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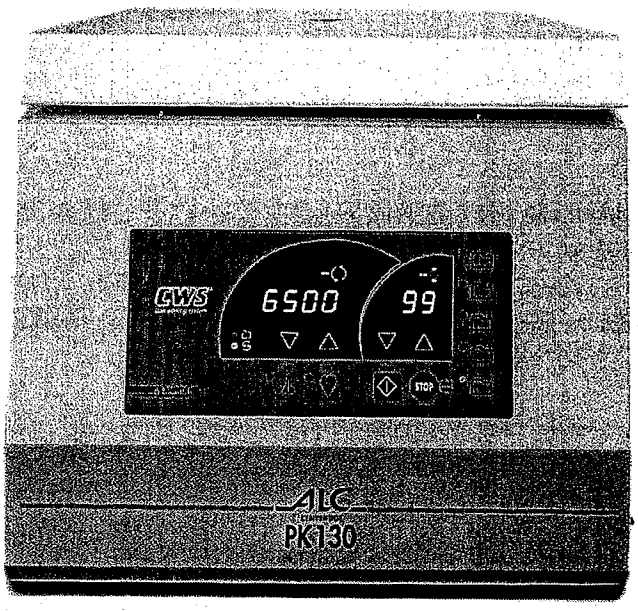
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Instruction /Service Manual

ALC Centrifuge
Model PK130



ALC
170 Marcel Drive
Winchester, VA 22602
USA
Phone: 540-869-8623
Toll Free: 800-556-2323
FAX: 540-869-0693

Manual P/N 36100137
Rev D Dated 11 June, 2004

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This symbol marks chapters and sections of this instruction manual which are particularly relevant to safety.
When attached to the unit, this symbol draws attention to the relevant section of the instruction manual.



This symbol indicates hazardous voltages may be present.

NOTICE

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REVISION STATUS

INDEX	DATE	AMENDED PAGES	NOTES
A			Initial release
B	20SEP00	Service section p20	Updated calibration info
C	22MAY03		Updated specs, added notices page, renumbered service section
D	JUNE 04	S20	Updated imbalance information

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SERVICE SECTION

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Warnings and Notices

Important: READ THESE NOTICES BEFORE INSTALLING THE UNIT

General Notices

AT LEAST 2 PEOPLE ARE REQUIRED TO LIFT THE CENTRIFUGE FROM THE PALLET AND PLACE IT ON THE BENCH.

LEAVE 12 INCHES OF FREE SPACE ON EACH SIDE OF AND BEHIND THE MACHINE TO FACILITATE PROPER VENTILATION.

BEFORE PROCEEDING TO THE INSTALLATION OPERATION, IT IS IMPORTANT TO TURN THE CENTRIFUGE OFF.

SHOULD THE POWER FAIL DURING CENTRIFUGATION, WAIT AT LEAST 40 MINUTES FOR THE ROTOR TO STOP TURNING. OPEN THE LID CAUTIOUSLY AND OBSERVE THE ROTOR; IF IT IS STILL ROTATING, CLOSE THE LID AND WAIT 10 MINUTES MORE BEFORE REPEATING THE OPERATION.

BE SURE THAT THE ROTOR IS LOCKED BEFORE STARTING THE CENTRIFUGE.

BECAUSE STRESS CORROSION IS LARGELY INVISIBLE, IT IS ESSENTIAL THAT ROTATING EQUIPMENT BE SCRUTINISED REGULARLY PAYING PARTICULAR ATTENTION TO SUSCEPTIBLE PARTS SUCH AS THE BOTTOM OF POCKETS, THE OUTER EDGES AND THE BASE OF THE ROTATING EQUIPMENT.

*THE USER HAS THE RESPONSIBILITY FOR CARRYING OUT APPROPRIATE DECONTAMINATION PROCEDURES. USERS SHOULD BE AWARE OF THE INTERNATIONALLY RECOGNIZED "*LABORATORY BIOSAFETY MANUAL*", WHICH GIVES INFORMATION ON DECONTAMINANTS, THEIR USE, DILUTIONS, PROPERTIES AND POTENTIAL APPLICATIONS. IF HAZARDOUS MATERIAL IS SPILLED ON OR INSIDE THE APPLIANCE, CLEAN THE APPLIANCE USING APPROPRIATE METHODS.*

ANY PART WHICH HAS BEEN SUBJECTED TO TEMPERATURES ABOVE 130°C MUST BE DISCARDED.

IF YOU HAVE A DOUBT ABOUT A PARTICULAR CLEANING METHOD, PLEASE CONTACT PRECISION TO VERIFY THAT THE PROPOSED METHOD DOES NOT DAMAGE THE APPLIANCE.

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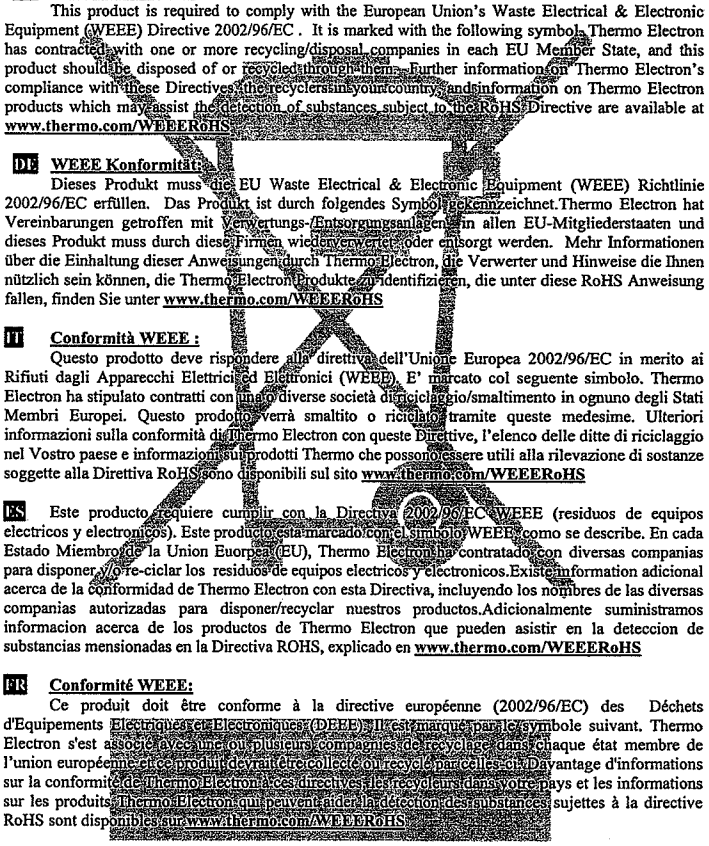
Electrical Warnings

ENSURE THAT THE POWER SOURCE IS PROPERLY GROUNDED.

BEFORE CHANGING THE FUSES, DISCONNECT THE CENTRIFUGE FROM THE MAIN POWER SOURCE.

ZONE 3 OF PCB IS AT MAINS VOLTAGE (SEE FIG. 9 PAGE S9)

DISCONNECT THE MAINS POWER LEAD TO THE CENTRIFUGE BEFORE ALL REPLACEMENT PROCEDURES !



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1. MANUFACTURER

For more information about the ALC PK130 centrifuge, please contact:

ALC
170 Marcel Drive
Winchester, VA 22602
Telephone (540) 869-8623
Toll Free (800) 556-2323
Fax (540) 869-0693

1.1 Safety Devices and Notices

To ensure operator safety the centrifuge has the following electrical and mechanical characteristics :

- The centrifuge will not start unless the lid is locked.
- The lid cannot be opened during centrifugation.
- The centrifuge has electronic self-diagnosis capability; any possible electrical system malfunctions are displayed digitally. At the same time, the centrifuge is disabled to prevent unsafe operation of the machine.
- The centrifuge is equipped with an automatic load imbalance safety device.
- The case of the centrifuge is armored, and the reinforced bowl is made of AISI 304 stainless steel.
- The lid is supported by a strong, dependable gas spring that holds the lid open until the operator actively closes it.
- The electrical main has a bipolar switch.
- Ground connection resistance, applied voltage and leakage current are tested and certified.
- The centrifuge is equipped with identification plates and operating instructions.

2. INSTALLATION

2.1 Transport, Packaging, Lifting



The centrifuge is shipped in special packaging to protect it from possible harm.
Due to the weight of the machine, proper handling equipment (e.g.: pallet jack or fork lift) must be used. The handling equipment should comply with current regulations, and should only be used by properly trained individuals.

1. The centrifuge should be stored and transported under the following conditions:
a) Ambient temperature -20°C to +50°C.
b) Relative humidity up to 90% and not exceeding the dew point.

2. After the centrifuge is unpacked, the contents of the package should be carefully compared to the items on the packing list.

3. Retain the packaging until the centrifuge has been tested.

2.2 Installation

The machine should be installed in a room free of dust and moisture. Place the centrifuge on a bench top rigid and strong enough to comfortably support its weight.

⚠ IMPORTANT:

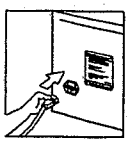
AT LEAST 2 PEOPLE ARE REQUIRED TO LIFT THE CENTRIFUGE FROM THE PALLET AND PLACE IT ON THE BENCH.

CAUTION:

LEAVE 12 INCHES OF FREE SPACE ON EACH SIDE OF AND BEHIND THE MACHINE TO FACILITATE PROPER VENTILATION.

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2.3 Power Source Wiring



Check main lines and frequency: They must correspond to the values shown on the instrument identification label.

PK130 230V:
230 V + 5% - 10% 50 Hz (1 phase + ground)

PK130 120V:
120 V + 5% - 10% 60 Hz (1 phase + ground)

WARNING:
ENSURE THAT THE POWER SOURCE IS PROPERLY GROUNDED.

The centrifuge is equipped with R.F.I. filters. The manufacturer declines all responsibility for any damages due to improper grounding of the machine.

2.4 Environmental conditions

- Indoor use.
- Temperature: 5°C to + 40°C.
- Maximum relative humidity: 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.

2.5 Lid Unlock



1. Turn the centrifuge on (switch is on the left side of the unit).

2. Check the lid indicator on the display panel. The light should be on indicating that the rotor is stationary and that the lid can be opened.

3. Pull the lever on the top right side of the machine to open the lid.

WARNING:
BEFORE PROCEEDING TO THE INSTALLATION OPERATION, IT IS IMPORTANT TO TURN THE CENTRIFUGE OFF.

4. After opening the lid, remove any possible packaging around the spindle. Unscrew the rotor nut from the top of the spindle. Carefully clean the inside of the centrifugation chamber removing any packaging residue. Because of the turbulence caused by centrifugation, solid particles accidentally left in the chamber could create excessive wear of the bowl and rotor.

2.6 Emergency Lid Unlock

In the event of power failure, the lid can be opened using the special tools supplied with the centrifuge. **The centrifuge must be unplugged before starting this procedure.**
1. Remove the nylon screw in the hole on the right side of the centrifuge as identified below.
2. Insert the unlocking tool, keeping the blade horizontal (*figure a*).
3. Lift the unlocking tool while simultaneously pulling the lever (*figure b*).

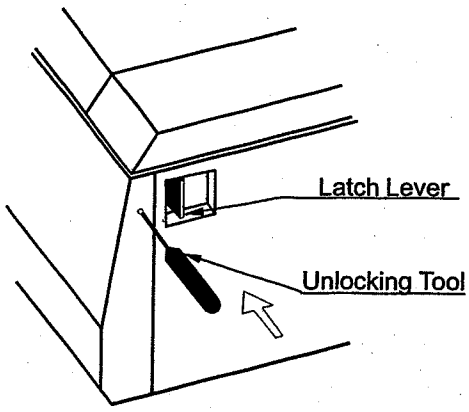


figure a

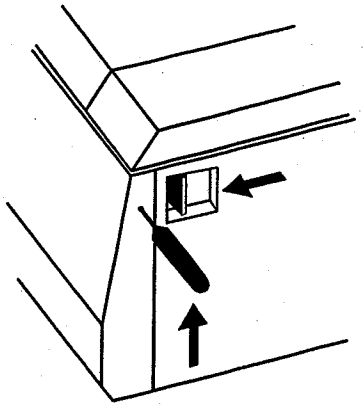


figure b

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4. After the lid is open, replace the nylon screw.

⚠ CAUTION:

SHOULD THE POWER FAIL DURING CENTRIFUGATION, WAIT AT LEAST 40 MINUTES FOR THE ROTOR TO STOP TURNING. OPEN THE LID CAUTIOUSLY AND OBSERVE THE ROTOR; IF IT IS STILL ROTATING, CLOSE THE LID AND WAIT 10 MINUTES MORE BEFORE REPEATING THE OPERATION.

2.7 Inspection

Before installation, the rotating equipment should be thoroughly inspected for corrosion and dirt (see 6.3). The rotor and spindle should be clean and undamaged. These accessories should be wiped clean before each use. Any failure to follow the above advice may have serious consequences for the safety of the appliance. Corrosion can lead to stress fatigue, which will eventually weaken the rotor and may lead to disruption and severe damage to the centrifuge. If visible signs of corrosion or anomalies in the rotor or buckets are present, do not use the affected accessories. Contact an authorized service provider for assistance.

2.8 Fitting the Rotor to the Drive Shaft

- Remove the rotor fixing shaft nut.
- Check the cleanliness of the shaft and the rotor.
- Place the rotor on the shaft .
- Secure the rotor on the shaft by turning the fixing nut clockwise.
- Tug on the rotor to make sure that it is secure.

⚠ CAUTION:

BE SURE THAT THE ROTOR IS LOCKED BEFORE STARTING THE CENTRIFUGE.

2.9 Removal of the Rotor

To remove the rotor from the motor shaft : Using the wrench supplied, unlock the shaft nut. Remove the nut and lift the rotor with both hands.

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3. SPECIFICATIONS

3.1 Dimensions and weight

Height x Width x Depth:	14.8 x 15.7 x 18.9 in (37.5 x 40 x 48 cm)	
Net Weight:	88 lbs. (40 kg)	

3.2 Centrifugation characteristics

Max. allowable capacity:	with swing-out rotor	4 x 280 ml (1120 ml)
	with fixed-angle rotor	6 x 94 ml (564 ml)
Max. Allowable density:	1200 Kg/ m^3	
Max. allowable weight:	1.34 Kg	
Max. speed:	with swing-out rotor	4000 rpm
	with fixed-angle rotor	6500 rpm
Max. RCF at tip:	with swing-out rotor	2933 x g
	with fixed-angle rotor	5289 x g
Working temperature:	Ta + ΔT	
Max. noise:	< 63 dBA	

3.3 Electrical characteristics

Nominal operating voltage:	230V + 5% - 10% 50 Hz	
	120V + 5% - 10% 60 Hz	
Current	3.8A (@ 230V)	
	7.0A (@ 120V)	
Max power (steady state):	350 W	

3.4. Specifications

- Microprocessor controlled
- 5 program memory, direct recall
- Set/reading speed 300 - 6500 rpm (in steps of 10 rpm or 100 rpm); accuracy: +/- 20 rpm
- 5 acceleration profiles
- 5 deceleration profiles
- Set timer 1 min. up to 99 min. + ∞
- Electronic imbalance detector
- Direct drive
- Brushless induction motor

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4. DESCRIPTION OF PERFORMANCE

4.1 Functional principles

The ALC PK130 centrifuge is designed for laboratory use. It will separate the components of fluids into layers of varying density by subjecting them to high forces. Swing out rotors can carry a greater load than fixed angle rotors. The larger the diameter of a rotor, with accessories, the greater its load capacity and the lower its maximum speed. Relative Centrifugal Force (RCF) generated by a rotor is directly proportional to its sedimentation useful radius and to the value of its speed squared.

4.1.1 Drive system

A three phase asynchronous motor drives the rotating equipment. The rotor is contained in a sealed, armor plated centrifugation chamber.

4.1.2 Lid interlock safety system

The centrifuge is equipped with an interlock system that prevents opening of the centrifuge lid when the rotor is spinning. The centrifuge will not operate until the lid is closed and latched in place. The lid remains latched until the rotor stops spinning. **NOTE:** If a power failure occurs, access to the samples in the centrifuge is possible. For this it is necessary to use a special tool. Follow the emergency lid unlock procedure found in Section 2.6.

4.1.3 Imbalance Sensor

The centrifuge is equipped with a load imbalance detector. In case of excessive imbalance the machine stops automatically. The display reads "IMbAL" – this message will disappear once the lid has been opened to balance the load (see Section 5.10). Imbalance tolerance depends upon the rotor in use. Carefully balance the sample load to avoid actuating the imbalance detection system.

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4.2 Rotors - Performance

4.2.1 Rotors - Table

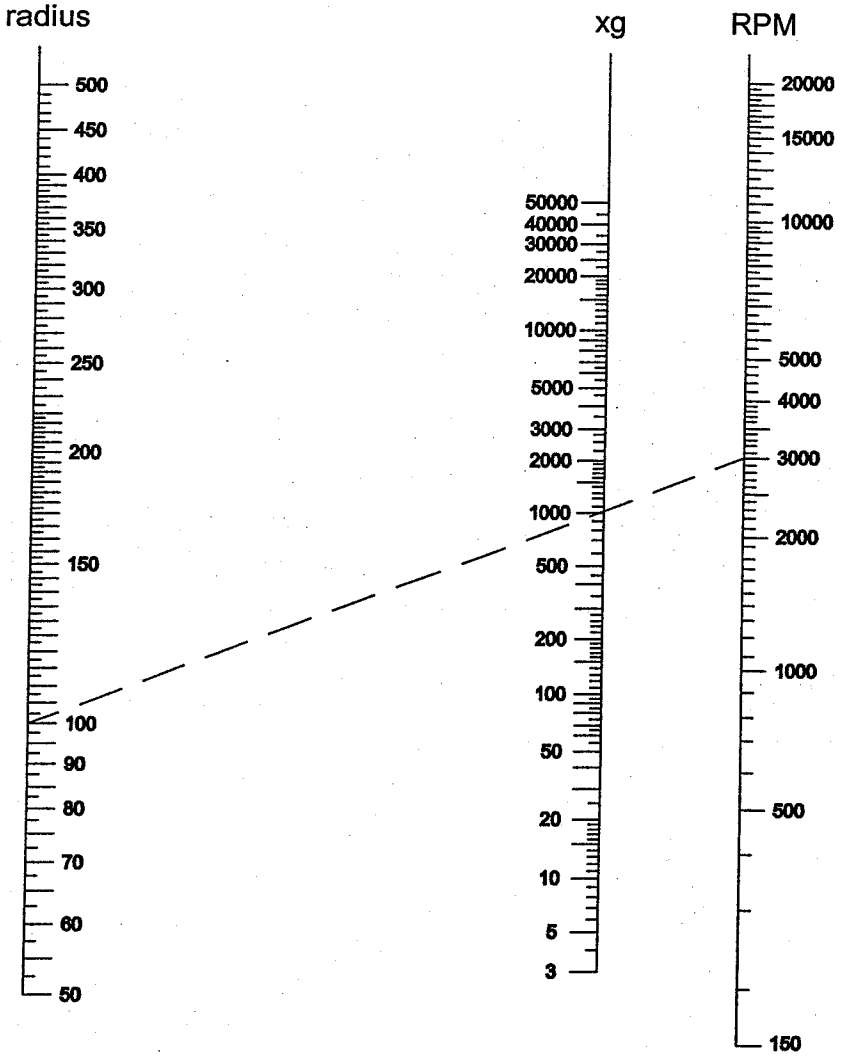
Type of Equipment	Load Composition		Eq. Composition			Accessories	Useful max radius
	Capacity	α	Rotating Head catalog #	Bucket catalog #	Sealing cap catalog #	Kit catalog #	
O-F25	4 X 280 ml	0° - 90°	11200091	—	11172534	CYTOKIT 11200093	0.164
O-F17	2 X 3 microplates	0° - 90°	11200094	—	SMP KIT 11172616	—	0.115
F-F6	30 X 15 ml	40°	11200095	—	—	—	0.135
A-F18	6 X 94 ml	25°	11200096	—	—	—	0.099
A-F10	6 x 50 ml conical	40°	11200079	—	—	—	0.112
A-F12	20 x 2.0/1.5 ml	45°	11200097	—	—	—	0.078

4.2.2 Performance

Type of equipment	Max. speed (rpm)	Max RCF (xg)
O-F25	4000	2933
O-F17	3000	1157
F-F6	4000	2414
A-F18	6500	4675
A-F10	6500	5289
A-F12	6500	3684

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4.3 RCF Calculation



Total separating force applied to a sample in a centrifuge depends on the duration of the centrifuge run and on the RCF (relative centrifuge force) applied to the sample. RCF is generally calculated in units x gravity (x g). The diagram above allows you to graphically calculate RCF by drawing a line from the centrifugal radius (on left) to the speed (on right). The value of the RCF (xg) applied to the sample is approximated by the value at the point where the line crosses the "xg" axis (center).

Centrifugal radius is defined as the distance from the axis of rotation to the point on the sample at which you wish to measure the RCF. This point is generally the tip of the sample farthest from the axis of rotation. By popular convention, this distance is measured in units of millimeters.

EXAMPLE

To find the RCF value (xg) applied to a sample in a rotor/bucket/accessory system with a centrifugal radius of 100 mm (0.1m) and rotating at 3000 RPM, place a ruler on the scale joining the point marked 100 on the left with the point marked 3000 on the right. At the point where the line crosses the center scale (xg), the corresponding value is approximately 1,000. In this example, the outer tip of the sample is subjected to RCF = 1,000 x g

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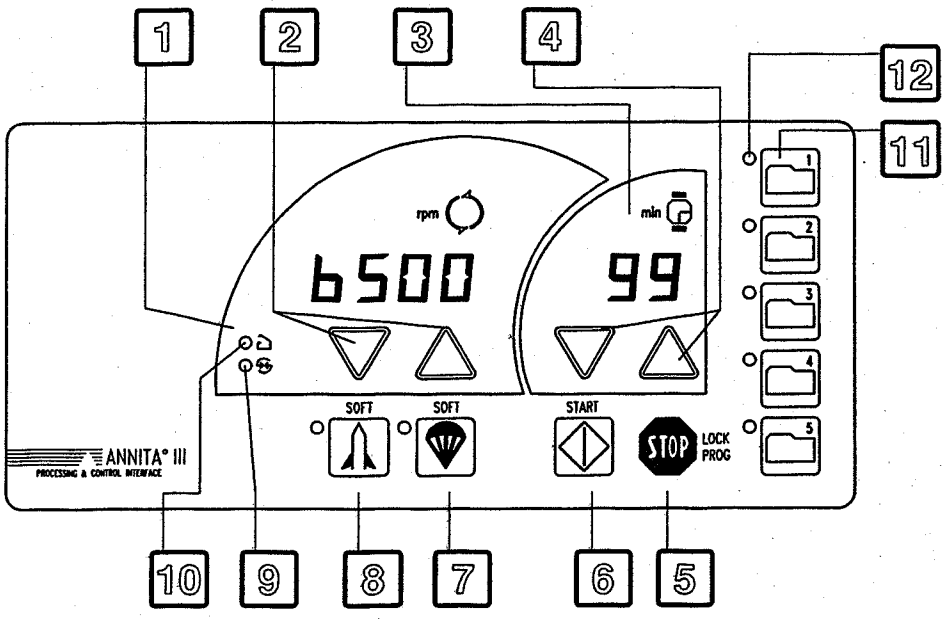
The following functions represent the mathematical relationship between RCF (xg), centrifugal radius (r) and speed (rpm). When the accuracy of the graphical method described above is not satisfactory, these functions can be used to obtain more accurate results.

RCF (units x g) = $1.118 \cdot 10^{-6} \cdot n^2 \cdot r$ where n = RPM

$$n = \sqrt{\frac{rcf}{1{,}118 \cdot 10^{-6} \cdot r}}$$

r = radius in millimeters

4.4 Processing & control interface



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1. **Speed display (units of rpm)** When the machine is stopped, this field displays the set speed. When the machine is running and the numbers are constant, this field displays actual speed. When the machine is running and the numbers are flashing, this field displays set speed.

2. **SET rpm keys** ▽ △ : These keys are used for increasing or decreasing speed settings.

3. **Time display (units of minutes)** When the machine is stopped, this field displays the set centrifugation time. When the machine is running, the remaining centrifugation time is displayed; when the time is set at "HOLD" (continuous operation), the display shows elapsed time.

4. **Set minutes keys** ▽ △ : These keys are used for increasing or decreasing time settings.

5. **STOP key** Pressing this key stops the centrifuge manually. When pressed simultaneously with key N°. 12, it toggles the password protection of the programs in memory.

6. **START key** Pressing this key starts the centrifugation cycle.

7. **SOFT deceleration key** This key is used to set low braking rate (illuminated LED indicates "on"). The braking rate can also be more precisely programmed to one of 5 deceleration profiles.

8. **SOFT acceleration key** This key is used to set low acceleration rate (illuminated LED indicates "on"). The acceleration rate can also be more precisely programmed to one of 5 acceleration profiles.

9. **GREEN LED**: This indicator flashes during the acceleration and the deceleration phases. It is constant when actual speed equals set speed.

10. **YELLOW LED**: When this indicator is illuminated the lid can be opened. It comes on when the rotor is stationary.

11. **Five PROGRAM KEYS**: for quick programming and recall of 5 profiles.

12 **Five LED indicators next to program keys**: When a program is selected, its corresponding LED is illuminated.

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5. OPERATION PROCEDURE

5.0 Instructions for the operator

1. As a precautionary measure, the operator should remain with the centrifuge until it reaches the set speed.

2. The operator should also return to the centrifuge immediately upon completion of the run.

5.1 Power Switch - Cover Unlock

1. When the centrifuge is turned on (switch is located on the left side of the centrifuge) both the centrifuge and the refrigeration circuit are connected to the main circuit.

2. When the rotor is stationary and the LED is on, it is possible to unlock the lid. The mechanical latch on the upper right panel of the centrifuge opens the lid when it is pulled toward the front.

5.2 Loading balance

5.2.1 All rotating equipment is dynamically balanced prior to shipment. For swinging bucket rotors, reference numbers and marks on the buckets correspond to matching marks on the rotor. Buckets should be positioned on the rotor so that the numbers on the buckets correspond to the same numbers on the rotor itself (eg. bucket #2 positioned in rotor position #2, see fig. 1).

5.2.2. For fixed angle rotors with carriers, all carriers must be inserted into the rotor before starting the run. This holds true even when partial loads are being processed (see fig. 2).

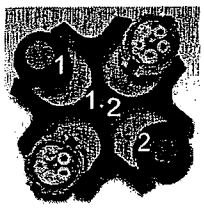


figure 1

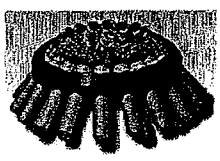


figure 2

5.2.3 Because buckets and carriers are pre-balanced, the buckets should never be weighed, but only their contents (adapters, tubes, etc.).

5.2.4 To correctly distribute the load, tubes and adapters should be placed so that the load is symmetrically distributed with respect to the axis of rotation. (see fig. 3)

5.2.5 For partial loads of swing-out rotating equipment tubes should also be symmetrically distributed with respect to the rotational axis of the swinging bucket. (see fig. 4).

5.2.6 When liquids with densities higher than 1.2 gm/ml must be processed, the max. rpm should be reduced according to the following formula:

Allowed rpm = max. rpm · (1.2/New density)

5.2.7 When closing the lid, lower it pressing on the front edges until the hook in the lid lock mechanism. The centrifuge will only operate when the lid is completely closed and locked. ***NOTE:*** *Tubes should be balanced within ± 2 grams to facilitate the best possible sample separation.*

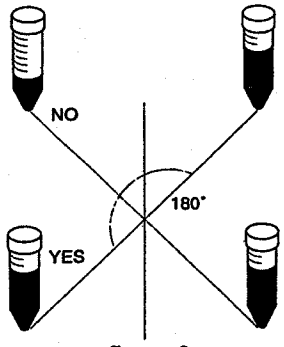


figure 3

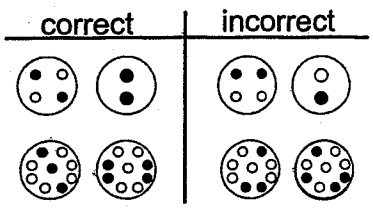


figure 4

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5.3 Centrifuge Operation

INTRODUCTION: The control interface of the PK130 is designed to make centrifuge operation as simple as possible. All of the buttons are dedicated to specific functions. Because of this, centrifuge operators do not need extensive training to understand the system. This section is designed to educate and prepare the user to use the PK120. The following centrifugation parameters can be set by the operator:

a) Speed in rpm (300 rpm up to 6,500 rpm).
b) Centrifugation time (1 min up to 99 min + ∞)
c) Temperature (-10°C to +40°C)
d) Acceleration (5 profiles)
e) Braking (5 profiles)

The microprocessor allows the centrifuge to be operated in **MANUAL** or in **PROGRAM** operative mode.

5.3.1 MANUAL Operative Mode

Manual operative mode is active when none of the five programs is activated. When the centrifuge is in manual mode, none of the LED's next to the program keys are illuminated. In manual mode, all of the parameters can be changed regardless if the centrifuge is running or on stand-by. For example: The user approaches the centrifuge wishing to operate it in manual mode. The LED indicator next to Program #3 is illuminated. To put the centrifuge into Manual mode, the user presses the button corresponding to Program #3 once. The LED goes off, indicating that the centrifuge is now in Manual mode.

5.3.2 PROGRAM Operative Mode

Up to 5 programs can be stored in the memory of the PK130. To set or change programs, follow this procedure:

- Make sure that the centrifuge is in **MANUAL** mode (all LED indicators next to program buttons are off).
- Set all parameters for your desired program. The display numbers will blink for about three seconds after you are done programming.
- Before the numbers stop blinking, press the program button for the program number under which you wish to store the protocol. This will save the newly-created program.
- To select a program, press the button corresponding to the program number that you wish to recall.

5.4 Setting Centrifugation Parameters

5.4.1 Default Condition

The centrifuge is always in the same operative mode as at the time of its last use. When the centrifuge is idle the display reads:

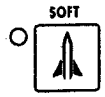
°C- Real temperature in the centrifugation chamber
rpm - set speed
min - set time

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5.4.2 Acceleration

The ALC PK130 control system allows the user to set acceleration rates in two different ways. The first method involves a simple choice between high or low acceleration rates.

High acceleration (LED off)
Low acceleration (LED on)



The system also allows for a more rigorous choice with 5 possible profiles. This method is as follows:

1. Press the 

(with LED on) for 3 sec.

   (The rpm-display shows "**ACL**" flashing and a number between 1 and 5)

2. With acceleration key still pressed, use the **SET rpm keys** ▽ △ to select an acceleration curve between 1 and 5.

5.4.3. Braking

The PK120 control system allows the user to set braking rates in two different ways. The first method involves a simple choice between high or low braking rates.

High braking rate (LED off)
Low braking rate (LED on)



The system also allows for a more rigorous choice with 5 possible profiles. This method is as follows:

1. Press 

(with led on) for 3 sec.

   (The rpm-display shows "**dCL**" flashing and a number between 0 and 4).

2. With deceleration key still pressed, use the **SET rpm keys** ▽ △ to select a braking curve between 0 and 4 (0 = inertial braking).

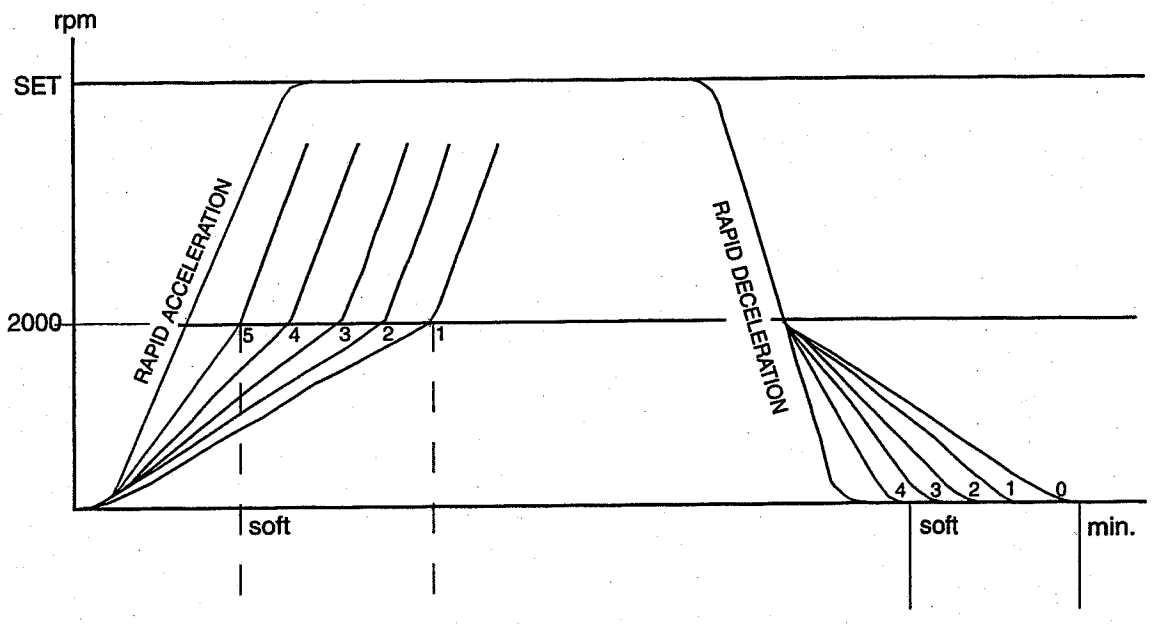
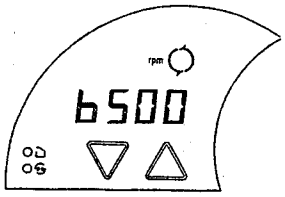


figure 5.4 Acceleration & Braking

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5.4.4. Setting speed and time values

- When you touch one of the **SET** keys ▽ △ , the corresponding display will start to flash.
- When the display flashes, it is possible to change the selected parameter using the **SET keys**.



SET **speed** 300 to 6000 rpm (see 4.2 for rotor speed ratings).

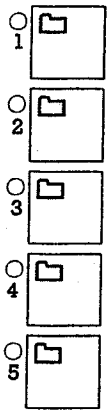


SET **time** 1 to 99 min + hold

3 seconds after changes are complete, the display stops flashing. This confirms the new SET values.

5.5 Storing a program in memory

BASIC CONDITION: Centrifuge stationary and "MANUAL" Operative Mode.



1. To store the SET parameters **press one of the program keys between 1 and 5 while the display is still flashing (within three seconds of the last button operation).** The **LED** next to the **program key** will light up, confirming that the program has been memorized. ***NOTE:*** *It is not possible to set a program with time set to "HOLD": if you try to put a "HOLD" program into memory, the timer display will continue flashing; you must enter a determinate time value.*

2. To restore "**MANUAL MODE**", press the selected **program key**; the LED corresponding to the program key goes off and it is possible to create a new program.

5.6 Protecting a program



1. To protect a program, press the **LOCK PROG key** (STOP) simultaneously with the program key when saving the program.

2. To cancel the program protection, press the **LOCK PROG key** (STOP) simultaneously with the program key.

5.7 Starting the centrifuge

BASIC CONDITION: Lid closed

1.Press "**START**" key.



In MANUAL OPERATIVE MODE and in PROGRAM MODE, the centrifuge will accelerate to the set speed. When the run time is elapsed, the centrifuge will brake to a stop.

- During the run time **the speed** display shows actual values. The **time** display shows remaining run time. If the time setting is "HOLD", the **time** display shows elapsed run time.

- The green LED on the left side of the control panel flashes while the rotor is accelerating and remains constantly illuminated while the rotor is at set speed.

NOTE: *if set **speed** is higher than the maximum speed of the rotor, the green LED will continue flashing (see 5.10 SET). In this case, the program should be corrected as soon as possible.*

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2. **During the run in "MANUAL" MODE** To read and change set values, press the SET cursors:

- The display starts to flash and shows the set values for 3 seconds.
- While the display is flashing it is possible to change the set values.
- During a run in MANUAL mode it is possible to change the deceleration

3. **During the run in "PROGRAM" MODE,** it is possible to display set values by pressing the corresponding SET cursors. It is not possible to change the programmed values.

5.8 Stopping the centrifuge



Once the pre-set time has elapsed, the centrifuge automatically stops the rotor at a rate determined by the deceleration setting.

Pressing  at any time will cause the centrifuge to stop the rotor. **NOTE:** *Automatic braking will occur under conditions of load imbalance, power failure, error or breakdown. In all cases the relevant code will appear on the message display.*

5.9 Messages - Alarms

The microprocessor displays error messages to indicate errors, malfunctions or breakdowns. The messages are expressed with the following codes.

End Appears at the end of every centrifugation cycle after the rotor comes to a stop. The message disappears when the lid is opened or when any key is pressed.

Lid Appears when the  (start button) is pressed and the lid is not locked. The "LID" message is accompanied by an audible signal. This message will disappear when the lid is locked.

IMbAL Appears when the load is unbalanced. The message is accompanied by an audible signal. The centrifuge stops to allow the user to rebalance the load (5.2). The message disappears when the lid is opened.

MAInS Appears when a power failure occurs. The centrifuge decelerates and the system shuts down. When power is restored, the message reappears. It remains on the display until the next operation is started.

SET Appears when set speed is higher than the maximum rated speed of the rotor. The message disappears when the centrifuge is stopped or when the parameter is corrected in Manual Operative Mode.

E01-E09 Messages 'E0..' (e.g. E01) together with an acoustic alarm indicate failure conditions. The 'E04' message will appear on the display after a power failure, in this case wait for the rotor head to stop before opening the lid. In the other cases contact ALC Customer Service.

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6. HAZARDS, PRECAUTIONS AND USE LIMITATIONS

6.1 Dangerous operations - work conditions to avoid

- Using the centrifuge if it has not been properly installed.
- Fitting the rotor on the drive shaft incorrectly or placing the buckets on the rotor incorrectly.
- Leaning on the machine.
- Placing dangerous objects in the area of the centrifuge.
- Moving or shifting the machine during centrifugation.
- Using the centrifuge with rotors and/or buckets showing corrosion, wear marks and/or cracking.
- Using the centrifuge with rotors and/or accessories not approved by the manufacturer.
- Using the centrifuge in explosive environments or with explosive samples or chemical materials subject to violent reaction.
- Running an Unbalanced load which causes excessive vibration of the centrifuge.
- Running a rotor without its full complement of buckets or carriers, even for partial loads.
- Leaving the appliance exposed to the elements (rain, sun, etc.).
- Exceeding the maximum speed indicated in the "max. rpm" column of the performance table (see 4.2.2).
- Using old accessories on a new machine.
- Using tubes and/or bottles not suited for centrifugation.
- Spinning samples of densities higher than allowed for the given speed.
- Alteration of and/or tampering with the electronic and mechanical parts of the centrifuge.

6.2 EN 61010-2-020 STANDARD

The En 61010-2-020 standard relative to laboratory centrifuges recommends that the user:

- Mark out a clearance envelope 300 mm around the centrifuge or establish special procedures for the non entry of all persons or all dangerous materials into this space during the operation of the centrifuge.
- Provide an emergency stop switch enabling the main power source to be cut in the case of malfunction. The switch should be placed at a safe distance from the centrifuge, preferably in a different room from that in which the centrifuge is situated.

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6.3 Rotor and accessory precautions

6.3.1 Corrosion information

ALC rotors are made of aluminium alloy and are designed to operate at their rated RCF for many years. With careful use they will resist corrosion, lowering the possibility of excessive imbalance, disruption and subsequent damage to the instrument. The primary conditions for the initiation of corrosion exist in every laboratory during daily use of the centrifuge. For this reason it is essential that due care and attention be paid to inspection and cleaning.

CHEMICAL CORROSION

This corrosion is characterized by chemical reactions due to the existence of any electrolytic liquid on the surface of the equipment. If these substances are allowed to remain on the surface corrosion will almost certainly occur. The first sign of this type of corrosion is a discoloration or pitting of the anodized surface.

Acidic and alkaline solutions sustaining their pH level will also create corrosion of aluminium equipment. Chlorides, which are present in salts (human skin secretions are a common source!), are among the most aggressive and harmful substances commonly found in the laboratory.

Chemical products that cause corrosion do not necessarily originate from broken tubes. For example, they could come from:

- Chemical vapors present in the laboratory which condense on the centrifuge and its accessories.
- Corrosive liquids originating from overfilled uncapped tubes (the liquid overflows during centrifugation)
- Inserts, adapters, racks and bottles with exteriors soiled by a chemical product or poorly rinsed after decontamination (with bleach, for example).

NOTE: If the products are very corrosive, simple rinsing is insufficient. Residual traces dissolve little by little with the humidity present in the bottom of the rotor pocket.

BEWARE of the presence of solid particles beneath tubes, inserts, racks or adapters. These particles are crushed by the centrifugal force and penetrate the protective, anodized layer of buckets and rotors, thus creating pathways for corrosion.

STRESS CORROSION

This term relates to the phenomenon of accelerated corrosion due to the effect of centrifugal force when a corrosive chemical is in contact with the alloy. From the time when the aluminium alloy has been attacked by chemicals, stress corrosion begins to appear. As it occurs on a microscopic scale it is even more dangerous than macroscopic corrosion since it is invisible to the naked eye.

During centrifugation chemicals responsible for corrosion are also subjected to very high forces, which push them against the alloy. This close contact facilitates the chemical reaction which occurs much faster than it does in a static situation. Moreover, centrifugal force is directional. Because of this, corrosion under stress creates, with a very small amount of corrosive product, straight microscopic fissures. Each centrifugation run allows the chemical to migrate further and further.

Fissures or cracks, although microscopic, are a flaw in the metal, breaking the cohesion of the material. As one weak link in a chain allows the chain to break, so the microfissures break the chain of resistance of the accessory to centrifugal force. Because accessories are designed with high safety factors, rupture does not occur as soon as the first microfissures are produced.

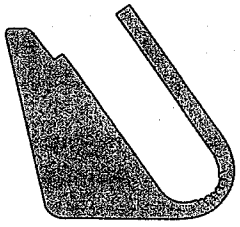
Depending on the location of the fissure, disruption may occur before it reaches the external surface of the accessory. The fissure creates a weakness, which makes the accessory less and less resistant to mechanical fatigue. The corrosion caused by

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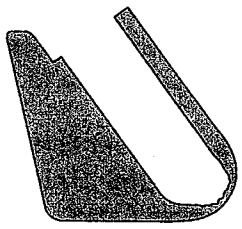
a small amount of corrosive product does not disrupt the accessory but makes it mechanically weaker and weaker until disruption occurs due to both centrifugal force and fatigue.

⚠ WARNING:

BECAUSE STRESS CORROSION IS LARGELY INVISIBLE, IT IS ESSENTIAL THAT ROTATING EQUIPMENT BE SCRUTINISED REGULARLY PAYING PARTICULAR ATTENTION TO SUSCEPTIBLE PARTS SUCH AS THE BOTTOM OF POCKETS, THE OUTER EDGES AND THE BASE OF THE ROTATING EQUIPMENT.



STRESS CORROSION



CHEMICAL CORROSION

6.3.2 Contamination hazards

ALC centrifuges are likely to be used in laboratories where hazardous substances are frequently present.

⚠ WARNING:

THE USER HAS THE RESPONSIBILITY FOR CARRYING OUT APPROPRIATE DECONTAMINATION PROCEDURES. USERS SHOULD BE AWARE OF THE INTERNATIONALLY RECOGNIZED "LABORATORY BIOSAFETY MANUAL", WHICH GIVES INFORMATION ON DECONTAMINATES, THEIR USE, DILUTIONS, PROPERTIES AND POTENTIAL APPLICATIONS. IF HAZARDOUS MATERIAL IS SPILLED ON OR INSIDE THE APPLIANCE, CLEAN THE APPLIANCE AND ITS DRAIN HOSE USING APPROPRIATE METHODS.

If decontamination procedures require the use of warming (eg. autoclave) the rotating equipment should always be completely disassembled before being subjected to heat. They should also be completely disassembled prior to external chemical cleaning. Seals, tubes and plastic components should be decontaminated with the method most suitable for them, which might not be the same as for the rotating equipment.

Note that the black color on the surface of the rotating equipment will be gradually washed out if the rotor is regularly autoclaved or bleached. This does not necessarily denote degradation of the anodized surface.

⚠ WARNING:

ANY PART WHICH HAS BEEN SUBJECTED TO TEMPERATURES ABOVE 130°C MUST BE DISCARDED.

⚠ WARNING:

IF YOU HAVE A DOUBT ABOUT A PARTICULAR CLEANING METHOD, PLEASE CONTACT ALC TO VERIFY THAT THE PROPOSED METHOD DOES NOT DAMAGE THE APPLIANCE.

ALC makes no claims as to the effectiveness of proprietary brands of decontaminating solutions.

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7. ROUTINE MAINTENANCE

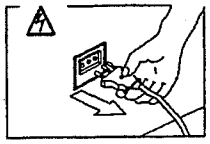


fig. 7.1

⚠ CAUTION:

During maintenance operations, *ALWAYS* disconnect the centrifuge from the main power source (fig. 7.1).

7.1 Rotating Equipment and Centrifugation Chamber Cleaning

Regular cleaning of rotors and of the centrifugation chamber is vital to maintain good working conditions. The operator must wear proper protective equipment during the cleaning (mask, gloves, etc.). It is also important to verify the integrity of biosafety components when they are used. The user should always inspect the condition of seals and lids prior to using them. Do not clean them with materials that damage silicone and polycarbonate. Ideally, rotors should be washed after every run (at least weekly) in warm water containing a few drops of mild (not alkaline) detergent (domestic liquid soap is ideal). **ROTORS MUST BE WASHED EVERY TIME SPILLAGE OCCURS.** Do not forget to wash the core of the rotating head that comes into contact with the drive spindle. Each rotor pocket (and bucket for swing-out rotors) must be washed thoroughly using a small nylon brush. Once the rotor has been removed, it is easy to clean the centrifugation chamber and gaskets. Use warm water with non- alkaline detergent. Do not use corrosive solvents. Once the rotor is clean, rinse it with running water, preferably distilled. Dry the rotor with a soft absorbent non-woven cloth or tissue. The equipment can be dried with a cloth or with a hair dryer. **DO NOT USE METAL WIRE BRUSHES** and **MAKE CERTAIN THAT ROTOR SLOTS AND BUCKETS ARE WELL-DRIED (fig. 7.2). NEVER LEAVE** damp rotors on a metal surface (particularly stainless steel) because an electrochemical reaction could take place with the aluminium or magnesium in the rotor. For swing-out rotors, be sure to clean the dirty grease from the studs and replace it with a small amount of fresh grease. This will ensure that the buckets swing freely. The majority of imbalance problems arise from the failure of the user to clean and grease the studs. **Never apply grease if studs and balancing slots have not been carefully cleaned** (fig. 7.3 a/b). **Use only the same kind of greases furnished in the rotor packaging.**

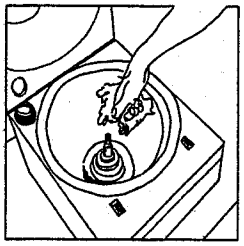


fig. 7.2

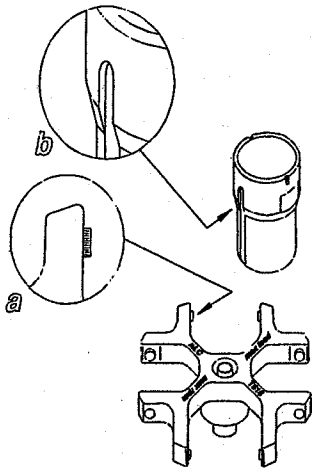


fig. 7.3

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7.2 Exterior cleaning

For correct cleaning, a light domestic-use detergent is recommended. A mixture of 50% isopropyl alcohol and water is also suggested because it will not damage the labels.

7.3 Fuses

There are two fuses in the power supply line. They are located in the power receptacle under the line cord. (see fig. 7.4)

Fuse Specifications:

230V(50-60HZ)	5 x 20 mm TA4/250V
120V (60HZ)	5 x 20 mm TA6.3/120V

⚠ WARNING:

BEFORE PROCEEDING TO CHANGE THE FUSES, DISCONNECT THE CENTRIFUGE FROM THE MAIN POWER SOURCE.

Do not attempt to replace blown fuses until a service engineer has determined the cause of the failure.

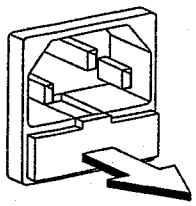
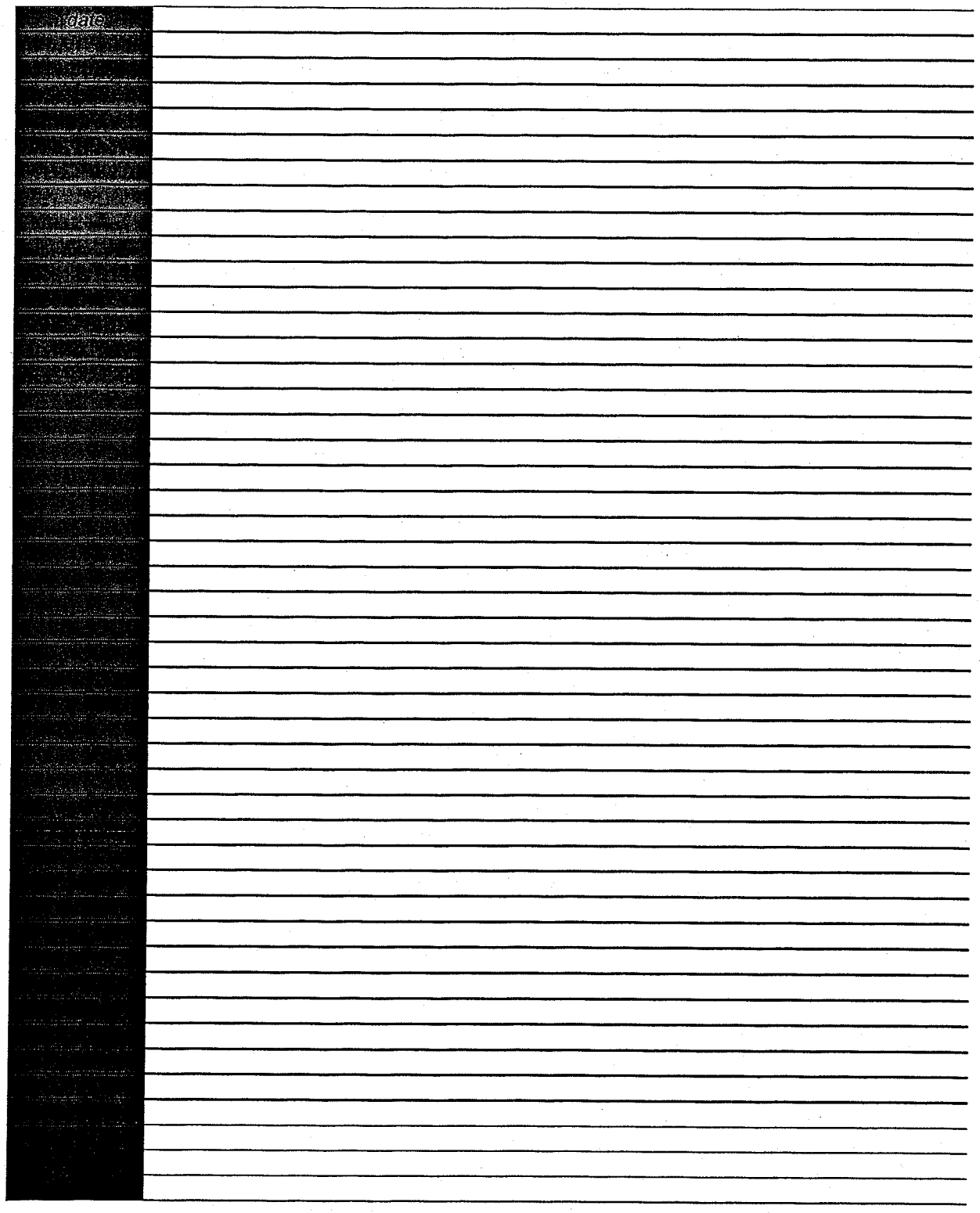


fig. 7.4

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8. OPERATOR'S NOTES



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9. CERTIFICATE of DECONTAMINATION and CLEANING

(For your convenience, use a copy of this page)

Read the instructions below carefully before sending an instrument, or parts of it, to ALC Technical Service.

MR / MRS (NAME) _____

ESTABLISHMENT _____

DEPARTMENT _____

ADDRESS _____ POST / ZIP CODE _____

CITY _____ STATE / COUNTRY _____

CERTIFIES the cleaning and decontamination of the following:

CENTRIFUGE _____ SERIAL N° _____

ROTOR _____ SERIAL N° _____

ROTOR _____ SERIAL N° _____

ACCESSORY - Description _____ SERIAL N° _____

ACCESSORY - Description _____ SERIAL N° _____

NATURE of contamination

_____

_____

Decontamination PROCEDURE USED

_____

_____

Decontamination CERTIFIED by:

Mr / Mrs. _____ Institution: _____

Date _____ Signature: _____

When an instrument, or parts of it, comes back after demonstration and requires servicing by Technical Service personnel, the following procedure must be followed to ensure safety:

- Clean the instrument and decontaminate it.
- Complete this *Decontamination Certificate* with all the information required.
- Attach this *Certificate* to the instrument (or accessory) before sending it to ALC.

Technical Service personnel **will not accept** instruments without this *Decontamination Certificate*.

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Warranty

ALC warrants its products against defects in material or in workmanship when used under appropriate conditions and in accordance with appropriate operating instructions for a period of no less than one (1) year from the date of delivery of the products.

The sole obligation of **ALC** shall be to repair or replace at our option, FOB factory or locally, without charge, any part(s) that prove defective within the warranty period, provided that the customer notifies **ALC** promptly and in writing of any such defect. Compensation for labor by other than **ALC** employees will not be our obligation. Part(s) replacement does not constitute an extension of the original warranty period.

ALC makes no warranty of merchantability, fitness for a particular purpose, or any other warranty, express or implied, as to the design, sale, installation, or use of its products, and shall not be liable for consequential damages resulting from the use of its products.

ALC will not assume responsibility for unauthorized repairs or failure as a result of unauthorized repairs, replacement, or modifications made negligently or otherwise improperly made or performed by persons other than **ALC** employees or authorized representatives.

While our personnel are available to advise customers concerning general application of all manufactured products, oral representations are not warranties with respect to particular application and should not be relied upon if inconsistent with product specification or the terms stated herein.

In any event, the terms and conditions continued in **ALC**, formal sales contracts shall be controlling; and any changes must be in writing and signed by an authorized executive of **ALC.**

All defective components will be replaced without charge for one (1) year from the date of delivery. There will be no charge for labor if the apparatus is returned to the factory prepaid.

Conditions and qualifications of the warranty statement shall prevail at all times.

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ALC PK130
Service Section

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1. INTRODUCTION

1.1. Purposes

This manual contains maintenance instructions intended for use by a qualified maintenance or service technician (We also suggest reading the respective Operating Manual).
It is organized to provide information on the theory of operation to assist in troubleshooting for personnel of ALC authorized service organization. Moreover, it outlines parts replacement and calibration procedures for putting the centrifuges back into service.
Should a specific maintenance problem arise which is not covered in this manual, please ask the authorized service organization, or contact one of our divisions indicated below.

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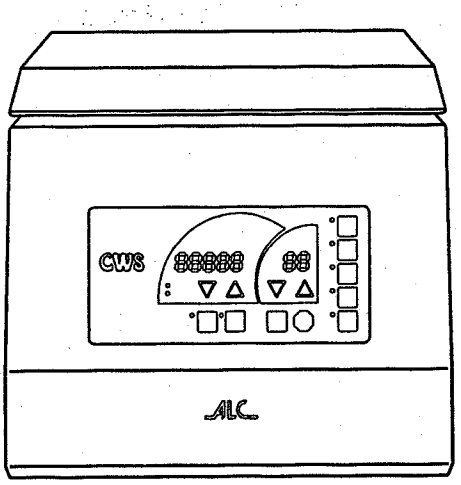
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2 DESCRIPTION AND THEORY OF OPERATION

2.1. DESCRIPTION

The PK130 centrifuge was designed for laboratory use. Using Relative Centrifugal Force (RCF) it allows the separation of substances made of different density elements.
The rotor is the main load; a swing-out design allows a higher load than does a fixed angle or aerodynamical design. The larger the diameter of a rotor, with accessories, the greater the load can be and thus the slower the speed will be.

The RCF is directly proportional to the useful radius of sedimentation and to the square of the speed. (For more information see Chapter 4, Operating Manual).



2.2. Specifications

Dimensions

Height	H	14.8 in (37.5 cm)
Width	W	15.7 in (40 cm)
Depth	D	18.9 in (48 cm)
Packaging	H x W x D	18.9 x 21.25 x 24 in (48 x 54 x 61 cm)

Weight

Net weight	80 lb (40 kg)
Net weight including packaging	45 kg

Centrifugation characteristics

Max allowable capacity:	
swing-out	(4 x 280 ml) 1120 ml
fixed-angle	(6 x 94 ml) 564 ml
Max allowable density	1200 kg/ m3
Max allowable weight	1.34 kg
Max speed:	
swing-out	4000 rpm
fixed-angle	6500 rpm
Max RCF at Tip:	
swing-out	2933 xg
fixed-angle	5289 xg
Working temperature	Ta + ΔT
Max noise	<63 dBA

Electrical characteristics

Nominal operating voltage:	230V + 5% - 10% 50 Hz
	230V + 5% - 10% 60 Hz
	120V + 5% - 10% 60 Hz
Power consumption:	3.8A (at 230V)
	7.0A (at 120V)
Max power. tot.	520 W
Max tot. Power (steady state)	350 W
Max power requirement	870 VA

Common Characteristics

- Microprocessor controlled
- 5 quick selection programs
- Work temperature Ta + DT
- Set/reading speed: 300 - 6500 rpm (10 - 100 rpm incr.)
- High or low (5 low shape) acceleration
- High or low (4 low coast-down + inertial) deceleration
- Set timer 1 min up to 99 min + ∞
- Electronic-accelerometric imbalance encoder
- Direct drive motor
- Brushless induction drive motor

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2.3. Installation procedure

The machine should be installed in a room free of dust and moisture. Place the centrifuge on a bench top rigid and strong enough to comfortably support its weight.

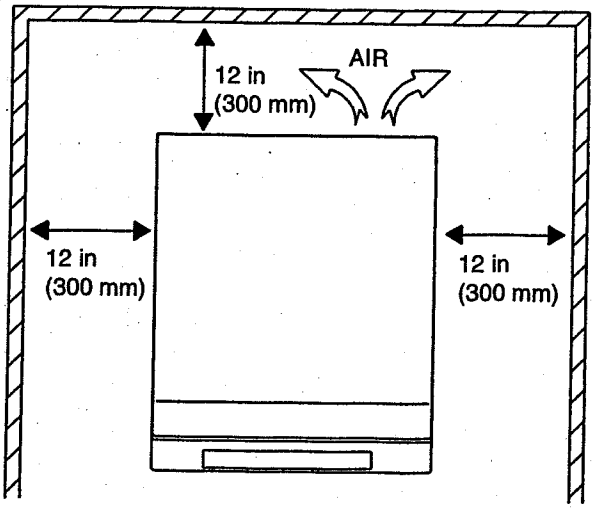
⚠ IMPORTANT:

AT LEAST 2 PEOPLE ARE REQUIRED TO LIFT THE CENTRIFUGE FROM THE PALLET AND PLACE IT ON THE BENCH.

CAUTION:

LEAVE 12 INCHES OF FREE SPACE ON EACH SIDE OF AND BEHIND THE MACHINE TO FACILITATE PROPER VENTILATION.

Fig. 1



2.4. Centrifuge component

The front panel (see 2.7), is made up by one keyboard and two display.

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2.4.1. Exploded view

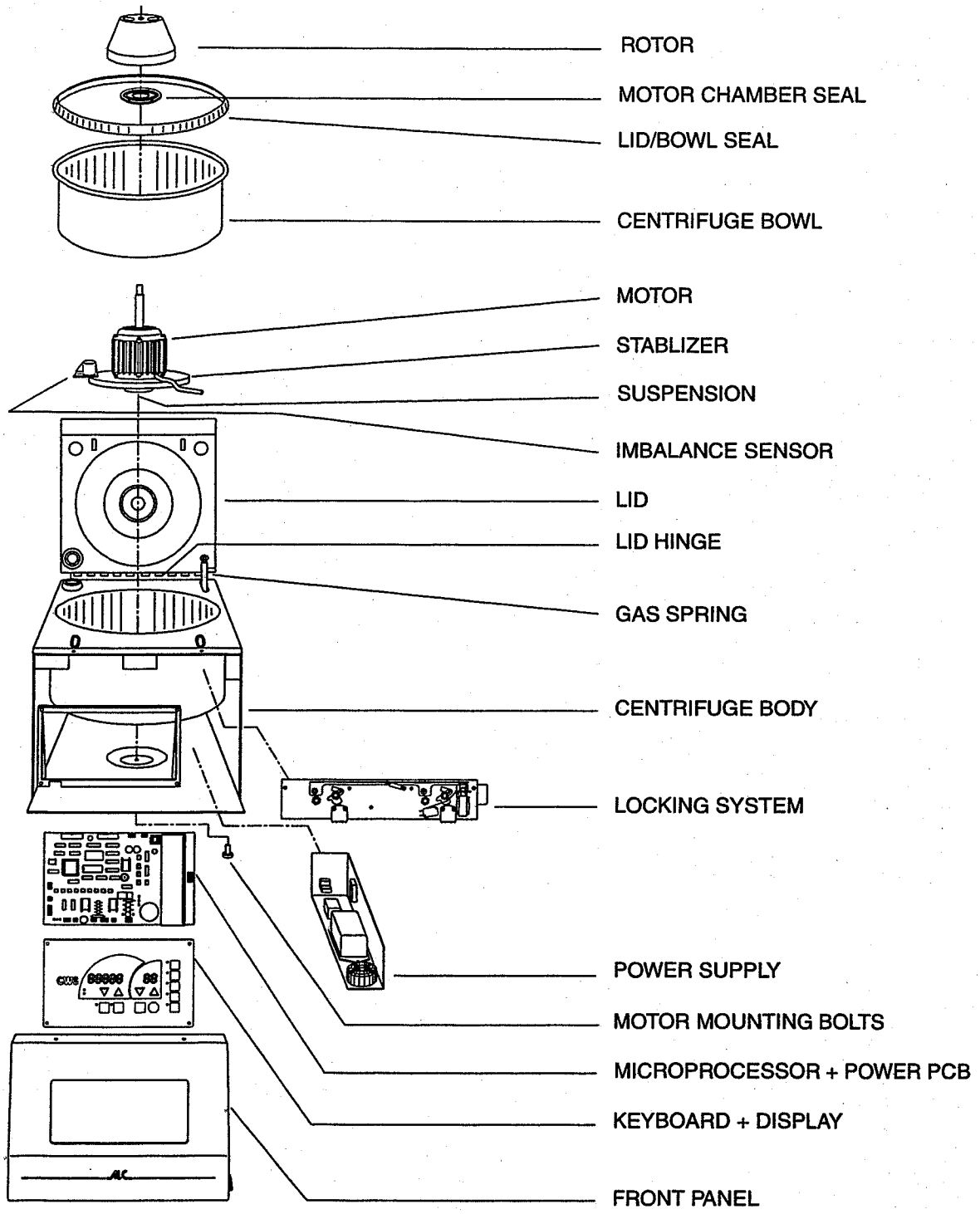


Fig.2

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2.4.2. Component layout

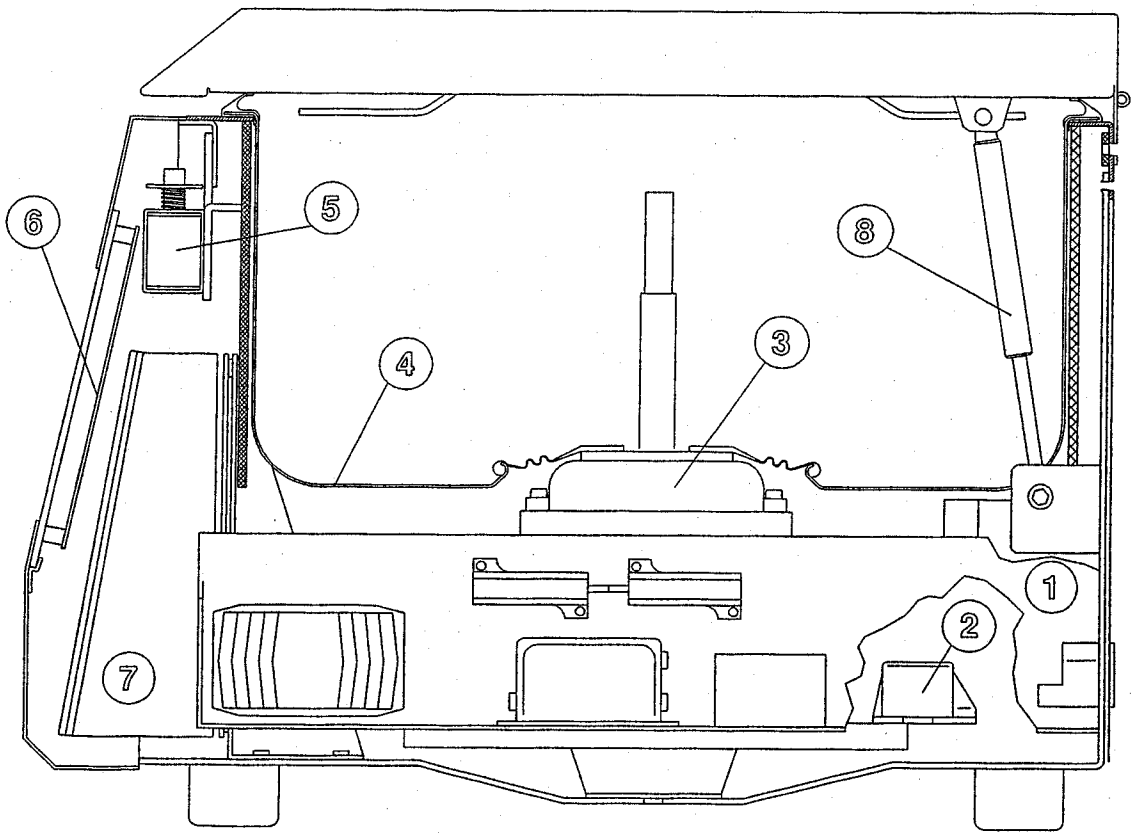


Fig. 3

① Power rack
② Load imbalance sensor
③ Electric motor
④ Centrifugation chamber
⑤ Lid solenoid
⑥ Display assembly + keyboard
⑦ µP +PWR board
⑧ Gas spring

2.4.3. Power supply rack

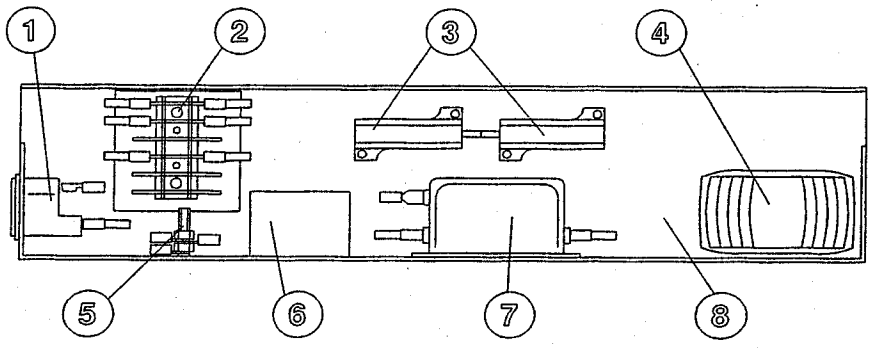


Fig. 4

① Main socket and fuse carrier
② Fast-on connection strip
③ Braking resistor
④ AC transformer
⑤ Ground/Earth
⑥ Motor filter
⑦ Mains filter
⑧ Rack

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2.5. Functional principles

The microprocessor system which controls the PK130 ensures the operation of the following major elements:

- Set operating conditions.
- The control electronics generates a system of sinusoidal 3 phase voltages, variable in amplitude and frequency.
- Automatic management of acceleration and deceleration ramps.
- Management of the safety devices:
  - recognition of rotating equipment and speed restriction;
  - lid lock;
  - zero speed detection;
  - imbalance detection;
  - motor overtemperature.
- Management of the diagnostic breakdown.

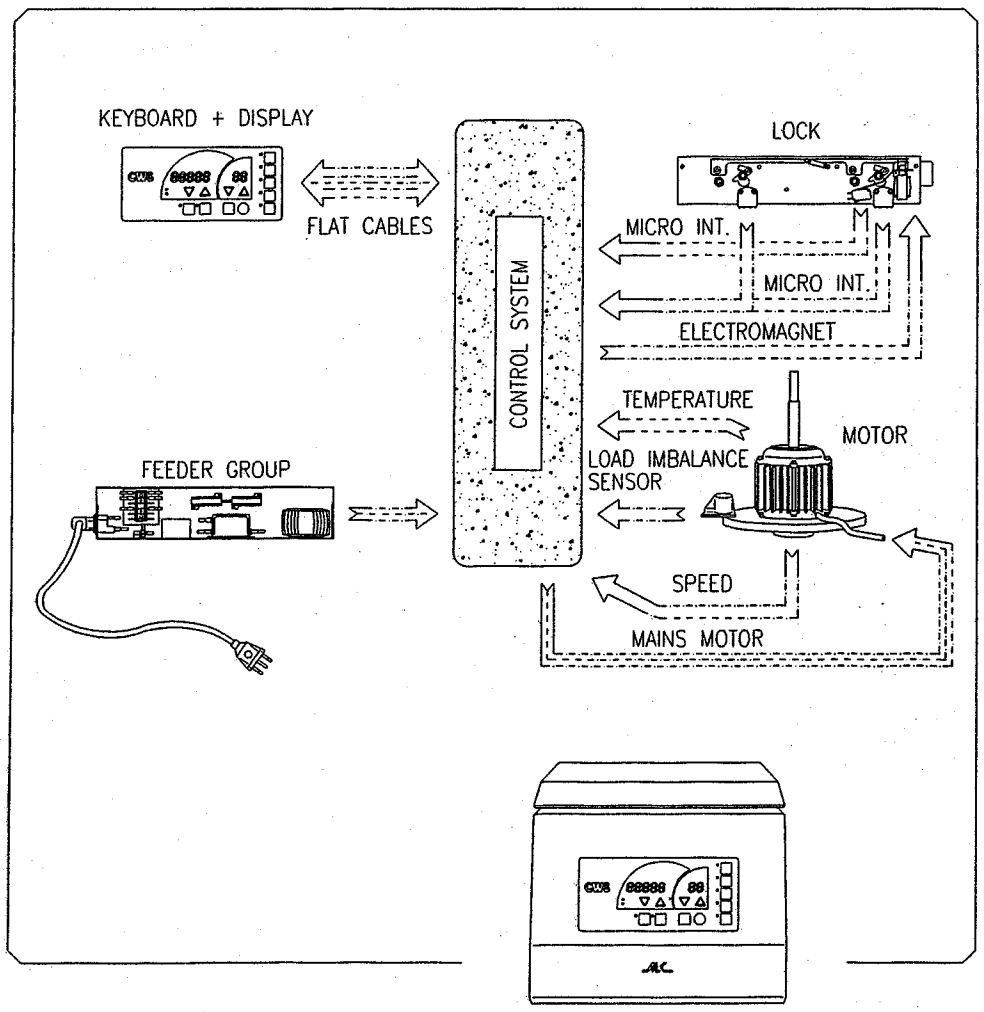


Fig. 5

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6. Management of the induction motor

2.6.1. Introduction

PK series centrifuges are fitted with an asynchronous 3 phase induction motor.

During centrifugation, the control electronics generates a system of sinusoidal 3 phase voltages, variable in amplitude and frequency.

During the braking phase, the energy returned by the motor is dissipated through a resistor.

2.6.2. The motor

The motor of the PK series comprises a 3 phase stator and a short-circuited rotor. When correctly powered, the stator creates a magnetic field rotating at the synchronised speed Ns:

Ns= (F/p) x 60

where: F is the supply frequency and P is the number of pairs of poles of the motor.

The rotating magnetic field generated in the motor induces e.m.f.'s. These e.m.f.'s produce currents in the short circuited rotor.
These induced currents found in the magnetic field create forces opposed to those which induced them.
It is the relative speed between the rotor and the stator which is the cause of these induced currents, thus the forces will reduced this relative speed by driving the rotor at a speed close to that of the field created at the stator.
The difference (s) between the synchronised speed Ns and the actual speed N of the rotor is called the slippage.

At a given frequency, the slippage value depends on the resisting torque (i.e. that of the rotor).

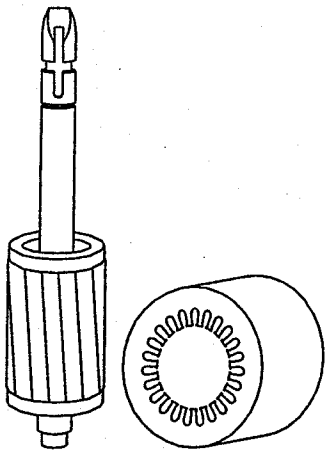


Fig. 6

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2.6.3. Power control

Three voltages, variable in amplitude and frequency, dephased by $2\pi/3$, must be supplied from a 50 or 60Hz single phase mains supply.

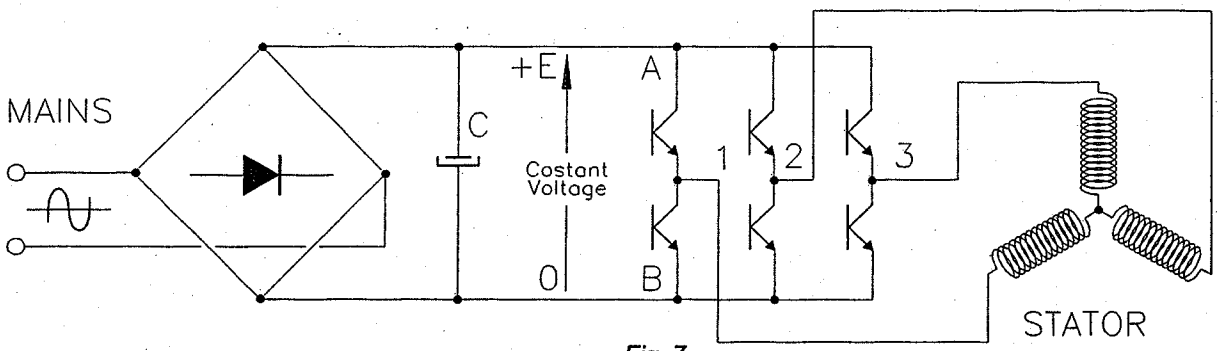


Fig. 7

The voltage is rectified then filtered by C to supply the constant voltage +E. The value of the capacitor C is high.

For a 230 V - 50 Hz mains supply:
E = 230 √2 = 325 V
C = 470µF / 400 V

For a 120 V - 60 Hz mains supply
E = 120 √2 = 170 V x 2 = 340V
C = 2 x 470µF / 400 V

The 6 transistors act as switches (open or closed).

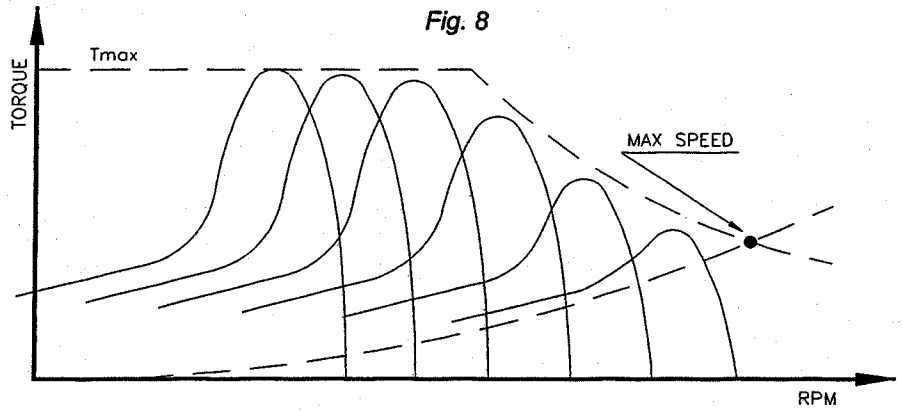
These transistor commute at a fixed frequency (8 kHz).
To affect he voltage at 1 we act upon the commands of the transistors A and B, B always being the opposite to A (A = closed, B = open). By changing the cycle ratio (closed/open) we obtain a mean sinusoidal value so we are able to vary the amplitude and frequency.

It is necessary that the pilot frequency must be elevated compared to the frequency of the generated sinusoidal voltage. The latter is around 400 Hz at 24000 r.p.m.(f pilot / f sin = 10 at N max. speed).
Speed synchronization is directly proportional to the frequency of the voltage supplied to the motor.
Ns = f x60 (for a 2 pole motor).
The motor rotates at a speed N below the speed Ns.

$\frac{Ns-N}{Ns}$ = SLIPPAGE (the slippage varies between 1 and 3%).

To vary the speed, it is necessary to vary Ns and thus the frequency of the voltage supplied to the motor.
The torque characteristics will be translated on the speed axis. The supply voltage will vary within 0 to 12000 r.p.m. in order to keep the U/f ratio (U = voltage) constant and not saturate the magnetic circuit.

Fig. 8



VARIATION OF THE CURVE OF THE MOTOR TORQUE AS A FUNCTION OF THE SPEED

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2.7. Electronics

2.7.1. Introduction

The electronic part of the apparatus is comprised of two boards: the microprocessor + the power pcb, and the processing and control interface, made by a display and a keyboard. The former is located inside the body (see fig.3, item ⑦), whereas the latter is located behind the front panel (see fig. 3, item ⑥).
The centrifuge management program is contained in the EPROM.
The load imbalance sensor is located on the motor stablizer (see fig. 3, item ②) and allows detection of an excessive imbalance due to the rotor loading.

2.7.2. µP+PWR board

On the microprocessor + power pcb, 3 distinct zones can be identified, whose functions are described below. Each of the 3 zones has its own independant power supply, and insulation between the different parts is ensured by the use of opto-couplers. (fig. 9).

ZONE 1
This zone includes the microprocessor, the EPROM containing the software and the non-volatile RAM containing the program parameters. The set of components in this zone is at the potential of the microprocessor: 5 VDC.

ZONE 2
This zone ensures the conformity of the signal type coming from the different detectors before their arrival at the microcontroller via opto couplers. The power supply for this zone is 12 VDC.

ZONE 3

⚠ WARNING:
THIS ZONE AT MAINS VOLTAGE!

This zone includes all the power circuit. It is made by:
1. The supply of the power module is 320 VDC through rectifier and filtering of the mains voltage;
2. The optical insulation allows to protect the microprocessor by the Driver;
3. Driver: IGBT circuit control. This module allows to control the couple of power transistors throw the 3 PWM (Pulse Width Modulating);
4. power module: this is the interface between "logic and motor";
5. Motor brake driver system.

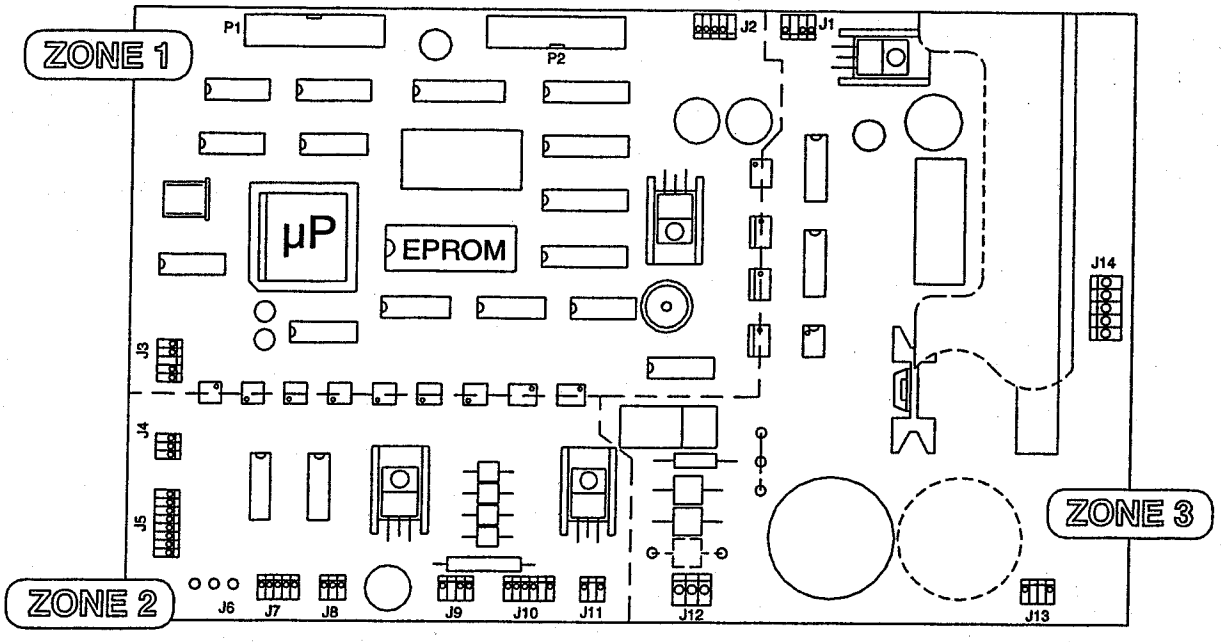


Fig. 9

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2.7.3. Load imbalance sensor

As described in the introduction, this sensor allows the detection of an excessive imbalance in the rotor loading. A piezzo ceramic converts the energy created by the vibration into an electric signal. This signal is conditioned, then dispatched to the µP for safety control.

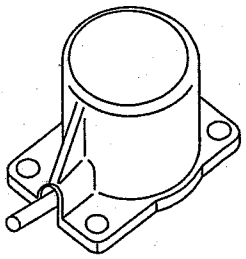


Fig. 10

2.7.4. Tacho sensor

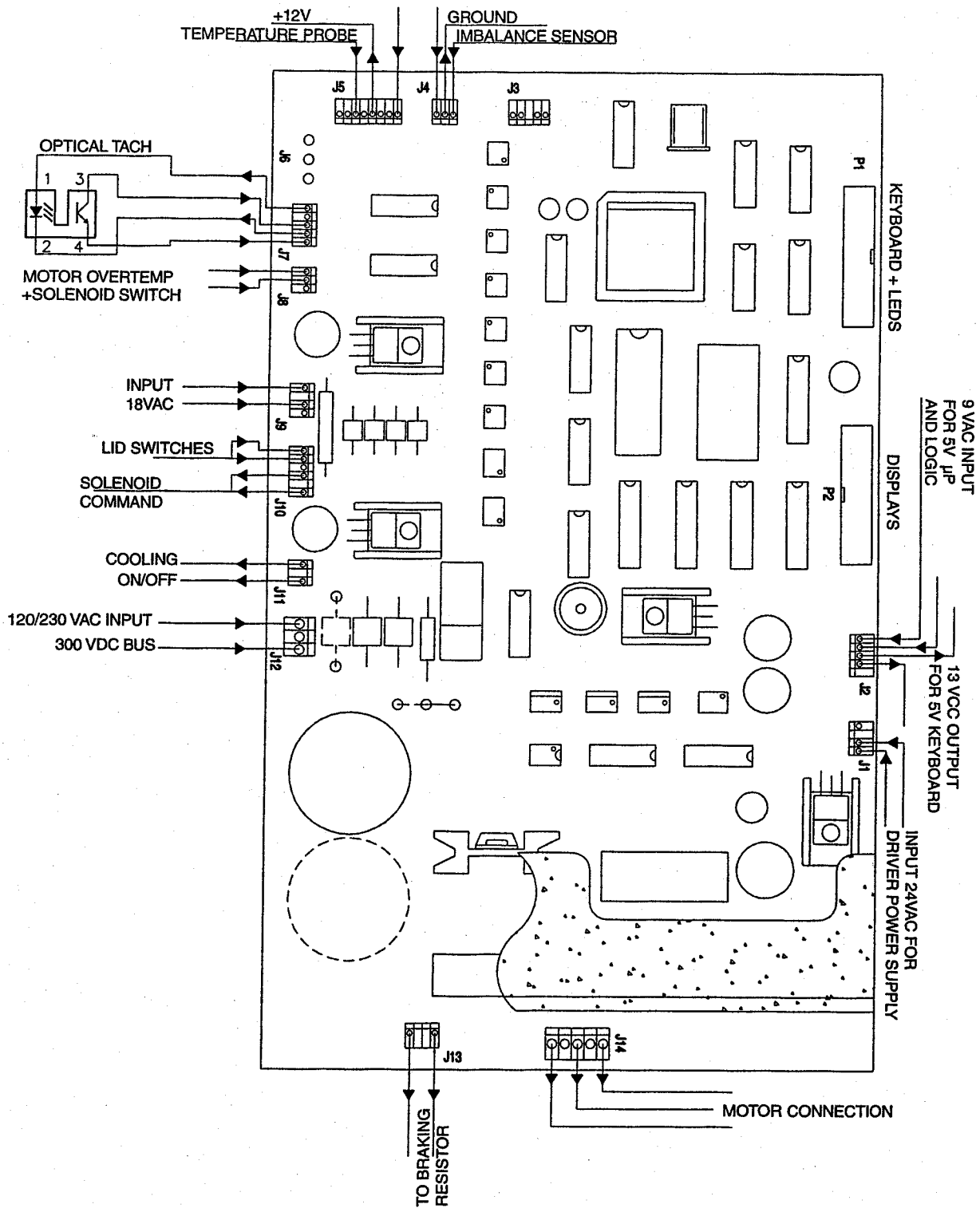
The tacho sensor is comprised of an optical sensor, which generates two pulses per revolution.

2.7.5. Temperature probe

After exiting the conditioning circuit the signal becomes 1.2Vcc 0°C ± 80mV/°C.

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2.7.6. Inputs - Outputs



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3 DIAGNOSTICS AND REPAIRS

3.1. Introduction

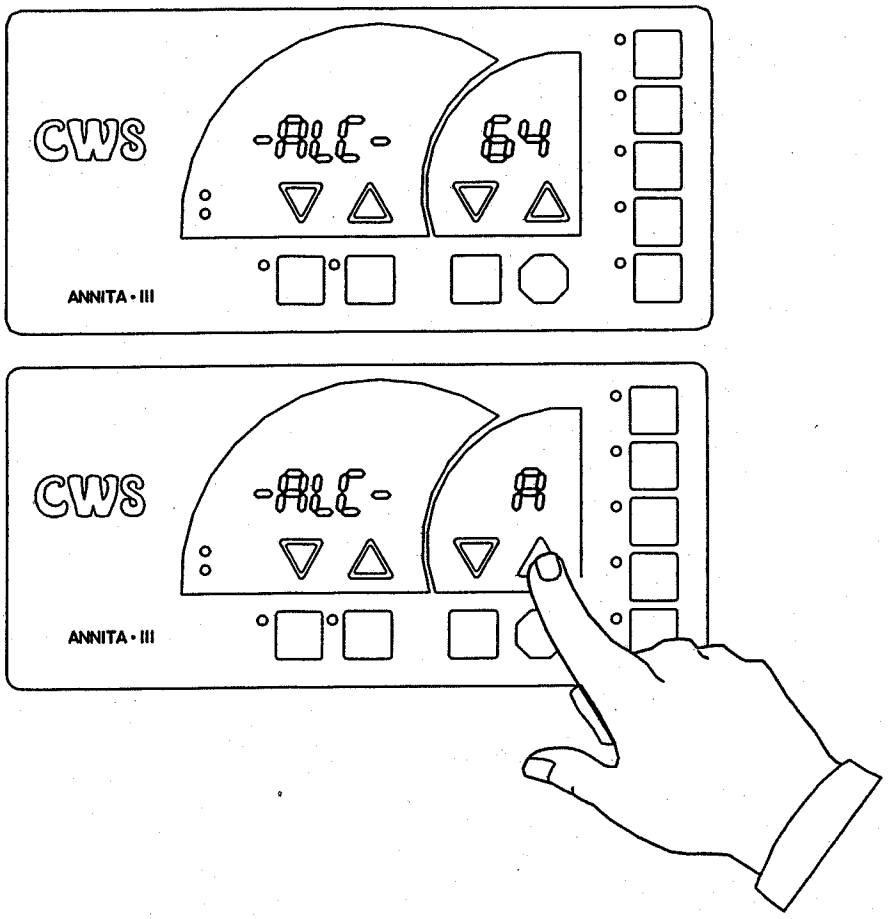
The PK series centrifuges offer a set of built-in functional tests to help locate possilble problems or runtime failures. If a problem is encoutered, an error code will appear in the display and an audible alarm will sound.

3.2. Messages

When the instrument is switched on, **"-ALC-"** is displayed for a few seconds at the bottom of the screen followed by a number corresponding to the kind of Eprom installed on the centrifuge:

- **64** = PK130

Pushing either of the two timer keys during start up will display the EPROM software revision level in the timer (MIN) display.



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3.3. Fault codes

When certain faults are detected an audible alarm is switched on in addition to a code and a message. according to the fault, the machine stops automatically under the conditions indicated in the following table:

CODE	MESSAGE	REASON	COMMENTS / EXIT
ERR 1		During rotation measured speed suddenly = zero	Tachometer information considered unreliable. Cycle stops without braking
ERR 2		Difference in values of succesive speed measurements too great.	Tachometer information considered unreliable. Cycle stops without braking
ERR 3	None	—	—
ERR 4	Equipment during rotating	Non zero speed when machine is switched on	When the motor is stopped lid may bre opened. Press any key to clear message
ERR 5	None	—	—
ERR 6	Lid unlocked	Lid unlocked during rotation	Run stops. Any operation is impossible until motor is stopped. Press any key to clear message
ERR 7	None	—	—
ERR 8	Motor over temperature	Motor over temperature (above 120°C), faults in the micro processor, lid unlock solenoid stuck or reed switch improperly adjusted.	The centrifuge stops if it is running. Motor will not operate if START is pressed. Wait for the motor to cool.
LID	Lid unlocked	Lid unlocked when START selected	It is impossible to START. Close the lid or check that it is properly locked. Message will clear once lid is properly closed and locked.
IMBAL	Imbalance	Imbalance detected	Run stops. Any operation is impossible until motor is stopped. Press any key to clear message
SET	Setting speed error	The set speed is greater than the rotor maximum speed.	Speed limit at: 4000 r.p.m. 10000 r.p.m.

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4 REPLACEMENT PROCEDURES

⚠ CAUTION:

DISCONNECT THE MAINS POWER LEAD TO THE CENTRIFUGE BEFORE ALL REPLACEMENT PROCEDURES !

4.1. Motor replacement

Disassembly (see fig.12)

1. Remove the pin from the gas spring ①
2. Remove the front panel ② unscrewing the five screws and disconnecting: the power switch, the flat cables, connector of the display and ground wire. The two flat cables can be disconnected either from the side of the mP+PWR (connectors P1 and P2) or from the side panel: it is better to disconnect both from the same side to avoid errors during refitting. The panel power cable (red-black) can be disconnected just from the panel. Lift up the bowl seal ③ and unscrew the three screws from the centrifugation chamber.
3. Remove the bowl seal chamber-motor ④.
4. Lift up and remove the centrifugation chamber ⑤.
5. Disconnect the connectors ⑥ of the motor (J14), of the tachometer (J4), of the load imbalance sensor (J7), from the µP+PWR board, then disconnect the Fast-on of the motor ground wire and the thermoswitch connector.
6. Unscrew the fixing screw of the motor which is located on the motor base ⑦.
7. lift up the motor and remove it ⑧.
8. To dispatch the counterweight stabilizing from the motor, insert the allen key, number 4, from the top, going along the fins of the dissipater.

Reassembly

1. Carry out the above operations in the reverse order.

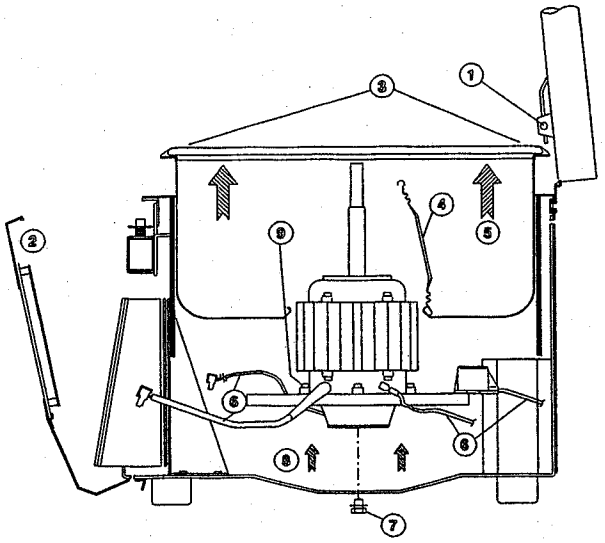


Fig. 12

4.2. Load imbalance sensor replacement

Disassembly

1. Remove the chamber (see paragraph 4.1)
2. The detector is attached at the counterweight stabilizing of the motor
3. Unscrew the 2 screws and dismount the sensor.

Reassembly

1. Carry out the above operations in reverse order.

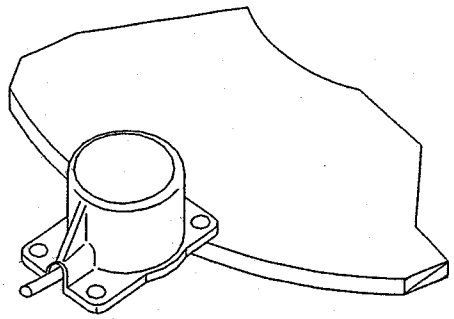


Fig.13

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4.3. Replacement of the lid lock assembly
(see fig. 14)

Disassembly

1. Open the lid.
2. Remove the front panel unscrewing the five mounting screws and disconnecting: the power switch, the flat cables, display connector and ground wire.
3. Disconnect the lid lock assembly from the µP+PWR board, disconnecting J8 and J10.
4. Unscrew the four mounting nuts ①.
5. Remove the lid lock assembly.

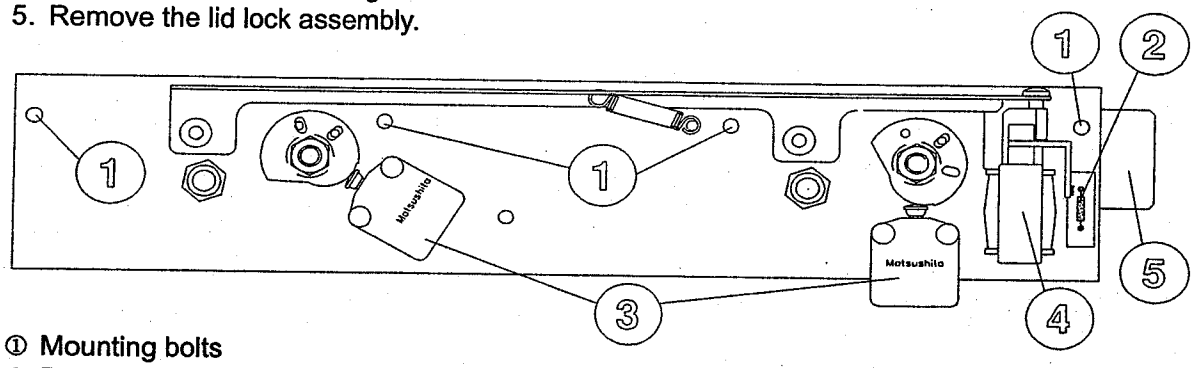


Fig.14

① Mounting bolts
② Reed switch
③ Lid microswitch
④ Solenoid
⑤ Lid handle

Reassembly

1. Remount the assembly on the body, making sure it is properly aligned with the four mounting nuts ①.
2. Check that the assembly is properly positioned so that lid will lock correctly.
3. Install the four mounting nuts to the chassis ①.
4. Connect the electrical connections.
5. Remount the front panel.

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4.4. Replacement of the lid lock assembly spare parts (see fig. 15)

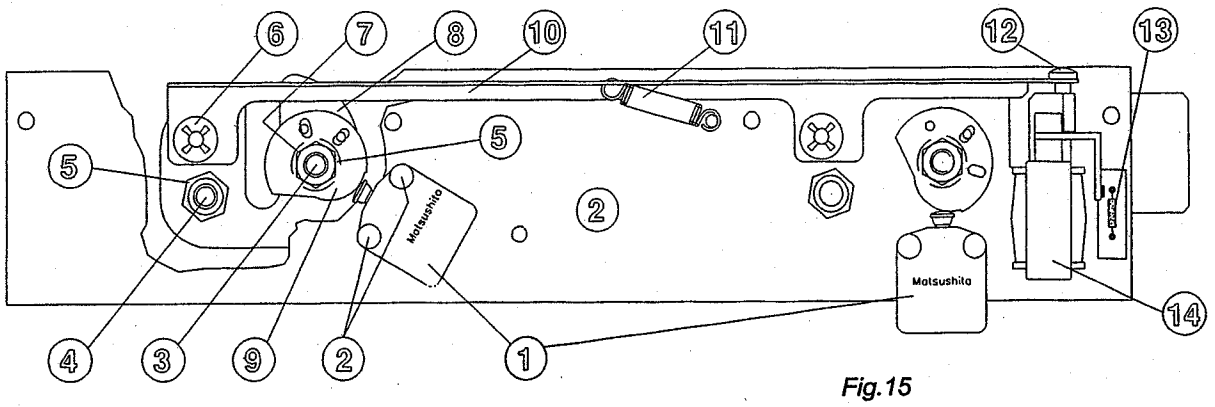


Fig.15

4.4.1 Lid lock microswitches replacement

Disassembly
1. Disconnect the microswitches ①.
2. Remove the mounting bolts ② then dismount the microswitch.

Reassembly
1. Carry out the above operations in reverse order. Check that the microswitche rod does not hit the cam when the lid is open to avoid a false alarm.

4.4.2 Lid Lock block

Disassembly
1. Unscrew the locknut ⑤.
2. Extract the screw ④
3. Extract the cam ⑨.
4. Extract the snap ring ⑥.
5. Unscrew the bolt ⑦ behind the cam ⑨.
6. Detaining the lock block⑧ ,unscrew and extract the screw ③.

Reassembly
1. Carry out the above operations in reverse order.

4.4.3 Lock Solenoid Microswitch replacement

Disassembly
Operating on this microswitch can be done without dismounting the lid lock support.
1. Unscrew the 2 nuts holding the reed switch ⑬ . Dismount the switch with the 2 bolts and the 2 spacers, then disconnect it.

Reassembly
1. Connect the new switch, then carry out the above operations in reverse order.

⚠ WARNING:
MAKE SURE THAT THE SOLENOID CORRECTLY MOVES THE SWITCH LEVER !

4.4.4 Solenoid

Replacement
1. Disconnect the solenoid ⑭ by cutting the 2 wires at the level of the sleeves.
2. Supporting the solenoid, remove the screws on the back of the lid lock assembly panel.

Refitting
1. Carry out the above operations in the reverse order.
2. Check that the plunger operates properly.
3. Resolder the wires to the solenoid and replace the insulating sleeves.

NOTE: Replacement of the lid lock microswitches and the solenoid microswitch can be pergormed without having to remove the lid entire lid lock assembly.

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4.5. Power supply rack replacement (see fig 16)

Disassembly

1. Dismount the front panel.
2. Remove the screws ②.
3. Remove the nuts situated in front of the transformer ③.
4. Disconnect all cables: J1, J2, J9, J12, J13, ground wires and supply cable.
5. Remove the rack.

Reassembly

Carry out the above operations in the reserve order.

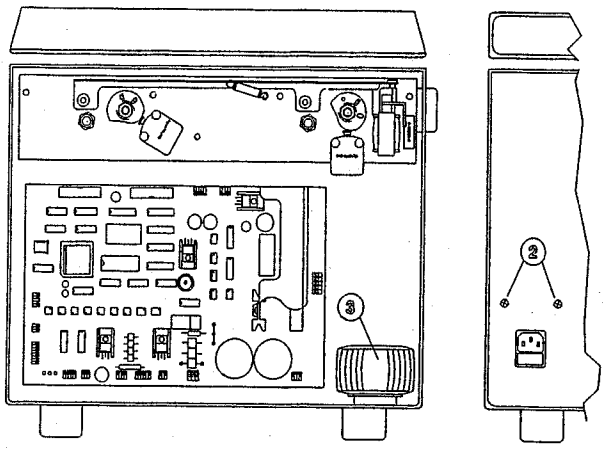


Fig.16

4.6. Electronic boards replacement

4.6.1 µP+PWR board replacement

Disassembly

1. Remove the front panel.
2. Disconnect all cables from the board: J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11, J12, J13, J14, P1, P2.
3. Remove the 5 screws holding the board.
4. Remove the board.

Reassembly

Carry out the above operation in reverse order. Do not forget to put the isolation (Mylar) between the chassis and the board.

⚠ WARNING:

TO CONNECT J1 SEE FIG. 17: IT IS ABSOLUTELY IMPERATIVE TO MAINTAIN THE POSITION OF ① AND ②

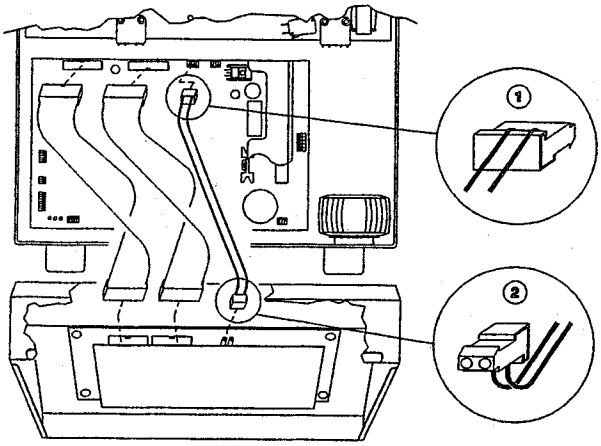


Fig.17

4.6.2. Keyboard-Display disassembly (see fig 18)

1. The keyboard-display is located behind the front panel: the latter must be removed by unscrewing the five mounting screws and disconnecting the power switch, flat cables, display supply and ground wire.
2. Remove the 4 nuts ① attached to the chassis then remove the board ②

Reassembly

Carry out the above operations in reverse order, taking care to correctly refit all the cables (see fig. 17).

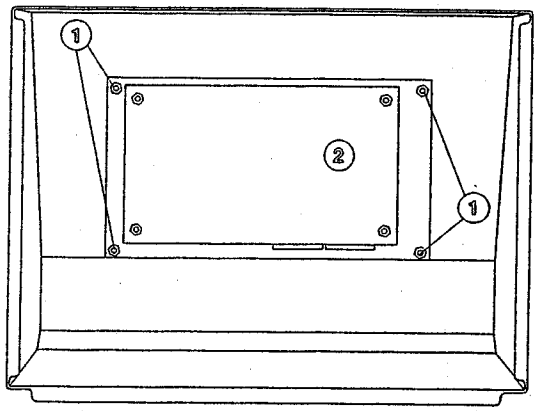


Fig.18

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4.7. Gas spring replacement

Disassembly

To replace the gas spring, see motor replacement (paragraph 4.1) (see also Component layout par. 2.4.2 number ⑧)

1. See paragraph 4.1. numbers 1 to 5
2. Remove the power supply rack (see par. 4.5).
3. Remove the screw located at the foot of the gas spring.
4. Remove the gas spring.

Reassembly

Carry out the above operations in the reverse order.

4.8. Tachometer replacement

Disassembly

1. Dismount the elastic suspension, unscrewing the 3 fixing screws ①.
2. Unscrew the two fixing screws of the optic sensor, then extract it (may attention to the number ②.

Reassembly

1. Carry out the above operations in the reverse order.

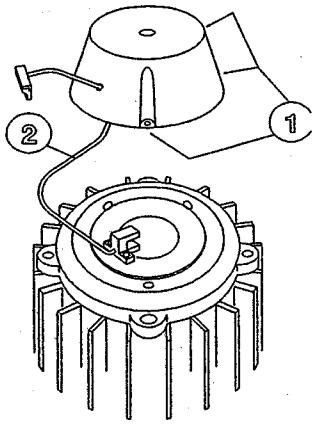


Fig. 19

4.9. Eprom replacement

⚠ CAUTION

A SUITABLE EXTRACTOR MUST BE USED WHEN PERFORMING EPROM REPLACEMENT. USE OF ANY TOOL NOT SPECIFICALLY DESIGNED FOR THIS PURPOSE COULD RESULT IN DAMAGE TO THE EPROM OR ITS SOCKET.

⚠ CAUTION

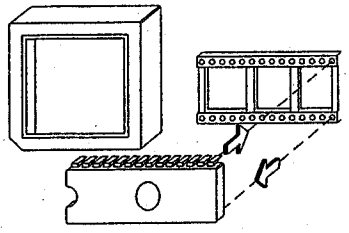
DURING REPLACEMENT OPERATION KEEP THE EPROM PARALLEL TO THE SOCKET !

Extraction

1. Dismount the front panel.
2. To substitute the EPROM it is not necessary dismount the µP+PWR board!
3. Extract the Eprom.

Insertion

1. See the figure below.



⚠ CAUTION

INSERT THE NEW EPROM WITH THE KEY (SLOT) TOWARDS THE MICROPROCESSOR

2. Perform the necessary calibrations: see CHAPTER 5

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4.10. Lid replacement

1. Open the lid
2. As indicated in paragraph 4.1 (see **Fig. 12**), remove the pin from the gas spring attached at the lid.
3. Remove the five screws connecting the lid to the lid hinge, **Fig. 20.**
4. Remove the lid.

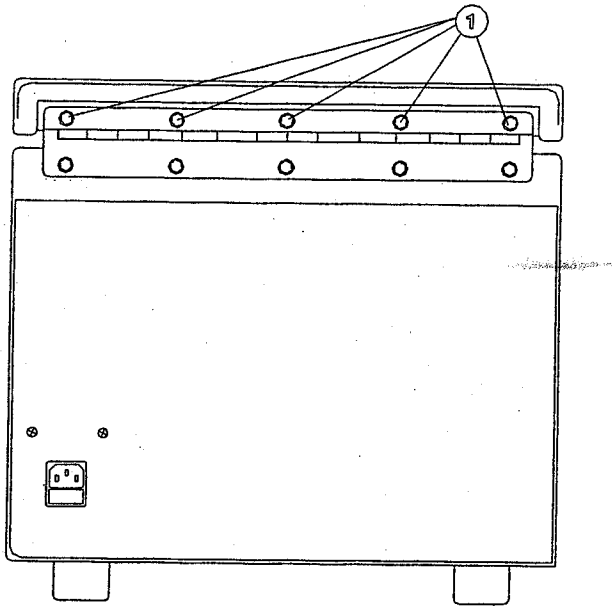


Fig. 20

4.11. Motor checking

To check the motor electrical circuit integrity, continuity between phases has to be checked.
As there are three wires, such a measurement has to be carried out alternately, at the terminals of two of them, choosing the third one as common.
The two resistance values obtained referred to two successive phases (as the state circuit is star-configured). Check that :

1. The two values are identical (allowable difference ± 0.2 Ω).
2. The two values are not lower than 7 ½ (± 0.2 Ω).
3. There is no discontinuity.

If there is no conformity to condition 1, the motor can run erratically.
If there is no conformity to condition 2, the motor can run irregularly with over heating.
If there is no conformity to condition 3, the motor cannot run.

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5. CALIBRATION

5.1. Load imbalance sensor

When the Eprom is changed, all previously saved information is lost. In the case of no calibration, to avoid unnecessary repairs, the Eprom contains imbalance threshold default value 350.

⚠ WARNING

THE DEFAULT THRESHOLD VALUE IS FOR SAFETY PURPOSES ONLY AND IS NOT SUITABLE FOR NORMAL OPERATIONS. CALIBRATION MUST BE DONE EVERY TIME THE EPROM IS REPLACED.

The calibration is done by a self learning of the vibration peak by the microprocessor, the calibration is no longer a manual procedure.
Perform as follows:

1. Power on and then load the centrifuge with p/n: 11200091 (PK130) or 11200082 (PK120).
2. Simulate the maximum imbalance, loading 17 gram weight (p/n: 39902747) into one bucket. Close lid and shut unit off.
3. To enter the configuration menu, simultaneously press the Program keys ① + ② + ③ when the machine is powered on.
4. Timer display will show: °C , while the speed display will show a random number.
5. Pressing START will cause both Displays to show respectively 88 and:

- value 00 if the Eprom has just been replaced;
- a value between 0 and 1024 if calibration was previously done.

6. Press PROG ⑤ to erase any previous calibration.
7. Unit will automatically start. Wait until the cycle is completed: once the cycle is complete, the display will show a number between 300 and 700. If the result is different, please repeat the calibration. If the result is still unsatisfactory, contact the manufacturer's service department.

Remark: by pressing PROG 3 it is possible to alternately view the rpm number and imbalance value. Press PROG3 then ▽△ to change the Imbal value as required.

8. Press STOP to exit the configuration menu and go into work mode.

⚠ WARNING

IT IS ONLY POSSIBLE TO SAVE THE NEW CONFIGURATION AT THE END OF THE CYCLE

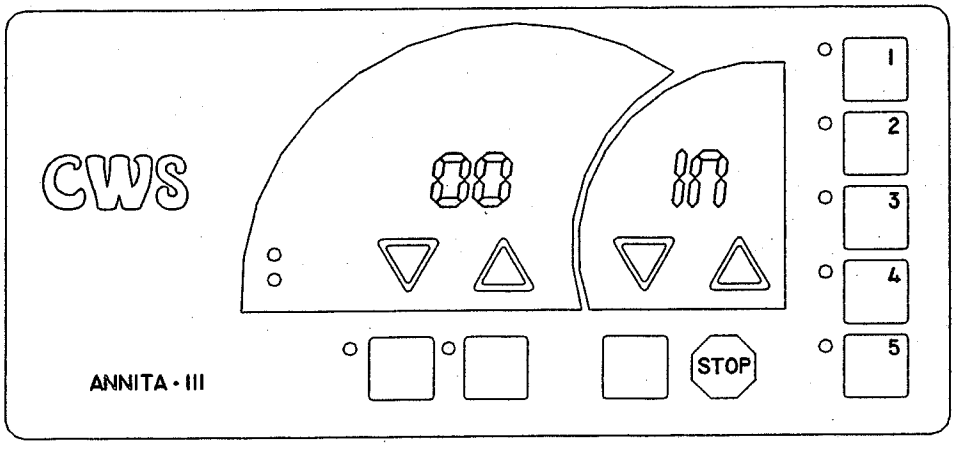
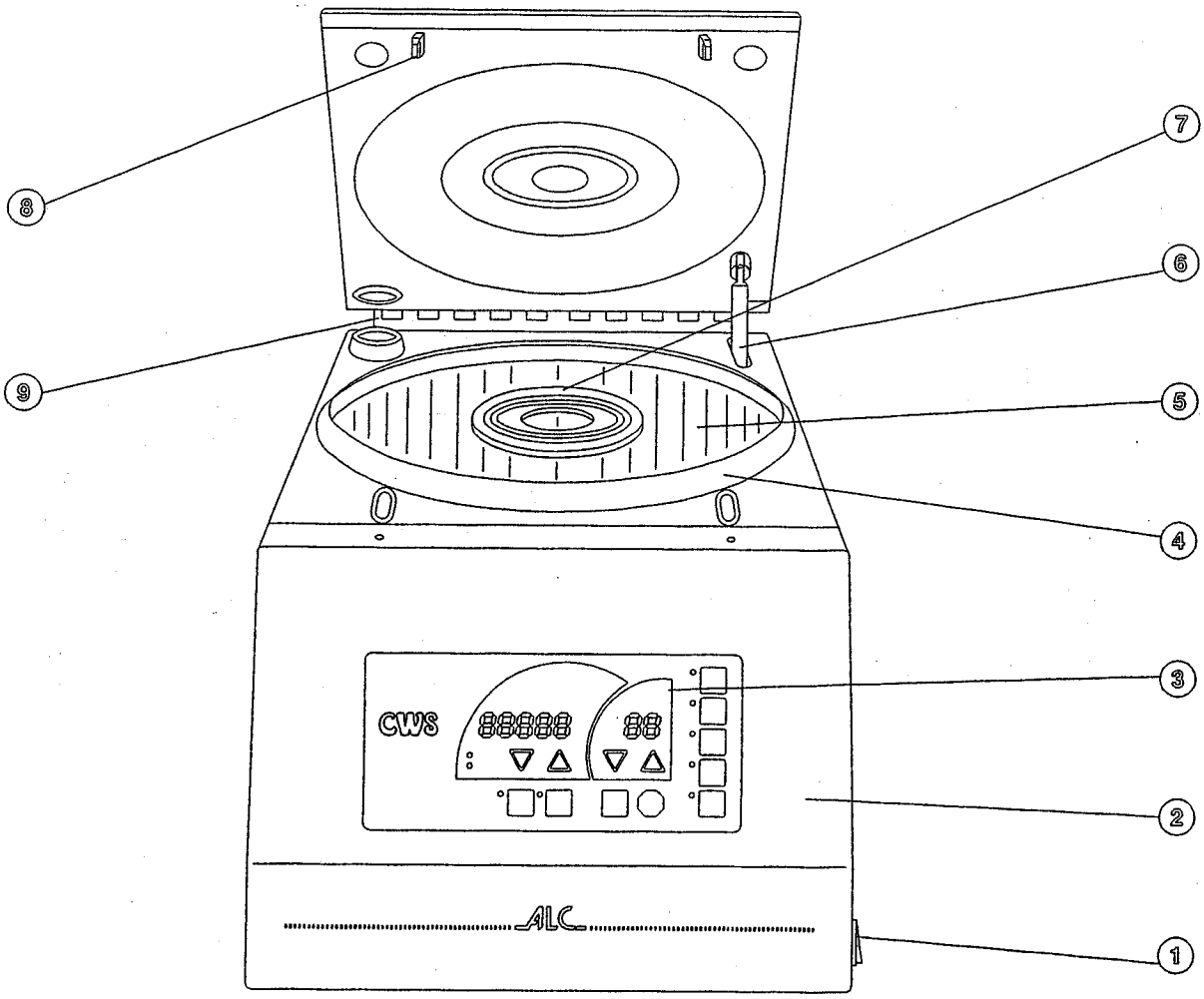


Fig. 21

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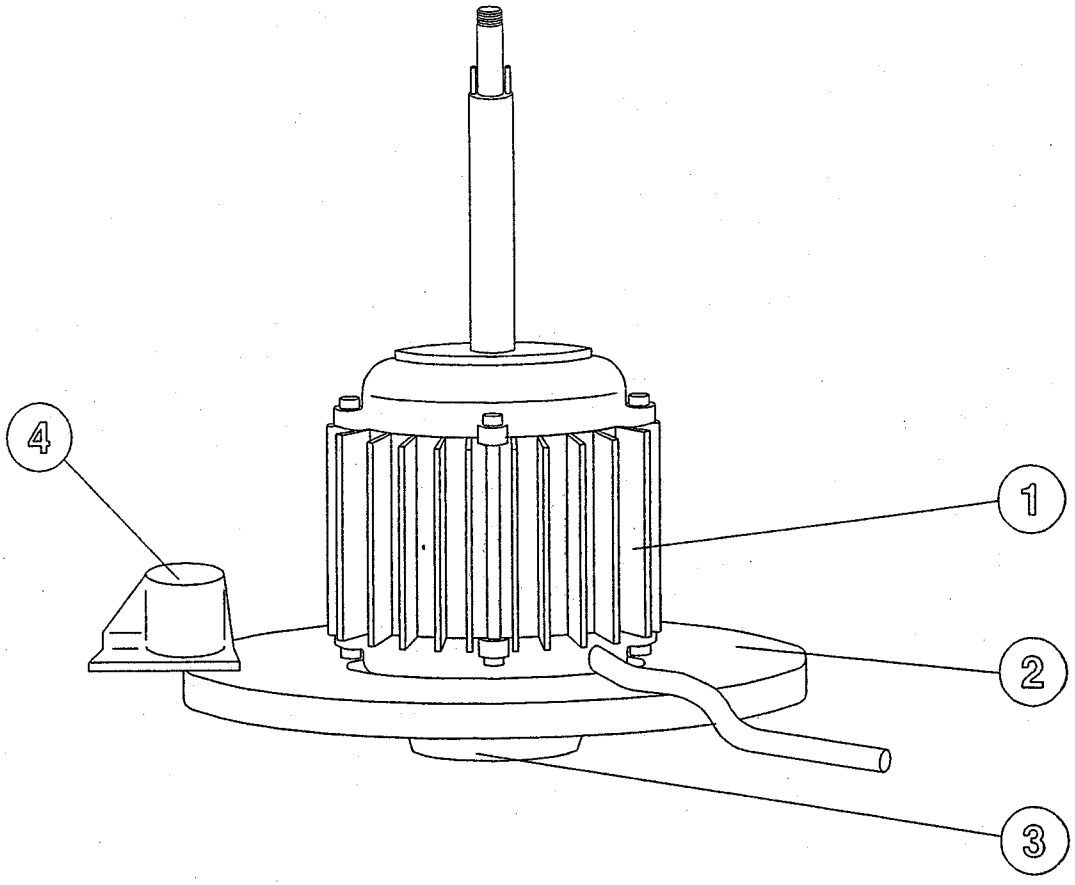
6. SPARE PARTS LIST



GENERAL VIEW

ITEM	Catalog no.	Description	Qty.
1	89000838	Power switch	1
2	85480510	Front Panel	1
3	11202459	Keyboard, overlay	1
4	89000943	Bowl seal, lid	1
5	89002039	Centrifuge chamber	1
6	89000840	Gas spring	1
7	89000839	Bowl seal chamber, motor	1
8	85240195	Lid latch catch	2
9	11200717	Lid hinge	1
	85280515	Main P.C.B.	1
	11202402	Display P.C.B.	1

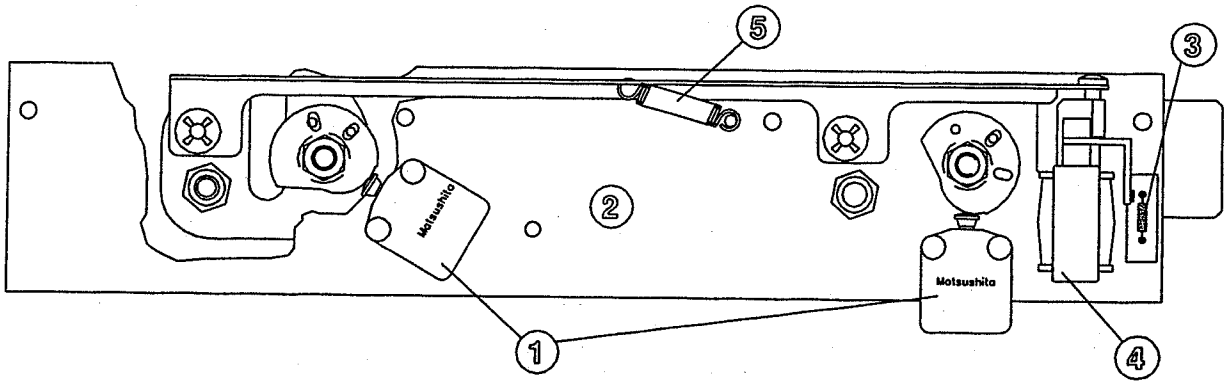
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MOTOR

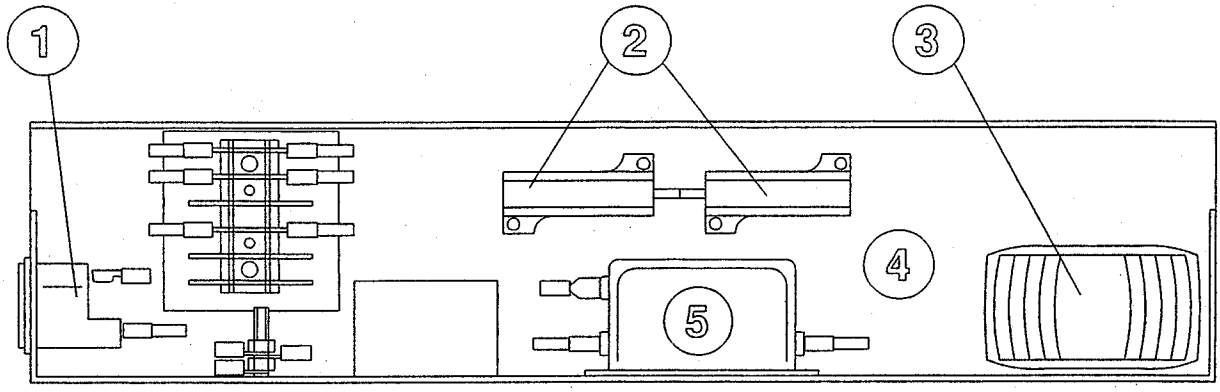
Item	Catalog No.	Description	Qty.
1	38500012	Motor	1
2	11200508	Counter Weight	1
3	89000853	Tachometer Sensor Assy. + Shock Mount	1
4	89000843	Load Imbalance Sensor	1

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Item	Catalog No.	Description	Qty.
1	89000842	Lid microswitch	2
2	11202913	Lock Assembly	1
3	11250006	Solenoid switch	1
4	11250002	Lid solenoid kit	1
5	89000846	Spring	1

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LOCK VIEW
POWER RACK

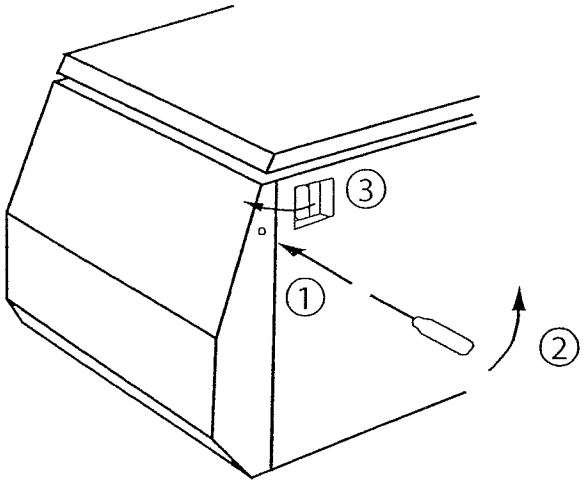
Item	Catalog No.	Description	Qty.
1	86000775	Mains receptacle	1
2	86003247	Braking resistor	2
3	86003242	Transformer, 230V	1
3	86003243	Transformer, 120V	1
4	11202935	Power supply rack, 230V	1
4	11202936	Power supply rack, 120V	1
5	86003248	Line filter, 230V	1
5	86003256	Line filter, 120V	1

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MANUAL LID OPENING

CENTRIFUGES WITH ELECTRICAL UNLOCKING SYSTEM



Use the unlocking tool provided in the tool kit.

Without handling the lid at all, simply insert the unlocking tool into the access hole in the top right hand corner of the centrifuge. Push the tool in as far as possible and then lift it so as to work the unlocking mechanism. At the same time, pull on the lever at the side of the machine to enable the lid to be opened.

Remove the unlocking tool after opening the lid.

WARNING: Check that the rotor has stopped before opening.

Part No. 36510071

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IMPORTANT MAINTENANCE INFORMATION

CENTRIFUGE ACCESSORIES

1. AVOID CORROSION: Centrifuge rotors and buckets may corrode as a result of:
   - 1.1 Marring of the surface finish
   - 1.2 Impact to the surface
   - 1.3 Centrifugation of corrosive products
   - 1.4 Centrifugation in a corrosive atmosphere
   - 1.5 Lack of periodic cleaning

WARNING: Corrosion of rotors and buckets may create a safety hazard, by weakening their structural integrity. Material loss from corrosion may result in an imbalance and cause vibration at high speed.

CAUTION: Corrosion appears, in its first stage, as white spots on the painted or anodized surface of the rotor or buckets. The most common chemical to attack aluminum is the chloride ion, present in solutions like ammonia salts.

CAUTION: If an ANTI-BACTERIAL DISINFECTANT is required for cleaning, Jouan Inc. recommends the following chemicals:
- 70% ETHANOL
- 05% PHENOL
- ORTHO PHENYL PHENOL
- FORMALDEHYDE
- GLUTERALDEHYDE

2. REGULAR CLEANING: Adherence to a regular program of rotor cleaning and maintenance will inhibit the process of corrosion.
   - 2.1 Weekly cleaning of rotors and buckets requires warm water and a mild detergent solution. Thoroughly dry the rotor and buckets in an oven less than 80 °C.
   - 2.2 Monthly cleaning involves the procedure described above, as well as application of a thin film of silicon grease to the rotor pins and the bucket shoulder that pivots on the pins. This silicon grease is supplied with the centrifuge accessory kit.

3. EMERGENCY CLEANING: After an accidental spill or tube breakage, immediately clean the rotor and buckets, as described in section 2.1.
   - 3.1 Insert cleaning is accomplished by lifting each segment of the insert and scrubbing with a bottle brush. Use only mild detergent solution and dry with a clean, absorbant towel.
   - 3.2 Cushion cleaning is required after spillage or glass breakage. Remove the cushion and clean thoroughly.

CAUTION: If an insert cushion cannot be thoroughly cleaned of broken glass, replace with a new cushion before re-using the insert.

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FOR J22a-1193

CERTIFICATE OF COMPLIANCE

{ PK130 / 120V }

Unit Catalog No. 11200016 **Unit Serial No.** 305120276

QC STATIC TEST:

Appearance	oui	Labelling	oui	Wiring	oui
Mechanical	oui	Tool Kit	oui	Documents	oui
Cleaning	oui	Packing	oui	Micro PCB N°	A053026 1
Keypad PCB N°	2005-0238685	Motor N°	705120019	EPROM Ver.	890025J7C

QC SAFETY TEST:

Static Leakage Current: (<= 0.5 mA, with S1 closed) FUIT OU 0,50mA

Ground res. (<=0.1)	0,029	Ω	S1 Open:			S1 Closed:		
HiPot (= 1.25 KV)	1,35	KV	S2-A		mA	S2-A		mA
HiPot, < 10mA	4,54	mA	S2-B		mA	S2-B		mA

QC DYNAMIC TEST: Test rotor = (4 x 280mL) with set/4 buckets (11200091 or 51231105)
Test RPM = 4000

Lid Interlock Safety	oui		Accel. Amps (2<<2.6)	2,39	Amps		
Rotor Recognition	oui		Accel. Secs. (35<<66)	43	Secs		
Imbalance value:	382		Run Amps (1.2<<1.8)	1,56	Amps	Brake Time	21" Secs
at 10 grams imbal. (300<< 800)							

Discrepancies:

Tested By	Lenoyer
Test Date	16/12/05

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MATERIAL SAFETY DATA SHEET

Product:	SGB-2	*Note: The information herein is*	
		given in good faith. No warranty,	
Printed:		*expressed or implied, is made.*	
Printed For:			
Original Issue Date:	11/08/85	**Approved By:**	Chuck Hiddema
Revision No.3 Date:	08/30/01		V.P. Technical Operations

Section I - Identification

Manufacturer:	AGS Company
Street Address:	2651 Hoyt St
City/State/Zip	Muskegon Hts., MI 49444
Phone:	800-253-0403
Phone:	231-733-2101
FAX:	231-733-1784
Transportation Emergency:	CHEM-TEL
Phone:	800-255-3924
Trade Name:	Sil-Glyde Lubricating Compound
Catalog No.:	SGB-2
Common Name:	Sil-Glyde Lubricating Compound
Container/Size:	Tube, 1.5 oz.
NFPA - Health:	0
Flammability:	0
Reactivity:	0
Specific Hazard:	
HMIS - Health:	0
Flammability:	0
Reactivity:	0
Protective Equipment:	

Section II - Hazardous Ingredients

Hazardous Ingredient	**CAS No.**	**Wgt. %**	**TLV**
1. Polypropylene Glycol	25322-69-4	45-60	Not Assigned
2. Castor Oil	8001-79-4	30-45	Not Assigned
3. Silicon Dioxide, Amorphous	7631-86-9	5-15	20 mppcf (PEL)
4. Polydimethylsiloxane	63148-62-9	1-5	Not Assigned
5. Oleoyl Sarcosine	110-25-8	1-5	Not Assigned
6			
7			
8			
9			
10			

NOTES:

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Section III Physical Data			Catalog No. SGB-2
pH - Supplied:	Not Determined		
pH - Diluted:	Not Applicable		
Water Solubility:	Insoluble		
Specific Gravity:	(Water = 1) 1.11		
Melting Point:	Not Applicable		
Boiling Point:	Not Determined		
% Volatiles:	Nil		
Vapor Pressure:	Nil		
Vapor Density:	(Air = 1) > 1		
Evaporation Rate:	Nil		
Appearance:	Opaque semi-solid, no odor.		

Section IV Fire & Explosion Data			
Flash Point:	>400°F.		
Method:	C.O.C.		
Auto Ignition Temperature:	Not Determined		
Flammable Limits In Air LEL:	Not Determined		
UEL:	Not Determined		
Extinguishing Media:	Foam, dry chemical and/or carbon dioxide.		
Special Procedures:	Wear self-contained breathing apparatus.		
Unusual Hazards:	None Known.		

Section V - Reactivity Data			
Unstable and/or Auto Reactive:	Stable		
Incompatible Materials:	Oxidizing materials.		
Hazardous Decomposition Products:	Oxides of carbon and silicon.		

Section VI - Emergency First Aid			
Eyes:	Flush with water for at least 15 minutes. Get medical attention.		
Skin:	Wash with soap and water. If adverse effects occur consult a physician.		
Ingestion:	Do not induce vomiting, get immediate medical attention.		
Inhalation:	Remove person to fresh air. Administer oxygen or artificial respiration as required. Consult a physician.		

Section VII - Health Effects			
Eyes:	May cause discomfort.		
Skin:	May cause discomfort on repeated or prolonged exposure.		
Ingestion:	May cause nausea, vomiting and/or diarrhea.		
Inhalation:	None known.		
Other Effects:	Aspiration in to lungs may cause chemical pneumonitis.		

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Section VIII - Ventilation and Protective Measures			Catalog No. SGB-2
Ventilation Requirement:	General acceptable.		
Eyes:	Yes		
Gloves:	No		
Clothing:	No		
Respiratory:	No		
Other:	Eye wash in area.		

Section IX - Storage and Handling Procedures			
Conditions to Avoid:	Open flame.		

Section X - Spill Procedures and Waste Disposal			
Spill Procedure:	Scrape up and place in an appropriate container. Remove residue with detergent and water.		
Disposal Method:	Removal by an approved, licensed waste hauler.		
EPA Waste I.D. NO.:	Not Reg.		

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