Operation Manual

Smart R17 Plus

Micro Centrifuge

hanil
since 1958

Contact Us
If you have and questions, contact Hanil Scientific Inc. or place of purchase.

+82-2-3472-0727
Inquiry: info@ihanil.com
Order: sales@ihanil.com
Tech. support: techsupport@ihanil.com

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1. Safety Precautions

1.1 Safety requirements

Centrifuge involves elements of risk all the time as it utilizes a high speed body of rotation. Follow precautions and all the safety Follow precautions and all the safety requirements described on this user manual to prevent any damage and failure of equipment and loss of lives.

1. Centrifuge should be placed on flat place to maintain level. Big vibration is caused by operation of equipment in the condition of spindle inclined.
2. Check voltage to be used before centrifuge is connected to power supply.
   Wrong voltage can damage equipment.
3. Use rotors provided by Hanil Science Industrial Co Ltd and use parts and accessories recommended.
   Hanil Science Industrial Co Ltd is not responsible for damages of equipment and accidents caused by using parts and accessories not recommended.
4. Understand property of matter fully and take needful safety actions in case you perform centrifugation of dangerous materials such as pathogenic, toxic and radioactive substances.
5. Remove contaminants completely and take needful actions such as ventilation or isolation of centrifuge in case centrifuge is contaminated with dangerous materials such as pathogenic, toxic and radioactive substances.
6. Do not perform centrifugation of materials capable of producing volatile and explosible steam.
7. Do not operate equipment more than maximum RPM allowed by rotor installed.
8. Do not decelerate or stop rotor rotating with hands.
9. Rotor should be used after balancing of symmetry between weight of samples to be used.
10. Rotor should be fixed into shaft and its lid should be tightened completely.
    Otherwise, the lid can be taken off during rotation.
11. A trained and qualified technician should perform repairing directions not mentioning on this user manual.
12. User should remove contaminants completely in advance in case user requests repairs to a qualified technician.
13. Rotor and chamber should be kept dry all the time before use of centrifuge to make long period use of centrifuge and maintain the best operating conditions.
14. Pay attention that aluminum rotor has a chemical reaction and starts to be corrosive if aluminum rotor contacts laboratory cleaning liquid, cesium, silver, and (especially chloride ion) of strong acid, strongly alkaline or strong alkali.
15. According to IEC61010-2-020, 30cm of a safe distance around centrifuge should be assured during operation.
    Nothing should be put on this safe distance in case it is destroyed.
16. According to IEC61010-2-020, 30cm of a safe distance around centrifuge should be assured during operation.
    Nothing should be put on this safe distance in case it is destroyed.
17. Turn the power switch off after using the device.
18. Unplug the power plug before cleaning or left unused for a long period of time.

1. Safety Precautions

1.2 Using & Storage condition

This device is designed to provide safe functioning under the following conditions:

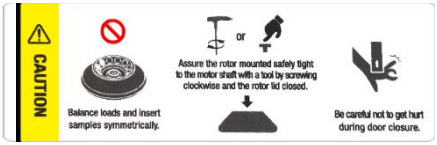
Using condition

Indoor use
Room temperature within 5℃ - 40℃
Relative humidity 30% - 85%
Air pressure 500 - 1060 hpa
Supply voltage fluctuation 220-240 V ± 10 %
Overvoltage category II
Pollution degree-
for the intended use environment: Pollution degree 2

Storage & transportation condition

Indoor storage
Surrounding temperature -10℃ - 40℃
Relative humidity 10% - 90%
Air pressure 500 - 1060 hpa

1.3 Safety Label attached to products



Mark indicating
danger and warning

Mark indicating
a place in danger of electric shock

1.4 Electric safety information

1. Use a power cord only provided with equipment
2. Do not use an extension cord.
   Contact an experienced electrician in case you check earthed system of electric outlet.
3. You can receive an electric shock if you connect an earth wire of equipment wrong
4. Install equipment not to be stepped on a power cord.
5. Do not insert anything into a slot or hole of equipment
6. Do not block a ventilating opening
7. If you have the following emergencies, shut off the power supply and pick out the power cord from outlet and contact our customer services.
   - Abnormal sound or smell from equipment
   - Damage or wear of a power cord
   - Breakdown of circuit breaker, fuse or safety device
   - If you spill liquid on equipment
   - If equipment is exposed to water
   - If Some of equipment has been damaged

2. Installation Directions

2.1 Packing Inspection

· Check packing conditions very carefully after arrival of centrifuge.
· Contact Hanil Science Industrial Co Ltd immediately if damages found .
· You can get contact details on packing boxes and outer cover of manual.

2.2 Installation directions

· Installation on hard and flat ground : Centrifuge should be installed on hard and flat ground. In case centrifuge is located on incline place, spindle can be bent due to heavy weight of rotor as centrifuge is rotating in condition of spindle inclined for long period of time.

· Smooth air circulation : Centrifuge should be located in leaving 30cm of room from both sides and the back for smooth air circulation. Especially, air circulation is not going smoothly if air vent on the case is covered with cloth or blocked by other equipment.
Avoid dusty place to install centrifuge.

· Constant temperature and humidity : Centrifuge is influenced by external environment such as temperature or humidity as it is controlled by a high degree of electromagnetic controller. Do not install centrifuge close to direct light or heater.
Keep centrifuge in proper temperature and humidity.

· Place unable to produce corrosive gas : Install centrifuge on the place unable to produce corrosive gas. Rotor and spindle can be corrosive and metal parts can be damaged if centrifuge contacts pyrosulfuric gas and chloric gas.

· Balancing : Centrifuge should be leveling for spindle of equipment to be vertical to the ground. Balance a centrifuge by using a water level if required.

2. Installation Directions

2.3 Rotor

· Rotor, tube rack(adapter), tube and adapter set recommended by manufacturer should be used.
· Do not use rotor and bucket with a visible corrosion or mechanical fault.
· Waring! In danger of injury due to asymmetric installation of a rotor.
· Make sure a rotor is tightened up before start.
· Make sure a lid of rotor is tightened up before start.
· Make sure of tubes arrangement before start
- Same tube buckets and plates should be placed on a rotor symmetrically.
- Make sure of use of adapters with suitable tubes or plates.
- Make sure of use of same type (weight, material/density, volume) of tube or plate all the time.
- Make sure you check balance of adapters, tubes or plates by using a scale and they become symmetric.

• Clean a motor spindle and rotor holes with a dry cloth before you install a rotor.

• When you tighten a rotor on a motor spindle, temperature of a rotor and a motor spindle should be between 10℃ and 30 ℃.

• Tighten a rotor screw turning clockwise with a hexagon wrench after you install a rotor on a motor spindle.

• When you take a rotor out, turn a rotor screw counterclockwise with a hexagon wrench

Applying load to a rotor

• Tubes and adapter should be placed on a rotor symmetrically.
Recommended tubes should be only placed on a rotor.

• Weight difference between tubes containing samples should be as small as possible to minimize noise and extend life of drive.

• Same type of tubes should be placed on a rotor due to a reason of mechanical stability.

• Clean rotor holes before you insert tubes.

2. Installation Directions

Tubes arrangement

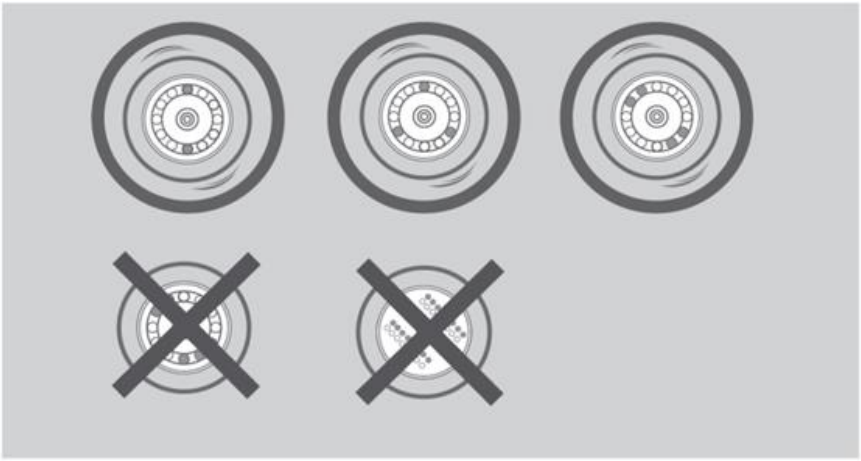
Same volume of sample should be put on tubes after you measure it exactly.
Tubes should be placed on a rotor symmetrically.
At this moment, if volume of symmetrical tube is different, a rotor and an axis of rotation can be damaged due to severe vibration during rotation.

Location of centrifuge tubes facing each other should be symmetrical even though tube's quantities are same.
If tubes are not symmetrical in quantity, new tubes should be inserted to keep balance.

User is encouraged to use a scale to minimize the difference of volume between tubes containing Samples.

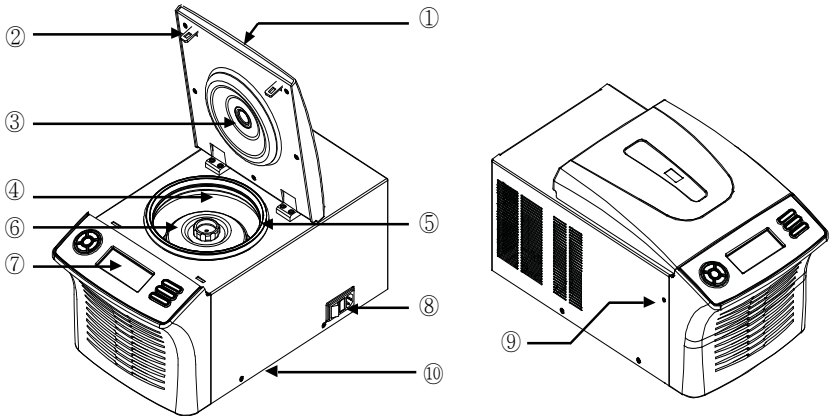
In case you open tube's lid for centrifugation by using a spin column, please lean tube's lid against the edge of a rotor for exact centrifugation and make sure type of tubes are same and close the lid of rotor.

This instruction should be applicable just in case you use tubes provided according to purpose of kit manufacturer.



3.Inspection of Operation

3.1 Appearance



① Lid: Lid protects the inside of the chamber and a rotor from coming out in danger
② Lid lock: This is a fixed part to keep the lid shut
③ RPM measuring window: This is a part measuring speed of rotor by a digital tachometer
④ Chamber: This is where a rotor is installed and it rotates
⑤ Lid packing : This packing is to prevent dew condensation from the outside for refrigeration
⑥ Rotor: This is connected to a spindle and rotates after you arrange tubes containing samples
⑦ Controller: This is where you can set up data such as RPM, TIME, Temperature and etc.
⑧ Power switch: This is where you can switch ON/OFF after you plug in
⑨ Emergency Lid Open system: This is where you can open a lid manually in case of emergency such as power failure
⑩ Drain : This is where sample or water flowed into the chamber is discharged

3.2 Components

① Smart R17 Plus Main body
② Power cable
③ User manual
④ Rotor Locking Tool (T wrench)
⑤ Extra fuse
⑥ Optional Components : Rotor and Accessory

※ ① ~ ⑤ : Built-in components
※ ⑥ : Optional Components, Purchase separately

3.Inspection of Operation

3.3 Technical Specifications

Max.RPM	17,000 rpm
Max. RCF	23,005 xg
Max. capacity	24 x 1.5/2.0 mL, 4 PCR strips
ACC/DEC ramps	9/10 steps
Acc. time to max. speed	≤ 15 sec
Dec. time from max. speed	≤ 15 sec
Temperature range	-10℃ to 40℃
Fast cool function	Yes
Time control	< 100 min, pulse, continuous
Program memory	10
Noise level	< 60 dB
Imbalance cutoff / tracking	Yes
Rotor identification	manual
Dimension (W x D x H, mm)	285 x 593 x 281
Weight without rotor	33 kg
Power requirement (VA)	700 VA
Power input (V, Hz)	210V~240V, 50/60 Hz (110V optional)
Cat. No.	SM-R17PL

3. Inspection of operation

3.4 Controller

No.	Button		Function
①		Display	Set-up information, operating condition is displayed.
②		Up	This is to select program and to increase set value of program as the upper button of direction key.
③ ④		Left Right	This is to select setting menu as left and right button of direction key.
⑤		Down Fast Cool	1. This is to reduce set value of program and select programs as the lower button of direction key. 2. This is for Fast Cool function.
⑥		Enter	This to practice the menus of various program.
⑦		Call/Save	This is to recall the stored programs and store programs according to user's requests.
⑧		Door	When you press Door button, a lid opens in its paused state.
⑨		Start/Stop/ Short	This is to start or stop rotating and practice instantaneous rotation.

3. Inspection of operation

3.5 RPM/RCF Input

1.In standby mode, press Setup/Enter (Setup Enter) button.

2. Press Left (◀) or Right (▶) button to change to rpm or rcf mode

3. Press Up (▲) or Down (▼) button to input the setting value.

4. Press the Setup/Enter (Setup Enter) button to save the settings.

3.6 Time Input

1.In standby mode, press Setup/Enter (Setup Enter) button.

2. Press Left (◀) or Right (▶) button to move to TIME position.

3. Press Up (▲) or Down (▼) button to change a set value.
▶ You can set up time up to 99min 59sec.

4. Press the Setup/Enter (Setup Enter) button to complete.

3.7 Accel/Decel Setting

1.In standby mode, press Setup/Enter (Setup Enter) button.

2. Press Left (◀) or Right (▶) button to move to Accel/Decel position

3. Press Up (▲) or Down (▼) button to select a set value.
▶ Accel/Decel step is 1 ~ 5.
▶ Step 1 is the slowest and step 5 is the fastest.
▶ Decel step as 0 means natural brake.

4. Press the Setup/Enter (Setup Enter) button to complete.

3. Inspection of operation

3.8 Temperature Setting

1.In standby mode, press Setup/Enter (Setup Enter) button.

2. Press Left (◀) or Right (▶) button to move to TEMP position.

3. Press Up (▲) or Down (▼) button to input the setting value.

▶ Setting temperature is available from -10℃ to +40℃.

4. Press the Setup/Enter (Setup Enter) button to save the settings.

3.9 Short spin mode

1.In standby mode, long press Start/Stop (Start/Stop) button.

▶ Centrifuge operates according to the previously set RPM.

▶ It decelerates according to the previously set Decel value after it reaches to the set RPM and it rotates for about 2 seconds.

3.10 Fast Cool

This function is usually used for sample which is sensitive to temperature and this also performs Reducing the temperature of a rotor before operation.

1.In standby mode, press down (▼) button for about 2 seconds.

▶ A rotor rotates with 1,500RPM and if equipment reaches to the previously set temperature, a rotor decelerates with very fast speed.

▶ If a rotor stops, standby mode comes up.

3. Inspection of operation

3.11 Saving and Recalling Program

Saving programs

1. Press Call/Save () button.

2. Select program No. by pressing Up (), down () button firstly and then, press Call/Save ( ) button.

3. Press the Setup/Enter () button to set menus.

▶ The initial menu is to set RPM in set-up mode.

4. Input the desired RPM by pressing up ( ), down ( ) button.

▶ If you press up/down button for about 2 seconds, it is changed to turbo function and numbers goes up or down fast.

5. Press Left () or Right () button to enter Time, Temp, Accel, Decel, Rotor position and then, press up ( ) and down ( ) button in put set values.

6. After inputting all the values, Press the Setup/Enter () button to complete storing programs.

Recalling/inputting programs

1. In standby mode, press Call/Save () button.

2. Press Up (), Down () button to select No to recall.

3. Lastly press Call/Save ( ) button.

4. Cleaning and Maintenance

4.1 General check points

Please check it out for followings

1. Shaft : Do not bend a shaft. Check whether they are worn out.
2. Motor bearing : check whether it makes noise or rotates smoothly.
3. Electrical connection : Check whether its connection is loosened.
4. Rotor : check whether it is cracked, cleaned and worn out.

4.2 Cleaning

Be sure to remove the plug from the outlet before cleaning.

Equipment outside

1. Clean the outside of equipment with a soft and dry cloth.
   If the outside of equipment is contaminated, clean it with a soft soapy cloth.
   Then, clean the outside of equipment with a dry cloth to remove water.
2. Do not use chemicals such as alcohol, benzene and thinner that can damage products.
   Clean the damaged part with a cloth soaked with a good quality of a neutral detergent.
3. Make sure do not scratch the surface of equipment when cleaning it.
   Do not use a metal sponge.
   Make sure do not scratch the surface of equipment when moving it.
   Equipment can be rusty if the surface of equipment is scratched.
4. If equipment becomes rusty as it is left with water for long after use, remove rust with a neutral Detergent and clean it with a dry cloth.

Equipment inside

1. Rotor & chamber installed into a refrigerated centrifuge should be defrosted and cleaned periodically for effective refrigeration function.
2. To defrost the chamber, firstly switch power off and clean the inside of the chamber with dry cloth.
3. After complete defrosting, clean the chamber with wet sponge or cloth.
   Then, clean the chamber with water again and dry it completely.

4. Cleaning and Maintenance

Rotor

1. Corrosion of rotor and surface treatment

   If a rotor is exposed to acid or basic liquid, it gets damaged. In case rotor weight is imbalanced due to corrosion, serious vibration and noise can happen when high speed rotating. Furthermore, it can damage a drive shaft.
   Rotor has good corrosion resistance in the atmosphere but its corrosion can be influenced by humidity, salt content and impurities volume in the atmosphere.
   Rotor is resistant to neutral aqueous solution such as carbonate, chromate, acetate and sulfide, but it is not well resistant to chloride solution.
   Also, its corrosion is getting faster due to increase in hydrogen ion concentration and it is eroded by sulfuric acid and phosphoric acid and especially it is eroded faster by hydrochloric acid.

2. Rotor maintenance

   Cleaning : In case a rotor is exposed to sample coming out of tube, clean it with a soft cloth soaked with warm water immediately. At this moment, make sure do not scratch the surface treated specially.
   Drying : Keep a narrow groove of a rotor dry with care. Hair dryer will be more effective for drying.
   Keeping : Keep a rotor on a clean and dry place. Especially, a lid of angle rotor should be separated and keep its body upside down.

3. Aerosol-tightness

   Check sealing condition before use.
   In case a lid screw of aerosol-tight rotor and sealing ring in pit parts are worn out, replace a rotor lid.
   Check a sealing ring periodically to protect a rotor.
   Keep aerosol-tight rotor with its lid loosened.

4. Rotor sterilization and disinfection

   Rotor, its lid and bucket can be autoclaved (121℃, 20mins).

Drive shaft

1. To keep efficiency of refrigeration system, radiator should be protected from dust or other contaminant. Otherwise, it can cause decline in refrigeration function.
   You should clean radiator once every three months.

Waste disposal

1. This centrifuge should not be scraped for household and you are forced to comply with local wastes law.

5. Troubleshooting

5.1 Warning signal

Error	Error message	Cause	Troubleshooting
E1	Imbalance error	• Dissymmetrical placement of tubes. • Irregular volume of sample in tubes. • Loosened rotor to the shaft. • Swaying or operation the unstable ground.	• Check the tightness of rotor loading. • Check the proper loading of tubes. • Check the stable ground or worktable.
E2	Over speed	• 2% over the set RPM. • Incorrect tuning of motor and controller.	• Check controller and motor. • Switch power on/off and re-start.
E3	Motor overheat	• Temp. hike inside of motor.	• Check the stator of motor. • Switch power off, restart after 1 hour.
E4	Low speed	• Deficiency, not reaching 200RPM within 2 secs.	• Check controller and motor. • Switch power off and re-start.
E5	Door open(Start)	• Door open during operation.	• Check door-in switch.
E6	Under speed	• 2% under the set RPM during operation.	• Switch power off and re-start.
E7	System error	• Error of controlling system. • Overload of motor, damage of IPM module.	• Switch power off and re-start. • contact Hanil A/S center.
E8	Door Open(Stop)	• Door not open in the stop status.	• Check door-in switch.
E9	Door Close error	• Door not close in the stop status.	• Check door-in switch.
E10	Over Temp.	• Over the pre set limit.	• Re-set the preset value of the limit. (The value of L-Cal of the preset menu)
E11	Temp. Sensor error	• Temp sensor connector has not connected.	• Check the connection of mainboard connector.

* Not satisfied with the above troubleshooting, contact Hanil customer service center.

5. Troubleshooting

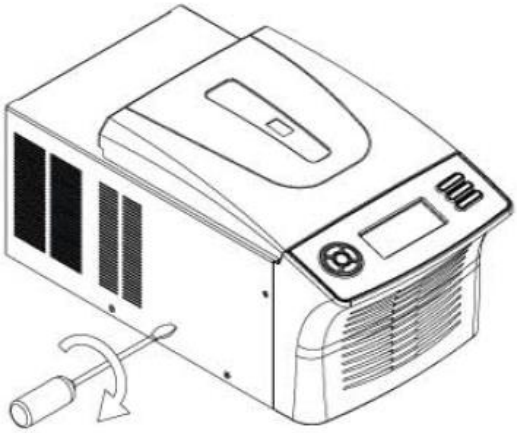
5.2 Emergency lid open system

In case a lid closed due to power failure, activate emergency lid open system manually.

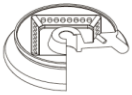
1.Switch off main power. Wait till a rotor stops through RPM measuring window.

2.As the below picture, Insert a flathead screwdriver into emergency lib open system on the left side of the equipment.

3. Turn the flathead screwdriver clockwise to open the lid.



6. Rotor and Accessories Guide

Rotor		Adaptable Centrifuge	Tube Capacity	Required Adaptor	Bore Ø x L (mm) Radius (mm)	Max. RPM (rpm) Max. RCF (xg)
A0.2-32 **(PCR Strip Rotor)** 	Hole angle : ∠45° Max. Capacity : 32 x 0.2 mL Size (ø x H) : ø124 x 22 mm	**Smart 13**	0.2 mL	-	6.5 x 15 Inner line : 31.13 (Min.) 44.06 (Max.) Outer line : 46.13 (Min.) 55.68 (Max.)	6,000 Inner line : 1,253~1,773 Outer line : 1,857~2,241
			0.2 mL strips	-		
A0.2M-32 **(PCR Strip Rotor)** 	Hole angle : ∠45° Max. Capacity : 32 x 0.2 mL Size (ø x H) : ø172 x 38.5 mm	**Smart R17 Plus** **Smart 15 Plus**	0.2 mL	-	6.5 x 17 55.5	12,500 9,695
			0.2 mL strips	-		
A2.0M-18 	Hole angle : ∠45° Max. Capacity : 18 x 1.5/2.0 mL Size (ø x H) : ø147 x 38.5 mm Max. height for tube fit : 53.5 mm **Incl. a lid**	**Smart R17 Plus**	1.5/2.0 mL Micro-filter tube	-	11 x 38 71.2	17,000 23,005
			0.5 mL	**TR0.5**	8 x 37 66	17,000 21,325
			0.2 mL	**TR0.2**	6 x 21 56	17,000 18,094
		Smart 15 Plus	1.5/2.0 mL Micro-filter tube	-	11 x 38 71.2	15,000 17,910
			0.5 mL	**TR0.5**	8 x 37 66	15,000 16,602
			0.2 mL	**TR0.2**	6 x 21 56	15,000 14,087
A2.0M-24 **A2.0MP-24** 	Hole angle : ∠45° Max. Capacity : 24 x 1.5/2.0 mL Size (ø x H) : ø172 x 38.5 mm Max. height for tube fit : 56 mm **Incl. a lid** **A2.0MP-24 incl. plastic lid**	**Smart R17 Plus** **Smart 15 Plus**	1.5/2.0 mL	-	11 x 38 83.7	15,000 21,055
			0.5 mL	**TR0.5**	8 x 37 78.5	15,000 19,747
			0.2 mL	**TR0.2**	6 x 21 68.5	15,000 17,231

* Radius : From the center of the rotor to the inner end of tube carrier.

MEMO

Hanil Scientific Inc.
16 Arayukro, Gimpo 10136, Rep. of KOREA
Tel. +82-2-3452-8965 Fax. +82-70-4275-5747
info@ihanil.com
www.ihanil.com