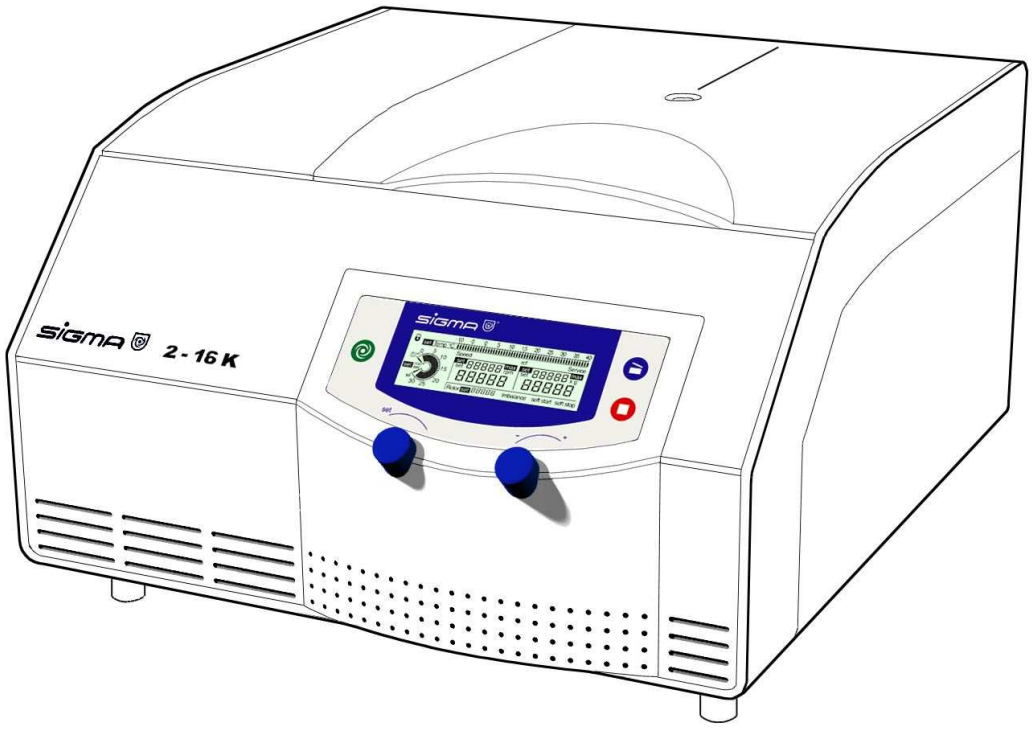


Refrigerated Centrifuge

2-16K

Operating Manual

Thank you very much for your confidence in the products of our company.

Our centrifuges are manufactured carefully according to the highest quality standards and we are sure that your demands will always be fulfilled.

Please read this manual carefully before installation of the centrifuge to ensure a proper and safe operation.

We are wishing you a successful use of the centrifuge.

SIGMA Laborzentrifugen GmbH
P.O. Box 1713 - 37507 Osterode/Germany
Phone 05522/5007-0 - Fax 05522/500712
Internet: www.sigma-zentrifugen.de
eMail: info@sigma-zentrifugen.de
SIGMA Service-Tel. 05522/5007-25

Konformitätserklärung
(73/23/EWG; 89/336/EWG; 98/37/EWG)
Statement of Conformity
(73/23/CEE; 89/336/CEE; 98/37/CEE)
Déclaration de conformité
(73/23/CEE; 89/336/CEE; 98/37/CEE)

Die nachfolgend bezeichnete Maschine wurde in Übereinstimmung mit den Richtlinien 73/23/EWG; 89/336/EWG und 98/37/EWG hergestellt und geprüft.
The following machine is manufactured and tested in compliance with directions 73/23/CEE; 89/336/CEE and 98/37/CEE.
La machine désignée ci-dessous est produit et examiné conforme aux directives 73/23/CEE; 89/336/CEE et 98/37/CEE

Bezeichnung der Maschine:	Laborzentrifuge
Machine:	Laboratory Centrifuge
Désignation de la machine:	Centrifugeuse de laboratoire
Maschinentyp :	2 – 16K
Type:	2 - 16 KC
Type de la machine:	2 - 16 KCH
Bestell Nr. :	10160, 10161, 10162, 10167, 10168, 10169, 10170
Part No.:	
Réf. usine:	
Normen:	EN 61010-2-020
Standards:	EN 61000-3-2 ; EN 61000-3-3
Normes :	EN 61326

Sigma Laborzentrifugen
An der Unteren Söse 50
D-37520 Osterode

01.08.2002 Geschäftsführer
Managing Director
Directeur Gérant

.....
Fabr. Nr. Serial No. Numéro de fabrique

General Information

Description of the Centrifuge

Installation and Start-up

Operating Elements

Notes for Centrifugation

Care and Maintenance

Appendix

1.1 Technical Data

Manufacturer:	S I G M A Laborzentrifugen GmbH 37520 Osterode
Type:	2-16K
Electr. connection: Protection class:	see nameplate I
Power consumption (kVA): Rated power (kW): Max. current (A):	1 0,72 4 (230 V/50 Hz) respectively 8 (120 V/60 Hz)
Power data:	
Max. speed (rpm): Max. capacity (l): Max. gravitational field (x g): Max. kin. energy (Nm):	15 300 0,4 21 918 9 962
Further parameters	
Time range: Temperature setting range:	0 - 30 min/continuous run/ short-time operation -10 to +40 °C
Dimensions:	
Depth (mm): Width (mm): Height (mm): Weight (kg): EMC (acc. to EN 55011): Noise level (dBA):	570 550 320 60 Class B < 65
Notes of user: Serial number: Supply date: Inventory number: Location: Responsibility:	 ....

The figures are valid for an ambient temperature of +23 °C +/- 2 °C and nominal voltage +/- 5 %. The minimum temperatures during run are < +4 °C and depend on type of rotor, speed and ambient temperature. For rotor 12132 approx. +6°C at 14000 rpm.
(Allowable ambient temperature +10 °C - +35 °C; max . humidity 80 %.)
Subject to technical alterations.

1.2 Accessories Suitable for SIGMA 2-16K

Part No.	Description	Max. speed (rpm)	Max. gravitational field (x g)
11124	Swing-out rotor 24 x 1.5-2.2 ml for reaction vials e.g. 15008, 15040, incl. hermetic aluminium lid, max. radius 7.4 cm, min. radius 3.5 cm	14 000	16 215
11409	Microhematocrite rotor for 24 capillary tubes 1.5 x 75 mm, 50 µl, incl. reader 17029, max. radius 9 cm, min. radius 1.5 cm	12 000	14 489
15001	Microhematocrite capillary tubes, heparinized, 1.5 x 75 mm, 50 µl, 200 pcs.		
17005	Capillary sealing putty (6 plates)		
17002	Reader for use with microhematocrite rotor		
17029	Reader for 1 capillary tube		
17004	Magnifying glass		
12139	Angle rotor 6 x 27-30 ml for sealed tubes e.g. 15029, 15030, 15032, incl. hermetic aluminium lid, max. radius 7.8 cm, min. radius 2.2 cm, angle 30° Attention! Rotors from batch number 201/00 may be run <u>with</u> lid, rotors of older batches (e.g. 15/00 or ../99) have to be run <u>without</u> lid	15 300	20 414
12141	Angle rotor 10 x 10-12 ml for sealed tubes e.g. 15000, 15010, 15039, incl. hermetic aluminium lid, max. radius 7.6 cm, min. radius 2.9 cm, angle 35°	15 300	19 890
12148	Angle rotor 24 x 1.5-2.2 ml for reaction vials e.g. 15008, 15040, incl. hermetic aluminium lid, max. radius 8.2 cm, min. radius 5 cm, angle 45°	15 300	21 460

Part No.	Description	Max. speed (rpm)	Max. gravitational field (x g)
12132	Angle rotor 30 x 1.5-2.2 ml for reaction vials e.g. 15008, 15040, incl. hermetic aluminium lid, max. radius 10 cm, min. radius 6.7 cm, angle 45°	14 000	21 913
12104	Angle rotor incl. hermetic lid, aluminium, for 12 strips with 8 PCR-tubes 0.2 ml each, max. radius 9.8 cm, min. radius 7.2 cm, angle 45°	14 000	15 777/21475
12105	Angle rotor incl. hermetic lid, aluminium, for 16 strips with 5 PCR-tubes 0.2 ml each, max. radius 9.6 cm, min. radius 7.3 cm, angle 45°	14 000	15 996/21 036
12072	Angle rotor 20 x 15 ml incl. buckets 13011, for round or conical tubes, max. ∅ 17 x 120 mm, e.g. 15015, 15020, 15023, 15024, Monovettes, culture tubes 15 ml 15115, max. radius 13.9 cm, min. radius 8 cm, angle 33°	3 900	2 364
12073	Angle rotor 30 x 15 ml incl. buckets 13011, for round or conical tubes, max. ∅ 17 x 120 mm, e.g. 15015, 15020, 15023, 15024, Monovettes, culture tubes 15 ml 15115, 2 lines, angle 33°		
	max. radius 13.9 cm, min. radius 8 cm,	3 900	2 364
	max. radius 11.6 cm, min. radius 5.8 cm	3 900	1 973
12151	Angle rotor for 6 culture tubes 50 ml 15151, incl. hermetic aluminium lid, max. radius 9.5 cm, min. radius 3 cm, angle 28°	9 000	8 603
13060	Adapter for 1 culture tube 15 ml 15115, suitable for 12151, 13150, 19776		
13079	Bottom adapter for 1 tube 40-42 ml 15051, 15052, 15054, suitable for 12151		

Part No.	Description	Max. speed (rpm)	Max. gravitational field (x g)
11190	Swing-out rotor 4 x 100 ml, complete, consisting of rotor 11192, 4 buckets 13097, 4 glass tubes 15100 and 4 rubber cushions 16051, max. radius 13.5 cm, min. radius 5 cm	5 000	3 773
11191	Swing-out rotor 16 x 15 ml, complete, consisting of rotor 11192, 4 multiple carriers 13012, 16 polystyrene tubes 15020 and 16 rubber cushions 16015, max. radius 13.4 cm, min. radius 5.1 cm	5 000	3 745
11192	Swing-out rotor for 4 buckets or multiple carriers 13004, 13009, 13012, 13022, 13040, 13041, 13047, 13097, 13150	5 000	3 773/3 745

Buckets and multiple carriers for 11192

13004	Multiple carrier, aluminium, incl. rubber cushion, for 5 tubes 7 ml, max. ∅ 12.5/16 x 95 - 105 mm, e.g. 15007, 15027
13009	Multiple carrier, aluminium, for 5 tubes 5 ml, max. ∅ 12.5/16.5 x 65 - 85 mm, flat and round bottom tubes, e.g. 15060, Vacutainer tubes
13012	Multiple carrier, aluminium, incl. rubber cushion 16015, for 4 tubes 5-15 ml, max. ∅ 17 x 90 - 110 mm, e.g. 15015, 15020, 15023, 15024, Monovettes
13022	Bucket, aluminium, incl. rubber cushion 16025, for 1 glass tube 25-30 ml, max. ∅ 24.5 x 95 - 110 mm, e.g. 15025, 15026, 15033
13047	Bucket, aluminium, incl. rubber cushion 16051, for 1 tube 50 ml, max. ∅ 35.5 x 95 - 110 mm, e.g. 15049, 15050, 15056

Part No.	Description	Max. speed (rpm)	Max. gravitational field (x g)
13097	Bucket, aluminium, incl. rubber cushion 16051, for 1 tube 100 ml, max. ∅ 45.5 x 95 - 105 mm, e.g. 15100, 15102, 15103, 15106		
13041	Bucket, aluminium, incl. screw cap 17130, for round carriers 14029, 14030, 14031, 14032, 14033, 14034, 14035, max. length of tubes 110 mm		
14029	Round carrier for 5 tubes 5-7 ml, max. ∅ 12.5/15 x 65 - 105 mm, e.g. 15007, 15027, 15060, polypropylene, suitable for 13041		
14033	Round carrier for 4 tubes 5 ml, ∅ 13.5/17.5 x 70 - 110 mm, e.g. Vacutainer tubes, polypropylene, suitable for 13041		
14034	Round carrier for 3 tubes 10-15 ml, max. ∅ 17.3/19 x 80 - 110 mm, e.g. 15020, 15023 and Monovettes 9 and 10 ml, polyethylene, suitable for 13041		
14030	Round carrier for 4 tubes 10-12 ml, max. ∅ 16.2/17.5 x 80 - 110 mm, e.g. 15000, 15010, 15015, 15024, 15039, polyethylene, suitable for 13041		
14031	Round carrier for 1 glass tube 25 ml, max. ∅ 25/30 x 70 - 105 mm, e.g. 15025, 15026, 15033, polypropylene, suitable for 13041		
14035	Round carrier for 1 sterilin tube 30 ml, graduated up to 20 ml, with skirt, incl. cap, max. ∅ 25/31 x 65 - 95 mm, polypropylene, suitable for 13041, see www.bibby-sterilin.co.uk, no. 03008		
14032	Round carrier for 1 tube 50 ml, max. ∅ 35/38 x 70 - 105 mm, e.g. 15049, 15050, 15056, polypropylene, suitable for 13041		
17130	Sealing cap, polysulfone, clear, for 13041		

Part No.	Description	Max. speed (rpm)	Max. gravitational field (x g)
13150	Bucket, aluminium, incl. screw cap 17151, for 1 culture tube 50 ml 15151		
17151	Sealing cap, polysulfone, clear, for 13150		
13060	Adapter for 1 culture tube 15 ml 15115, suitable for 12151, 13150, 19776		
13040	Bucket, aluminium, incl. screw cap 17140, for round carriers 17205, 17215, 17225, 17250, max. length of tubes 110 mm		
17140	Sealing cap, polysulfone, clear, for 13040		
17205	Round carrier for 4 tubes, max. ∅ 13.5/16.5 x 70 - 90 mm, e.g. Vacutainer tubes, polypropylene, suitable for 13040		
17215	Round carrier for 3 tubes 10-15 ml, max. ∅ 17 x 90 - 100 mm, e.g. 15015, 15020, 15023, 15024, polypropylene, suitable for 13040		
17225	Round carrier for 1 tube 25-30 ml, max. ∅ 25.4/28 x 70 - 105 mm, e.g. 15025, 15026, 15029, 15030, 15032, 15033, polypropylene, suitable for 13040		
17222	Round carrier for 1 sterilin tube 30 ml, graduated up to 20 ml, with skirt, incl. cap, max. ∅ 25/31 x 65 - 95 mm, polypropylene, suitable for 13040, see www.bibby-sterilin.co.uk, no. 03008		
17250	Round carrier for 1 tube 50 ml, max. ∅ 35/38 x 70 - 105 mm, e.g. 15049, 15050, 15056, polyethylene, suitable for 13040		

Part No.	Description	Max. speed (rpm)	Max. gravitational field (x g)
11122	Swing-out rotor for microtiter plates. incl. 2 carriers 13222, radius edge 12.3 cm, radius max. 10.5 cm, radius min. 6.5 cm, max. plate height 56 mm	3 000	 1 238 1 057 654
11123	Swing-out rotor for microtiter plates, incl. 2 carriers 13223, radius edge 11.9 cm, radius max. 10 cm, radius min. 6.5 cm, max. plate height 48 mm	4 000	 2 129 1 789 1 163

Adaptors and Plastic Vessels

13000	Adapter for reaction vials 0.25-0.4 ml 15014, suitable for 11124, 12132, 12148, polyallomer
13002	Adapter for reaction vials 0.5-0.75 ml 15005, Ø 7.9/10 x 28/31 mm, suitable for 11124, 12132, 12148, polyallomer
13021	Adapter for PCR-tube 0.2 ml, ∅ 5.85/6.95 x 20/23.4 mm, suitable for 11124, 12132, 12148, polyallomer
13059	Adapter for 1 tube with screw cap 10-12 ml, max. Ø 16.2/19 x 75 - 85 mm, e.g. 15000, 15010, 15039
15014	Reaction vials 0.4 ml (Beckman system), polypropylene, 1 pack contains 100 pcs., suitable for 13000
15005	Reaction vials 0.5 ml, Ø 7.9/10 x 28/31 mm, 1 pack contains 100 pcs., suitable for 13002
15008	Reaction vials 1.5 ml, 1 pack contains 100 pcs., suitable for 11124, 12132, 12148
15040	Reaction vials 2.2 ml, 1 pack contains 100 pcs., suitable for 11124, 12132, 12148

Part No.	Description
15010	Polycarbonate tube with screw cap 12 ml, ∅ 16.1 x 81.1 mm, suitable for 12141, 13059
15000	ditto, Teflon
15039	ditto, polypropylene
13026	Stainless steel tube 10 ml, ∅ 15.7 x 76 mm, closeable with cap 17126, suitable for 12141, 13059
17126	Stainless steel sealing cap for 13026
15020	Polystyrene tube 15 ml, ∅ 17 x 100 mm, suitable for 11191, 12072, 12073, 13012, 14034, 17215
15021	Polypropylene stopper for 15020, 15023
15023	Polypropylene tube 15 ml, ∅ 17 x 100 mm, suitable for 12072, 12073, 13012, 14034, 17215
15115	Culture tube incl. screw cap 15 ml, suitable for 12072, 12073, 13060
15029	Teflon tube with screw cap 28 ml, Ø 25.3 x 96 mm, 12139, 17225
15030	Polycarbonate tube with screw cap 30 ml, ∅ 25.3 x 92 mm, suitable for 12139, 17225
15032	Polypropylene tube with screw cap 28 ml, ∅ 25.3 x 92 mm, suitable for 12139, 17225
13079	Bottom adapter for 1 tube 42-50 ml 15051, 15052, 15054, suitable for 12151
15049	Polycarbonate tube 50 ml, graduated 0 - 50 ml in steps of 1 ml, ∅ 34 x 100 mm, suitable for 13047
15051	Teflon tube with screw cap 42 ml, ∅ 28.5 x 107 mm, suitable for 13079

Part No.	Description
15052	Polypropylene tube with screw cap 42 ml, ∅ 28.8 x 107 mm, suitable for 13079
15054	Polycarbonate tube with screw cap 40 ml, ∅ 28.8 x 107 mm, suitable for 13079
15151	Culture tube with screw cap 50 ml, pointed bottom, suitable for 12151, 13150
15102	Polypropylene tube 100 ml, ∅ 45 x 100 mm, suitable for 13097
15103	Polycarbonate tube 100 ml, ∅ 45 x 100 mm, graduated 2 - 100 ml in steps of 2 ml, suitable for 13097

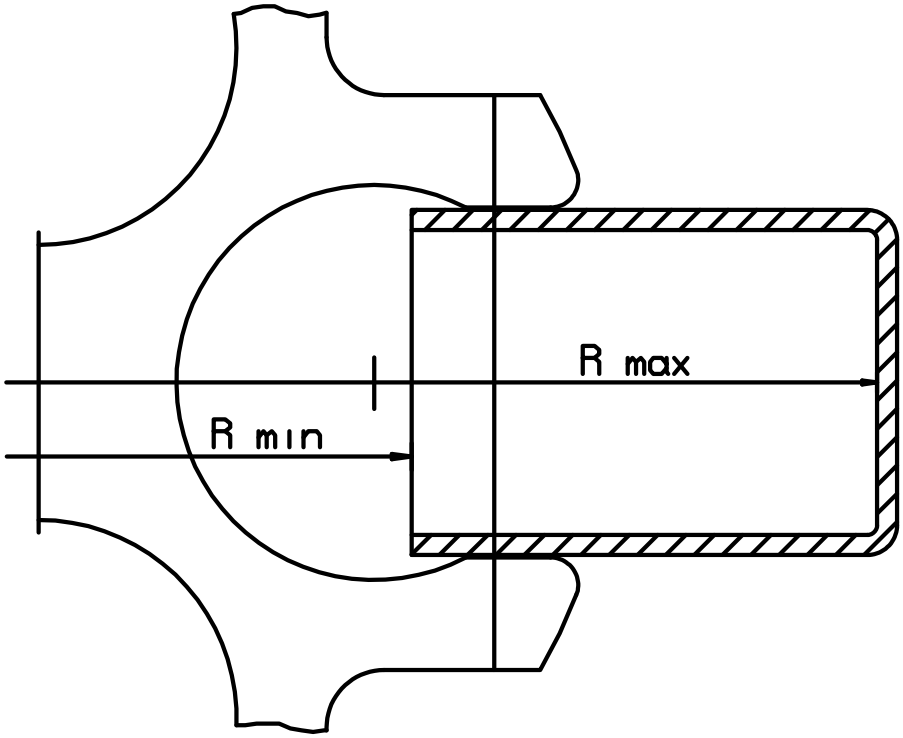
Centrifuge Glass Tubes

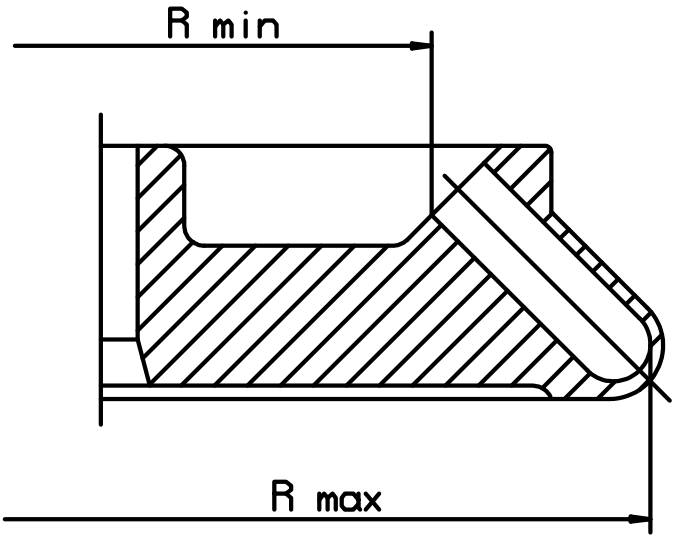
15007	Centrifuge glass tube 7 ml, ∅ 12 x 100 mm, suitable for 13004, 14029
15027	ditto, graduated, 0 - 5.5 ml in steps of 0.1 ml
15015	Centrifuge glass tube 15 ml, ∅ 16 x 100 mm, suitable for 12072, 12073, 13012, 14030, 17215
15024	ditto, graduated, 0 - 10 ml in steps of 0.1 ml
15025	Centrifuge glass tube 25 ml, ∅ 24 x 100 mm, suitable for 13022, 14031, 17225
15026	ditto, graduated, 5 - 25 ml in steps of 1 ml
15050	Centrifuge glass tube 50 ml, ∅ 34 x 100 mm, suitable for 13047, 14032, 17250
15056	ditto, graduated, 4 - 50 ml in steps of 1 ml
15100	Centrifuge glass tube 100 ml, ∅ 44 x 100 mm, suitable for 11190, 13097
15106	ditto, graduated, 1 - 100 ml in steps of 1 ml

Further accessories available on request.

Maximum speed for tubes

Some tubes, e.g. centrifuges glass tubes, microtubes, culture tubes, Teflon tubes and especially high volume tubes can be used in our rotors, buckets and adapters at higher speeds than their breaking limit. We recommend to always fill up the tubes and to follow the recommendations of the manufacturer.


R max
R min


R min
R max

1.3 Scope of Supply

The following belongs to the centrifuge:

Connection cable	Part No. 269 010
Rotor wrench	Part No. 930 100
20 ml slushing oil	Part No. 70104
1 tube of grease for load-bearing bolts	Part No. 70284

Documentation:

Operating Manual
"Rotor and Accessories, Operation and Use"
EU-Statement of Conformity
Equipment Decontamination Certificate

Accessories according to your order, our order confirmation and our delivery note.

Rotor Part No.	Rotor No.
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....

1.4 Standards and Regulations

Please refer to the enclosed EU-Statement of Conformity.

1.5 Safety Instructions

According to the German trade association regulation BGR500 chapter 2.11 part 3 the owner of the instrument is advised to take care of the following points:

1. According to BGR500 the owner has to provide operating instructions based on those of the manufacturer and to inform the employees accordingly.

2. For safety reasons these operating instructions must clearly state that the stamped max. speed of the used rotor and the max. allowable filling quantity must not be exceeded.

3. If the density of the material exceeds 1.2 g/cm^3, the max. speed of the centrifuge must be reduced (see formula chapter 7.1.2).

4. Operation of the centrifuge in hazardous locations is not allowed.

5. During operation the centrifuge must not be moved. Leaning against or resting on the centrifuge is not allowed.

6. Do not spin explosive or highly inflammable materials.

7. Substances which could damage the material of the centrifuge, the rotors or the buckets anyhow must not be centrifuged or only under consideration of special safety measures. Infectious, toxic, pathogene or radioactive substances must be centrifuged in certified rotors only.

8. Keep a clearance of at least 30 cm around the centrifuge. Dangerous materials of any kind must not be put down or stored in that area.

9. Attention!
   Defective lid relieving devices could cause the centrifuge lid to fall down (contact Service). Risk of bruising!

1.6 Symbol Table

International symbols used for the centrifuge:

Symbol	Title
	Gefährliche elektrische Spannung Dangerous voltage Courant haute tension
	Achtung, Bedienungsanleitung beachten Attention, consult accompanying documents Attention, consulter les documents joints
I	Ein (Netzverbindung) On (Power) Marche (mise sous tension)
O	Aus (Netzverbindung) Off (Power) Arrêt (mise hors tension)
	Schutzleiteranschluß Protective earth (ground) Liaison à la terre
	Erde Earth (ground) Terre
	Netzstecker ziehen Unplug mains plug Tirer la fiche de prise
	Vorsicht Quetschgefahr Caution! Risk of bruising Attention! Danger de blessure
→	Drehrichtungspfeil Arrow direction of rotation Flèche sens de rotation
	Heiße Oberfläche Hot surface Surface chaude

2.1 General Outlay

The new generation of SIGMA laboratory centrifuges is equipped with newest state-of-the-art electronics and is driven by brushless, silent and long-life asynchronous motors.

The problem of carbon brush change is no longer existent and as there is no carbon dust pollution, operation in clean rooms is possible if the appropriate accessories are used.

2.2 Construction and Constructive Safety Measures

The centrifuge is built into a solid steel housing. The centrifuge lid is also made of solid steel. From the back, the lid is secured by solid hinges and at the front by two separate cover locks.

2.3 Drive

The drive motor is a well dimensioned asynchronous motor.

2.4 Operation and Display

The grafical LCD display is hermetically sealed, operation is executed via two knobs. Any operating status is indicated.

2.5 Electronics

The electronics controlled by a microprocessor allows extensive adaptations of the centrifuge to the different tasks. The following parameters can be set:

- Speed in steps of 1 respectively 100 rpm *
- RCF in steps of 1 respectively 10 x g *
- Time in steps of 1 min respectively 1 sec
- Continuous operation
- Short-time operation
- Temperature setting range between – 10 °C and + 40 °C in steps of 1 °C
- Preselection of rotor

* Preselection of 1 x g respectively 1 rpm by pressing and holding (2 – 3 seconds) the stop key.

2.6 Safety Devices

Apart from the passive safety devices due to the instrument's mechanical design there are the following active precautions for your safety:

2.6.1 Lid Lock, Cover Closing Device

The centrifuge can only be started when the lid is correctly closed. Both locks must close. The lid can only be opened when the rotor has stopped. If the lid is opened via the emergency release during operation (which is not allowed), the centrifuge will immediately switch off and decelerate brakeless. If the lid is open, the drive is completely separated from the mains supply, that means starting of the centrifuge is impossible (refer to point 7.2.4 "Emergency lid release").

2.6.2 Standstill Monitoring

Opening of the centrifuge lid may only be possible, if the rotor is at standstill. This standstill is checked by the microprocessor.

2.6.3 System Check

An internal system check monitors data transmission and the sensor signals with regard to plausibility. In case of a malfunction an error message is displayed under a number in the “Speed“ and “rcf“ display.

2.6.4 Ground Wire Check

For ground wire check there is a ground screw at the rear panel of the centrifuge. A ground wire check can be carried out using an appropriate measuring instrument.

2.6.5 Imbalance Monitoring System

The display “Imbalance“ indicates by lightning up that the centrifuge is in the still permitted imbalance area.
In the event that bigger uneven loading leads to imbalance, the drive is switched off during acceleration or during run.
“Imbalance“ is flashing and “ERROR“ is displayed. The centrifuge has to be opened with the lid key. In both cases the loading has to be checked and balanced.

3.1 Unpacking of the Centrifuge

Open cardboard. Take out the box containing accessories. Remove upper foam cushions. Lift centrifuge upwards with a lifting device or with several persons. When lifting or carrying the centrifuge please always reach under the instrument from the side.

Proceeding when using a slip box:
Remove cover of cardboard box and take out accessories. Remove upper foam cushions and remove slip box. Lift centrifuge upwards with a lifting device or with several persons. When lifting or carrying the centrifuge please always reach under the instrument from the side.

Attention: The instrument is heavy!

Please keep case for possible transport of centrifuge later.

3.1.1 Transport Safety Device (made of foamed material)

The SIGMA 2-16K has a transport safety device between the rotor chamber and the motor.

It is accessible after opening of the centrifuge lid (refer to chapter 3.3 up to 3.4.2 or 7.2.4“ Emergency lid release“).

The transport safety device has to be removed, the motor is slightly lifted at the shaft.

Align centrifuge and continue start-up.

The transport safety device should be kept for possible transport of the centrifuge (service, repair).

3.2 Installation

3.2.1 Site

All energy consumed by the centrifuge is converted into heat and emitted into the ambient air. Therefore, sufficient ventilation is important. As the air-ducts in the unit must be open, keep a clearance of at least 30 cm around the centrifuge. Also, the centrifuge shouldn`t be positioned near radiators and should not be directly exposed to sunshine.

The table should have a solid, even top.

For normal operation the ambient temperature should not fall below 10 °C and not exceed 35 °C. The max. humidity of air is 80 %. During transport from cold to warmer places water will condensate inside the centrifuge. It is important that there is enough time for drying before the centrifuge can be started again.

3.2.2 Connection

The operating voltage on the name plate must correspond to the local supply voltage!

SIGMA laboratory centrifuges are units of safety class I, DIN VDE 0700, and include a three wire power cord 2,5 m long with shockproof right angle plug. The instrument has thermal fuses. In case of a disconnection through the thermal fuses, allow a cool-down phase of two minutes, after which they could be reactivated by a switch.

At the back, next to the mains supply, there is an additional ground wire connection where a separate ground wire can firmly be connected to ground any non-hazardous leakage current. The leakage current is harmless but secondary effects would occur.

3.2.3 Fuses / Emergency Circuit Breaker on Site

Each centrifuge must be protected with a 16 A time lag fuse.

An emergency circuit breaker to cut the power to the centrifuge in the event of a malfunction is required on site. This switch should be located away from the centrifuge, preferably outside the room where the centrifuge is used or at the exit of this room.

3.3 Installation of Rotors and Accessories

1. Open centrifuge lid by pressing Lid-key.

2. Unscrew rotor tie-down screw from motor shaft (anticlockwise).

3. Lower the rotor straight down onto the motor shaft.

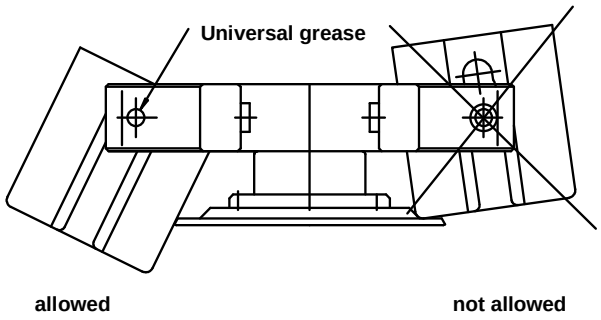
4. Tighten the tie-down screw (clockwise) with the rotor wrench so that the disc spring is pressed together.

Fastening torque:	1-6/1-13/1-15/2-5/1-15K/2-16/2-16K/ 2-16KC:	approx. 5 Nm
	3-16/3-16K/3-18K/3K 30:	approx. 7,5 Nm
	4-15/4K15/6-15/6K15:	approx. 10 Nm

In the event of frequent use the tie-down screw must be loosened by some turns and fastened again. **This should be done once a day or after approx. 20 cycles.** This ensures a proper connection between rotor and shaft (please refer to chapter 6.2 "Care and cleaning of accessories" as well).

5. Fill all positions of swing-out rotors with buckets. Make sure that all buckets are inserted correctly.

6. Use only appropriate vessels for the rotor (please refer to chapter 1.2 "Suitable accessories" as well).



7. Fill vessels external to the centrifuge.

8. Put or screw on covers of vessels.

9. Opposite places of the rotors must always be loaded with same accessories and same filling.

10. In angle rotors the plastic vessels must always be totally filled to avoid cracks of vessels and leakages or loosening of the caps in case of partial filling.

Attention, follow the special comments of chapter 1.5.

11. **Attention**: The centrifuge will absorb smaller differences in weight when loading the rotors. But it is recommended to balance the vessels as accurately as possible in order to ensure a run with minimal vibrations. Should the centrifuge be operated with very uneven load, the imbalance monitoring will switch off the drive. An imbalance warning would be displayed (refer to 4.1).

12. Rotors with lid should always be run with their lid. The rotor lid is tightened by hand. Correct fastening must be ensured. **Attention: The lid screw serves for fastening of the lid onto the rotor only, not for fastening of the rotor onto the drive!** Before installation of the lid, the correct fastening of the rotor fixing screw must always be checked using a wrench.

3.3.1 Fastening of Angle Rotors with Hermetically Sealed Lid

(Please refer to drawing on next page.)

1. Screw rotor lid (2) onto rotor and tighten it.

2. Lower rotor with lid (2) onto motor shaft.

3. Put rotor tie-down screw (1) onto motor shaft and tighten using the wrench.

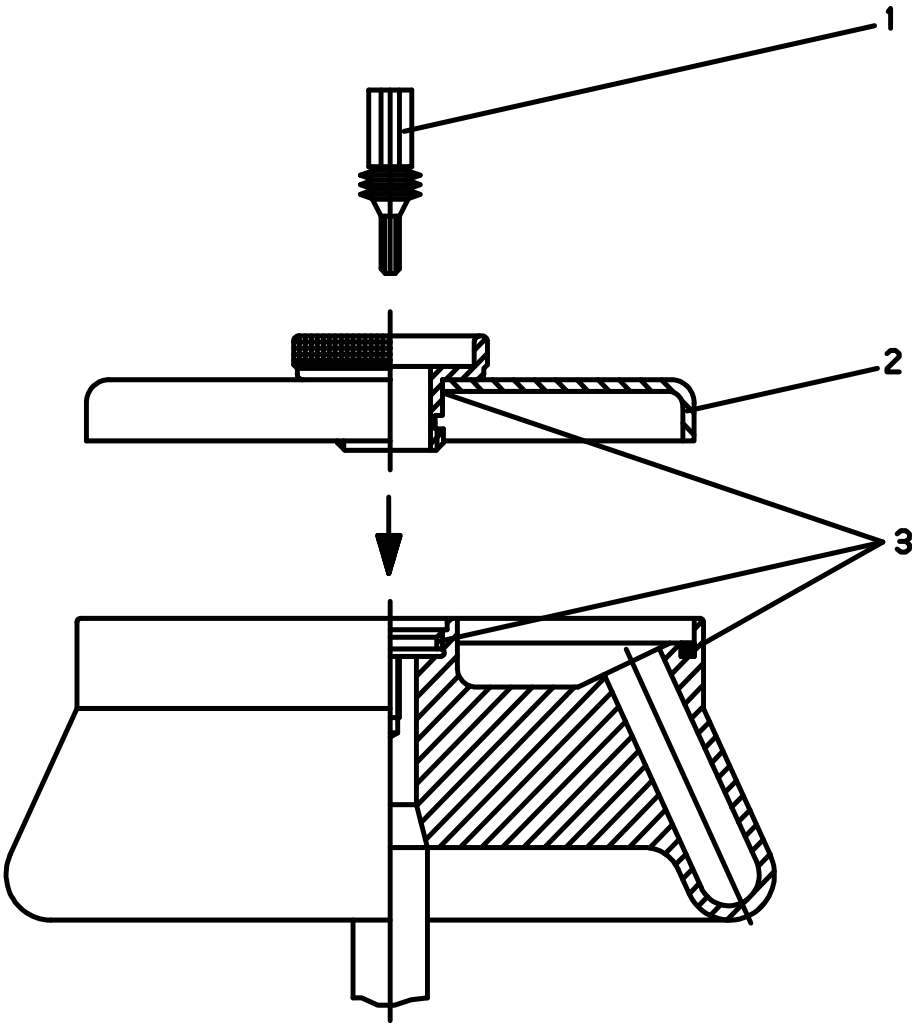
4. The rotor can be run without lid (2) as well.

5. The rotor and lid seals (3) must be greased after cleaning.

6. Special instructions for the use of hermetically sealed rotors:

   All rotors can be installed or removed with closed lid after loosening the rotor tie-down screw. All rotors are autoclavable (refer to chapter 6.6 "Sterilization and disinfection of rotor chamber and accessories").
   To increase life of rotors and seals the rotors must be cleaned with slushing oil and the seals and thread areas with vaseline or grease after cleaning.

   Attention!
   Please follow the special comments of chapter 1.5.


1
2
3

3.4 Initial Start-Up

Attention!

Before initial start-up please take care that your centrifuge is orderly installed (refer to chapter 3.2 "Installation").

3.4.1 Switching on of the Centrifuge

Press mains switch (on the right side panel).

– The centrifuge display is illuminated.

3.4.2 Opening of the Lid

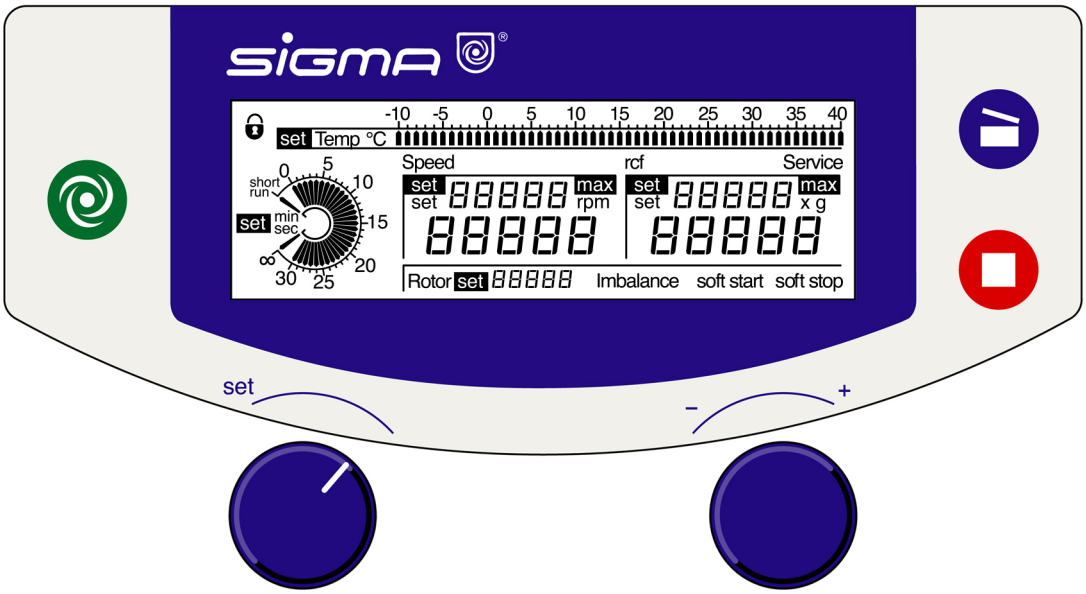
Press the lid-key.

– The lid opens.

3.4.3 Installation of a Rotor

Put a rotor onto the shaft and fasten it by screwing the rotor tie-down screw clockwise onto the drive shaft. Please use the supplied rotor wrench (refer to chapter 3.3 "Installation of rotors and accessories").

4.1 Operating Panel



The centrifuge is operated via the operating panel. Keys can be pressed when their LED is on.

When power is applied, all LEDs and the display are illuminated for a short time.

4.1.1 Start-key

This key can be used for the following:

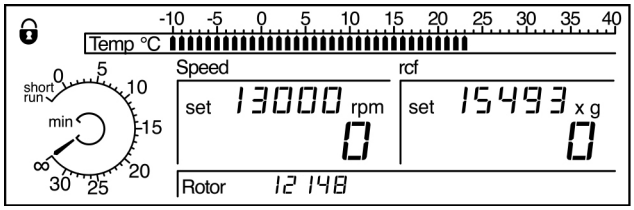
- starting centrifuge operation when the lid is closed and the start-key is illuminated,
- terminating a previously started deceleration process and restarting the centrifuge,
- shifting to short-run (refer to chapters 4.2.3.2.1, 4.2.3.2.2),
- saving a program. The parameters speed, time and rotor preselection can be locked, thereafter a change is impossible. Starting and stopping the centrifuge and opening of the lid is always possible.

  Open centrifuge lid. Press the start-key 3 x and hold for approx. 2 seconds when pressing for the third time. The symbol " 🔒 ' in the display is flashing. Cancellation of this function occurs in the same way.

4.1.2 Stop-key with Preselection of the Soft Stop and/or Soft Start Function

This key can be used for the following:

- early terminating the run,



The centrifuge decelerates to a complete stop. Deceleration can be terminated by pressing the start-key again and the centrifuge can be restarted.

- activating the soft stop and/or soft start function resulting in a longer deceleration and/or acceleration time. When activated “soft stop“ and/or “soft start“ is displayed.
  This is possible when

  - <u>the centrifuge is at standstill:</u>
    Activation or deactivation of “soft stop“ and/or “soft start“ by pressing the stop-key.

  - <u>the centrifuge is running, stop-key illuminated:</u>
    Press the stop-key. “soft stop“ and/or “soft start“ can be activated or deactivated during deceleration by pressing the stop-key again.

4.1.3 Lid-key 

This key is used to open the lid.

This is possible when

- the centrifuge has come to a complete stop,
- the lid-key is illuminated.

When the lid-key is flashing, the lid has to be opened again. When closing the lid both locks must catch.

4.1.4 Knobs

The parameters are set by turning the knobs.

Left knob:

Activation of “set“ by selecting speed, rcf, time, temperature, rotor or lock.

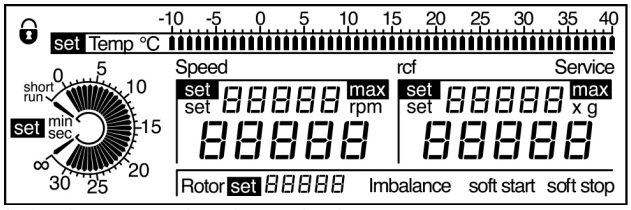
Remark: “set“ is automatically deactivated after 60 seconds, if no further changes are made, the lock symbol appears.

Thereafter, changes are impossible.

Right knob:

Preselection of the desired set value after activation of “set“.

4.2 Displays



(Display completely active)

The display consists of the following areas:

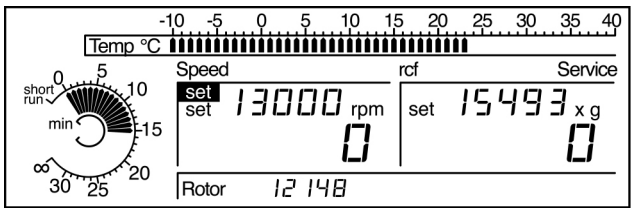
- Time
- Symbol lock
- Temperature
- Speed
- RCF
- Rotor, Imbalance, run mode

4.2.1 Speed/RCF (Relative Centrifugal Force)

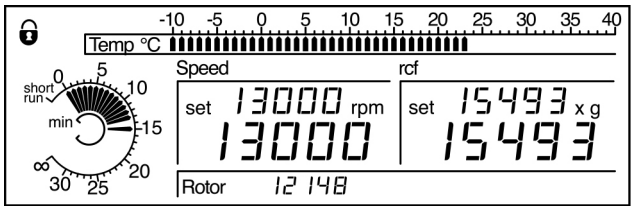
Rotor dimensions and speed determine the RCF value. Entry of one value automati-
cally determines the other one.

4.2.1.1 Speed

The display “Speed“ shows the rotations per minute. This value can be set by turning the right knob. Preselection of 1 rpm by pressing and holding (2 – 3 seconds) the stop key.



The actual speed is displayed below the set value.

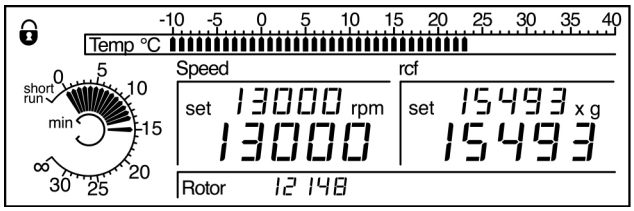


Activate “set“ in the “Speed“ area by turning the left knob. The speed value can be changed during the run by turning the right knob.

4.2.1.2 Relative Centrifugal Force (RCF)

The relative centrifugal force (RCF) is the acceleration which the sample is exposed to.

The display “rcf“ shows the rcf-value. Activate “set“ in the “rcf“ area with the left knob. The rcf value can be changed by turning the right knob. This is also possible when the centrifuge is running. Preselection of 1 x g by pressing and holding (2 – 3 seconds) the stop key.

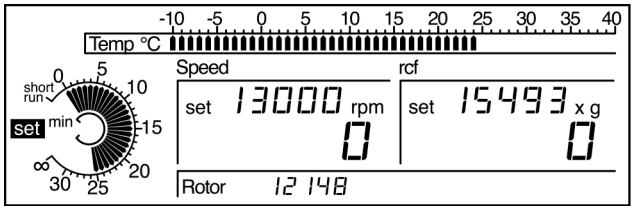


Please refer to chapter 1.2 “Suitable accessories“ for the maximum values for the used rotor combination.

4.2.2 Time

This display shows the total set time, the remaining run time or the elapsed time.

The time value as well as different time modes can be set by turning the right knob.

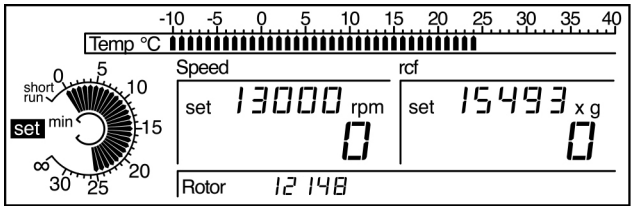


If the time is changed during centrifugation, the total newly entered period is run, the
time elapsed before is not considered.

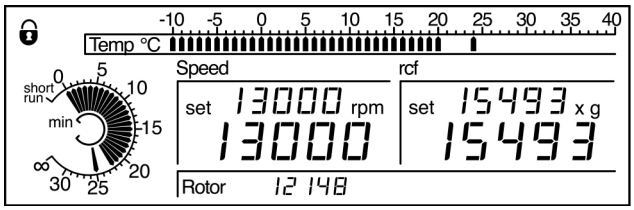
4.2.3 Standard Time Mode

For the standard time mode the time is set in minutes. Active “set“ in the time area with the left knob. Enter the time by turning the right knob (the display shows “min“).

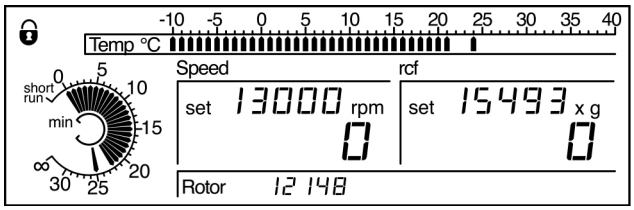
This total run time (max. 30 minutes) is displayed by a sequence of bars before starting the centrifuge.



During centrifugation this time is counted down, the sequence of bars indicates the remaining run time. The set time is indicated by one single bar.



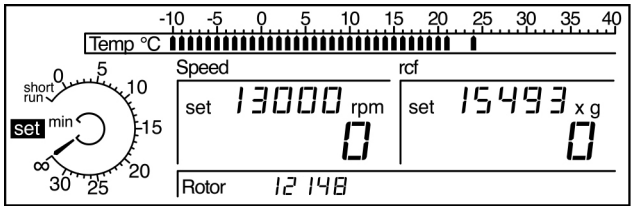
The centrifuge run can be early terminated by pressing the stop-key. The set time and the remaining run time remain on the display.



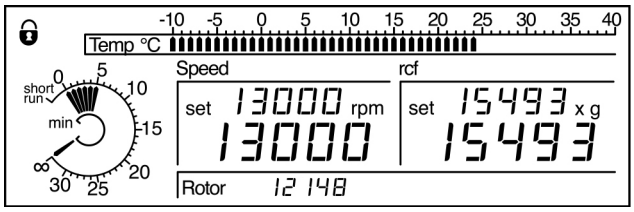
4.2.3.1 Continuous Operation Mode

During continuous run (∞) the centrifuge accelerates up to the set speed and the run has to be terminated manually.

Activate “set“ in the time area using the left knob. Select ∞ by turning the right knob and press the start-key to activate the continuous run.

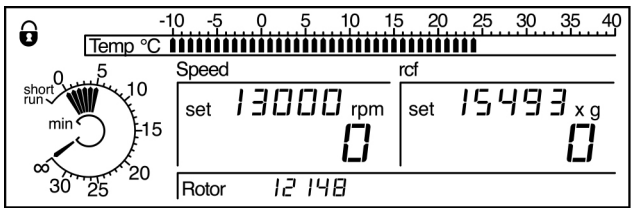


Unlike the standard run mode the minutes are counted up. A sequence of bars indicates the elapsed run time. One single bar at ∞ is indicating the continuous run mode.



After 30 minutes the remaining run time is no longer displayed but the run continues.

The continuous run is terminated by pressing the stop-key and the centrifuge decelerates to a complete stop. The elapsed time is displayed in minutes.



The continuous run mode can be left by selecting a set value as well.

4.2.3.2 Short-Time Operation

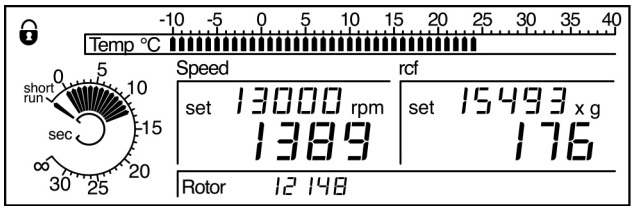
There are two options:

4.2.3.2.1 Short-Run 1

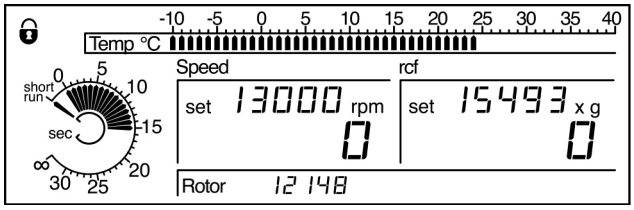
Press the start-key during the whole short-run. The centrifuge accelerates with maximum power to the maximum speed. After release of the start-key the centrifuge decelerates with maximum power to standstill.

During short-run the time is counted up in seconds, "sec" is displayed.

A sequence of bars is indicating the elapsed run time. One single bar at "short run" indicates that short-time operation had been selected.



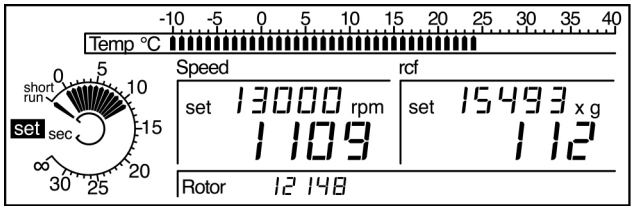
After termination of the short-run the elapsed run time in seconds remains on the display.



4.2.3.2.2 Short-Run 2

During this short-run the centrifuge is running max. 30 seconds and accelerates to the set speed (rotor dependent).

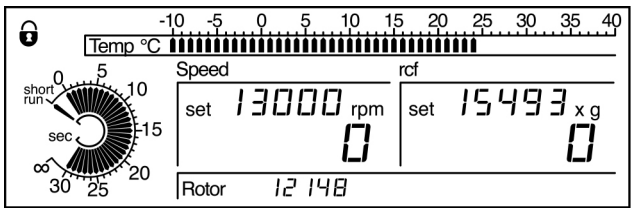
Select "short run“ by turning the left knob and press the start-key.



During the short-run the time is counted up in seconds. A sequence of bars indicates the elapsed run time. One single bar at "short run“ indicates that short-time operation had been selected.

After 30 seconds the centrifuge decelerates to a complete stop.

The short-run can be early terminated by pressing the stop-key. The centrifuge decelerates to standstill. The elapsed run time in seconds remains on the display.

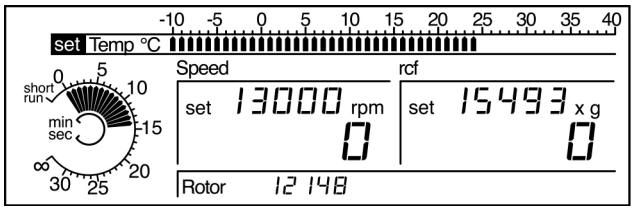


The "short run“ can be left by selecting a set value as well.

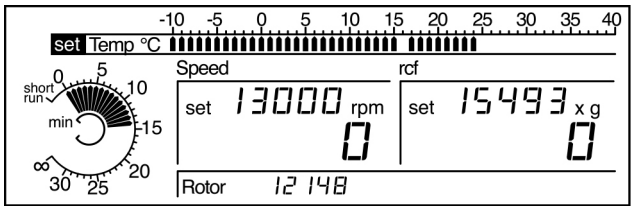
4.2.4 Temperature

The centrifuge is cooled with a cooling system. When a run is started, there is a temperature difference between the sample and the rotor which is minimized after a certain operating period has passed.

The scale of the upper display area shows the actual temperature in the chamber. Activate “set“ in the temperature area using the left knob and select the set value by turning the right knob. This is possible in steps of 1 °C.



Temperatures between – 10 °C and + 40 °C can be pre selected. If the set temperature is lower than the actual temperature, the set value is indicated by a flashing bar.



As soon as the lid is opened, the cooling system is disconnected in order to avoid icing of the rotor chamber.

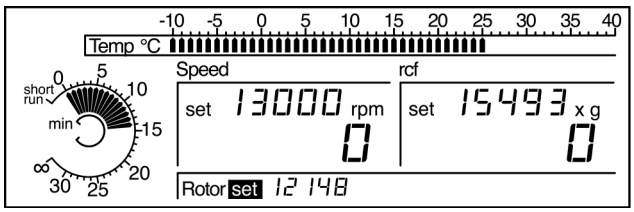
Precooling of the rotor below 0 °C during standstill is not recommended. Differences between actual and displayed temperature and icing of the compressor would be the result. This would reduce life of the compressor. We recommend precooling at 5000 rpm.

The obtainable temperatures depend on rotor type, speed and ambient temperature. (A change of the limit values might cause deviations.)

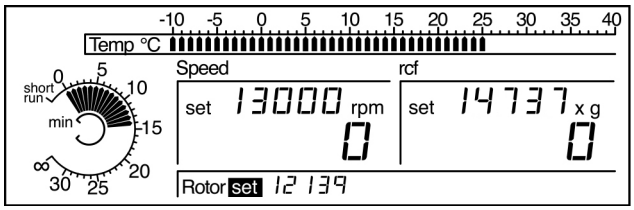
4.2.5 Preselection of a Rotor

The display “Rotor“ shows the preselected respectively the recognized rotor. Activate “set“ in the “Rotor“ area using the left knob. An other rotor can be selected by turning the right knob. This is not possible during a centrifuge run.

Attention: An automatic rotor identification occurs after the centrifuge has been started. If the used rotor is not the same than the preselected one, the used rotor is displayed and the preselected speed is corrected.



Preselected rotor 12148



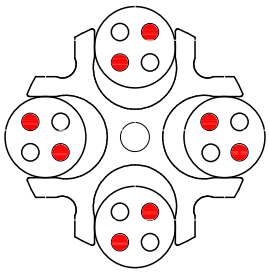
Changed to rotor 12139

!!! Attention, special case: !!!

If the rotors 12072, 12104 or 12105 are not preselected, rotor 12073 is automatically displayed for 12072 and rotor 12132 for 12104 and 12105.

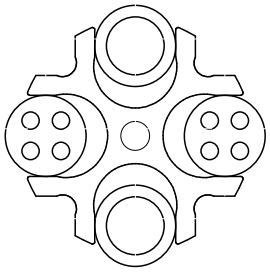
5.1 Practical Notes for Centrifugation

1. Locate centrifuge horizontally on a level surface.
2. Ensure safe location.
3. Keep at least 30 cm free space around the centrifuge.
4. Provide for sufficient ventilation.
5. Tighten rotor firmly onto motor shaft.
6. Avoid imbalance.
7. Load opposite buckets with same accessories.

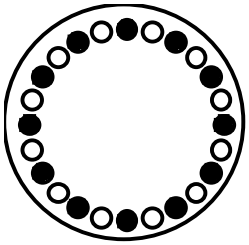


8. Centrifugation with low capacity:

   The example shows a complete swing-out rotor 16 x 15 ml which is loaded with 8 vessels only. The vessels must be loaded symmetrically so that the buckets and their suspensions are loaded evenly. Loading an eg. only an outer position of the bucket is not allowed.

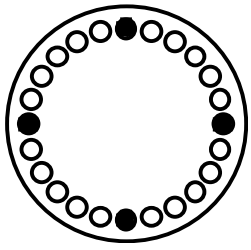


8.1 Centrifugation with different tubes:
Working with different tube sizes is possible. Opposite places must be loaded with the same vessels.The example shows a swing-out rotor with buckets and 2 x carriers 100 ml and 2 x carriers 4 x 15 ml with tubes.



8.2 Another example is the fixed angle rotor 24 x 2,2 ml:
The vessels should be placed symmetrically so that the rotor is loaded evenly. Loading e.g. only one position is not allowed.

9. Load all positions of swing-out rotors.



10. Load vessels outside the centrifuge.

11. Please pay attention to the max. speed. At speeds over 4 000 rpm there is an increased breaking glass hazard.

12. Fill vessels carefully to same weight. Imbalances would result in increased wear of bearings.

13. Use perfect accessories only.

14. Avoid corrosion to accessories by careful maintenance.

15. Spin infectious material in sealed rotors and buckets only.

16. Do not spin explosive or highly imflammable materials.

17. When centrifuging substances with a density > 1,2 g/cm^3 the allowable max. speed must be reduced (refer to chapter 7.1.2 "Density").

18. Grease joints of buckets and rotor pins in swing-out rotors.

5.2 Forbidden Centrifuging Operations

1. Operation of not carefully installed centrifuge.

2. Operation without front or back panels.

3. Operation by non authorized personnel.

4. Operation with rotor not installed properly (refer to chapter 3.3).

5. Operation with incompletely loaded drum rotor, swing-out rotor or angle rotor with interchangeable buckets.

   A rotor must always be loaded completely, empty places are not allowed! Opposite buckets or carriers may nevertheless be empty. Mixed loading is allowed, if opposite places are loaded with same buckets and carriers of same weight.

6. Operation with overloaded rotors.

   The load for a rotor is limited by its design and the max. speed (see rotor/bucket engraving) and must not be exceeded. The rotors are intended for liquids of max. homogeneous density of 1.2 g/cm^3 if centrifuged at max. speed. If liquids of higher density are used, the speed must be reduced accordingly (refer to chapter 7.1 "Mathematical relations").

7. Operation with rotors and adapters showing corrosion or other defects.

8. Operation of very corrosive substances which can cause damages to material and affect mechanical strength of rotors and adapters.

9. Operation of rotors and accessories not allowed by the manufacturer. The use of poor commodity goods is not recommended. At high speeds breaking glass or bursting vessels can cause dangerous imbalances.

10. Operation in hazardous locations.

11. Operation with vessels of improper size.

12. Centrifugation of improper material.

13. Operation with partially filled plastic tubes in high-speed angle rotors.

14. Lifting or moving of the centrifuge during operation. Leaning against or resting on the centrifuge is not allowed.

15. Do not place potential dangerous material - e.g. glass vessels containing liquids - near the centrifuge.

16. Attention:
    Do not open cover and/or reach into rotor chamber unless the rotor is at standstill. Never attempt to override the lid interlock system while the rotor is spinning.

17. Such materials are prohibited which chemically interact vigorously.

18. Do not spin explosive or inflammable materials.

19. Substances which could damage the material of the centrifuge, the rotors or the adapters must not be centrifuged. Infectious, toxic, pathogene or radioactive substances must be centrifuged in certified rotors and vessels only and all necessary safety precautions are taken.

6.1 Care and Cleaning of Centrifuge

Please use water-soluble, mild detergents for cleaning. Avoid corroding and aggressive substances. Do not use alkaline solutions or solvents or agents with abrasive particles. Before using detergents or decontamination agents which had not been recommended by us, the user has to contact us to make sure that such procedure would not damage the centrifuge.

Remove product particles from the rotor chamber using a cloth or paper towl. It is recommended to open the cover when the centrifuge is not in use so that moisture can evaporate. Increased wear of the motor bearings will thus be avoided. **If there is the risk of toxic, radioactive or pathogene contamination, special safety measures must be kept.**

6.2 Care and Cleaning of Accessories

For care of accessories special safety measures must be considered as these are measures ensuring operational safety at the same time.

Buckets, trunnions and also synthetic buckets are produced exactly in order to withstand the permanent high stress with high gravitational fields.

Chemical reactions as well as stress-corrosion (combination of oscillating pressure and chemical reaction) can affect or destroy the metals. Hardly detectable cracks on the surface expand and weaken the material without visible signs. When detecting a visible damage of the surface, a crack, a mark or any other change, also corrosion, the part (rotor, etc.) must be replaced immediately.

In order to avoid corrosion, rotor incl. tie-down screw and cover seal and adapters must be cleaned and greased regularly with the supplied slushing oil (Sigma part no.: 70104 for 20 ml slushing oil). Before using detergents or decontamination agents which had not been recommended by us, the user has to contact us to make sure that such procedure would not damage the centrifuge. The rotor tie-down screw must be greased using grease (Sigma part no.: 70284).

Cleaning of accessories should be done outside of the centrifuge once a week or preferably after every use. Adapters should be removed. After this the parts should be dried with a soft cloth or, alternatively, in a drying chamber at approx. 50 °C. **If there is the risk of toxic, radioactive or pathogene contamination, special safety measures must be kept.**

Especially aluminium parts are extremely corrosive. A neutral cleaning detergent with a pH-value between 6 and 8 should be used for such parts. Alkaline agents exceeding pH 8 must be avoided. Especially aluminium parts must be greased regularly with slushing oil. This procedure essentially increases life time and reduces corrosion.

Careful maintenance increases life time and avoids premature failure of the rotor. Corrosion or resultant damages which are caused by insufficient care do not constitute a warranty claim.

6.3 Rotor Pins

The trunnion pins of the rotor should always be greased as only this ensures evenly swinging of buckets and thus quiet run of the centrifuge (part no. 70284 Grease).

6.4 Glass Breakage

In case of glass breakage all glass particles must be carefully removed. Rubber inserts have to be cleaned carefully and possibly be replaced. If a problem has occured, the following has to be considered:

Glass particles in the rubber cushion will cause glass breakage again.

Glass particles in the centrifuge chamber will cause metal abrasion due to the strong air circulation. This dust will not only pollute the centrifuge chamber, the rotor and the material to be centrifuged but also damage the surfaces of the accessories, the rotors and the centrifuge chamber.

In order to totally remove the glass particles and the metal dust from the rotor chamber, it is advisable to grease the upper part of the centrifuge chamber with e.g. Vaseline. Then the rotor should rotate for some minutes at a moderate speed. The glass and metal particles will now collect at the greased part and can easily be removed with a cloth together with the grease. If necessary repeat this procedure.

6.5 Care and Cleaning of the Condenser

A lamellar condenser is used to cool the compressed refrigerant. It is installed in the back part of the centrifuge and cooled with air.

The location for the centrifuge should therefore be as clean as possible, ie. dirt, dust etc. should not prevent the air from streaming through the condenser and obstruct heat transfer. Dust on the condenser pipes and the lamella will reduce heat exchange and decrease the performance of the refrigerator.

The condenser should therefore be regularly checked for dirt and cleaned if necessary. Generally blowing of the lamella with compressed air from inside and outside is sufficient (or a simple hoovering with a vacuum cleaner).

6.6 Sterilization and Disinfection of Rotor Chamber and Accessories

All usual disinfectants like eg. Sagrotan, Buraton or Terralin (to obtain at chemist's shops) can be used. The centrifuges and the accessories consist of different materials. A possible incompatibility must be considered. Before using detergents or decontamination agents which had not been recommended by us, the user has to contact us to make sure that such procedure would not damage the centrifuge. For sterilization by steam resistance to temperature of the individual material must be checked (refer to point 6.6.1 "Autoclaving"). Please contact your laboratory safety officer regarding proper methods to use**. If dangerous materials are used, the centrifuge and the accessories must be disinfected.**

Principally we want to point out that for centrifuging of e.g. infectious material certified and hermetically sealed accessories have to be used in order to avoid that the centrifuge is contaminated.

6.6.1 Autoclaving

The life of the accessories essentially depends on the frequency of autoclaving and use. When the parts are showing changes in colour or structure or in the event of leaks etc., the accessories have to be replaced.

During autoclaving the caps of the tubes must not be screwed on to avoid deformation of the tubes. It can not be excluded that plastic parts, e.g. lids or carriers, would deform during autoclaving.

Autoclaving:

Accessories	max. temp. ℃	min. time min	max. time min	max. cycles
Glass tubes	134-138	3	5	-
Polycarbonate tubes	115-118	30	40	20
Polypropylene tubes	115-118	30	40	30
Teflon tubes	134-138	3	5	100
Aluminium rotors	134-138	3	5	-
Polypropylene rotor 12034	115-118	30	40	20
Polypropylene rotor 12124	115-118	30	40	20
Polycarbonate/Polyallomer lids for angle rotors	115-118	30	40	20
Polysulfone lids for angle rotors	134-138	3	5	100
Aluminium buckets	134-138	3	5	-
Polycarbonate caps for buckets	115-118	30	40	50
Polypropylene caps for buckets	115-118	30	40	50
Polysulfone caps for buckets	134-138	3	5	100
Rubber adapters	115-118	30	40	-
Rubber cushions	115-118	30	40	-
Round carriers for 13104/ 13117, Polypropylene	115-118	30	40	-
ditto, Polyallomer and Polycarbonate	115-118	30	40	-
Round carriers for 13350/ 13550, Polypropylene	115-118	30	40	-
Rectangular carriers, Polypropylene	115-118	30	40	-
ditto, Polyallomer and Polycarbonate	115-118	30	40	-

6.7 Checks by Operator

The operator has to ensure that no important part of the centrifuge is damaged. This especially refers to:

1. Motor suspension
2. Concentricity of the motor shaft
3. Fastening of the trunnions in the rotor
4. Rotors and accessories have a limited life. For safety reasons a regular check is recommended after 50.000 cycles. Any changes like e.g. corrosion, cracks, material abrasion etc. require special attention.
5. Screw connections have to be tight.

Furthermore, the earth wire must be checked regularly.

7.1 Mathematical Relations

7.1.1 Relative Centrifugal Force (RCF)

The parameters speed, RCF and the diameter of the rotor are interrelated via the following formula:

$$RCF = 11{,}18 \times 10^{-6} \times r \times n^2$$

If two values are given, the third value is determined by the equation. If the speed or the rotation radius is changed, the resulting RCF will be recalculated. If the RCF is changed, the speed under consideration of the radius is adapted accordingly.

r = radius in cm
n = speed in rpm
RCF without dimension

7.1.2 Density

If the density of the liquid is higher than 1.2 g/cm^3, the allowed maximum speed of the centrifuge is reduced according to the following formula:

$$n = n_{max} \times \sqrt{(1{,}2 / Rho)}$$

Rho = density in g/cm^3

7.2 Error Correction

Most of the errors can be reset by power off/on. In the event of a short power failure during a run, this run is interrupted and can be continued by pressing the Start-key.

No indication on the display:	**Actions:**
– No power in the socket?	• Check fuse in mains supply.
– Power cord plugged in and line voltage present?	• Plug in power cord correctly.
– Input fuse ok?	• Replace input fuse (see nameplate for rating).
– Power switch on?	• Switch on power.
– Lid closed?	• Close lid (please refer to chapter 7.2.3 „Lid cannot be opened/closed.“).

7.2.1 Centrifuge cannot be Started

– Start-key LED illuminated:	• Power off/on. If error occurs again, call service.
– Lid-key LED flashing:	• Open and close the lid again. If error occurs again although both locks engaged, call service.

7.2.2 Centrifuge Decelerates during Operation

– Centrifuge displays an error 1 to 11 after power on.	• Power off/on. If error occurs again, call service (please refer to chapter 7.3.1 "Error codes").

7.2.3 Lid cannot be Opened/Closed

– When first trying to open the lid the locks are not released. The Lid-key LED is flashing. Open and close lid again.

7.2.4 Emergency Lid Release

At the upper right panel there is a stopper which can be removed eg. with a screw driver. The lid can be released by pulling the visible string.

Attention!

The lid may only be unlocked and opened when the rotor is at standstill.

7.2.5 Problems with the Centrifuge?

Please contact your supplier for support or in the event of malfunctions and for supply of spare parts.

7.3 Error Mode

In the error mode the Start-, Stop- and Lid-keys are flashing. “ERROR“ is displayed in the speed area and the error code in the rcf area.

7.3.1 Error Codes

Error no.	Kind of error	Actions
1	Tacho signal disturbed	• Power off/on
4	Lid does not open after pressing the Lid-key	• Power off/on • Emergency lid release
2, 3, 5 – 11, 17 - 30	Internal fault	• Power off/on
12	Imbalance determined	• Remove imbalance
13	Temperature sensor	• Contact service
14	Excess temperature (>50°C)	• Let centrifuge cool down

Should it not be possible to repair the failure, please contact Service!

7.4 Speed-RCF-Diagram

An additional help is the enclosed Speed-RCF-Diagram.

7.5 Declaration of Decontamination / Return Declaration

The following declarations serve for keeping safety and health of our employees. Fill in the forms and attach them when returning centrifuges, accessories and spare parts. Please understand that we cannot carry out any work before we have the declarations. (We recommend to make **several copies of this page.**)

✂----------

SIGMA Laborzentrifugen
Laboratory Centrifuges

!!! Attention – This form must be glued on outside of the box !!!

Return declaration

	YES	NO
Decontamination declaration inside :		
Unit / component contaminated :		
Unit / component unused (new) :		

!!! Attention – This form must be glued on outside of the box !!!

✂----------

Please make some copies before removing this page.

✂----------

Declaration of Decontamination of Centrifuges, Accessories and Spare Parts

This declaration may only be filled in and signed by authorised staff.

SIGMA Laborzentrifugen
Laboratory Centrifuges

Repair Order dtd. : _____

Order No. : _____

Type of unit : _____ Serial No. : _____

Type of unit : _____ Serial No. : _____

Type of unit : _____ Serial No. : _____

Type of unit : _____ Serial No. : _____

Accessories : _____

_____

Is the equipment free from harmful substances ? YES **O** NO **O**

If not, which substances have come into contact with the equipment?

Name of the substances : _____

_____

Remarks (e.g to be touched with gloves only) : _____

_____

General characteristics of the substances :

Corrosive	**O**	Explosive	**O**
Biologically hazardous	**O**	Radioactive	**O**
Toxic	**O**		

In combination with which substances may hazardous mixtures develop?

Name of the substances : _____

_____

Has the equipment been cleaned before shipment? YES **O** NO **O**

Is the equipment decontaminated and not harmful to health? YES **O** NO **O**

Prior to repair, radioactively contaminated components must be decontaminated according to the valid regulations for radiation protection.

Legally Binding Declaration

I / we hereby declare that the information on this declaration are correct and complete.

Company / Institute : _____

Street : _____

Postcode, City : _____

Tel. : _____ FAX : _____

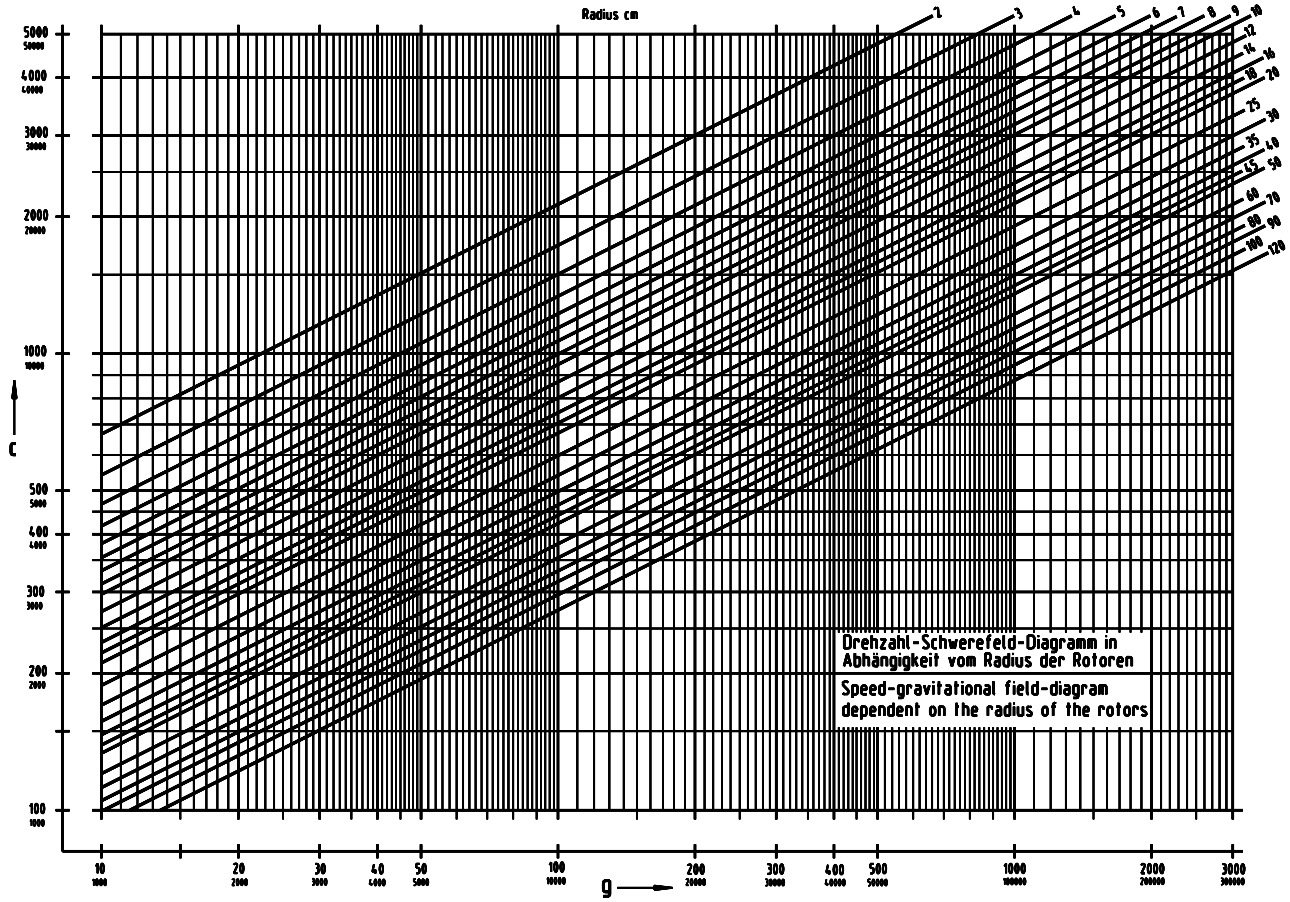
Name : _____

Date : _____ Stamp :

Signature : _____ _____

✂----------

Please make some copies before removing this page.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Drehzahl-Schwerefeld-Diagramm in Abhängigkeit vom Radius der Rotoren
Speed-gravitational field-diagram dependent on the radius of the rotors