PCR plate 384 wells 1/2	 5825 713 001	Flat 89 mm	2170 × <i>g</i> 3700 rpm 14.2 cm
	PCR plate 96 wells 1/2	 5825 711 009	Flat 89 mm	2220 × <i>g</i> 3700 rpm 14.5 cm
Slide	CombiSlide 8 slides 8/16	 5825 706 005	Flat 89 mm	100 × <i>g</i> 791 rpm 14.3 cm

14.12 Rotor A-2-DWP-AT

Swing-bucket rotor for 2 × plate bucket with aerosol-tight cap.

Always use the plate bucket together with the removal tool.

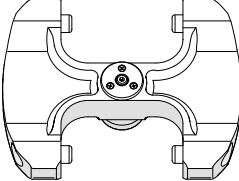
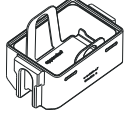
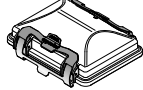
Rotor A-2-DWP-AT			
		Max. <i>g</i> -force:	3486 × <i>g</i>
		Max. rotational speed:	4500 rpm
		Max. load per bucket (removal tool, adapter, plate, and contents):	500 g
Plate bucket with aerosol-tight cap			

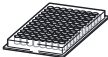
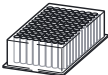
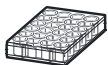
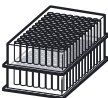
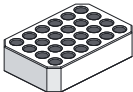
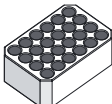
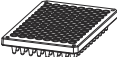
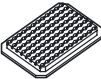
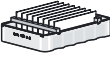
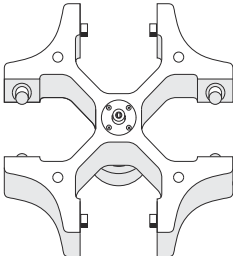
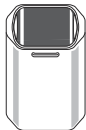
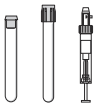
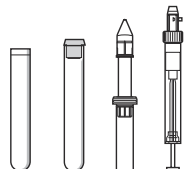
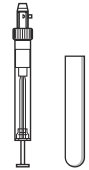
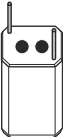
Plate	Plate Capacity Number per adapter/rotor	Adapter Order no. (international)	Bottom shape Tube diameter Max. loading height	Max. <i>g</i> -force Max. rotational speed Radius
	Microplate 96/384 wells Aerosol-tight 75/ not aerosol-tight 89 5/10	–	Flat – 75 mm	$3486 \times g$ 4500 rpm 154 cm
	Deepwell plate 96 wells Aerosol-tight 75/ not aerosol-tight 89 1/2	–	Flat	$3486 \times g$ 4500 rpm 154 cm
	Cell-culture plate Aerosol-tight 75/ not aerosol-tight 89 2/4	–	Flat	$3486 \times g$ 4500 rpm 154 cm
	Kit Aerosol-tight 75/ not aerosol-tight 89 1/2	–	Flat	$3486 \times g$ 4500 rpm 154 cm
	IsoRack 24 × 0.5 mL reaction vessels 1/2	 5825 708 008	Open Ø 6 mm	$2500 \times g$ 3900 rpm 147 cm
	IsoRack 24 × 1.5 mL reaction vessels 1/2	 5825 709 004	Flat Ø 11 mm 60 mm	$2432 \times g$ 3900 rpm 143 cm
	PCR plate 384 wells Aerosol-tight 75/ not aerosol-tight 89		Flat	$3373 \times g$ 4500 rpm

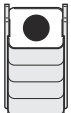
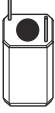
Plate	Plate Capacity Number per adapter/rotor	Adapter Order no. (international)	Bottom shape Tube diameter Max. loading height	Max. <i>g</i> -force Max. rotational speed Radius
	1/2	5825 713 001		149 cm
	PCR plate 96 wells Aerosol-tight 75/ not aerosol-tight 89		Flat	3486 × <i>g</i> 4500 rpm
	1/4	5825 711 009		154 cm
Slide	CombiSlide 8 slides		Flat	100 × <i>g</i> 772 rpm
	8/16	5825 706 005		150 cm

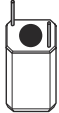
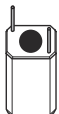
14.13 Rotor A-4-44

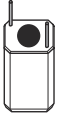
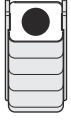
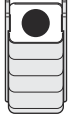
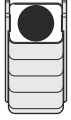
Swing-bucket rotor for 4 × 100 mL rectangular buckets with aerosol-tight cap.

Rotor A-4-44			
		Max. <i>g</i> -force:	4400 × <i>g</i>
		Max. rotational speed:	5000 rpm
		Max. load per bucket (adapter, vessel, and contents):	310 g
100 mL rectangular buckets with aerosol-tight cap			

Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Reaction vessel 1.5 mL/2.0 mL 12/48	 5804 751 000	Flat Ø 11 mm 43 mm/43 mm	4100 × <i>g</i> 5000 rpm 14.8 cm
	Vessel 1.2 mL – 5 mL 14/56	 5804 750 004	Flat Ø 11 mm 102 mm/05 mm	4200 × <i>g</i> 5000 rpm 15.0 cm
	Vessel 2.6 mL – 7 mL 9/36	 5804 752 007	Flat Ø 13 mm 106 mm/108 mm	4200 × <i>g</i> 5000 rpm 15.0 cm
	Vessel 3 mL – 15 mL 7/28	 5804 753 003	Flat Ø 16 mm 106 mm/108 mm	4200 × <i>g</i> 5000 rpm 15.0 cm
	Vessel 7 mL – 17 mL 6/24	 5804 754 000	Flat Ø 17.5 mm 106 mm/110 mm	4200 × <i>g</i> 5000 rpm 15.0 cm
	Conical vessel 15 mL 4/16	 5804 755 006	Conical Ø 17.5 mm –/121 mm	4300 × <i>g</i> 5000 rpm 15.5 cm
	Conical vessel 15 mL		Conical Ø 17.5 mm	4400 × <i>g</i> 5000 rpm

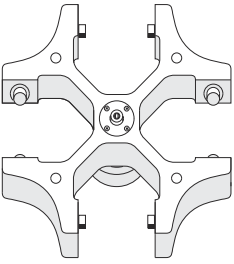
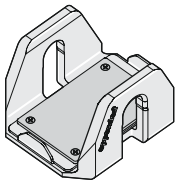
Vessel	Vessel Capacity	Adapter	Bottom shape	Max. <i>g</i> -force
	Number per adapter/rotor	Order no. (International)	Vessel diameter	Max. rotational speed
			Max. length of vessel with/without aerosol-tight cap	Radius
	2/8	5804 717 007	121 mm/121 mm	15.7 cm
	Vessel 7 mL – 18 mL		Flat Ø 20 mm	4200 × <i>g</i> 5000 rpm
	4/16	5804 756 002	104 mm/107 mm	15.0 cm
	Vessel 18 mL – 30 mL		Flat Ø 26 mm	4200 × <i>g</i> 5000 rpm
	2/8	5804 757 009	100 mm/110 mm	15.0 cm
	Conical vessel 25 mL		Conical Ø 30 mm	4332 × <i>g</i> 5000 rpm
	1/4	5804 758 005 Highest adapter module removed	78.5 mm/84.5 mm	15.5 cm
	Conical vessel 25 mL	 	Conical Ø 30 mm	3186 × <i>g</i> 5000 rpm
	1/4	5804 758 005 Highest adapter module removed 5802 733 004	78.5 mm/84.5 mm	11.4 cm
	Conical vessel 25 mL	 	Conical Ø 30 mm	3326 × <i>g</i> 5000 rpm

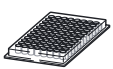
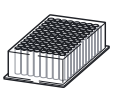
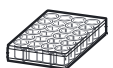
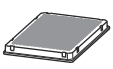
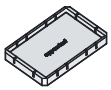
Vessel	Vessel Capacity	Adapter	Bottom shape	Max. <i>g</i> -force
	Number per adapter/rotor	Order no. (International)	Vessel diameter	Max. rotational speed
			Max. length of vessel with/without aerosol-tight cap	Radius
	1/4	5804 718 003 5820 734 000	82.5 mm/86 mm	11.9 cm
	Conical vessel 25 mL		Conical Ø 30 mm	4332 × <i>g</i> 5000 rpm
	1/4	5804 758 005	83 mm/89 mm	15.5 cm
	Conical vessel 25 mL	 	Conical Ø 30 mm	3633 × <i>g</i> 5000 rpm
	1/4	5804 718 003 5820 733 004	87 mm/93 mm	13 cm
	Conical vessel 50 mL		Conical Ø 30 mm	4332 × <i>g</i> 5000 rpm
	1/4	5804 758 005	–/120 mm	15.5 cm
	Conical vessel 50 mL		Conical Ø 30 mm	4388 × <i>g</i> 5000 rpm
	1/4	5804 718 003	119 mm/120 mm	15.7 cm
	Conical vessel 50 mL		Flat with conical insert –	4500 × <i>g</i> 5000 rpm
	–/8	5804 706 005 Max. load: 144 g (insert, vessel, and contents)	–/120 mm	16.1 cm

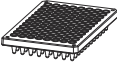
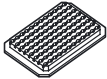
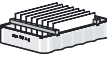
Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Conical vessel 50 mL 1/4	 5804 758 005	Conical Ø 30 mm ~118 mm	4332 × <i>g</i> 5000 rpm 15.5 cm
	Conical vessel 50 mL 1/4	 5804 718 003	Conical Ø 30 mm ~120 mm	4388 × <i>g</i> 5000 rpm 15.7 cm
	Vessel 30 mL – 50 mL 2/8	 5804 759 001	Flat Ø 31 mm 108 mm/122 mm	4200 × <i>g</i> 5000 rpm 15.0 cm
	Conical vessel 50 mL 1/4	 5804 759 001 5804 737 008 (white)	Flat Ø 30 mm 108 mm/122 mm	4200 × <i>g</i> 5000 rpm 15.0 cm
	Vessel 50 mL – 75 mL 1/4	 5804 760 000	Flat Ø 35 mm 108 mm/119 mm	4200 × <i>g</i> 5000 rpm 15.0 cm
	Vessel 80 mL – 100 mL 1/4	 5804 761 006	Flat Ø 45 mm 100 mm/114 mm	4200 × <i>g</i> 5000 rpm 15.0 cm

14.14 Rotor A-4-62 with MTP bucket

Swing-bucket rotor for 4 × MTP buckets.

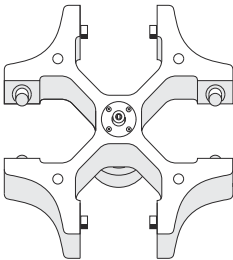
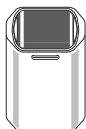
Rotor A-4-62				
	Max. <i>g</i> -force:		2750 × <i>g</i>	
	Max. rotational speed:		4000 rpm	
	Max. load per bucket (adapter, vessel, and contents):		380 g	
MTP bucket				

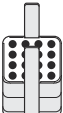
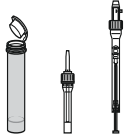
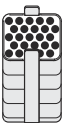
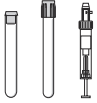
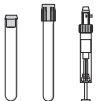
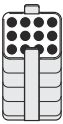
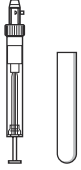
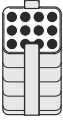
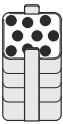
Plate/vessel	Plate Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. loading height	Max. <i>g</i> -force Max. rotational speed Radius
	Microplate 96/384 wells 4/16	—	Flat 53 mm	2750 × <i>g</i> 4000 rpm 15.4 cm
	Deepwell plate 96/384 wells 1/4	—	Flat 53 mm	2750 × <i>g</i> 4000 rpm 15.4 cm
	Cell-culture plate 2/8	—	Flat 53 mm	2750 × <i>g</i> 4000 rpm 15.4 cm
	PCR plate 384 wells 1/4	 5825 713 001	Flat 53 mm	2700 × <i>g</i> 4000 rpm 14.9 cm

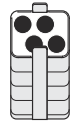
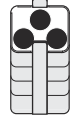
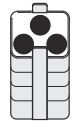
Plate/vessel	Plate Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. loading height	Max. <i>g</i> -force Max. rotational speed Radius
	PCR plate 96 wells 1/4	 5825 711 009	Flat 53 mm	2600 × <i>g</i> 4000 rpm 14.9 cm
Slide	CombiSlide 12 slides 12/48	 5825 706 005	Flat 53 mm	1000 × <i>g</i> 2442 rpm 15.0 cm

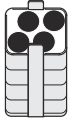
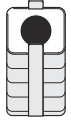
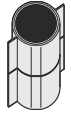
14.15 Rotor A-4-62 with 250 mL rectangular bucket

Swing-bucket rotor for 4 × 250 mL rectangular buckets with aerosol-tight cap.

Rotor A-4-62			
		Max. <i>g</i> -force:	3220 × <i>g</i>
		Max. rotational speed:	4000 rpm
		Max. load per bucket (adapter, vessel, and contents):	620 g
250 mL rectangular buckets with aerosol-tight cap			

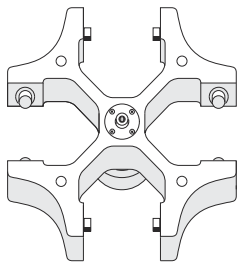
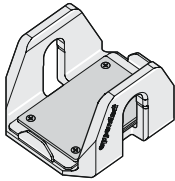
Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Reaction vessel 1.5 mL/2.0 mL 16/64	 5810 751 000	Flat Ø 11 mm 43 mm/43 mm	3000 × <i>g</i> 4000 rpm 17.1 cm
	Vessel 1.2 mL – 5 mL 25/100	 5810 750 008	Flat Ø 11 mm 115 mm/123 mm	3050 × <i>g</i> 4000 rpm 17.3 cm
	Vessel 2.6 mL – 7 mL 15/60	 5810 752 000	Flat Ø 13 mm 118 mm/121 mm	3050 × <i>g</i> 4000 rpm 17.3 cm
	Vessel 3 mL – 15 mL 12/48	 5810 753 007	Flat Ø 16 mm 116 mm/121 mm	3050 × <i>g</i> 4000 rpm 17.3 cm
	Vessel 7 mL – 17 mL 12/48	 5810 754 003	Flat Ø 17.5 mm 114 mm/118 mm	3050 × <i>g</i> 4000 rpm 17.3 cm
	Conical vessel 15 mL 9/36	 5810 755 000	Conical Ø 17.5 mm 121 mm/127 mm	3150 × <i>g</i> 4000 rpm 17.8 cm
	Vessel 7 mL – 18 mL 8/32	 5810 756 006	Flat Ø 20 mm 119 mm/126 mm	3050 × <i>g</i> 4000 rpm 17.3 cm

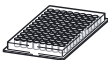
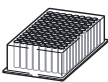
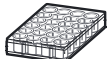
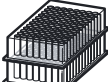
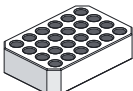
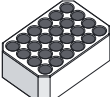
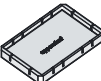
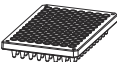
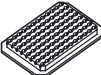
Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Vessel 18 mL – 30 mL 4/16	 5810 757 002	Flat Ø 26 mm 116 mm/119 mm	3050 × <i>g</i> 4000 rpm 17.3 cm
	Conical vessel 25 mL 3/12	 5810 758 009 Highest adapter module removed	Conical Ø 30 mm 80 mm/85 mm	3184 × <i>g</i> 4000 rpm 17.8 cm
	Conical vessel 25 mL 3/12	 5810 758 009 Highest adapter module removed	Conical Ø 30 mm 91 mm/91 mm	3184 × <i>g</i> 4000 rpm 17.8 cm
	Conical vessel 50 mL 3/12	 5810 758 009	Conical Ø 30 mm 116 mm/122 mm	3094 × <i>g</i> 4000 rpm 17.8 cm
	Conical vessel 50 mL 4/16 If aerosol-tight, only 2 vessels per bucket	 5810 763 002 5804 728 009 (blue)	Flat Ø 30 mm If aerosol-tight: 2 vessels per bucket/122 mm	3094 × <i>g</i> 4000 rpm 17.3 cm

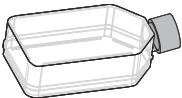
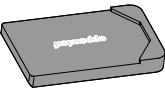
Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Conical vessel 50 mL 3/12	 5810 758 009	Conical Ø 30 mm ~118 mm	3094 × <i>g</i> 4000 rpm 17.8 cm
	Conical vessel 50 mL 4/16	  5810 759 005 5804 737 008 (white)	Flat Ø 30 mm 113 mm/115 mm	3050 × <i>g</i> 4000 rpm 17.3 cm
	Vessel 30 mL – 50 mL 4/16	 5810 759 005	Flat Ø 30 mm 113 mm/115 mm	3050 × <i>g</i> 4000 rpm 17.3 cm
	Vessel 50 mL – 75 mL 2/8	 5810 760 003	Flat Ø 17 mm: 4 vessels/Ø 35 mm: 2 vessels 118 mm/122 mm	3050 × <i>g</i> 4000 rpm 17.3 cm
	Vessel 80 mL – 120 mL 1/4	 5810 761 000	Flat Ø 45 mm 125 mm/138 mm	3050 × <i>g</i> 4000 rpm 17.3 cm
	Centrifuge bottle		Flat	3220 × <i>g</i>

Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Conical bottle 180 mL to 225 mL Flat bottle 180 mL to 250 mL 1/4	5810 770 009 Conical bottles require the adapter supplied by the manufacturer	Ø 62 mm 127 mm/136 mm	4000 rpm 18.0 cm

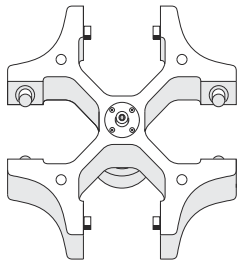
14.16 Rotor A-4-81 with MTP/Flex bucket

Rotor A-4-81 with MTP/Flex bucket		
	Max. <i>g</i> -force:	$2900 \times g$
	Max. rotational speed:	4000 rpm
 MTP/Flex buckets	Max. load per bucket (adapter, vessel, and contents):	380 g

Plate/vessel	Plate Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. loading height	Max. <i>g</i> -force Max. rotational speed Radius
	Microplate 96/384 wells 4/16	–	Flat 60 mm	2900 × <i>g</i> 4000 rpm 16.3 cm
	Deepwell plate 96 wells 1/4	–	Flat 60 mm	2900 × <i>g</i> 4000 rpm 16.3 cm
	Cell-culture plate 2/8	–	Flat 60 mm	2900 × <i>g</i> 4000 rpm 16.3 cm
	Kit 1/4	–	Flat 60 mm	2900 × <i>g</i> 4000 rpm 16.3 cm
	IsoRack 24 × 0.5 mL reac- tion vessels 1/4	 5825 708 008	Flat Ø 6 mm 60 mm	2700 × <i>g</i> 4000 rpm 15 cm
	IsoRack 24 × 1.5 mL reac- tion vessels 1/4	 5825 709 004	Flat Ø 11 mm 60 mm	2600 × <i>g</i> 4000 rpm 14.6 cm
	PCR plate 384 wells 1/4	 5825 713 001	Flat 60 mm	2700 × <i>g</i> 4000 rpm 15.8 cm
	PCR plate 96 wells 1/4	 5825 711 009	Flat 60 mm	2600 × <i>g</i> 4000 rpm 16.1 cm
Slide	CombiSlide 12 slides 12/48	 5825 706 005	Flat 60 mm	1000 × <i>g</i> 2372 rpm 15.9 cm

Plate/vessel	Plate Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. loading height	Max. <i>g</i> -force Max. rotational speed Radius
	Cell-culture flask with/without filter 25 cm ² : Sarstedt 83.1810.002/ 83.1810 Greiner Bio-One 690175/690160 TPP 90026/90025 IWAKI 3102-025 1/4	 5825 719 000	Flat 60 mm	1000 × <i>g</i> 2501 rpm 14.3 cm

14.17 Rotor A-4-81 with conical vessels

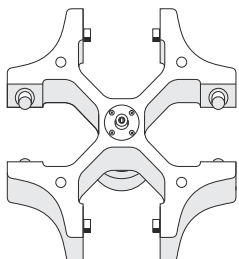
Rotor A-4-81 with conical vessels		
	Max. <i>g</i> -force:	3220 × <i>g</i>
	Max. rotational speed:	4000 rpm
 Bucket for 7 × 50 mL conical vessels	Max. load per bucket (adapter, vessel, and contents):	7 × 75 g

Plate/vessel	Plate Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. vessel length	Max. <i>g</i> -force Max. rotational speed Radius
	Conical vessel 15 mL 7/28	 5820 718 005	Conical Ø 17.5 mm 120 mm	3184 × <i>g</i> 4000 rpm 17.8 cm
	Conical vessel 50 mL 7/28	–	Conical Ø 30 mm 117 mm	3220 × <i>g</i> 4000 rpm 18.0 cm
	Conical vessel 25 mL 7/28	 5820 733 004	Conical Ø 30 mm 60 mm / 91 mm	2739 × <i>g</i> 3700 rpm 17.9 mm / 91 mm
	Conical vessel 25 mL 7/28	 5820 734 000	Conical Ø 30 mm 52 mm / 91 mm	2586 × <i>g</i> 3700 rpm 16.9 mm / 91 mm
	Conical vessel 50 mL 7/28	–	Conical Ø 30 mm 118 mm / 91 mm	3153 × <i>g</i> 3700 rpm 20.6 mm / 91 mm

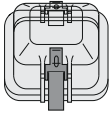
14.18 Rotor A-4-81 with 500 mL rectangular bucket

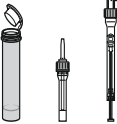
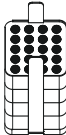
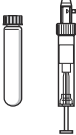
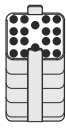
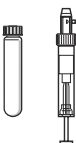
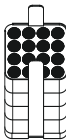
Swing-bucket rotor for 4 × 500 mL rectangular buckets with aerosol-tight cap.

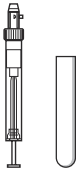
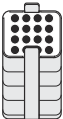
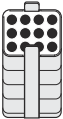
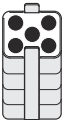
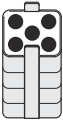
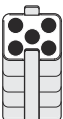
Rotor A-4-81 with 500 mL rectangular bucket

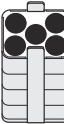
	Max. <i>g</i> -force:	3220 × <i>g</i>
	Max. rotational speed:	4000 rpm

Rotor A-4-81 with 500 mL rectangular bucket

		Max. load per bucket (adapter, vessel, and contents):	780 g
500 mL rectangular bucket			

Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Reaction vessel 1.5 mL/2.0 mL 20/80	 5810 745 004	Flat Ø 11 mm 43 mm/43 mm	2950 × <i>g</i> 4000 rpm 16.5 cm
	Vessel 1.2 mL – 5 mL 20/80	 5810 746 000	Flat Ø 11 mm 108 mm/108 mm	3000 × <i>g</i> 4000 rpm 16.8 cm
	Vessel 2.6 mL – 5 mL 25/100	 5810 720 001	Flat Ø 13 mm 107 mm/108 mm	3000 × <i>g</i> 4000 rpm 16.8 cm
	Vessel 2.6 mL – 7 mL 18/72	 5810 747 007	Flat Ø 13 mm 108 mm/108 mm	3000 × <i>g</i> 4000 rpm 16.8 cm
	Vessel 3 mL – 15 mL 16/64	 5810 748 003	Flat Ø 16 mm 108 mm/108 mm	3000 × <i>g</i> 4000 rpm 16.8 cm

Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Vessel 7 mL – 17 mL 16/64	 5810 721 008	Flat Ø 17.5 mm 118 mm/118 mm	3000 × <i>g</i> 4000 rpm 16.8 cm
	Conical vessel 15 mL 12/48	 5810 722 004	Conical Ø 17.5 mm 121 mm/121 mm	3100 × <i>g</i> 4000 rpm 17.3 cm
	Conical vessel 25 mL 5/20	 5810 723 000 Highest adapter module removed	Conical Ø 30 mm 78.5 mm/78.5 mm	2647 × <i>g</i> 4000 rpm 14.8 cm
	Conical vessel 25 mL 5/20	 5810 723 000 Highest adapter module removed	Conical Ø 30 mm 83 mm/83 mm	2826 × <i>g</i> 4000 rpm 15.8 cm
	Conical vessel 50 mL 5/20	 5810 723 000	Conical Ø 30 mm 116 mm/122 mm	3100 × <i>g</i> 4000 rpm 17.3 cm
	Conical vessel 50 mL 5/20	 5810 723 000	Conical Ø 30 mm ~118 mm	3100 × <i>g</i> 4000 rpm 17.3 cm

Vessel	Vessel Capacity Number per adapter/rotor	Adapter Order no. (International)	Bottom shape Vessel diameter Max. length of vessel with/without aerosol-tight cap	Max. <i>g</i> -force Max. rotational speed Radius
	Midi Parasep® 5/20	 5810 723 000	Conical Ø 30 mm 116 mm/122 mm	3100 × <i>g</i> 4000 rpm 17.3 cm
	Conical vessel 50 mL 5/20	  5810 739 004 5804 737 008 (white)	Flat Ø 30 mm ~119 mm	3100 × <i>g</i> 4000 rpm 17.3 cm
	Centrifuge bottle Conical bottle 180 mL to 225 mL Flat bottle 180 mL to 250 mL 1/4	5825 722 000 Conical bottles require the adapter supplied by the manufacturer	Flat Ø 62 mm 137 mm/133 mm	3100 × <i>g</i> 4000 rpm 17.3 cm
	Wide-neck bottle, square 500 mL ~4	–	Flat Ø 83 mm 134 mm/134 mm	3220 × <i>g</i> 4000 rpm 18.0 cm

Ordering information

Centrifuge 5811 R

English (EN)

15 Ordering information**15.1 Rotors****Rotor A-4-81, 500 mL bucket**

Description	Order no.
Rectangular bucket 500 mL for Rotor A-4-81 4 pcs.	5810 730 007
Rotor A-4-81 for 500 mL rectangular buckets or MTP/Flex buckets, incl. 4 x 500 mL rectangular buckets For Centrifuge 5810/5810 R without buckets	5810 718 007
For Centrifuge 5810/5810 R	5810 743 001

Rotor A-4-81, MTP/Flex bucket

Description	Order no.
MTP/Flex buckets for Rotors A-4-81, S-4x500 for use with IsoRack and cell culture flask adapters as well as MTP and DWP, 4 pcs.	5810 741 009
for use with IsoRack and cell culture flask adapters as well as MTP and DWP, 2 pcs.	5810 742 005
Rotor A-4-81-MTP/Flex Swing-bucket rotor, incl. 4 MTP/Flex buckets For Centrifuge 5810/5810 R	5810 725 003

Rotor A-4-81, bucket for conical tubes

Description	Order no.
Bucket for 7 x 50 mL conical tubes for Rotor A-4-81 4 pcs.	5825 730 003

Rotor A-4-62

Description	Order no.
Rectangular bucket 250 mL for Rotor A-4-62 4 pieces	5810 716 004
Rotor A-4-62 incl. 4 × 250 mL rectangular buckets For Centrifuge 5810/5810 R	5810 709 008

Rotor A-4-62-MTP

Description	Order no.
MTP bucket for Rotor A-4-62 for 4 MTP or 1 DWP 4 pcs.	5810 702 003
Rotor A-4-62-MTP with 4 MTP buckets For Centrifuge 5810/5810 R	5810 711 002

Rotor A-4-44

Description	Order no.
Bucket for 2 × 50 mL conical tubes for Rotor A-4-44 4 pcs.	5804 706 005
Rectangular bucket 100 mL for Rotor A-4-44 4 pcs.	5804 741 005
Rotor A-4-44 incl. 4 × 100 mL rectangular buckets For Centrifuge 5804/5804 R/5810/5810 R	5804 709 004

Ordering information

Centrifuge 5811 R

English (EN)

Rotor A-2-DWP-AT

Description	Order no.
Bucket for Rotor A-2-DWP-AT 2 pcs.	5820 711 000
Rotor A-2-DWP-AT incl. 2 buckets, 2 aerosol-tight caps and 2 plate carriers For Centrifuge 5810/5810 R	5820 710 004

Rotor A-2-DWP

Description	Order no.
Plate bucket for use in A-2-DWP 2 pcs.	5804 743 008
Rotor A-2-DWP For Centrifuge 5804/5804 R/5810/5810 R	5804 740 009

Rotor FA-45-6-30

Description	Order no.
Rotor FA-45-6-30 aerosol-tight, incl. rotor lid, for 6 × 15/50 mL conical tubes For Centrifuge 5804/5804 R/5810/5810 R	5820 715 006

Rotor F-34-6-38

Description	Order no.
Rotor F-34-6-38 incl. rotor lid, for 6 × 85 mL tubes For Centrifuge 5804/5804 R/5810/5810 R	5804 727 002

Rotor F-45-30-11

Description	Order no.
Rotor F-45-30-11 incl. rotor lid, for 30 × 1.5/2.0 mL reaction vessels For Centrifuge 5804/5804 R/5810/5810 R	5804 715 004

Rotor FA-45-30-11

Description	Order no.
Rotor FA-45-30-11 aerosol-tight, for 30 × 1.5/2.0 mL reaction vessels For Centrifuge 5804/5804 R/5810/5810 R	5804 726 006

Rotor S-4-104

Description	Order no.
Plate bucket for Rotor S-4-104, aerosol-tight capable incl. plate carrier, 4 pcs. incl. plate carrier, 2 pcs.	5820 743 000 5820 744 006
Plate bucket (open) for Rotor S-4-104, incl. plate carrier 4 pcs. 2 pcs.	5820 757 000 5820 758 007
Rotor S-4-104 incl. 4 × 750 mL round buckets For Centrifuge 581x aerosol-tight capable, incl. 4 plate buckets For Centrifuge 581x without buckets	5820 740 000 5820 754 001 5820 755 008
Round bucket 750 mL for Rotor S-4-104, aerosol-tight capable 4 pcs. for Rotor S-4-104 2 pcs.	5820 741 007 5820 742 003

Rotor S-4-72

Description	Order no.
Rotor S-4-72 incl. 4 × 250 mL round buckets For Centrifuge 5804/5804 R/5810/5810 R	5804 746 007
Round bucket 250 mL for Rotor S-4-72 Set of 4 pcs.	5804 747 003

Ordering information

Centrifuge 5811 R

English (EN)

Rotor F-35-48-17

Description	Order no.
Rotor F-35-48-17 for 24 × 15 mL conical tubes, incl. 24 steel sleeves and adapters For Centrifuge 5804/5804 R/5810/5810 R	5820 771 003
for 40 × 15 mL conical tubes, incl. 48 steel sleeves and adapters For Centrifuge 5804/5804 R/5810/5810 R	5820 772 000

Rotor F-45-48-11

Description	Order no.
Rotor FA-45-48-11 aerosol-tight, incl. rotor lid, for 48 × 1.5/2.0 mL tubes For Centrifuge 5804/5804 R/5810/5810 R	5820 760 001

Rotor F-45-20-17

Description	Order no.
Rotor FA-45-20-17 incl. rotor lid, for 20 Eppendorf Tubes® 5.0 mL For Centrifuge 5804/5804 R/5810/5810 R	5820 765 003

15.2 Accessories**Rotor A-4-81, 500 mL bucket**

Description	Order no.
Cap aerosol-tight, for 500 mL rectangular bucket 2 pcs.	5810 724 007
Replacement clamp for adapter for 500 mL rectangular buckets 2 pcs.	5810 735 009
Rotor key for Rotor A-4-81, S-4-104	5810 718 309
Rubber mat for adapter for 500 mL rectangular bucket 4 pcs.	5810 734 002

Rotor A-4-62

Description	Order no.
Caps for rectangular bucket 250 mL, aerosol-tight 2 pcs.	5810 710 006
Replacement clamp for adapter for 250 mL rectangular bucket 2 pcs.	5810 781 000
Rubber mat for adapter for 250 mL rectangular buckets 4 pcs.	5810 782 007
for adapter 5810770009 4 pcs.	5810 783 003

Rotor A-4-44

Description	Order no.
Caps for 100 mL rectangular bucket, aerosol-tight 2 pcs.	5804 712 005
Replacement clamp for the adapter of rotor A-4-44 2 pcs.	5804 781 007
Rubber mat for the adapter of rotor A-4-44 4 pcs.	5804 782 003

Rotor A-2-DWP-AT

Description	Order no.
Cap aerosol-tight, for Rotor A-2-DWP-AT 2 pcs., for Centrifuge 58xx	5820 713 003
Plate carrier for Rotor A-2-DWP-AT 2 pcs.	5820 712 007

Ordering information

Centrifuge 5811 R

English (EN)

Rotor FA-45-6-30

Description	Order no.
Rotor lid for Rotor FA-45-6-30 aerosol-tight, aluminum for Centrifuge 58xx	5820 716 002
Seal for rotor lid for FA-45-18-11, FA-45-6-30 and FA-6x50 5 pcs.	5418 709 008

Rotor F-34-6-38

Description	Order no.
Rotor lid for F-34-6-38 for Centrifuge 58xx	5804 727 509

Rotor FA-45-30-11

Description	Order no.
Rotor lid for FA-45-30-11 aerosol-tight, aluminum for Centrifuge 58xx	5804 736 001

Rotor F-45-30-11

Description	Order no.
Rotor lid for F-45-30-11 aluminum for centrifuge 5804/5804R, 5810/5810R	5804 715 403

Rotor S-4-104

Description	Order no.
Caps rotors S-4-104, S-4x750, plate bucket, aerosol-tight 2 pcs.	5820 748 001
Caps for 750 mL/1000 mL for rotors S-4-104, S-4x750, S-4x1000, aerosol-tight 2 pcs.	5820 747 005

Description	Order no.
Plate carrier Rotoren S-4-104, S-4x750 2 pcs.	5820 756 004
Rotor key for Rotor A-4-81, S-4-104	5810 718 309
Sealings for aerosol-tight caps Rotors S-4-104, S-4x750, S-4x1000, round bucket 750 mL/1000 mL 5 pcs.	5820 749 008
Rotors S-4-104, S-4x750, S-4x1000, plate buckets 4 pcs.	5820 780 002

Rotor F-35-48-17

Description	Order no.
Steel sleeves and adapter for vessels 15 mL, for Rotor F-35-48-17 24 pcs.	5820 774 002

Rotor FA-45-48-11

Description	Order no.
Rotor lid for FA-45-48-11 aerosol-tight 1 piece, for Centrifuge 58xx	5820 761 008
Seal for rotor lid For Rotor FA-45-24-11-Kit, FA-45-20-17, FA-30x2, and FA-48x2. Also for Rotors FA-45-48-11 produced after 05/2019. 5 pcs.	5820 767 006

Rotor FA-45-20-17

Description	Order no.
Rotor lid for FA-45-20-17 aerosol-tight 1 piece, for Centrifuge 58xx	5820 766 000
Seal for rotor lid for FA-45-20-17, FA-45-48-11 and FA-20x5 5 pcs.	5409 718 002

Ordering information

Centrifuge 5811 R

English (EN)

16 Glossary

Autoclaving

Physical method of sterilization. Thermal process used to kill microorganisms and inactivate viruses and enzymes. This process does not completely destroy the DNA. The objects to be autoclaved are stored in a pressure vessel with water vapor at 121 °C, 1000 hPa (1 bar) positive pressure for 20 min.

CE

Conformité Européenne – The CE marking indicates that a product has been assessed before reaching the market and is deemed to meet EU safety, health and/or environmental protection requirements.

Centrifugation cycle

Each run during which the rotor is accelerated and braked again. A cycle is independent of the speed and the duration of the centrifugation run.

Deepwell plate

Plate with 48, 96, or 384 wells with larger volumes than microplates. Suitable for preparing, mixing, centrifuging, transporting and storing solid and liquid samples.

***g*-force**

Indicates the acceleration during centrifugation, which is calculated from the rotational speed and the radius of the rotor bowl.

Ramp

The user sets the acceleration and deceleration times of the device using ramps.

rcf

relative centrifugal force – The relative centrifugal force represents the centrifugation force as a multiple of the gravitational acceleration.

Residual current circuit breaker

Protective device that disconnects the voltage when there is a dangerously high rated residual current flowing to ground. Residual current circuit breakers protect persons from electric shock.

rpm

revolutions per minute – Mechanical unit of rotational speed, which gives the number of complete revolutions during a period of 60 s.

Vessel

Micro test tube or individual well in a plate.

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