Operation Manual

BCMI-304

Mini Centrifuge

Thank you very much for Choosing Biolab products. Please read the "Operating Instructions" and "Warranty" before operating this unit to assure proper operation.

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01 General Information

1.1 Technical Data

Electr. Connection: Protection class:	See Nameplate I
Power consumption (kVA): Rated power (kW):	0.157 0.095
Power data:	
Max. speed (rpm): Min. speed (rpm): Max. capacity (ml): Max. gravitational field (x g): Min. gravitational field (x g): Max. kin. energy (Nm):	14 800 200 53 16 163 2 1 721
Further parameters	
Time range:	0-99 min 59 sec continuous run short-time operation
Dimensions:	
Depth (mm): Width (mm): Height (mm): Weight (kg): EMC (acc. to EN 55011): Noise level (dBA):	212 226 176 6 Class B <60
Notes of user: Serial number: Supply date: Inventory number: Location: Responsibility:	---- ---- ---- ---- ---- ----

The figures are valid for an ambient temperature of 23 ° C +/- 2 ° C and nominal voltage +1-5%. (Allowable ambient temperature + 4 ° C - +40 ° C; max. humidity 80 %.) Subject to technical alterations.

1.2 Accessories Suitable:

Part No.	Description	Max. speed (rpm)	Max. gravitational field (x g)
1	Angle rotor, polypropylene, 24X1.5-2.2 ml, max. radius 6.6 cm, min. radius 3.0 and 3.8 cm, incl. polysulfone lid	14 800	16 163
2	Angle rotor, aluminium, 24X1.5-2.2 ml, max. radius 6.6 cm, min. radius 3.0 and 3.8 cm, incl. polysulfone lid	14 800	16 163
3	Angle rotor, polypropylene, 2X8X0.2 ml PCR-tube, max. radius 4.8 cm, min. radius 2.1 cm, incl. polysulfone lid	14 800	11 756

1.3 Scope of Supply:

The following belongs to the centrifuge:

Connection cable

Rotor fastening nut Part

Angle rotor, polypropylene, 24 x 1.5-2.2 ml

Polysulfone lid

Operating Manual

1.4 Standards and Regulations:

Please refer to the enclosed EU-Statement of Conformity.

1.5 Safety Instructions:

The operator should take care of the following points:

1. For safety reasons these operating instructions must clearly state that the stamped max. speed of the used rotor and the max. allowable filling quantity must not be exceeded.

2. If the density of the material exceeds 1.2 g/cm5, the max. speed of the centrifuge must be reduced (see formula chapter 7.1.2).

3. Operation of the centrifuge in hazardous locations is not allowed.

4. During operation the centrifuge must not be moved. Leaning against or resting on the centrifuge is not allowed.

5. Do not spin explosive or highly inflammable materials.

6. Substances which could damage the material of the centrifuge, the rotors or the buckets anyhow must not be centrifuged or only under consideration of special safety measures. Infectious, toxic, pathogene or radioactive substances must be centrifuged in certified rotors only.

7. Keep a clearance of at least 30 cm around the centrifuge. Dangerous materials of any kind must not be put down or stored in that area.

8. Attention! Defective lid relieving devices could cause the centrifuge lid to fall down (contact Service). Risk of bruising!

Symbol	Title
	Dangerous voltage
	Attention, consult accompanying documents
I	On (Power)
O	Off (Power)
	Protective earth (ground)
	Earth (ground)
	Unplug mains plug
	Caution! Risk of bruising
→	Arrow direction of rotation
	Hot surface

02 Description of Centrifuge

2.1 General Outlay:

The centrifuge is equipped with newest state-of-the-art electronics and is driven by brushless, silent and long-life asynchronous motors.

The problem of carbon brush change is no longer existent and as there is no carbon dust pollution, operation in clean rooms is possible if the appropriate accessories are used.

2.2 Construction and Constructive Safety Measures:

The centrifuge is built into a solid diecasting housing. The centrifuge lid is also made of solid diecasting. From the back, the lid is secured by a solid hinge and at the front by the motorized cover lock. Due to these elements there is a solid safety case around the rotor chamber.

2.3 Drive:

The drive motor is an asynchronous motor.

2.4 Operation and Display

The foil keyboard with clearly distincted keys includes the hermetically sealed graphical LCD display. Any operating status is indicated.

2.5 Electronics

The electronics controlled by a microprocessor allows extensive adaptations of the centrifuge to the different tasks. The following parameters can be set:

Speed in steps of 100 rpm

RCF in steps of 100 x g

Time (99 min, 59 sec) in steps of 1 sec

Short-time operation

Continuous operation

Soft start/soft stop

2.6 Safety Devices

Apart from the passive safety devices due to the instrument's mechanical design there are the following active precautions for your safety:

2.6.1 Lid Lock, Cover Closing Device

The centrifuge can only be started when the power switch is switched to"ON "and when the lid is correctly closed. After closing the lid the motorized lid lock is automatically locked. The lid opens automatically after the centrifuge run, when the rotor is at standstill. In the event of a power supply

failure, the lid can be opened via the emergency lid release. Attention: The lid must not be released and opened unless the rotor is at standstill (refer to chapter 7.2.3 “Emergency lid release”).

2.6.2 System Check

An internal system check monitors data transmission and the sensor signals with regard to plausibility. In case of a malfunction an error message is displayed under a number.

2.6.3 Ground Wire Check

For ground wire check measurements can be carried out at the metal parts of the centrifuge using an appropriate measuring instrument.

03 Installation, Start-up

3.1 Unpacking of the Centrifuge

Open cardboard box. Take out the box containing accessories. Remove centrifuge upwards together with the upper foam cushions. When lifting or carrying the centrifuge please always reach under the instrument from the side.

Please keep case for possible transport of centrifuge later.

3.2 Installation

3.2.1 Site

All energy consumed by the centrifuge is converted into heat and emitted into the ambient air. Therefore, sufficient ventilation is important. As the air-ducts in the unit must be open, keep a clearance of at least 30 cm around the centrifuge. Also, the centrifuge shouldn’t be positioned near radiators and should not be directly exposed to sunshine.

The table should have a solid, even top.

For normal operation the ambient temperature should not fall below 4 ° C and not exceed 40 ° C. The max. humidity of air is 80 %. During transport from cold to warmer places water will condensate inside the centrifuge. It is important that there is enough time for drying before the centrifuge can be started again.

3.2.2 Connection

The operating voltage on the name plate must correspond to the local supply voltage!

The laboratory centrifuges are units of safety class I, DIN VDE 0700, and in-clude a three wire power cord 2,5 m long with shockproof right angle plug.

3.2.3 Fuses / Emergency Circuit Breaker on Site

The centrifuges must be protected typically with at least 16 Amp B or L slow acting fuses.

An emergency circuit breaker to cut the power to the centrifuge in the event of a malfunction is required on site. This switch should be located away from the centrifuge, preferably outside the room

where the centrifuge is used or at the exit of this room.

3.3 Installation of Rotors and Accessories

1. Open centrifuge lid by pressing the Lid-key.

2. Unscrew rotor fastening nut from motor shaft (anticlockwise).

3. Lower the rotor straight down onto the motor shaft.

4. Tighten the rotor fastening nut (clockwise) by hand (which is corresponding to 1 Nm).

Attention: The spring washer of the rotor fastening nut has to show in direction of the rotor.

In the event of frequent use the rotor fastening nut has to be loosened by some turns and fastened again. This should be done once a day or after approx. 20 cycles. This ensures a proper connection between rotor and shaft (please refer to chapter 6.2 "Care and cleaning of accessories" as well).

5. Use only appropriate vessels for the rotor (please refer to chapter 1.2 "Suitable accessories" as well).

6. Fill vessels external to the centrifuge.

7. Put or screw on covers of vessels.

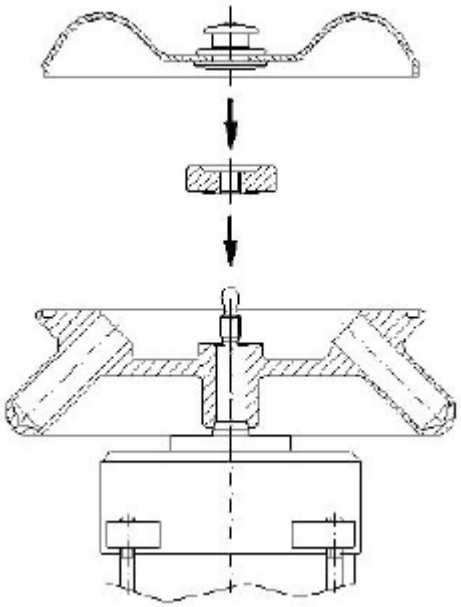
8. Opposite places of the rotors must always be loaded with same accessories and same filling.

9. Put snap-on lid onto rotor and lock.

10. In angle rotors the plastic vessels must always be totally filled to avoid cracks of vessels and
leakages or loosening of the caps in case of partial filling.

Attention:
follow the special comments of chapter 1.5.

11. **Attention:** The centrifuge will absorb smaller differences in weight when loading the rotors. But it is recommended to balance the vessels as accurately as possible in order to ensure a run with minimal vibrations.



3.4 Initial Start-Up

Attention!

Before initial start-up please take care that your centrifuge is orderly installed (refer to chapter 3.2 "Installation").

3.4.1 Switching on of the Centrifuge

Press mains switch (rear panel).

2.7 The centrifuge display is illuminated.

3.4.2 Opening Lid

Press the Lid-key.

2.8 The lid opens automatically.

3.4.3 Installation of a Rotor

Put a rotor onto the shaft and fasten it by screwing the rotor fastening nut clockwise onto the drive shaft, hold rotor with one hand (refer to chapter 3.3 “Installation of rotor and accessories”).

04 Operating Elements

4.1 Operating Panel

The centrifuge is operated via the operating panel.

When power is applied the centrifuge is in the display mode after a short system check.

4.1.1 Start / Stop Key 

This key can be used for the following:

starting centrifuge operation;

terminating a previously started deceleration process and restarting the centrifuge;

shifting to short run (refer to chapter 4.2.3.2);

early termination of the centrifuge run.

The centrifuge can be started when the lid is closed.

4.1.2 Select Key 

This key can be used in

a) display mode

to change from display of speed to display of RCF;

b) edit mode

to select the parameter to be changed.

4.1.3 Lid Key O

This key is used to open the lid.

The lid can only be opened, if the centrifuge has not been started yet.

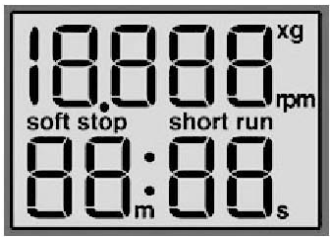
4.1.4 Arrow Key Preselection/Edit

This key can be used for the following:

activation of the edit mode;

change of the parameters.

4.2 Display



The display consists of three segments:

In the upper line speed and gravitational field are displayed, the lower line shows the run time, the middle line indicates soft stop and short run.

4.2.1 Speed/RCF (Relative Centrifugal Force)

Rotor dimensions and speed determine the RCF value. Entry of either speed or RCF automatically determine the other one. In the run mode change between speed and RCF display is possible by pressing the select key.

4.2.1.1 Speed/Relative Centrifugal Force/Time

In the upper line the set speed or the relative centrifugal acceleration is displayed.

The speed is displayed in rotations per minute (rpm).

The relative centrifugal force/RCF is the acceleration which the sample is exposed to (xg).

The time is displayed in minutes/seconds (m, s).

Activate the edit mode using the arrow key. One segment of the display is flashing.

Select the desired parameter using the select key and change the value using the arrow key.

By pressing the start/stop key the values are entered immediately, but automatically after 15 seconds.

Close the centrifuge lid and start the run by pressing the start/stop key.

4.2.1.2 Alteration of Parameters During a Centrifuge Run

Activate the edit mode using the arrow key for changing a parameter during a run. One area of the display is flashing.

Select the desired parameter using the select key and change the parameter using the arrow key. The parameters are entered immediately.

4.2.2 Time

In the lower line the set total run time is displayed respectively the remaining run time in the run mode (for change of parameters refer to 4.2.1.1).

In the short run mode the total run time is counted up in seconds.

4.2.3 Standard Run Mode

The maximum total run time is 99 minutes 59 seconds which is displayed before the centrifuge has been started.

During centrifugation this time is counted down. The centrifuge run can be early terminated by pressing the start/stop key. The remaining run time remains on the display until the centrifuge lid opens automatically (for change of parameters refer to 4.2.1.1).

4.2.3.1 Continuous Run Mode

In the continuous run mode the run time of is not limited and has to be terminated manually. The centrifuge accelerates up to the set speed alter pressing the start/stop key.

The display of " " indicates the continuous run mode. Unlike the standard run mode the time is counted up in the continuous run mode.

After 99 minutes 59 seconds the run time is no longer displayed but the run continues.

The continuous run is terminated by pressing the start/stop key and the centrifuge decelerates up to standstill of the rotor.

The continuous run mode can be changed to a normal run by selecting a set value (for change of parameters refer to 4.2.1.1).

4.2.3.2 Short Run

Press the start/stop key for the whole short-run. The centrifuge accelerates to the maximum speed. After release of the start/stop key the centrifuge decelerates to standstill. This mode is indicated by display of " short run " .

During short run the time is counted up in seconds.

After termination of the short run the elapsed run time is displayed until the centrifuge lid opens automatically.

4.2.3.3 Soft Stop/Soft Start Function

The following options are available (for change of parameters refer to 4.2.1.1):

Soft = soft acceleration and soft deceleration

Stop = standard acceleration and deceleration

Soft stop = soft deceleration

The soft stop, stop or soft function results in a longer deceleration and/or acceleration time. Active "

soft stop " , " stop " or " soft " functions are displayed.

Activation/deactivation is possible as desired.

05 Notes for Centrifugation

5.1 Practical Notes for Centrifugation

1. Locate centrifuge horizontally on a level surface.

2. Ensure safe location.

3. Keep at least 30 cm free space around the centrifuge.

4. Provide for sufficient ventilation.

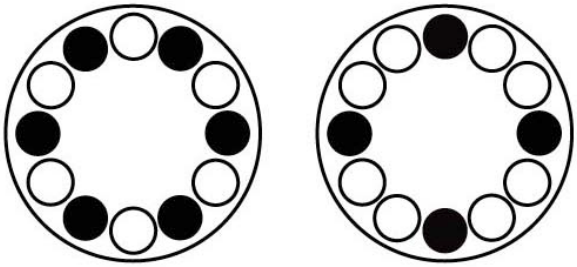
5. Tighten rotor firmly onto motor shaft.

6. Avoid imbalance.

7. Load opposite places with same accessories.

8. Centrifugation with low capacity:

The vessels should be placed symmetrically so that the rotor is loaded evenly. Loading e.g. only one position is not allowed.



9. Load vessels outside the centrifuge.

10. Fill vessels carefully to same weight. Imbalances would result in increased wear of bearings.

11. Use perfect accessories only.

12. Avoid corrosion to accessories by careful maintenance.

13. Spin infectious material in sealed rotors and buckets only.

14. Do not spin explosive or highly inflammable materials.

15. When centrifuging substances with a density > 1.2 g/cm' the allowable max. speed must be reduced (refer to chapter 7.1.2 "Density").

16. Rotors can be run without their lid which would result in slightly increased running noise and temperatures.

5.2 Forbidden Centrifuging Operations

5.3 Operation of not carefully installed centrifuge.

5.4 Operation without front or back panels.

5.5 Operation by non authorized personnel.

1. Operation with rotor not installed properly (refer to chapter 3.3).

2. Operation with overloaded rotors.

The load for a rotor is limited by its design and the max. speed (see rotor/bucket engraving) and must not be exceeded. The rotors are intended for liquids of max. homogeneous density of

1.2 g/crn' if centrifuged at max. speed. If liquids of higher ctensity are used, the speed must be reduced accordingly (refer to chapter 7.1 "Mathematical relations").

3. Operation with rotors and adapters showing corrosion or other defects.

4. Operation of very corrosive substances which can cause damages to material and affect mechanical strength of rotors and adapters.

5. Operation of rotors and accessories not allowed by the manufacturer.

The use of poor commodity goods is not recommended. At high speeds breaking glass or bursting vessels can cause dangerous imbalances.

6. Operation in hazardous locations.

7. Operation with vessels of improper size.

8. Centrifugation of improper material.

9. Operation with partially filled plastic tubes in high-speed angle rotors.

10. Lifting or moving of the centrifuge during operation. Leaning against or resting on the centrifuge is not allowed.

11. Do not place potential dangerous material-e.g.glass vessels containing liquids - near the centrifuge.

12. **Attention:** Do not open cover and/or reach into rotor chamber unless the rotor is at standstill. Never attempt to override the lid interlock system while the rotor is spinning.

13. Such materials are prohibited which chemically interact vigorously.

14. Do not spin explosive or inflammable materials.

15. Substances which could damage the material of the centrifuge, the rotors or the adapters must not be centrifuged. Infectious, toxic, pathogene or radioactive substances must be centrifuged in certified rotors and vessels only and all necessary safety precautions are taken.

06 Care and Maintenance

6.1 Care and Cleaning of Centrifuge

Please use water-soluble, mild detergents for cleaning. Avoid corroding and aggressive substances.

Do not use alkaline solutions or solvents or agents with abrasive particles. Before using detergents or decontamination agents which had not been recommended by us, the user has to contact us to make sure that such procedure would not damage the centrifuge.

Remove product particles from the rotor chamber using a cloth or paper towel. It is recommended to open the cover when the centrifuge is not in use so that moisture can evaporate. Increased wear of the motor bearings will thus be avoided. If there is the risk of toxic, radioactive or pathogene contamination, special safety measures must be kept.

6.2 Care and Cleaning of Accessories

For care of accessories special safety measures must be considered as these are measures ensuring operational safety at the same time.

Chemical reactions as well as stress-corrosion (combination of oscill ating pressure and chemical reaction) can affect or destroy the metals.

Hardly detectable cracks on the surface expand and weaken the material without visible signs. When detecting a visible damage of the surface, a crack, a mark or any other change, also corrosion, the part (rotor, etc.) must be replaced immediately.

Cleaning of accessories should be done outside of the centrifuge once a week or preferably after every use. Adapters should be removed. After this the parts should be dried with a soft cloth or, alternatively, in a drying chamber at approx. 50 ° C. If there is the risk of toxic, radioactive or pathogene contamination, special safety measures must be kept.

Careful maintenance increases life time and avoids premature failure of the rotor. Corrosion or resultant damages which are caused by insufficient care do not constitute a warranty claim.

6.3 Glass Breakage

In case of glass breakage all glass particles must be carefully removed. Rubber inserts have to be cleaned carefully and possibly be replaced. If a problem has occured, the following has to be considered:

Glass particles in the rubber cushion will cause glass breakage again.

Glass particles in the centrifuge chamber will cause metal abrasion due to the strong air circulation. This dust will not only pollute the centrifuge chamber, the rotor and the material to be centrifuged but also damage the surfaces of the accessories, the rotors and the centrifuge chamber.

In order to totally remove the glass particles and the metal dust from the rotor chamber, it is advisable to grease the upper part of the centrifuge chamber with e.g. Vaseline. Then the rotor should rotate for

some minutes at a moderate speed. The glass and metal particles will now collect at the greased part and can easily be removed with a cloth together with the grease. If necessary repeat this procedure.

6.4 Sterilization and Disinfection of Rotor Chamber and Accessories

The centrifuges and the accessories consist of different materials. A possible incompatibility must be considered. Before using detergents or decontamination agents which had not been recommended by us, the user has to contact us to make sure that such procedure would not damage the centrifuge. For sterilization by steam resistance to temperature of the individual material must be checked (refer to point 6.4.1 " Autoclaving "). Please contact your laboratory safety officer regarding proper methods to use. If dangerous materials are used, the centrifuge and the accessories must be disinfected.

Principally we want to point out that for centrifuging of e.g. infectious material certified and hermetically sealed accessories have to be used in order to avoid that the centrifuge is contaminated.

6.4.1 Autoclavin

The life of the accessories essentially depends on the frequency of autoclaving and use. When the parts are showing changes in colour or structure or in the event of leaks etc., the accessories have to be replaced.

During autoclaving the caps of the tubes must not be screwed on to avoid deformation of the tubes. It can not be excluded that plastic parts, e.g. lids or carriers, would deform during autoclaving.

Autoclaving: Accessories	**Max. Temp. ° C**	**Min. time Min**	**Max. time Min**	**Max. cycles**
Glass tubes	134-138	3	5	-
Polycarbonate tubes	115-118	30	40	20
Polypropylene tubes	115-118	30	40	30
Teflon tubes	134-138	3	5	100
Aluminium rotors	134-138	3	5	-
Polypropylene rotors	115-118	30	40	20
Polycarbonate/ Polyallomer Lids for angle rotors	115-118	30	40	20

Polysulfone lids for angle rotors	134-138	3	5	100
Aluminium buckets	134-138	3	5	-
Polycarbonate caps for buckets	115-118	30	40	50
Polycarbonate caps for buckets	115-118	30	40	50
Polysulfone caps for buckets	134-138	3	5	100
Rubber adapters	115-118	30	40	-
Rubber cushions	115-118	30	40	-
ditto, Polyallomer and Polycarbonate	115-118	30	40	------
Rectangular carriers, Polypropylene	115-118	30	40	------

6.5 Checks by Operator

The operator has to ensure that no important part of the centrifuge is damaged. This especially refers to:

1. Motor suspension
2. Concentricity of the motor shaft
3. Rotors and accessories have to be free from corrosion, cracks, material abrasion etc.
4. Screw connections have to be tight.

Furthermore, the earth wire must be checked regularly.

07 Appendix

7.1 Mathematical Relations

7.1.1 Relative Centrifugal Force (RCF)

The parameters speed, RCF and the diameter of the rotor are interrelated via the following formula:

$RCF = 11{,}18 \times 10^{-6} \times r \times n^2$

If two values are given, the third value is determined by the equation. If the speed or the rotation radius is changed, the resulting RCF will be recalculated. If the RCF is altered, the speed under consideration of the radius is adapted accordingly, r = radius in cm n = speed in rpm RCF without dimension.

7.1.2 Density

If the density of the liquid is higher than 1.2 g/cm\ the allowed maximum speed of the centrifuge is calculated according to the following formula:

$$n — n_{max} X \sqrt{y}(1,2/Rho)$$

Rho=density in g/cm^3

7.2 Error Correction

Most of the errors can be reset by power off/on. In the event of a short power failure during a run, this run is interrupted and can be continued by opening the lid and pressing the start/stop key.

No indication on the display:	**Actions:**
—No power in the socket?	Check fuse in mains supply.
—Power cord plugged in and line Voltage Present?	Plug in power cord correctly.
—Power switch on?	Switch on power.
—Lid closed?	Close lid.

7.2.1 Centrifuge cannot be started

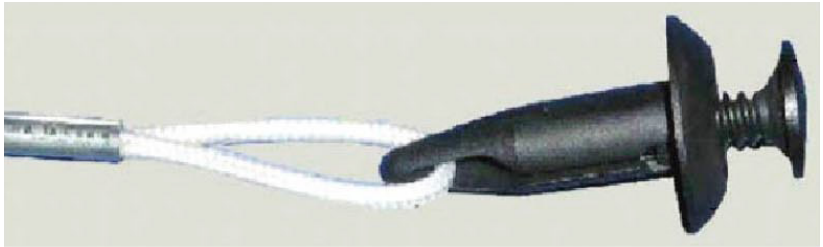
Set speed remains in the display	Power off/on. If error occurs again, Call service。

7.2.2 Centrifuge Decelerates during Operation

Centrifuge displays an error No. after Power on.	Power off/on. If error occurs again, call service (please refer to chapter 7.3.1 “Error codes”).

7.2.3 Emergency Lid Release

In the event of e.g. a power supply failure it is possible to manually open the lid. At the bottom panel there is a stopper which can be removed e.g. with a screw driver. The lid can be released by pulling the visible string.



Attention! The lid may only be unlocked and opened when the rotor is at standstill.

7.2.4 Problems with the Centrifuge

Please contact your supplier for support or in the event of malfunctions and for supply of spare parts.

7.3 Error Mode

In the error mode " ERR " is displayed. The error codes are displayed on the time display.

Error no.	Kind of error
E01:	Motor overload
E02:	The current is more than current rating in operation.
E04:	Overvoltage protection
E05:	Low-voltage protection
E07:	Hardware circuit protection or power failure.
Ell:	Motor stalling
E51:	Lock failure Unlocking does not reach the designated Position.
E52:	Lock failure Locking does not reach the designated Position.
E53:	Lock failure Lock anomaly open.
E61:	Procedure failure Speed display when power on.
E31:	Storer failure

For the failure alarm except for system failure, it can be cleared by lid key. For the system failure alarm, system will automatically protect 10-30 seconds. After this 10-30 seconds finish, please clear the failure by restarting the centrifuge (If you turn off the centrifuge during this 10-30 seconds, when starting, the system will go on timing)

Should it not be possible to repair the failure, please contact service.

If the display changes between "ERR" and "SAFE" , Power off/on on when "OFF" is displayed.

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