

# USER MANUAL

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## Tabletop High-speed Refrigerated Micro Centrifuge




This user manual needs to be read before operating this product.  
Please follow the safety instructions provided in this manual.


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## Safety Warnings

The symbol  is an internationally accepted safety mark. Please carefully read and fully understand the following safety rules:

- Comply with the operation requirements contained herein and ensure safe operation.
- Carefully read all safety information and reminders provided in this manual.
- Safety information is marked as follows. The safety symbol  is combined with the “Warning” and “Caution” respectively, reminding users of the potential danger. These two combinations and the “reminder” symbols are defined as follows:



Warning: personal danger.

Warning against potential dangers, which might result in injury or death if the requirements contained herein are not strictly complied.



Caution: Potential danger to instrument

Ensure to comply with all the safety requirements as mentioned to avoid potential dangers of damage to the instrument

Reminder: matters that generally call for attention.

- Do not use this centrifuge in any manner not mentioned in this user manual.
- In case of any problem, please contact the vendor/supplier.
- This user manual provides complete details of the potential dangers, however users are advised to stay alert against unpredictable circumstances and use this centrifuge with care.



**Warning:**

- This centrifuge is non-explosion proof and may not be used for separation of flammable or explosive samples.
- Do not install this centrifuge in the vicinity of any flammable gas or chemical substances.
- Do not place anything that causes danger within 30cm radius of this centrifuge.
- Don't centrifuge any toxic, radioactive or pathogenic organisms without appropriate safety measures. If the microorganism sample being centrifuged is secondary hazard (as defined in the WHO's "Laboratory Biosafety Manual"), ensure to use biological sealing devices.
- Ensure to sterilize it according to decontamination procedures that are mentioned under sterilization

section.

- If there is any need for onsite assistance, sterilize and decontaminate the centrifuge in advance and notify the service representative about the details.
- Never touch the power cable/switch with wet hands and avoid electric shocks.
- As a safety measure, ensure to maintain atleast 30cm distance from the centrifuge while in operation.
- For safety reasons, when the centrifuge is running, the personnel should maintain a 30cm distance from the centrifuge.
- Never open the outer lid while the rotor is in operation.
- The centrifuge should be opened for repair/ dismantling by trained staff only.

### Caution

- Ensure that the centrifuge is stable, before its operation.
- Ensure that the angle between the outer lid and housing is larger than 90° while opening the lid.
- Never place hands/any other things in between the outer lid and the housing.
- Never open the outer lid while the centrifuge is in operation.
- Don't move or lean against the centrifuge if it is in operation mode.
- If there is any liquid found in the centrifuge, ensure to wipe it OFF with a cloth in time to prevent sample contamination.
- Ensure that the centrifuge chamber is left clean and free of any foreign objects/ tube fragments before each and every operation
- Reminders about rotor:
- Check and ensure that the rotor surface is free of corrosions/ damages before its operation.
  - (1) The set rotation speed of the centrifuge should not exceed the allowed minimum speed of the rotor assembly and accessories (rotor and adapter) and ensure to run the centrifuge under minimum allowed speed.
  - (2) Don't exceed the allowed amount of imbalance.
  - (3) The centrifuge tubes used should be within their allowed capacity.
  - (4) If the rotor has a lid, ensure to tighten it before operation.
  - (5) Use genuine accessories only.
- If there is any abnormality or strange noise observed in operation, please stop the centrifuge operation and contact the service center and intimate the failure code immediately.
- Earthquake might cause damage to the centrifuge. If any abnormality occurs, please contact the service center.

## 1. Performance indicators

|   |   |
|---|---|
| Maximum rotation speed                    | 15,000rpm (200-15,000rpm)<br>step: 100rpm   |
| Maximum relative centrifugal acceleration | 21,380×g, step: 10×g  |
| Capacity                                  | 1.5/2ml×24; 0.5ml×36; PCR8 tube bank ×4; 5ml×12; 5ml×18;  |
| Temperature setting range                 | Tabletop high-speed refrigerated micro-centrifuge: -20°C- 40°C  |
| Timing                                    | 30s-99 min; HOLD (continuous running)   |
| Drive motor                               | DC brushless motor  |
| Safety performance                        | Dual door locks, overspeed, overtemperature and Internal diagnosis system.  |
| Power                                     | Single phase, 200-240V, 50Hz, 500W  |
| Dimensions (mm)                           | (Width) 332× (depth) 553× (height) 283  |
| Weight                                    | 30kg  |
| Acceleration and deceleration time        | 25s↑25s↓  |
| Noise                                     | ≤56dB   |
| Other functions                           | Rotation speed/RCF switchover, inching operation, running process indication and sound reminder; 9-step acceleration, 9-step deceleration; stored program capability. |

## 2. Conformity to standards

The centrifuge's structure conforms to the following safety standards:

IEC 61010-1:2010,

AMD1: 2016/EN 61010-1:2010,

UL 61010-1:2012 R4.16 and CAN/CSA-C22.2 NO.61010-1-12+ GI1+GI2

CB Scheme N/A

EN 61010-2-020

The centrifuge's structure conforms to the following electromagnetic compatibility standard:

EN 61326-1

Compliant with the following EU standards:

EMC standard: 2014/30/EU

## 3. Environmental conditions

### 3.1 Basic operating conditions

(1) Power supply: single phase, 220-240V, 50Hz, 500W

(2) Ambient temperature: 2~40°C.

(3) Relative humidity: ≤80%.RH

- (4) No vibration or air flow present nearby that might affect performance.
- (5) No conductive dust, explosive gas or corrosive gas exists in ambient air.

### 3.2 Transport and storage conditions

- (1) Range of ambient temperature:  $-40^{\circ}\text{C}$ - $55^{\circ}\text{C}$ .
- (2) Range of relative humidity:  $\leq 93\%.\text{RH}$
- (3) The centrifuge must remain upright while in transit, suitably protected using wooden Kart box
- (4) Lift the centrifuge by the chassis only.
- (5) Pay attention to the centrifuge's weight while in transit (see the "performance indicators").
- (6) Centrifuges with cooling device, should be left for about 1 hour after being relocated to a new position to stabilize the refrigerant in the compressor

## 4. Installation

Users must strictly comply with the installation instructions contained in this chapter.

Be advised! Remove the rotator before moving the centrifuge.

### Warning

- Improper power connection might damage the centrifuge.
- Before connecting the power supply, please check the power supply for compliance with the requirements.

### 4.1 Mounting position

- (1) This centrifuge must be mounted on a solid, flat and tabletop with contact between the four feet of the centrifuge and the tabletop. Don't mount the centrifuge on any sliding tabletop, otherwise significant vibration might occur. Carefully place the centrifuge to avoid damage.
- (2) The ideal ambient temperature is  $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and the ambient temperature should not be more than  $30^{\circ}\text{C}$ . Avoid direct sunlight on this centrifuge.
- (3) Place the centrifuge at  $>30\text{cm}$  distance from the wall and other instruments if using multiple units together to ensure effective cooling.
- (4) Ensure that there is no water leakage/ heat loss near the centrifuge as it may cause the rise in temperature and thereby leading to centrifuge failure.

## 4.2 Connection between power cable and ground wire

⚠ Warning

- Don't touch the power cable with wet hands and avoid electric shocks.
- Ensure that the centrifuge is well grounded.

(1) This centrifuge uses three-core power cable and three-core flat plug, the latter of which may be directly connected to the power socket.

(2) Ensure that the centrifuge is protected by good grounding terminal and that the label on it indicated the correct voltage (>10A) before connecting the device to power supply.

## 5. Structure

离心机

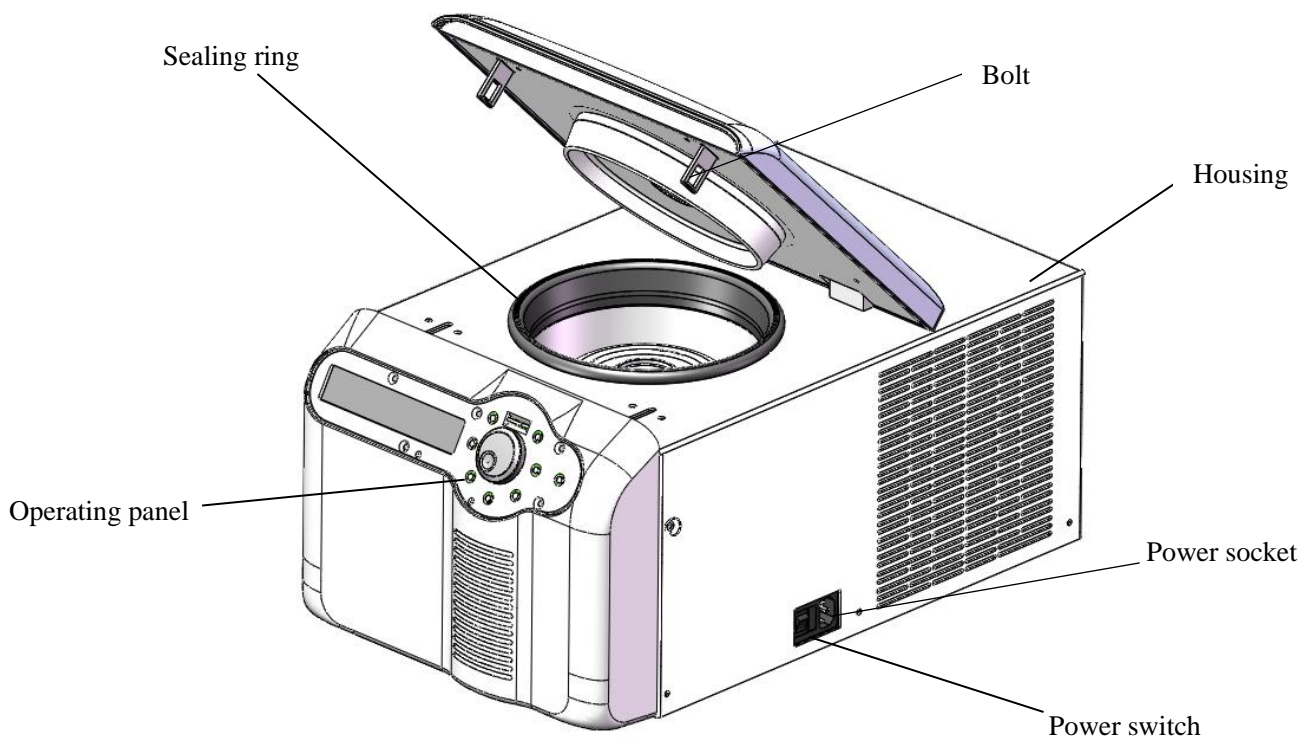


Fig. 5.3. Front view of centrifuge



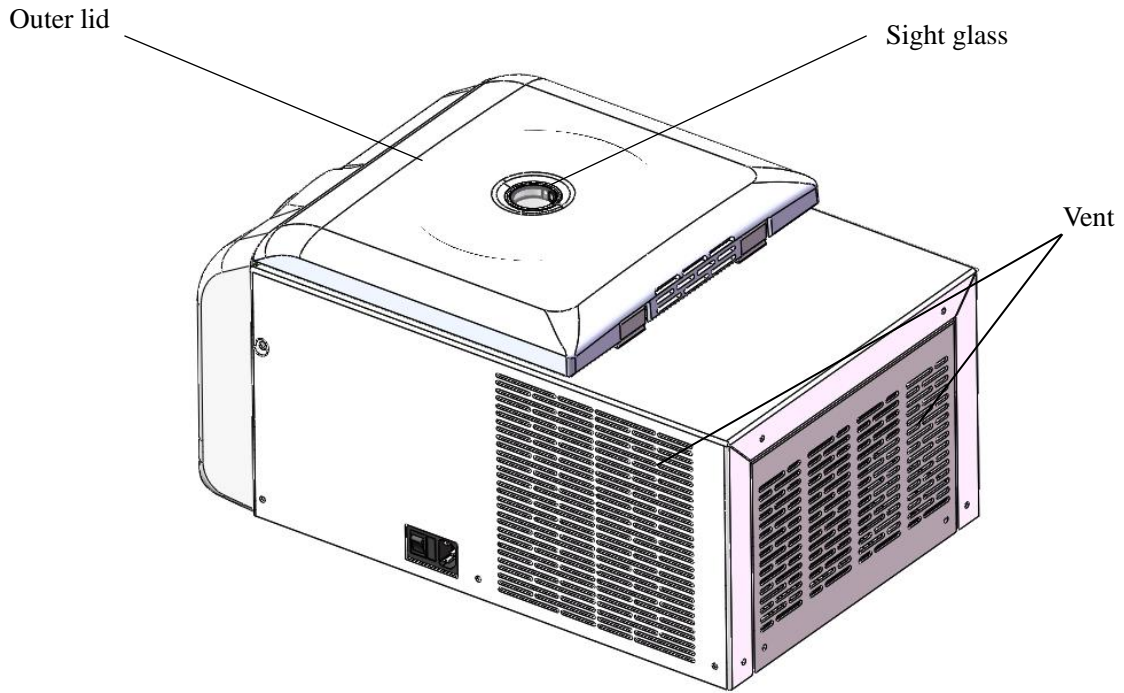


Fig. 5.4 Rear view of centrifuge

## 6. Operating panel

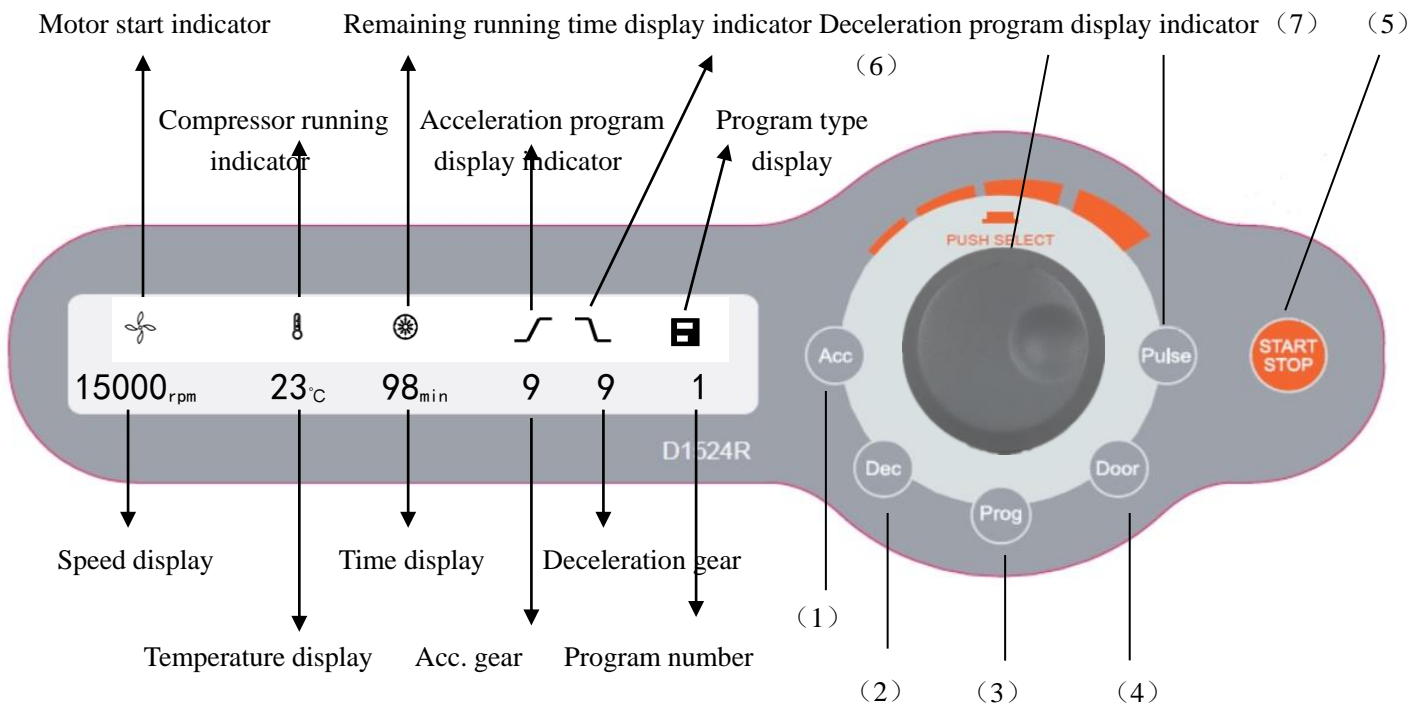









Fig. 6.1 Schematics of operating panel

| No. | Legend  | Name                               | Function  |
|-----|---|------------------------------------|---|
| 1   |    | Acceleration level adjustment+ key | Press this key to increase the speed level by 1; acceleration level 1-9 cycle.  |
| 2   |    | Deceleration level adjustment+ key | Press this key to decrease the speed level by 1; deceleration level 1-9 cycle.  |
| 3   |    | Program key                        | Press this key to switch to the stored program +1, stored program, program 0-9 cycle.   |
| 4   |    | Door lock open key                 | When the speed is zero, press this key to release the door lock. When the speed setting is above zero, the door locks automatically.  |
| 5   |    | Inching key                        | When the outer lid is locked tightly, by pressing and keeping this key, the centrifuge runs up to the set rotation speed. Press and hold this key   |
| 6   |   | Running/stop key                   | When the speed is zero, press this key to start run operation<br>While the centrifuge is operating, press this key to stop its run.   |
| 7   |  | Parameter input key                | Turn this key clockwise to increase the parameter; turn this key counterclockwise to decrease the parameter. Press this key to choose the speed setting, centrifugal force setting, temperature setting and time setting. |

The following table provides comparison between acceleration and deceleration time in 1-9 positions:

(error  $\pm 10\%$ )

| Position | Acc (0—15,000rpm) | Dec (15,000-0rpm) |
|----------|-------------------|-------------------|
| 1        | 75s               | 73s               |
| 2        | 52s               | 44s               |
| 3        | 44s               | 42s               |
| 4        | 35s               | 38s               |
| 5        | 30s               | 36s               |
| 6        | 28s               | 34s               |
| 7        | 26s               | 31s               |
| 8        | 24s               | 28s               |
| 9        | 23s               | 26s               |

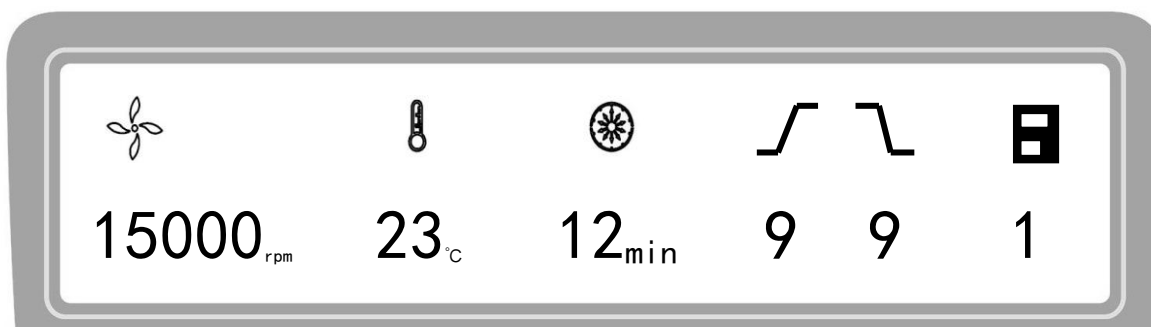





Fig. 6.2 Schematics of main display

The 离心机 main display is shown in Fig. 6-2. At this time, the speed is set at 15,000rpm, indicating the presumed sample temperature of 23°C and the set running time of 12 min.

When the speed icon  rotates, it indicates that the machine is in run mode.

The temperature display icon  indicates three states: when it is lit ON, it indicates the presumed sample temperature; when it is OFF, it indicates the set temperature; when it flashes, it indicates the compressor starts refrigerating to control the temperature of the centrifugal chamber.


The time display icon  divides the entire running time into 10 equal parts, displaying the ratio of elapsed time to the total time.

## 7. Rotor preparation

### 7.1 Prepare the samples to be separated

### 7.2 Place samples into the centrifuge tube

The amount of sample should not exceed the allowed maximum amount set forth in this user manual.

 **Caution:** Adding excessive samples into the centrifuge tube will result in leakage, therefore don't add excessive samples.

### 7.3 Ensure the balanced centrifuge tube

- Although this centrifuge may be used with visually confirmed balance, it is suggested that samples be weighed using a balance to ensure balanced centrifuge tube in order to prolong the service life of centrifuge.
- Although the partial imbalance is allowed, don't run this centrifuge under poor balance conditions.

## 7.4 Check the rotor

Check the rotor for any corrosion or scratch before use

 Caution:

- Avoid using the rotor with scratches or corrosion.
- Never use the rotor of other brands/ specifications on this centrifuge.
- Do not expose the rotor and its accessories to direct sunlight/Ultraviolet.

## 7.5 Insert the centrifuge tubes symmetrically onto the rotor in place without imbalance

 Caution:

- Ensure to tighten the rotor to the main shaft firmly and the lid is secured properly on the rotor. Otherwise, the rotor might fall OFF while the centrifuge is in operation, resulting in centrifuge or rotor damage.
- Tighten the rotor lid and rotor firmly.

## 8. Operation

### 8.1 Normal operation

When the power switch is turned ON, the display screen is lit and the centrifuge shows HELLO page, as shown in Fig. 8-1.

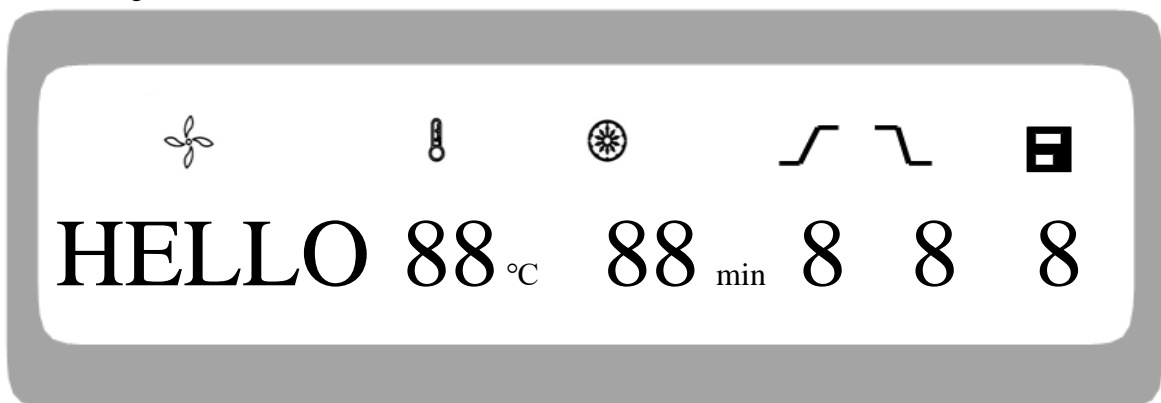


Fig. 8-1. Self-test page of centrifuge

The centrifuge shows the centrifuge model 1524R and program version 1.0, as shown in Fig. 8-2.

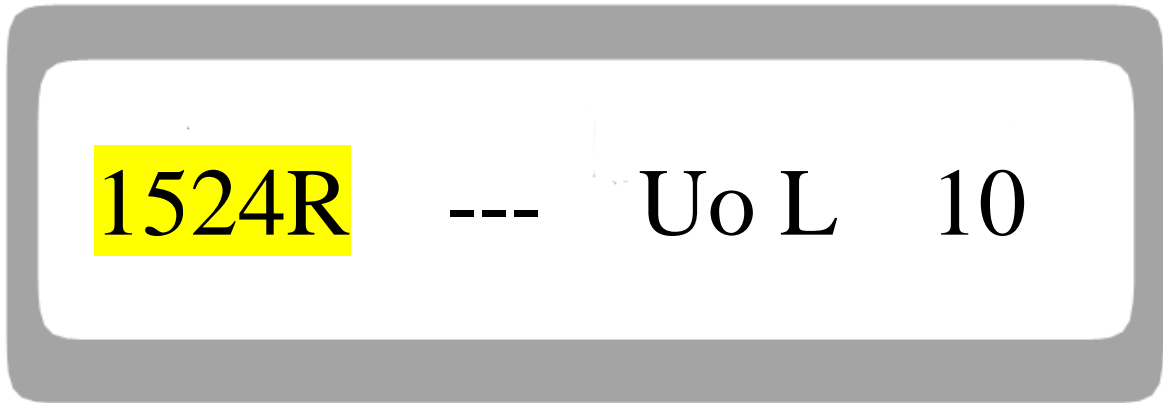


Fig. 8-2 Model and version interface

Then, the centrifuge displays the last operating parameters, as shown in Fig. 8-3.

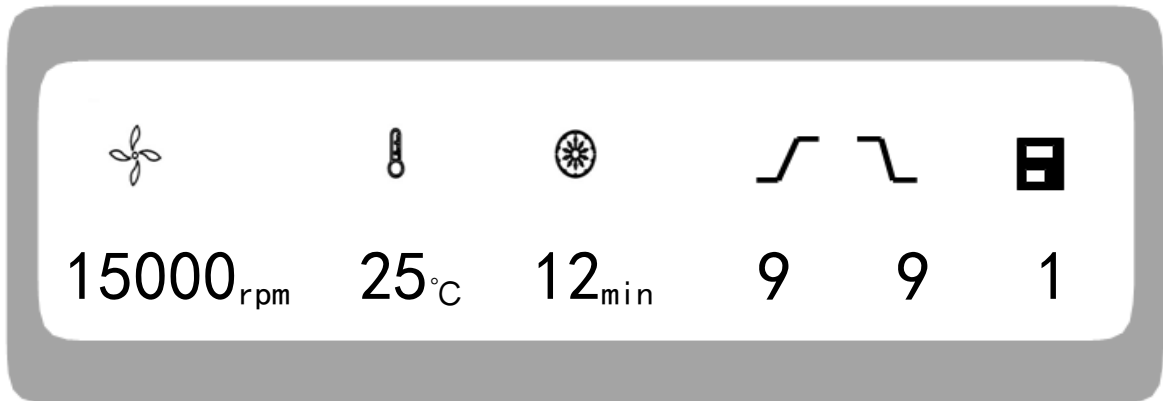


Fig. 8-3. Last operation interface

- Speed set at 15000rpm, time set at 12 min and centrifugal chamber temperature 25°C.
- The outer lid lock is released.

### 8.1.1 Rotor installation and replacement

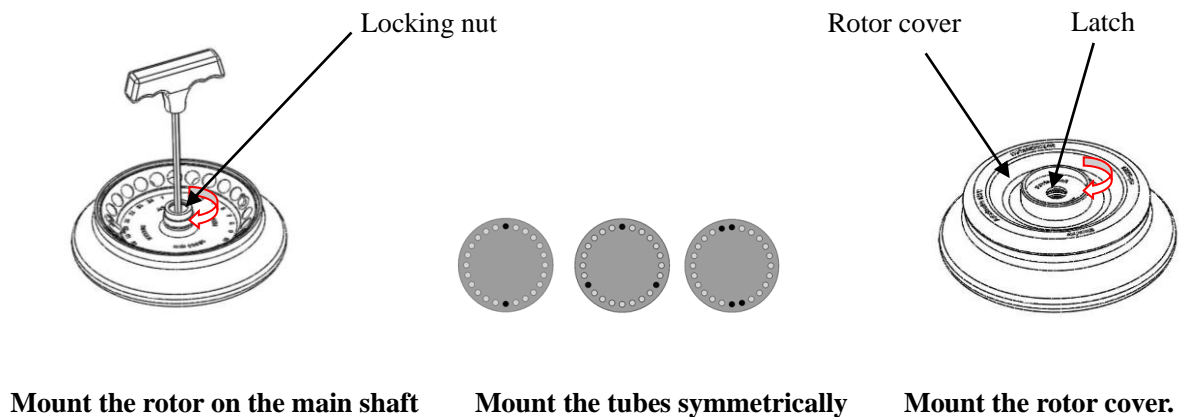




Fig. 8-4. Rotor installation



 Caution

- Place the rotor on the main shaft and ensure full contact between the rotor and the main shaft. Screw up the nut on the rotor tightly using a wrench to connect the rotor with the main shaft firmly, otherwise the rotor might fall OFF, causing damage to the centrifuge.
  - Tighten the rotor and the lid firmly.
- When placing the rotor, ensure the full contact between the rotor and the main shaft.
  - After placing the rotor in place, rotate the rotor gently with hands to check for normal operation of the rotor. Check and adjust the rotor position once again.
  - Rotate the locking nut clockwise using the rotor wrench and tighten the rotor and main shaft firmly.
  - Place the rotor lid and rotate it clockwise to screw the rotor tightly. Close the outer lid and run the centrifuge.
  - The rotor is dismantled in a manner opposite the aforesaid, with the tightening direction being counterclockwise.


### 8.1.2 Set operating parameters


The parameter key  is used to input and modify the operating parameters. Press the parameter key  gently so that the centrifuge enters into adjustment mode. Press and select the parameter to adjust its value to desired setting. Adjust the values only when the required parameter icon flashes. The minimum rotation speed is 100rpm, the minimum step of centrifugal force is 10g and the minimum step time is 1second if within 1 minute and if not it is 1 minute.

(1) Set the rotation speed




- Press the parameter key  to choose the rotation speed parameter value in rpm.
- Set the speed value to desired setting when it enters into the adjustment mode and flashes.
- The minimum set speed is 200rpm, and the minimum step is 100rpm.
- The parameter increase or decrease is cyclic. Turn the parameter key  clockwise or anticlockwise to increase or decrease the adjusting parameter values.

(2) Set the run time

- Press the parameter key  to select the time parameter and wait until its value flashes.
- Set the time parameter value to desired setting within the range of 10s-99min.

- Turn the parameter key  to input the set time within a range of 10 s-99min.
- When the time enters HD, it indicates that the instrument is in continuous run mode.

(3) Set the operating temperature



- Press the parameter key  to set the temperature and wait until its value flashes.
- Turn the parameter key  to adjust the temperature within a range of -20°C ~ 40°C.
- When the temperature icon  flashes, it means the refrigerating system is working, otherwise the refrigerating system is not working.

### 8.1.3 Start Run

(1) Press the  key to start operation.

- The rotor starts rotating.
- Timer starts to operate after the instrument reaches the set rotation speed only.
- The screen displays the actual time left to complete the running operation.


(2) Inquire and change the operating parameters

- The operating parameters can be modified after the centrifuge operates at a steady speed.
- Press the parameter key  to return to ready mode interface with set operating parameters.
- Press the parameter key  gently and required parameter to modify the set values.
- After 7 seconds of no activity, the centrifuge will return to the normal operating state with the new operating parameters.
- In case if there are any changes in the operation time setting, the elapsed time will not be zeroed.

(3) Error message

- The centrifuge will automatically stop if any failure occurs in the run mode, with the failure code indicated on the time display window. By looking up table 10-1, the cause of failure can be found and appropriate action should be taken.

### 8.1.4 Stop running

(1) When the set run time is completed the centrifuge stops its run operation automatically or it can be stopped by pressing the .

(2) The outer lid lock is opened.

- The centrifuge beeps when the rotor ceases to rotate, indicating that the operation is over.
- After the end of operation, the outer lid lock on the centrifuge remains closed and the outer lid

lock should be opened by pressing  key. Open the outer lid to remove the samples and rotor.



- The centrifuge will automatically retrieve the last set parameters as soon as it is switched ON.

## 8.2 RCF operation

Turn power switch ON and Set the RCF (relative centrifugal force).

### Caution

- The relative centrifugal force set should not exceed the maximum relative centrifugal force allowed by the centrifuge tube and its adaptor.
- The relative centrifugal acceleration is calculated based on the maximum centrifugal radius and operating speed of the rotor. (See Table 11.1 for the maximum centrifugal radius).

- Press the parameter key  to choose the rotation speed unit as  $xg$ . If the RCF value flashes it indicates that the RCF value can be set as it is in adjustment mode.
- Turn the parameter key  to adjust the relative centrifugal acceleration, in increments of  $100xg$ .
- The instrument will automatically enter into ready mode from adjustment mode, if it is left inoperated for more than 7seconds.

Set the operating conditions

See Section 8.1 for operation of other parts.


## 8.3 Transient operation

This function is generally used to remove the samples attached to the inner wall of the centrifuge tube.

Reminder: this key works only when the rotor is inactive and the outer lid is locked firmly.

- (1) Turn power switch ON, fix the rotor on the main shaft and secure tightly with the rotor lid.
- (2) Close the outer lid.
- (3) The centrifuge enters into ready mode and displays the last operated parameter values.



(4) Press and hold the  key down to increase and set the rotation speed.

(5) Release the  key to start decelerating and shutdown.

## 9. Maintenance and servicing

### 9.1 Cleaning

 Caution

- Disconnect the power supply before cleaning the centrifuge.

#### (1) Centrifuge

- The color of housing might change and the label thereon might fall OFF if the centrifuge is exposed to ultraviolet for a prolonged period of time and hence cover the centrifuge with cloth to avoid exposure to light.
- Clean the centrifuge using a cloth/ sponge soaked with neutral cleansing agent in case if it is dirty after use
- The centrifuge can be sterilized using cloth soaked with 70% alcohol solvent.

#### (2) Centrifugal chamber

 Caution

- Never pour water or other solvents directly into the centrifugal chamber as they might enter into the drive unit and cause corrosion or damage to the bearings.

#### (3) Drive shaft

- It is suggested that the drive shaft be subjected to periodical maintenance by wiping it using soft cloth and applying a thin layer of silicone grease on it.

#### (4) Outer Lid

- Clean or sterilize the outer lid in the same manner as mentioned under subsection (1) centrifuge.

#### (5) Rotor

- If the rotor is left unused for a prolonged period of time, remove the rotor and its lid from the centrifugal chamber, and place the rotor upside down to dry the rotor hole and prevent corrosion.

- Clean the rotor using mild detergent with PH value of 6-8 and immediately dry the aluminum portion after cleaning by putting it into a warm-air dryer at a temperature not exceeding 50°C.

#### (6) Drainage

- 离心机 is equipped with drainage slots, which need to be drained when a substantial amount of water is accumulated in those slots.

## 9.2 Sterilization

If the centrifuge tubes contain infectious materials leaks, you must immediately sterilize the rotor and/or centrifuge.

- Infectious substances might enter the centrifuge if the centrifuge tube breaks or is overfilled.
- Danger of infection might occur through contact. Personnel shall be provided with suitable protective measures.
- Be aware of the allowed filling volume and loading limit of the centrifuge tubes.
- When contamination occurs, the operator must ensure that others are not endangered.
- The contaminated portion must be sterilized immediately.
- Take further protective measures if necessary.

### 9.2.1 Sterilize using common neutral sanitizers

The rotor and the centrifugal chamber must be treated with common neutral sanitizers. The most suitable way is to spray the spray-type sanitizer evenly over the rotor and accessories.

Sterilize the rotor and accessories as follows:

- (1) Disconnect the power supply.
- (2) Unscrew the rotor from the rotating shaft.
- (3) Remove the rotor and pull it up vertically from the rotating shaft.
- (4) Take out the centrifuge tubes and adaptors and sterilize or dispose of them when necessary.
- (5) Treat the rotor and rotor lid (soaking or spraying) according to the sanitizer instructions.
- (6) Drain the sanitizer by turning the rotor upside down and then flush it with water.
- (7) Remove the residual sanitizer in an effective way.
- (8) The aluminum rotor must then be treated with anti-corrosion oil.
- (9) All sealing rings must be re-lubricated.

### 9.2.1 Sterilize using bleaching alkali liquor

 Caution

Bleaching alkali liquor contains highly concentrated erosive hypochlorite, therefore it may not be used for aluminum rotor.

The following are the protective measures for plastic rotor:

- (1) Avoid high temperature and ensure the temperature of bleaching solution and rotor is not more than 25°C.
- (2) Do not bleach longer than necessary!
- (3) After sterilization, flush the rotor thoroughly with distilled water and dry it.
- (4) All sealing rings must be re-lubricated.

### 9.3 Wearing parts

Please replace the below wearing parts in time according to the suggestions in the following table or whenever it is necessary.

| No. | Wearing part                        | Replacement conditions |
|-----|-------------------------------------|------------------------|
| 1   | Rubber seat of temperature sensor   | Crack                  |
| 2   | Sealing ring of centrifugal chamber |                        |

### 9.4 Replacement of rotor seal

#### 9.4.1 Introduction

Three rubber rings are used in order to achieve biological sealing, as shown in the following figure. After multiple autoclaving runs, the rubber rings might age or fall off and need to be replaced or remounted.

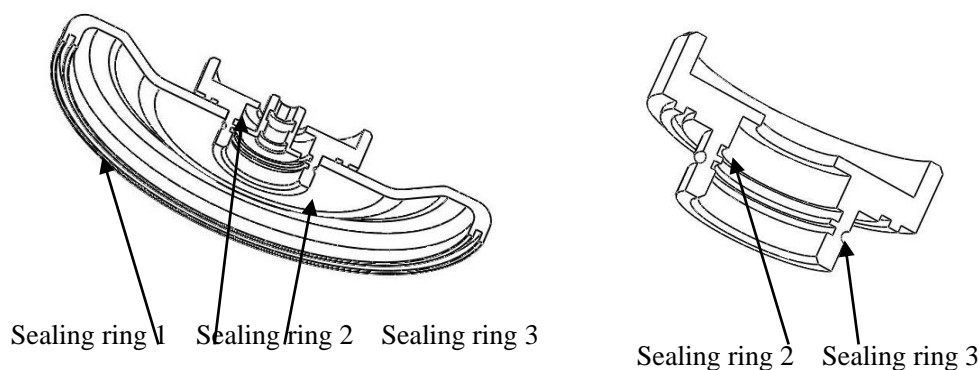


Fig. 9-1 Rotor sealing ring

#### 9.4.2 How to replace

- (1) Clean the rubber ring groove using neutral cleaning solution before air drying it.
- (2) Apply glue evenly inside the rubber ring groove before placing the rubber ring into its groove and evenly pressing it to make the rubber ring contact with the groove bottom and firmly adhered.

(3) Leave it for 20 min and wait for the glue to completely solidify.

## 9.5 Routine check


(1) Ensure that the centrifuge is placed on a solid, level and flat table top surface and ensure that 3/4<sup>th</sup> of it is on the table surface.

(2) Ensure that the machine is reliably grounded: using a multi-meter, check whether the grounding pin in the power cable plug and the centrifugal chamber and motor shaft are short-circuited. In case of short-circuit, it indicates reliable grounding. In case of disconnection, identify the causes and eliminate the failure before the centrifuge operation.

## 10. Common failures and solutions

### 10.1 List of common failures

This centrifuge is capable of self diagnosis. When the centrifuge fails, the time display window will indicate the failure code, leading to the immediate identification of possible failure causes.

| Phenomenon                               |   | Possible cause  | Solution   |
|--|---|---|--|
| No display after power ON                |   | <ul style="list-style-type: none"> <li>· No power supply to the power socket.</li> <li>· Fuse burned out.</li> </ul>  | <ul style="list-style-type: none"> <li>· Eliminate the failure and reconnect the power supply.</li> <li>· Replace the fuse.</li> </ul> |
| Alarm code indicated on the time display | E-02<br>Outer lid failure               | <ul style="list-style-type: none"> <li>· The door opens while in operation.</li> <li>·  is pressed when the door is opened.</li> </ul> | <ul style="list-style-type: none"> <li>· Immediately close the cover.</li> <li>· Close the outer lid before operation.</li> </ul>      |
|  | E-04<br>Temperature abnormality         | <ul style="list-style-type: none"> <li>· The housing vent might got blocked.</li> <li>· The cooling fan might got damaged.</li> </ul>   | <ul style="list-style-type: none"> <li>· Unblock the vent.</li> <li>· Replace the cooling fan.</li> </ul>                              |
|  | E-06<br>Abnormal rotation speed setting | <ul style="list-style-type: none"> <li>· Change the set rotation speed value.</li> </ul>  | <ul style="list-style-type: none"> <li>· Change the set rotation speed value.</li> </ul>   |

|  |         |                            |                                      |
|--|---------|----------------------------|--------------------------------------|
|  | E-10~86 | ·Check the service manual. | ·Contact the service representative. |
|--|---------|----------------------------|--------------------------------------|


Table 10-1 Common failures and solutions

- Failure code E-1~E-6 is related to erroneous operation. The centrifuge may continue running after elimination of the failure.

## 10.2 How to open the outer lid


### 10.2.1 When turned ON

Reminder: When the centrifuge is switch power ON, open the outer lid only when the rotor is not running.

- (1) When the centrifuge is turned ON, the outer lid opens automatically.
- (2) At the end of centrifuge operation, the outer lid remains locked.
- (3) When the rotor stops, press  key and unlock the outer lid and one can observe that the lid can be opened now.

### 10.2.2 When power is OFF

When the outer lid cannot be opened in case of unexpected power failure, the outer lid may be opened as follows:

- (1) Check whether the rotor is in run mode.
  - Listen carefully to ensure that there is no rotation sound.
- (2) Insert a wrench into the housing hole to open the outer lid lock.
  - The hole is located above the front end of the right side panel.
  - Insert the wrench into the right hole to push forward and rotate  clockwise to open the outer lid lock and then the lid.

## 10.3 Replace the fuse

- (1) The 离心机 centrifuges fuse is 250V, 10A, fast-acting, size:  $\Phi 5 \times 20$ , one fuse.
- (2) The centrifuges 250V, 10A fuse is on the power socket. It may be replaced by taking the fuse box out of the power socket; 250V, 3.15A fuse is on the circuit board, It may be replaced by taking the fuse box out of the circuit board.

## 11. Introduction to rotor and centrifuge tube

**⚠ Caution**

- Carefully read the user manual and correctly install and use the rotor correctly.
- Don't exceed the maximum allowed speed of the rotor, test tube and adaptor. The maximum allowed speed by certain adaptors is lower than the maximum speed of the rotor and check before operation.

## 11.1 Rotor description

### 11.1.1 Rotor structure

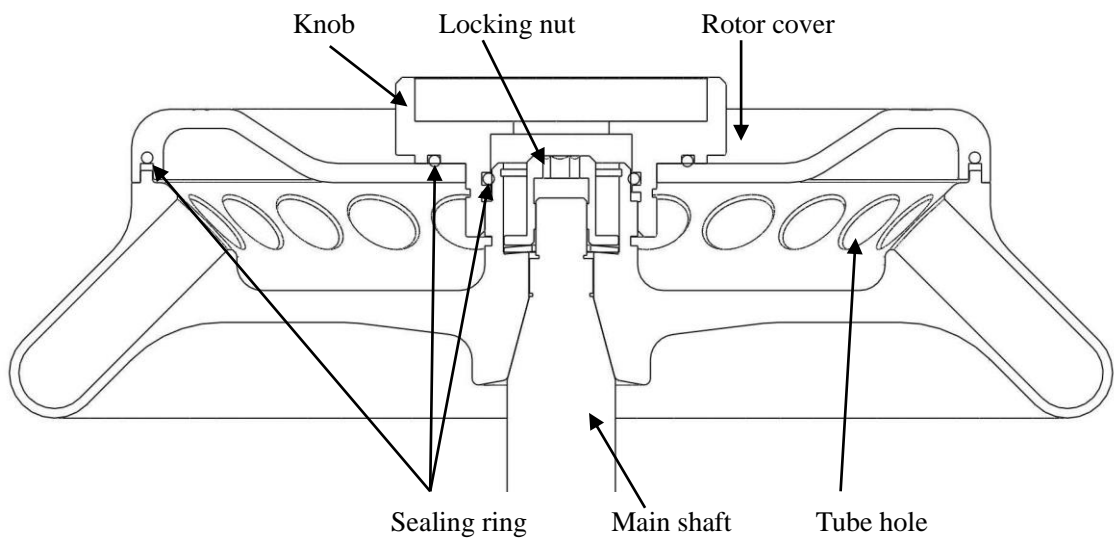


Fig. 11-1 Rotor structure

### 11.1.2 Rotor and adaptor

All rotors are bio-sealed such that centrifuge tube is sealed inside the rotor and when the rotor lid and rotor are secured tightly to ensure no sample leakage during the centrifuge operation. While the rotor lid is not used, the rotor will be incapable of bio-sealing. The rotors and adaptors which are suitable for use with this centrifuge are listed as follows:

Table 11.1 List of rotors and adaptors

| Rotor number | Rotor name | Centrifuge tube         | Adaptor | Maximum speed (rpm) | Maximum centrifugal radius $r_{max}$ (cm) | Maximum relative centrifugal force RCF ( $\times g$ ) |
|--------------|------------|-------------------------|---------|---------------------|---|---|
| 1            | AS24-2     | 2/1.5mL centrifuge tube |         | 15000               | 8.5                                       | 21380 (program correspondence)                        |
|              |            | 0.2mL PCR tube          | A02P2   | 15000               | 6.9                                       | 17350   |
|              |            | 0.5mL micro-tube        | A05P2   | 15000               | 7.6                                       | 19100   |

|   |          |                  |        |       |         |                                |
|---|----------|------------------|--------|-------|---------|--------------------------------|
| 2 | AS36-05  | 0.5mL micro-tube |        | 15000 | 8.5     | 21380 (program correspondence) |
|   |          | 0.2mL PCR tube   | A02P05 | 15000 | 7.6     | 19100                          |
| 3 | AS4-PCR8 | PCR8 tube bank   |        | 15000 | 6.5/7.2 | 16350/18100                    |
| 4 | AS12-V5  | 5mL conical tube |        | 15000 | 8.5     | 21380                          |
| 5 | AS18-5   | 5mL culture tube |        | 15000 | 8.5     | 21380                          |

### 11.1.3 Precautions

(1) The density of sample that the centrifuge rotor can separate is less than 1.2g/ml. If the density of sample to be separated exceeds 1.2g/ml, please calculate the allowed rotation speed using the following formula:

$$\text{Allowed rotation speed (rpm)} = \text{maximum rotation speed} \times (1.2 \text{ (g/ml)} / \text{sample density (g/ml)})^{1/2}$$

(2) If the rotor is left unused for long time, please remove the rotor from the centrifugal chamber, remove the rotor lid and place the rotor upside down to dry the rotor hole and prevent corrosion.

(3) If any sample leaks into the rotor hole, flush the rotor hole with clean water and apply a thin layer of silicone grease on the rotor surface after it dries up.

(4) It is suggested that the rotor to be cleaned once in every three months to ensure cleanliness of the tube hole and main shaft hole before applying a thin layer of silicone grease.

### 11.1.4 Autoclaving

This rotor is made of high-strength aluminum alloy and may be autoclaved at 121°C ( 1.0kg/cm<sup>2</sup>) for 20 min.

### 11.1.5 Bio-sealing

The rotor of this device employs bio-sealed structure and uses three high-temperature-resistant rubber rings for sealing. After multiple autoclaving runs, the rubber rings might age or *fall off* and need to be replaced or remounted using the method detailed in 9.4.

## 11.2 Centrifuge tube

### 11.2.1 Please clean and sterilize the centrifuge tube by reference to the following table.

Table 11.2 Conditions for cleaning and sterilization of centrifuge tube

O: Yes    X: No

| Condition |                | Material                               | PA | PC | PP |
|-----------|----------------|--|----|----|----|
| Cleaning  | Fluid cleaning | Acidic cleaning agent (pH5 or lower)   | X  | X  | X  |
|           |                | Acidic cleaning agent (above pH5)      | O  | O  | O  |
|           |                | Alkaline cleaning agent (above pH9)    | O  | X  | O  |
|           |                | Alkaline cleaning agent (pH9 or lower) | O  | O  | O  |
|           |                | Neutral cleaning agent (pH7)           | O  | O  | O  |
|           |                | 70°C hot water                         | O  | O  | O  |



|               |                           |                                      |   |   |   |
|---------------|---------------------------|--------------------------------------|---|---|---|
|               | Ultrasonic cleaning       | Neutral cleaning agent (pH7)         | O | O | O |
| Sterilization | Autoclaving               | 115°C (0.7kg/cm <sup>2</sup> ) 30min | O | O | O |
|               |                           | 121°C (1.0kg/cm <sup>2</sup> ) 20min | X | O | O |
|               |                           | 126°C (1.4kg/cm <sup>2</sup> ) 15min | X | X | X |
|               | Boiling sterilization     | 15-30min                             | O | O | O |
|               | Ultraviolet sterilization | 200-300nm                            | X | X | X |
|               | Gas sterilization         | Ethylene oxide                       | O | X | O |
| Formaldehyde  |                           | O                                    | O | O |   |

PA: polyallomer PC: polycarbonate PP: polypropylene

### 11.2.2 PC centrifuge tube cleaning

PC material has relatively low chemical stability to alkaline solvent, therefore use of cleaning agent with pH value of over 9 should be avoided. Some neutral cleaning agents still have pH value of over 9 after being diluted as recommended by the vendor, therefore use of cleaning agent with pH value of 7-9 only is recommended.

### 11.2.3 Autoclaving of PA, PC and PP centrifuge tube

PA begins softening at the temperature of 120°C, while PC and PP begin softening at 130°C. Generally, PA may be sterilized for 30 min at 115°C (0.7 kg/cm<sup>2</sup>), while PC and PP may be sterilized for 20 min at 121°C (1.0 kg/cm<sup>2</sup>). Too high temperature would result in deformation of centrifuge tube.

When autoclave is used, take the following steps:

- (1) Place the centrifuge tube upright with opening facing upward. If the centrifuge tube is placed in an inclined or horizontal manner, it will deform due to the effect of gravity.
- (2) Remove the threaded cover and inner cover to prevent deformation or crack of the centrifuge tube.
- (3) Take the centrifuge tube only when the autoclave cools down to the room temperature.

### 11.2.4 Service life of centrifuge tube

The service life of plastic centrifuge tube depends upon the nature of sample, rotor speed and centrifugation temperature. When the plastic centrifuge tube is used for centrifugation of conventional neutral samples (pH5-pH9), its estimated service life at the maximum rotation speed is as follows:

High-quality centrifuge tube (PA, PC, PP): 30-50 times.

Conventional centrifuge tube: about 10 times (frequency of use may be increased in case of low-speed application use)

The service life of centrifuge tube is also related to the cleaning and sterilization conditions.

**Note: Never use any centrifuge tube with cracks.**

## 12. RCF calculation

Relative centrifugal force (RCF) can be calculated using the following formula:

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

r-rotation radius, unit: cm; n-rotation speed, unit- rpm

## 13. Ordering information

| Order code         | Model          | Description  |
|--------------------|----------------|--|
| 9013111121         | The centrifuge | Tabletop high-speed refrigerated micro-centrifuge, national standard-compliant plug, 220V, 50Hz  |
| <b>Accessories</b> |                |  |
| 19400002           | AS24-2         | Rotor package, suitable for the centrifuge, maximum speed 15,000 rpm, maximum capacity 2 ml*24   |
| 19400003           | AS36-05        | Rotor package, suitable for the centrifuge, maximum speed 15,000 rpm, maximum capacity 0.5 ml*36 |
| 19400004           | AS4-PCR8       | Rotor package, suitable for the centrifuge, maximum speed 15,000 rpm, maximum capacity 4-PCR8    |
| 19400032           | AS12-V5        | Rotor package, suitable for the centrifuge, maximum speed 15,000 rpm, maximum capacity 5ml*12    |
| 19400012           | AS18-5         | Rotor package, suitable for the centrifuge, maximum speed 15,000 rpm, maximum capacity 5 ml*18   |
| 19500001           | A02P2          | 0.2 ml rotor adaptor, suitable for A12-2/AS24-2 rotor, 24 pcs/pk                                 |
| 19500002           | A05P2          | 0.5 ml rotor adaptor, suitable for A12-2/AS24-2 rotor, 24 pcs/pk                                 |
| 19500003           | A02P05         | 0.2 ml rotor adaptor, suitable for AS36-05 rotor, 36 pcs/pk                                      |

## **14. Warranty**

### **14.1 Unit warranty**

The entire unit will have two-year warranty period commencing from delivery date under the conditions of normal maintenance.

### **14.2 Rotor warranty**

The rotor will have 5-year warranty period from the date of delivery. Don't use any rotor damaged due to corrosion or fatigue. The damage to the entire unit or rotor due to any of the following reasons is outside the scope of warranty:

- (1) Damage due to improper installation;
- (2) Damage due to brutal or improper operation;
- (3) Damage due to relocation or transport after completion of installation;
- (4) Damage due to dismantling or modification by any unauthorized entity or individual;
- (5) Damage due to use any parts not supplied by our company, such as rotor and adaptor;
- (6) Damage due to natural disasters, including fire and earthquake;
- (7) Wearing parts and parts with warranty period.

## **15. After-sales services**

To ensure safe and efficient operation of the centrifuge, periodical maintenance is required. If the centrifuge fails, don't attempt to repair it. Please contact the service center.

# USER MANUAL

台式高速冷冻型微量离心机

使用说明书




在操作使用离心机之前，请认真阅读本使用说明书，充分理解与安全有关的注意事项。


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# 安全警示

符号  是国际通用的安全标志，请仔细阅读并充分理解下面的安全细则：

- 遵守说明书的操作要求，确保正确、安全地使用该离心机。
- 仔细阅读所有安全信息和安全提示。
- 安全信息作一下标记，安全符号  分别同“警告”和“告诫”组合，提示用户潜在的危  
险。这两种组合以及提示符号的具体定义如下：



**警告：**人身危险。

警告潜在的危  
险，如不严格遵守说明书的要求，可能会导致人身伤亡。



**告诫：**离心机损坏危险。

警告潜在的离心机损坏危险，如不严格遵守说明书的要求，可能会导致离心机损坏。

**提示：**通常需要注意的事项。

- 不要以本说明书没有提及的方式使用该离心机，若遇到任何问题请与厂家制造商/供应商联系。
- 本说明书对潜在的危  
险已经作了比较完整的提示，然而，用户对不可预测的事情还须有  
必要警惕，小心使用该离心机。



**警告：**

- 该离心机是非防爆型，不要用于易燃、易爆样品的分离。
- 不要将该离心机安装在易燃气体、易燃化学物质附近。
- 该离心机 30cm 范围内不要放置危险品。
- 不要离心分离有毒或放射性物质或没有适当安全措施病原微生物。如果离心分离的是微生物样品属于二级危害（根据世界卫生组织的“实验生化安全手册”）必须使用生物密封装置
- 如果离心机、转子及其它附件受到污染，请严格按照去污程序清洗消毒。（见“消毒”）

- 如果需要我们的现场帮助，需事先对该离心机进行消毒、去污，并告知服务代表所涉及的特殊物质详情。
- 不要用湿手接触电源线和电源开关，以防电击。
- 为安全起见，当离心机运行时，人员与离心机保持 30 厘米距离。
- 当转子运行时不要打开上盖。
- 除本公司的维修人员外，禁止非授权单位或个人维修、拆卸该离心机。

### 告诫

- 确保该离心机置于坚实而平整的水平桌面上。
- 离心机运行前要确保离心机水平。
- 打开上盖时要确保上盖与机壳角度大于 90 度。
- 当关上盖时，不要将手放在上盖和机壳之间。
- 当离心机运行时不要移动离心机，也不要依靠离心机。
- 当离心机运行时，不要打开上盖。
- 不要在上盖打开的状态下运行离心机。
- 当离心腔内有液体时，请及时用干布擦干，以避免污染样品。
- 在运行离心机前要保证离心腔清洁，务必取走离心腔中的异物，如离心管碎片等。
- 对于转子的提示：
  - (6) 在使用转子前检查转子表面是否有腐蚀或损坏，若有此类问题，则停止使用。
  - (7) 离心机设定转速不能超过转子组件及附件（转子、适配器）中所允许的最大转速，务必使离心机运行在最大允许转速以下。
  - (8) 不要超出所允许的不平衡量。
  - (9) 所使用的离心管应在它们的允许容量以内。
  - (10) 如果转子有盖子，运行前确保将盖子锁紧。
  - (11) 只使用原装配件。
- 在运行过程中出现奇怪噪音等异常现象，请马上停机，与服务中心联系，并告知所显示的故障码。
- 地震有可能对离心机造成损坏，如果出现不正常情况，请与服务中心联系。



## 1. 性能指标

|           |   |
|-----------|---|
| 最高转速      | 15000rpm(200-15000rpm)步长: 100rpm                        |
| 最大相对离心加速度 | 21380×g, 步长: 10×g                                       |
| 容量        | 1.5/2ml×24; 0.5ml×36; PCR8 排管×4; 5ml×12; 5ml×18;        |
| 温度设定范围    | 台式高速冷冻型微量离心机: -20℃到 40℃                                 |
| 定时        | 30s-99 分; HOLD (连续运行)                                   |
| 驱动电机      | 直流无刷电机  |
| 安全性能      | 双门锁、超速、过温、状态诊断系统  |
| 功率        | 单相, 200-240V, 50Hz, 500W                                |
| 尺寸 (毫米)   | (宽) 332× (深) 553× (高) 283                               |
| 重量        | 30kg  |
| 升降速时间     | 25s ↑ 25s ↓   |
| 噪音        | ≤56dB   |
| 其他功能      | 转速/相对离心力转换功能、点动运行功能、运行进程显示、声音提示功能; 9 档升速; 9 档降速; 存储程序功能 |

## 2. 符合标准

离心机结构符合以下安全标准:

IEC 61010-1:2010, AMD1:2016/EN 61010-1:2010, UL 61010-1:2012 R4.16 and CAN/CSA-C22.2 NO. 61010-1-12+ GI1+GI2

CB Scheme

N/A

EN 61010-2-020

离心机结构符合以下电磁兼容标准:

EN 61326-1

符合以下欧盟标准:

EMC 标准: 2014/30/EU

## 3. 环境条件

### 3.1 基本运行条件

(1) 电源: 单相, 220-240V, 50Hz, 500W

(2) 环境温度: 2℃~40℃。

- (3) 相对湿度：≤80%。
- (4) 周围无影响性能的振动和气流存在。
- (5) 周围空气中无导电尘埃、爆炸性气体和腐蚀性气体存在。

### 3.2 运输和贮存条件

- (1) 环境温度范围：-40°C-55°C。
- (2) 相对湿度范围：≤93%。
- (3) 运输离心机必须直立，使用特制的箱子和器械适当地保护它。
- (4) 只能从底盘抬起离心机。
- (5) 在运输期间注意离心机的重量。（见“性能指标”）
- (6) 带有冷却装置的离心机，为了让压缩机中的冷冻剂稳定，离心机在搬到新位置后必须先放置大概 1 小时。

## 4. 安装

用户必须严格遵守本章的安装说明，切记！在移动离心机前必须取下转子。

### 警告

- 不正确的电源连接会损坏离心机。
- 在连接电源前请检查供电电源是否满足要求。

### 4.1 安装位置

- (1) 该离心机必须安装在坚实、平整和水平的台面上，且保证离心机四个脚与台面接触。  
不要将离心机安装在滑动台面上，否则容易引起较大振动。小心地放置离心机避免损伤。
- (2) 理想环境温度为 20°C±5°C，环境温度不宜超过 30°C，避免阳光直接照射该离心机。
- (3) 确保离心机两侧 30cm 间隙，离心机后侧 30cm 间隙，以确保离心机的制冷效果。
- (4) 离心机附近不能有热源或水源泄漏，否则容易导致样品温度升高或离心机故障。

### 4.2 电源线与地线的连接

#### 警告

- 不要用湿手接触电源线，以防止电击。
- 该离心机必须良好地接地。

- (1) 该离心机使用三芯电源线，插头为三芯扁平插头，可将插头直接连接到电源插板上。
- (2) 电源插板额定电流应为 10A 以上，并且要满足地方电气安全要求，保证具有良好的保护地端。

## 5. 结构

### 离心机

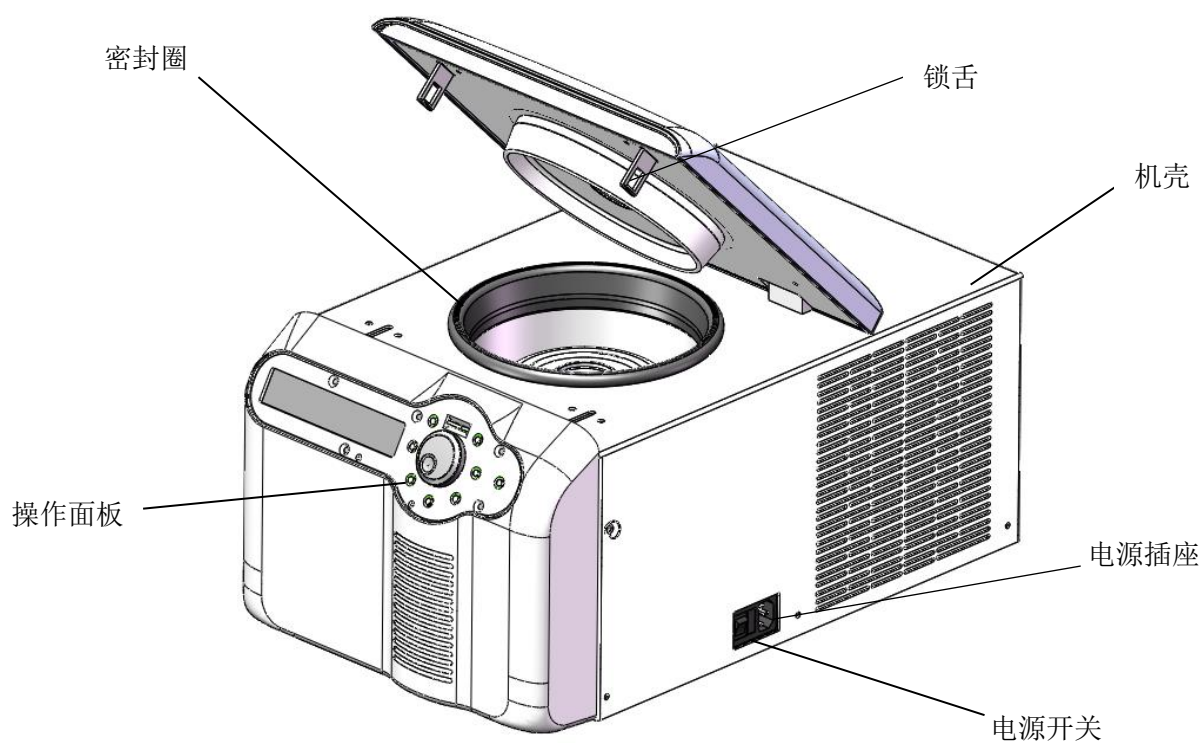


图 5.3 离心机正面图

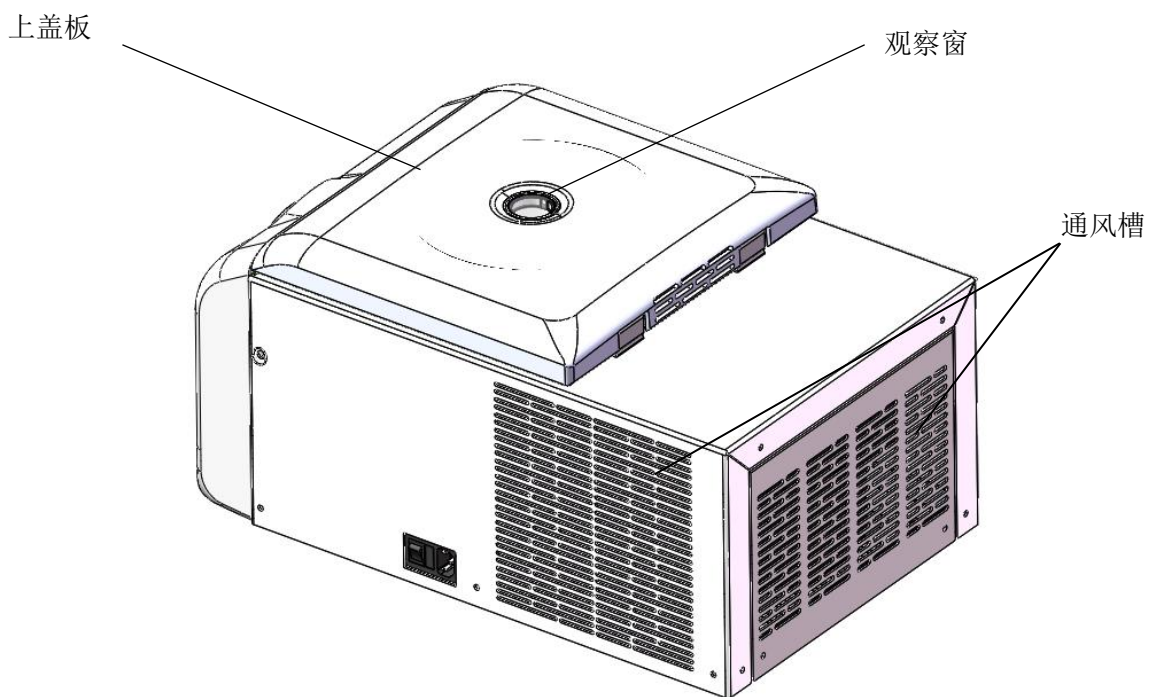


图 5.4 离心机背面图

## 6. 操作面板

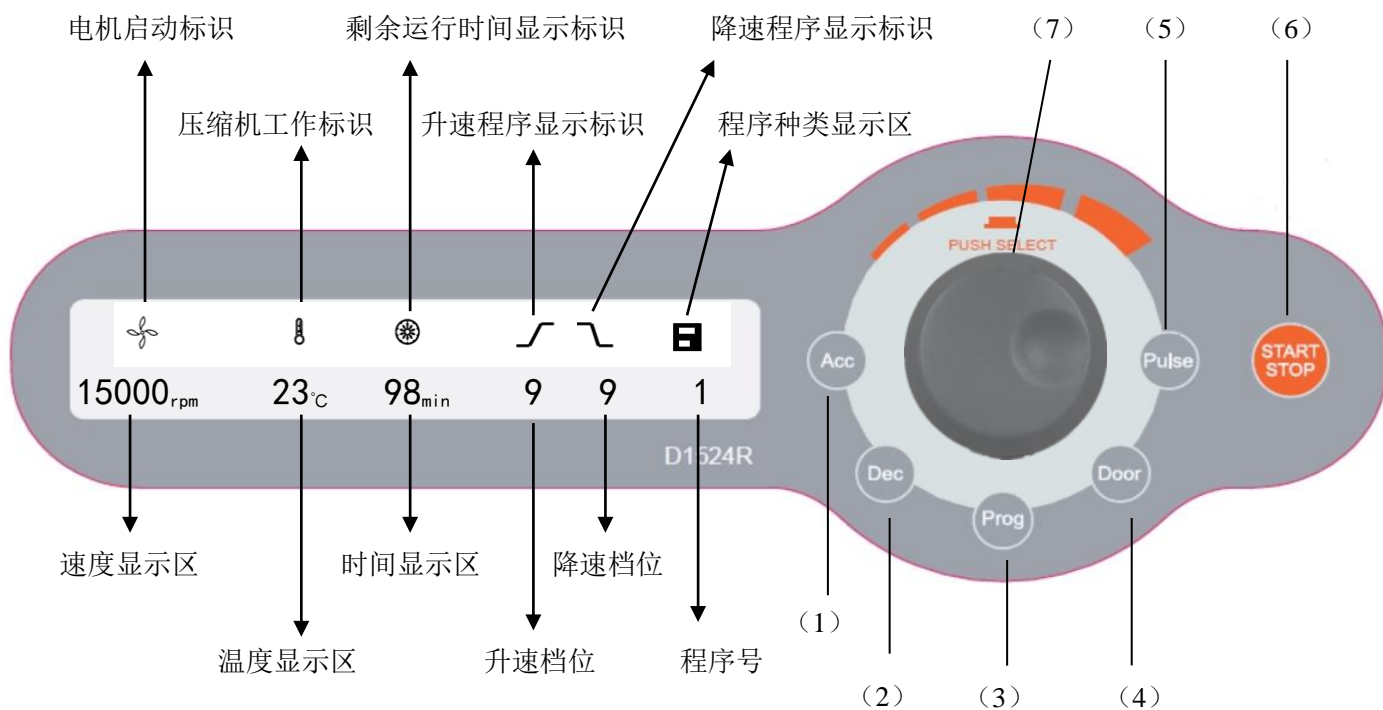




图 6-1 操作面板示意图

| 序号 | 图示   | 名称       | 功能   |
|----|--|----------|--|
| 1  |   | 升速等级调节+键 | 升速等级调节+键，按下该键，升速等级+1；升速等级 1-9 循环。                            |
| 2  |   | 降速等级调节+键 | 降速等级调节+键，按下该键，降速等级+1；降速等级 1-9 循环。                            |
| 3  |   | 程序键      | 按下该键，切换到已保存的程序+1,已保存的程序，程序 0-9 循环。                           |
| 4  |   | 门锁开按键    | 当转速为零时，按下该键，门锁打开。转速不为零时，按该键无效。                               |
| 5  |   | 点动键      | 当上盖锁紧时，按下此键并保持住，则离心机升速运行，松开该键，则离心机停车。                        |
| 6  |   | 运行/停车键   | 当转速为零时，按下该键，离心机开始运行。<br>离心机运行过程中，按下该键，离心机开始停车。               |
| 7  |  | 参数输入键    | 顺时针旋转，参数增加。逆时针旋转，参数减小。<br>按下该键，可以选择转速设置、离心力设置、温度设置、时间设置循环切换。 |

下表为 1-9 档位升降速时间对比表：（误差±10%）

| 档位 | Acc (0—15000rpm) | Dec (15000—0rpm) |
|----|------------------|------------------|
| 1  | 75s              | 73s              |
| 2  | 52s              | 44s              |
| 3  | 44s              | 42s              |
| 4  | 35s              | 38s              |
| 5  | 30s              | 36s              |
| 6  | 28s              | 34s              |
| 7  | 26s              | 31s              |
| 8  | 24s              | 28s              |
| 9  | 23s              | 26s              |

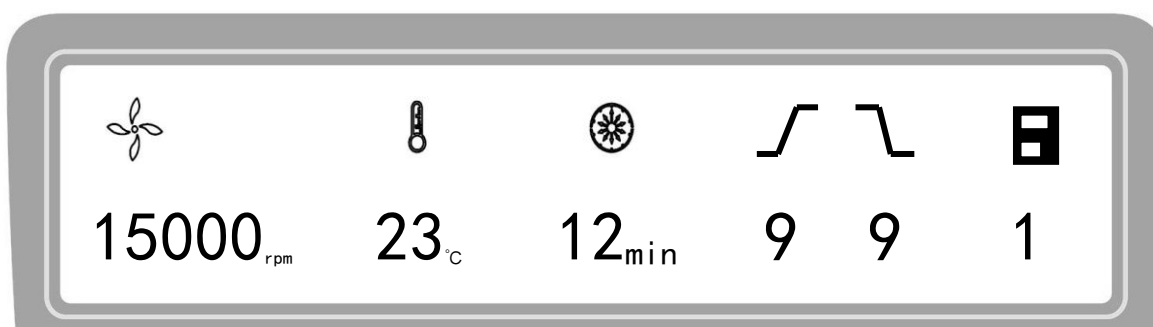





图 6-2 主画面示意图

离心机主画面如图 6-2 所示。此时转速设定为 15000rpm，显示推测样品温度 23℃，设定的运行时间为 12 分钟。

速度图标  旋转时，表示机器正在运行。

温度显示图标 ，三种状态：亮时显示推测样品温度；灭时显示设置温度；闪烁时压缩机开始制冷，对离心腔温度进行控制。


时间显示图标 ，将运行时间分成 10 等分，显示已运行时间占总时间的比例。

## 7. 转子准备

### 7.1 准备要分离的样品

### 7.2 将样品放入离心管中

样品量不超过说明书中所允许的最大限量。


 告诫：在离心管中加入过量样品会引起泄露，因此不要加入过量样品。

### 7.3 确保离心管平衡

- 尽管该离心机允许目测平衡方法使用，但是，为了延长离心机使用寿命，建议样品使用天平称量，确保平衡。
- 尽管不平衡量以下是允许的，也不要在不好的平衡条件下运行该离心机。

### 7.4 检查转子

使用前需要检查转子是否有腐蚀或划痕。

 告诫：

- 如果发现转子上存在腐蚀或划痕等，请停止使用。
- 禁止在本机上使用其它牌号或规格的转子。
- 转子和配件是不能遭受直接的日光和紫外线照射。

## 7.5 确保将平衡好的离心管对称地放入转子孔内

⚠ 告诫:

- 确保将转子与主轴旋紧，盖子安全固定在转子上。否则，在离心机运行时转子可能脱落，造成离心机或转子损坏。
- 转子盖与转子旋紧牢固。

## 8. 操作

### 8.1 正常运行操作

打开电源开关显示亮，离心机显示 HELLO 界面。见图 8-1 所示。

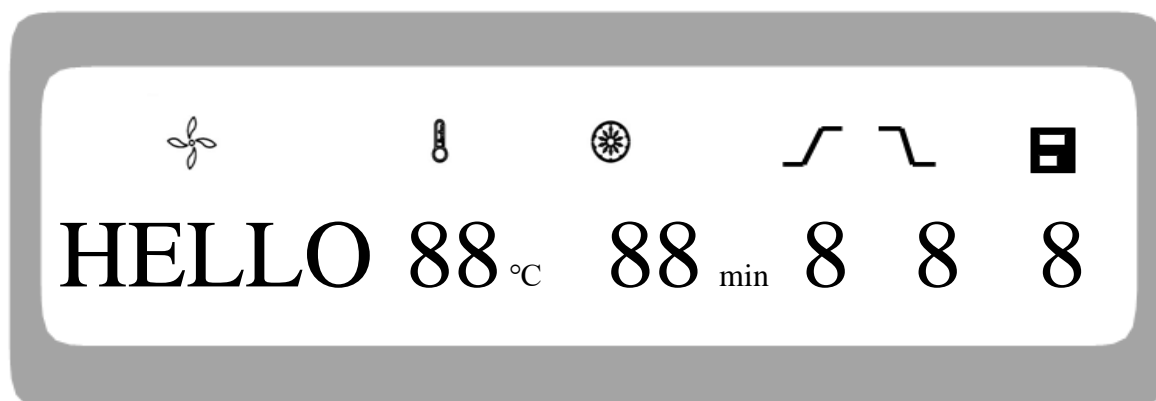


图 8-1 离心机自检画面

显示离心机型号 1524R 及程序版本 1.0，见图 8-2。

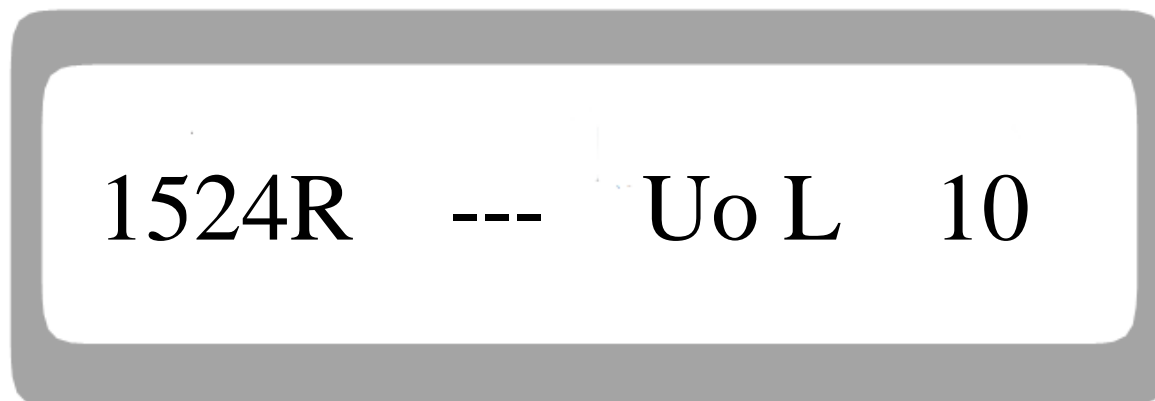


图 8-2 型号及版本界面

然后，离心机显示上一次运行参数，见图 8-3。

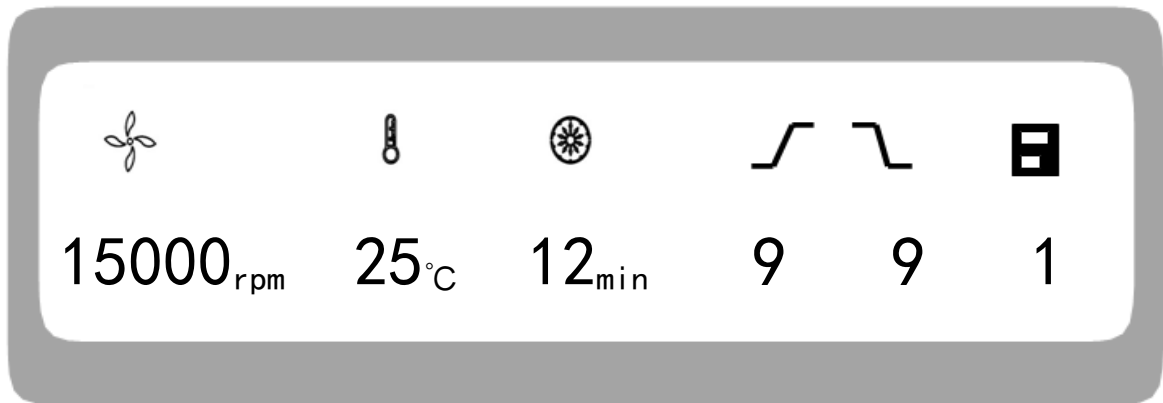


图 8-3 上一次运行界面

- 速度设定 15000rpm，时间设定为 12 分钟，离心腔温度 25°C。
- 上盖门锁释放。

### 8.1.1 转子安装和更换

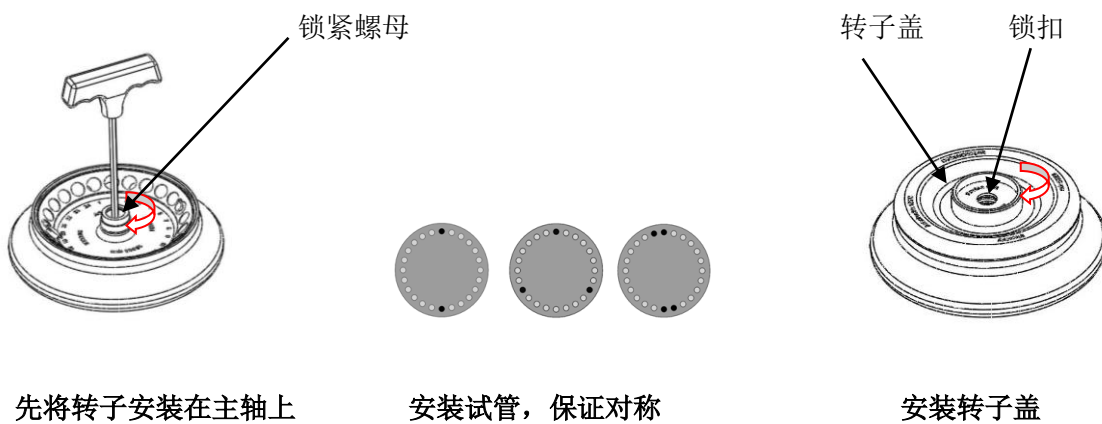


图 8-4 转子安装示意图

#### ⚠ 告诫






- 将转子放在主轴上，保证转子与主轴完全接触，并使用扳手旋紧转子上的螺母，使转子与主轴连接牢固，否则转子有可能脱落，损坏离心机。
- 盖子与转子旋紧牢固。

- 放置转子时要保证转子与主轴完全接触。
- 转子放在主轴上，放置完转子后，可以用手轻转检查转子，观察是否正常，如果转子有明显晃动，则需要重新放置转子。










- 使用转子扳手顺时针旋转锁紧螺母，将转子与主轴旋紧牢固。
- 盖上转子盖，并将转子盖旋钮顺时针旋转，与转子锁紧，保证牢固。关好上盖门，运行离心机。
- 转子的拆卸与上述方法相反，旋转方向为逆时针。



### 8.1.2 设置运行参数

通过参数键  可以输入、修改运行参数。向下轻按参数键  可以选择需要输入的参数对象，使该参数图标闪烁，进入参数输入状态。这时右旋参数键 ，可以增加参数，左旋，则减小参数。参数键  转动越快，输入参数的值变化越快，反之，参数键  转动越慢，输入参数的值变化越慢。转速最小步长为 100rpm，离心力最小步长为 10g，时间的最小步长 1 分钟以内为 1 秒，1 分钟以外为 1 分。




#### (1) 设定转速

- 按参数键 ，选择转速单位为 rpm，这时表示速度参数。
- 当选中速度位时，速度值闪烁，进入速度参数输入状态。
- 最小转速设定值为 200rpm，最小步长为 100rpm。
- 顺时针旋转参数键 ，参数增加；反之，逆时针旋转参数键 ，参数减小。
- 参数键  具有快速输入功能，快速旋转参数键 ，可以加快参数的变化。
- 增加、减少参数具有循环功能。顺时针旋转参数键 ，数值从小→大→最大→最小，如此循环；逆时针旋转参数键 ，数值从大→小→最小→最大，如此循环。





#### (2) 设定运行时间

- 按参数键 ，使时间值闪烁，进入时间设定模式。
- 旋转参数键 ，输入时间设定值，设定范围 30 秒-99 分钟。
- 当时间显示 HD 时，表示连续运行模式。



#### (3) 设定运行温度

- 按参数键 ，使温度值闪烁，进入温度设定模式。
- 旋转参数键 ，输入温度设定值，设定范围-20℃~40℃。
- 当温度图标  闪烁时表示制冷系统正在工作，否则，制冷系统没有工作。

### 8.1.3 开始运行


- (1) 按运行键 ，启动运行
  - 转子开始旋转。
  - 当转子开始运转到设定转速后开始计时，时间显示剩余运行时间。
- (2) 运行参数的查询和修改
  - 离心机稳速运行后可对其运行参数进行修改。
  - 按参数键 ，显示返回预备模式界面，显示设定的运行参数。这时，再轻按参数键 ，使所需要修改的参数图标闪烁，再旋转参数键 ，修改其参数。无键操作 7 秒后离心机回到正常运行状态，并按新参数继续运行。
  - 时间设定参数修改后，已运行时间不清零而将继续累加。
- (3) 错误显示
  - 离心机运行过程中出现故障，将自动停车，并在时间显示窗显示出故障代码，通过查询表 10-1，即可知道出错原因并可进行相应处理。

### 8.1.4 结束运行



- (1) 当运行时间到或按  键时，离心机开始停车。
  - 当转子停止旋转后，离心机鸣叫，告诉用户运行结束。
- (2) 上盖门锁打开。
  - 当转子停止旋转后，离心机鸣叫，告诉用户运行结束。
  - 运行结束，离心机保持上盖门锁关闭，可以通过  按键打开上盖门锁。
  - 运行结束后，程序将自动储存本次运行的设定参数。再次开机时程序将自动调出最后一次运行的设定参数。
- (3) 打开上盖门，取出样品和转子。

## 8.2 RCF 运行操作

- (1) 接通电源开关
- (2) 设定 RCF (相对离心加速度)

 告诫

- 所设定的相对离心加速度不要超过离心管及其适配器所允许的最大相对离心加速度。
- 相对离心加速度是根据转子最大离心半径和运行转速计算的。(最大离心半径参考表 11.1)

- 按下参数键 ，选择转速单位为 $\times g$ ，使离心加速度值闪烁，进入相对离心加速度输入状态。
- 加速度参数闪烁 7 秒后仍无按键操作，输入模式将被关闭。
- 旋转参数键 ，输入相对离心加速度，相对离心加速度以  $10\times g$  步长变化。



(3) 设定运行条件

其它部分操作，请参照 8.1 部分。

## 8.3 短时运行操作


该功能通常用于去掉附着在离心管内壁上的样品。

提示：只有当转子没有转动并且上盖门锁紧时该按键才有效。

- (1) 打开电源开关，将转子固定在主轴上，旋紧转子盖，并保证旋紧牢固，关闭上盖门。
- (2) 离心机进入预备模式，并显示上次运行的参数值。
- (3) 按  键并保持住，转速不断上升，直到达到最高转速。当松开  键时开始减速停车。

# 9. 维护和保养

## 9.1 清洗

 告诫


在清洁离心机之前请拔出电源插头

(2) 离心机

- 离心机长期暴露在紫外光线下，机壳的颜色会有变化，其上面的标签可能脱落。  
用完后请用布盖住离心机，避免光线照射。

- 离心机脏了后，请用布或海绵配以中性清洁剂清洗。
- 可以用布配以 70% 的酒精溶剂对离心机消毒。

## (2) 离心腔

 告诫

- 不要将水及其它溶剂直接倒入离心腔，否则，这些溶剂可能进入驱动单元而引起轴承腐蚀或损坏。

- 如果离心腔脏了，可以用布或海绵配以中性清洁剂擦干净，用布配以 70% 酒精可以对离心机消毒。

## (3) 驱动轴

- 建议对驱动轴做定期维护，可以用软布擦净驱动轴，然后在轴上涂润滑剂。

## (4) 上盖门

- 清洗或消毒上盖门方法同 (1) 离心机部分。

## (5) 转子

- 为防止腐蚀，如果转子长期不用，请将转子从离心腔中取出，并取下转子上盖，将转子倒置，晾干转子孔。
- 使用 PH 值在 6-8 之间的温和清洁剂清洁，在清洁之后立刻弄干铝制部分放入温度不超过 50°C 的暖风干燥机内干燥。

## (6) 排水

- 离心机配有排水槽，当排水槽里积水较多时要及时将水排掉。

## 9.2 消毒

如果离心机含有感染性材料的离心管有泄漏，你必须对转子和（或）离心机立刻进行消毒。

- 离心管发生破裂或溢出感染性物质会进入离心机。
- 通过接触可能发生感染危险。人员要有适当的保护措施。
- 注意离心管的允许灌入体积和载入限制。
- 在发生污染时操作者必须确定没有危害到其他人。
- 污染部分必须马上消毒。
- 必要时启动进一步的防护措施。

### 9.2.1 用普通中性消毒剂消毒


转子和离心腔体必须要用普通中性消毒剂处理。最合适的是用喷雾式的消毒剂将转子和配件表面均匀喷洒覆盖。

按以下步骤对转子和配件进行消毒：

- (10) 拔开电源插头。

- (11) 从转动轴上拧松转子。
- (12) 用两只手抓住转子并从转动轴上垂直地上拉。
- (13) 取出离心管和适配器，对他们进行消毒或必要时丢弃处理。
- (14) 按照消毒剂的说明处理转子和转子盖（浸泡或喷洒处理）。
- (15) 将转子头部朝下沥干消毒剂然后用水冲洗。
- (16) 按有效的方法出去残留的消毒剂。
- (17) 随后铝制转子必须用防蚀保护油处理。
- (18) 所有的密封圈必须重新润滑。

### 9.2.1 用漂白碱液消毒

 告诫

漂白碱液含有高浓度的侵蚀性次氯酸盐所以不能用于铝制转子。

下列的是对塑胶转子的防护措施：

- (5) 避免高温，漂白液和转子温度不高于 25℃。
- (6) 不要让漂白时间超过必要！
- (7) 在消毒之后，用蒸馏水彻底地冲洗转子并弄干。
- (8) 所有密封圈必须重新润滑。

## 9.3 易损件

下面为该离心机易损件列表，请按照下表建议及时更换易损件。

| 序号 | 易损件      | 更换条件 |
|----|----------|------|
| 1  | 温度传感器橡胶座 | 裂纹   |
| 2  | 离心腔密封圈   |      |

## 9.4 转子密封圈的更换

### 9.4.1 介绍

为实现生物密封，使用了三个橡胶圈，见下图。经过多次高压灭菌，橡胶圈可能老化或脱落，需要更换或重新安装。

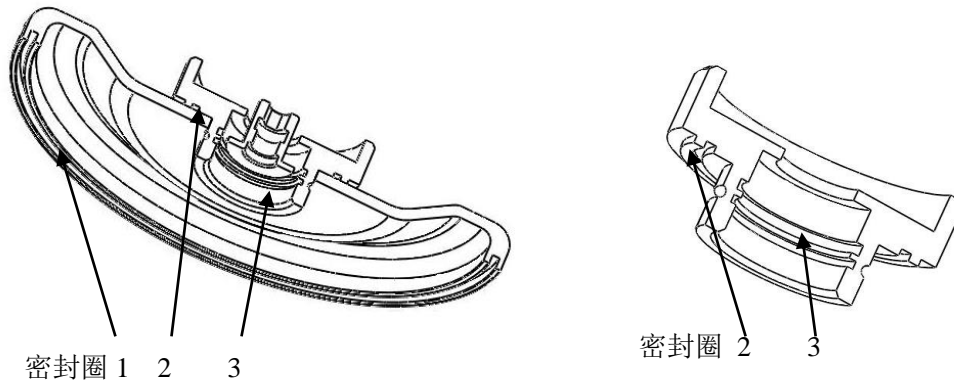


图 9-1 转子密封圈

### 9.4.2 更换方法

- (1) 先使用中性清洗液将橡胶圈槽清洗干净并晾干。
- (2) 在橡胶圈槽内均匀涂上胶水（501），然后，将橡胶圈至于其槽内，均匀按压，使橡胶圈与其槽底部接触，粘结牢固。
- (3) 放置 20 分钟，等待胶水完全凝固即可。


## 9.5 常规检查

- (1) 检查放置离心机的台面是否坚实、平整和水平，且保证离心机四个脚与台面接触。
- (2) 检查机器接地是否可靠：使用万用表，检查电源线插头的接地插针与离心腔、电机轴等是否短路，如果是短路，说明接地可靠；如果断路，则需查明原因，解除故障后才可运行离心机。

# 10. 常见故障及解决办法

## 10.1 常见故障列表

该离心机具有自我诊断功能，当离心机出现故障不能运行时，在时间显示窗上会显示故障代码，根据故障代码即可知道故障原因。

| 现象                   | 可能原因  | 解决办法                  |
|----------------------|---|-----------------------|
| 通电，没有显示              | ·电源座断电<br>·保险烧断   | ·排除故障，重新通电<br>·更换保险   |
| 显示窗上<br>显示时间<br>报警码显 | E-02<br>上盖门故障<br>·运行中门打开<br>·门开着时按下  键 | ·马上关闭盖门<br>·关闭盖门，然后运行 |

|  |                |                       |                   |
|--|----------------|-----------------------|-------------------|
|  | E-04<br>温度异常   | ·机壳通风孔堵塞<br>·散热风扇损坏   | ·疏通通风孔<br>·更换散热风扇 |
|  | E-06<br>转速设定异常 | ·设定转速超出转子所允许的<br>最高转速 | ·修改转速设定值          |
|  | E-10~86        | ·见服务手册                | ·与服务代表联系          |


表 10-1 常见故障及解决办法

- 故障代码 E-1~E-6 与操作错误有关，故障清除后可以继续运行离心机。

## 10.2 如何打开上盖门


### 10.2.1 通电情况下

提示：只有当离心机通电并且转子不转动时才能打开上盖门。

- (1) 离心机通电，上盖门锁自动打开。
- (2) 离心机运行结束后，上盖门锁保持关闭。
- (3) 当转子停止运行，按  键，可以打开上盖门锁，这时可以翻开上盖门。

### 10.2.2 断电情况下

突然断电不能打开上盖门时，可按以下步骤打开上盖门。

- (1) 检查转子是否运转
  - 仔细听，确保没有转动声音。
- (2) 用扳手插入机壳小孔打开上盖门锁
  - 小孔在右侧面板前端上方。
  - 用扳手插入右小孔向前推动并顺时针旋转 ，即可打开上盖门锁，翻开上盖门。

## 10.3 更换保险

- (1) 离心机保险为 250V, 10A，快断型，尺寸：Φ5 × 20，一个。
- (2) 离心机的 10A 保险在电源插座上，将电源插座上的保险盒拽出，即可更换保险。3.15A 保险在电路板上，将电路板上的保险盒拽出，即可更换保险。

## 11. 转子及离心管介绍

⚠ 告诫

- 仔细阅读说明书，正确地安装和使用转子。
- 不要超过转子、试管及适配器等组件所允许的最高转速，有些适配器所允许的最高转速低于转子的最高转速。

## 11.1 转子介绍

### 11.1.1 转子结构

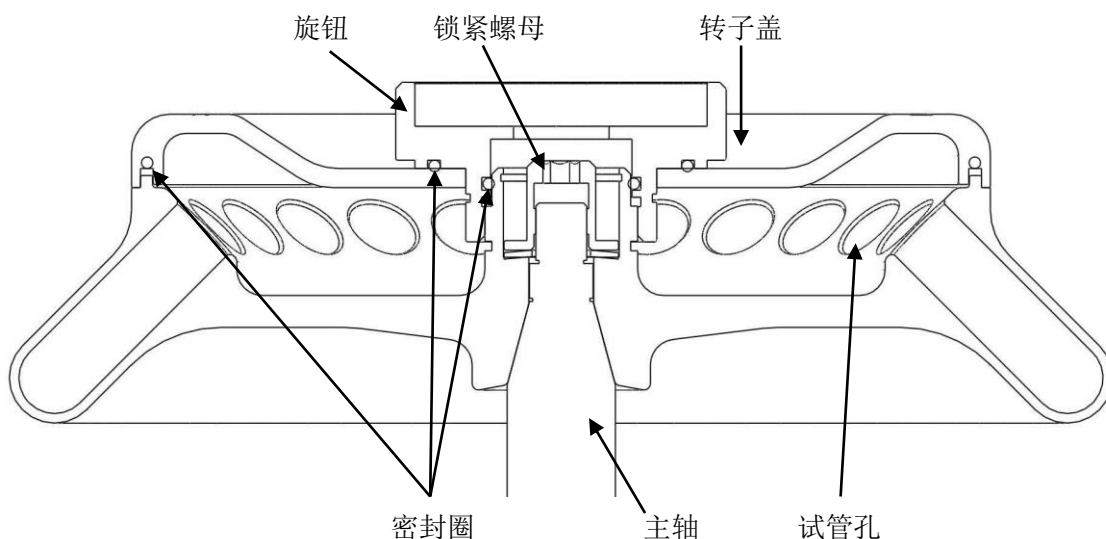


图 11-1 转子结构

### 11.1.2 转子和适配器

所有转子都是生物密封的，当转子盖与转子旋紧后，就将离心管封闭在转子内，保证离心过程中样品不泄漏。当不使用转子盖时，转子就没有生物密封功能。该离心机可使用的转子和适配器列表如下：

表 11.1 转子和适配器列表

| 转子序号 | 转子名称   | 离心管         | 适配器   | 最高转速 (rpm) | 最大离心半径 $r_{\max}$ (cm) | 最大相对离心加速度 Rcf ( $\times g$ ) |
|------|--------|-------------|-------|------------|------------------------|------------------------------|
| 1    | AS24-2 | 2/1.5ml 离心管 |       | 15000      | 8.5                    | 21380 (程序对应)                 |
|      |        | 0.2ml PCR 管 | A02P2 | 15000      | 6.9                    | 17350                        |
|      |        | 0.5ml 微量管   | A05P2 | 15000      | 7.6                    | 19100                        |



|   |          |             |        |       |         |              |
|---|----------|-------------|--------|-------|---------|--------------|
| 2 | AS36-05  | 0.5ml 微量管   |        | 15000 | 8.5     | 21380 (程序对应) |
|   |          | 0.2ml PCR 管 | A02P05 | 15000 | 7.6     | 19100        |
| 3 | AS4-PCR8 | PCR8 排管     |        | 15000 | 6.5/7.2 | 16350/18100  |
| 4 | AS12-V5  | 5ml 锥形管     |        | 15000 | 8.5     | 21380        |
| 5 | AS18-5   | 5ml 培养管     |        | 15000 | 8.5     | 21380        |

### 11.1.3 注意事项

(1) 离心机转子可分离样品的密度在 1.2g/ml 以下，如果被分离的样品密度超过 1.2 g/ml，请根据下面的公式计算允许的转速：

$$\text{允许转速 (rpm)} = \text{最大转速} \times (1.2 \text{ (g/ml)} / \text{样品密度 (g/ml)})^{1/2}$$

(2) 为防止腐蚀，如果转子长期不用，请将转子从离心腔中取出，并取下转子上盖，将转子倒置，晾干转子孔。

(3) 如果有样品泄露在转子孔内，则用清水冲洗转子孔，晾干后在转子表面涂一薄层硅脂。

(4) 转子需要定期维护，建议每三个月进行一次清洗，保证试管孔与主轴孔清洁，并涂一薄层硅脂。

### 11.1.4 高压灭菌

该转子使用高强度铝合金材料制造，可以进行高压灭菌：121°C (1.0kg/cm<sup>2</sup>) 20 分钟。

### 11.1.5 生物密封

该机器的转子均采用生物密封结构，使用三个耐高温橡胶圈实现密封。经过多次高压灭菌，橡胶圈可能老化或脱落，需要更换或重新安装，具体方法详见 9.4。

## 11.2 离心管

### 11.2.1 请参照下表对离心管进行清洗和消毒

表 11.2 离心管的清洗和消毒条件

O: 可用 X: 不可用

| 条件   |             | 材料              | PA | PC | PP |
|------|-------------|-----------------|----|----|----|
| 清洗   | 流动清洗        | 酸性清洗剂 (pH5 或更低) | X  | X  | X  |
|      |             | 酸性清洗剂 (高于 pH5 ) | O  | O  | O  |
|      |             | 碱性清洗剂 (高于 pH9 ) | O  | X  | O  |
|      |             | 碱性清洗剂 (pH9 或更低) | O  | O  | O  |
|      |             | 中性清洗剂 (pH7)     | O  | O  | O  |
|      |             | 70°C热水          | O  | O  | O  |
| 超声清洗 | 中性清洗剂 (pH7) | O               | O  | O  |    |

|    |       |                                      |   |   |   |
|----|-------|--------------------------------------|---|---|---|
| 消毒 | 高压灭菌  | 115°C (0.7kg/cm <sup>2</sup> ) 30 分钟 | O | O | O |
|    |       | 121°C (1.0kg/cm <sup>2</sup> ) 20 分钟 | X | O | O |
|    |       | 126°C (1.4kg/cm <sup>2</sup> ) 15 分钟 | X | X | X |
|    | 煮沸灭菌  | 15-30 分钟                             | O | O | O |
|    | 紫外线灭菌 | 200-300nm                            | X | X | X |
|    | 气体灭菌  | 乙烯氧化物                                | O | X | O |
| 甲醛 |       | O                                    | O | O |   |

PA: 同质异晶聚合物 PC: 聚碳酸脂 PP: 聚丙烯

### 11.2.2 PC 离心管清洗

PC 材料对碱性溶剂具有较低的化学稳定性, 应避免使用 pH 值大于 9 的清洗剂。一些中性清洗剂按厂家的说明冲淡使用后其 pH 值仍大于 9, 因此, 建议使用 pH 值在 7-9 之间的清洁剂。

### 11.2.3 PA、PC 和 PP 离心管的高压灭菌

PA 在 120°C 开始变软, 而 PC 和 PP 是 130°C。通常, PA 可以在 115°C (0.7 kg/cm<sup>2</sup>) 经 30 分钟灭菌, 而 PC 和 PP 可以在 121°C (1.0 kg/cm<sup>2</sup>) 经 20 分钟灭菌。如果温度过高, 离心管就会变形。

当使用灭菌皿时按如下操作:

- (4) 将离心管口向上, 竖直放置。如果将离心管倾斜或侧向放置, 由于重力作用将会变形。
- (5) 取下螺纹盖子和内部盖子以防止离心管变形或裂口。
- (6) 当灭菌皿降到室温之后才能将离心管取出。

### 11.2.4 离心管的寿命

塑料离心管的寿命取决于样品特性、转子转速、离心温度等。当塑料离心管用于离心常规中性样品 (pH5-pH9) 时, 其寿命估计如下:

在最高转速下使用:

优质离心管 (PA、PC、PP): 30-50 次。

常规离心管: 10 次左右 (低速使用可以增加使用次数)。

离心管寿命还与清洗和消毒的条件有关, 使用寿命会有所降低。

**注: 不要使用有裂纹的离心管。**

## 12. 相对离心力的计算

相对离心加速度（RCF）可以通过计算公式计算：

$$\text{计算公式：RCF}=1.118 \times r \times n^2 \times 10^{-5}$$

其中，r— 旋转半径，单位：cm；n— 旋转转速，单位：rpm

## 13. 订货信息

| 订货号码       | 型号       | 描述   |
|------------|----------|--|
| 9013111121 | 离心机      | 台式高速冷冻型微量离心机，国标插头，220V/50Hz                |
| 附件         |          |  |
| 19400002   | AS24-2   | 转子套装，适用于离心机，最高转速 15000 rpm，最大容量 2 ml*24    |
| 19400003   | AS36-05  | 转子套装，适用于离心机，最高转速 15000 rpm，最大容量 0.5 ml*36  |
| 19400004   | AS4-PCR8 | 转子套装，适用于离心机，最高转速 15000 rpm，最大容量 4-PCR8     |
| 19400032   | AS12-V5  | 转子套装，适用于离心机，最高转速 15000 rpm，最大容量 5ml*12     |
| 19400012   | AS18-5   | 转子套装，适用于离心机，最高转速 15000 rpm，最大容量 5 ml*18    |
| 19500001   | A02P2    | 0.2 ml 转子适配器，适用于 A12-2/AS24-2 转子，24 pcs/pk |
| 19500002   | A05P2    | 0.5 ml 转子适配器，适用于 A12-2/AS24-2 转子，24 pcs/pk |
| 19500003   | A02P05   | 0.2 ml 转子适配器，适用于 AS36-05 转子，36 pcs/pk      |

## 14. 质保

### 14.1 整机质保

整机从交货之日起在正常维护的情况下保修两年。

### 14.2 转子质保

转子自交货之日起担保 5 年。特别注意，当转子已经被腐蚀或疲劳损坏，请不要再使用。因以下原因引起的主机或转子的损坏不属于担保范围。

- (8) 由于不正确安装引起的损坏。
- (9) 野蛮或不正确操作引起的损坏。
- (10) 安装完毕后重新移位或运输引起的损坏。
- (11) 由于无授权单位的拆卸或修改而引起的损坏。
- (12) 使用非我公司的部件，如转子、适配器等造成的损坏。
- (13) 由于自然灾害，包括火灾、地震等造成的损坏。
- (14) 易损件和具有保修期的部件。

## 15. 售后服务

为了确保离心机安全高效地运行，需要定期维护。如果离心机出现问题，不要试图自己修复，请与服务代表中心联系。