

Operating Instructions

EBA 22

Please enter the following details :	
Stock No.
Monitoring No.
Location

The operating instruction has to be used for the centrifuges bearing the following Manufacturing No.

(the Manufacturing No. of a centrifuge can be see from the name plate)

Type of centrifuge	Voltage	Article No	Manufacturing No.
EBA 22	230 V	1005	XXXX
EBA 22	115 V	1005-01	XXXX



Certificate of EU - Conformity

as defined by the EU regulations

- for machines 89/392/EWG
- for electro-magnetic compatibility 89/336/EWG, amended by regulations 91/263/EWG, 92/31/EWG and 93/68/EWG
- for low voltage 73/23/EWG, amended by regulation 93/68/EWG

We, Messrs. Andreas Hettich
Gartenstraße 100
D-78532 Tuttlingen,

hereby certify that centrifuge model(s)

EBA 22

is (are) manufactured in accordance with the following standards and regulations:

EN 61010 part 1 and 2

EN 55011

in addition the following national standards and regulations are applied:

VBG 1 DIN 58970

VBG 4 BS 4402

VBG 7z

VBG 20

Tuttlingen 11.05.1999

Hettich Zentrifugen

i. V. H. Pistor, sales manager

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1. Intended application

The centrifuge is used for separating substances or mixtures with a density of up to max. 1.2 kg/dm³.

Through the production of centrifugal force it can separate mixtures or alter the proportions in a mixture.

2. Notes on safety



- This centrifuge is a state-of-the-art piece of equipment which is extremely safe to operate.
 - However, it can lead to danger for users or others if used by untrained staff, in an inappropriate way or for a purpose other than that it was designed for.
- Before the initial operation of your centrifuge you should read and pay attention to the operating instructions.
- Along with the operating instructions and the legal regulations on accident prevention, you should also follow the recognised professional regulations for working in a safe and professional manner.

These operating instructions should be read in conjunction with any other instructions concerning accident prevention and environmental protection based on the national regulations of the country where the device is to be used.
- The centrifuge should be installed on a good, stable base.
- When setting the equipment up you should pay attention to the following points:
 - A 300 mm safety zone must be established around the centrifuge in accordance with IEC 1010-2-2.
 - This safety zone must be kept clear of both people and hazardous substances at all times when the centrifuge is in operation.
- Do not place any object in front of the ventiduct.
- The centrifuge should always be loaded evenly.
- Centrifuge containers must not be filled beyond the capacity specified by the manufacturer.
 - Centrifuge containers should only be filled outside the centrifuge.
- Standard centrifuge containers of glass will not stand RCF values exceeding 4000 (DIN 58970, pg. 2)
- No attachments should be used other than those authorised by the manufacturer.
- The centrifuge may only be operated when the balance is within the bounds of acceptability.
- The centrifuge must not be operated in areas subject to danger of explosions.
- The centrifuge must not be used with:
 - inflammable or explosive materials
 - materials that react with one another producing a lot of energy.
- If users have to centrifuge hazardous materials or compounds contaminated with toxic, radioactive or pathogenic micro-organisms, they must take appropriate measures.

In the case of material belonging to risk group II (see the World Health Organisation's "Laboratory Biosafety Manual") they should employ a biosafety system. Under this system small drips and aerosols are prevented from escaping by a bioseal (packing ring) located between the hanger and the lid. Centrifuge containers with special

screw caps, as obtainable through trade suppliers, can also be used for hazardous substances.

In the case of materials from the higher risk groups greater safety provision is required than the arrangements described above. In a biosafety system, centrifuge containers with special screw caps must be used.

- For further details of available biosafety systems see section “Rotors and accessories”.
- The centrifuge must not be operated with highly corrosive substances which could impair the mechanical integrity of rotors, hangers and accessories.
- Any rotors, hangers or accessories showing clear signs of corrosion or mechanical defects must not be used for centrifuging.
- In order to prevent corrosion developing through cleaning or disinfectant agents, it is most important that any specific instructions from the manufacturers of such agents should be followed carefully.

If in doubt, you should obtain relevant information from the manufacturers.

- Only original spare parts and authorised original accessories may be used.
- In case of fault or emergency release, never touch the rotor before it has stopped turning.
- This centrifuge is classified in Germany as a Group 3 device according to the *Medizinische Geräteverordnung MedGV* (the regulations on medical equipment).
- It conforms to safety regulations based on:
 - IEC 1010-1/-2
 - DIN - EN61010 Parts 1 and 2
- The safe operation and reliability of the centrifuge can only be guaranteed if:
 - the centrifuge is operated in accordance with the operating instructions,
 - repairs are carried out by engineers approved by the manufacturer,
 - the electrical installation on the site where the centrifuge is installed conforms to the demands of IEC stipulations,
 - prescribed tests to UVV-VBG7z are carried out by an expert.

No claim under guarantee will be considered by the manufacturer unless the above instructions have been adhered to.

3. Warning symbols



Caution! Follow instructions carefully.



Load centrifuge rotor evenly.
All positions on rotor must be filled.



Do not fill centrifuge containers inside the centrifuge.

4. Delivery checklist

The following items and accessories are delivered with the centrifuge:

	Order no.
1 Connecting cable	
- 230 V version	4718
- 115 V version	6083
1 Hex. pin driver	E613
1 Release pin	E003
1 Notes on moving the equipment safely	AH048XX
1 Operating instructions	AB048GB
1 Rotor instructions	B032

The rotor(s) and associated accessories are included in the delivery in the quantity ordered.

5. Technical specifications

Manufacturer	Hettich Zentrifugen D-78532 Tuttlingen	
Model	EBA 22	
Product No.	1005	1005-01
Mains voltage ($\pm 10\%$)	208-240 V 1~	115 V 1~
Mains frequency	50-60 Hz	50-60 Hz
Connected load	1,9 A	A
Current consumption	260 W	W
Power consumption	400 VA	VA
Max. capacity	6 x 50 ml	
Max. density	1,2 kg/dm ³	
Speed RPM	15000	
Force RCF	21382	
Kinetic energy	3000	
Obligatory inspection	no	
Environment	5°C to 40°C	
– Ambient temperature	max. 80% to 31°C,	
– Relative humidity	descending in a linear pattern down to 50% at 40°C	
Sample overtemp.	≤ 15 K	
Class of protection	I	
Radio interference suppression	230 V, 50 / 60 Hz EN 55011 ISM Klasse B	
Noise level (dependent on rotor)	60 dB(A)	
Dimensions		
• Width	332 mm	
• Depth	389 mm	
• Height	276 mm	
Weight approx.	16 kg	

6. Initial operation



- The amount of space required is given under dimensions in the “Technical specifications” section.
The centrifuge should be set up in a suitable position on a good, firm surface.
When setting up the equipment, care should be taken to provide the required safety area of 300 mm around the centrifuge in accordance with IEC 1010-2-2.



The safety area must be clear of all persons and hazardous substances at all times when the centrifuge is in operation.

- You should check that the mains voltage corresponds to that stipulated on the model plate.
- Using the connecting cable provided, the centrifuge should be connected to a standard mains socket.
- Mains switch "**ON**". Switch position "I".
The software type and version are displayed.
After 8sec change over to the normal position occurs

#	XXXXX	XX:XX
Memory	RPM	Time

- After the  LED has illuminated, swivel the hand grip on the cover upwards.
The  LED will go out
- Open the lid.



The lid can only be opened when the centrifuge is switched on and the rotor is at rest. If it cannot be opened under these circumstances, see the section on “Emergency release”.

- Remove the transport safety device (see instruction sheet on “Moving the equipment safely.”).

7. Installing the rotor and fitting attachments

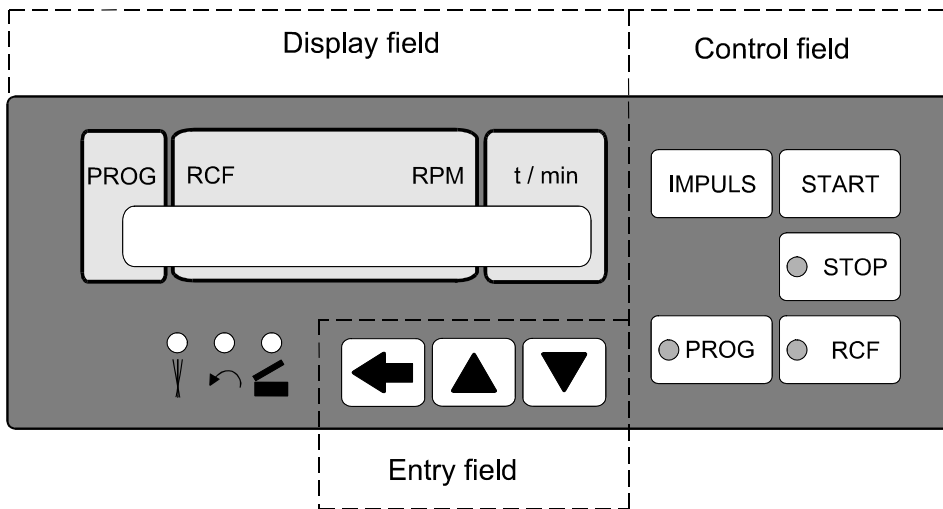
See Rotor Instructions B032 or the section “Changing the rotor”.

- All spaces must be filled on rotors with free-swinging hangers. No empty rotor positions are permitted.
- Always fill the centrifuge containers outside the centrifuge.
- Check by eye that each container is filled to the same level.
- Loads must be equal between opposing positions.

For details of allowable combinations see the section “Rotors and accessories” in the appendix.

Close the lid. Swivel the hand grip downwards.

8. Control and display elements



8.1. Entry field



Selector key for selecting the individual parameters for numerical input.. The next parameter can be selected by pressing the selector key again.



Pressing the arrow keys has the effect of increasing or decreasing the numerical value of a selected parameter.



By keeping either of these arrow keys pressed down you can increase or decrease the value at an ever-increasing rate.

8.2. Control field



Start centrifuging in accordance with the parameters displayed in the display field.

The rotation indicator  illuminates in the display field.



Stop centrifuging.

The rotor will run down with the brake applied according to the parameter defined. The LED in the key remains lit until the rotor comes to rest.

Pressing the  key twice triggers the EMERGENCY STOP.

If braking level 1-9 has been set, the rotor decelerates with braking level 9 (shortest run-down time).

If braking level 0 has been set, the rotor does not decelerate with braking level 9 but with a reduced braking force.



Selector key for toggling between RPM and RCF menus.

The chosen menu is confirmed by the cursor " ^ ".



The rotor spins at the predetermined speed or with the predetermined relative centrifugal force (RCF) for as long as this key remains pressed down.



Key for program input or program retrieval.

Repeated pressing of this key triggers a rolling display of programs 1 - 2 - 3 - #.

8.3. Display field

When RPM or RCF menus are preselected

t/min Display of remaining time if time is preset.
t/sec Display of on-transition time in the case of continuous operation or short-time operation.



Run-up parameter (run-up time).



Run-down parameter (run-down time).

When RPM menu is preselected

RPM Chosen rotational speed (RPM) is displayed when rotor is stationary. Current speed (RPM) is displayed while the centrifuge is running.

When RCF menu is preselected

RCF Chosen relative centrifugal force (RCF) is displayed when rotor is stationary. Current >RCF< is displayed while the centrifuge is running.

mm Chosen radius of centrifuge attachments.

PROG Indication of program 1, 2, 3 or #

9. Symbols (LEDs) on the operating console



Balance error.

If this LED is lit, the rotor must be loaded evenly.



Rotation indicator.

The rotation indicator is lit after the **START** key is pressed. It remains lit until the rotor comes to rest.



When this LED is lit, it means:

1. Lid can be opened.
2. Centrifuge is ready for operation.





LED is lit after the lid is closed and locked.

Operating faults or other errors that may arise are represented by symbols in the display (see Troubleshooting).

10. Acoustic signal



When centrifuging has finished and the rotor come to rest, an acoustic signal is emitted at 30 sec. intervals. This acoustic signal can be switched off by opening the lid or pressing any key.

To switch signal **OFF** or **ON**:

1. Hold down the  key for 8 secs.
2. After 8 secs. the message " **SOUND/BELL** " will be displayed.
3. Press  or  to display **OFF** or **ON1** respectively.
4. Press the  key. ***** OK ***** is displayed to confirm the setting.

If any error condition arises while the centrifuge is running, the signal will be emitted at 3 sec. intervals.

11. Retrieving the number of operating hours

1. Press the  key and hold it down for 8 secs.
2. After 8 secs. " **SOUND/BELL** " will be displayed on the screen.
3. Use the  key to select the " **CONTROL Xh** " symbol.
4. The number displayed represents the number of operating hours.

12. Setting the centrifuging parameters

When setting or modifying the centrifuging data, please note the following

1. Each setting or modification must be performed within 8 sec. If no new setting or command occurs during this 8 sec, the following display occurs in the normal setting:

RPM menu: # XXXXX XX:XX
 RCF menu: # >XXXXX< XX:XX

2. After setting or modifying centrifuging data, the **START** key must be pressed.

If you press the **START** key after performing a setting, the following confirmation appears in the display



***** OK *****





and at the same time the data are stored in the # program. The display then returns to the normal setting.

If the **START** key is not pressed, after 8 sec the display returns to the normal setting. All settings must then be repeated.




12.1. – Input data:

1. Call up the RPM or RCF menu with the **RCF** key




		RCF menu LED in the key illuminates		RPM menu LED in the key does not illuminate
t/min	⇒	XX:XX	⇒	XX:XX
t/sec	⇒	XX:XX	⇒	XX:XX
RPM		----	⇒	XXXXX
RAD/mm	⇒	XXX		----
R:XXX RCF	⇒	XXXXX		----
	⇒	X	⇒	X
	⇒	X	⇒	X
PROG	⇒	X	⇒	X

2. Select the required parameters with the  key.
3. Specify corresponding numerical value with the   keys.
4. Select next parameters with the  key, etc
5. Enter the parameter by pressing the key **START**.

12.2. Optional settings:

t/min	On-transition time = run-up time + centrifuging time Preset 1 - 99 min Entered in 1 min steps.
t/sec	Preset 1-59 sec Entered in 1 sec steps
∞	Continuous operation When the time 00:01 is displayed , after pressing the  key the symbol ∞ appears The time count starts from 00:00
RPM	Rotational speed. Numerical value that can be set to any value up to the rated speed n_{max} of the rotor. Lowest settable speed 1000 RPM. n_{max} see rotor or the "Rotor and accessories" table in the appendix Preset from 1000 RPM to 10000 RPM in steps of 10 rpm from 10000 RPM to n_{max} in steps of 100 rpm.
RAD/mm	Centrifuging radius. As in the "Rotor and accessories" table in the appendix. Preset from 10 to 110 mm
RCF	Relative centrifugal force. Any numerical value can be set with which a calculation can be performed at a speed between 1000 RPM and the speed of the last rotor identified by the sensor. Preset in steps of 10 rpm
	Run-up levels 1 - 9. Level 9 relates to the shortest run-up time.
	Braking levels 0 - 9. Level 9 relates to the shortest run-down time.
PROG	Program input, program call up Preset 1 – 2 – 3 – #

12.3. Modification during centrifugation

1. Select the required parameters with the  key in the display.
2. Change numerical value with the   keys.
3. Press the **START** key. ***** OK ***** appears in the display.
4. The changed value will be entered and stored in the memory # only by pressing the key **START**.

13. Calculating rotational speed RPM and relative centrifugal force RCF

These values are calculated using the formulas below:

$$RCF = \left(\frac{RPM}{1000} \right)^2 \times r \times 1.118 \qquad RPM = \sqrt{\frac{RCF}{r \times 1.118}} \times 1000$$

RCF = Relative centrifugal force








RPM = Rotational speed (revolutions per minute)

r = Radius in mm = Distance from the centre of the axle to the floor of the centrifuge container. For further details on radius see "Rotor and accessories" section.








A calculation can only be performed at a speed between 1000 RPM and the rated speed of the last rotor identified.


13.1. RCF calculation

1. Select RPM parameters with the  key.
2. Enter the numerical value with the   keys.
3. Press the  key; the LED in the key will illuminate. RAD/mm parameter is selected.
4. Enter numerical value with the   keys.
If no numerical value is entered, the calculation occurs with radius R=100mm.
5. Press the  key. Radius R:XXX and RCF=XXXXX can be read in the display

13.2. RPM calculation

1. Select the RPM parameters with the  key. The LED in the key will illuminate.
2. Select the RAD/mm parameters with the  key.
Enter the numerical value with the   keys.
3. Select the RCF parameters with the  key. Press the key once.
4. Press the RCF key; the LED in the key goes out.
5. RPM = XXXXX can be read in the display







In order to store the result in the program, the  key must be pressed within 8 sec.


If this does not occur, then the normal setting will appear in the display after 8 sec.

14. Centrifuging


14.1. - with the long run parameter

- Define the parameters required.
- Using the  key, select the parameter " **t/min or t/sec** ".
- Using the  key, display the " ∞ " symbol on the screen.
- Press the **START** key. The rotation light  will come on.
- Press the  **STOP** key. This will stop the centrifuge.

14.2. - with the time parameter

- Define the required parameters.
- Press the **START** key; the rotation light  will come on.
- The centrifuge will run until the defined time.
- Once the time has expired, the drive switches off.
- The centrifuge will run down at the selected braking level.



The centrifuge can be stopped by pressing the  **STOP** key.
It will run down at the selected braking level.

14.3. - short-term operation

- Define the parameters required.
 - Press the **IMPULS** key.
- The centrifuge will spin for as long as the key remains pressed.
Time is displayed in seconds up to max. 1 minute.

14.4. - of denser substances

The rotors are designed to centrifuge substances up to a maximum mean homogenous density of 1.2 kg/dm³ when rotating at the stated speed.
Denser substances must be centrifuged at lower speed.

The permissible speed can be calculated using the following formula:

$$\text{Reduced speed (n}_{\text{red}}) = \sqrt{\frac{1.2}{\text{Greater density}}} \times \text{Rated speed}$$

e.g.: RPM 4000, density 1.6 kg/dm³

$$n_{\text{red}} = \sqrt{\frac{1.2}{1.6}} \times 4000 = 3464 \text{ RPM}$$

If in doubt you should obtain clarification from the manufacturer.

15. EMERGENCY STOP

- Press **STOP** key twice.
- If braking level 1-9 has been set, the rotor decelerates with braking level 9 (shortest run-down time).
- If braking level 0 has been set, the rotor does not decelerates with braking level 9 but with a reduced braking force.

16. Programming

16.1. Program input

1. Select the required parameters with the **←** key.
2. Set the numerical value with the **▲ ▼** keys.
3. Select the PROG parameter with the **←** key.
The LED in the key will illuminate.
4. Use the **▲ ▼** keys to set the required program no. 1 – 2 – or 3.
5. Press the PROG key. The LED in the key goes out and
***** OK *****
appears in the display.
The centrifuging data are now stored in the memory under the program no. set.

16.2. Program call up

1. Select the required number in the display with the PROG key.
The centrifuging data will appear in the display.
2. The centrifuging data can be reviewed with the **←** key.
3. Press the **START** key. Centrifugation occurs.

16.3. Program modification

1. Select the required program no. with the PROG key.
2. Select the required parameters with the **←** key.
3. Set the numerical value with the **▲ ▼** keys.
4. Select the PROG parameter with the **←** key.
The LED in the key will illuminate.
5. Use the **▲ ▼** keys to set the required program no. 1 – 2 – or 3.
6. Press the PROG key. The LED in the key goes out and
***** OK *****
appears in the display.
The centrifuging data are now stored in the memory under the program no. set.

17. Changing the rotor

- Open the lid.
- Loosen the rotor tensioning nut by turning it counter-clockwise with the appropriate spanner (see delivery checklist) until the release point is reached. Once this point is passed, the tension link opens. Turn the nut another half-turn to the left to enable the rotor to be lifted off the motor shaft.
- Clean the motor shaft.
- Place the new rotor vertically on the motor shaft and press it down until it engages. The motor shaft must engage audibly with the spring chuck.
- Tighten the tensioning nut.
- Check that the rotor is seated securely.

18. Rotor identification

- When the centrifuge starts it picks up the rotor identification with the aid of a sensor. The speed rating displayed on the rotor can therefore not be exceeded.
- If the new rotor's speed rating is lower than the last speed entered or picked up, the drive will cut out after a few revolutions and the new rotor's speed rating will be displayed.
Press the **START** key.
- If the new rotor's speed rating is higher than the last speed entered or picked up, the drive will cut out after a few revolutions and the new rotor's speed rating will be displayed.
Press the **START** key.
- Any speed up to the rated speed can be entered while the centrifuge is running. During centrifugation a query can be made about the speed (RPM) or the relative centrifugal force (RZB) of the calculated value corresponding to the radius. Simply press the RCF key.

19. Emergency release

If loss of current or a centrifuge fault occurs while the centrifuge is running, the lid remains locked.



To release in an emergency, unplug the centrifuge from the mains.
Wait for the rotor to stop turning before opening the lid.

Insert the release pin (see scope of supply) horizontally into the hole located at the top right of the front panel. Push the release pin as far as the stop. Push the tip of the pin down, at the same time swivelling the hand grip upwards. Open the lid.

20. Care / maintenance



Before applying any cleaning or disinfecting procedure other than those recommended by the manufacturer, the user should ensure that the planned process will not damage the equipment.

- The centrifuge should be cleaned regularly for reasons of hygiene, and if necessary should also be cleaned with soap or a mild cleaning agent.
- Any adherent impurities should be removed as they can cause corrosion.
- Humidity in the air or centrifuge containers with no hermetic seal can lead to condensation. The centrifuge chamber (stainless steel) should therefore be cleaned regularly with a cloth or similar.
- For instructions on how to clean the rotor and accessories see the rotor instructions B032.
- In the case of glass breakage, the fragments of glass along with any spilt centrifuge product should be removed carefully from the centrifuge chamber, the containers or container drill holes.



After a glass breakage the rubber inserts for the containers must be replaced because any residual glass fragments in these inserts can cause further glass breakage.

- If any infectious material should find its way into the centrifuge chamber it should be disinfected immediately.
- When a biosafety system is in use (see section “Rotors and accessories”), the bioseal (packing ring) between the hangers and the lid must be checked and cleaned regularly. This routine should be performed at least once a week. The packing ring should be replaced as soon as any signs of tears, brittleness or wear are shown.

20.1. Supporting lugs

The supporting lugs on the rotor must always be well lubricated (use Hettich lubricating grease no. 4051). Only when the supporting lugs are lubricated can it be guaranteed that the hangers will swing out evenly and that the centrifuge will not cut out during operation.

21. Faults

21.1. Note on faults

- If any fault or defect should arise, this is indicated by a symbol on the screen, while at the same time an acoustic signal is emitted at 3 sec. intervals.
- The drive cuts out. Depending on the error message the run-down is either with or without braking. After the rotor has come to rest, clearance for opening the lid is issued.
MAINS RESET: - Mains switch OFF for longer than 10 secs.
- Mains switch ON.
- If the fault cannot be rectified by following the troubleshooting guide and if the error message reappears after performing a MAINS RESET, you should contact Customer Services.

21.2. Troubleshooting

Message / fault		Cause	Remedy
No display	---	<ul style="list-style-type: none"> - No voltage. - Overvoltage protection tripped out. 	<ul style="list-style-type: none"> - Check supply voltage. - Mains switch ON.
TACHO - ERROR	01	<ul style="list-style-type: none"> - Faulty speedometer. 	<ul style="list-style-type: none"> - Open lid. - Turn rotor manually. - MAINS-RESET (see section of notes on faults), when power is switched on, rotor should turn.
	02	<ul style="list-style-type: none"> - No rotor installed. - Defective motor, frequency converter or drive. 	
IMBALANCE	---	Imbalance about motor axis through weight differential in rotor assembly.	<ul style="list-style-type: none"> - Open lid. - Correct imbalance.
CONTROL - ERROR	04	Error in lid locking or lid closure.	<ul style="list-style-type: none"> - Open lid. - MAINS-RESET, (see section of notes on faults).
N > MAX	05	Rotation too fast	
N < MIN	13	Rotation too slow	
ROTORCODE	10	Incorrect rotor coding	
MAINS INTERRUPT	---	Power failure, centrifuging not completed	
VERSIONS-ERROR	12	Mismatch between electronic components	<ul style="list-style-type: none"> - Open lid. - MAINS-RESET, (see section of notes on faults).
CONTROL-ERROR	21 - 26	Error / defective control unit	
SER I/O - ERROR	30, 31, 33, 36	Error / defective interface	
° C * - ERROR	52, 53	Error / defective cooling	
FU / CCI - ERROR	60 - 64, 67 - 69, 83, 84	Error / defective motor control	

22. Repairs



Repairs must only be carried out by personnel authorised to do so by the manufacturer.

23. Customer Services / Servicing

Should your centrifuge break down or develop a fault, it should not be touched by anyone except an engineer authorised by the manufacturers.

In such a case you should contact Hettich Customer Services.

Before contacting our Customer Services department you should make a note of the following:

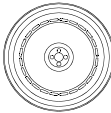



1. Centrifuge model
2. The factory number

Both of these numbers can be found on the centrifuge's model plate.



Note down any problems experienced.

25. Rotors and accessories

Rotor Sales No.	Hanger	Reduction	Capacity per Tube	Measurement Ø x L (mm)	Number per Frame	Number per Rotor	RPM	RCF	Run-up time to 97% in sec	Run-down time min / max	Radius in mm	Temp. in C° cooled ☒☒☒
6-times	1123		15 ml	17 x 100	1	6	5000	2879	9	9 / 110	103	----
		1056	5 ml	13 x 75	1	6	5000	2264	9	9 / 110	81	----
1013		0716	10 ml	17 x 70	1	6	5000	2739	9	9 / 110	98	----
8 times	1131		5 ml	13 x 75	1	8	5000	2879	9	9 / 110	103	----
	1132		10 ml	17 x 70	1	8	5000	2879	9	9 / 110	103	----
1020												
24-times	---	---	Capillary	---	---	24	15000	21382	9	10 / 200	85	----
	1455: Evaluation disk with adjustable zero point											
1023	1456: Evaluation disk with adjustable and fixable zero point.											
4-times	1680 		1671 ① / ② 0,3 / 1,5	62, / 30	1	4	4000	1431	9	10 / 150	80	----
		1672	① / ②	8,7 / 60	1	4	4000	1431	9	10 / 150	80	----
		1673	0,3/0,75	12,4 / 120	1	4	4000	1431	9	10 / 150	80	----
	1662 		① Volume One-Step methode									
			② Volume Two-Step methode									
1048		① 1696	① Filtercard One-Step methode									
		② 1676	② Filtercard Two-Step methode									

☒☒☒ Lowest possible temperature during the highest revolutions and 1 hour running time.

