



Thermo Scientific Sorvall LYNX 4000 / 6000

Superspeed Centrifuge

Instruction Manual

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WEEE Conformity

This product is subject to the regulations of the EU Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU. It is marked by the following symbol:

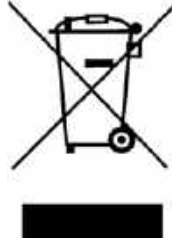


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Preface

Before starting to use the centrifuge, read through this instruction manual carefully and follow the instructions.

The information contained in this instruction manual is the property of Thermo Fisher Scientific; it is forbidden to copy or pass on this information without explicit approval.

Failure to follow the instructions and safety information in this instruction manual will result in the expiration of the sellers warranty.

Scope of Supply

| Article Number | Description | Quantity | Check |
|----------------|--|---|--------------------------|
| | Centrifuge | 1 | |
| 75006580 | Sorvall LYNX 4000, 200-240 V \pm 10 % | | <input type="checkbox"/> |
| 75006590 | Sorvall LYNX 6000, 200-240 V \pm 10 % | | <input type="checkbox"/> |
| 75006581 | Sorvall LYNX 4000, 380-415 V \pm 10 % | | <input type="checkbox"/> |
| 75006591 | Sorvall LYNX 6000, 380-415 V \pm 10 % | | <input type="checkbox"/> |
| | Power Supply Cable | 1 | |
| 20190357 | IEC60309 32A-6h 3-pin blue, 200-250 V |  | <input type="checkbox"/> |
| 20190358 | NEMA 6-30P 32A-6h, 200-250 V |  | <input type="checkbox"/> |
| 20190359 | IEC60309 32A-6h 5-pin red, 230-400 V |  | <input type="checkbox"/> |
| 20190360 | IEC60309 16A-6h 5 pin red (3P + N + PE), 380-415 V |  | <input type="checkbox"/> |
| 50136234 | CD with Manual | 1 | <input type="checkbox"/> |
| 20280119 | Bubble Level | 1 | <input type="checkbox"/> |

If any parts are missing, please contact your nearest Thermo Fisher Scientific representative.

Intended Purpose

- This centrifuge is a laboratory product designed to separate components by generation of a relative centrifugal force. It separates human samples (e.g. blood, urine and other body fluids) collected in appropriate containers, either alone or after addition of reagents or other additives.
- As research laboratory or bioprocessing laboratory centrifuge, it is designed to also run other containers filled with chemicals, environmental samples and other non-human body samples.
- Maximum sample density at maximum speed: $1.2 \frac{g}{cm^3}$
- This centrifuge should be operated by trained specialists only.

Symbols used in this Manual



This symbol refers to general hazards.

CAUTION means that material damage could occur.

WARNING means that injuries or material damage or contamination could occur.



This symbol refers to biological hazards.

Observe the information contained in the instruction manual to keep yourself and your environment safe.



This symbol refers to electrical hazards.

Symbols used on the Centrifuge



This symbol refers to general hazards. Follow the instructions in the instruction manual in any case.



This symbol refers to information on hazards, described within the manual.



This Symbol refers to check, if the rotor is installed correct by lifting it slightly at the handle. See [“Rotor Installation”](#) on [page 27](#).

Precautions

A trained specialist can be a laboratory assistant or medical technologist.



WARNING

- Plug the centrifuge only into sockets which have been properly grounded.
- If a hazardous situation occurs, turn off the power supply to the centrifuge and leave the area immediately.

Note In order to ensure safe operation of the Sorvall LYNX 4000 / 6000 centrifuge, general safety regulations must be followed: Mind the accident prevention regulations in your country.

The work environment should guarantee the following:

WARNING



- Maintain a radius of at least 30 cm around the centrifuge.
The clearance around the centrifuge is reduced, when the centrifuge is bolted down (Optional Seismic Bolt-down Kit 75006500).
- Implementation of special measures which ensure that no one can approach the centrifuge for longer than absolutely necessary while it is running.

The power supply must be interrupted in case of an emergency. Turn off the centrifuge at the main switch. The mains plug must be freely accessible at all times. Pull out the power supply plug or disconnect the power supply in an emergency.

In case of rotor failure the centrifuge can be damaged. The coolant can escape. Ventilate the room well and leave it. Inform customer service.

Note Not following these instruction can cause damage.

WARNING

In order to ensure safe operation of the Sorvall LYNX 4000 / 6000 centrifuge , the following general safety regulations must be followed:

- The centrifuge should be operated by trained specialists only.
- The centrifuge is to be used for its intended use only.
- Do not move the centrifuge while it is running.
- Do not lean on the centrifuge.
- Do not place anything on top of the centrifuge during a run. This applies also for the rotor landing pad.
- Use only rotors and accessories for this centrifuge which have been approved by Thermo Fisher Scientific. Exceptions to this rule are commercially available glass or plastic centrifuge tubes, provided they have been approved for the speed or the RCF value of the rotor.
- Do not use rotors which show any signs of corrosion and/or cracks.
- Do not touch the mechanical components of the rotor and do not make any changes to the mechanical components.
- Use only with rotors which have been properly installed. Follow the instructions on the Thermo Scientific Auto-Lock™ rotor exchange in section “Rotor Installation” on [page 27](#).
- Use only with rotors which have been loaded properly. Follow the instructions given in the rotor manual.
- Never overload the rotor. Follow the instructions given in the rotor manual.
- Never start the centrifuge when the door is open.
- Never open the door until the rotor has come to a complete stop and this has been confirmed in the display.
- The door emergency release may be used in emergencies only to recover the samples from the centrifuge, e.g. during a power failure (see section “Manual Door Release” on [page 44](#)).
- Never use the centrifuge if parts of its cover panels are damaged or missing.
- Do not touch the electronic components of the centrifuge or alter any electronic or mechanical components.
- Please observe the safety instructions.



WARNING

Please pay particular attention to the following aspects:



- Location: well-ventilated environment, set-up on a level and rigid surface with adequate load-bearing capacity.
- Rotor installation: make sure the rotor is locked properly into place before operating the centrifuge.
- Especially when working with corrosive samples (salt solutions, acids, bases), the accessory parts and vessel have to be cleaned carefully.
- Always balance the samples.

Centrifuging hazardous substances:

- Do not centrifuge explosive or flammable materials or substances which could react violently with one another.
- The centrifuge is neither inert nor protected against explosion. Never use the centrifuge in an explosion-prone environment.
- Do not centrifuge inflammable substances.

Remaining risk: Improper use can cause damages, contamination, and injuries with fatal consequences.



- Do not centrifuge toxic or radioactive materials or any pathogenic micro-organisms without suitable safety precautions.

When centrifuging microbiological samples from the Risk Group II (according to the "Laboratory Biosafety Manual" of the World Health Organization (WHO)), aerosol-tight biological seals have to be used.

For materials in a higher risk group, extra safety measures have to be taken.

- If toxins or pathogenic substances have gotten into the centrifuge or its parts, appropriate disinfection measures have to be taken (see "Disinfection" on page 39).
Remaining risk: Improper use can cause damages, contamination, and injuries with fatal consequences.
- Highly corrosive substances which can cause material damage and impair the mechanical stability of the rotor, should only be centrifuged in corresponding protective tubes.



WARNING In case of rotor failure the centrifuge is not aerosol-tight.



CAUTION Due to air friction the temperature of rotor may raise significantly while the centrifuge is spinning. Refrigerated units have limitations in cooling capabilities. Displayed and set temperature can deviate from sample temperature. Sample temperature might exceed critical temperature of your application.



WARNING The magnets built into the rotors can have a negative effect on active implants, such as cardiac pacemakers. The magnets are mounted on the bottom of the rotor. Always keep a distance of 20 cm between the rotor and the active implant, as the product generates permanent magnetic fields. The magnetic field strength at a distance of 20 cm is less than 0.1 mT, so there should be no interference.

Introduction and Description

Contents

- “Characteristics of the Sorvall LYNX 4000 / 6000 Centrifuge” on page 2
- “Technical Data” on page 3
- “Directives, Standards and Guidelines” on page 4
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Characteristics of the Sorvall LYNX 4000 / 6000 Centrifuge

Several rotors with a wide range of tubes can be used.

The set speed is reached within seconds. The maintenance-free induction motor ensures quiet and low-vibration operation even at high speeds, and guarantees a very long lifetime.

The user-friendly control panel makes it easy to preset the speed, RCF value, run time, temperature, and run profile (acceleration and deceleration curves). You can choose between the display of speed and RCF in the entry mode.

These settings can be changed even while the centrifuge is running.

The Sorvall LYNX 4000 / 6000 centrifuge is equipped with various safety features:

- The housing and rotor chamber consist of steel plate, the interior of armor steel, while the front panel is made of high-impact resistant plastic.
- The centrifuge door is equipped with a centrifuge door lock.
- The centrifuge door can only be opened while the centrifuge is switched on and the rotor has come to a complete stop. The centrifuge cannot be started until the centrifuge door has been closed properly.
- The rotor recognition Auto-ID identifies the rotor when inserted thus avoiding over-speeding the rotor and simplifying run set-up.
- An electronic imbalance recognition is designed to prevent damage to the centrifuge spindle.
- Centrifuge door emergency release: For emergencies only, e.g. to retrieve samples during power failures (see [“Manual Door Release”](#) on page 44).
- The Sorvall LYNX 4000 / 6000 centrifuge can be equipped with an optional HEPA filter (HEPA-Filter Kit 75000011).
- The Sorvall LYNX 4000 / 6000 centrifuge can be bolted down to the floor (Optional Seismic Bolt-down Kit 75006500) optionally.

Technical Data

The technical data of the Sorvall LYNX 4000 / 6000 centrifuge is listed in the following table.

Table 1. Technical Data

| Feature | Sorvall LYNX 4000 | Sorvall LYNX 6000 |
|---|--|---|
| Environmental Conditions | -Use in interior Spaces -Altitudes of up to 2,000 m above Sea Level -Max. relative humidity 85 % up to 30 °C | |
| Environmental Conditions during Storage and Shipping | Temperature: -10 °C to +55 °C Humidity: 15 % to 85 % | Temperature: -10 °C to +55 °C Humidity: 15 % to 85 % |
| Permissible Ambient Temperature | +5 °C to +35 °C | +5 °C to +35 °C |
| Overvoltage Category | II | II |
| Pollution Degree | 2 | 2 |
| Heat Dissipation /h* | 2.0 kWh / 6,830 Btu / 7,200 kJ | 1.2 kWh / 4,100 Btu / 4,320 kJ |
| IP (statement of the degree of protection according to IEC 60529) | 20 | 20 |
| Run Time | 99 hours:59min, hold | 99 hours:59min, hold |
| Maximum Speed n_{max} | 24000 rpm (depending on the rotor) | 29000 rpm (depending on the rotor) |
| Minimum Speed n_{min} | 500 rpm | 500 rpm |
| Maximum RCF-Value at n_{max} | 68905 x g | 100605 x g |
| Maximum kinetic Energy | < 203 kJ | < 203 kJ |
| Noise Level for swinging Bucket at maximum Speed | < 61 dB (A)** | < 61 dB (A)** |
| Noise Level for Fixed Angle Rotors at maximum Speed | < 59 dB (A)** | < 59 dB (A)** |
| Temperature Setting Range | -10 °C to +40 °C | -20 °C to +40 °C |
| Dimensions | | |
| Height with Door closed (incl. GUI) | 1048 mm | 1048 mm |
| Height with Door open | 1531 mm | 1531 mm |
| Width | 700 mm | 700 mm |
| Depth | 805 mm | 805 mm |
| Weight without Rotor | 285 kg | 295 kg |

* Rotor A27-8x50, Typical Run 4 °C at 24,000 rpm 30 minutes, 60 Hz +5 %, 30 min stand by 4° C (lid closed)

** Measures at 1 m distance and at 1.6 m height

Directives, Standards and Guidelines

The Sorvall LYNX 4000 / 6000 centrifuge is produced and inspected according to the following standards and guidelines:

Table 2. Directives, Standards and Guidelines

| Tension / Frequency | Directives and Guidelines | Observed by the following standards |
|--|--|--|
| Europe 220 V / 230 V / 240 V / 380 V / 400 V / 415 V 50 / 60 Hz | <p><u>2006/42/EC Machinery</u></p> <p><u>2014/35/EU Low Voltage</u> (protective goals)</p> <p><u>2014/30/EC Electromagnetic Compatibility (EMC)</u> (protective goals)</p> <p><u>2011/65/EC RoHS</u> Directive on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment.</p> | <ul style="list-style-type: none"> • EN 61010-1 • EN 61010-2-020 • EN 61326-1 Class B • EN ISO 14971 • ISO 9001 |
| USA & Canada 208 V / 220 V / 230 V / 240 V 60 Hz | | <ul style="list-style-type: none"> • ANSI/UL 61010-1 • UL 61010-2-020 • EN ISO 14971 • ISO 9001 |
| Japan 200 V 50 / 60 Hz | | <ul style="list-style-type: none"> • IEC 61010-1 • IEC 61010-2-020 • IEC 61326-1 Class B |
| China 220 V / 230 V / 240 V / 380 V 50 / 60 Hz | | <ul style="list-style-type: none"> • EN ISO 14971 • ISO 9001 |

Functions and Features

The following table gives an overview of the important functional and performance characteristics of the Sorvall LYNX 4000 / 6000 centrifuge.

Table 3. Functions and Features

| Component / Function | Description / Features |
|--------------------------------------|--|
| Structure / Housing | Galvanized Steel Chassis with Armoured Plating |
| Rotor Chamber | Stainless Steel |
| Drive | Induction Drive without Carbon Brushes |
| Touchscreen and Display | Easy-to-clean Touchscreen and Display Surface |
| Controls | Microprocessor-controlled |
| Internal Memory | Most recent Data is saved |
| Functions | RCF, Temperature, and Pre-temp Selection |
| Acceleration / Deceleration Profiles | 9 Acceleration and 10 Deceleration Curves |
| Rotor Recognition | Automatically and instantly, when Inserting the Rotor |
| Imbalance Recognition | Electronic, contingent on Rotor and Speed |
| Centrifuge Door Lock | Automatic Centrifuge Door Closing and Locking starting from an initial Hold Position |
| Rotor Lid Holder | Lefthand Side of the Centrifuge |
| Rotor Landing Pad | Righthand Side of the Centrifuge in Front of the Touchscreen |

Refrigerants

| Order No. | Centrifuge | Refrigerant | Quantity | Pressure | GWP | CO2e |
|-----------|-------------------|-------------|----------|----------|------|--------|
| 75006580 | Sorvall LYNX 4000 | R-449A | 1.25 kg | 34 bar | 1387 | 1.73 t |
| 75006581 | Sorvall LYNX 4000 | R-449A | 1.25 kg | 34 bar | 1387 | 1.73 t |
| 75006590 | Sorvall LYNX 6000 | R-449A | 1.36 kg | 34 bar | 1387 | 1.89 t |
| 75006591 | Sorvall LYNX 6000 | R-449A | 1.36 kg | 34 bar | 1387 | 1.89 t |

This product complies with F-Gas regulation (EU) No. 517/2014.

Contains fluorinated greenhouse gases in a hermetically sealed system.

Mains Supply

The following table contains an overview on the electrical contact data of the Sorvall LYNX 4000 / 6000 centrifuge. This data is to be taken into consideration when selecting the mains connection socket.

Table 4. Electrical Connection Data

| Mains Voltage in V | Frequency in Hz | Rated Current in A | Power Consumption in W | Building Fuse in A ¹ | Equipment Fuse in A |
|--------------------|-----------------|--------------------|------------------------|---------------------------------|---------------------|
| 200 | 50 | 24 | 4600 | 30 | 30 |
| 208 | 50 | 23 | 4600 | 30 | 30 |
| 220 | 50 | 21 | 4600 | 32 ² | 30 |
| 230 | 50 | 20 | 4600 | 32 ² | 30 |
| 240 | 50 | 19 | 4600 | 32 ² | 30 |
| 380 | 50 | 13.5 | 4600 | 16 ³ | 16 |
| 400 | 50 | 12.5 | 4600 | 16 ³ | 16 |
| 415 | 50 | 11.5 | 4600 | 16 ³ | 16 |
| 200 | 60 | 24 | 4800 | 30 | 30 |
| 208 | 60 | 23 | 4800 | 30 | 30 |
| 220 | 60 | 21 | 4800 | 32 ² | 30 |
| 230 | 60 | 20 | 4800 | 32 ² | 30 |
| 240 | 60 | 19 | 4800 | 32 ² | 30 |
| 380 | 60 | 13.5 | 4800 | 16 ³ | 16 |
| 400 | 60 | 12.5 | 4800 | 16 ³ | 16 |
| 415 | 60 | 11.5 | 4800 | 16 | 16 |

¹ For the 200-240 V units the inrush current is 120 A for up to 1 second during the refrigeration start period. For the 380 / 400 V units it is 60 A. Circuit breakers, whether thermal or magnetic actuated, must have a delay type applicable for the start of motors.

² Use a 25 A or 32 A Trip Char. C circuit breaker (D or K are also applicable).

³ For 380 / 400 V, 3-phase (unbalanced load, no neutral used) use a 16 A Trip Char. C circuit breaker (D or K are also applicable).

⁴ For North America: use for example GES-9888 30 A.

Rotor Selection

The Sorvall LYNX 4000 / 6000 centrifuge is supplied without a rotor.

Various Thermo Scientific rotors are available to choose from.

| | |
|----------------|------------|
| BIOFlex HC | 75003000 |
| BIOFlex HS | 75003002 |
| TH13-6x50 | 75003010 |
| F9-6x1000 LEX | 096-061075 |
| F10-4x1000 LEX | 096-041075 |
| F12-6x500 LEX | 096-062375 |
| F14-6x250y | 096-062075 |
| F14-14x50cy | 096-145075 |
| F20-12x50 LEX | 096-124375 |
| F21-8x50y | 096-084275 |
| F23-48x1.5 | 096-484075 |
| TCF-20 Zonal | 75003013 |
| TCF-20 | 75003012 |
| T29-8x50 | 75003009 |
| A27-8x50 | 75003008 |
| A27-6x50 | 75003007 |
| A22-24x16 | 75003005 |
| A21-24x15c | 75003004 |
| A23-6x100 | 75003006 |

The technical data of the rotors and the corresponding adapters and reduction sleeves for various commercially available containers can be found in the corresponding rotor operating manuals.

For more information visit our website at www.thermofisher.com/rotors

Before Use

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- “Location” on page 10
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- “Leveling the Centrifuge” on page 14
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- “Transporting the Centrifuge” on page 17

Before Setting Up

1. Check the centrifuge and the packaging for any shipping damage.
Inform the shipping company and Thermo Fisher Scientific immediately if any damage is discovered.
2. Remove the packaging.
3. Check the order for completeness (see “Scope of Supply” on page iii).
If the order is incomplete, please contact Thermo Fisher Scientific.

Location



WARNING Risk of impact!

The centrifuge can crush into objects and people within a radius of 30 cm when spinning. To ensure safe operation maintain a safety zone of 30 cm around the centrifuge

Note The safety zone around the centrifuge can be reduced to 10 cm using the Seismic Bolt-Down-Kit (750006500) to bolt it down to the ground.

Note Ensure, that no one is within the safety zone while the centrifuge is spinning as long as needed.

The centrifuge should only be operated indoors.

The set-up location must fulfill the following requirements to ensure safe operation:

- A safety zone of at least 30 cm (orange area) must be maintained around the centrifuge. The clearance on both sides of the centrifuge is reduced (blue area), when the centrifuge is bolted down (Seismic Bolt-Down-Kit 75006500).
See “Bolting down the Centrifuge (optional)” on page 11.
- People and hazardous substances must be kept out of the safety zone while centrifuging.
- The set-up location must be well-ventilated at all times. A clearance of at least 10 cm around the centrifuge is required for ventilation.

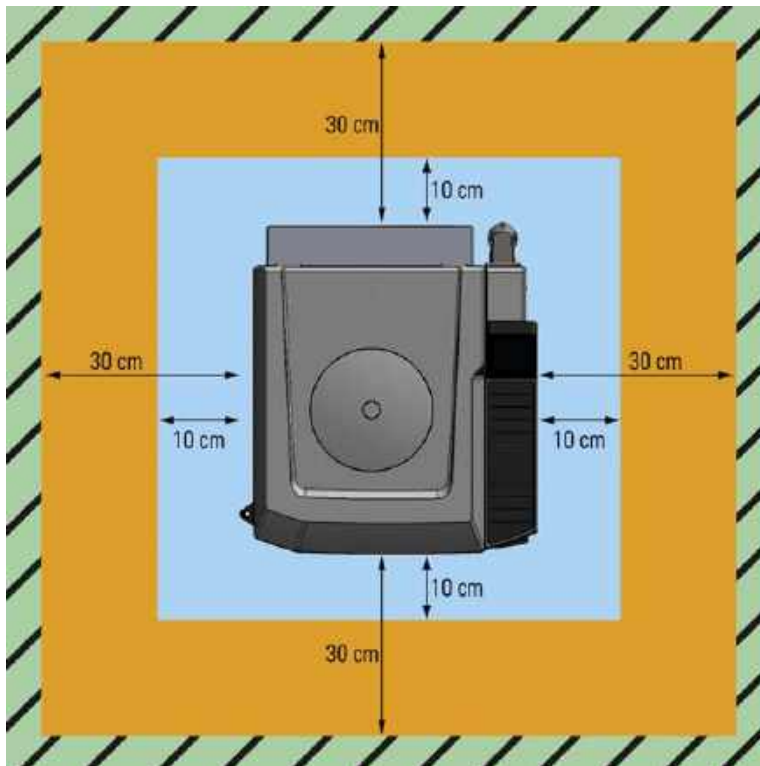


Figure 1. Centrifuge Clearance

- The supporting structure must be stable and free of resonance.
- The supporting structure must be suitable for horizontal setup of the centrifuge.
- The supporting structure must support the weight of the centrifuge.
- The centrifuge should not be exposed to heat and strong sunlight.



CAUTION UV rays reduce the stability of plastics.
Do not subject the centrifuge, rotors and plastic accessories to direct sunlight.

Bolting down the Centrifuge (optional)

As a safety measure for earthquake areas or to comply with laboratory regulations, the centrifuge can be bolted down to the floor. If the centrifuge is bolted down to the floor the safety zone is reduced to 10 cm (Seismic Bolt-down Kit 75006500).

Contact a Thermo Scientific service technician if you wish to bolt down the centrifuge.

Setting Up

1. Place the pallet with the centrifuge so that you have at least 2 m room in front of the pallet.
2. Release the rails from the pallet.

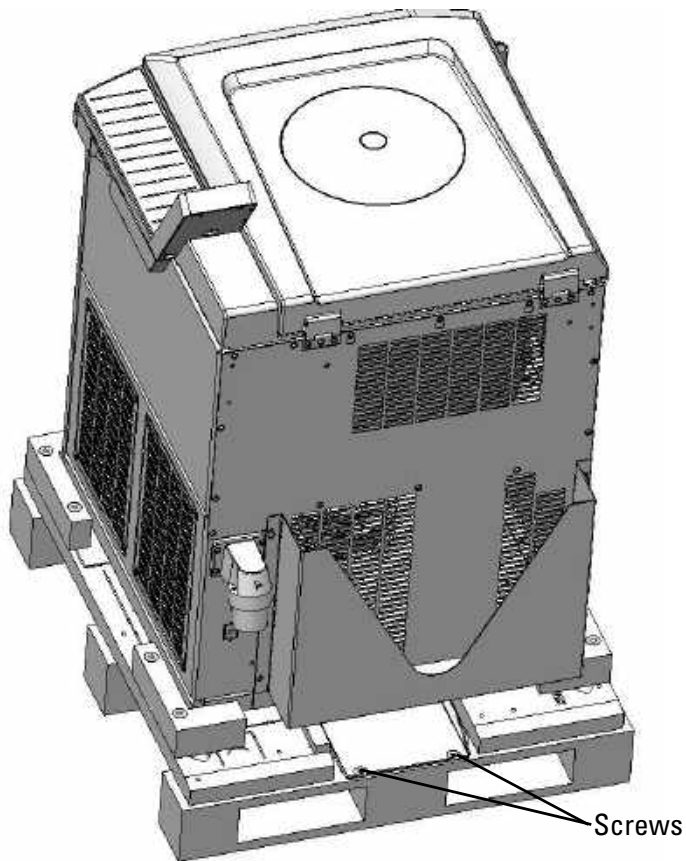


Figure 2. Rails screwed onto the pallet for transport.

3. Screw the rails onto the pallet behind the centrifuge.

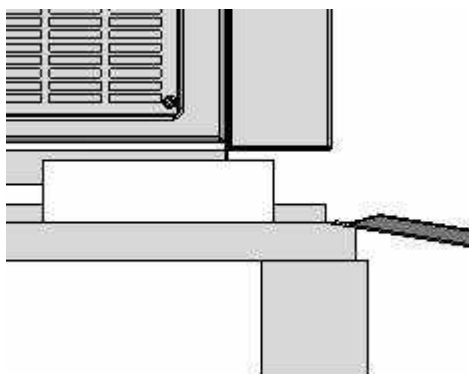


Figure 3. Screw the rails onto the pallet for installation.

4. Remove the rear wooden protectors.

5. Place the wooden protection profiles under the rails.

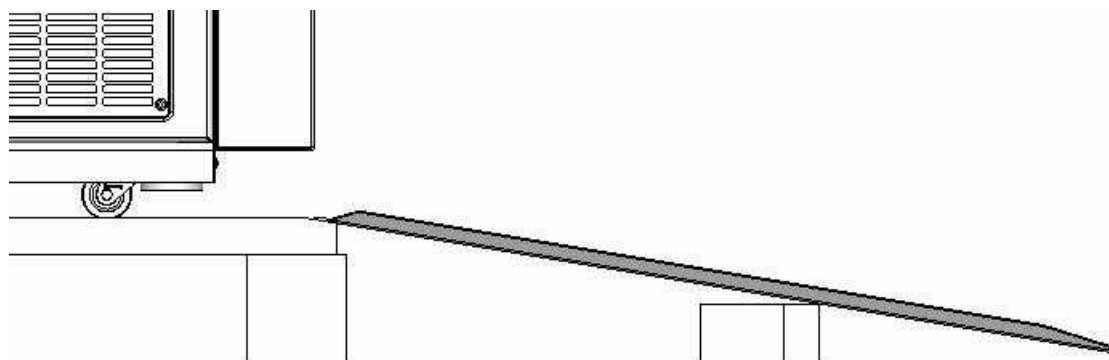


Figure 4. Support the rail with the wooden protection profiles for the installation.

6. Use several people and other means in order to roll the centrifuge off the pallet.



CAUTION Do not push at the control panel. Due to the centrifuges weight it must be controlled by two or more people when rolling of the pallet. Do not stand in front of the centrifuge when rolling it down the ramp as it is very heavy and it may cause severe injury. The centrifuge has four steering casters that must be parallel to the rails so the centrifuge cannot roll of the pallet to the side.

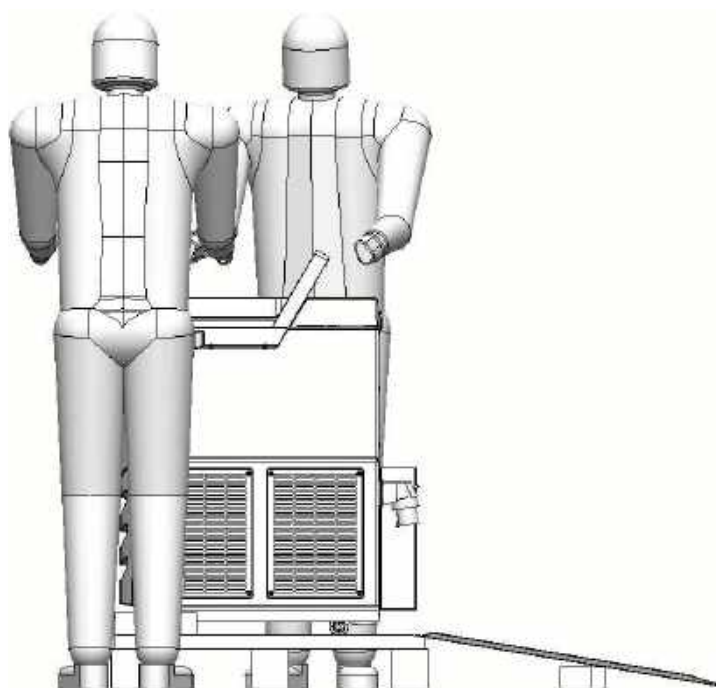


Figure 5. Rolling the Centrifuge of the Pallet with two Persons

7. Once the centrifuge is in its final position screw the rubber feet entirely down. First use your hand then the wrench to lower the feet. The casters should be 5-15 mm off the ground.

Leveling the Centrifuge

Note The centrifuge spindle is flexible. Therefore the centrifuge must be leveled before using the first time. Otherwise the centrifuge might fail due to imbalance and damages might occur.

The horizontal leveling of the centrifuge must be checked every time after moving it to a different location.

Do not move the centrifuge with a rotor attached to the centrifuge spindle as drive damage may result.

Level the centrifuge as follows:

1. Place the enclosed bubble level on the top surface of the Auto-Lock adapter in the rotor chamber.
2. Adjust the centrifuge feet until the bubble inside the level is completely inside the marked circle.
3. Turn the Auto-Lock adapter with the bubble level around a full 360°.

If 50 % of the bubble remains within the marked area, the leveling of the centrifuge is fine. If more than 50 % of the bubble leaves the circle marking, the centrifuge must be leveled again.



Figure 6. Position of the bubble in the water level.

4. Fastening the centrifuge feet you have to fasten both lock nuts. The lower lock nut has to be fastened gently downward the foot. The upper lock nut has to be fastened upward to the centrifuge.

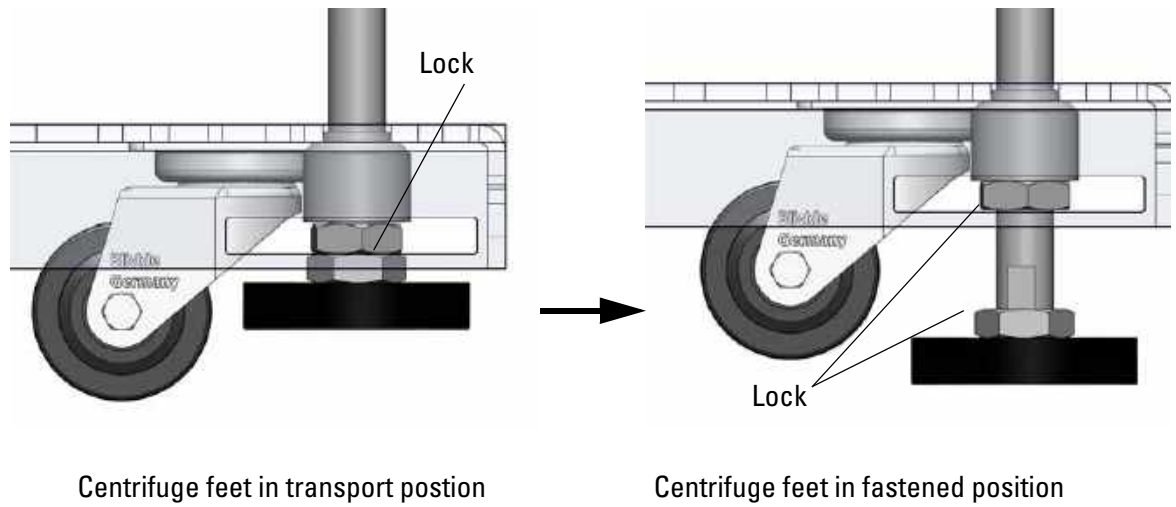


Figure 7. Fixating the centrifuge feet.



CAUTION If the centrifuge is not leveled, imbalances can occur and the centrifuge can be damaged.
Do not place anything under the centrifuge feet to level the centrifuge.

Mains Connection

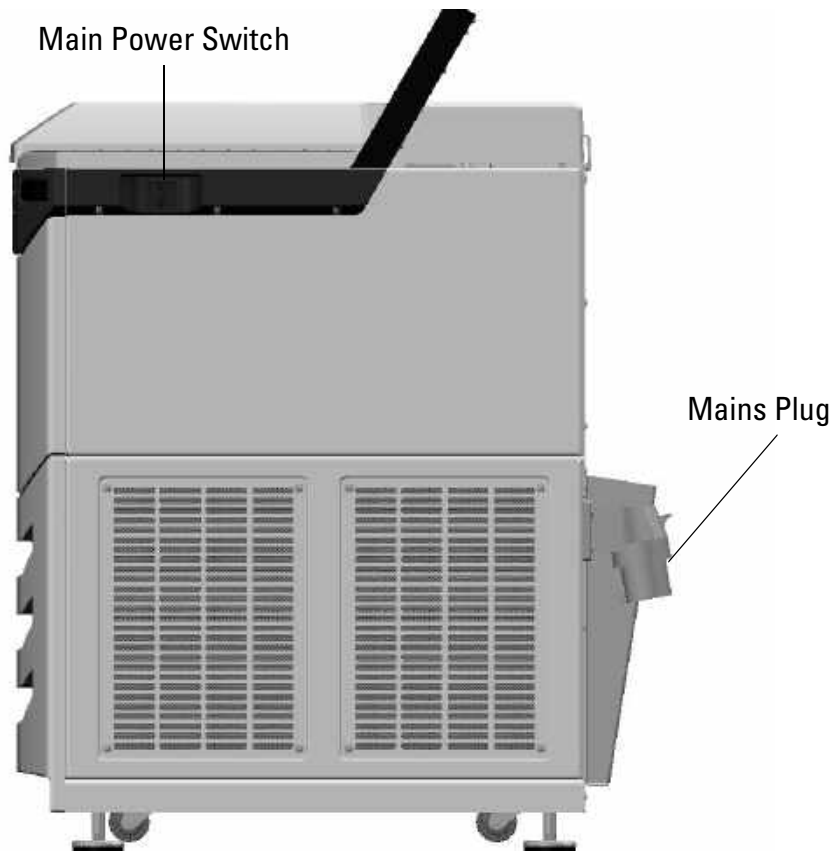


Figure 8. Mains Connection

1. Turn off the power supply switch located on right side (pull the switch handle towards the front of the centrifuge).
2. Check whether the cable complies with the safety standards of your country.
3. Make sure that the voltage and frequency correspond to the figures on the rating plate.
4. Plug the centrifuge into grounded electrical sockets only.

Storage

- Before storing the centrifuge and the accessories it must be cleaned and if necessary disinfected and decontaminated.
- Store the centrifuge in a clean, dust-free location.
- For safety, store the centrifuge on its rubber feet and not on its casters.
- Avoid storing the centrifuge indirect sunlight.

Shipping the Centrifuge

Before shipping the centrifuge please bear the following in mind:

- The centrifuge must be cleaned and decontaminated.
- The decontamination must be confirmed in a special form.



WARNING Before shipping or depositing centrifuges and accessories you have to clean and if necessary disinfect or decontaminate the entire system.

Transporting the Centrifuge

- Use a forklift to lift the centrifuge.
- The centrifuge can be damaged by impact.
- Transport the centrifuge upright and if at all possible in packaging.

Note Store the centrifuge packaging. Contact a shipping company for the transport. Inform customer service.

Always remove the rotor before moving the centrifuge. If you do not remove the rotor you might damage the centrifuge drive or centrifuge spindle.

Control Panel

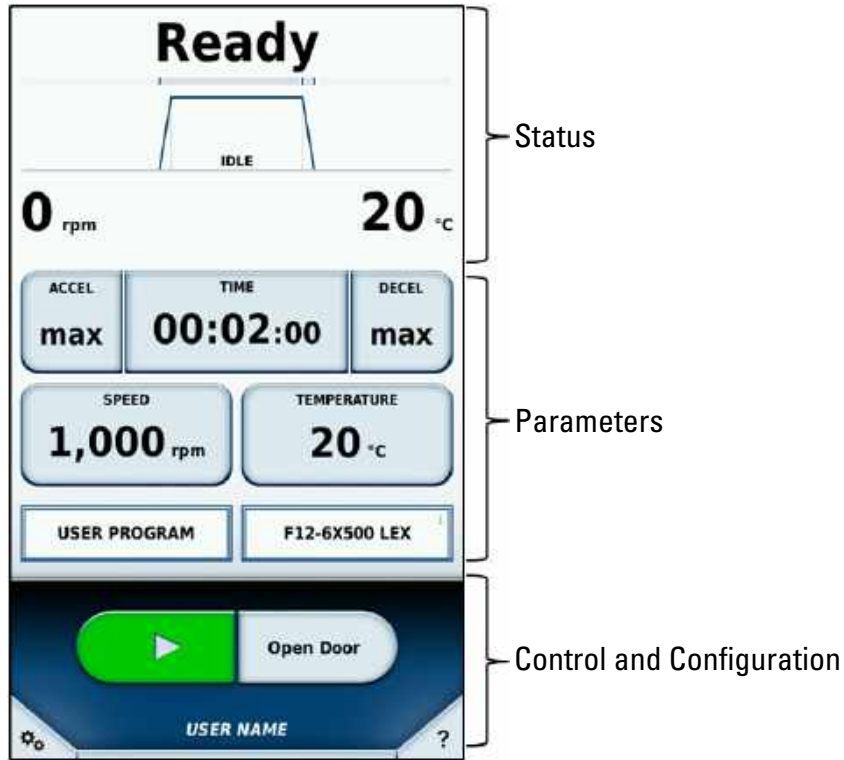
Contents

- “Control Panel” on page 20
- “Status” on page 21
- “Run Parameters” on page 22
- “Control and Configuration” on page 23

Control Panel

The control panel is a touchscreen that contains the centrifuge display. All parameters can be selected and changed during operation.

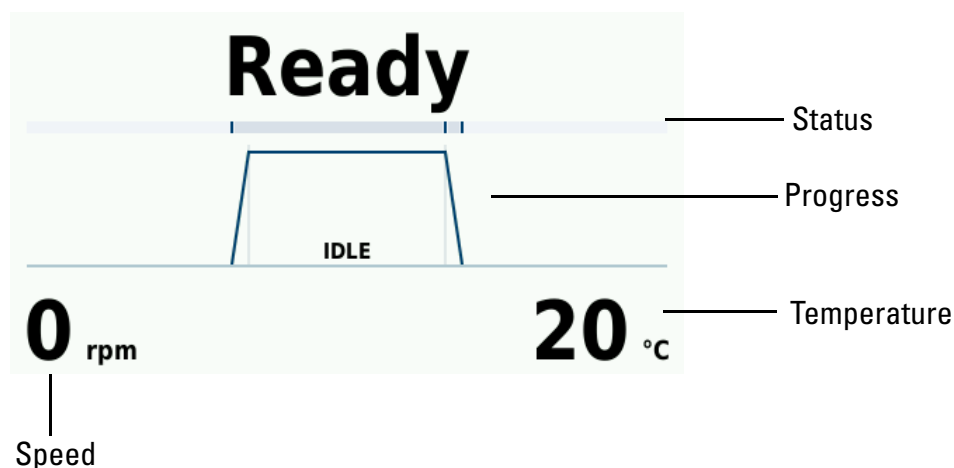
The main screen is divided into the following sections:



Status

The upper part of the touchscreen displays the centrifuge status.

The remaining time is indicated while centrifugation is in progress. The progress bar shows in which phase centrifugation is currently at.



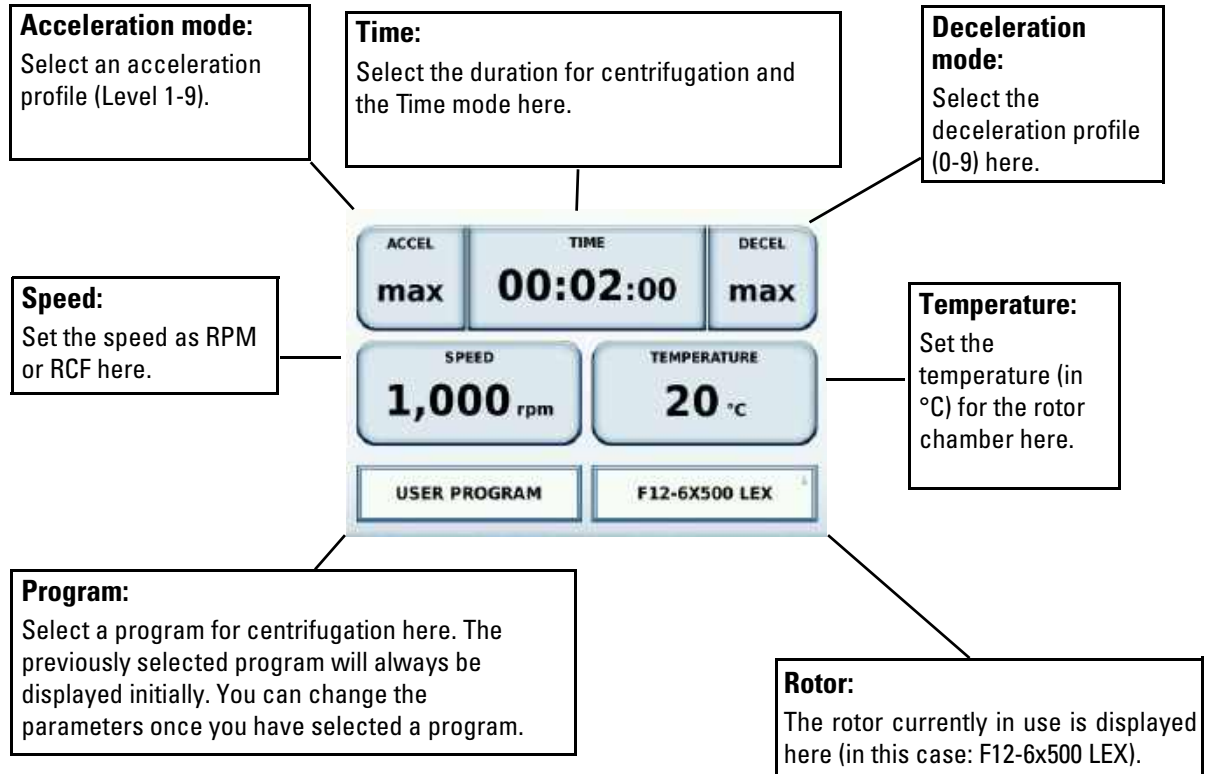
| | |
|---------------------|---|
| Status: | In the Time mode, the remaining time for the centrifugation process is shown here. In the Hold mode, the elapsed time is displayed. |
| Progress: | The curve diagram is divided into the sections Accelerate, Centrifugation and Deceleration. |
| Temperature: | The current temperature in the rotor chamber is shown here. |
| Speed: | The current speed of the rotor is shown here. |

Statuses that can be displayed:

| | |
|------------------------|--|
| Ready | Centrifugation can be started. |
| Door open | Centrifuge door is open |
| Door blocked | Not possible to open centrifuge door automatically. |
| Error | An error has occurred. |
| Canceled | Centrifugation has been halted manually. |
| Complete | Centrifugation has been successfully completed. |
| Pretempering completed | Pretempering has been successfully completed. |
| No rotor | No rotor is being used in the centrifuge. |
| Idle | The centrifuge is in idle operation. |
| Initialization | The centrifuge is being prepared for operation. |
| Timeout | It was not possible to reach the target temperature for pretempering in the defined time period. |

Run Parameters

The set points for centrifugation can be defined and set in the parameterization window. Clicking one of these buttons will open a new window in which you can input the appropriate set point value.



Control and Configuration

In this section you can start and halt centrifugation. You can also define settings, such as for the centrifugation programs. If you are not sure of the general use of a button you can use the tooltip mode, which provides information about all of the operator control elements.

The diagram shows a control panel interface with several key elements and callout boxes:

- Start centrifugation:** A green play button. Text: "Centrifugation can only be started when a rotor has been installed and identified, when all parameters are acceptable and when the centrifuge door is closed."
- Open Door / Stop:** A button that changes from "Open Door" to a red stop button. Text: "When centrifugation starts, this button switches to Stop. When the rotor comes to a complete stop, this button" (with a red stop button icon).
- Configuration:** A gear icon. Text: "The configuration menu is displayed when this button is clicked. This button is not active while centrifugation is in progress."
- Operator:** A button labeled "USER NAME". Text: "In certain modes, touching the operator name opens a window for selecting other options."
- Tooltip Mode:** A question mark icon. Text: "This button is used to activate the Tooltip mode. All functional elements are de-activated with this mode. When an element is selected in the Tooltip mode a field is displayed with information about that particular element. If you press the Tooltip button again, this mode is canceled."

At the bottom, a navigation bar shows "Help", "Runs", "Configuration", a gear icon, and a question mark icon.

Operation

Contents

- “Switch on the Centrifuge” on page 26
- “Centrifuge Door” on page 26
- “Rotor Installation” on page 27
- “Entering Parameters” on page 28
- “Programmed Operation” on page 32
- “Starting Centrifuge Program” on page 32
- “Stopping the Centrifugation Program” on page 32
- “Removing the Rotor” on page 33
- “Turning Off the Centrifuge” on page 33
- “Additional Features” on page 33

Switch on the Centrifuge

Turn on the power switch on the right side of the centrifuge (push the switch handle towards the back of the centrifuge).
The centrifuge performs a self-check of its software.


Centrifuge Door

Two gas pistons open the centrifuge door.



CAUTION The performance of the gas springs might diminish after some time. Do not place your hand in the door opening when the door is not totally open. Contact a service technician when the performance of the gas pistons diminishes.

Check the gas pistons as described below:


- Press  on the touchscreen or the big key on the right corner of the centrifuge.
 - If the centrifuge door opens completely, the gas pistons are functioning properly.
 - If the centrifuge door does not open, the gas pistons need to be replaced.

Door Opening



CAUTION Open the centrifuge only when the rotor stopped spinning. The display shows the current speed also during a failure. In case of a power cut the time until the rotor is in standstill depends on the speed. It can take up to 60 min for the rotor to reach standstill. Never reach into the rotor chamber while the rotor is spinning.

The centrifuge door can only be opened when the centrifuge is turned on.

- Press  on the touchscreen or the big key on the right corner of the centrifuge.



CAUTION Do not reach into the gap between the centrifuge door and the housing. The centrifuge door is drawn shut automatically. Place your hands always on top of the centrifuge door.

Use the emergency release only for malfunctions and power failures (see “[Manual Door Release](#)” on page 44).

Close Centrifuge Door

1. Close the centrifuge door by pressing down on it lightly in the middle or on both sides of it. Two locks close the centrifuge door completely.

Note The door should audibly click into place. Do not slam the centrifuge door.



CAUTION Do not reach into the gap between the centrifuge door and the housing. The centrifuge door is drawn shut automatically. Place your hands always on top of the centrifuge door.

Use the emergency release only for malfunctions and power failures (see “Manual Door Release” on page 44).

Rotor Installation

The approved rotors for the Sorvall LYNX 4000 / 6000 centrifuge are listed in section “Rotor Selection” on page 7. Use only the rotors and accessories from this list in the centrifuge.



CAUTION Unapproved or incorrectly combined accessories can cause serious damage to the centrifuge.

The rotors are equipped with an Auto-Lock rotor exchange. This system is used to automatically lock the rotor to the centrifuge spindle. The rotor does not have to be bolted on to the centrifuge spindle.



CAUTION Make sure that the length and width of the tubes are fitting into the adapter and cavities. Do not use tubes that are too short or too thick for the adapter and the cavities.

Proceed as follows:

1. Open the door of the centrifuge and if necessary remove any dust, foreign objects or residue from the chamber.
Auto-Lock and o-ring must be clean and undamaged.

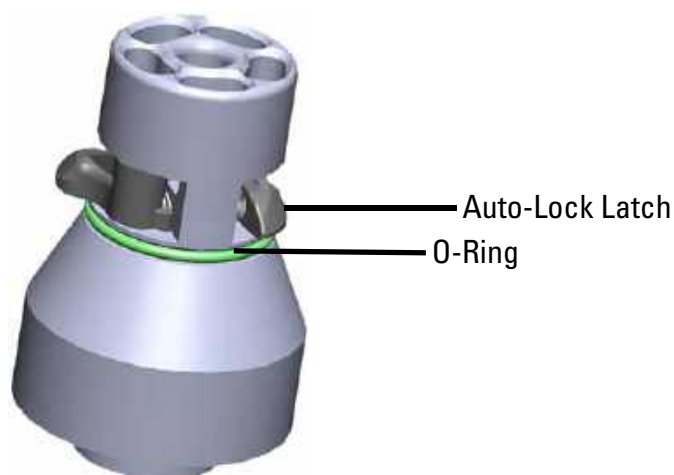


Figure 9. Auto-Lock Adapter

2. Place the rotor over the centrifuge spindle and let it slide slowly down the centrifuge spindle. The rotor clicks automatically into place.

Note Do not force the rotor onto the centrifuge spindle. If the rotor is very light, then it may be necessary to press it onto the centrifuge spindle with a bit of pressure.

3. Check if the rotor is properly installed by lifting it slightly on the handle. If the rotor has not been locked, place the rotor over the centrifuge spindle again.



WARNING If the rotor cannot be properly locked in place after several attempts, then the Auto-Lock is defective and you are not permitted to operate the rotor. Check for any damage to the rotor: Damaged rotors must not be used.

Note Keep the centrifuge spindle area of the rotor clear of objects.



WARNING Check that the rotor is properly locked on the centrifuge spindle before each use by pulling it at its handle.

4. Close the rotor with the rotor lid.



WARNING Be sure to check all sealings before starting any aerosol-tight applications. See the information in the rotor instruction manual.

5. Close the centrifuge door.

Entering Parameters

Acceleration / Deceleration Profiles

There are 9 curves (1-9) for acceleration and 10 for deceleration(0-9). The acceleration / deceleration profile can be selected in the main screen.



Figure 10. Enter Acceleration and Deceleration Profile

Touch the desired field and a window will open.

Touch the number of the desired profile or move the slider by sliding your fingers over the numbers. Select **Apply** to confirm this selection for the next run.

The profile with the lowest number has the shallowest incline marked with **min**; profile number 9 is the steepest incline which is marked with **max**.

Preselecting Speed / RCF-Value

1. Press **100,000**.
The following screen appears:



Figure 11. Screen for Speed and RCF-Value

2. Press **rpm** or **rcf** depending on the value you would like to change. The selected function is highlighted in yellow.
3. Enter the desired value using the numeric pad.
The digits show in sequential order.
4. Confirm your entry by pressing **Confirm**.

Note If an extremely low or high speed or RCF-value has been selected, a message will appear with the permissible values.

Explanation of RCF-Value

The relative centrifugal force (RCF) is given as a multiple of the force of gravity g. It is a unitless numerical value which is used to compare the separation or sedimentation capacity of various devices, since it is independent of the type of device. Only the centrifuging radius and the speed come into play in it:

$$RCF = 11,18 \times \left\langle \frac{n}{1000} \right\rangle^2 \times r$$

r = centrifuging radius in cm


n = rotational speed in rpm

The maximum RCF value is related to the maximum radius of the tube opening.

Remember that this value is reduced depending on the tubes and adapters used.

This can be accounted for in the calculation above if required.

Run Time Preselection

1. Press the  key in order to open the runtime selection menu.

Press **Time**, **Hold** or $\int w^2 dt$, depending on the value you would like to change.

| Time | Hold | ACE |
|---|---|--|
| Duration of centrifugation; input as hh:mm. The set time is counted down when centrifugation is in progress. Initial value: Defined duration hh:mm:00 | Unlimited duration of centrifugation. The time elapsed so far is displayed while centrifugation is in progress. Initial value: 00:00:00 | Accumulated Centrifugal Effect enter in x.y * 10z X: Whole digits (1 st input field) Y: Decimal numbers (2 nd input field) Z: Power (3 rd input field) |

Enter the desired value using the numeric pad.
The digits show in sequential order.

2. Confirm your entry by pressing **Confirm**.

Preselecting the Temperature

For the Sorvall LYNX 4000 centrifuge you can preselect temperatures between -10° C and +40 °C.
For the Sorvall LYNX 6000 centrifuge you can preselect temperatures between -20 °C and +40 °C.

To set the temperature, proceed as follows:

1. Press the temperature field in order to open the temperature menu.



Figure 12. Screen for Temperature

2. Enter the desired temperature using the numeric pad.
The digits show in sequential order.
3. Confirm your entry by pressing **Confirm**.

Pre-warming or Pre-cooling the Centrifuge

To pre-temp the centrifuge, proceed as follows:



Figure 13. Screen for Pre-Temp

4 Operation

Programmed Operation


Use **Configuration** and **Runs** to select a stored program. The pre-temp function is fixed on program 1. Press **Load** to select programmed parameters. In the main screen you can then set the required target temperature.

Programmed Operation

The Sorvall LYNX 4000 / 6000 centrifuge can store up to 120 programs.

In order to create and store programs refer to the separate manual.

Starting Centrifuge Program

Press the  key on the touchscreen. The centrifuge accelerates to the preset speed with the time display active.

You cannot open the centrifuge door as long as the centrifuge is running.

Imbalance Indicator

If a load is imbalanced, this will be indicated at speed higher than approx. 300 rpm by the message **Imbalanced load**.

The run will terminate.


Check the loading and start the centrifuge once again. See the information on proper loading in the rotor instruction manual. For information on troubleshooting, see section “[Troubleshooting by User](#)” on [page 45](#).

Stopping the Centrifugation Program



With preset Run Time

Usually the run time is preset and you only have to wait until the centrifuge stops automatically when the preset time limit expires.

As soon as the speed drops to zero, the message **Complete** will appear in the display. By pressing the  key, you can open the centrifuge door and remove the centrifuge material.

You can also stop the centrifuging program manually at any time by pressing the  key.

Continuous Operation

If you selected continuous operation, you will have to stop the centrifuge manually. Press the  key on the control panel. The centrifuge will be decelerated at the designated rate. The message **Complete** will illuminate, and after pressing the  key, the centrifuge door will open and you can remove the centrifuged material.

Removing the Rotor

To remove the rotor, proceed as follows:

1. Open the centrifuge door.
2. Grab the rotor handle with one or both hands and push down on against the Auto-Lock button. At the same time, pull the rotor directly upwards with both hands and remove it from the centrifuge spindle. Make sure not to tilt the rotor while doing this.



Figure 14. Holding the Rotor during Removal

Turning Off the Centrifuge

Turn off the power supply switch located on right side (pull the switch handle towards the front of the centrifuge).

Additional Features

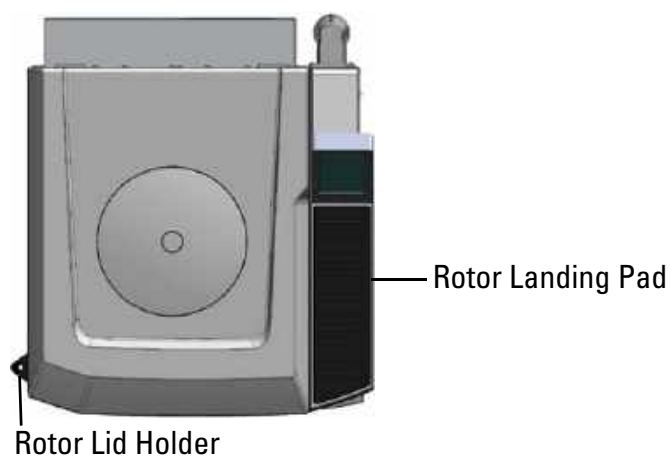


Figure 15. Additional Features of the Sorvall LYNX 4000 / 6000

Rotor Landing Pad

You can place the rotor on the right hand side of the centrifuge in front of the touchscreen. The surface is anti-skidding.



CAUTION Do not place anything on the rotor landing pad when the centrifuge door is closed.

Rotor Lid Holder

You can place the rotor lid in the rotor lid holder feature on the left hand side of the centrifuge.

Note Some rotors lids have a mandrel that is part of the Auto-Lock. Use the rotor lid holder to store the rotor lid.

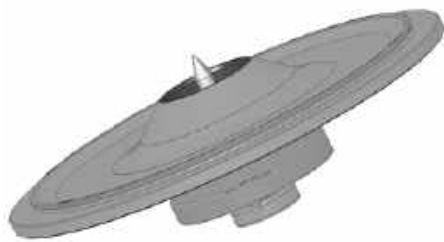


Figure 16. Auto-Lock Rotor Lid



CAUTION Mind the Auto-Lock mandrel inside the rotor lid. Do not touch the mandrel.

Maintenance and Care

Contents

- “Cleaning Intervals” on page 36
- “Cleaning” on page 36
- “Cleaning the Touchscreen” on page 38
- “Cleaning the Condenser Filter” on page 38
- “Disinfection” on page 39
- “Decontamination” on page 40
- “Autoclaving” on page 41
- “Service of Thermo Fisher Scientific” on page 41
- “Shipping and Deposing of Accessories” on page 42

Cleaning Intervals

For the sake of personal, environmental, and material protection, it is your duty to clean and if necessary disinfect the centrifuge on a regular basis.

| Maintenance | Recommended interval |
|-------------------------|----------------------|
| Clean Rotor Chamber | Daily or when soiled |
| Clean Rotor | Daily or when soiled |
| Clean Accessory | Daily or when soiled |
| Clean Housing | Once per month |
| Clean Condenser Filter | Every six months |
| Clean Ventilation Holes | Every six months |



CAUTION Refrain from using any other cleaning or decontamination procedure than those recommended here, if you are not entirely sure that the intended procedure is safe for the equipment.
Use only approved cleansers.
If in doubt, contact Thermo Fisher Scientific.

Cleaning

When cleaning centrifuge mind the following:

- Use warm water with a neutral solvent.
- Never use caustic cleaning agents such as soap suds, phosphoric acid, bleaching solutions or scrubbing powder.
- Rinse the cavities out thoroughly.
- Use a soft brush without metal bristles to remove stubborn residue.
- Afterwards rinse with distilled water.
- Place the rotors on a plastic grate with their cavities pointing down.
- If drying boxes are used, the temperature must never exceed 50 °C, since higher temperatures could damage the material and shorten the lifetime of the parts.
- Use only disinfectants with a pH of 6-8.
- Dry aluminum parts off with a soft cloth.
- After cleaning, treat the entire surface of aluminum parts with corrosion protection oil (70009824). Also treat the cavities with oil.
- Store the aluminum parts at room temperature or in a cold-storage room with the cavities pointing down.

- Make sure that the rotor chamber is always dry.

Note Before using any cleaning or decontamination methods except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.

Clean centrifuge and accessories as follows:

1. Open the centrifuge.
 2. Turn off the centrifuge.
 3. Pull out the power supply plug.
 4. Grab the rotor handle with one or both hands and press against the Auto-Lock button. At the same time, pull the rotor directly upwards it from the centrifuge spindle.
 5. Remove the centrifuge tubes and adapters.
 6. Use a neutral cleaning agent with a pH value between 6 and 8 for cleaning.
 7. Dry all of the rotors and accessories after cleaning with a cloth or in a warm air cabinet at a maximum temperature of 50 °C.
- After cleaning, treat the entire surface of aluminum parts with corrosion protection oil (70009824). Also treat the cavities with oil.

Note When cleaning, do not allow liquids, especially organic solvents, to get on the drive shaft or the bearings of the centrifuge. Organic solvents break down the grease in the motor bearing. The drive shaft could freeze up.

After some applications there might be ice in the rotor chamber. Let the ice melt and drain it off. Clean the rotor chamber as described above.

Cleaning the Touchscreen

1. Pull out the power supply plug.
2. Clean the touchscreen using a dry microfiber cloth.
3. If necessary moisten the microfiber cloth and wipe the touchscreen again.

Cleaning the Condenser Filter



CAUTION The fins of the condenser are very sharp. Make sure to wear protective gloves when removing the filter mats.

The Sorvall LYNX 4000 / 6000 centrifuge has two filter mats to prevent dust from entering the centrifuge. In order to clean them proceed as follows:

1. Loosen the four screws of both venting grids on the right side of the centrifuge.
2. Remove the venting grids and the filter mats (75000014).
3. Use a vacuum cleaner on both sides of both filter mats.
4. Inserting the filter mats again.
5. Reinstall the venting grids.

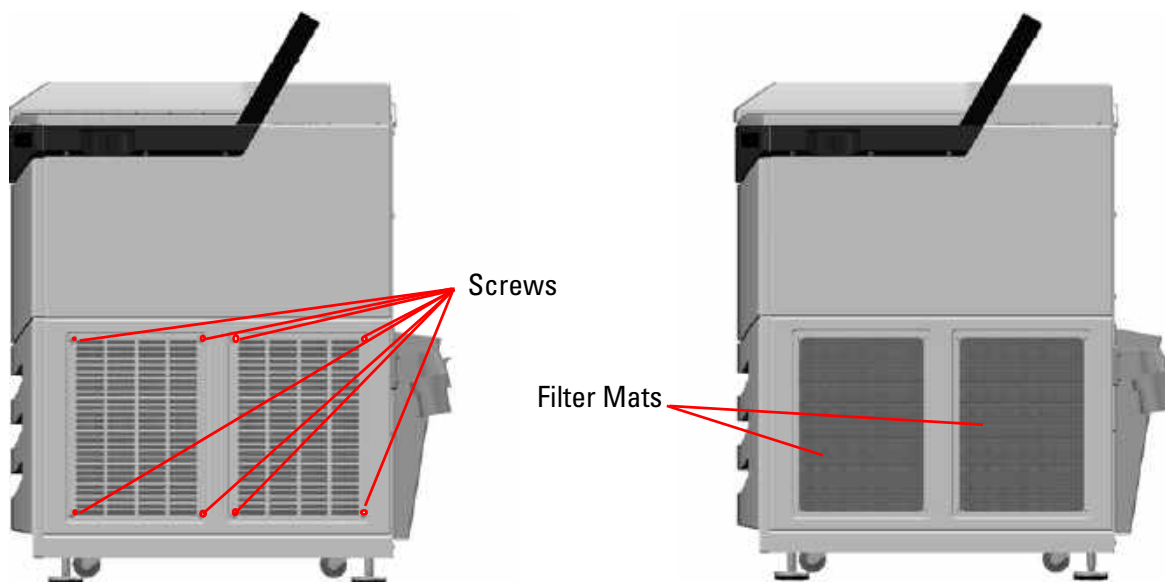


Figure 17. Venting Grids

Disinfection

Disinfect the centrifuge immediately whenever infectious material has spilled during centrifugation.



WARNING Infectious material can get into the centrifuge when a tube breaks or as a result of spills. Keep in mind the risk of infection when touching the rotor and take all necessary precautions.

In case of contamination, make sure that others are not put at risk. Decontaminate the affected parts immediately. Take other precautions if need be.

The rotor chamber and the rotor should be treated preferably with a neutral disinfectant.

Note Before using any cleaning or decontamination methods except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.

Observe the safety precautions and handling instructions for the cleaning agents used.

Contact Thermo Fisher Scientific for questions regarding the use of other disinfectants.

Disinfect the rotor and accessories as follows:

1. Open the centrifuge.
2. Turn off the centrifuge.
3. Pull out the power supply plug.
4. Grab the rotor handle with one or both hands and press against the Auto-Lock button. At the same time, pull the rotor directly upwards it from the centrifuge spindle.
5. Remove the centrifuge tubes and adapters and dispose of them or disinfect them.
6. Treat the rotor and accessories according to the instructions for the disinfectant. Adhere strictly to the given application times.
7. Be sure the decontamination solution can drain off the rotor.
8. Rinse the rotor and accessories thoroughly with water.
9. Dispose of the disinfectant according to the applicable guidelines.
10. Dry all of the rotors and accessories after cleaning with a cloth or in a warm air cabinet at a maximum temperature of 50 °C.
11. After cleaning, treat the entire surface of aluminum parts with corrosion protection oil (70009824). Also treat the cavities with oil.

Decontamination

Decontaminate the centrifuge immediately whenever radioactive material has spilled during centrifugation.



WARNING Radioactive material can get into the centrifuge when a tube breaks or as a result of spills. Keep in mind the risk of infection when touching the rotor and take all necessary precautions.

In case of contamination, make sure that others are not put at risk. Decontaminate the affected parts immediately. Take other precautions if need be.



CAUTION Before using any cleaning or decontamination methods except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.

For general radioactive decontamination use a decontamination solution of equal parts of 70 % ethanol, 10 % SDS and water.

1. Open the centrifuge.
2. Turn off the centrifuge.
3. Pull out the power supply plug.
4. Grab the rotor handle with one or both hands and press against the Auto-Lock button. At the same time, pull the rotor directly upwards it from the centrifuge spindle.
5. Remove the centrifuge tubes and adapters and dispose of them or disinfect them.
6. Rinse the rotor first with ethanol and then with de-ionized water.

Note Adhere strictly to the given application times.

7. Be sure the decontamination solution can drain off the rotor.
8. Rinse the rotor and accessories thoroughly with water.
9. Dispose of the decontamination solution according to the applicable guidelines.
10. Dry all of the rotors and accessories after cleaning with a cloth or in a warm air cabinet at a maximum temperature of 50 °C.
11. After cleaning, treat the entire surface of aluminum parts with corrosion protection oil (70009824). Also treat the cavities with oil.

Autoclaving

1. Before autoclaving clean rotor and accessories as described above.
2. Place the rotor on a flat surface.
 - Rotors and adapter can be autoclaved at 121 °C.
 - The maximum permissible autoclave cycle is 20 minutes at 121 °C.



CAUTION No chemical additives are permitted in the steam.
Never exceed the permitted temperature and duration when autoclaving.



WARNING If the rotor shows signs of corrosion or wear, it must be replaced.

Service of Thermo Fisher Scientific

Thermo Fisher Scientific recommends having the centrifuge and accessories serviced once a year by an authorized service technician. The service technician checks the following:

- the electrical equipment;
- the suitability of the set-up site;
- the centrifuge door lock and the safety system;
- the rotor;
- the fixation of the rotor and the drive shaft;
- the protective casing.

Thermo Fisher Scientific offers inspection and service contracts for this work. Any necessary repairs are performed for free during the warranty period and afterwards for a charge.

This is only valid if the centrifuge has only been maintained by a Thermo Scientific service technician.

Shipping and Depositing of Accessories

Contact the Thermo Scientific customer service before returning any item. You will receive a Return Materials Authorization (RMA) that must be used for the shipping. When you have questions regarding the depositing the customer service will help you as well.



WARNING Before shipping or depositing centrifuges and accessories you have to clean and if necessary disinfect or decontaminate everything. Before storing the centrifuge and the accessories it must be cleaned and if necessary disinfected and decontaminated.

Troubleshooting

Contents

- “Manual Door Release” on page 44
- “Troubleshooting by User” on page 45
- “When to contact a Service Technician” on page 46

Manual Door Release

During a power failure, you will not be able to open the centrifuge door with the regular electric centrifuge door release. A mechanical override is provided to allow sample recovery in the case of an emergency. However, this should be used only in emergencies and after the rotor has come to a complete stop.



CAUTION The rotor can still be spinning at high speed. If touched, it can cause serious injuries.

Always wait until the rotor has come to a stop without braking. The brake does not work when there is no current. The deceleration process lasts much longer than usual.

Proceed as follows:

1. Wait until the rotor has stopped. This might take some 60 minutes or even longer.



CAUTION Never use your hand or any tools to brake the rotor.

2. Pull out the power supply plug.
3. On the left side of the housing are two white plastic plugs which you can pry out of the side plate with a screwdriver or a knife.
Pull the release cords attached to it at the same time to trigger the mechanical centrifuge door release. The centrifuge door will open and the samples can be removed.

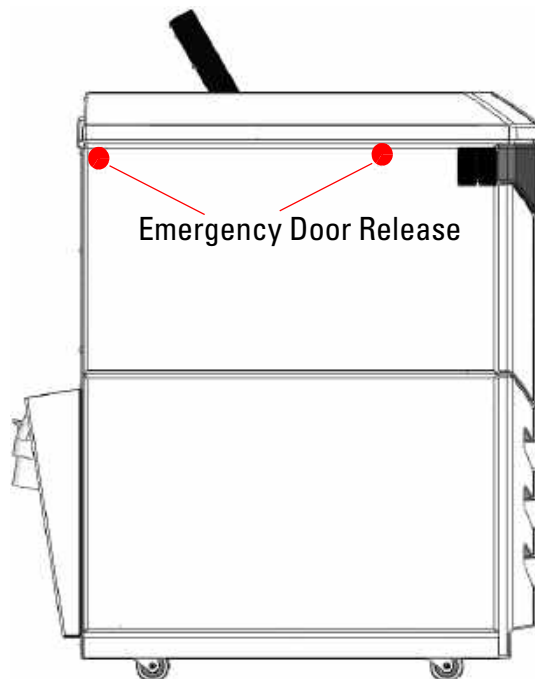



Figure 18. Emergency Door Release

Note You need to pull both release cords in order to unlock both locks.

4. Push the release cords back into the centrifuge and mount the plug.
5. Reconnect the centrifuge once the power has been restored.
6. Switch on the centrifuge, this will reset the lock.
7. Press  on the touchscreen or the big key on the right corner of the centrifuge.

Troubleshooting by User

Error message appear in a red screen.

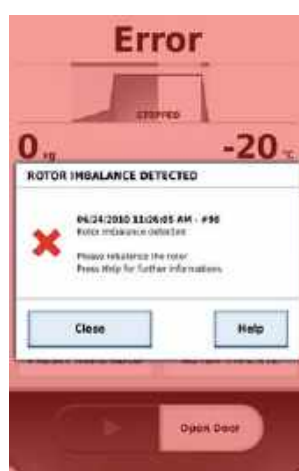


Figure 19. Example for an error message

Note If problems occur other than those listed in this table, service technician must be contacted.

| Failure message | Problem with centrifuge | Possible causes and cures |
|-----------------|---|--|
| E-1 - E-97 | | Restart the centrifuge. If the message appears again, inform a service technician. |
| E-98 | The centrifuge cannot be operated. The run does not start or the centrifuge brakes and ends the run. | Imbalance detected. Check the load placed in the rotor. Check that the bolts of the rotor are well greased. Restart the centrifuge. If the message appears again, inform a service technician. |
| E- 99 | | Restart the centrifuge. If the message appears again, inform a service technician. |

6 Troubleshooting

When to contact a Service Technician

At very high speeds the Sorvall LYNX 6000 centrifuge creates a partial vacuum. In case of problems due to the vacuum pump or a seal failure the Sorvall LYNX 6000 centrifuge displays an error message. Contact a service technician. Until the problem has been solved you can operate the Sorvall LYNX 6000 centrifuge at lower speeds. Confirm with the speeds given for the Sorvall LYNX 4000 centrifuge in the rotor manual.

When to contact a Service Technician

If you need to contact a service technician, please provide the order no. and the serial no. of your centrifuge. This information can be found on the back near the inlet for the power supply cable.

To identify the software version, proceed as follows:

1. Switch on the centrifuge.
2. Open the configuration menu.
3. Select **Configuration**.
4. Select **Device**.
Now you can read all required data.
5. Communicate the software version to the service technician.

Rotor Care Guide

Contents

- “Routine Evaluation and Care of Your Rotor” on page 48
- “Proper Handling” on page 48
- “Stress Corrosion” on page 49
- “Missing Paint and Anodization” on page 49
- “Dropped Rotors” on page 49
- “Overheating” on page 49
- “Rotor Maintenance” on page 49
- “Maintenance and Care” on page 51
- “Storage” on page 51
- “Decontamination” on page 52

A Rotor Care Guide

Routine Evaluation and Care of Your Rotor

Each time you use a rotor, visually inspect its condition for signs of physical wear or damage:

- Corrosion in the rotor cavities or exterior surfaces.
- Scratches or gouges to the base metal.
- Missing or worn anodizing.
- Damage to contact points, such as thread, hubs and screws.

Over time, stress observed in a typical fixed angle rotor will cause metal fatigue.

Heavy corrosion can result in premature rotor failure.



Routine Evaluation and Care of Your Rotor

Rotors are frequently damaged in use and this damage may be exacerbated under centrifugal forces. As a result, even a tiny flaw in a critical part of the rotor may generate stresses greater than the rotor was designed to withstand. Rotors are also subject to high levels of stress due to the centrifugal force created by high rotational speeds, and repeated cycles can cause metal rotors to stretch and change in size.

Proper Handling

Improper installation can lead to failure so it is imperative to:

- Always make sure that the rotors are fixed with the Autolock.
- Ensure buckets are properly seated on their trunnions.
- Avoid dropping or striking the rotor against a hard surface.
- Avoid putting anything inside the rotor that could scratch or nick the surface.

In addition, ensure that all tubes, bottles and adapters are being used within their specified limits and according to the manufacturer's directions. Tube or bottle failures during centrifugation can result in minor to severe damage to rotors and centrifuges.

Stress Corrosion

Stress distribution is an important consideration when evaluating the extent of rotor damage. Ultraspeed rotors experience the highest level of stress of all rotors; if it is run above its rated speed, it probably has exceeded its yield point. In this event, the metal is permanently deformed and rotor life is severely compromised. Lower speed metal rotors will also become fatigued, depending on the rotor type, number of runs and the speed of those runs. However, corrosion, improper handling and misuse will often require that you retire your rotor long before normal fatigue becomes a danger.

Missing Paint and Anodization

While missing paint will not affect the life of a titanium or carbon fiber rotor, missing anodization on an aluminum rotor may signal that it is time to retire the rotor.

Dropped Rotors

Deformation caused by dropping a metal rotor cannot be repaired, requiring that the rotor be replaced. In some cases, carbon fiber rotors are repairable if damaged. The test is carried out by TFS.

Overheating

Melted bottles or other plastic or a rotor that is too hot to touch are indications that a rotor has overheated. Aluminum and carbon fiber rotors can be autoclaved up to 121 °C, while titanium and stainless steel rotors can withstand higher temperatures and are not likely to be damaged by heat generated in the centrifuge.

Rotor Maintenance

Protect your rotor against damage or failure with preventive measures and maintain maximum centrifuge performance. However, if rotor damage is observed, ensure the safety of your lab by taking recommended action or contacting your sales representative for an inspection.

| Potential Damage | Preventive Measures | Recommended Action |
|--------------------------------------|--|--|
| Damage to lid assembly | <ul style="list-style-type: none"> Lubricate periodically with a light film of o-ring or vacuum grease. Keep lid assembly lubricated with anti-galling grease Avoid banging or dropping Use care when removing o-rings. Clean with non-abrasive cloth and mild detergent. | Return lid assembly parts to manufacturer for repair or replacement. |
| Damage to biocontainment sealing lid | <ul style="list-style-type: none"> Use care when removing o-rings. Inspect and replace o-rings regularly. | Replace sealing lid to ensure proper containment |

| Potential Damage | Preventive Measures | Recommended Action |
|--|---|---|
| Scoring to the bottom of the rotor (outside of cone area) | <ul style="list-style-type: none"> Gently place rotor on the centrifuge spindle. Clean with non-abrasive cloth and mild detergent. Inspect centrifuge mated parts for burrs and ensure no debris in centrifuge chamber. Store rotor on rotor stand or soft surface. | Return rotor to manufacturer for evaluation or replacement. |
| Damage to the rotor drive pins | <ul style="list-style-type: none"> Gently place rotor on the centrifuge spindle. Ensure rotor is securely locked to centrifuge drive. | Return rotor to manufacturer for replacement of rotor hub adapter or replace rotor depending on degree of damage/corrosion. |
| Pitting from corrosion in the bottom of tube cavity (metal rotors) | <ul style="list-style-type: none"> Ensure rotor is dried thoroughly between runs. Clean rotor immediately after use and when exposed to chemicals with approved solvent. Remove adapters after use, rinse and dry. | Return rotor to manufacturer for evaluation. |
| Cracked or de-laminated rotor | <ul style="list-style-type: none"> Avoid sharp impact. Avoid harsh chemicals Clean the surface of rotor and coat with a thin layer of oil to prevent corrosion. | Return rotor to manufacturer for evaluation. |
| Damage to rotor tie-down threads | <ul style="list-style-type: none"> Avoid cross threading of parts. Never use metallic or abrasive objects to clean. Clean and lubricate regularly. | Replace rotor tie-down assembly. |
| Damage to bucket seats | <ul style="list-style-type: none"> Lubricate buckets regularly. Slide buckets into place carefully to avoid dropping or forcing into position. | Replace rotor bucket set. |
| Windshield damage | <ul style="list-style-type: none"> Avoid banging or dropping. Do not exceed rotor's maximum compartment mass. Ensure windshield area is free of debris. | Replace rotor to avoid vibration that will wear the drive. |
| Rotor bucket cap damage | <ul style="list-style-type: none"> Avoid cross threading of parts. Never use metallic objects to clean. Clean and lubricate regularly. | Replace rotor bucket caps and return set for rebalancing (if applicable). |
| Rotor bucket damage | <ul style="list-style-type: none"> Avoid banging or dropping Do not exceed rotor's maximum compartment mass. Ensure buckets are free of debris. | Replace rotor buckets or return bucket set for rebalancing. |

| Potential Damage | Preventive Measures | Recommended Action |
|--|--|---|
| Gouges or corrosion on surface of rotor | <ul style="list-style-type: none"> Inspect before every use. | Return rotor to manufacturer for evaluation or replacement. |
| Septa damage in continuous flow or zonal rotor | <ul style="list-style-type: none"> Avoid sharp impact. Avoid harsh chemicals Clean the surface of rotor and coat with a thin layer of oil to prevent corrosion. | Return rotor to manufacturer for evaluation. |
| Light scratches on surface | <ul style="list-style-type: none"> Avoid banging or dropping. Never use metallic objects to remove debris. | Monitor to ensure no corrosion has occurred. |
| Bent centrifuge spindle | <ul style="list-style-type: none"> Remove rotor in a straight up motion. Ensure samples are properly balanced | Call service for replacement of centrifuge spindle |

Corrosion, pitting and even minor surface imperfections affect metal rotor life by increasing stress and, as a result, make it difficult to predict at what point the rotor material could fail.

Maintenance and Care

Metal corrosion can be avoided by following a routine maintenance program after each rotor use:

- Clean rotors, lids, adapters and any associated parts with a neutral cleaning agent with a pH value between 6 and 8. Rinse with distilled water and dry thoroughly with a soft cloth.
- Do not use strong alkaline laboratory detergent on aluminum rotors; if encrusted material is present, remove it with a soft, twisted-bristle brush and the 1 % non-alkaline soap solution.
- For benchtop, lowspeed and superspeed swinging bucket rotors, keep the bucket trunnion pins clean and lubricated.
- Lubricate o-rings with vacuum grease and metal rotor threads with anti-galling grease (75003786) weekly, when specified in rotor manual.
- Apply an additional coating of anti-corrosion oil (70009824) to prolong the life of an anodized coating.
- Refer to the Maintenance and Care chapter in this rotor manual.

Storage

Any moisture left on a metal rotor can initiate corrosion, so after cleaning ensure proper storage:

- Remove all adapters from rotor cavities when not in use.
- Dry and store upside-down Use a PTFE-coated or plastic matting to allow for airflow or a ventilated shelf to avoid gathering condensation in the cavity or bucket bottom.

Decontamination

Given the nature of samples processed in a rotor, biological or radioactive contamination is possible. For biological contamination of rotors, a 2 % glutaraldehyde solution, ethylene oxide or ultraviolet radiation are the recommended methods of sterilization, While for a rotor that may be contaminated by a radioactive sample, use a solution of equal parts of 70 % ethanol, 10 % SDS and water. In addition:

- Do not use chlorine bleach on aluminum rotors.
- When autoclaving, rotor components should be separated.
- If sterilization is not necessary, a 70 % solution of ethanol can be used.
- Most commercially available detergents for radioisotopic contamination are not compatible with aluminum or anodized coatings and shall not be used.
- Rinse with ethanol, followed by water and dry with a soft cloth.
- Do not immerse Thermo Scientific Fiberlite rotors; spin rotor to remove liquid.
- Fiberlite composite rotors are not compatible with ethylene oxide.

Chemical Compatibility Chart

| CHEMICAL | MATERIAL | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------|----------|-----------------------------|--------|----------------------------|--------------------------|------------------------------|---------|--------------------|-------|----------|-------|-------|--|-------------|---------------|----------------------------|----------------|--------------|---------------|-------------|--------------------|-----------------|-----------------|-----------------|----------|-------|-------|---|
| | ALUMINUM | ANODIC COATING for ALUMINUM | BUNA N | CELLULOSE ACETATE BUTYRATE | POLYURETHANE ROTOR PAINT | COMPOSITE Carbon Fiber/Epoxy | DELRIIN | ETHYLENE PROPYLENE | GLASS | NEOPRENE | NORYL | NYLON | PET ¹ , POLYCLEAR, CLEARCRIMP | POLYALLOMER | POLYCARBONATE | POLYESTER, GLASS THERMOSET | POLYETHERIMIDE | POLYTRHYLENE | POLYPROPYLENE | POLYSULFONE | POLYVINYL CHLORIDE | RULON A, TEFLON | SILICONE RUBBER | STAINLESS STEEL | TITANIUM | TYGON | VITON | |
| 2-mercaptoethanol | S | S | U | - | S | M | S | - | S | U | S | S | U | S | S | - | S | S | S | S | U | S | S | S | S | S | S | S |
| Acetaldehyde | S | - | U | U | - | - | - | M | - | U | - | - | - | M | U | U | U | M | M | - | M | S | U | - | S | - | U | |
| Acetone | M | S | U | U | S | U | M | S | S | U | U | S | U | S | U | U | U | S | S | U | U | S | M | M | S | U | U | |
| Acetonitrile | S | S | U | - | S | M | S | - | S | S | U | S | U | M | U | U | - | S | M | U | U | S | S | S | S | U | U | |
| Alconox | U | U | S | - | S | S | S | - | S | S | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S | S | U | |
| Allyl Alcohol | - | - | - | U | - | - | S | - | - | - | - | S | - | S | S | M | S | S | S | - | M | S | - | - | S | - | - | |
| Aluminum Chloride | U | U | S | S | S | S | U | S | S | S | S | M | S | S | S | S | - | S | S | S | S | S | M | U | U | S | S | |
| Formic Acid (100%) | - | S | M | U | - | - | U | - | - | - | - | U | - | S | M | U | U | S | S | - | U | S | - | U | S | - | U | |
| Ammonium Acetate | S | S | U | - | S | S | S | - | S | S | S | S | S | S | S | U | - | S | S | S | S | S | S | S | S | S | S | |
| Ammonium Carbonate | M | S | U | S | S | S | S | S | S | S | S | S | S | S | U | U | - | S | S | S | S | S | S | M | S | S | S | |
| Ammonium Hydroxide (10 %) | U | U | S | U | S | S | M | S | S | S | S | S | - | S | U | M | S | S | S | S | S | S | S | S | S | M | S | |
| Ammonium Hydroxide (28 %) | U | U | S | U | S | U | M | S | S | S | S | S | U | S | U | M | S | S | S | S | S | S | S | S | S | M | S | |
| Ammonium Hydroxide (conc.) | U | U | U | U | S | U | M | S | - | S | - | S | U | S | U | U | S | S | S | - | M | S | S | S | - | U | | |
| Ammonium Phosphate | U | - | S | - | S | S | S | S | S | S | S | S | - | S | S | M | - | S | S | S | S | S | S | M | S | S | S | |
| Ammonium Sulfate | U | M | S | - | S | S | U | S | S | S | S | S | S | S | S | S | - | S | S | S | S | S | U | S | S | U | | |
| Amyl Alcohol | S | - | M | U | - | - | S | S | - | M | - | S | - | M | S | S | S | S | M | - | - | - | U | - | S | - | M | |
| Aniline | S | S | U | U | S | U | S | M | S | U | U | U | U | U | U | U | - | S | M | U | U | S | S | S | S | U | S | |
| Sodium Hydroxide (<1 %) | U | - | M | S | S | S | - | - | S | M | S | S | - | S | M | M | S | S | S | S | S | S | M | S | S | - | U | |
| Sodium Hydroxide (10 %) | U | - | M | U | - | - | U | - | M | M | S | S | U | S | U | U | S | S | S | S | S | S | M | S | S | - | U | |
| Barium Salts | M | U | S | - | S | S | S | S | S | S | S | S | S | S | S | M | - | S | S | S | S | S | M | S | S | S | S | |
| Benzene | S | S | U | U | S | U | M | U | S | U | U | S | U | U | U | M | U | M | U | U | U | U | U | U | S | U | S | |
| Benzyl Alcohol | S | - | U | U | - | - | M | M | - | M | - | S | U | U | U | U | U | U | U | - | M | S | M | - | S | - | S | |
| Boric Acid | U | S | S | M | S | S | U | S | S | S | S | S | S | S | S | S | U | S | S | S | S | S | S | S | S | S | S | |
| Cesium Acetate | M | - | S | - | S | S | S | - | S | S | S | S | - | S | S | - | - | S | S | S | S | S | M | S | S | S | S | |

C Chemical Compatibility Chart

| CHEMICAL | MATERIAL | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------|----------|-----------------------------|--------|----------------------------|--------------------------|------------------------------|--------|--------------------|-------|----------|-------|-------|--|-------------|---------------|----------------------------|----------------|--------------|---------------|-------------|--------------------|-----------------|-----------------|-----------------|----------|-------|-------|--|
| | ALUMINUM | ANODIC COATING for ALUMINUM | BUNA N | CELLULOSE ACETATE BUTYRATE | POLYURETHANE ROTOR PAINT | COMPOSITE Carbon Fiber/Epoxy | DELRIN | ETHYLENE PROPYLENE | GLASS | NEOPRENE | NORYL | NYLON | PET ¹ , POLYCLEAR, CLEARCRIMP | POLYALLUMER | POLYCARBONATE | POLYESTER, GLASS THERMOSET | POLYETHERIMIDE | POLYRTHYLENE | POLYPROPYLENE | POLYSULFONE | POLYVINYL CHLORIDE | RULON A, TEFLON | SILICONE RUBBER | STAINLESS STEEL | TITANIUM | TYGON | VITON | |
| Cesium Bromide | M | S | S | - | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | M | S | S | S | |
| Cesium Chloride | M | S | S | U | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | M | S | S | S | |
| Cesium Formate | M | S | S | - | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | M | S | S | S | |
| Cesium Iodide | M | S | S | - | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | M | S | S | S | |
| Cesium Sulfate | M | S | S | - | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | M | S | S | S | |
| Chloroform | U | U | U | U | S | S | M | U | S | U | U | M | U | M | U | U | U | M | M | U | U | S | U | U | U | M | S | |
| Chromic Acid (10 %) | U | - | U | U | S | U | U | - | S | S | S | U | S | S | M | U | M | S | S | U | M | S | M | U | S | S | S | |
| Chromic Acid (50 %) | U | - | U | U | - | U | U | - | - | - | S | U | U | S | M | U | M | S | S | U | M | S | - | U | M | - | S | |
| Cresol Mixture | S | S | U | - | - | - | S | - | S | U | U | U | U | U | U | - | - | U | U | - | U | S | S | S | S | U | S | |
| Cyclohexane | S | S | S | - | S | S | S | U | S | U | S | S | U | U | U | M | S | M | U | M | M | S | U | M | M | U | S | |
| Deoxycholate | S | S | S | - | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | S | S | S | S | |
| Distilled Water | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | |
| Dextran | M | S | S | S | S | S | S | - | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | M | S | S | S | |
| Diethyl Ether | S | S | U | U | S | S | S | U | S | U | U | S | U | U | U | U | U | U | U | U | U | S | S | S | S | M | U | |
| Diethyl Ketone | S | - | U | U | - | - | M | - | S | U | - | S | - | M | U | U | U | M | M | - | U | S | - | - | S | U | U | |
| Diethylpyrocarbonate | S | S | U | - | S | S | S | - | S | S | U | S | U | S | U | - | - | S | S | S | M | S | S | S | S | S | S | |
| Dimethylsulfoxide | S | S | U | U | S | S | S | - | S | U | S | S | U | S | U | U | - | S | S | U | U | S | S | S | U | U | U | |
| Dioxane | M | S | U | U | S | S | M | M | S | U | U | S | U | M | U | U | - | M | M | M | U | S | S | S | S | U | U | |
| Ferric Chloride | U | U | S | - | - | - | M | S | - | M | - | S | - | S | - | - | - | S | S | - | - | - | M | U | S | - | S | |
| Acetic Acid (Glacial) | S | S | U | U | S | S | U | M | S | U | S | U | U | U | U | U | M | S | U | M | U | S | U | U | S | - | U | |
| Acetic Acid (5 %) | S | S | M | S | S | S | M | S | S | S | S | S | M | S | S | S | S | S | S | S | M | S | S | M | S | S | M | |
| Acetic Acid (60 %) | S | S | U | U | S | S | U | - | S | M | S | U | U | M | U | S | M | S | M | S | M | S | M | U | S | M | U | |
| Ethyl Acetate | M | M | U | U | S | S | M | M | S | S | U | S | U | M | U | U | - | S | S | U | U | S | M | M | S | U | U | |
| Ethyl Alcohol (50 %) | S | S | S | S | S | S | M | S | S | S | S | S | U | S | U | S | S | S | S | S | S | S | S | M | S | M | U | |
| Ethyl Alcohol (95 %) | S | S | S | U | S | S | M | S | S | S | S | S | U | S | U | - | S | S | S | M | S | S | S | U | S | M | U | |
| Ethylene Dichloride | S | - | U | U | - | - | S | M | - | U | U | S | U | U | U | U | U | U | U | - | U | S | U | - | S | - | S | |
| Ethylene Glycol | S | S | S | S | S | S | S | S | S | S | S | S | - | S | U | S | S | S | S | S | S | S | S | M | S | M | S | |
| Ethylene Oxide Vapor | S | - | U | - | - | U | - | - | S | U | - | S | - | S | M | - | - | S | S | S | U | S | U | S | S | S | U | |
| Ficoll-Hypaque | M | S | S | - | S | S | S | - | S | S | S | S | - | S | S | - | S | S | S | S | S | S | M | S | S | S | S | |
| Hydrofluoric Acid (10 %) | U | U | U | M | - | - | U | - | - | U | U | S | - | S | M | U | S | S | S | S | M | S | U | U | U | - | - | |
| Hydrofluoric Acid (50 %) | U | U | U | U | - | - | U | - | - | U | U | U | U | S | U | U | U | S | S | M | M | S | U | U | U | - | M | |

| CHEMICAL | MATERIAL | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------|----------|-----------------------------|--------|----------------------------|--------------------------|------------------------------|--------|--------------------|-------|----------|-------|-------|--|-------------|---------------|----------------------------|----------------|--------------|---------------|-------------|--------------------|-----------------|-----------------|-----------------|----------|-------|-------|
| | ALUMINUM | ANODIC COATING for ALUMINUM | BUNA N | CELLULOSE ACETATE BUTYRATE | POLYURETHANE ROTOR PAINT | COMPOSITE Carbon Fiber/Epoxy | DELRIN | ETHYLENE PROPYLENE | GLASS | NEOPRENE | NORYL | NYLON | PET ¹ , POLYCLEAR, CLEARCRIMP | POLYALLOMER | POLYCARBONATE | POLYESTER, GLASS THERMOSET | POLYETHERIMIDE | POLYRTHYLENE | POLYPROPYLENE | POLYSULFONE | POLYVINYL CHLORIDE | RULON A, TEFLON | SILICONE RUBBER | STAINLESS STEEL | TITANIUM | TYGON | VITON |
| Hydrochloric Acid (conc.) | U | U | U | U | - | U | U | M | - | U | M | U | U | M | U | U | U | - | S | - | U | S | U | U | U | - | - |
| Formaldehyde (40 %) | M | M | M | S | S | S | S | M | S | S | S | S | M | S | S | S | U | S | S | M | S | S | S | M | S | M | U |
| Glutaraldehyde | S | S | S | S | - | - | S | - | S | S | S | S | S | S | S | - | - | S | S | S | - | - | S | S | S | - | - |
| Glycerol | M | S | S | - | S | S | S | S | S | S | S | S | S | S | S | S | - | S | S | S | S | S | S | S | S | S | S |
| Guanidine Hydrochloride | U | U | S | - | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | U | S | S | S |
| Haemo-Sol | S | S | S | - | - | - | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | S | S | S | S |
| Hexane | S | S | S | - | S | S | S | - | S | S | U | S | U | M | U | S | S | U | S | S | M | S | U | S | S | U | S |
| Isobutyl Alcohol | - | - | M | U | - | - | S | S | - | U | - | S | U | S | S | M | S | S | S | - | S | S | S | - | S | - | S |
| Isopropyl Alcohol | M | M | M | U | S | S | S | S | S | U | S | S | U | S | U | M | S | S | S | S | S | S | S | M | M | M | S |
| Iodoacetic Acid | S | S | M | - | S | S | S | - | S | M | S | S | M | S | S | - | M | S | S | S | S | S | M | S | S | M | M |
| Potassium Bromide | U | S | S | - | S | S | S | - | S | S | S | S | S | S | S | S | S | S | S | - | S | S | S | M | S | S | S |
| Potassium Carbonate | M | U | S | S | S | S | S | - | S | S | S | S | S | S | U | S | S | S | S | S | S | S | S | S | S | S | S |
| Potassium Chloride | U | S | S | - | S | S | S | S | S | S | S | S | S | S | S | - | S | S | S | S | S | S | S | U | S | S | S |
| Potassium Hydroxide (5 %) | U | U | S | S | S | S | M | - | S | S | S | S | - | S | U | S | S | S | S | S | S | S | M | U | M | S | U |
| Potassium Hydroxide (conc.) | U | U | M | U | - | - | M | - | M | S | S | - | U | M | U | U | U | S | M | - | M | U | - | U | U | - | U |
| Potassium Permanganate | S | S | S | - | S | S | S | - | S | S | S | U | S | S | S | M | - | S | M | S | U | S | S | M | S | U | S |
| Calcium Chloride | M | U | S | S | S | S | S | S | S | S | S | S | S | S | M | S | - | S | S | S | S | S | S | M | S | S | S |
| Calcium Hypochlorite | M | - | U | - | S | M | M | S | - | M | - | S | - | S | M | S | - | S | S | S | M | S | M | U | S | - | S |
| Kerosene | S | S | S | - | S | S | S | U | S | M | U | S | U | M | M | S | - | M | M | M | S | S | U | S | S | U | S |
| Sodium Chloride (10 %) | S | - | S | S | S | S | S | S | - | - | - | S | S | S | S | S | - | S | S | S | S | - | S | S | M | - | S |
| Sodium Chloride (sat'd) | U | - | S | U | S | S | S | - | - | - | - | S | S | S | S | S | - | S | S | - | S | - | S | S | M | - | S |
| Carbon Tetrachloride | U | U | M | S | S | U | M | U | S | U | U | S | U | M | U | S | S | M | M | S | M | M | M | M | U | S | S |
| Aqua Regia | U | - | U | U | - | - | U | - | - | - | - | - | U | U | U | U | U | U | U | - | - | - | - | - | S | - | M |
| Solution 555 (20 %) | S | S | S | - | - | - | S | - | S | S | S | S | S | S | S | - | - | S | S | S | - | S | S | S | S | S | S |
| Magnesium Chloride | M | S | S | - | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | M | S | S | S |
| Mercaptoacetic Acid | U | S | U | - | S | M | S | - | S | M | S | U | U | U | U | - | S | U | U | S | M | S | U | S | S | S | S |
| Methyl Alcohol | S | S | S | U | S | S | M | S | S | S | S | S | U | S | U | M | S | S | S | S | S | S | M | S | M | U | U |
| Methylene Chloride | U | U | U | U | M | S | S | U | S | U | U | S | U | U | U | U | U | M | U | U | U | S | S | M | U | S | U |
| Methyl Ethyl Ketone | S | S | U | U | S | S | M | S | S | U | U | S | U | S | U | U | U | S | S | U | U | S | S | S | S | U | U |
| Metrizamide | M | S | S | - | S | S | S | - | S | S | S | S | - | S | S | - | - | S | S | S | S | S | M | S | S | S | S |
| Lactic Acid (100 %) | - | - | S | - | - | - | - | - | - | M | S | U | - | S | S | S | M | S | S | - | M | S | M | S | S | - | S |

C Chemical Compatibility Chart

| CHEMICAL | MATERIAL | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|----------|-----------------------------|--------|----------------------------|--------------------------|------------------------------|--------|--------------------|-------|----------|-------|-------|--|-------------|---------------|----------------------------|----------------|--------------|---------------|-------------|--------------------|-----------------|-----------------|-----------------|----------|-------|-------|
| | ALUMINUM | ANODIC COATING for ALUMINUM | BUNA N | CELLULOSE ACETATE BUTYRATE | POLYURETHANE ROTOR PAINT | COMPOSITE Carbon Fiber/Epoxy | DELRIN | ETHYLENE PROPYLENE | GLASS | NEOPRENE | NORYL | NYLON | PET ¹ , POLYCLEAR, CLEARCRIMP | POLYALLUMER | POLYCARBONATE | POLYESTER, GLASS THERMOSET | POLYETHERIMIDE | POLYRTHYLENE | POLYPROPYLENE | POLYSULFONE | POLYVINYL CHLORIDE | RULON A, TEFLON | SILICONE RUBBER | STAINLESS STEEL | TITANIUM | TYGON | VITON |
| Lactic Acid (20%) | - | - | S | S | - | - | - | - | - | M | S | M | - | S | S | S | S | S | S | S | M | S | M | S | S | - | S |
| N-Butyl Alcohol | S | - | S | U | - | - | S | - | - | S | M | - | U | S | M | S | S | S | S | M | M | S | M | - | S | - | S |
| N-Butyl Phthalate | S | S | U | - | S | S | S | - | S | U | U | S | U | U | U | M | - | U | U | S | U | S | M | M | S | U | S |
| N, N-Dimethylformamide | S | S | S | U | S | M | S | - | S | S | U | S | U | S | U | U | - | S | S | U | U | S | M | S | S | S | U |
| Sodium Borate | M | S | S | S | S | S | S | S | S | S | S | U | S | S | S | S | - | S | S | S | S | S | S | M | S | S | S |
| Sodium Bromide | U | S | S | - | S | S | S | - | S | S | S | S | S | S | S | S | - | S | S | S | S | S | S | M | S | S | S |
| Sodium Carbonate (2 %) | M | U | S | S | S | S | S | S | S | S | S | S | S | S | U | S | S | S | S | S | S | S | S | S | S | S | S |
| Sodium Dodecyl Sulfate | S | S | S | - | S | S | S | - | S | S | S | S | S | S | S | - | S | S | S | S | S | S | S | S | S | S | S |
| Sodium Hypochlorite (5 %) | U | U | M | S | S | M | U | S | S | M | S | S | S | M | S | S | S | S | M | S | S | S | M | U | S | M | S |
| Sodium Iodide | M | S | S | - | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | M | S | S | S |
| Sodium Nitrate | S | S | S | - | S | S | S | S | S | S | S | S | S | S | S | S | - | S | S | S | S | S | U | S | S | S | S |
| Sodium Sulfate | U | S | S | - | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | M | S | S | S |
| Sodium Sulfide | S | - | S | S | - | - | - | S | - | - | - | S | S | S | U | U | - | - | S | - | - | - | S | S | M | - | S |
| Sodium Sulfite | S | S | S | - | S | S | S | S | M | S | S | S | S | S | S | M | - | S | S | S | S | S | S | S | S | S | S |
| Nickel Salts | U | S | S | S | S | S | - | S | S | S | - | - | S | S | S | S | - | S | S | S | S | S | M | S | S | S | S |
| Oils (Petroleum) | S | S | S | - | - | - | S | U | S | S | S | S | U | U | M | S | M | U | U | S | S | S | U | S | S | S | S |
| Oils (Other) | S | - | S | - | - | - | S | M | S | S | S | S | U | S | S | S | S | U | S | S | S | S | - | S | S | M | S |
| Oleic Acid | S | - | U | S | S | S | U | U | S | U | S | S | M | S | S | S | S | S | S | S | S | S | M | U | S | M | M |
| Oxalic Acid | U | U | M | S | S | S | U | S | S | S | S | S | U | S | U | S | S | S | S | S | S | S | U | M | S | S | S |
| Perchloric Acid (10 %) | U | - | U | - | S | U | U | - | S | M | M | - | - | M | U | M | S | M | M | - | M | S | U | - | S | - | S |
| Perchloric Acid (70 %) | U | U | U | - | - | U | U | - | S | U | M | U | U | M | U | U | U | M | M | U | M | S | U | U | S | U | S |
| Phenol (5 %) | U | S | U | - | S | M | M | - | S | U | M | U | U | S | U | M | S | M | S | U | U | S | U | M | M | M | S |
| Phenol (50 %) | U | S | U | - | S | U | M | - | S | U | M | U | U | U | U | U | S | U | M | U | U | S | U | U | U | M | S |
| Phosphoric Acid (10 %) | U | U | M | S | S | S | U | S | S | S | S | U | - | S | S | S | S | S | S | S | S | S | U | M | U | S | S |
| Phosphoric Acid (conc.) | U | U | M | M | - | - | U | S | - | M | S | U | U | M | M | S | S | S | M | S | M | S | U | M | U | - | S |
| Physiologic Media (Serum, Urine) | M | S | S | S | - | - | S | - | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S |
| Picric Acid | S | S | U | - | S | M | S | S | S | M | S | U | S | S | S | U | S | S | S | S | U | S | U | M | S | M | S |
| Pyridine (50 %) | U | S | U | U | S | U | U | - | U | S | S | U | U | M | U | U | - | U | S | M | U | S | S | U | U | U | U |
| Rubidium Bromide | M | S | S | - | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | M | S | S | S |
| Rubidium Chloride | M | S | S | - | S | S | S | - | S | S | S | S | S | S | S | - | - | S | S | S | S | S | S | M | S | S | S |
| Sucrose | M | S | S | - | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S |

| CHEMICAL | MATERIAL | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------|----------|-----------------------------|--------|----------------------------|--------------------------|------------------------------|--------|--------------------|-------|----------|-------|-------|--|-------------|---------------|----------------------------|----------------|--------------|---------------|-------------|--------------------|-----------------|-----------------|-----------------|----------|-------|-------|---|
| | ALUMINUM | ANODIC COATING for ALUMINUM | BUNA N | CELLULOSE ACETATE BUTYRATE | POLYURETHANE ROTOR PAINT | COMPOSITE Carbon Fiber/Epoxy | DELRIN | ETHYLENE PROPYLENE | GLASS | NEOPRENE | NORYL | NYLON | PET ¹ , POLYCLEAR, CLEARCRIMP | POLYALLOMER | POLYCARBONATE | POLYESTER, GLASS THERMOSET | POLYETHERIMIDE | POLYRTHYLENE | POLYPROPYLENE | POLYSULFONE | POLYVINYL CHLORIDE | RULON A, TEFLON | SILICONE RUBBER | STAINLESS STEEL | TITANIUM | TYGON | VITON | |
| Sucrose, Alkaline | M | S | S | - | S | S | S | - | S | S | S | S | S | S | U | S | S | S | S | S | S | S | S | M | S | S | S | |
| Sulfosalicylic Acid | U | U | S | S | S | S | S | - | S | S | S | U | S | S | S | - | S | S | S | - | S | S | S | U | S | S | S | |
| Nitric Acid (10 %) | U | S | U | S | S | U | U | - | S | U | S | U | - | S | S | S | S | S | S | S | S | S | M | S | S | S | S | |
| Nitric Acid (50 %) | U | S | U | M | S | U | U | - | S | U | S | U | U | M | M | U | M | M | M | S | S | S | U | S | S | M | S | |
| Nitric Acid (95 %) | U | - | U | U | - | U | U | - | - | U | U | U | U | M | U | U | U | U | M | U | U | S | U | S | S | - | S | |
| Hydrochloric Acid (10 %) | U | U | M | S | S | S | U | - | S | S | S | U | U | S | U | S | S | S | S | S | S | S | S | U | M | S | S | |
| Hydrochloric Acid (50 %) | U | U | U | U | S | U | U | - | S | M | S | U | U | M | U | U | S | S | S | S | S | M | S | M | U | U | M | M |
| Sulfuric Acid (10 %) | M | U | U | S | S | U | U | - | S | S | M | U | S | S | S | S | S | S | S | S | S | S | U | U | U | S | S | |
| Sulfuric Acid (50 %) | M | U | U | U | S | U | U | - | S | S | M | U | U | S | U | U | M | S | S | S | S | S | U | U | U | M | S | |
| Sulfuric Acid (conc.) | M | U | U | U | - | U | U | M | - | - | M | U | U | S | U | U | U | M | S | U | M | S | U | U | U | - | S | |
| Stearic Acid | S | - | S | - | - | - | S | M | S | S | S | S | - | S | S | S | S | S | S | S | S | S | M | M | S | S | S | |
| Tetrahydrofuran | S | S | U | U | S | U | U | M | S | U | U | S | U | U | U | - | M | U | U | U | U | S | U | S | S | U | U | |
| Toluene | S | S | U | U | S | S | M | U | S | U | U | S | U | U | U | S | U | M | U | U | U | S | U | S | U | U | M | |
| Trichloroacetic Acid | U | U | U | - | S | S | U | M | S | U | S | U | U | S | M | - | M | S | S | U | U | S | U | U | U | M | U | |
| Trichloroethane | S | - | U | - | - | - | M | U | - | U | - | S | U | U | U | U | U | U | U | U | U | S | U | - | S | - | S | |
| Trichloroethylene | - | - | U | U | - | - | - | U | - | U | - | S | U | U | U | U | U | U | U | U | U | S | U | - | U | - | S | |
| Trisodium Phosphate | - | - | - | S | - | - | M | - | - | - | - | - | - | S | - | - | S | S | S | - | - | S | - | - | S | - | S | |
| Tris Buffer (neutral pH) | U | S | S | S | S | S | S | - | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | |
| Triton X-100 | S | S | S | - | S | S | S | - | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | |
| Urea | S | - | U | S | S | S | S | - | - | - | - | S | S | S | M | S | S | S | S | - | S | S | S | M | S | - | S | |
| Hydrogen Peroxide (10 %) | U | U | M | S | S | U | U | - | S | S | S | U | S | S | S | M | U | S | S | S | S | S | S | M | S | U | S | |
| Hydrogen Peroxide (3 %) | S | M | S | S | S | - | S | - | S | S | S | S | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S | |
| Xylene | S | S | U | S | S | S | M | U | S | U | U | U | U | U | U | M | U | M | U | U | U | S | U | M | S | U | S | |
| Zinc Chloride | U | U | S | S | S | S | U | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | U | S | S | S | |
| Zinc Sulfate | U | S | S | - | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | |
| Citric Acid (10 %) | M | S | S | M | S | S | M | S | S | S | S | S | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S | |

¹Polyethyleneterephthalate

Key

- S Satisfactory
- M Moderate attack, may be satisfactory for use in centrifuge depending on length of exposure, speed involved, etc. Suggest testing under actual conditions of use.
- U Unsatisfactory, not recommended.
- Performance unknown; suggest testing, using sample to avoid loss of valuable material.

Chemical resistance data is included only as a guide to product use. No organized chemical resistance data exists for materials under the stress of centrifugation. When in doubt we recommend pretesting sample lots.

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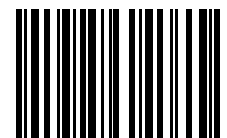
Shown pictures within the manual are examples and may differ considering the set parameters and language. Pictures of the user interface within the manual are showing the English version as example.

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