Medical Centrifuge

MS-CE4000

User Manual

MARSHALL

Preface

Thanks for purchasing the MS-CE4000 centrifuge (hereinafter referred to as the centrifuge or this instrument).
In order to give you a better understanding of this centrifuge, this user manual mainly introduces the product technical parameters, installation environment, operation methods, maintenance methods and simple troubleshooting of the centrifuge.

purpose of usage

Centrifuge is a special equipment for rapid separation, concentration and purification of mixtures with different precipitation coefficients through centrifugal force generated by high-speed rotation. It is widely used in medical and health, blood stations, pharmaceutical plants, biomedical engineering, animal and plant research and other fields. This product is mainly used for sample separation before sample analysis.

User

This user manual is intended for clinical laboratory technicians who operate this instrument.
In order to give full play to the best performance of this instrument and ensure safe operation, please read the contents of this user manual carefully before using the product, and use the product correctly. Please keep this user manual properly for easy reference at any time. If the precautions in this user manual are not followed during use, the warranty will not be provided.

Safety instructions

The safety precautions in this section and in the manual must be followed throughout the operation, maintenance and repair of this product. Failure to follow these safety precautions will reduce the safety protection of the equipment. The manufacturer declares that it is not responsible for the user's violation of such requirements.

Disclaimer

Statement

Our company has the final interpretation right of this user manual.

Only when all of the following requirements are met, the company considers to be responsible for the safety, reliability and performance of the product, namely:

- The assembly operation, expansion, re-adjustment, improvement, maintenance and parts replacement are all carried out by professionals approved by the company.
- All repaired parts involved in replacement and supporting accessories and consumables are the original equipment (original) of our company or approved by our company.
- The relevant electrical equipment complies with the national standards and the requirements of this user manual.
- The operation of the product is carried out in accordance with this user manual.

Disclaimer

The company is not responsible for the failure and damage of the instrument under the following conditions, or the direct or indirect damage during use.

1. Failure and damage caused by violation of the usage method, precautions and purpose of use described in this user manual.
2. Failures and damages caused by operators who are not trained by our company or the company's designated agents, such as inspection professionals, doctors, or experimenters.
3. Failure and damage caused by maintenance or modification by a company not designated by the company.
4. Failure and damage caused by the use of instruments not specified by our company.
5. Failure and damage caused by the inconsistency between the operating environment and the operating environment specified by the company (power supply conditions, installation environment, etc.).
6. Failure and damage caused by natural disasters such as earthquakes and floods.
7. Failure and damage caused by unknowingly moving or transferring (transporting) the equipment after the equipment is installed

After-sales service and contact information

After-sales service

During or outside the warranty period, any abnormal phenomenon in use can be dialed to the manufacturer 24h for professional technical support.

The service life of the instrument is 5 years, and the production date is detailed on the product nameplate.

Repair steps

- Confirm the fault and repair method: first contact the company's after-sales service department to confirm the fault situation, and confirm whether the repair method is on-site repair or return to the factory for repair.
- Maintenance cost: negotiate with the company according to the specific situation.
- Freight: If the instrument is shipped to our company for repair, the user must bear the freight (including customs fees).

Return step

- Obtain the right to return the product. Get in touch with the company's after-sales service department and inform the product serial number (see the nameplate on the back of the instrument for details) and explain the reason for the return. If the product serial number is not clearly identifiable, the company will not return the product.
- On the premise of obtaining the right to return the goods, please go through the relevant procedures in accordance with the requirements of the company.

EC Declaration of Conformity

This medical device has been assigned to class I according to Annex VIII of the Regulation (EU) 2017/745. It bears the mark

CE

whose single Authorized EU-Representative:

Name:Luxus Lebenswelt GmbH

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Catalogue

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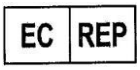
Security Information

In order to use this instrument safely, please read the following safety regulations carefully. Any operation that violates the following safety regulations may cause accidental injury or instrument failure.

Description of related symbols:

Symbol	Marker	Description
	General warning	People who are not familiar with this product are not allowed to disassemble or replace, otherwise there may be electric shock or fire. Do not perform any operations other than the maintenance operations described in the user manual. In all cases marked with this symbol, it is necessary to consult the documents in order to clarify the nature of the potential hazards and any countermeasures that must be taken.
	Biological hazard	Biological hazards, disposable rubber gloves must be worn when operating the instrument. Do not touch the instrument when the skin is broken to prevent virus infection. The instrument should be disinfected before it is used or repaired.
	Warning crush	When closing the centrifuge door, be careful not to put your hands in the centrifuge room to avoid crushing injuries.
	CE mark	This medical device has been assigned to class I according to Annex VIII of the Regulation (EU) 2017/745. It bears this mark.
	European Authorized Representative	European Authorized Representative:Represents the authorized representative of the European Union..

Safety Precautions

EMI protection

To prevent EMI from damaging the instrument, please observe the following precautions during use.

Warning

Since the centrifuge has both an electric drive system that produces strong electromagnetic interference, and a microcomputer weak current system that is sensitive to electromagnetic interference, it is the user's responsibility to ensure that there is no corrosive gas and electromagnetic field interference around the instrument to prevent premature failure of the protective layer on the outside of the instrument and prevent interference with electrical components.

When the instrument is used in a dry environment, especially in a dry environment with artificial materials (artificial fabrics, carpets, etc.), it may cause damaging electrostatic discharge, which may interfere with normal operation.

It is forbidden to use the instrument near strong radiation sources, otherwise it may interfere with the normal operation of the equipment.

Prevent electric shock

To prevent electric shock, please observe the following precautions.

Warning

- Do not plug or unplug the power supply with wet hands, it may cause electric shock.
- Do not use damaged wires and connecting cables, which may cause electric shock or fire.
- Do not use wires and cables other than those required by the design, and do not use power cords or sockets that are not certified by 3C, which may cause electric shock or fire.
- Do not put detergent and water on the surface of the instrument to avoid liquid leaking into the instrument and causing damage to the instrument.

Prevent fire and explosion

To prevent fire and explosion, please observe the following precautions.

Warning

The alcohol used for instrument cleaning is flammable, so be very careful when cleaning and using it.

This machine is not suitable for separating flammable and explosive liquids. Centrifugation of such substances is strictly prohibited, and flammable and explosive materials cannot be stored inside the instrument or within 30 cm of the instrument.

It is strictly forbidden to move the centrifuge or to open the door manually during operation.

If the glass test tube ruptures during centrifugation, it will cause greater vibration. It should be shut down immediately. After the instrument is stable, the inside of the instrument should be disinfected to prevent aerosol infection, and then the inside of the instrument should be cleaned and replaced with new tubes.

Because the rotor is running at high speed, centrifugal stress will be generated inside, and because centrifugal samples are mostly corrosive, even ordinary tap water is corrosive to aluminum rotors. The coexistence of stress corrosion and chemical corrosion produces double corrosion fatigue, which can lead to failure of the rotor and even head explosion. In order to avoid this, users should always carefully observe the parts of the rotor that are prone to corrosion, such as the bottom of the test tube hole, the connection between the bottom of the rotor and the main shaft, and the large thread on the upper part of the rotor.

Protection against chemical hazards

To prevent personal injury caused by chemical dangerous goods, please observe the following precautions.

Warning

Certain samples or reagents may damage the skin. Please use it carefully to prevent direct contact between hands and clothes. If you accidentally touch your hands or clothes, please wash them immediately with soap and water. If it gets into the eyes accidentally, rinse immediately with plenty of water and consult an ophthalmologist.

Prevent biological infection

In order to effectively protect against biological hazards, please observe the following precautions.

Biological infection risk

- Improper use of samples may result in infection. Do not touch samples, mixtures, and waste liquids directly with your hands. If the tube cap is found to fall off when the centrifuge door is opened, there may be a risk of aerosol infection. Please be sure to wear gloves, a mask, and work clothes to prevent infection during operation, and wear protective glasses if necessary.
- If the sample accidentally touches the skin, please handle it immediately in accordance with the user's working standards and consult a doctor.
- When cleaning the instrument, please wear gloves. Do not use chemical reagents such as turpentine oil and benzene to clean external stains, because it may cause changes in color and shape. Use a soft or damp cloth to scrub. For serious stains, use detergent or 75 % Alcohol clean. For spilled samples at risk of infection, clean them with 75% alcohol.

Waste liquid treatment

To prevent waste liquid from causing environmental pollution and personal injury, please observe the following precautions when disposing of waste liquid.

Biological infection risk

- Some substances in the waste liquid containing samples, washing liquid, etc. are controlled by pollution regulations and discharge standards. Please comply with local standards and consult the relevant reagent manufacturer or distributor.
- After the centrifuge is used, the casing of the instrument, the interior of the centrifugal chamber and the rotor should be disinfected in sequence
- When accidents such as sample spilling or test tube rupture occur, stop the machine in time. After the instrument is completely stopped and stabilized, turn on the instrument manually to clean the inside of the instrument. Please wear gloves, masks, and work clothes during operation. If you are infected, wear protective glasses if necessary. When the test tube is broken, please be extra careful when checking and cleaning the sealing ring and the centrifuge chamber to avoid glass fragments from scratching your hands and causing infection.

Chapter 1 Overview

The MS-CE4000 centrifuge is a microcomputer-controlled desktop low-speed centrifuge. The instrument is a steel body, multi-layer explosion-proof design, good rigidity and high strength. This instrument adopts a mechanical and electronic double-layer door lock protection system. The centrifuge is only started after the door lock is closed, and the cover can be opened only after the motor brake is completely stopped, making your operation safer and more reliable. This instrument uses a microcomputer processor for precise control, digital display of parameters such as speed, time, etc., has alarm protection functions, and is convenient to operate. This instrument uses a brushless DC motor, simple operation, maintenance-free, fast lifting speed, low noise, and low temperature rise. This instrument can be equipped with a variety of rotors, and various adapters can be designed according to the experimental requirements.

This instrument is widely used in medical and health, blood stations, pharmaceutical factories, biomedical engineering, animal and plant research and other fields. It is suitable for any laboratory. It has a small footprint and greatly saves limited laboratory space. The opening height is low, and it is also suitable for the laboratory bench with clamps.

1.1 Product overview

1.1.1 Working principle

The centrifuge adopts the two principles of centrifugal filtration and centrifugal sedimentation. Under the action of centrifugal force, the cells (particles) of different densities in the solution can be separated, concentrated or purified under the action of centrifugal force.

Place the centrifuge tube containing the same amount of test solution symmetrically in the test tube hole of the rotor, and cover the door. After starting the instrument, the relative centrifugal force (RCF) generated by the high-speed rotation of the rotor driven by the motor separates the cells(or particles) with different densities in the test solution. The size of RCF depends on the horizontal distance from the position of the sample to the axis, that is, the rotation distance r and the rotation speed n. The calculation formula is as follows:

$RCF=1.118\times10^{-5}n^2r\times g$

n——Speed (r/min) r——
Rotation radius (cm)

The time T required for the separation and precipitation of particles in the mixed liquid is calculated by the following formula:

$$Ts=\frac{27.4\times(\log_e R_{max}-\log_e R_{min})\mu}{n^2r^2(\sigma-\rho)}$$

Rmax——Rotation radius of the test solution farthest from the axis (cm)
Rmin——Rotation radius of the test solution closest to the axis (cm)
ρ——Density of mixed liquid (g/cm³)
μ——Mixture viscosity (P)
n——Speed (r/min) r——
Particle radius (cm) σ——
Particle density (g/cm³)

1.1.2 Configuration and structure

MS-CE4000 centrifuge is mainly composed of control system, drive system, door lock protection system, etc. The appearance of the instrument is shown in Figure 1-1.

Figure 1-1 The appearance of MS-CE4000 centrifuge

1.1.3 Symbols and meaning

Symbol	Meaning
~	Alternating current
｜	The power switch is turned on (total power supply)
O	The power switch is off (total power)

1.2 Main parameters

This product belongs to I medical equipment, and its basic performance parameters are as follows:

Table 1-1 Main parameters

Main parameters	**Specifications**
Power supply	AC220V 50/60Hz
Power	150W
Maximum speed	4000r/min
Speed control accuracy	±10rpm
Speed up time	≤20 s
Slowdown time	≤40 s
Max. RCF	2250xg
Maximum centrifugal volume	4×100ml
Timing range	1-99min
Timing control accuracy	≤±1%
Noise	≤60 dB
Temperature condition	10℃~35℃
Size（L×W×H）mm	340mm*425mm*278mm
Package size（L×W×H）mm	480mm*580mm*400mm
Net weight	21kg
Gross weight	24kg

The rotor parameters of the centrifuge are as follows:

Table 1-2 Rotor parameters

Rotor No.	Name	Specification
4M0001	Angle rotor	6*50ml
	Adapter	1.5ml、5ml、10ml、15ml、20ml
4M0002	Angle rotor	4*50ml
	Adapter	1.5ml、5ml、10ml、15ml、20ml
4M0003	Angle rotor	12*20ml
	Adapter	1.5ml、5ml、10ml、15ml
4M0004	Angle rotor	12*15ml
	Adapter	1.5ml
4M0005	Angle rotor	8*15ml
	Adapter	1.5ml
4M0006	Angle rotor	24*10ml
	Adapter	1.5ml
4M0007	Angle rotor	18*10ml
	Adapter	1.5ml
4M0008	Angle rotor	12*10ml
	Adapter	1.5ml
4M0009	Angle rotor	12*1.5/2ml
	Adapter	0.2ml、0.5ml
4M0010	Angle rotor	4*100ml

Notice:

1. It is strictly prohibited to exceed the rotor capacity specified in Table 1-2!
2. The rotors listed in the attached table are all suitable for this type of centrifuge, and users can choose according to the needs of their own laboratory. The specific delivery is subject to the actual order signed by both parties.

1.3 Product transportation

In order to ensure that the product is not damaged by natural or mechanical damage during transportation and storage, in accordance with the requirements in GB/T 14710-2009 "Environmental Requirements and Test Methods for Medical Electrical Appliances", the centrifuge adopts three-layer packaging. Among them, inner packaging: plastic moisture-proof bag; middle packaging: rigid shockproof foam; outer packaging: three-layer corrugated carton. The special packaging provided by our company is required when transporting the centrifuge.

Transportation: The fully packaged centrifuge can be transported by automobile, rail, air and sea transportation. The instrument must be in a packaged state during transportation. At the same time, take care to prevent rain and snow, sun exposure, strong vibration, overweight pile pressure, over-temperature and over-humidity or dumping.

Note: If the instrument needs to be moved after being unpacked, please repack the instrument before it can be transported.

Storage: The packaged instrument should be stored at -20℃~55℃, relative humidity no more than 95%, atmospheric pressure 86kPa~106kPa, no corrosive gas and well ventilated environment.

The outer packaging for transportation should contain the following symbols:

Table 1-3 Outer packaging identification

Symbol	Marker	Description
	Upwards	Indicates that the transport package should be upright during transportation.
	Fragile goods	Indicates that the transport package contains fragile items and should be handled with care when handling.
	Afraid of rain	Indicates that the transport package is afraid of rain.
	No tumbling	Indicates that the transport package cannot be rolled during transportation.
	No stacking	Indicates that the package can only be placed in a single layer.

Chapter 2 Installation

The installation and operation of this instrument are simple and easy to operate. In principle, no engineer will be sent to install it. The instrument is debugged and calibrated by professionals before leaving the factory. After the customer receives the instrument, it can be installed and operated according to the requirements of this chapter.

2.1 Installation requirements

Before installation, the user must check whether the laboratory meets the requirements of space, power supply, and working environment.

2.1.1 Space requirement

In order to ensure that there is enough space for heat dissipation, repair and maintenance, the space must meet the following requirements:

1. The distance between the instrument and its surrounding walls or other objects should not be less than 50 cm (left, right, rear), and the work table must be placed horizontally and can safely support the operation of the centrifuge to ensure that all four feet of the centrifuge are on the table and without shaking.
2. There should be enough space where the power cord plug is inserted into the socket to ensure that the power plug can be unplugged from the power socket quickly and smoothly in an emergency;
3. It is required that there be no experimental equipment that generates a large heat source and a strong vibration source near the centrifuge.

Notice:

The centrifuge must be placed steadily. When the four legs of the centrifuge are not evenly stressed, it will produce vibrations, loud noises, affect the separation effect, and even cause explosions in the centrifuge chamber, resulting in safety hazards.

2.1.2 Power requirements

1. Power supply: AC220V, 50Hz, if the voltage is unstable, UPS voltage regulator equipment needs to be configured to ensure a stable 220V 50Hz power output.
2. There is a well-grounded socket within one meter of the equipment.
3. In order to reduce the risk of electric shock, this machine adopts a three-core plug, which must be connected to the three-core socket of the grounding wire.
4. Make sure that the wall socket is well connected to the ground wire, and make sure that the power supply voltage is consistent with the voltage used

by the machine.

5. It is strictly forbidden to use the extended power adapter with three holes to two holes.
6. It is strictly forbidden to use a two-wire extension socket or use a multi-purpose power adapter without a grounding wire.

Notice:

- The power socket should be within one meter of the analyzer to ensure that the plug can be unplugged in time when an accident occurs.
- Check whether the instrument voltage is consistent with the grid voltage.

2.1.3 Environmental requirements

The centrifuge should be kept away from electromagnetic interference and corrosive indoor places. The instrument should be placed in a ventilated place to avoid direct heat and strong light. The indoor environment should be dry and clean. It is not suitable to work in an environment with excessive humidity or excessive temperature changes. The instrument is required to operate in accordance with the normal operating conditions specified in the environmental parameters in section 1.2 above.

2.2 Unpackage

When you receive the centrifuge, please confirm whether the specification and model of the centrifuge are consistent with the one you ordered.

Please carefully check the equipment packaging for any damage (such as damage, water immersion, stains). If you find any problems with the packaging, please contact our company immediately. After confirming that there is no external damage, follow the steps below to unpack:

- Open the box, check the product packing information according to the packing list, and check whether the corresponding items and supporting documents are complete.
- Take out the instrument, check the appearance of the equipment carefully , if there is any damage, please contact our company in time.
- Pull out the screws on the right side of the main unit to open the door; check the centrifuge chamber, take out items except the rotor, and clean the centrifuge chamber.

2.3 Device installation

1. Take out the centrifuge carefully and place it on a horizontal work table (the instrument weighs about 21 kg, and the work table is required to bear more

than 75 kg).

2. Confirm that the power supply voltage is consistent with the required voltage of the machine (check the power supply voltage mark at the socket at the back of the machine, the power supply used by this machine is a single-phase three-wire AC 220V, 50Hz power supply). Connect the plug of the power cord to the socket on the centrifuge first, then insert the plug at the other end of the power cord into the external power socket, and press the centrifuge power switch to "｜" to turn on the power.

3. Installation of the rotor:

- Take out the rotor, check the rotor carefully, and pay attention to whether there are cracks on the rotor caused by transportation bumps.
- Wipe the motor shaft and rotor with a clean soft cloth.
- Install the rotor on the motor shaft. Pay attention to the center hole position and the slot of the rotor base matches the motor shaft pin. After the rotor is installed in place, use the matching screws and washers to fasten it to ensure that the rotor is stable and not loose.
- Put pipe sleeves into the rotor holes.

Notice:

- It is strictly forbidden to use a rotor that has exceeded the warranty period or a rotor that is not our company.
- It is strictly forbidden to use a rotor with cracks or corrosion spots.
- The rotor and the motor shaft must be closely matched during operation.

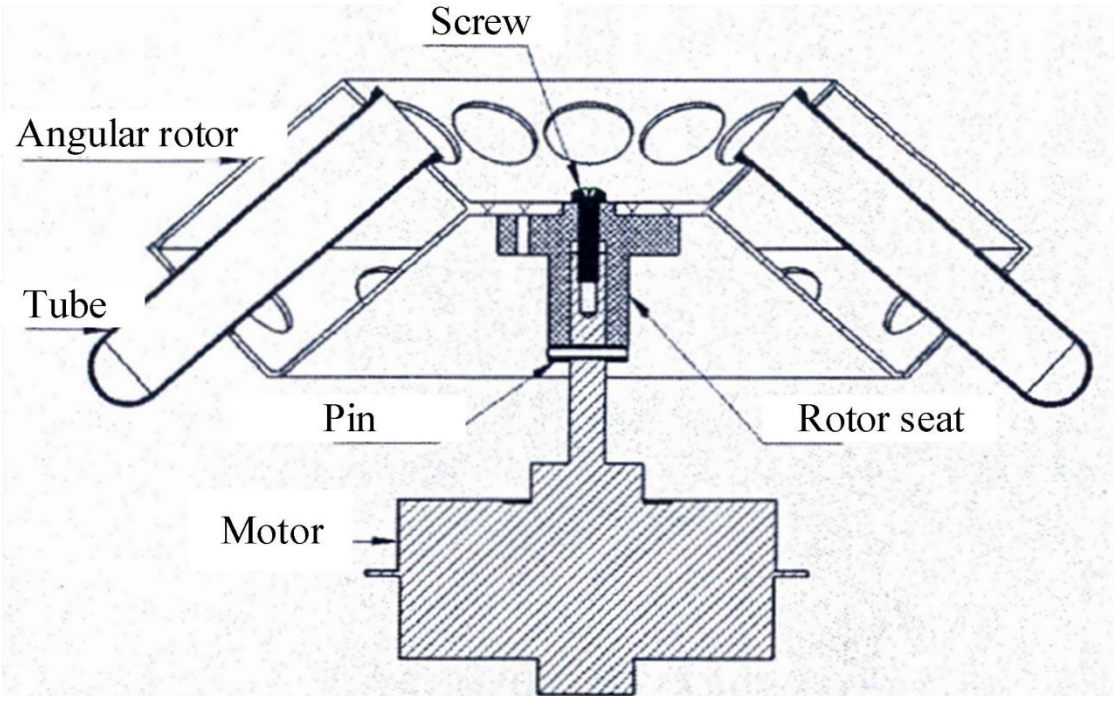


Figure 2-1 Installation of the rotor

Chapter 3 Instrument Operation

3.1 Operation panel

The operation panel of the MS-CE4000 centrifuge is located directly in front of the instrument, as shown in Figure 3-1:

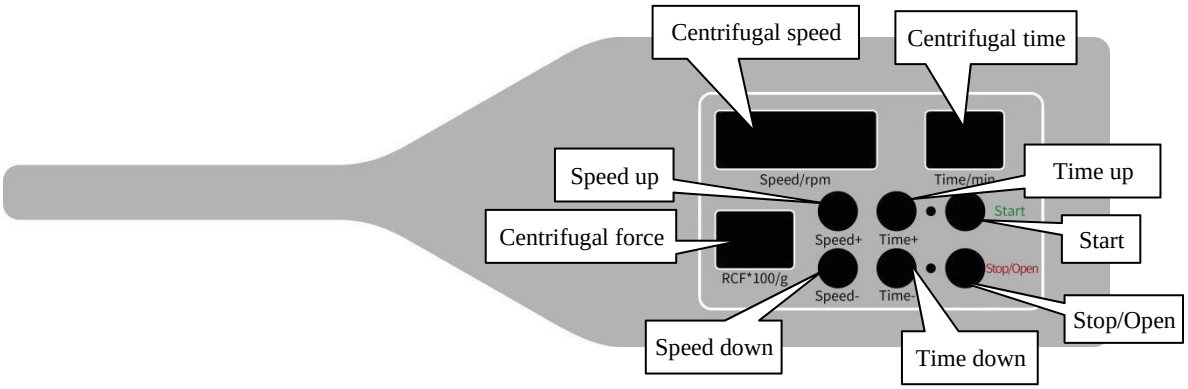


Figure 3-1 Operation panel

3.2 Daily operation process

1. Check before power-on

- Confirm that the table on which the centrifuge is placed is stable and firm, and there is no liquid placed near the centrifuge.
- The power switch is located on the right rear of the instrument and is marked on (|) and off (O). It controls the power supply connected to the centrifuge. Turn the power switch to the " | " position, the centrifuge is powered on, and the indicator light and display window on the operation panel light up.

2. Check before start

- Keep the door cover in the closed state, press the "Stop" button, and check whether the security screw on the right side of the host can be ejected normally and the door cover can be opened normally.
- Open the door and check whether the inside of the centrifuge chamber is clean and free of debris.
- Check whether there are cracks in the rotor and whether the screws fixing the centrifuge rotor are stable and firm without looseness.

Note: The centrifuge rotor should be disassembled regularly and checked for cracks at the bottom connection. It is strictly forbidden to operate with a cracked rotor!

3. Put in the centrifuge tubes

- Check whether the cap of the centrifuge tube is well installed.

- Place the centrifuge tube into the centrifuge tube sleeve symmetrically.
- The centrifugal tube liquid should be added with a balance to measure the liquid of equal weight. The two symmetrical centrifugal tubes in the rotor should have the same weight and cannot exceed the maximum allowable imbalance of 0.5g.
- Centrifuge tubes must be an even number and placed symmetrically, otherwise vibration and noise will be generated due to unbalance. If you are using the centrifuge tube with a cap, please tighten the centrifuge tube cap.

 Note: If the centrifuge tubes are placed unevenly, the rotor will swing greatly during the rotation, and in severe cases, the centrifuge may even explode!

4. Set centrifugation parameters

- Click the button on the operation panel to set the speed and time in turn, the operation panel will automatically calculate and display the centrifugal force during operation.
- The adjustable range of speed is 100~4000r/min, and the adjustable range of centrifugal time is 1s~99min.

 Note: The parameters cannot be changed at any time during operation.

5. Start up

- Close the centrifuge door and slightly lift the door manually to check if the door is locked.
- Press the "Start" button on the operation panel, the green running indicator lights up, the motor runs, and the speed steadily rises to the set speed. After the speed reaches the preset speed, the time display interface starts timing.

 Note: It is strictly forbidden to click the "Start" button when the door is not locked!

6. Shutdown

- When the instrument reaches the preset time, the red LED lights up, the motor brakes, and the speed drops steadily to 0. After the speed drops to 0, the instrument sounds a beep, and you can press "stop" "Button to open the upper cover.
- In the process of running, if you want to stop, you can manually press the "Stop" button, the red stop indicator lights up, the motor brakes, and the speed drops to 0 steadily. After the speed drops to 0, the instrument sounds a beep. You can press "Stop" button, the door lock pops out and the door can be opened.
- During operation, if there is a power outage in the laboratory or unexpected power outage of the instrument, wait at least 10 minutes for the motor to naturally

slow down, gently pull down the steel wire pull ring at the bottom of the machine, and hear the "patter" sound, which means that the door lock has been opened and the door cover can be opened. It is strictly forbidden to open the door in advance or attempt to manually brake the rotor.

 Note: It is strictly forbidden to touch the safety screw or try to open the door manually during the operation of the instrument!

The control system of the instrument is equipped with automatic monitoring and alarm functions. When the following abnormalities occur, the motor will automatically brake and display the fault code on the operation panel:

E1--Start the instrument without closing the door or open the door during operation

E2--Overspeed alarm

E3--Motor blocked

E4--The motor has not stabilized to the set speed for a long time after starting

E5--Motor vibration detection

7. Shutdown and maintenance after shutdown

- Turn off the power on the back of the instrument, turn the power switch to the "0" position, and unplug the power cord.
- Take out all the centrifuge tubes and tube sleeves, and wash the tube sleeves with alcohol and pure water successively.
- Use a moist but non-drip soft cloth dipped in alcohol to disinfect and wipe the inside of the centrifuge chamber, the sealing strip and the inside of the door.
- Use a moist but non-drip soft cloth dipped in pure water to gently wipe the keys on the operation panel.
- Install the dried pipe sleeve into the rotor and close the centrifuge door.

 Note: When cleaning the instrument, it is strictly forbidden to drip liquid on the operation panel of the centrifuge or inside the cavity of the centrifuge chamber!

Chapter 4 Maintenance

4.1 Maintenance of the centrifuge chamber

After the centrifuge is finished, the centrifuge chamber should be disinfected, and the door should be opened for a period of time to allow the centrifuge chamber to air dry. If the centrifuge is not used for a long time, put desiccant in the centrifuge chamber and close the door.

4.2 Maintenance of drive shaft

Take out the rotor vertically upwards, and be careful not to damage the motor shaft when the rotor falls during the disassembly process. The motor shaft should not be bumped or scratched. Wipe the motor shaft and rotor mounting holes clean with a soft cloth, and apply a little medical petroleum jelly or other grease.

4.3 Maintenance of operation panel and housing

The operation panel and the centrifuge door must be kept clean. The rotor, centrifuge tube or centrifuge cup and other tools cannot be stacked on the centrifuge door to prevent scratches. The operation panel and the centrifuge housing can only be wiped with a soft cloth and neutral detergent to prevent the paint from falling off.

 Note: It is forbidden to use corrosive disinfectant (such as 84 disinfectant, etc.) to disinfect the centrifuge.

4.4 Maintenance of the rotor

Take out the rotor, and then wash it with a neutral detergent. After washing, wipe it dry and turn it upside down to allow the water in the centrifuge tube hole to fully dry. For long-term storage, after sterilizing the rotor at high temperature, apply some lubricating oil to the center hole of the rotor and store it in a dry and ventilated place.

Chapter 5 Faults and Troubleshooting Methods

The following failures may be encountered during the use of the centrifuge. Please refer to the following methods for simple failure analysis:

1. The operation panel does not light up after power-on

- Use a multimeter to check whether the input power of the centrifuge is consistent with the centrifuge's rated voltage.
- Check whether the power cord is properly connected to the power socket of the centrifuge, and check whether the power cord is loose.

2. Large vibration or noise when the centrifuge is running

- Check whether the centrifuge tubes placed symmetrically in the rotor have equal weights. If they are not equal, please reconfigure them so that the weights of the centrifuge tubes placed symmetrically are equal.
- Check whether the centrifuge tube is broken. If the centrifuge tube is broken, clean the rotor and reconfigure the centrifuge tube with the same weight.
- Check whether the machine is placed horizontally on a level platform, whether the force on the four feet is even, whether the table is solid, and whether there is a strong seismic source around.
- Check whether the instrument is placed horizontally on a level platform, whether the force on the four feet is even, whether the platform is solid, and whether there is a strong seismic source around.
- Check whether the centrifuge tubes in the rotor are placed symmetrically. If they are not placed symmetrically, please place the centrifuge tubes of equal weight in pairs.
- Check whether the motor shaft is deformed and the rotor is cracked.
- Check whether the buffer part of the motor has been damaged, if it has been damaged, please replace the buffer system. (Please proceed under the guidance of professional after-sales engineers).

3. The centrifuge does not run

- Remove the centrifugal chamber, check whether the internal circuit is loose, check whether the wiring plug-in and the circuit board are plugged in, if not plugged in, please fasten the wiring.
- Use a multimeter to check the power supply transformer and check whether the input and output voltages are correct. If the power supply transformer is damaged, please replace it with one of the same model and specifications.
- Use a multimeter to check whether the motor is energized. If the motor is energized but does not run, it indicates that the motor is damaged. Please replace

the motor.

- The motor can run but the rotor cannot. Please check whether the rotor has been installed correctly.

 Note: If the power supply display is normal, but the centrifuge does not work, please contact our customer service center for help in time, and perform troubleshooting under the guidance of professional engineers. It is strictly forbidden to disassemble internal components without permission.

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