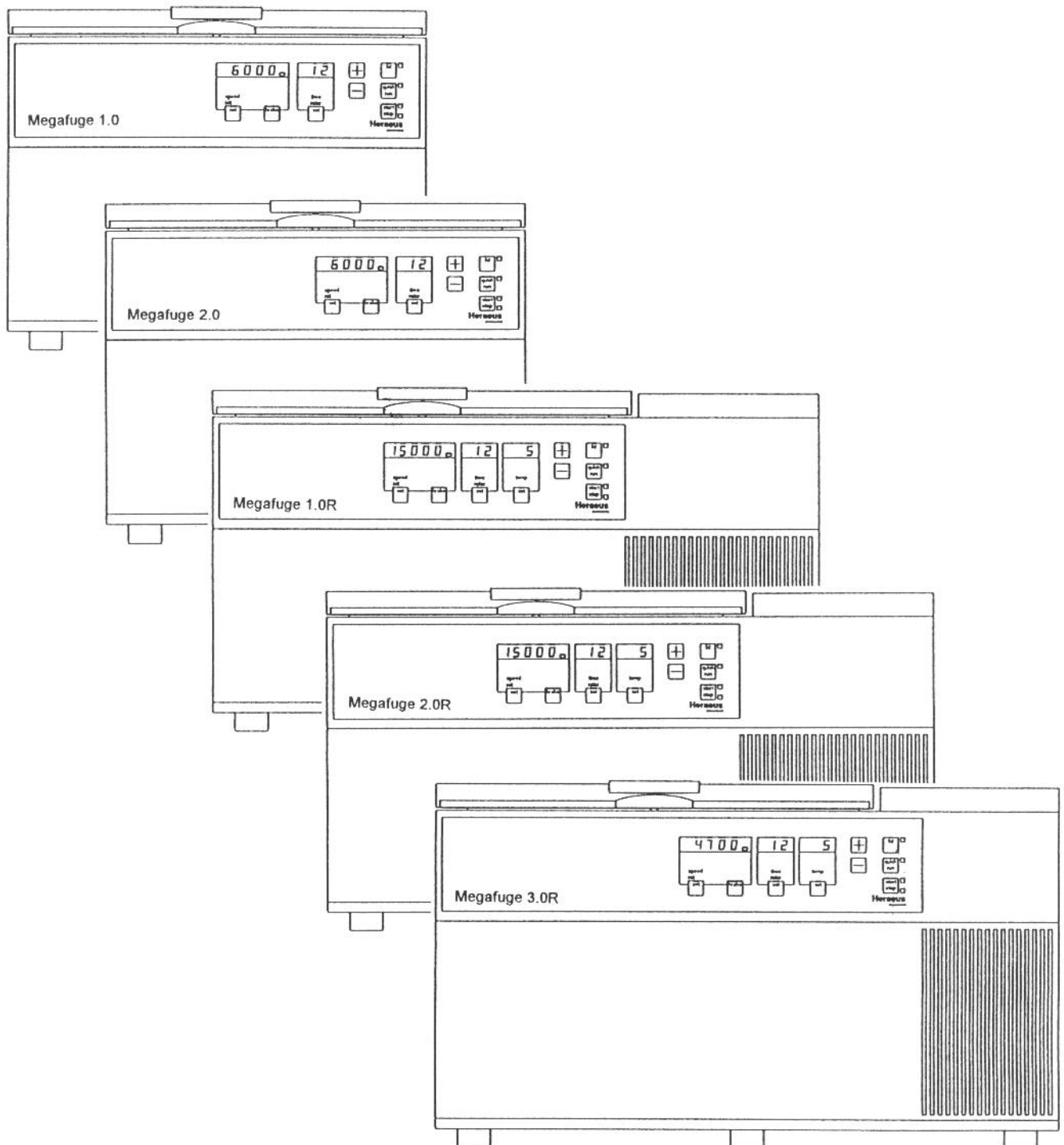


MEGAFUGE 1.0
MEGAFUGE 2.0
MEGAFUGE 1.0 R
MEGAFUGE 2.0 R
MEGAFUGE 3.0 R

Operating Instructions



PRECAUTIONS AND HAZARDS

Please read this manual **very carefully** before attempting to operate the centrifuge!

The centrifuge **must not** be operated by **unqualified** personnel! Avoid causing damage to the unit or its accessories through **incorrect operation**!

In the event of errors, **proceed exactly according to the instructions**!

Never transport the centrifuge with a rotor installed on its shaft!

Use only **original spare parts**!

ATTENTION – DANGER!

Never open the lid manually while the rotor is **spinning**!

It is forbidden to program a rotor or bucket type, **which is not physically installed** (see 7.2.1).

The following rules must be strictly observed:

- **Never operate** the centrifuge if the rotor is **not correctly installed** (see 5.1).
- Do **not operate** the centrifuge with any **parts or covers removed**.
- Never run the centrifuge when the electrical or mechanical equipment have been tampered with by **unauthorized or unskilled** personnel.
- Never attempt to run the centrifuge with an **incompatible rotor** (see 2.4 – It is forbidden to use the rotor #8155 with any buckets in the Megafuge 1.0 or 1.0R).
- Do not operate the centrifuge with **incorrectly installed buckets**.
- **The maximum rotor load and speed must be observed**.
- Do not spin **corrosive** samples which may impair the material strength of the rotors and buckets **without** taking all necessary precautions (e.g. sealed rotors or buckets).
- **Never use accessories** (rotors or buckets) which **show noticeable traces of corrosion** or mechanical damage.
- Do not spin samples which can create **flammable or explosive mixtures** when exposed to air, unless adequate safety precautions have been taken (e.g. shelter).
- Do not operate the centrifuge in **explosion-hazardous locations**. The Megafuges are neither explosion-proof nor inert gas shielded.
- Do not use **accessories which are not approved** by Heraeus, except commercially available centrifuge tubes of glass or plastic.

The manufacturer is only responsible for the security, reliability and performance of the unit, if

- the unit is operated in accordance with the operating instructions
- installations, expansions, new adjustments, changes or repairs are performed by Heraeus authorized personnel

NOTE:

When performing centrifugation and other functions which may expose workers to splashed blood or body fluids, all laboratory personnel must follow universal laboratory precautions including wearing gloves, facial protection, gowns or laboratory coats, and plastic aprons. For further details, consult your local laboratory safety director.

FAST START UP REFERENCE GUIDE

Setting up the MEGAFUGE

1. Set unit on a flat sturdy, resonance-free table (or lorry with lockable wheels) in a well ventilated area (without exposure to direct sunlight) and **mark a safety zone of 30 cm around it** (details in Section 4.1).
2. Insure the mains supply available is equal with the required on identification plate (see Electrical Connection, Section 4.2).
3. After plugging into the adequate wall socket, turn on the main power located on the rear panel (left hand side).
4. Wait for the illumination of the yellow LED next to the LID key. Open the lid by pressing the LID keypad and remove all packing materials and accessories.
5. Remove the rotor packaging and mount it on the drive shaft (see Section 5.1 + 5.2).
6. Rotor must move freely, when installing the swing-out rotor all **four buckets must be occupied!**
7. Load all adaptors and tubes making sure the rotor is symmetrically balanced (see Symmetrical Charge, Section 6.1).

WARNING!

Do not centrifugate dangerous material without taking all necessary precautions (see PRECAUTIONS AND HAZARDS)!

8. Close the lid firmly, but do not slam it. The "Open" message will disappear from the display, if the lid is closed correctly.

Programming the First Run

9. To set the Cat. No. of the installed rotor press the SET key of the TIME field once and then press again and keep pressed for the whole setting procedure. The rotor sign "ro" will appear and the flashing Cat. No. shown in the SPEED/RCF field can now be changed by using the yellow "+" or "-" keys. If the flashing Cat. No. is equal with the installed one, release the pressed SET key (see Programming of Rotor, Section 7.2.1).

WARNING!

On using the swing-out rotor, always program the Cat. No. of the really installed buckets, otherwise the maximum allowed bucket speed can be overwritten and damage to persons or property may result.

10. To set time, press the SET keypad of the TIME field. Change time by pressing the "+" or "-" keypads (see Programming of Time, Section 7.2.5).
11. To set speed for a timed run, press the SET keypad in the SPEED field. Change speed setting by pressing "+" or "-" keypad (for setting RCF instead of SPEED values see 7.2.2).
12. For timed runs, press the START keypad. Slow and fast acceleration can be toggled with the BRAKE key (see Smooth Acceleration and Deceleration, Section 7.1.5). After termination of the programmed time, unit will shut off automatically.

Preparing the next run

13. Wait for release of LID key (yellow LED indicates end of cycle), open the lid and remove all tubes from the rotor.
14. Check for broken glass or leakage into rotor, buckets and/or chamber (see 10.1 and for disinfecting see 10.2).

ATTENTION!

In case of contamination, the user is obligated to disinfect the unit and its accessories.

15. To remove rotor, unscrew and grasp it on opposing points and detach from the shaft by pulling vertically to the top.

Caution!

Remove the rotor only in vertical position otherwise the drive shaft will be damaged.

To prepare the next run, follow the routine cleaning procedures (of Section 10), if necessary, then repeat steps 5 to 15. For more detailed information about the MEGAFUGE features, operation and guidelines, consult other sections of this manual.

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1. DESCRIPTION

1.1 Classification

The **MEGAFUGES** are technically highly developed microprocessor controlled laboratory centrifuges with frequency controlled and maintenance-free induction motor.

The **MEGAFUGES** are bench-top models with an extensive range of accessories.

1.2 Definition

The centrifuges have low vibration solid polymer bottom plates. The housing is built of sheet steel. The front panel is made of plastic. Housing and front panel are fixed tightly to the bottom plate.

The rotors are started directly with a frequency controlled induction drive (brushless) with high acceleration power. This drive ensures quiet, low vibration running at high speed with high reliability. The drive is mounted with shock absorbers to the bottom plate and sealed with a rubber flange to the rotor chamber. The main microprocessor controls the functions for speed measuring and regulation, the temperature measuring and regulation (**MEGAFUGE 1.0R/2.0R/3.0R**) program storage, safety control and error coding. An additional microprocessor is responsible for the key and display functions. The centrifuge is controlled by the "Megacontrol" system (see section 7.)

MEGAFUGE 1.0/2.0

The air, drawn through the rear hole of the lid during operation of the motor, cools the rotor, motor and electronics and is discharged from the centrifuge via louvers in the housing (see fig.1).

MEGAFUGE 1.0R/2.0R/3.0R

These models are equipped with a compressor plant for temperature control (see section 9.2).

1.3 Safety Inspections, Standards and Regulations

Safety inspections according to GS, CSA, CLA, UL, VDE and SEV.

- Accident prevention regulations for centrifuges, UVV VBG 7z.
- Accident prevention regulations for electrical plants and supplies UVV VBG 4.
- Electrical safety according to IEC 1010-1 and IEC 1010-2-D
- Electrical noise suppression according to VDE 0871 grade B
- DIN 58 970, part 2 for laboratory centrifuges
- **MEGAFUGE 1.0R/2.0R/3.0R**: Accident prevention regulations for cooling units, UVV VBG 20.

1.4 Standard Accessories

The centrifuges are supplied with a collet chuck and a special socket wrench to fasten the rotors. (Spare Part No's see below).

Centrifuge	Collet chuck	Socket wrench
MEGAFUGE 1.0/2.0R/1.0R/2.0R	# 70003100	# 20360047
MEGAFUGE 3.0R	# 70904041	# 20005492

50 ml of anti-corrosive oil (Spare Part No. #70009824) to protect the metallic surface of rotors and buckets and a small vial of special grease (Spare Part No. #70006692) to coat the trunnions of swing out rotors are supplied as well.

Printed documentation supplied are:

- a prospectus with all available accessories
- the operating instructions
- a notice card for the correct fastening of rotors
- a warranty registration form
- a plastic case for keeping all documentation (should be fastened aside the centrifuge)

1.5 Warranty

The warranty period starts with the day of delivery. Within the warranty period the centrifuge is repaired or replaced free of cost if there are demonstrable faults in materials or workmanship.

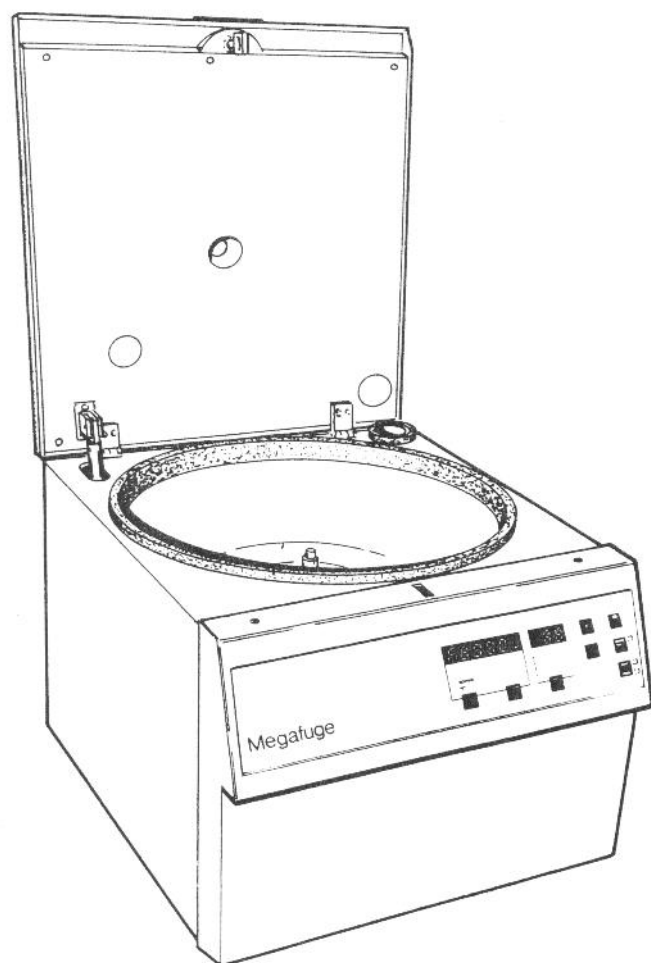


Fig. 1 MEGAFUGE 1.0/2.0 – lid showing the holes for integrated air circulation

2. TECHNICAL DATA

2.1 Performance Features

2.1.1 Common Features

Base construction:	solid polymer bottom plate ensures low vibration centrifugal runnings
Housing:	motor and back panel made of sheet steel covered with annealing color
Front panel:	synthetic resin for incorporation of key and display elements covered with cleanable membrane.
Operation:	By programming of MEGACONTROL (features see 2.2)
Drive:	frequency controlled, maintenance-free induction motor
Lid opening:	key button, the lid pops up and opens by the gas lid stay(s)
Closing:	press the lid down and push on top of the lid locks.
Locking at run:	double safety circuit (hard- and software controlled)
Starting/Stopping:	dual function key button indicated by LED's (start at green, stop at red)
Re-starting:	at any time during braking phase
Quick-run/-stop:	with quick-run press-and-hold key/quick stop on release
Imbalance stop:	automatic during acceleration, if allowed imbalance is exceeded
Range of ambient temp.:	
– during operation	4°C – 35°C (39°F – 95°F)
– in case of storage or shipping	–10°C – 50°C (14°F – 122°F)

2.1.2 Special features of the standard MEGAFUGES

	MEGAFUGE 1.0	MEGAFUGE 2.0	
max. speed: with rotor:	6 000 rpm # 3360	6 000 rpm # 3360	
max. RCF: with rotor:	6 240 x g # 3360	6 240 x g # 3360	
max. power input:	700 W	700 W	
max. capacity: with rotor/bucket:	4 x 220 ml # 2704 / # 2706	4 x 500 ml # 8155 / # 8160	
max. kin. energy:	26.0 kNm	29.8 kNm	
max. sample overtemp.: (above ambient temp.)	15 K	15 K	
rotor chamber – material: – size (ø x H):	enamelled steel (430 x 210) mm (17" x 8¼")	enamelled steel (430 x 210) mm (17" x 8¼")	
dimension (H x W x D):	(41 x 46 x 54) cm (16¼" x 18¼" x 21¼")	(41 x 46 x 54) cm (16¼" x 18¼" x 21¼")	
weight:	52 kg 115 pounds	55 kg 122 pounds	
noise level:	≤ 70 dB(A)	≤ 70 dB(A)	

2.1.3 Special features of the refrigerated MEGAFUGES

	MEGAFUGE 1.0R	MEGAFUGE 2.0R	MEGAFUGE 3.0R
max. speed: with rotor:	15 000 rpm # 1379 / # 3041	15 000 rpm # 1379 / # 3041	4 700 rpm # 5315
max. RCF: with rotor:	20 120 x g # 1379	20 120 x g # 1379	4 790 x g # 5315
max. power input:	1 100 W	1 100 W	1 450 W
max. capacity: with rotor/bucket:	4 x 220 ml # 2704 / # 2706	4 x 500 ml # 8155 / # 8160	4 x 750 ml # 8074 / # 8080
max. kin. energy:	26.0 kNm	29.8 kNm	40.6 kNm
rotor chamber – material: – size (ø x H):	fine steel (430 x 210) mm (17" x 8 1/4")	fine steel (430 x 210) mm (17" x 8 1/4")	fine steel (460 x 230) mm (18" x 9")
dimension (H x W x D):	(41 x 71 x 58) cm (16 1/4" x 28" x 23")	(41 x 71 x 58) cm (16 1/4" x 28" x 23")	(44 x 73 x 60) cm (17 1/2" x 29" x 24")
weight:	104 kg 230 pounds	109 kg 240 pounds	128 kg 282 pounds
noise level:	≤ 64 dB(A)	≤ 64 dB(A)	≤ 64 dB(A)

2.2 "MEGACONTROL"-Features

Parameter storage:	for speed, RCF value, rotor type, brake cut-out point, running time MEGAFUGE 1.0R/2.0R/3.0R : also temperature
Data memory:	with NV-RAM's (non – volatile random – access – memory)
Diagnostic indications:	– lid open – imbalanced loading – general troubles in the unit – data transmitting errors – rotor over temperature (MEGAFUGE 1.0R/2.0R/3.0R)
Digital parameter display:	speed, RCF, rotor, time MEGAFUGE 1.0R/2.0R/3.0R : also temperature
Acceleration:	2 stepped reproducible profiles: smooth start and fast, can be switched over at any time using the brake key
Deceleration:	1 reproducible profile and unbraked deceleration, can be switched over at any time using the brake key
Speed selection:	adjustable in stages of 100 rpm up to max. rotor or bucket speed
RCF selection:	adjustable to max. rcf value (see 2.4) converted into stages of 100 rpm
Brake cut-out point:	adjustable in stages of 100 rpm up to the preselected speed
Rotor selection:	preprogrammed menu, arranged in ascending rotor or bucket Cat. Numbers
Time selection in 2 modes:	
"hd" mode:	continuous operation
min mode:	adjustable in minutes from 1 min to 99 min
Time display by Quick-Run:	
sec mode:	1 s – 99 s
MEGAFUGE 1.0R/2.0R/3.0R	
Temperature selection:	0°C – 40°C

2.3 Mains Supply

Centrifuge	Cat. No.	Voltage / Frequency	Power input	Main Fusing
MEGAFUGE 1.0	#3490	230 V / 50 Hz	700 W	16 A
MEGAFUGE 1.0	#3491	120 V / 60 Hz	700 W	15 A
MEGAFUGE 1.0	#3495	100 V 50 / 60 Hz	700 W	15 A
MEGAFUGE 1.0	#3496	240 V 50 Hz	700 W	16 A
MEGAFUGE 2.0	#3482	230 V / 50 Hz	700 W	16 A
MEGAFUGE 2.0	#3485	120 V / 60 Hz	700 W	15 A
MEGAFUGE 1.0R	#3060	230 V / 50 Hz	1100 W	16 A
MEGAFUGE 1.0R	#3061	120 V / 60 Hz	1100 W	15 A
MEGAFUGE 1.0R	#3066	100 V / 50 Hz	1100 W	15 A
MEGAFUGE 1.0R	#3067	100 V / 60 Hz	1100 W	15 A
MEGAFUGE 2.0R	#3080	230 V / 50 Hz	1100 W	16 A
MEGAFUGE 2.0R	#3085	120 V / 60 Hz	1100 W	15 A
MEGAFUGE 3.0R	#8100	230 V / 50 Hz	1450 W	16 A
MEGAFUGE 3.0R	#8107	208/240 ¹⁾ V / 60 Hz	1450 W	15 A

ATTENTION!

¹⁾ Voltage for use: see identification label.

2.4 Rotor-Tables

2.4.1 MEGAFUGE 1.0 Rotors

Rotors with Swing-out Buckets					
rotor/bucket Cat.-No. [#]	max. capacity [ml]	max. speed [rpm]	max. RCF [xg]	max. radius [cm]	max. load per position [g]
2705 + 2252	48 × 15	4000	2890	16.2	510
2705 + 2706 ¹⁾	4 × 220	4300	3490	16.9	425
2705 + 2708 ³⁾	8 plates	2800	1280	14.6	360
3360 ⁴⁾	48 × 15	6000	6240	15.5	510
2704 + 8030 ⁵⁾	48 × 15	4000	3220	18.1	510

2.4.2 MEGAFUGE 2.0 Rotors

Rotors with Swing-out Buckets					
rotor/bucket Cat.-No. [#]	max. capacity [ml]	max. speed [rpm]	max. RCF [xg]	max. radius [cm]	max. load per position [g]
3360 ⁴⁾	48 × 15	6000	6240	15.5	510
8155 + 8082	2 carriers	3300	1850	15.2	260
8155 + 8160	4 × 500	3500	2570	18.8	800

¹⁾ round bucket with hermetically tight lid

²⁾ vacutainer (tubes up to 132 mm length)

³⁾ 4 microtiter carriers with 2 plates in each

ATTENTION – DANGER! The maximum speed of 2800 rpm must never be exceeded!

⁴⁾ sealed rotor – **ATTENTION!** Instructions in Section 6.7 must be observed absolutely!

⁵⁾ rectangle bucket with hermetically sealed lid

ATTENTION – DANGER! Hermetical sealing is only guaranteed by troublefree operation of the centrifuge and its accessories!

2.4.3 MEGAFUGE 1.0R Rotors

Rotors with Swing-out Buckets and Angle Rotors					
rotor/bucket Cat.-No. [#]	max. capacity [ml]	max. speed [rpm]	max. RCF [xg]	max. radius [cm]	max. load per position [g]
1379	24 × 1.5	15000	20120	8.0	3
2705 + 2252	48 × 15	4000	2890	16.2	510
2705 + 2706 ¹⁾	4 × 220	4300	3490	16.9	425
2705 + 2708 ³⁾	8 plates	2800	1280	14.6	360
3041	18 × 2.0	15000	17860	7.1	4.9
3360 ⁴⁾	48 × 15	6000	6240	15.5	510
2705 + 8030 ⁵⁾	48 × 15	4000	3220	18.1	510

2.4.4 MEGAFUGE 2.0R Rotors

Rotors with Swing-out Buckets and Angle Rotors					
rotor/bucket Cat.-No. [#]	max. capacity [ml]	max. speed [rpm]	max. RCF [xg]	max. radius [cm]	max. load per position [g]
1379	24 × 1.5	15000	20120	8.0	3
3041	18 × 2.0	15000	17860	7.1	4.9
3360 ⁴⁾	48 × 15	6000	6240	15.5	510
8155 + 8082	2 carriers	3300	1850	15.2	260
8155 + 8160	4 × 500	4000	3360	18.8	800

1) round bucket with hermetically tight lid

2) vacutainer (tubes up to 132 mm length)

3) 4 microtiter carriers with 2 plates in each

ATTENTION – DANGER! The maximum speed of 2800 rpm must never be exceeded!

4) sealed rotor – ATTENTION! Instructions in Section 6.7 must be observed absolutely!

5) rectangle bucket with hermetically sealed lid

ATTENTION – DANGER! Hermetical sealing is only guaranteed by troublefree operation of the centrifuge and its accessories!

Notice! The minimum reachable sample temperatures in MEGAFUGE 1.0R/2.0R/3.0R are equal to or lower than 4°C for all rotors at maximum speed.

2.4.5 MEGAFUGE 3.0R Rotors

Rotors with Swing-out Buckets					
rotor/bucket Cat.-No. [#]	max. capacity [ml]	max. speed [rpm]	max. RCF [xg]	max. radius [cm]	max. load per position [g]
5315 ¹⁾	8 × 12 × 15	4700	4790	19.4	510
8070 ²⁾	4 carriers	2800	1910	21.8	260
8074 + 8078 ³⁾	4 × 24 × 15	3500	2510	18.3	1020
8074 + 8080 ⁴⁾	4 × 750	3500	2890	21.1	1100
8074 + 8082	2 carriers	3300	1960	16.1	260

1) sealed rotor – ATTENTION! Observe instructions in Section 6.7!

2) rotor for mineral oil glasses (up to 200 mm length)

ATTENTION – DANGER! When using the standard glasses # 3110, # 3111 and # 3112, the speed must be reduced to 1800 rpm

3) double-rectangular bucket

4) round bucket with hermetically sealed lid

ATTENTION – DANGER! Hermetical sealing is only guaranteed by troublefree operation of the centrifuge and its accessories!

Notice! The minimum reachable sample temperatures in MEGAFUGE 1.0R/2.0R/3.0R are equal to or lower than 4°C for all rotors at maximum speed.

3. SAFETY SYSTEMS

3.1 Rotor Chamber

MEGAFUGE 1.0/2.0

The rotor chamber consists of a solid steel armor coated with enamel.

MEGAFUGE 1.0R/2.0R/3.0R

The stainless steel rotor chamber is surrounded by a solid armored vessel.

3.2 Lid Lock

The cabinet lid can only be opened when the rotor speed is at zero and the mains power on. The centrifuge can only be started when the lid is correctly locked and the "open" message has turned off.

3.3 Thermal Motor Protection

The power to the motor is switched off in the event of motor overtemperature to protect the drive system.

MEGAFUGE 1.0R/2.0R/3.0R

An additional motor temperature switch turns on cooling fans to keep the temperature inside the unit a suitable range.

3.4 Imbalance Switch

All MEGAFUGES are equipped with an imbalance switch.

If the allowable imbalance is exceeded, the message "bal" will alternate with the speed display and the drive brakes to standstill automatically (see 11.1).

3.5 Check of Acceleration Rate (only MEGAFUGE 1.0R/2.0R)

Whenever the rotor #1379 or #3041 is set, the microprocessor will check the acceleration rate to protect the drive system or other rotor types from damage in the event of false programming (see 11.1, E-18).

3.6 Emergency Lid Release

ATTENTION – DANGER!

It is dangerous to open the lid while the rotor is spinning!

In the event of a failure of the electrical supply, the automatic lid release is rendered inoperative.

To remove the samples when the rotor has come to standstill, a manually operated release is provided. Performance as follows:

- look into lid window to ensure rotor is not spinning
- turn off the power, remove main power plug
- MEGAFUGE 1.0/1.0R/2.0/2.0R:
plastic stopper is located to the right center under the front panel
- MEGAFUGE 3.0R:
plastic stoppers are located to the left and right of the rotor chamber under the front panel
- pry the stoppers from the unit using a flat bladed tool
- pull the stoppers and its attached cords downwards to unlock the lid mechanically

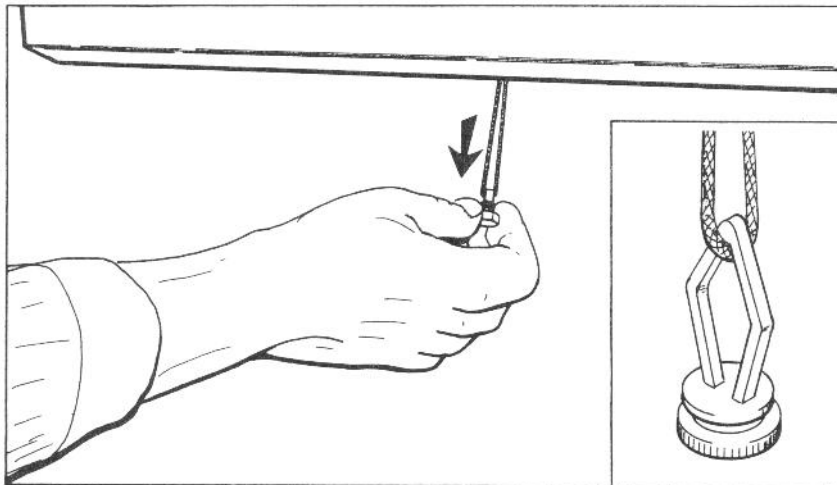


Fig. 2

After opening push the cord back through the hole and refit the plug.

3.7 Overtemperature Protection (only MEGAFUGE 1.0R/2.0R/3.0R)

These models are equipped with a rotor overtemperature protection. If the temperature inside the rotor chamber exceeds 51°C, the microprocessor will indicate an overtemperature alarm (see 11.1, E-07).

4. INSTALLATION

4.1 Location

The centrifuges are delivered in a special cardboard or wooden box. Open the box carefully, remove the transport protection parts (foam) and put the unit in its location.

The unit must be set up on a sturdy, level laboratory table or a suitable carriage with lockable wheels.

WARNING!

Do not place the unit next to a heat emitting element or instrument!

There must be a minimum clearance to the wall and any adjacent equipment of 10 cm to ensure unrestricted air circulation.

The international european regulations for centrifuges require a safety zone of 30 cm around the centrifuge. We recommend to mark this area to keep away persons or dangerous goods (e.g. comprising inflammable or infectious liquids) during centrifugation.

4.2 Electrical Requirements

Before connecting the Megafuge to the mains supply, make certain that:

1. the line voltage imprinted on the identification plate is equal with the one available (see 2.3 Mains Supply)
2. the line voltage circuit breaker is a 13, 15 or 16 Amp type with a slow release feature commonly used for instruments.

4.3 Main Power Switch

Connect the line cord plug to the appropriate wall socket. Turn on the main power switch located on the back left hand side. All displays and diodes will light up for two seconds (system check).

ATTENTION!

The main power switch should not be used (except in case of emergency) to interrupt the centrifugation. For that, the STOP key is provided.

Note: When powered off, all parameters of the last run are maintained.

4.4 Opening the lid

The lid can only be opened with the lid key when the **yellow** LED is lit. This is only possible when the rotor is not turning and no error messages are displayed.

WARNING – DANGER!

The mechanical lid unlocking mechanism (see 3.6) must not be used to interrupt centrifugation. It is absolutely necessary to wait until the drive has come to standstill (can be checked through the window in the center of the lid).

5. ROTOR EXCHANGE

CAUTION!

Before inserting the rotor, make sure that the rotor chamber is free of contaminations (dust, debris etc.). Condensate or residual sample liquid must be removed before centrifugation.

When clamping on the rotor to the drive shaft, the temperature of the rotor, the drive shaft and the collet chuck must all be in the range of 10-30°C to avoid loosening of the collet chuck by temperature imbalance.

WARNING!

The rotor must be removed before transporting the centrifuge! Damage to the rotor and centrifuge may result if the rotor is not removed prior to transporting.

5.1 Use of Collet Chuck

The rotor must be clamped firmly onto the drive shaft using a collet chuck (Cat.-No. # 70003100 for MEGAFUGE 1.0/1.0R/2.0/2.0R and Cat.-No. # 70904041 for MEGAFUGE 3.0R).

The troublefree condition of the collet chuck must be checked before each rotor installation (see 10.3.).

First, grease the conical drive shaft (incl. thread) and the collet chuck slightly.

Place the collet chuck onto the drive shaft ④ and twist it by hand at maximum 3 turns clockwise (see Fig. 3).

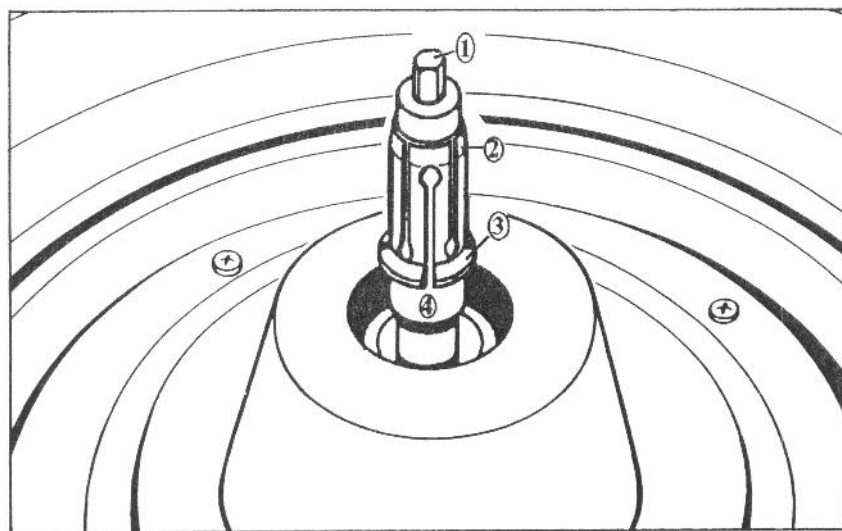


Fig. 3 rotor chamber with correctly attached collet chuck

WARNING!

The collet chuck must not spread out (vanes ② must not open) yet.

Otherwise the rotor cannot be pushed down completely onto its annular seat ③ in which case collet chuck, rotor and centrifuge may be damaged!

5.2 Mounting

Seat the rotor gently onto the collet chuck and push it all the way down until its bottom bears against the annular seat ③ of the collet chuck.

Then use the 6mm (or 10 mm for **MEGAFUGE 3.0R**) box spanner wrench to turn the hexagonal screw ① (see Fig. 3) of the collet chuck clockwise, thereby spreading the collet chuck until tight.

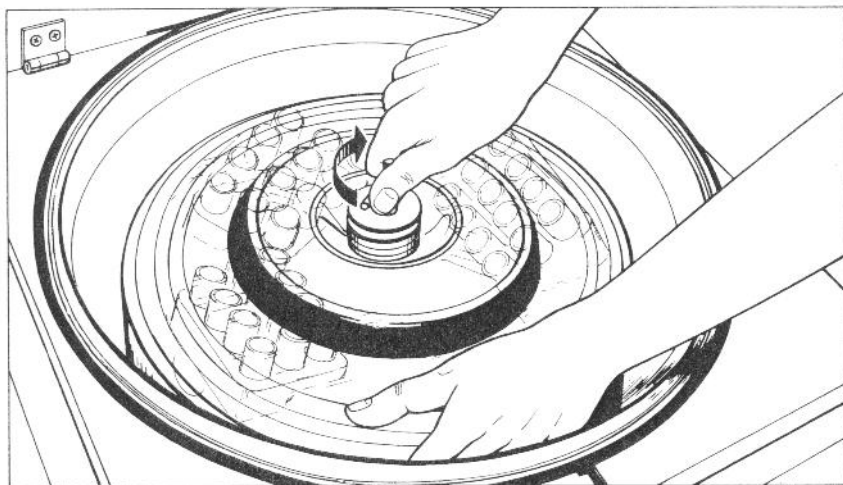


Fig. 4 Fastening the rotor clockwise

5.3 Removing

To remove the rotor, reverse the sequence.

CAUTION!

The collet chuck should always be removed – when not in use – so that it can't be damaged by inadvertently starting without the rotor installed.

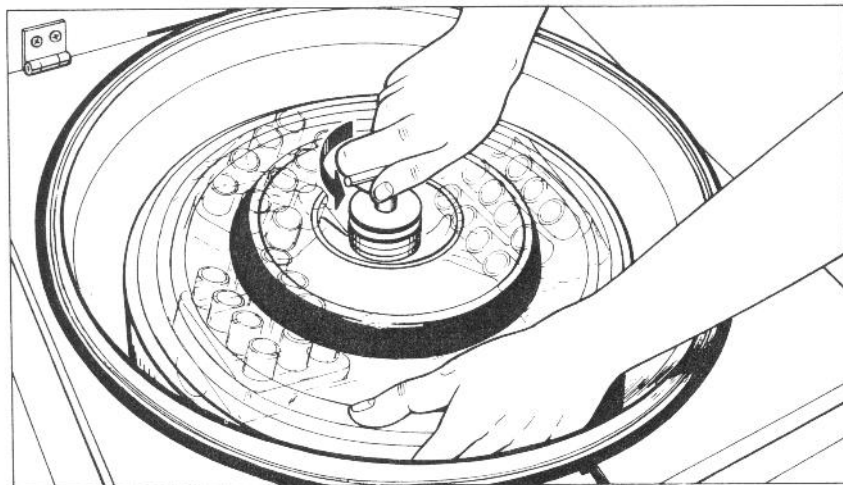


Fig. 5 Unscrew the rotor counter-clockwise

6. ROTOR LOADING

WARNING!

The following instructions must be observed exactly to avoid damage!

When using the sealed rotor # 3360 or # 5315, the loading instructions in Section 6.7 must be observed in every detail. All adapters must only be loaded with tubes which have the right shape, size and material (observe tube manufacturer recommendations).

6.1 Swing-out Rotors

WARNING!

In swing-out rotors all positions must be occupied with swinging buckets. The buckets may have an identification letter which states the weight class. (e.g. "E" or "D"). Only equal weight classes may be inserted in opposing places. **Make sure that the tubes or adapters in opposing buckets are identical.**

6.2 Symmetrical Charge

All rotors must be loaded symmetrically. Tubes and racks must be evenly distributed.

Following figures show how 48 and 24 tubes can be correctly or incorrectly placed in a rotor with 48 places.

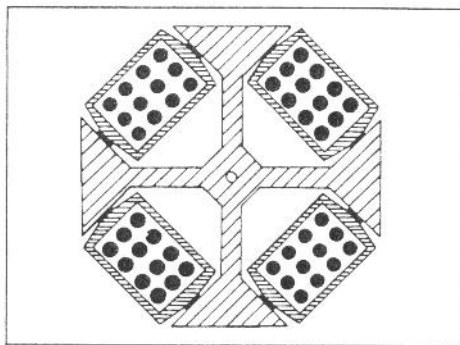


Fig. 6a
rotor fully loaded

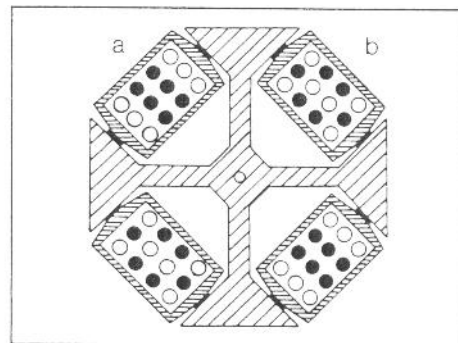


Fig. 6b
rotor symmetrically loaded
a = best solution

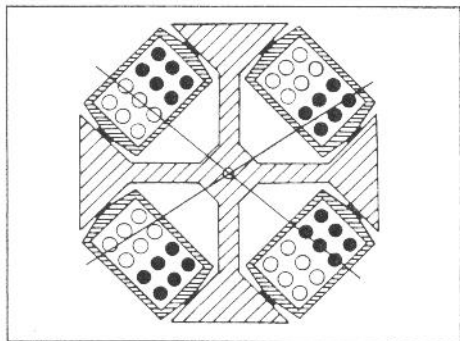


Fig. 6c
not allowed, because trunnions are
not evenly loaded

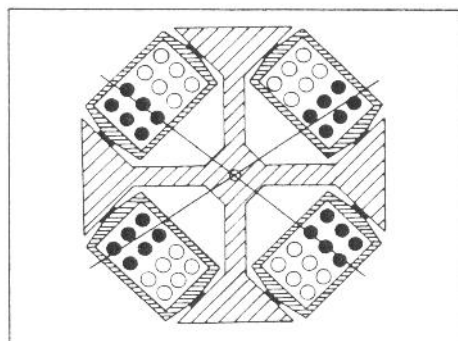


Fig. 6d
not allowed, because trunnions are
also not evenly loaded

6.3 Distribution of Racks

In order to avoid rotor wobble which might cause damage to both the centrifuge and the sample, **opposing places must be provided with identically loaded adapters, multiple carriers, tubes, bottles etc. to obtain the best possible balance.**

Imbalance causes running noises and produces a negative effect on the drive system (excessive wear out of the motor support).

The permissible difference in total weight (or load) between opposing buckets is rotor dependent (see Rotor Tables 2.4).

To determine the bucket weights, any laboratory scale is suitable but a taring balance is best.

6.4 Tube Filling

Centrifuge tubes up to approx. 30 mm in diameter may be filled evenly by eye (up to 5-10 mm below the rim, depending upon size).

NOTE!

Using an angle rotor and tubes without caps, only partial filling is possible (about 60% and 75% of the maximum capacity). The actual amount of filling depends on the rotor's angle.

6.5 Partial Load

With only a partial load, the tubes must be symmetrically distributed so that an even loading of the rotor is achieved (see also Fig. 6b).

If a small number of sample tubes is to be centrifuged (less than the full capacity of the rotor), it is advisable to observe the following rules for distribution of the tubes within the adapters.

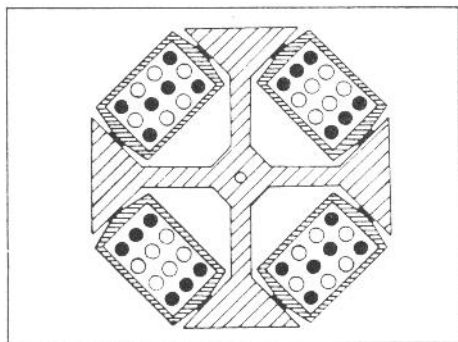


Fig. 6e
correct loading

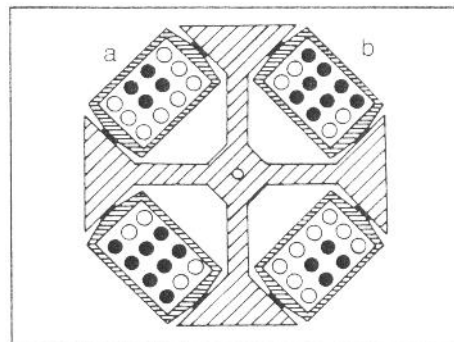


Fig. 6f
correct loading for tube length
> 100 mm

WARNING!

To avoid glass breakage when using tubes **greater than 100 mm** in length, use the configurations shown in Fig. 6f. In this case, always conduct a manual swing-out test with empty tubes before committing samples.

6.6 Loading limits

The material strength of every rotor is limited with regard to the mass and speed-dependent forces acting on its yoke and other components during centrifuge operation.

HERAEUS rotors are designed in such a way that they still possess high strength reserves at the maximum permissible load and speed. **Still the maximum permissible limits must not be exceeded. It is the operator's responsibility to avoid overloading the rotor.**

The max. permitted load is reached when all tubes are filled with a fluid of $1.2 \text{ g} \cdot \text{cm}^{-3}$ density. When the density is higher than 1.2 the tubes may only be partly filled. The total weight of a bucket may not exceed the value corresponding to total filling with a liquid of 1.2 density.

As an alternative in such cases, it is possible to reduce the maximum permitted speed n_{max} in accordance with the following formula:

$$n_{\text{adm}} = n_{\text{max}} \sqrt{\frac{\text{Total weight of the buckets incl. sample with a density of } 1.2 \text{ g} \cdot \text{cm}^{-3}}{\text{Total weight of the buckets incl. sample with higher density}}}$$

6.7 Sealed Rotors 3360/5315

ATTENTION!

Special loading instructions must be observed when using the Sealed Rotors # 3360 or # 5315!

The operating instructions which are supplied with the sealed rotors must also be read and observed exactly!

The Sealed Rotor is a swing-out rotor with a sealing lid designed for applications involving infectious or pathogenic samples. The centrifugal force of the buckets in this rotor is absorbed by an exterior ring of fiberglass-reinforced plastic. The lid reduces air friction which allows this rotor to reach a higher maximum speed than without lid.

Lock the rotor lid correctly to protect against spills due to broken glass or damaged tubes that may result in aerosol contamination.

The buckets of rotor # 3360 or # 5315 should be loaded with Centri-Lab racks or inserts of identical exterior dimensions and weight.

The rotor is intended to accommodate tubes 100 mm in length. However, shorter or longer tubes can be used. Under certain circumstances, only the middle positions of the tube rack (see fig. 6f) may be occupied by the longer tubes to prevent them from being knocked against the rotor yoke. Check that the buckets swing out freely.

Do not run the centrifuge with empty glass tubes. Glass tubes of equal weight may exhibit very different centers of gravity resulting in substantial imbalance. This effect is reduced by filling the tubes.

The unique construction of the Sealed Rotor requires special precautions when operating. The following rules must be absolutely observed in every detail.

WARNING!

It is essential that these rules are precisely followed in order to prevent damage to the rotor or centrifuge resulting in a potential hazard to nearby equipment and personnel.

- 1) Attach the rotor correctly
- 2) Ensure each counter-weight is in its own position 1 - 4 (only for rotor # 3360 being balanced by these weights)
- 3) Insert **all** buckets and **all** tube racks. **All buckets must be loaded.**
- 4) Load buckets evenly and symmetrically
- 5) Do not exceed permitted weight differences:
adjacent buckets: **100 g**
opposing buckets: **10 g**
- 6) Do not exceed maximum sample load (**510 g** per bucket)
- 7) Check troublefree operation of the rotor lid and observe expiration date (5 years later than imprinted date)
- 8) Lock rotor lid correctly
- 9) Do not exceed the speed limit of the rotor (see Rotor Tables 2.4)

7. "MEGACONTROL" PROGRAMMING INSTRUCTIONS

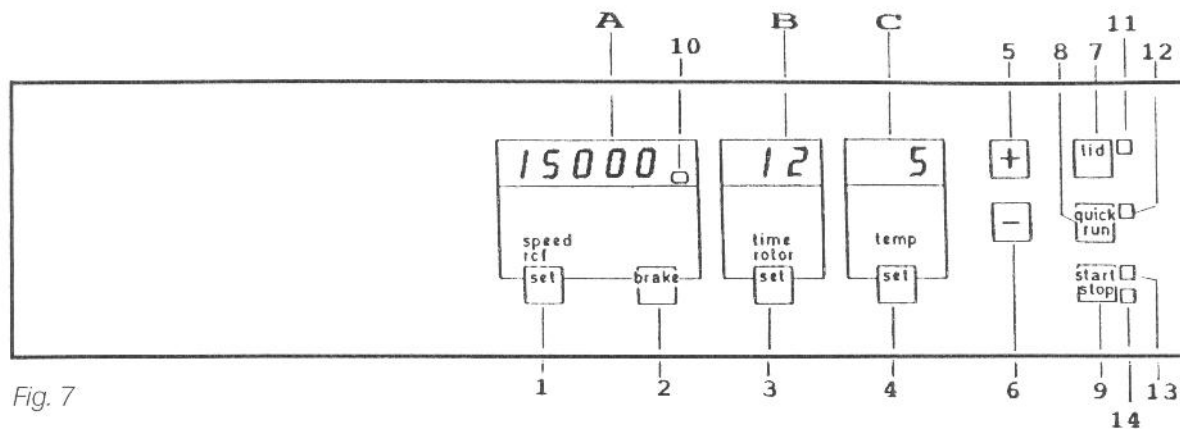


Fig. 7

MEGACONTROL – Key and Indication Board

Temperature display is only existant on MEGAFUGE 1.0R/2.0R/3.0R

- | | |
|-----------------|--|
| A Display | for speed, RCF value, rotor type, brake cut-off point and special indications |
| B Display | for running time, "hd" (continuous operation), "ro" (rotor type), "rc" (RCF) |
| C Display | for temperature (MEGAFUGE 1.0R/2.0R/3.0R) |
| 1 "set" – key | for speed- or RCF selection |
| 2 "brake" – key | a) to set brake cut-off point,
b) to switch between normal and slow acceleration
c) to switch brake on/off |
| 3 "set" – key | for running time- and rotor selection |
| 4 "set" – key | for temperature selection (MEGAFUGE 1.0R/2.0R/3.0R) |
| 5 "+" – key | to increase the selected value (auto-repeat) |
| 6 "-" – key | to decrease the selected value (auto-repeat) |
| 7 "lid" – key | to open the lid |
| 8 "quick run" | press-and-hold key for short cycles, upon release, maximum braking occurs |
| 9 "start stop" | dual function key for start and stop |
| 10 red LED | a) on indicates normal acceleration
b) on indicates brake activated |
| 11 yellow LED | on indicates lid may be opened |
| 12 green LED | on indicates "quick run" may be used |
| 13 green LED | on indicates run may be started (or restarted) |
| 14 red LED | on indicates run may be terminated manually |

7.1 Control Keys

7.1.1 Lid

The lid can only be unlocked with the "lid" key when the centrifuge is powered on and the rotor is at standstill. The **yellow** LED must be illuminated and no error messages are indicated.

7.1.2 Start

When start is enabled (**green** LED illuminated) the centrifugation can be initiated with the "start/stop" key. After centrifugation has started, the lid key is disabled (**yellow** LED is extinguished).

7.1.3 Stop

The stop function becomes enabled (**red** LED is lit) immediately after each start. Pressing the "start/stop" key will terminate the run. After pressing stop, the **green** "start" LED lights again. This means that the interrupted centrifugation can be continued at any time (it is not necessary to wait for standstill if the run was stopped inadvertently).

7.1.4 Quick Run

Each centrifugation can also be started with the "quick run" key when the **green** LED is illuminated. The quick-run function is designed for short cycles. Quick-run requires pressing and holding the key.

ATTENTION!

As long as the key is pressed, the motor accelerates at maximum rate to the highest speed of the preselected rotor or bucket type. That means, the set speed (see 7.2.2) will be ignored when using the "quick run" function.

Centrifugation will continue until the key is released. On release the rotor will be decelerated at maximum braking. If the "quick run"-key is pressed and held for a second time, acceleration will be re-activated.

7.1.5 Smooth Acceleration and Deceleration

At any time during the acceleration or deceleration phases, except quick run operation, the multifunction key "brake" may be used to switch between quick and smooth centrifugation (and back again). Fast speed changes are generally indicated by the **red** control LED in the speed display section. This LED goes out on switching over to smooth centrifugation.

7.2 Programming

7.2.1 Rotor Selection

ATTENTION – Settings are only allowed at rotor standstill!

Press "set" key in the **time/rotor** section once and then press again and keep it pressed. The rotor input mode is indicated with "ro" in the "time" display and the stored Cat. Number (#) of the rotor or bucket type is shown in the **speed/rcf** display section. The rotor Cat. Numbers (#) can now be displayed in turn by using the "+/—" keys. After release of the "set" key, the new rotor Cat. No. (#) will be stored.

DANGER!

The rotor cross # 2704 is designed for the use of different swing out buckets with different maximum speeds (see rotor tables 2.4). Therefore, the Cat.-No. of the inserted bucket must be programmed for speed limitation to avoid accidents caused by false speed settings.

This applies especially to the Microtiter Carriers # 2708. Damage can occur to the instrument, if they are operated above their maximum allowable speed (see rotor tables 2.4).

7.2.2 Speed Selection

On pressing the "set" key in the "speed/rcf" display section, the speed setting mode is activated (speed display digit flashes). The indicated speed value can now be changed in steps of 100 rpm with the "+/—" keys (for faster scrolling hold pressed). On pressing the "set" key **again**, the set value is stored as the new set speed.

7.2.3 RCF Selection

Press the **"set"** key in the **"speed/rcf"** display section, release, press again and keep it pressed (as in rotor setting). The display switches to RCF setting mode; **"rc"** will be indicated in the **"time/rotor"** display section. The **RCF** value can now be changed in steps of 100 rpm with the **"+/-"** keys. **After release** of the **"set"** key, the last set value will be stored.

7.2.4 Brake Cut-out Speed Selection

Press the **"set"** key in the **"speed/rcf"** display section, then press and hold the **"brake"** key. The setting of the brake cut-out speed allows the brake to be turned off at any speed up to the preprogrammed value of the set speed (7.2.2). If there is no use of any brake cut-out speed set this value to zero. **After release** of the **"brake"** key, the set brake cut-out speed will be stored.

7.2.5 Time Selection

The time setting can be activated with the **"set"** key of the **"time/rotor"** display section. The flashing position can be changed in minute-steps with the **"+/-"** keys. Centrifugation runs can be programmed from 1 minute to 99 minutes. If no time is preselected (**"hd"** indication) then continuous operation is possible. The **"set"** key must be pressed **again** to store the new set value.

7.2.6 Temperature Selection (only MEGAFUGE 1.0R/2.0R/3.0R)

Press the **"set"** key in the **"temp"** display section to activate the setting mode (temperature digit flashes). The setpoint value of the sample temperature is variable in degree Celsius-steps with the **"+/-"** keys in the range from 0°C to 40°C. By pressing the **"set"** key **again**, the displayed value is stored as the new set temperature.

7.3 Display

7.3.1 Speed

The speed display is updated every second.

7.3.2 RCF

The RCF value may be displayed by pressing and holding the **"set"** key.

7.3.3 Time

During **"quick run"** centrifugation, the elapsed time will be indicated in seconds – normally time is shown in whole minutes only.

7.3.4 Rotor

If the **"set"** key in the **time/rotor** section is kept pressed, the set rotor Cat. Number can be checked any time. New rotor settings are only possible at rest (see 7.2.1).

7.3.5 Standby

If the centrifuge is idle for a few minutes, the microprocessor will switch off the digital display to save energy. This state is indicated by a decimal point in the time display flashing. Pressing any key will immediately reactivate the whole display.

7.3.6 Temperature (only MEGAFUGE 1.0R/2.0R/3.0R)

The sample temperature display will be updated every second and is indicated in degree Celsius.

8. ACCELERATION AND BRAKING PROFILES

To optimize the numerous applications of the Megafuges, two different acceleration profiles and one reproducible braking profile are available. An unbraked deceleration can also be selected.

8.1 Profile Principles

All profiles include a cushioned acceleration and deceleration phase to avoid re-suspension of the sample, followed by a phase with quick acceleration for shortest total run times.

The natural resonance vibrations of the rotating assembly occur within the phases of fast acceleration and deceleration to ensure that they exert a minimal effect on the drive system.

8.2 Selection of Profiles

The fastest acceleration and braking time can be reached with the **"quick run"** key. In this case each rotor is operated with the maximum possible acceleration and braking force. On using the **"start/stop"**-key fast and slow acceleration as well as fast and slow deceleration profiles can be performed. Whenever the **red** control LED in the **"speed"** display is on, fast acceleration and deceleration is preselected. The slow acceleration as well as the unbraked deceleration can be preprogrammed by the **"brake"** key (see 7.1.5 – red LED is not illuminated).

8.3 Turbulence During Deceleration (Swing-out Rotors)

With swing-out rotors, the transition from the horizontal to the vertical position occurs between 800 rpm to 1000 rpm. Based on this physical effect a turbulence occurs inside the centrifugation container and may cause a re-mixing of the sample. This turbulence is suppressed more effectively when the centrifuge stops slowly and steadily.

8.4 Brake Setting for Delicate Samples

With samples producing a firm sediment during centrifugation the maximum (or nearly the maximum) braking force can be used. For samples with easily disturbed sediments you can choose either to work without the brake or to select a brake cut-out point so that the rotor then coasts without braking (smooth) e.g. from below 500, 400, 300, 200 or 100 rpm to rest.

9. TEMPERATURE FEATURES

9.1. MEGAFUGE 1.0/2.0 with Air Circulation Cooling

During centrifugation, heat is generated by friction between the rapidly spinning rotor and the air inside the chamber. The temperature of the rotor, buckets and samples will increase. The temperature rise depends on the rotor size, bucket type, running time, ambient temperature, location (air circulation) and the set speed of the rotor. A certain amount of the heat will be eliminated by the air flow through the rotor chamber and so a thermal balance will be reached after some time.

The warming of the samples does not exceed the standard value of $(38 \pm 2)^{\circ}\text{C}$ at ambient temperature $(23 \pm 2)^{\circ}\text{C}$ when the **MEGAFUGE 1.0/2.0** is running at maximum rotor speed. By carrying out appropriate tests it is possible to make a speed-temperature chart for any rotor. But it must be kept in mind that the sample temperature will be affected by the ambient temperature and that the **MEGAFUGE 1.0/2.0** has no temperature control of its own.

9.1.1 Preparing a Speed-Temperature Chart

To avoid discrepancies caused by evaporation (e.g. of water), use glycerine in the buckets to measure the temperature. The buckets should be evenly filled to the middle with 80% glycerine (taring). The required speed is selected and the instrument started. The temperature of the glycerine in each of the buckets should then be measured at regular intervals (10 to 30 minutes) until there is no further change in the reading.

ATTENTION – Important note!

It is essential to dip the thermometer into each bucket in order to avoid false readings.

Continue starting and stopping the **MEGAFUGE 1.0/2.0** with the same running program until the temperature does not change from the previous reading.

9.1.2 Thermo-Delicate Samples

Samples, which can be destroyed by exceeding a fixed temperature (e.g. 38°C) can be centrifugated in the **MEGAFUGE 1.0/2.0** only at reduced speeds.

A **MEGAFUGE 1.0R/2.0R** with temperature control is recommended when working with thermo-sensitive samples.

9.2 MEGAFUGE 1.0 R/2.0R/3.0R – Cooling Unit with Temperature Control

A sensor located in the rotor chamber measures the temperature. Depending on the selected rotor, speed and temperature settings, the microprocessor determines the parameters for temperature control.

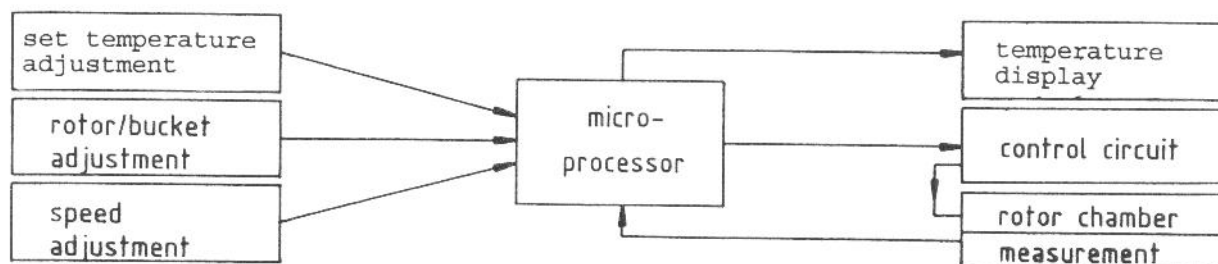


Fig. 8 MEGAFUGE 1.0R/2.0R/3.0R Schematic Diagram of Temperature Control

In the **equilibrium condition** (thermal balance), the sample temperature will be indicated with a tolerance of $\pm 2^\circ\text{K}$.

The minimum reachable sample temperature of each rotor is dependent on the set speed and ambient temperature (see rotor table 2.4).

ATTENTION – Important notice!

The temperature control is only activated if the lid is closed correctly (no "open" message)!

9.2.1 Pre-cooling or Pre-heating of Empty Rotors and Buckets

If the sample cannot tolerate temperature differences of the rotor (or empty buckets), the rotor chamber (incl. rotor) must be pre-cooled or pre-heated first.

For this purpose following procedure is recommended:

1. set the Cat. Number (#) of the installed rotor or bucket type
2. set the required sample temperature
3. set the half of the maximum rotor or bucket speed – if the set temperature is more than 15°C , (for pre-heating), preselect the speed to 90 %
4. set running time to 15 min (if the Sealed Rotor # 3360/# 5315 is installed set the time to 30 min.) and press the start key

9.2.2 Pre-cooling or Pre-heating of Samples

Depending on the additional heat transfer from the rotor pocket (or bucket inwall) via the racks and tubes to the original sample, a **longer** running period may be necessary.

10. MAINTENANCE AND CARE

Maintenance of the centrifuge should be performed annually by an authorized service technician. Contact Kendro Laboratory Products if maintenance or service is required or proceed to the Servicing Schedule (see 10.7).

10.1 Cleaning

Care of the centrifuge is restricted to the cleanliness of the rotor chamber, bench top, rotors and their accessories.

Cleaning is not only necessary for reasons of hygiene, but is also essential to prevent corrosion.

Accessories of anodized aluminium like rotors, buckets and adapters are particularly susceptible to corrosion. Clean them with mild detergents of pH values ranging from 6 to 8.

After cleaning, dry the aluminium accessories with a soft cloth or put them in a drying oven (**rotors and buckets must never be heated $> 50^{\circ}\text{C}$**).

To increase durability and reduce their susceptibility to corrosion, it is necessary to regularly apply an anti-corrosive oil (Cat. No. 70009824) to all anodized surfaces.

10.2 Disinfection

Should infectious samples spill due to glass breakage etc., a disinfection after completion of the spinning cycle is required.

ATTENTION!

The rotor and buckets are **not** autoclavable (except: Sealed Rotor – see special operating instructions). The Centri-Lab racks may be autoclaved at 121°C .

In case of rotor and rotor chamber contamination disinfect with a neutral, universal disinfectant (e.g. with an aldehyde base). Best suited for this purpose are disinfectant sprays, which ensure that all rotor and accessory surfaces are covered evenly.

10.3 Collet Chuck

CAUTION!

The condition of the collet chuck must be checked at each rotor exchange.

The collet chuck **must be replaced** in case of:

- 1) evident damage (wings torn off, horizontal groove lines are visible etc.)
- 2) functional impairments (e.g. wings are spread in unloaded condition, the collet chuck cannot be screwed onto the motor shaft by hand or the rotor cannot be fastened to the collet chuck).

10.4 Greasing

ATTENTION – GREASE THE TRUNNIONS!

The trunnions of swing-out rotors must be lightly greased to avoid jerky movements of the buckets. Greasing should be done daily.

Before greasing the trunnions the bucket grooves should be thoroughly cleaned with a dry cloth. In no case may organic solvents, alkaline or household scouring powder be used!

Grease is supplied with the centrifuge and is available under Cat. No. 70006692.

ATTENTION – Important note!

Molycote and graphite lubricants are not permitted!

MOTOR BEARINGS – DO NOT GREASE!

The motor bearings are lubricated for the motor's life.

CAUTION!

Make sure that no liquids or organic solvents penetrate the annular slot around the motor shaft which might wash the grease off the bearings.

10.5. Glass Breakage

Centrifuge glassware shows a higher failure rate with rising g-forces.

WARNING!

Glass splinters must be removed immediately from the buckets, adapters and rotor chamber. The glass splinters can damage the surface protection or could get stuck on the trunnions of the swing-out rotors where they can impair smooth movement of the swinging buckets.

When glass splinters get into the rotor chamber and are whirled around by air circulation, a very fine (black) metal dust can develop. Metal abrasion can contaminate the rotor chamber, rotor, buckets and samples. With a strip of vaseline or trunnion grease applied vertically on the chamber wall (from top to bottom) the glass dust can be removed with a smooth centrifugation cycle.

10.6 Condensed Water (MEGAFUGE 1.0R/2.0R/3.0R)

Air, humidity or non-hermetically sealed samples will cause condensation inside the rotor chamber depending on the chamber temperature. The liquid must be removed from the rotor chamber regularly (e. g. with a dry cloth).

10.7 Servicing Schedule

We recommend to perform the following maintenance routine which should be done at least once a year by an authorized service technician only:

1. Electrical Installation and Safety

- switch OFF the centrifuge and disconnect the unit from power
- check voltage supply and mains fusing (15 Amps slow blow characteristic)
- check condition of plug and wall socket – replace defective parts
- check cord condition and fixing – replace or refit it

2. Location and Mechanical Installation

- check the base (table, lorry with lockable wheels etc.) for resonance-free and stable conditions
- check for a well ventilated place and sufficient distances to walls or adjacent equipment
- check the leveling of the centrifuge – use any spirit level

3. Lid Locking Mechanism and Safety Device

- connect the centrifuge to power and switch ON
- check for easy lid closing and self-acting lid opening – if in disorder, readjust lid looped hook and/or hinges and smear hook slightly with grease
- check the function of the emergency lid unlocking device (see Section 3.6).
- open the lid and turn the rotor by hand, then close the lid and try to open it using the lid key: the lid must not be opened as long as the speed values ($> 10\text{rpm}$) are indicated – if safety circuit is out of function, call the Service of Heraeus Instruments.

4. Cleanliness of Spin Chamber and Motor Cover

- open the lid and remove the rotor (for loosening turn socket wrench in arrow direction – see rim of rotor chamber)
- clean the spin chamber with a dry and absorbent cloth (remove all dust and moisture)
- check the correct seat and condition of the motor cover and take care of the cleanliness of the annular slot around the motor shaft: penetrating fluids can damage the upper motor bearing

5. Rotor and Bucket Condition and Sealing

- check the condition of rotor and buckets (especially all supporting or stressed partitions as jib arms, rim of the bucket's bearing surface etc.): the rotor and/or buckets must not be used any longer, if there are visible traces of mechanical damage or rust
- check the condition of rotor and/or bucket sealings and replace them in case of malfunction

6. Rotor Fixing and Motor Shaft

- check the trouble-free operation of the collet chuck (see 10.3) and order a new one in case of malfunction
- check the condition of the drive motor shaft: the centrifuge must not be used any longer, if the drive shaft is damaged (bend, thread is worn out, horizontal grooves etc.)

11. TROUBLE SHOOTING

11.1 Measures to Do-it-yourself

Trouble Indication	Trouble Symptom	Cause	Remedy
all displays remain dark	drive shuts off suddenly, rotor coasts to rest, lid cannot be opened at rest	power failure	check mains supply, if in order call Service
displays are momentarily dark	drive shuts off suddenly and coasts to rest	temporary mains failure	start again
unusual loud running noises perhaps with imbalance indication	drive is disconnected, brakes or continues running with noise	possible cause: 1. sudden imbalance following tube breakage and mass shifting 2. defective drive or rotor 3. disorder of speed control 4. MEGAFUGE 1.0R/2.0R/3.0R faulty fan or compressor	if the centrifuge does not stop on its own, press "stop" key or switch OFF the mains check for obvious faults at standstill and if possible do repair, otherwise call Service
"OPEN" message – lid supposedly locked	centrifuge cannot be started	lid not properly locked	close lid correctly, if "OPEN" doesn't disappear, call Service
"lid" message flashes in speed section	drive is disconnected, unbraked deceleration	1. lid lock was manually opened with draw-thread during operation impermissible manipulation! 2. lid switch protection circuit has released	1. close lid, then switch mains OFF/ON, press start to continue centrifugation, else press stop 2. if error happens again, call Service
"bal" message flashes in speed display section	centrifuge stops with max. braking force	1. rotor is not properly loaded	1. distribute tubes or fillings evenly
		2. bucket does not swing out properly or not at all	2. clean trunnions and bucket grooves and grease with lubricant #70006692
		3. sudden tube breakage and shift of center of gravity by escaping fluid	3. remove splinters and debris, clean and reload bucket, restart with reduced speed if necessary
		4. defective drive system (e. g. damaged motor shaft)	4. do not start the drive again! Call Service!
		5. mechanical or other damage to rotor	5. do not use this rotor again! Call Service!
		6. centrifuge is not leveled	6. level instrument or call Service

Trouble Indication	Trouble Symptom	Cause	Remedy
"E-03" message flashes	rotor coasts to standstill without braking	speed measuring is disturbed during run	mains OFF/ON, open lid and check rotor locking
"E-07" message flashes in speed display section only MEGAFUGE 1.0R/2.0R 3.0R	rotor coasts to standstill without braking, cooling unit operates continuously	overtemperature alarm, because the chamber temperature exceeds allowable limit; pay attention to max. ambient temperature of 35°C and the min. distance of 10 cm to the wall – do not place the instrument in front of heating apparatus and do not expose it to direct sunlight	let centrifuge cool down, remove samples after standstill and cool them, precool centrifuge and start new run, if error happens again and if there are no obvious causes, call Service
"E-17" message appears	just after pressing the "lid" key at standstill	1. lid locking mechanism is clamping and doesn't open 2. faulty lid locking assy	1. turn power OFF check locking mechanism, do corrections 2. call KENDRO
"E-18" message flashes in speed display section only MEGAFUGE 1.0R/2.0R	set rotor is # 1379 or # 3041: drive is cut-out in speed range from (0 to 100) rpm, if rotor # 1379 or # 3041 is really installed, drive will brake, all other rotors will coast to standstill	1. rotor # 1379 or # 3041 preselected, but another rotor is installed 2. speed is set too low, (900 rpm or lower) 3. start key is pressed too fast after lid closing 4. rotor # 1379 or # 3041 is started with slow acceleration (not practical for this purpose)	1. to 4. wait until rotor has come to standstill; correct the parameter settings: (rotor Cat.-No. or speed or normal acceleration), open and close the lid, wait a few seconds, then start again
"E-21" message flashes	drive is cut out during acceleration and coasts to standstill	insufficient acceleration power (e.g. in case of tremendous imbalance)	wait until rotor has come to standstill; open the lid and e.g. replace all buckets or racks, switch mains OFF/ON and start again
"E-xx" message flashes in speed display possible xx-values 00 – 19	during run: drive shuts off unbraked	release of thermal or electrical safety trip	switch OFF the centrifuge. After rotor standstill, switch ON, wait 15 min, then start again if error occurs again – call Service
	at standstill: drive is switched off right after start	troubles or defect in the electronics, measuring or data transmission	switch mains OFF/ON- if error happens again, call Service

11.2 Servicing

Before calling for service, please make a note of **all** the operating parameters as follows:

- rotor type, bucket number and loading procedures used
- speed or RCF value
- brake cut-out speed
- time
- temperature (only MEGAFUGE 1.0R/2.0R/3.0R)

also the control procedures used:

- start or stop phase
- quick run pressed or released
- normal or slow acceleration
- brake on or off
- lid closed or opened

and describe the fault signals exactly as possible e.g.:

- illuminated or flashing diagnostic messages
- E-xx – display (make a note of any error no.)
- unusual parameter indication
(speed, RCF, time, rotor, temperature on MEGAFUGE 1.0R/2.0R/3.0R)

and the fault symptoms:

- unusual noises during starting, acceleration, running or braking stages
- deceleration with or without braking etc.

and then call the Service Department.

ATTENTION – Important note!

Following switch-on, the centrifuge performs a check of all its display elements, display its software identification numbers in the "speed" and "time" windows for a short time, and then completes its internal self-checks.

Make a note of these software identification numbers whenever you contact KENDRO Service Department.



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In the interest of continuous product development, we reserve the right to make changes without express notice.