



High Speed Refrigerated Centrifuge LB-12HRC

Operational Manual

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1. Safety Measures

1.1 Caution

- To ensure safety and the centrifugal effect, set the instrument on a strong, shockproof, horizontal platform with the four machine feet uniformly stressed.
- Before turning on the centrifuge, remove any foreign objects from the centrifugal chamber and use the machine's Allen wrench to tighten the rotor and motor drive shaft.
- It is strictly forbidden to operate above the maximum speed specified by the rotor design.
- Unbalanced use of the rotor is strictly prohibited. Centrifugal tubes cannot be used in single tubes and must be positioned symmetrically. To guarantee balanced operation, the solution in the tube needs to be consistent.
- Operating at high speeds without a rotor is prohibited.
- The machine's Allen wrench should be used to loosen the rotor nut and pull it up to remove the rotor. To prevent harming the motor's flexible support, it is strictly prohibited to manually pull the nut up until it is completely withdrawn.
- Examine the centrifugal pipe and rotor for ageing, corrosion, and cracks before using. Replace it right away if there is. Using a rotor that is fractured or rusted is prohibited.
- The centrifugal chamber is a dynamic, fast-rotating environment. Following chamber operation, the host machine's temperature sensor program measures the dynamic air temperature. The heat energy produced following the high-speed rotation of the constant rotor surface serves as the key component of the refrigeration system, controlling temperature rise and safeguarding the sample. The air temperature in the cavity and the temperature in the rotor's test tube hole must differ in temperature. It comes closer and closer as the cavity's cooling period lengthens! For samples and centrifugal tests with high temperature requirements, the rotor should be stored in a 4-degree refrigerator for 8 hours or more to assure the low-temperature carrier of the rotor body!
- Check that the instrument is grounded and that the external power source satisfies the specifications.
- When the centrifuge is operating, it must not be moved. If the speed on the screen is not 0 r/min, do not open the door cover.
- The instrument or rotor must be run at low speed for ten minutes after being out of commission for three months before it can be run at the rotor's maximum speed.
- To avoid instrument damage and personal safety, do not mix rotors from different vendors.
- Do not place a liquid-filled container on the instrument. If the container is overturned, the liquid may enter the centrifuge and corrode its mechanical or electrical components.
- After separation, clean the instrument well, turn off the instrument's power switch, and unplug the power plug.

1.2 Centrifuge safety system

- Main current protection settings. When the power supply current exceeds the rated value, the micro circuit breaker protects the main machine and displays the message "**overcurrent protection**" at the top of the machine screen.
- Overspeed prevention instrument. When the speed is out of control or surpasses the predetermined speed of ± 300 r/min (over-speed treatment can be performed only when the control system assures that the speed is stable). The buzzer will sound, the machine screen will read "**over-speed**" at the top, and the control system will immediately go into shutdown mode to cut the motor, stop the machine from going too fast, and safeguard both the machine and the person's safety.
- A device that protects against imbalance. The buzzer will sound when the machine's vibration amplitude from imbalanced operation surpasses a predetermined threshold. The word "**unbalanced**" appears at the top of the machine screen. The siren will sound at this point, and the control system will immediately go into the shutdown phase to cut the motor, stop the machine from vibrating mechanically because it is unbalanced, and safeguard both the machine and the user.
- Over-temperature protection. When the temperature exceeds the specified temperature by $\pm 6^{\circ}\text{C}$ (the over-temperature treatment will be performed only when the control system determines that the temperature reaches the set temperature), the "over-temperature" message will appear at the top of the machine screen. At this point, the buzzer will sound an alert, and the control system will immediately enter the shutdown mode to stop the motor, prevent the machine from overheating, and safeguard the machine and personal safety, and better safeguard the test sample.
- **Door opening protection:** The door cover is not closed or not closed properly, the door lock sensor is faulty, the door protection detection cannot operate when no signal is detected, the buzzer alarms, and the top of the machine screen displays "The door is not closed properly", at this time, the instrument cannot start; When the door is opened during operation, the buzzer will alarm and shut down, and the control system will automatically enter the shutdown step to stop the motor, prevent the door from running, and protect the machine and personal safety. When the above prompts appear on the top of the machine display screen, the buzzer will beep for a long time and shut down. Only after the error has been resolved can the display prompt be released, and only then may the instrument be launched.

2. Introduction

High Speed Refrigerated Centrifuge LB-12HRC operates at a maximum speed of 16,500 rpm and achieves a maximum RCF of $26,145 \times g$. It is equipped with a refrigeration system and maintains a temperature range from -20°C to $+40^{\circ}\text{C}$. It offers up to 10 levels of acceleration and deceleration, providing smooth transitions and protecting delicate samples. The centrifuge features a large HD LCD, enabling real-time monitoring and easy parameter adjustments.

3. Features

- Automatic rotor recognition
- linear drive system
- Overspeed protection
- Electric lid lock
- Microcomputer control
- Eco-friendly refrigeration
- Overheat protection
- Overheat protection
- Unbalance detection
- Low noise operation

4. Specifications

Model No.	LB-12HRC
Maximum Speed	16500 rpm
Maximum RCF	$26,145 \times g$
Maximum Capacity	$6 \times 50 \text{ mL}$
Speed Accuracy	$\pm 10 \text{ r/min}$
Temperature Range	-20°C to $+40^{\circ}\text{C}$
Temperature Accuracy	$\pm 1^{\circ}\text{C}$
Timer Range	1m to 99h 59min 59s
Noise Level	$\leq 60\text{dB(A)}$
Power Consumption	800W
Power Supply	AC $220 \pm 22 \text{ V}$, 50 Hz, 10 A
Dimension (L×W×H)	$610 \times 560 \times 370 \text{ mm}$
Weight	73 kg

5. Applications

High Speed Refrigerated Centrifuge LB-12HRC is used for precise and rapid separation of biological samples. It is widely used in clinical laboratories, research institutes, biotechnology labs, and pharmaceutical facilities.

6. Instrument Introduction

Instrument Structure:

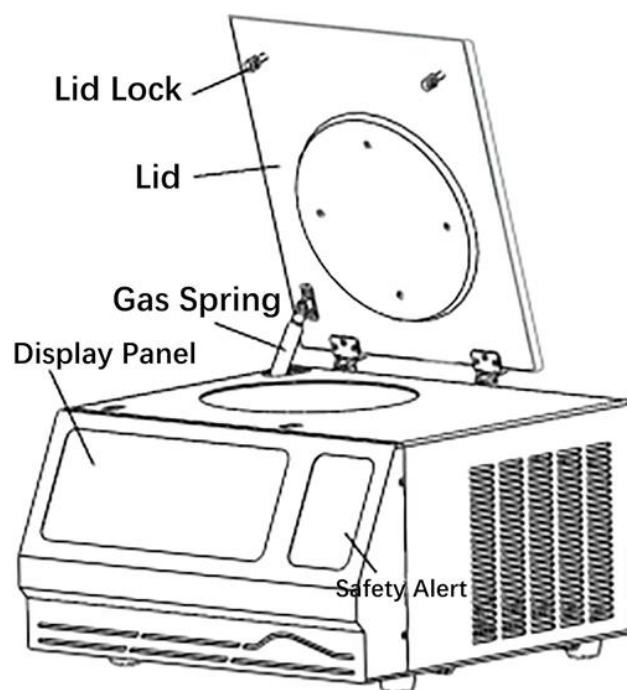


Figure-1

7. Installation

7.1 Unpacking Inspection

- 1) Ensure the instrument has not been damaged during transit before receiving it.
- 2) Check that the goods are according to the packing list.
- 3) Remove the package and place the articles in the centrifuge chamber.

7.2 Instrument Installation

7.2.1 Installation site requirements

- 1) Avoid direct sunlight and ensure the installation table is clean, dry, and solid indoors.
- 2) Near the centrifuge, there should not be any significant sources of vibration.
- 3) Under typical operating conditions, the centrifuge's interior temperature should be between 10 and 30°C for refrigerated machines and between 5 and 40°C for non-refrigerated machines. Additionally, the relative humidity should be below 80%.
- 4) Avoid placing heat sources close to the centrifuge.
- 5) A separate ground wire ought to be included in the space to provide power safety.

7.2.2 Installation of host

- 1) Install the host machine on a sturdy tabletop such that all four feet contact it.
- 2) To ensure adequate ventilation, there should be more than 20 cm between the centrifuge and the wall.

7.2.3 Power requirements

- 1) A 220V 50Hz AC circuit must be used by the centrifuge; the voltage must be steady and fluctuate no more than $\pm 10\%$. The voltage on the machine's nameplate and the supplied voltage should match. To find the voltage, use a voltmeter. The power supply does not satisfy the installation requirements if the voltage differential between the rated voltage and the power supply is greater than 10%. (It is advised that the machine be fitted with an automated electronic AC voltage regulator purifier if the power supply voltage is insufficient.)
- 2) The distance between the centrifuge and the power connector, socket, or circuit breaker must not exceed one metre.
- 3) To ensure safety, the centrifuge should be connected to a remote emergency switch, ideally outside the room where it is placed or close to the exit. This way, in the event of a breakdown, the connection between the centrifuge and the main power supply may be turned off.
- 4) Ensure the socket is grounded and connected correctly before using it. Never use a three-wire to two-wire conversion plug; using a two-wire extension wire or a multi-jack terminal block of the two-wire grounding type is strictly prohibited.

7.3 Rotor installation and removal

7.3.1 Angle rotor assembly and disassembly method

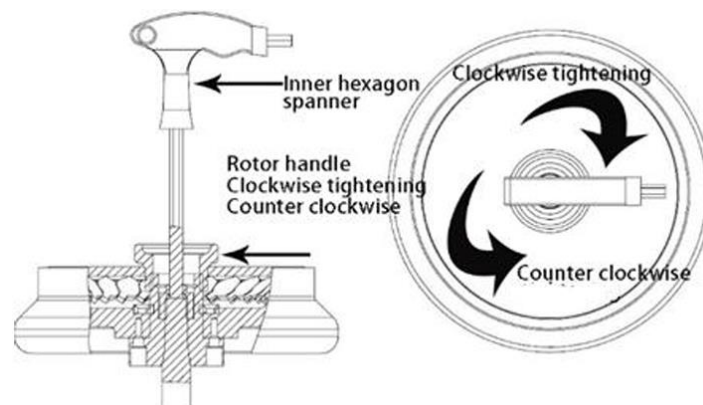


Figure-2

7.3.2 Swing-out rotor assembly and disassembly method

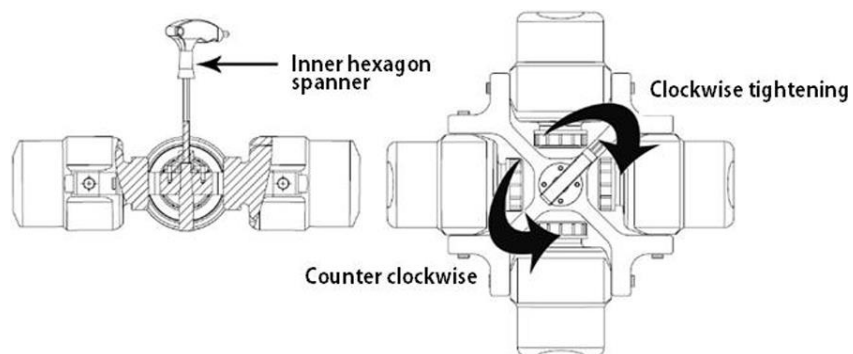


Figure-3

8. Working Principle

Based on the principle of centrifugal sedimentation, the centrifuge separates particles according to their density by using centrifugal force. High-speed spinning of a sample in a centrifuge produces a powerful outward force that affects every particle in the sample. This force pushes particles away from the axis of rotation because it is far stronger than gravity.

The size, shape, and density of the particles in the sample all affect how they react to this force. Particles that are denser and heavier are subject to a greater force and go outward faster, landing at the bottom or along the centrifuge tube's outside border. Lighter, less dense particles, on the other hand, stay nearer the tube's top or centre. Consequently, the sample separates into different layers according to the density of the particles.

Because of this concept, the centrifuge can be used for a number of tasks, including component separation, concentration, and purification. Centrifugation can be used, for instance, in biological labs to separate blood components, isolate cells, purify proteins, or gather precipitates from a solution.

The relative centrifugal force (RCF), which is determined by the specimen's position in relation to the horizontal distance of the axis of rotation radius (r) and speed (n), is generated by the rotor's low-speed rotation, which separates the cells from cells with varying densities in the test solution. The formula is as follows:

$$RCF=1.118 \times 10^{-5} n^2 r \times g$$

n: Speed (rpm)

r: Rotation radius (cm)

The time T_s for mixed solution separation and precipitation is calculated by the following formula:

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

$R_{\max}$: The radius of rotation of the test solution at the furthest distance from the axis

$R_{\min}$: The radius of rotation of the test solution at the nearest distance from the axis

ρ : Mixture density (g/cm)

μ : The viscosity of the mixture (poise)

n: Speed (r/min)

r: Particle radius (cm)

σ : Particle density (g/cm)

9. Operations

9.1 Operation Panel

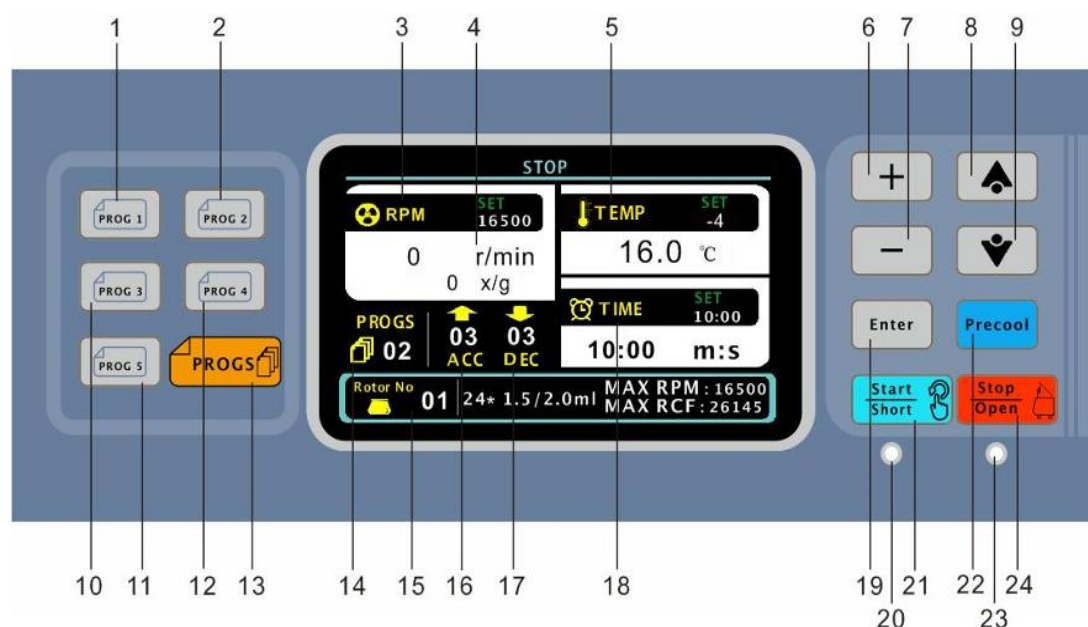


Figure-4

- | | |
|---|---------------------------|
| 1) Program 1 | 12) Program 4 |
| 2) Program 2 | 13) Program group key |
| 3) Speed/centrifugal force switch | 14) Program group display |
| 4) Speed setting, centrifugal force setting | 15) Rotor number |
| 5) Temperature setting | 16) Acceleration |
| 6) Increase key | 17) Deceleration |
| 7) Decrease key | 18) Time setting |
| 8) Up key | 19) Confirmation key |
| 9) Down key | 20) Operation indicator |
| 10) Program 3 | 21) Start/instant key |
| 11) Program 5 | 22) Pre-cooling key |
| | 23) Stop indicator |
| | 24) Stop/open key |

The operating steps of the instrument are as follows:

- 1) To ensure the centrifuge is positioned steadily, place it on the platform, visually balance it, and give it a gentle hand shake.
- 2) To open the door cover, turn on the power source, press the power switch, and then press the **"Stop/Open"** key after ensuring the positioning is steady.
To prevent damage to the motor's flexible support, open the door cover, place the rotor gently on the motor drive shaft, screw the rotor's nut clockwise, and securely fasten the rotor to the motor drive shaft. Take care to avoid excessive shaking to the left and right, as well as upward and downward pressure.

High Speed Refrigerated Centrifuge LB-12HRC

After fixing the horizontal rotor, if it is installed, suspend the lifting cup into the appropriate pin position. Once finished, turn the rotor body a little so that it can spin freely. Without blocking or colliding, the hanging cup (hanging basket, pipe rack) must tilt freely on the horizontal rotor.

- 3) To ensure the rotor operates balanced, insert the balanced centrifugal tube symmetrically into the test tube hole or rotor cup.
- 4) Close the door cover and make sure it is securely latched. If it is, it will not open when you gently and firmly lift it after closing. Pressing "**Start**" will cause the buzzer to sound and the stop signal to flash if the door cover is not properly closed.
- 5) Configure the rotor number, speed, centrifugal force, temperature, time, speed up and down gear, and other operating settings.

- **Set the speed:** Move the pointer to the "Speed setting" column, press the "Up" or "Down" keys, adjust the speed by pressing the "+" or "-" keys, then save the settings by pressing the "Confirm" key.

Set centrifugal force: To modify the centrifugal force, press the "Up" or "Down" keys, move the cursor to the "Centrifugal force setting" column, press the "+" or "-" keys, and then press the "**Confirm**" key to save the settings.

To change the rotation speed or centrifugal force setting, look at the "Rotation speed/centrifugal force switching" column and click the "**Confirm**" key.

- **Set temperature:** Move the pointer to the "**temperature setting**" column, press the "up" or "down" keys, modify the temperature by pressing the "+" or "-" keys, then save the settings by pressing the "**OK**" key. (Take note of the machine's precooling feature. To enter the precooling mode after starting, press the "**precooling**" key. The machine will finish precooling after a predetermined amount of time. The user can continue to adjust other operating parameters after the machine has shut down.)
- **Set the time:** Press the "up" or "down" key, move the cursor to the "time setting" column, press the "+" or "-" key to adjust the time, and press the "**OK**" key to save the parameters.
- **Set the rotor number:** The machine can automatically identify the rotor number, press the "**Start**" key to automatically identify the rotor specification, and call the corresponding rotor operation parameters for operation. To change the corresponding rotor number, press the "Up" or "Down" keys, move the cursor to the "**Rotor number**" column, press the "+" or "-" keys, and press the "**Confirm**" key to save the parameters.
- **Set the speed up and down gear:** The cursor can be moved to the "acceleration" or "deceleration" column by pressing the "up" or "down" keys. The gear can be adjusted by pressing the "+" or "-" keys, and the settings can be saved by pressing the "**OK**" key.
- From 0 to 9, the system contains 10 gears. The slowest number is nine, and the fastest is zero. Other gears can be chosen, and the slower gear can be chosen when using an angle rotor or a horizontal rotor with a large volume.
- **Set program group:** Press program group 1 once all the parameters have been set. Once more, press the OK key. Program group 1 allows you to save the settings that were set this time. 99 groups of program storage space can be configured by the system. To set the new program value or call the set program value, press the "**program group**" key, move the cursor straight to the program group column, and then use the "**up**" or "**down**" keys.

- It is not possible to set the rotor number or program group while the machine is operating. During the operation, the only variables that may be changed are "speed," "centrifugal force," "temperature," "time," "acceleration gear," and "deceleration gear."
- Check the screen's settings and ensure there are no errors before turning on the computer. When you press the **"Start"** key, the operation indicator illuminates and the machine begins to run. Before stabilizing at the predetermined value, the speed begins to increase. The rotor's real speed is shown in the speed display window. The centrifugal chamber's real temperature is the one shown in the temperature pane. The countdown on the time display window begins.
- To activate the instant centrifugal function, press and hold the start (immediate release) key for a long time. To stop the machine from operating, manually release the key.
- The stop indication will illuminate, and the speed display will show 0 r/min, indicating that the machine has been stopped when the time bar reaches 0 or the **"Stop"** key is pressed. Now, remove the centrifuge tube by opening the centrifuge chamber's door cover.
- The separation process is finished once the door cover is opened and the centrifuge tube is safely removed.

Note:

- Avoid opening the door too often. To prevent component damage, it is advised that the interval be longer than 10 seconds.
- Switch off the power and disconnect the centrifuge's power supply.
- This machine's screen incorporates a touch feature. By selecting the relevant function area on the screen, you may also finish the parameter setup.

9.2 Centrifuge tube placement

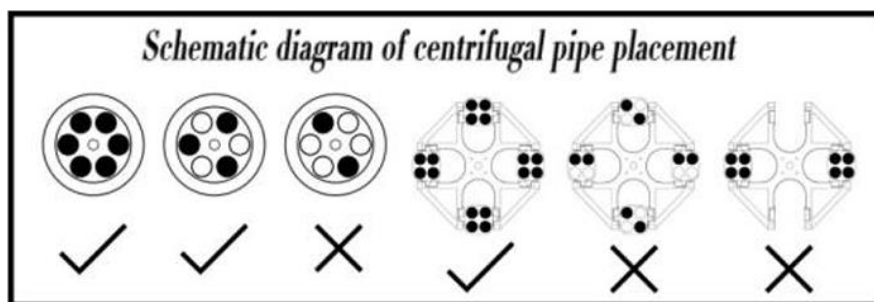


Figure-5

By the schematic diagram, place the test tube appropriately. Unbalanced and asymmetrical positioning is forbidden.

- 1) Overspeeding is prohibited; the rotor must be utilised and operated at the designated speed.
- 2) Determine whether the centrifuge chamber contains any foreign objects by opening the door cover. Before the procedure, make sure to clear it of any foreign objects.

- 3) Prior to starting the machine, the separated sample is symmetrically inserted into the angular or horizontal rotor after the counterweight has been removed, and the weighing error is less than 0.5g. During every operation, all centrifuge bottles (also known as centrifuge tubes) must be turned on. Placing the split samples asymmetrically for operation is prohibited. When centrifuge bottles (also known as centrifuge tubes) are used incorrectly, they can produce excessive vibration, harm the machine, and danger to user safety. The horizontal rotor should verify that the hanging cup is hung appropriately once it has been placed in the test tube, and the angle rotor should verify that its cover is tight.

9.3 Refrigeration system

High efficiency, quick cooling and heating speed, and a refrigeration and heating double circuit to regulate the centrifugal chamber's temperature are all features of the refrigeration system, which uses a highly efficient compressor.

Each time the centrifuge is finished, the water vapour in the centrifuge cavity must be evaporated by opening the refrigerator door cover.

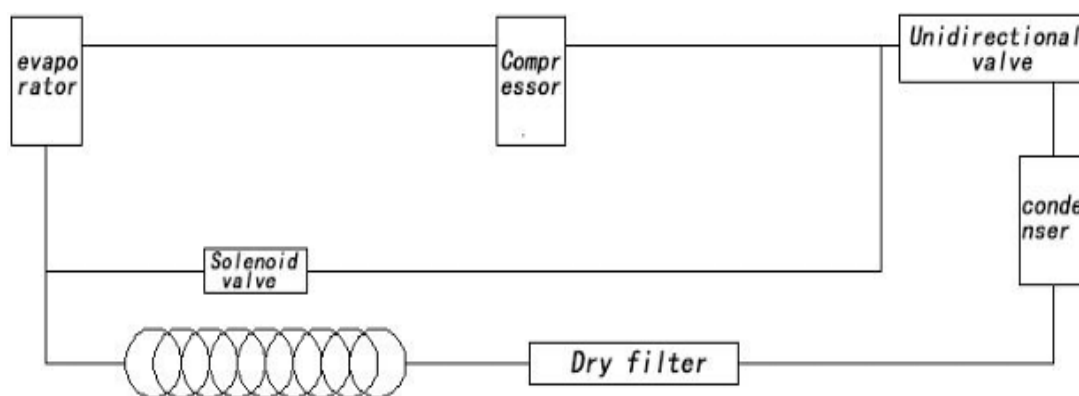


Figure-6

10. Maintenance

- 1) To maintain voltage stability, the centrifuge must utilize a 220V 50Hz AC circuit. It is recommended to install a completely automated electronic AC voltage stabilizer and purifier on the machine if the user's voltage is unstable to prevent centrifuge damage. To ensure adequate ventilation, the centrifuge should be placed on a level, sturdy, and solid surface with some room left around the chassis.
- 2) To keep the compressor from being blocked and damaged, there must be a minimum of five minutes between restarts following each shutdown (power off).
- 3) A dry or moist towel can be used to scrub the centrifuge shell, which should be kept dry and clean. Acid/alkaline detergents cannot be used; neutral detergents can be used.
- 4) It is important to maintain the centrifuge chamber dry and clean. When foreign objects are present in the centrifuge chamber, remove the debris with rags or tweezers. Rinse and dry with clean water after wiping with dry or wet towels and, if required, neutral detergent. Chlorinated detergent disinfectants and acidic/alkaline solvents that erode objects are prohibited, though. 70% alcohol is suitable for disinfection. If there is radioactive contamination, clean with 70% alcohol, 10% SDS, and water, then clean with alcohol and deionized water, and finally dry with a soft, dry towel. Normal operation results in condensation from the air's interaction with the low-temperature centrifugal chamber wall; this condensation needs to be dried quickly to avoid icing. If frosting appears, take out the rotor, shut the door of the centrifugal chamber, set the temperature to 25°C, open the chamber door when the temperature reaches 20°C, dry the wall of the centrifugal chamber, put the rotor in, and adjust the temperature as needed.
- 5) Open the door cover, remove the condensate, and let the centrifuge air dry naturally after each usage. To prevent collisions with the motor drive shaft and the rotor itself, the rotor must be carefully and vertically lowered or raised both before and after centrifugation.
- 6) The rotor seat and the bottom of the centrifuge chamber, as well as the upper portion of the chamber and the door cover, are connected by rubber sealing rings. As the service duration is extended, it is important to monitor for deformation to stop external heat from seeping in and affecting the centrifuge's performance because of inadequate temperature regulation. Replace it promptly if it becomes deformed or aged.
- 7) Regularly use compressed air (vacuum cleaner) to clear the centrifuge's ventilation window and condenser of dust, guarantee the condenser's ventilation and heat transfer effects, and improve the refrigeration and heating effects.
- 8) The rotor body should be removed and anti-rust oil applied to the rotor base (or drive shaft) when the centrifuge is not in use for an extended period. This will stop the rotor base from rusting, which will impair the instrument's ability to balance when operating. To stop the rotor seat (or drive shaft) from rusting, desiccant can be added to the centrifugal chamber to absorb moisture.
- 9) Regular inspections are necessary to determine whether the door cover's pneumatic support rod can function normally and whether the connection is in excellent shape. Replace them right away if there are cracks or other issues.
- 10) Centrifuging polluted, radioactive, and poisonous substances requires extra safety precautions.

- 11) The rotor and other accessories must be inspected for corrosion and cracks, the rotor's inner nut must be tightened with the motor drive shaft, and the rotor must be placed in the proper position.

12) Centrifuge function inspection

The operator is responsible for making sure the centrifuge's key components are in good condition, which primarily means that the motor is mounted steadily and that the rotor seat (shaft) is not deviating.

The ground wire is securely attached.

Maintenance of rotor:

- The rotor should ideally be precooled before use. After every centrifugal operation, use a fresh, soft cloth to remove any remaining liquid or water from the rotor's inner and outer surfaces as well as the centrifugal cup, then dry it before using. When not in use, the rotor and centrifugal cup must be removed from the centrifugal chamber and kept dry and clean. When not in use for an extended period, the rotor should be covered with a coating of paraffin.
- The quality of the centrifuge cups and tubes used must be ensured, and regular maintenance, cleaning, and disinfection should be done. Examine the rotor and centrifugal cup's inner and outer surface oxidation layers on a regular basis. Stop using if there is peeling, rust, a minor crack, a major scratch, or deformation.
- Use in humid or toxic gas environments will shorten the centrifuge rotor's service life and hasten the onset and spread of rotor corrosion.
- Overfilling, improper sealing, or damage to the centrifugal pipe during operation can all cause the rotor to leak. It is important to remove the rotor from the shaft, clean it, and apply a protective coating as soon as possible after use. If the rotor is left on the shaft for an extended time, compressive stress will cause the rotor and motor drive shaft to come into contact, which could lead to increased corrosion and "seizure." When using the rotor, care should be taken to ensure that the centrifugal tube is filled with sample and that the seal is tight. Additionally, the sealing ring should be inspected frequently to ensure that it is in excellent condition to prevent corrosion and hidden hazards. In case of aging and damage, replace it in time to avoid liquid leakage.
- Directly touch the rotor with a corrosive solvent. Wash, wipe, spray a protective agent, and apply protective grease as soon as possible after using the rotor.
- To avoid mechanical damage, attempt to keep the rotor from getting scratched, bruised, or otherwise damaged while using and storing it.
- The rotor must be operated at a lower speed when the average density of the separated sample exceeds 1.2 g/ml, as determined by the formula below.
- Stainless steel centrifugal pipes require the rotor to be used and the speed to be decreased.

Note: From a safety standpoint, the metal rotor of a centrifuge can last for three years, while the non-metal rotor can last for one year. The rotor cannot be used again because it has outlived its permitted service life!

Warning: It is forbidden to operate the rotor that comes with this machine faster than what is stated in the instruction manual. The user will be responsible for any damage resulting from driving too fast. Rotors with rust and cracks cannot be used.

Anti-pollution measures:

To prevent contamination, the following procedures should be undertaken if radioactive or pathological samples have been processed in the centrifuge or rotor.

- 1) As previously said, clean the centrifuge and rotor surface.
- 2) Remove the entire set of rotors.
- 3) Remove the sealing ring and gasket of the motor and clean them.
- 4) Clean the centrifuge's centrifugal chamber, door cover, and spinning shaft.
- 5) Clear the area around the motor and rotor seat of any scales and foreign objects.
- 6) The rotor body and shroud should be cleaned.

11. Troubleshooting

11.1 Debugging

Fault	Reason	Solution
The screen is not bright when plugged in	No power supply	Check the power supply
	The fuse is blown	Check and replace the fuse
	The communication wire is loosened	Check and tighten it.
Large vibration after start	The inner centrifuge tube is not placed symmetrically	Check and adjust the centrifuge
	The centrifugal pipe is ruptured	Check and replace the pipe
	The rotor is not tightened	Check and tighten the rotor
	The damping part is damaged	Check and replace it
The display screen shows 0000. Press the start button machine does not work	The circuit board or transformer is damaged	Replace the circuit board or transformer
	The control system connector is loose	Re-connect the control system connector
	The key is damaged	Replace the key
	The motor is damaged or leakage	Replace the motor
Capable of running but not fast, the machine has a strange sound or a peculiar smell	Control system or motor fault	
Actual speed is different from the set or displayed speed, out of control, or unstable	The Control system fault	
The temperature cannot meet the set low temperature requirements	Without precooling or insufficient precooling	Full pre-cool
	The compressor is damaged	Check and replace the compressor
	The solenoid valve is damaged	Replace the solenoid valve
	Insufficient refrigerant	Add a proper amount of refrigerant

11.2 Error codes

There is a fault display window on this machine. The following characters, which have the following meanings, will appear in the "**Information Window**" column (at the top of the display frequency) when the machine fails:

Error Code	Error Type	Solve
E1	Unbalanced	Check whether the motor damping is loose
E2	Excess speed	Re-energize
E3	The lid is opening	
E4	The lid is opened during operation	Close the door again
E7	Zero speed	Check whether the motor connector is loose
E8	Communication error	Restart
E9	Drive fault	Restart
E10	Over current	Check whether the rotor is blocked
E12	High-voltage	Equal-voltage return to normal
E13	Low-voltage	Equal-voltage return to normal

12. Rotor Selection

Rotor Type	Capacity	Maximum Speed	Maximum RCF
Fixed Angle Rotor 1	24 × 1.5/2.0ml	16500rpm	26145×g
Fixed Angle Rotor 2	12 × 5ml	16000rpm	17344×g
Fixed Angle Rotor 3	32 × 1.5/2.0ml	14000rpm	19940×g
Fixed Angle Rotor 4	8 × 8 × 0.2ml PCR Row	14000rpm	15032×g
Fixed Angle Rotor 5	6 × 30ml (Round bottom)	13500rpm	17482×g
Fixed Angle Rotor 6	12 × 10ml	13000rpm	15228×g
Fixed Angle Rotor 7	48 × 1.5/2.0ml	13000rpm	18327×g
Fixed Angle Rotor 8	6 × 50ml (Round/Conical bottom)	12000rpm	16227×g



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