

SERVICE MANUAL



BENCH TOP CENTRIFUGE ScanSpeed Model 406

Low Speed Centrifuge, 406 – Service manual

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1. Operating Instruction

1.1 About this manual

- This service manual should be used by specialized engineers authorized by Gyrozen Co., Ltd.
- Any repairing work operated by non-authorized personnel cannot be protected and guaranteed.
- This service manual aims to find possible errors quickly and fix them properly.
- Refer to the user's manual for detailed operation of Centrifuge.
- Do not copy or reprint without approval

1.2 Safety Label and safety precaution

1.2.1 Safety label

The labels attached to the device give information for safety.

Label	Information	Label	Information
	Attention label to show risk and warning		Attention label to warn electric shock

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1.2.2 Safety precautions

Make sure to

- Supply proper voltage power according to device's power requirement.
 - Let all repairing works done by authorized or qualified personnel.
 - Use rotors or accessories which are approved by Gyrozen.
 - Not try to open the lid and or move the device while the rotor is running.
 - Operate the centrifuge with a rotor properly attached and secured to the shaft.
 - Not use flammable, hazardous, explosive, or corrosive materials.
- NOTE:** When it is required to use toxic, radioactive materials or pathogenic micro-organisms, which belong to the Risk Group II of WHO: "Laboratory Bio-safety Manual," should follow the regulation guidelines from WHO.
- <http://www.who.int/csr/resources/publications/biosafety/Labbiosafety.pdf>
- Keep away hazardous materials farther than 30 cm (12 in) from the device during centrifugation, as recommended in IEC standards 61010-2-020.
 - Keep the rpm or rcf under its maximum speed in the case that the density of sample materials is greater than 1.2 g/ml to avoid rotor failure.
 - Load samples symmetrically in the rotor diagonally to make balance between the tubes.
 - Balance the load on the rotor totally to prevent the damage to the device even by using several water-filled tubes.
 - Place device on a flat, level, rigid and stable surface.
 - Disconnect power supply prior to maintenance and service work to avoid electrical shock.
 - Use proper disinfection procedures when centrifuging bio hazardous compounds.

In Blackout

When a blackout takes place while the device is running, the door does not open. And the rotor speed begins to decrease at natural level. Even if the power turns on before the rotor stops completely, the rotor does not return to the original speed, but decreases more rapidly with buzzer sound.

Door opening

The door is closed/opened automatically by a door lock unit operated by a solenoid, and it will not be opened while the rotor is running at all. Even if the door is opened accidentally, a door limit switch senses it instantly to make the rotor speed decrease.

Device vibration

If the rotor loses balance while running by any reason, it invokes vibration on the device itself. In this case the Imbalance sensor senses it and makes the rotor begin to decrease with preset level issuing Imbalance Error warning. This safety function protects the device from damage during operation.

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2. Installation

2.1 Unpacking

- 1) Check if the box contains such parts as;
 - ① Power cable, 1ea
 - ② Emergency door open tool, 1ea
 - ③ User's manual, 1ea
 - ④ Rotor (Optional)
 - ⑤ Rotor coupling device
- 2) Open the box and lift out the instrument carefully together with the safety padding.
- 3) Remove the safety padding and vinyl wrap.



- 4) Place the device on the flat surface.

2.2 Location

- 1) Install the device at the solid and flat floor or table. If you place the centrifuge at the slope, the axis of rotation is possibly changed because of the rotor weight.
- 2) Install the device keeping a distance of 30cm at least from the wall. The distance is needed for the air circulation around the device.
- 3) Install the device at the place with appropriate temperature and humidity. These conditions have to be maintained constantly as soon as possible.
- 4) Install the device at the place without any kinds of corrosive gases.

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2.3 Supply the power

- 1) 406 model uses 110V or 220V. Check proper voltage of the device and connect to adequate power outlet.
- 2) If the power input is more than +/- 10% of the recommended voltage or fluctuating frequently, it may affect some functions of the device. In that case it is recommended to use AVR (Automatic Voltage Regulator).
- 3) If you want to use the device under the other voltage range, please contact us for safe usage.

2.4 Power On and opening the door

- 1) Turn on the device by the switch on the right side of the machine.
- 2) Press the 'Door' button to open the door.
If it does not work (door not open), use the emergency door open tool (as the figure)



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3. Device Information

3.1 Special qualities

- High safety and low noise
- Fixed angle rotor available
- Simultaneous display of rpm and rcf speed
- Automatic Alarm function for Imbalance, Door open, Speed trouble
- High tech AC Induction Motor adopted

3.2 Technical Specifications

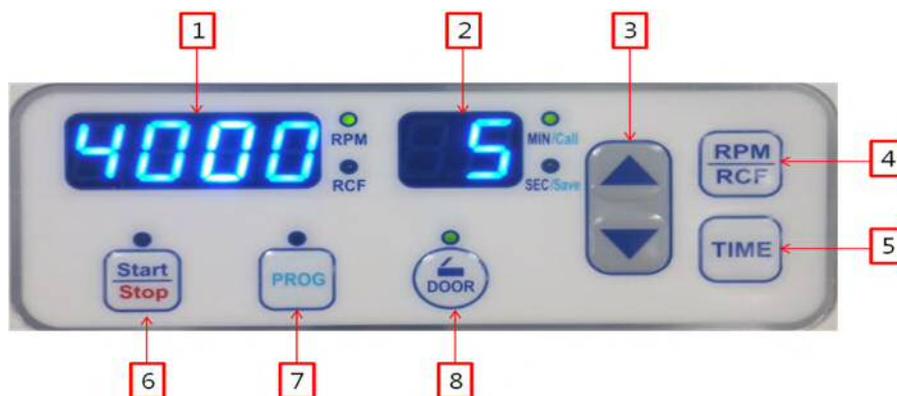
Max. RPM	4,000 rpm
Max. RCF(Fixed Angle)	2,075 xg
Max. capacity(Fixed Angle)	6 x 15 ml
Run time	≤ 99 min 59 sec or continuous
Acc/Dec time	<20 / <20 sec
Program memory	10
Power supply	220V, 50/60Hz
Power requirement	120 VA
Dimension (WxDxH) mm	296 x 412 x 206
Weight	17.5 Kg
CE Certification	Yes

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3.3 Outer Description



3.4 Operating Function of Control Panel



- 1) RPM/RCF display: to show the current RPM/RCF
- 2) TIME display: to show pre-set time up to 99 min 59 sec (00: continuous)
- 3) Up & down button: Uses to change input data.
- 4) RPM/RCF: to switch the RPM/RCF display
- 5) TIME: to set test time up to 99 min 59 sec (00: continuous)
- 6) START/STOP: to start/stop running device
- 7) PROG: to save a set of setting values or call the saved setting values.
- 8) DOOR: to open the door.

* If you press the arrow button longer than 3 seconds, the numbers change rapidly and the set-up is achieved faster.

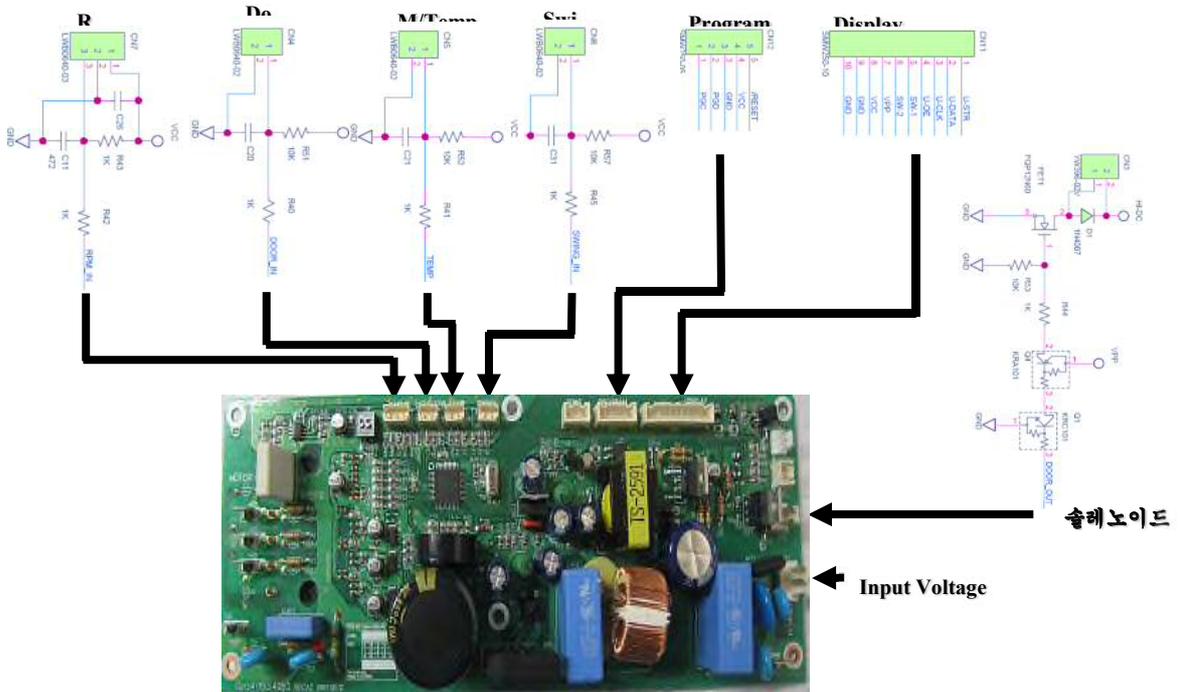
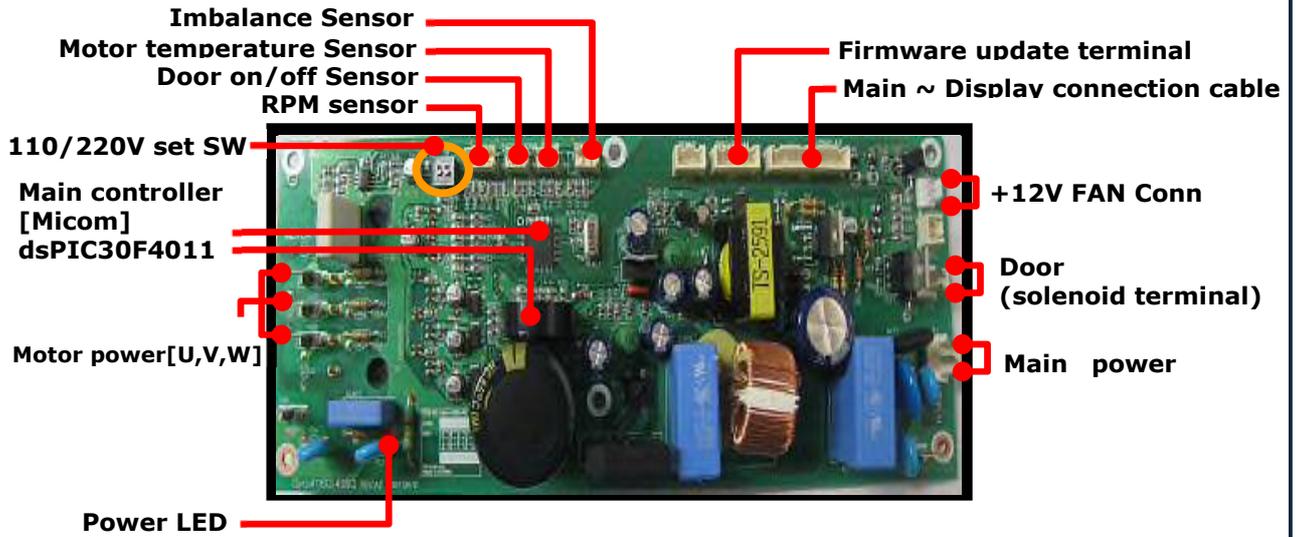
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3.5 Operating System

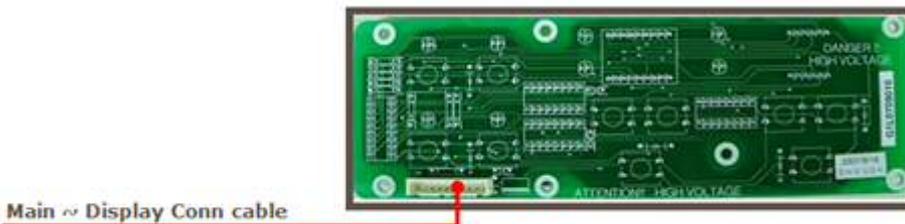


- 1) DSPIC 30F4011, MICOM; It controls all devices.
- 2) SMPS; distributes inlet power to each part as appropriate form.
- 3) Inverter; transforms the single phase power to the 3 phase for running the AC induction motor.
- 4) IPM FSBS5CH60; controls the AC induction motor.
- 5) Solenoid; open and close the door lid automatically.
- 6) Temp sensor; measure the temperature of motor at its surface and issue E3 error if too high(above 110°C).
- 7) Firmware program; is used to update the firmware with notebook and interfacing connector.

3.6 Main Controller Board



3.7 Display Controller Board



4. Disassembling

4.1 Front panel, controller board and bracket

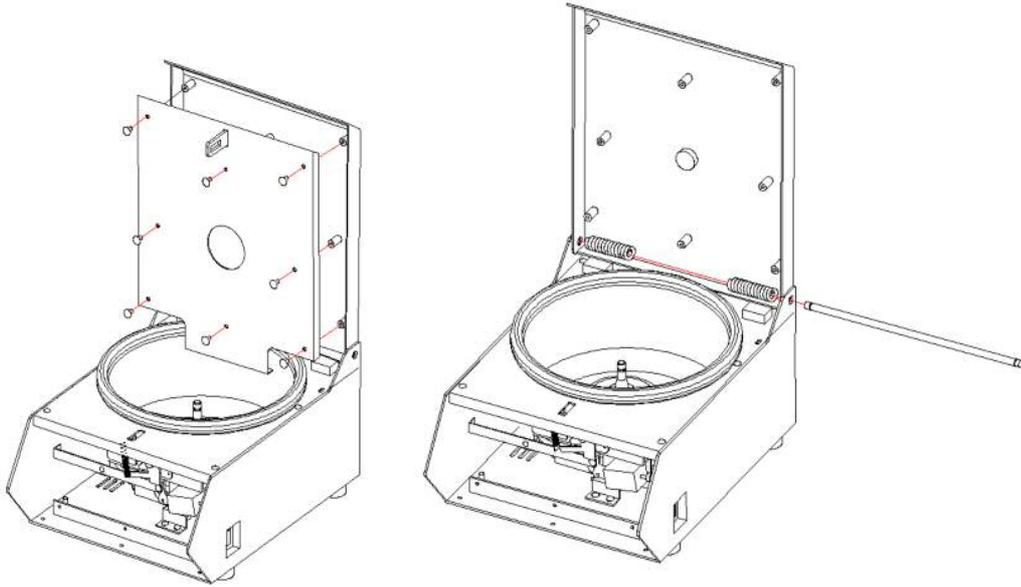


- 1) Open the door
- 2) Remove the 5 screws(red circle).
- 3) Loosen the 2 screws(yellow circle).
- 4) Insert a tool(ex. Driver) into inside(blue circle)
- 5) Pull the tool to detach the front panel.

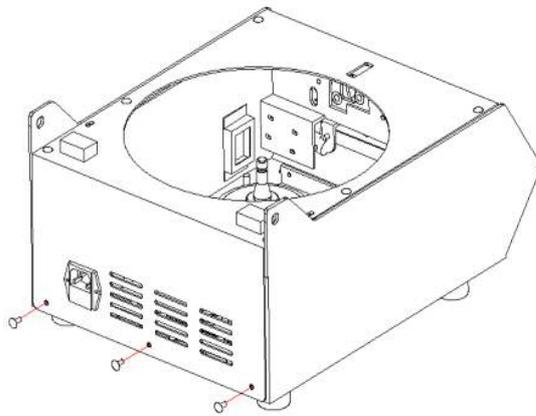


- 6) Remove the screws that fix the controller board.
- 7) Remove 3 screws that fix the board bracket if needed.

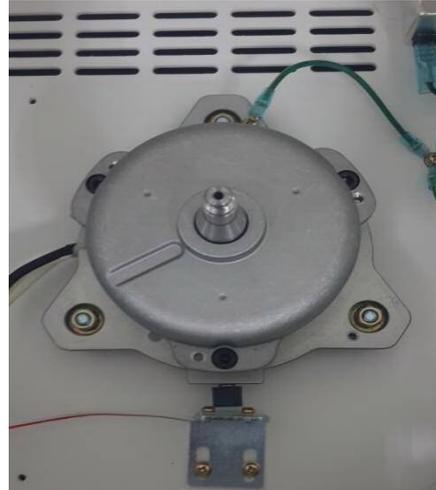
4.2 Door Assembly



- 1) Remove the screws and detach the door bottom.
- 2) Disassemble the shaft and springs that couple the door and case top.
- 3) Disassemble the door assembly.



4.3 Motor cover & Chamber



- 1) Remove the 3 screws and the motor cover.
- 2) Remove the Chamber.

4.4 Door Lock Assembly



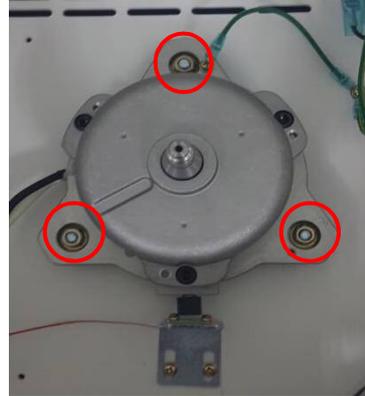
- 1) Remove the front panel.
- 2) Detach the connectors of solenoid and door sensor from the main board.
- 3) Remove the Main Board bracket.
- 4) Remove the 3ea screws at the door lock assembly
- 5) If needed, door sensor or solenoid can be replaced.

4.5 Motor assembly

<Ver 1>

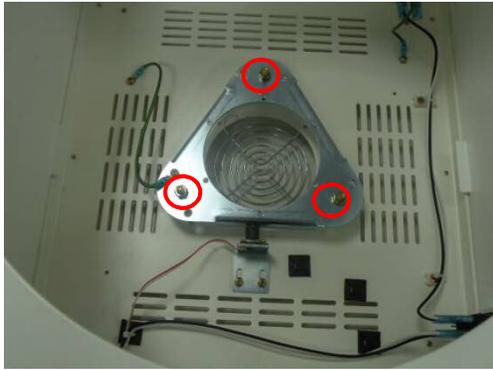


<Ver 2>



- 1) Remove the motor cover and the chamber.
- 2) Remove 3 ea of screws on the motor assy(old model).
- 3) Remove the 3ea of nuts(new model)
- 4) Detach the motor assy

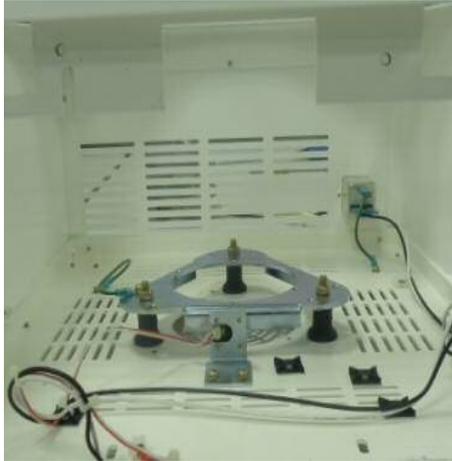
4.6 Anti-vibration rubber



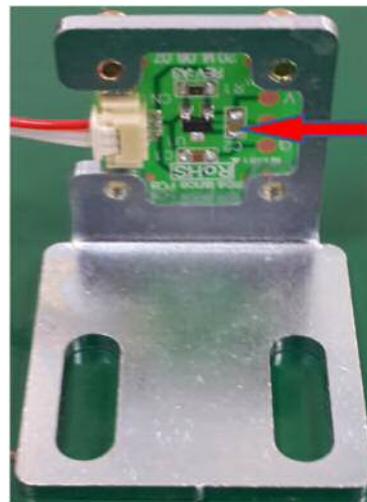
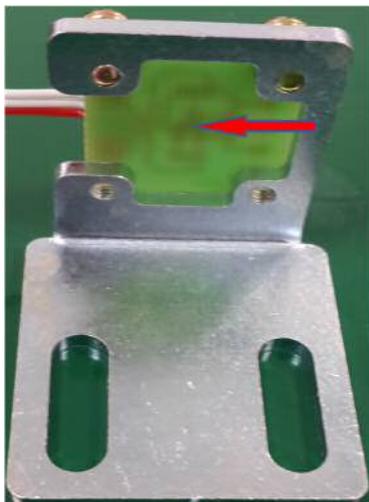
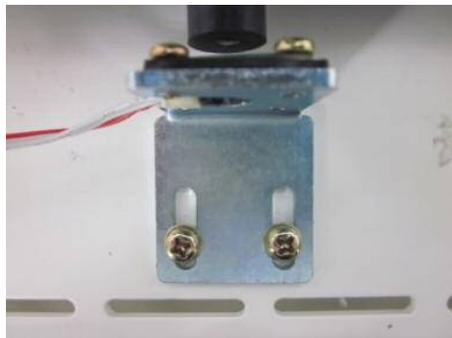
- 1) Remove 3 ea of nuts from the motor bracket(old model).
- 2) Detach the motor bracket(old model)
- 3) Remove the 3ea of nuts from motor assy(new model).
- 4) Remove the motor assy(new model).
- 5) If needed, detach the anti-vibration rubber to replace them.

4.7 Imbalance sensor assembly

<Ver 1>

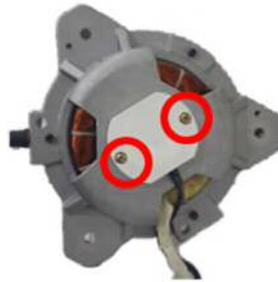
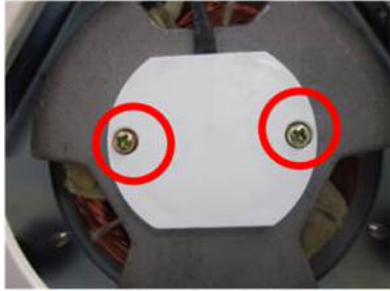


<Ver 2>



- 1) Remove the 2 ea of screws.
- 2) Detach the imbalance sensor bracket.
- 3) Remove the 4 ea of screws.
- 4) Detach the imbalance sensor (Hall sensor).
- 5) In the case of adjusting the imbalance sensor, refer to 5.3

4.8 RPM sensor assembly



- 1) Detach 2 ea of screws at the bottom of the motor assy.
- 2) Detach the RPM sensor assy.

5. Service Mode and Adjustment

5.1 Transition into service mode

On the Control panel



- 1) Power ON while pushing the RPM key and TIME key at the same time
- 2) When beep sounds push the UP(▲) key and push the DOWN(▼) key until "Set Window" appears. (beginning of Service mode).

5.2 Handling values

- 1) Confirm the set values with the Up/Down key.
The numeric value on the right FND varies by one. (refer to figure below)
- 2) Imbalance sensitivity can be adjusted by RPM(increase) and TIME(decrease) button when the right numeric value is '9'. And it can be saved by pushing the RPM key and TIME key at the same time.
- 3) Power off to return from service mode.

	RPM Current
	Motor output frequency
	Motor output voltage
	Motor input voltage
	Motor Temperature
	Main program
	Motor running time total
	Imbalance distance
	Imbalance error range

5.3 Procedure for Imbalance adjustment

1) Press ▲ or ▼ until the number of right side becomes "8" as the picture below.



- Displayed Value(176 or 87) means **HALL** i.e. the physical distance status of the hall sensor.
- The normal value of imbalance sensor lies between 170 and 200 (70~100). If it lies between 170 and 200 (70~100), the sensor position is fine. The adjustment to align the sensor position is not needed.

2) Press ▲ or ▼ until the number of right side is "9" as below picture.



- Displayed Value(10 or 15) means **Imbalance** i.e. **The tolerance of imbalance sensitivity window**
- Set the imbalance range to become 176 +/-10 (87+/-15). If the distance of imbalance sensor goes over 176 +/-10 (87+/-15), the sensor will make alarm for warning.
- **Increase Number:** to Lower sensitivity
- **Decrease Number:** to Higher sensitivity
- The values can be changed by pressing  button to increase the value or  button to decrease the value.

3) Press  and  buttons simultaneously to save the value.

5.4 Door lock ass'y adjustment

By some reason when the door does not fit, so it does not open or close normally, the Door lock ass'y can be adjusted.(position moved).



- 1) Detach the front panel and Main Board bracket.
- 2) Loosen the 3 screws that fix the Door lock.(red line)
- 3) Reposition the Door lock ass'y.
- 4) Fasten the 3 screws.

6. Error code and Troubleshooting

6.1 Error code

In the event of a malfunction, an error message with code number appears indicating the possible causes and the device is forced to stop. Turn off the power immediately, identify the causes and follow the corrective actions as recommended below.

Error Code	Problem	Possible Cause/Co
E1	RPM Sensor Error: <i>Failure to reach to 200 rpm within 2 sec.</i>	<ul style="list-style-type: none"> • Motor is out of order • RPM Sensor is defective or damaged. • RPM sensor cable or wire is not connected. <p>Corrective Action</p> <ul style="list-style-type: none"> • Turn the power switch off. • Check RPM sensor and cable. • Test again to see if the problem is repaired. <p>If the problem is not be fixed;</p> <ul style="list-style-type: none"> • Replace the RPM sensor assy
E2	Door Open Error: <i>Door opens during operation</i>	<ul style="list-style-type: none"> • Door lock is loosened • Door open sensor is defective or damaged. <p>Corrective Action</p> <ul style="list-style-type: none"> • Turn the power switch off. • Detach the front panel. • Test by Door button to see if the solenoid works. • Adjust the Door lock position. <p>If the problem is not fixed;</p> <ul style="list-style-type: none"> • Replace the Door Lock assy or, • Replace the solenoid assy and sensor
E3	Motor Overheated: <i>Detected internal temperature is higher than 110°C</i>	<ul style="list-style-type: none"> • Ventilation inlet opening is blocked. • Temperature sensor is defective or damaged. <p>Corrective Action</p> <ul style="list-style-type: none"> • Clean the ventilation inlet opening or remove any objects blocking inside. • Turn the power switch off and wait about 1 hour with the door opened for cooling down the motor. • Test again to see if the problem remains. <p>If the problem is not fixed;</p> <ul style="list-style-type: none"> • Replace the motor
E4	Under voltage <i>Supply voltage to Motor is lower than required.</i>	<ul style="list-style-type: none"> • SMPS and Inverter on the main board does not work normally. <p>Corrective Action</p> <ul style="list-style-type: none"> • Confirm the voltage under the Test mode. • Replace the motor.
E5	Over voltage <i>Supply voltage to Motor is lower than allowed.</i>	<ul style="list-style-type: none"> • SMPS and Inverter on the main board does not work normally. <p>Corrective Action</p> <ul style="list-style-type: none"> • Confirm the voltage under test mode. • Replace the motor.
E6	Over speed <i>Actual rpm speed value is higher 1,000 rpm than set speed value</i>	<ul style="list-style-type: none"> • Inverter on the main board does not work normally. <p>Corrective Action</p> <ul style="list-style-type: none"> • Confirm the speed under test mode or by tachometer. • Upgrade the firmware <p>If the problem is not fixed;</p> <ul style="list-style-type: none"> • Replace the motor
E7	Control system failure <i>Device does not work at all</i>	<ul style="list-style-type: none"> • Failure of control firmware <p>Corrective Action</p> <ul style="list-style-type: none"> • After power on, check if the beep sound issued. • Check if the Power LED on the main board is on.

		<p>If some trouble of firmware is confirmed;</p> <ul style="list-style-type: none"> • Update the firmware
E8	<p>Rotor Imbalance</p> <p><i>Rotor is not balanced around its center of rotation (E8 is issued always during the operation)</i></p>	<ul style="list-style-type: none"> • Device is not positioned on a flat, level, and vibration free surface <p>Corrective Action</p> <ul style="list-style-type: none"> • Relocate instrument to a flat, level, and vibration free surface. <ul style="list-style-type: none"> • Rotor is loaded with samples not evenly weighted symmetrically <p>Corrective Action</p> <ul style="list-style-type: none"> • Make sure that samples are evenly weighted and distributed symmetrically around the center of rotation. <ul style="list-style-type: none"> • Rotor is not securely attached to the shaft <p>Corrective Action</p> <ul style="list-style-type: none"> • Make sure the rotor and/or rotor lid is securely attached to the shaft. <ul style="list-style-type: none"> • Imbalance sensor is setup too sensitively <p>Corrective Action</p> <ul style="list-style-type: none"> • Test 1st time with imbalance distance between 170 and 200 and with imbalance range of 10. • Test 2nd time with imbalance range more than 10. • Refer to 6.3 for details. <p>If E8 error is issued on 1st and not on 2nd test;</p> <ul style="list-style-type: none"> • Imbalance sensor works normally. • Set the distance and range with the original value at the time of production.
E9	<p>RPM sensor error</p> <p><i>Rotor is not recognized and RPM data is lost.</i></p>	<ul style="list-style-type: none"> • Rotor is installed properly <p>Corrective Action</p> <ul style="list-style-type: none"> • Install the rotor as instructed in the manual • Make sure that rotor is aligned correctly. <ul style="list-style-type: none"> • Incorrect rotor is installed <p>Corrective Action</p> <ul style="list-style-type: none"> • Replace the rotor with correct one. <ul style="list-style-type: none"> • RPM sensor is defective or damaged. <p>Corrective Action</p> <ul style="list-style-type: none"> • Check if RPM value on the display <p>If RPM value does not vary;</p> <ul style="list-style-type: none"> • Replace RPM sensor with normal one.
E15	<p>Motor Temperature error</p> <p><i>Temperature of Motor goes too high</i></p>	<ul style="list-style-type: none"> • Temperature sensor is defective or damaged. <p>Corrective Action</p> <ul style="list-style-type: none"> • Measure the resistance value of temperature sensor. • Check if the value falls on 10,000Ω(10kΩ) at 25°C. <p>If Temperature sensor is not normal;</p> <ul style="list-style-type: none"> • Replace the sensor with normal one.

6.2 Troubleshooting

If other malfunctions without error code indication occur, turn off the power immediately. Then identify the causes and carry out the corrective action as indicated below. If the device stops due to the error indication, it cannot be restarted until error is cleared. After the problem is fixed, restart the device to check if the error occurs again.

Error Indication	Possible Reason
No display or power: <i>Power failure during operation; display screen is blank</i>	<ul style="list-style-type: none"> Device is powered up incorrectly
	Corrective Action <ul style="list-style-type: none"> Plug the power cord into the appropriate power outlet.
	<ul style="list-style-type: none"> Device is not connected to the power outlet
	Corrective Action <ul style="list-style-type: none"> Make sure to securely connect the power cord to the power outlet.
Operation cannot start <i>Rotor does not rotate</i>	<ul style="list-style-type: none"> Rotor recognition or sensor error
	Corrective Action <ul style="list-style-type: none"> Perform the corrective action as listed in E1 and/or E9.
	<ul style="list-style-type: none"> Door is not closed completely
	Corrective Action <ul style="list-style-type: none"> Make sure to press down the door firmly until the latch handle is fully retracted.
Door does not open/close <i>Door does not fit the door lock</i>	<ul style="list-style-type: none"> Door lock sensor error
	Corrective Action <ul style="list-style-type: none"> Replace the sensor with normal one.
	<ul style="list-style-type: none"> Temporary system error
	Corrective Action <ul style="list-style-type: none"> Turn the power switch off and reset device.
Door does not open/close <i>Door does not fit the door lock</i>	<ul style="list-style-type: none"> Door lock is not assembled at proper position. Door latch does not work properly.
	Corrective Action <ul style="list-style-type: none"> Open the door by emergency door open tool. Detach the front panel check the trouble cause. Adjust the position of Door lock or replace it.
Door open LED always on <i>Device does not start</i>	<ul style="list-style-type: none"> Door lock sensor is defective or damaged.
	Corrective Action <ul style="list-style-type: none"> Detach the front panel. Check if the sensor is defective Replace the defective sensor with normal one
Vibration is excessive. <i>Unusual noise issues</i>	<ul style="list-style-type: none"> Rotor is not balanced
	Corrective Action <ul style="list-style-type: none"> Perform the recommended corrective action as listed in E8.

7. Maintenance

7.1 Cleaning and disinfection

1) Outer part of device

- ① Clean the outside of the device with a dry soft cloth. If necessary, dip the cloth with neutral detergents and clean contaminated parts. Keep dry completely after cleaning.
- ② Do not use any volatile chemicals such as alcohol, benzene, etc.
- ③ If any rust appears, clean with neutral detergents and dry it.

2) Inner part of device

- ① Keep dry inside the chamber after every use of the device.
- ② Clean the shaft always for avoiding an imbalance error during the rotation.
- ③ If any part is contaminated, clean with neutral detergents.

3) Rotor

- ① Clean the rotor if rotor is contaminated by any samples.
- ② Keep dry it after usage.

4) Moving or shipping of device

- ① If you need to move the device, make sure to protect the shaft from any physical impact.
- ② Remove the rotor and fill inside the chamber with proper materials to keep the shaft on place.

7.2 Device test for centrifuges

7.2.1 Validation of actual RPM



1. Prepare a RPM speed tachometer (hand tachometer) and fluorescent light tape.



2. Attach some fluorescent light tape on a grip of a rotor lid.



3. Set the specific rpm and start the operation.

4. Measure an actual rpm using the tachometer through center window of main body lid.

7.2.2 Validation of Motor performance



Check the resistance value at motor output terminals (Unit: Ω)

<i>Motor</i>	<i>U</i>	<i>V</i>	<i>W</i>
AC Induction 200watt	White	Red	Black

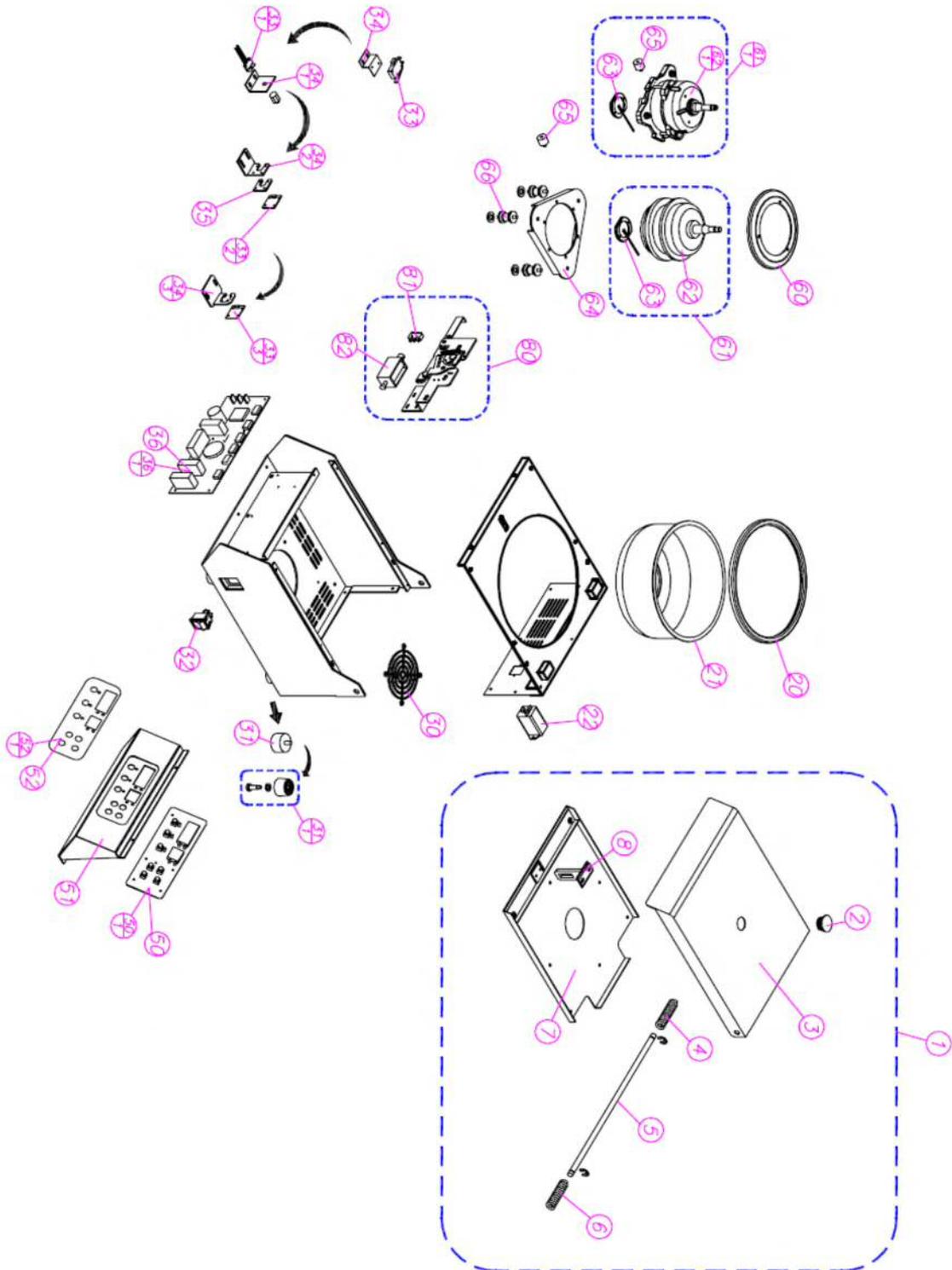
Measuring method

- 1) Use 'Multi meter tester' tool
- 2) Place the tool at the resistance location
- 3) Check the resistance value at u-v, u-w, v-w with tester lead
- 4) If the value is 0 or ∞ ohm, it means some trouble so it needs repairing.
- 5) The normal status is that 3 resistance values(u-v, v-w, w-u) are all same within a range of $\pm 5\%$.

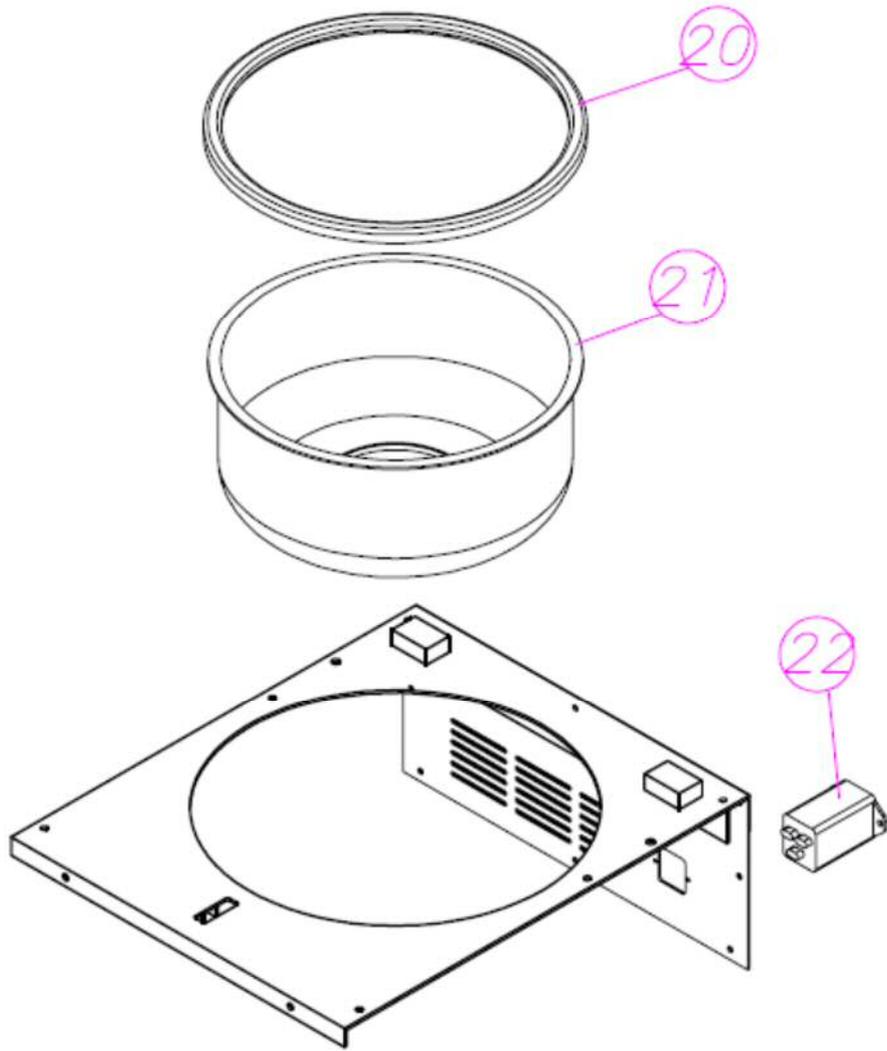
8. Parts Information

8.1 Assembly Drawing

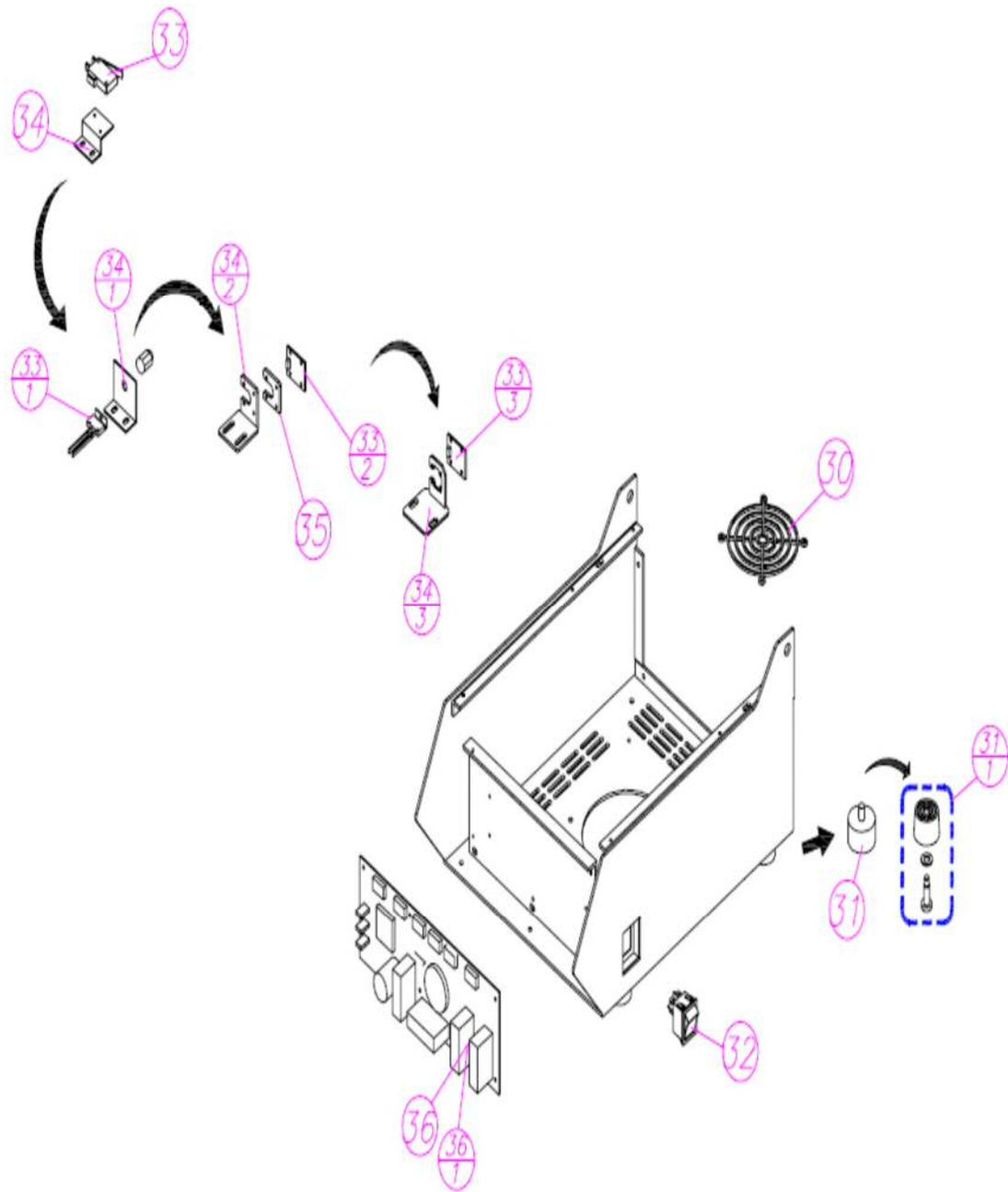
1) All parts



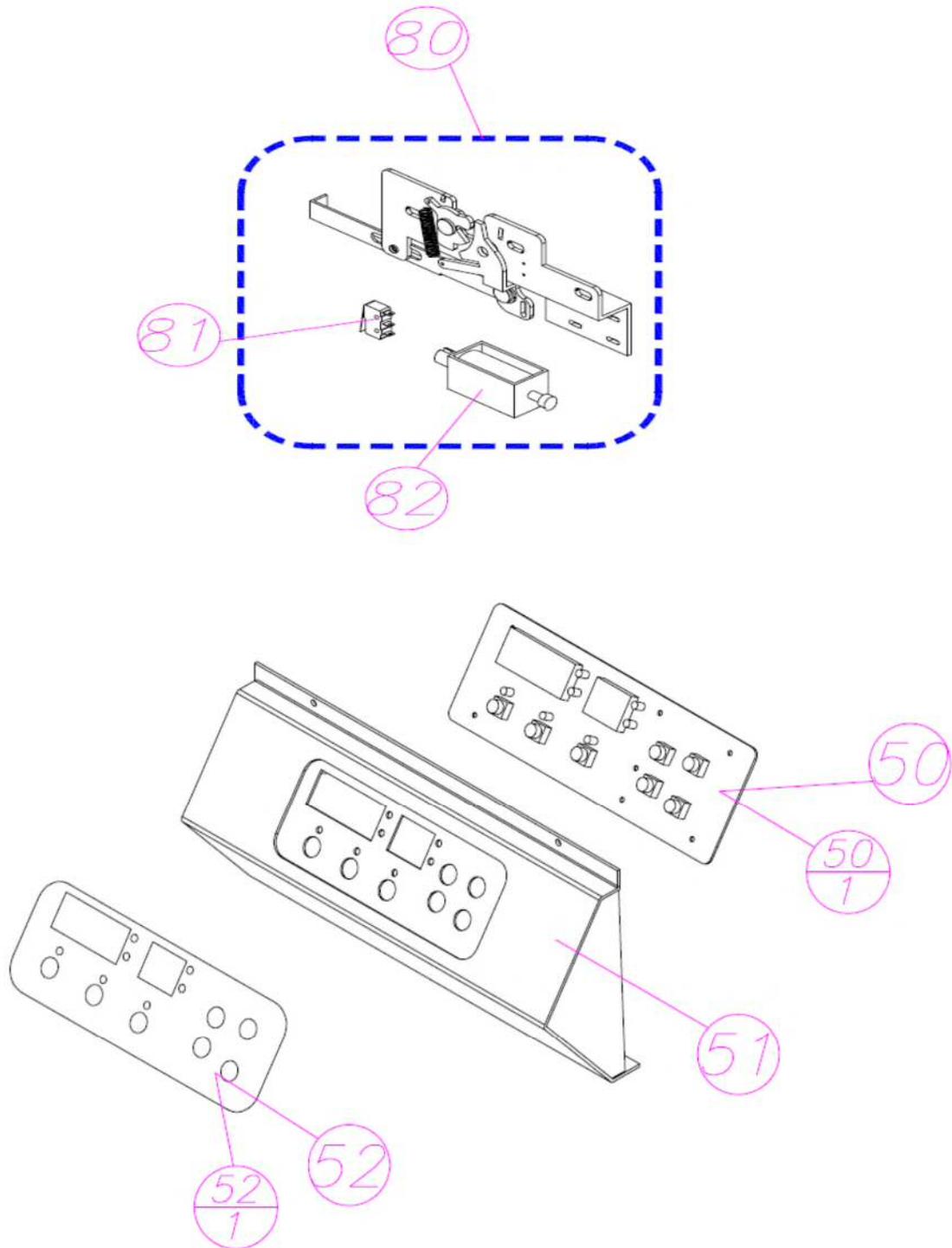
2) Case(Top) & Chamber



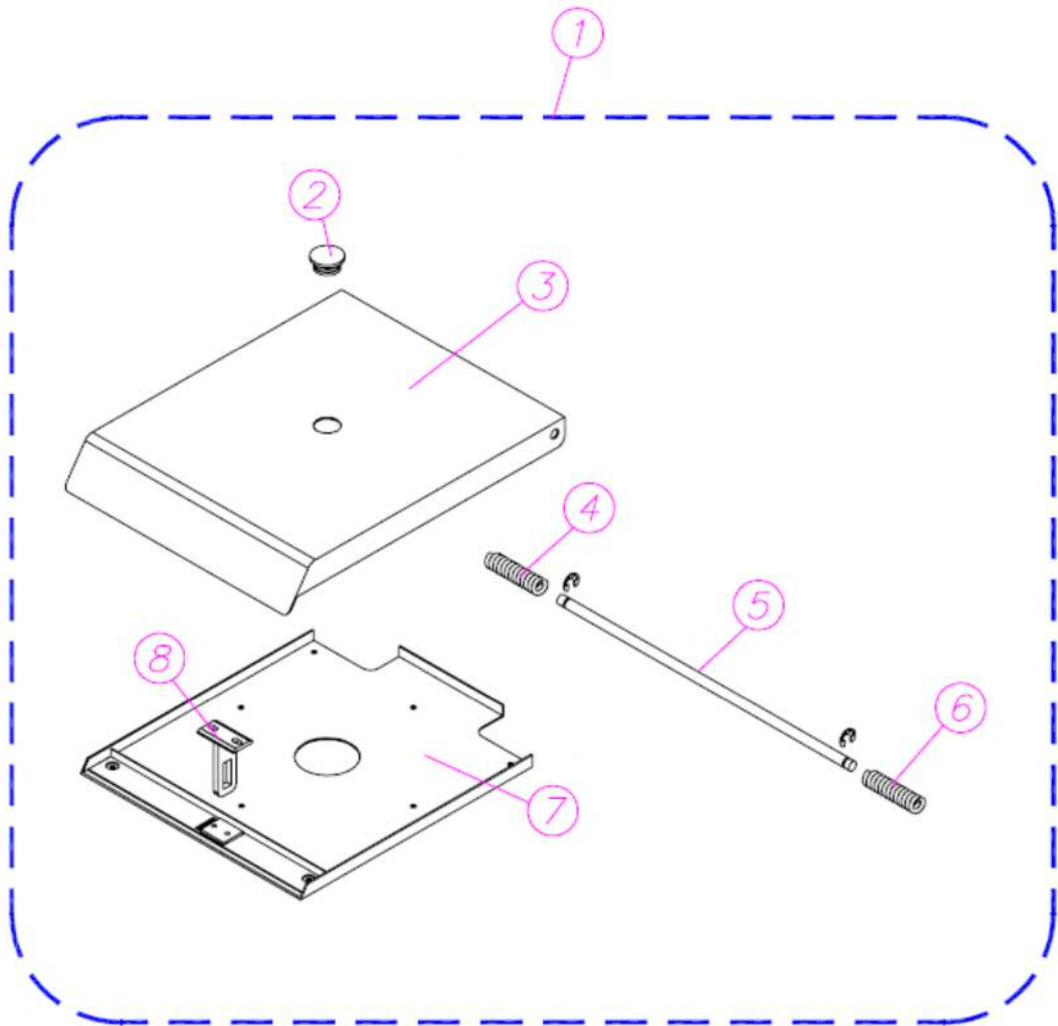
3) Case(Bottom)



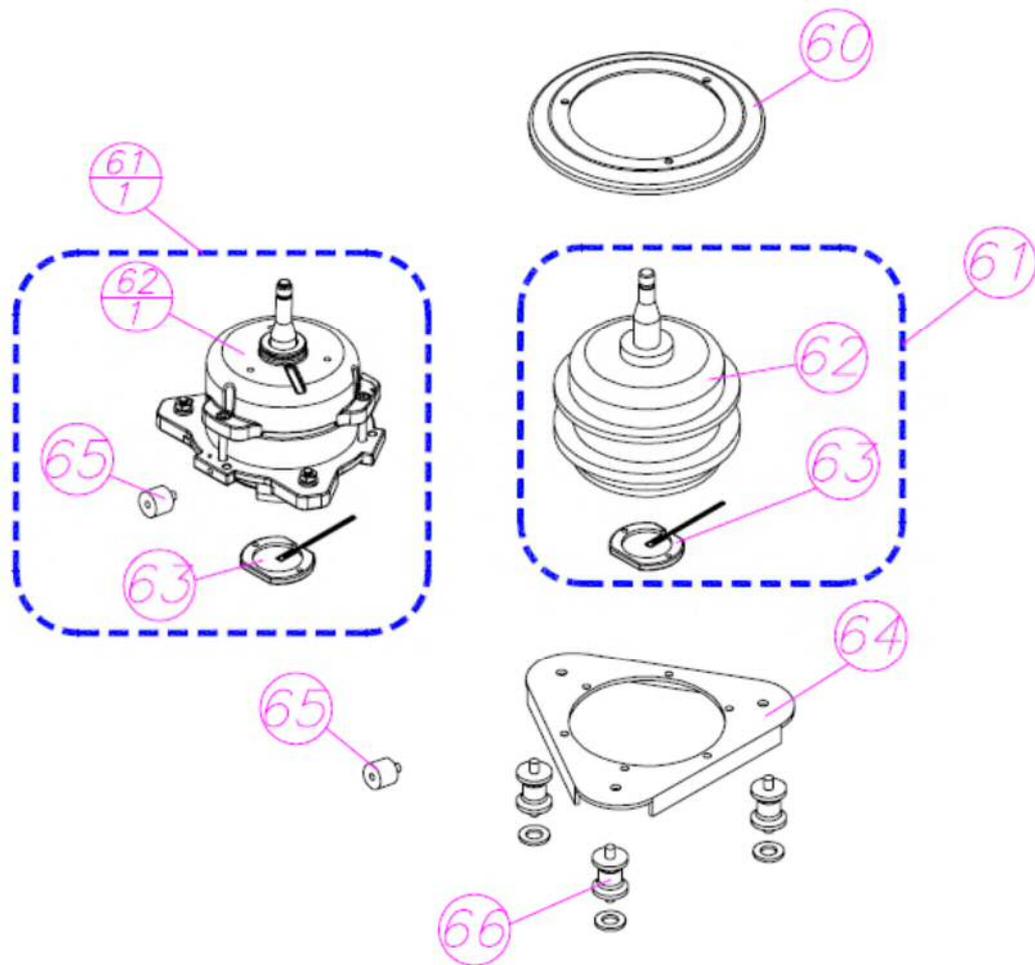
4) Door lock & Front Panel



5) Door



6) Motor



8.2 Part List

No.	Part No.	Part Name	Remark
1	C00DR90100-00	Door Ass'y	
2	C99DR00420-03	Center window	
3	C00DR00132-02	Door (Top)	Without a center window
4	C00DR05120-01	Hinge spring (Left) - 406	
5	C00DR04420-01	Hinge pin - 406	
6	C00DR05020-01	Hinge spring (Right) - 406	
7	C00DR00332-01	Door (Bottom)	
8	C99DR00520-04	Door Striker(51mm)	
20	C00RB00220-01	Chamber Packing - 406	
21	C00CH00134-03	Chamber - 406	
22	C01EL01110-00	Noise filter	
30	V01CS04610-00	Wired guard 120mm(Motor)	
31	G1101120	Foot, rubber	An instrument requires 4ea.
31-1	C01RB00820-01	Foot, rubber	An instrument requires 4ea.
32	C99EL00610-00	Power switch	
33	G1103230	Imbalance sensor	
33-1	G1103232	Imbalance sensor	
33-2	C99BD00720-01	Imbalance sensor (PCB A2)	
33-3	C99BD00720-02	Imbalance sensor (PCB A3)	
	C99EL81100-00	Imbalance Sensor Ass'y	Imbalance sensor (PCB A3) and Cable(Imbalance)
	C99EL08220-01	Cable(Imbalance)	
34	G1103221	Imbalance Bracket	For Imbalance sensor (G1103230)
34-1	G1103222	Imbalance Bracket	For Imbalance sensor (G1103232)
34-2	C99CS02633-04	Imbalance Bracket (for PCB A2)	Imbalance sensor(PCB A3) and Cable(Imbalance)
34-3	C99CS02633-06	Imbalance Bracket (for PCB A3)	
35	C99RB00520-00	Insulator rubber for Imbalance sensor (PCB A2)	

36	G1109011	Main PCB - 406/416G (A5)	
36-1	C01BD00120-02	Main PCB - 406/416G (A6)	From G023511090107 / L022611090046
50	C00BD00220-00	Display Board -406	
50-1	C00BD00220-01	Display Board -406 (Blue)	
51	C00CS00322-03	Case(Front) (406)	
52	C00CS04020-04	Overlay-406 (Green)	
52-1	C00CS04020-05	Overlay-406 (Blue)	
60	C01CS02434-02	Cover of Motor	
61	C00MT90200-00	Final Motor Assembly (220V)	Until 2013.02.06
	C00MT90100-00	Final Motor Assembly (110V)	Until 2013.02.06
61-1	C00MT90200-01	Final Motor Assembly (220V)	From 2013.02.07
	C00MT90100-01	Final Motor Assembly (110V)	From 2013.02.07
62	C00MT80200-00	Motor Assembly (220V)-406	Until 2013.02.06
	C00MT80100-00	Motor Assembly (110V)-406	Until 2013.02.06
62-1	C00MT80200-01	Motor Assembly (220V)-406	From 2013.02.07
	C00MT80100-01	Motor Assembly (110V)-406	From 2013.02.07
63	C00MT80700-00	RPM sensor holder Assembly - 406	
64	C01CS02733-06	Bracket for Motor	
65	C99RB00620-00	Magnet packing for Imbalance sensing	
66	C00RB00120-00	Anti-vibration Dampers	One set is composed of three dampers.
80	C00DR90200-00	Door Lock Assembly (220V) - 406	
	C00DR90100-00	Door Lock Assembly (110V) - 406	
81	C00EL90100-01	Door sensor - 200	
82	C99EL03020-00	Solenoid - 110V	
	C99EL03120-00	Solenoid - 220V	