

# Instruction Manual

## KR4i



Analyze · Detect · Measure · Control™

P/N 50116933-1

**Thermo**  
SCIENTIFIC



# Instruction Manual

## Jouan KR4i

PN 50116933-1  
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**Thermo**  
S C I E N T I F I C



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# Foreword

Before starting to use the centrifuge, read through this manual carefully and follow the instructions.

The information contained in this instruction manual is the property of Thermo Fisher Scientific; it is forbidden to copy or pass on this information without explicit approval.

Failure to follow the instructions and safety information in this instruction manual will result in the expiration of the seller's warranty.

# Accident Prevention

Prerequisite for the safe operation of the **KR4i** is a work environment in compliance with the following standards, directives and trade association safety regulations and proper instruction of the user:

- EEC Directive 89/391/EEC on “Measures for Improving the Safety and Health Protection of the Worker on the Job”
- Accident Prevention & Insurance Association Regulation A1 – Principles of Prevention
- Accident Prevention & Insurance Association Regulation A3 – Electrical Systems and Equipment
- BGR 500 – Operation of Equipment, Chapter 2.11 “Machines of Chemical Processing Technology”, Part 3
- Machine Directive: **98 / 37 / EC**
- Low Voltage Directive: **72 / 23 / EC - 93 / 68 EC**
- EMC Directive: **89 / 336 EG - 92 / 31 EG - 93 / 68 EG**
- **EN 292**
- **EN 61326 (+ EN 61000-3-2/A14:2000-06)**
- **EN 55011 B** (Radio Interference Suppression)
- **EN 61000-6-2**
- Safety Standard: **EN 601010-1 - EN 61010-2-020 IEC 1010-2-020**

This centrifuge fulfils the requirements of the international safety standard IEC 1010-2-020 for laboratory centrifuges.

The safety regulations contain the following basic recommendations:

- Maintain a radius of at least 30 cm around the centrifuge
- Implementation of special measures which ensure that no one can approach the centrifuge for longer than absolute necessary while it is running,
- installation of an easy-to-use and always accessible emergency stop switch that cuts off the power supply in an emergency. Such a switch must be installed at a certain distance to the centrifuge, preferably in another room.



# Precautions

In order to ensure safe operation of the **KR4i**, the following general safety regulations must be followed:

- The centrifuge should be operated by trained personnel only.
- The centrifuge is to be used for its intended purpose only. “Proper use” on [page vi](#).
- Do not move the centrifuge while it is running.
- Do not use rotors which show any signs of corrosion and/or cracks. Do not touch the electronic components of the rotor and do not make any changes to the electronic or mechanical components.
- Use only with rotors which have been expertly installed.
- Use only with rotors which have been loaded properly.
- Never overload the rotor.
- Do not touch the electronic components of the centrifuge or alter any electronic or mechanical components.
- Never start the centrifuge when the lid is open.
- Never open the lid until the rotor has come to a complete stop and this has been confirmed in the display.
- The lid emergency release may be used in emergencies only, e.g. during a power failure.
- Never use the centrifuge if parts of its cover panels are damaged or missing.
- Plug the centrifuge only into sockets which have been properly grounded.
- Use only rotors and accessories for this centrifuge which have been approved by Thermo Fisher Scientific. Exceptions to this rule are commercially available glass or plastic centrifuge tubes, provided they have been approved for the speed or the RCF value of the rotor.
- Please observe the safety instructions.

Please pay particular attention to the following aspects:

- Location: Place the centrifuge in a well-ventilated environment on a solid level surface with adequate load-bearing capacity.

- Rotor installation: make sure the rotor is locked properly into place before operating the centrifuge.
- Especially when working with corrosive samples (salt solutions, acids, bases), the accessory parts and vessel have to be cleaned carefully.
- Always balance the samples.

Centrifuging hazardous substances:

- Do not centrifuge explosive or flammable materials or substances which could react violently with one another.
- The centrifuge is neither inert nor protected against explosion. Never use the centrifuge in an explosion-prone environment.
- Do not centrifuge toxic or radioactive materials or any pathogenic micro-organisms without suitable safety precautions.

When centrifuging microbiological samples from the Risk Group II (according to the „Laboratory Bio-safety Manual“ of the World Health Organization WHO), aerosol-proof biological seals have to be used.

For materials in a higher risk group, extra safety measures have to be taken.

- If toxins or pathogenic substances have gotten into the centrifuge or its parts, appropriate disinfection measures have to be taken.
- Highly corrosive substances which can cause material damage and impair the mechanical stability of the rotor, should only be centrifuged in corresponding protection tubes.

**IF A HAZARDOUS SITUATION OCCURS, TURN OFF THE POWER SUPPLY TO THE CENTRIFUGE AND LEAVE THE AREA IMMEDIATELY.**

#### Proper use

The centrifuge is to be used for separating materials of different density or particle size suspended in a liquid.

Maximum sample density at maximum speed:  $1,2 \frac{\text{g}}{\text{cm}^3}$



The symbol opposite refers to general hazards.

WARNING means that injuries or material damage or contamination could occur.

ATTENTION means that material damage could occur.

# Chapter 1 Presentation of product

## Description

The Jouan **KR4i** centrifuge is designed to separate substances of different density by centrifugal force.

Different rotors can be fitted to the drive in order to match the sample containers and the required performance. The maximum speed (and, by consequence, the resultant centrifugal force) is a function of the rotor in use.

A control system permits the speed, acceleration and braking rates, run time and temperature to be monitored and controlled.

The refrigeration is assured by a refrigerant group charged with a CFC-free fluid. The refrigerant fluid circulates around the bowl to achieve maximum efficiency.

The Jouan **KR4i** is mainly dedicated to the following application fields:

- Blood separation processing
- Large volume industrial processing
- Biochemistry
- Radio immune assay

## Relative Centrifugal Force

Suspended solids are separated by the Relative Centrifugal Force (RCF) applied to the sample. The effective force increases with the square of the speed of rotation and the distance from the axis of rotation.

The following formulae permit the calculation of primary parameters and of transformations relating to changes in primary parameters.

**Note** The value introduced for the radius can be adjusted to allow for position within the tube such as at a boundary. Maximum radii are quoted in the specifications tables (chapter 1.9).

## Centrifugation formulae

R	radius (in millimetres)
N	speed (in r.p.m.) ÷ 1000
RCF	gravitational acceleration 'g'
M+	add to memory
MR	memory recall

**Note** To calculate actual results, press the keys on a pocket calculator in the order shown.

Primary calculations	Key sequence (not valid for CASIO, HP)
$RCF(xg) = 1.118RN^2$	$Nx = x1.118xR=$
$Speed (rpm) = 946 \sqrt{\frac{RCF}{R}}$	$RCF \div R = \sqrt{x946}$
$Radius (mm) = \frac{RCF}{1.118N^2}$	$Nx = x1.118 = M + RCF \div MR=$

Transformations	Key sequence
To determine actual 'g' achieved at a different speed:	
$RCF2 = RCF1 \left(\frac{N2}{N1}\right)^2$	$Nx \div x1.118 = M + RCF \div MR=$

To determine actual speed required to achieve a different 'g' at the same radius:

$N2 = N1 \sqrt{\frac{RCF2}{RCF1}}$	$RCF2 \div RCF1 = \sqrt{xN1}=$
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To determine actual speed required to achieve the same 'g' at a different radius:

$N2 = N1 \sqrt{\frac{R1}{R2}}$	$R1 \div R2 = \sqrt{xN1}=$
--------------------------------	----------------------------

## Drive System

The rotor is driven by a three phase asynchronous motor. The rotor is situated in the centre of an armour plated centrifugation bowl. A control system ensures the correct drive.

## Refrigeration System

Information about the refrigeration system:

- Max pressure: 26 bars
- Type of refrigerant: R404A
- Total weight of refrigerant: 1.5 kg
- The system is CFC free and is without inflammable fluid.

## Dimensions and Weight

KR4i	
Height (lid open)	650/1670 mm
Height (lid closed)	915/935 mm
Width	798 mm
Depth	905 mm
Weight (uncrated)	346 kg
Weight (crated)	380 kg
Required surface area	1.2 m <sup>2</sup> + safety zone

## Electrical Specifications

KR4i		
Mains supply		230 V $\pm$ 10%, 50 Hz or 208/230 V, 60 Hz
Fuses	Main pcb	T 5 x 20, 160 mA 26387014
	Supply pcb	F1 T 5 x 20, 63 mA 86001807
	Supply pcb	F2 T 5 x 20, 250 mA 34000207
Motor		2000 W at 4400 rpm
Refrigeration		1.5 hp. (1100 W)
Average power		3500 VA
Maximum power		4500 VA

## Performance

KR4i		
Max. speed		4900 rpm
Max. RCF		7300 x g
Max. capacity		4 x 1600 ml 6 x 1000 ml 8 or 12 quin. or quad. bags, with or without filter 4 x 2160 ml; 6 x 2000 ml buckets
Speed	Range	500 to 4900 rpm
	Step	10 rpm
	Accuracy	$\pm$ 10 rpm
RCF (x g)	Range	80 to 7300 x g
	Step	1 x g
	Précision	<0.5%

KR4i		
Timer	Range Step	0 to +99 h 59 min 59 sec + hold position 1 min / 1 sec
Energy	Max. density Max. load on drive shaft Max. energy	1.2 g/ml 37 kg 129050 J

**Note** The maximum rotational energy is not systematically that obtained with the maximum permissible load on the drive shaft.

KR4i		
Integrator	Range Step	0 to 999 x 10 <sup>11</sup> m.rd <sup>2</sup> . sec 1 m.rd <sup>2</sup> . sec
Acceleration rates		10
Braking rates		10
Temperature	Range Step Accuracy	-20 to +40 °C 1 °C ±1.5 °C
Motor		Induction
Display		High visibility digital display, 240 x 128 pixels
Control		Microprocessor (16 bit)
Memory size		24 programs
Program protection		Individual password

#### Winshielded rotor RP4 (Cat N° 11178250)

Bucket	Cat N°	Max speed/RCF with lid	Max speed/RCF without lid	Bucket weight (kg)	Load density	Load weight kg/bucket*
N4C 1600 ml Cylindrical	11178143	4250 rpm 5513 x g	4000 rpm 4883 x g	1.671	1.2	2.13
N4T Transfusion	11178088	4250 rpm 5372 x g	4000 rpm 4758 x g	2.025	1.1	1.679

\* At bucket maximum speed

#### Winshielded rotor RP6 (Cat N° 11178252)

Bucket	Cat N°	Max speed/RCF with lid	Max speed/RCF without lid	Bucket weight (kg)	Load density	Load weight kg/bucket
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### Presentation of product

Winshielded rotor RP6 (Cat N° 11178252)						
N6CD Cylindrical Hard anodised	11178152	4250 rpm 5735 x g	3800 rpm 4585 x g	1.375	1.2	1.5
N6CE Cylindrical Sealed	11178135	4250 rpm 5735 x g	3800 rpm 4585 x g	1.375	1.2	1.5
N6B Biochemistry Rectangular open	11178138	4250 rpm 5392 x g	3800 rpm 4310 x g	1.54	1.2	1.4
N6BMT Rect. Sealed $\mu$ T	11178140	4250 rpm 5392 x g	3800 rpm 4310 x g	1.54	1.2	1.4
N6T Transfusion	11178155	4250 rpm 5674 x g	3800 rpm 4536 x g	1.575	1.1	1.64

Winshielded rotor RC6 (Cat N° 11178254)						
Bucket	Cat N°	Max speed/ RCF with lid	Max speed/ RCF without lid	Bucket weight (kg)	Load density	Load weight kg/bucket*
N6 Cylindrical	11178136	4900 rpm 7301 x g	4300 rpm 5623 x g	1.375	1.2	1.5
N6CE Cylindrical Sealed	11178135	4900 rpm 7301 x g	4300 rpm 5623 x g	1.375	1.2	1.5

Rotor RHK4B (Cat N° 11178255)						
Bucket	Cat N°	Max speed/RCF with lid	Max speed/RC F without lid	Bucket weight (kg)	Load density	Load weight kg/bucket*
NHK4B	11174023	-	3300 rpm	3.6	1.2	3.7
RIA		2301 x g				

## Accessories

Accessories have been marked with a maximum usable lifetime, that must be respected. For commentary concerning expected lifetime of accessories, please refer to section 5.13.

Only accessories specifically designed for use with the Jouan **KR4i** are authorized for use with this centrifuge.

The accessories used with the Jouan **KR4i** are:

RP4 windshielded 4 place swing-out rotor, without lid:

Designed for blood banking (8 quin or quad bags, with or without filter) or large volume processing (4 x 1600 ml). It can be equipped with a lid. The performance is 4250 rpm (5513 x g) with lid and 4000 rpm (4883 x g) without lid.

RC6 windshielded 6 place swing-out rotor, without lid:

Designed for multi purpose uses: blood banking (6 quad bags), large volume processing (6 x 1000 ml), biochemistry (cylindrical plastic inserts). It can be equipped with a lid: the performance then rises from 4300 rpm to 4900 rpm (5623 x g to 7301 x g).

RP6 windshilded 6 place swing-out rotor, without lid (12 quin or quad bags):

Designed for multi purpose uses: blood banking (12 quin bags or quad bags), large volume processing (6 x 1000 ml), biochemistry (cylindrical or rectangular plastic inserts), and microtitre carriers. The maximum authorized speed, whatever accessory used, is 3800 rpm (without lid). It can be equipped with a lid (in the case of blood banking buckets Cat No 11178155, and cylindrical buckets Cat. N<sup>os</sup> 11178136, 11178135, 11178152). Performance can then reach a speed of 4250 rpm (5735 x g).

RHK4B 2 place swing-out rotor:

Designed for RIA, usual RIA counter racks can be directly centrifuged without transferring the tubes (see tables). Maximum RCF is 3300 rpm (2301 x g).

**Table 1-1. Rotor RP4**

	Blood Banking			Large Volumes		
	11178088 Set of 4			11178143 Set of 4		
	11178158 with partition (2 quin bags)			41193596 PC 1600 ml		
	11178159 without partition (2 quin bags)			41193600 PP 1600 ml		
	11178170 2 bags with filter in line*					
	RPM	RCF	RAD	RPM	RCF	RAD
- without rotor lid	4 000	4 758	266	4 000	4 883	273
- with rotor lid	4 250	5 372	266	4 250	5 513	273

**Table 1-2. RP6**

	Biochemistry			Biochemistry			Biochemistry		
	11178138 Set of 6			11178136 Set of 6			11178140 Set of 6		
	11178216 1 piece			11178135 Set of 6			Complete with transparent cap & stainless steel tray also accepts two rectangular plastic inserts		
	11178190 1 piece			See detailed table					
	RPM	RCF	RAD	RPM	RCF	RAD	RPM	RCF	RAD
- without rotor lid	3 800	4 310	267	3 800	4 585	284	3 800	4 310	267
- with rotor lid	4 250	5 392	267	4 250	5 735	284	4 250	5 392	267



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	<b>Blood Banking</b>			<b>Blood Banking</b>			<b>Large Volumes</b>		
	11178155 Set of 6			11178136 Set of 6			11178136 Set of 6		
	11178256 with partition (2 quin or quad bags)			11178135 Set of 6			11178135 Set of 6		
	11178157 with partition (2 quad bags)			11178203 (1 triple or quad bags)					
	11178195 Set of 6 for 4 buffy coat bags			11178108 (1 double bag)					
	RPM	RCF	RAD	RPM	RCF	RAD	RPM	RCF	RAD
- without rotor lid	3 800	4 536	281	3 800	4 585	284	3 800	4 585	284
- with rotor lid	4 250	5 674	281	4 250	5 735	284	4 250	5 735	284

**Table 1-3. RC6**

	<b>Biochemistry</b>			<b>Blood Banking</b>			<b>Large Volumes</b>		
	11178136 Set of 6			11178136 Set of 6			11178136 Set of 6		
	11178135 Set of 6			11178135 Set of 6			11178135 Set of 6		
	See detailed table			11178203 (1 triple or quad bags)			11178203 1000 ml		
				11178108 (1 double bag)					
	RPM	RCF	RAD	RPM	RCF	RAD	RPM	RCF	RAD
- without rotor lid	3 800	4 585	284	3 800	4 585	284	4 300	5 623	272
- with rotor lid	4 250	5 735	284	4 250	5 735	284	4 900	7 301	272

**Table 1-4. RHK 4 B**

<b>RIA</b>		
RIA bucket 11174023 Set of 2 + Trays (See detailed table)		
RPM	RCF	RAD
3 300	2 300	189

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**Table 1-5. RP6 ROTOR ACCESSORIES IN 11178138 AND 11178140 BUCKETS**

	CAT N° SET OF 4 INSERTS	Colour	CAPACITY (3 sets of 4 inserts)				Ø x HEIGHT min / max (mm)	MAX RADIUS (mm)
			N° inserts	Tubes per insert	Volume (ml)	Total tubes		
Set of 6 buckets 11178138 for 2 inserts 1 sealing cap 11178216	11175341	Salmon	12	20	1.5 microtube	240	11 - 35 / -	257
	11175343	Beige	12	26	5	312	12.7 - 67 / 107	257
	11175344	Light blue	12	20	6	240	13.5 - 65 / 107	257
	11175347	Cream	12	12	5 - 10 flat bottom	144	17.5 - 65 / 112	257
	11175358	White	12	7	12 flat bottom	84	18 - 65 / 122	257
	11175348	White	12	7	15 conical	84	18 - 90 / 122	259
	Set of 6 sealed buckets 11178140 for 2 inserts and for microtitre plates	11175349	Orange	12	7	15 vac.	84	16.5 - 90 / 127
11175351		Coral	12	8	20	96	22.2 - 90 / 116	259
11175353		Dark red	12	4	50	48	30.5 - 90 / 122	259
11175354		Light blue	12	3	50 conical	36	30 - 90 / 117	259
11175355		Green	12	1	100	12	45 - 90 / 132	255
11175356		Turquoise	12	1	250 flat bottom	12	63 - 65 / 125	264
	11175360	4 sets of 5 decanting rubber pads (Ø 10.5 - 12.1 mm) for 11175343 inserts						

**Table 1-6. RP6 AND RC6 COMMON ACCESSORIES IN 11178135 AND 11178136 BUCKETS**

	CAT N° SET OF 6 INSERTS	Colour	CAPACITY (3 sets of 4 inserts)				Ø x HEIGHT min / max (mm)	MAX RADIUS (mm)
			N° inserts	Tubes per insert	Volume (ml)	Total tubes		
Set of 6 standard buckets 11178136	11178208	Grey	6	37	3 - 5	222	12.7 - 50 / 107	266 / 254
	11178210	Light blue	6	30	6	180	13.5 - 50 / 107	266 / 254
Set of 6 sealed buckets 11178135 (with cap)	11178211	Yellow	6	20	5 - 7 vac.	120	13.5 - 70 / 150	266 / 254
	11178212	Red	6	19	10 - 15 vac.	114	17 - 70 / 150	266 / 254
	11178304	White	6	12	15 conical	72	17 - 122 / -	266 / 254
	11178306	Coral	6	12	20	72	22.2 - 75 / 148	271 / 259
	11178308	Blue	6	5	50 conical	30	30 - 115 / -	280 / 268
	11178309	Blue	6	4	50	24	35 - 75 / 153	283 / 271
	11178311	Turquoise	6	1	250 flat bottom	6	63 - 75 / 160	266 / 254
	11178313	Black	6	1	250 conical	6	61 - 127 / -	281 / 269
	11178312	Black	6	1	500 flat bottom	6	70 - 127 / 171	281 / 269
	11178203	White	6	1	1000 or quad. bag	6		282 / 270
11178108	White	6	1	Double bag	6		271 / 259	

**Table 1-7. RHK4B ACCESSORIES IN 11174023 BUCKETS AND 11178801 TRAYS**

CAT N° SET OF 2 INSERTS	CAPACITY (3 sets of 4 inserts)				Ø x HEIGHT min / max (mm)
	N° inserts	Tubes per insert	Volume (ml)	Total tubes	
11179472	6	11	50	66	31 - 65 / 110

**Table 1-8. RHK4B ACCESSORIES IN 11174023 BUCKETS**

	CATALOGUE N° SET OF 2 TRAYS WITH SPACERS	CAPACITY
Set of 2 standard buckets 11174023	11178801	2 x 15 LKB

# RS485 Specification Communication

Type of transmission line	differential
Maximum number of drivers	32
Maximum number of receivers	31
Maximum cable length	1500 m
Maximum data rate	9.6 K octets/s
Maximum CMV	-7 V
Driver output	1,5-6 V
Driver load	60 omega

**Note** For the physical characteristics relating to RS485 communication, please refer to the specifications described in the user manual (3° 89000821, chapter 3).

## Mechanical Risks and Mechanical Safety

Mechanical risks under normal use conditions are as follows:

Cause	Effect	Design Safeguards
Bucket that ruptures or escapes from rotor	Internal explosion due to impact of buckets and rotor on the bowl	<ul style="list-style-type: none"> <li>• Lid interlock system</li> <li>• Armored chamber around bowl</li> <li>• Highly stable chassis</li> </ul>
Rupture of rotor or trunnion pin	Internal explosion due to impact of buckets and rotor on the bowl	<ul style="list-style-type: none"> <li>• Lid interlock system</li> <li>• Armored chamber around bowl</li> <li>• Highly stable chassis</li> </ul>
Broken drive shaft or drive system component	Internal explosion due to impact of buckets and rotor on the bowl	<ul style="list-style-type: none"> <li>• Lid interlock system</li> <li>• Armored chamber around bowl</li> <li>• Highly stable chassis</li> </ul>
Rupture or leakage of a sample during centrifugation	Imbalance that causes severe vibrations, and in the worst case, a crash of the rotor and buckets	<ul style="list-style-type: none"> <li>• Automatic imbalance shutdown</li> <li>• Lid interlock system</li> <li>• Armored chamber around bowl</li> <li>• Highly stable chassis</li> </ul>
Insufficient dynamic balancing of samples Automatic imbalance shutdown	Imbalance that causes severe vibrations, and in the worst case, a crash of the rotor and buckets	<ul style="list-style-type: none"> <li>• Lid interlock system</li> <li>• Armored chamber around bowl</li> <li>• Highly stable chassis</li> </ul>
Loss of seal or rupture of the refrigeration system or one of its components	Pressurized stream of liquid shooting out of refrigeration system	The refrigeration system is enclosed by the external panels of the centrifuge. There is no risk of explosion in this case.

## Internal and External Markings of Centrifuge

**Note** The following table lists and describes the notices and markings found on the interior or exterior of the machine.

Type of notice or marking	Interior/ exterior	Specific Location	Description
Product information label	Exterior	Rear panel	• Name of manufacturer
Danger symbol	Exterior	Rear panel	• Reference and serial numbers
Identification sticker	Exterior	Working surface next to bowl (visible when lid is open)	• Main characteristics of machine
Sticker, ISO 9001 certification	Exterior	Front panel	Beware of electric shock (precaution: unplug the machine prior to performing any service).
Environmental protection sticker	Exterior	Front panel	• Name of machine
Danger symbol	Exterior	Right panel, next to opening used for manual lid unlock procedure	• Reference and serial numbers
Other stickers (for the purpose of information or warning)	Interior	On certain component parts (not made by Thermo Fisher Scientific)	Information concerning Thermo Fisher Scientific's ISO certification
	Interior	Compressor	Guaranteed CFC-free: helps to

## Responsibility

The user of this centrifuge is responsible to respect the recommendations made by the manufacturer, with respect to installation, use, maintenance, storage, hygiene, safety, lifetime limits, etc.

The manufacturer can be held responsible for the non-conformity of the product. For his part, the user can bear a part of the responsibility if he has not verified for himself that the product is in practical conformity, even if it conforms to administrative guidelines. The user is also held responsible if he does something himself to accentuate any possible problems with the product: the responsibility of the manufacturer can be reduced or eliminated taking into account all circumstances when damages are caused jointly by product problems and by the fault of the victim or by the fault of someone for whom the victim is responsible.

## Chapter 1

### Presentation of product

It is the responsibility of the user to train (according to the instructions in this manual) everyone who will use or service this equipment. It is also the responsibility of the user to verify the quality of each sample after centrifugation.

## Chapter 2 Shipment /Transportation

### Environmental Conditions for Transport

Transport conditions must be in accordance with the following recommendations if the machine is to function properly once installed and used under normal operating conditions.

**Note** If required to do so, refer to local or national transportation standards.

The machine is transported in an integrated packaging system of carton and protection, fixed to a wooden pallet.

Required environmental conditions for transport are as follows:

- Temperature:  $-10^{\circ}\text{C} \leq - \leq +50^{\circ}\text{C}$
- Humidity:  $20\% \leq \text{RH} \leq 90\%$
- Light: no particular recommendation (machine is enclosed in opaque packaging)
- Protection from elements: the packaging may not be exposed to precipitation
- Restraints may be necessary to prevent lateral movement of the package

Stacking is strictly prohibited.

### Lifting and Transport

Due to the weight of the machine, all lifting and transporting must be carried out using proper handling equipment (e.g.: fork lift trolley) that complies with current regulations, and by people having undergone the necessary training.

**Note** The machine must be supported from underneath. If it has to be transported without its pallet, for example on a staircase, professional handling assistance is required.





## Chapter 3 Storage

Whatever the duration of storage, the following conditions apply.

Environmental conditions:

- Temperature:  $-10^{\circ}\text{C} \leq - \leq +50^{\circ}\text{C}$
- Humidity:  $20\% \leq \text{RH} \leq 90\%$
- Light: no particular recommendation (machine is enclosed in opaque packaging)
- Storage in a clean area that is not polluted by industrial activity.

Conditions related to proximity to other stored goods:

- Away from all inflammable or explosive goods
- Away from all corrosives or strong solvents that may be spilled or spread and that may for any reason come into contact with the packaging

**Note** The machine must be handled using all necessary precautions, using a forklift or pallet jack, by trained and authorized personnel.



## Chapter 4 Installation

**Note** The Jouan **KR4i** centrifuge must be installed by a Thermo Fisher Scientific approved technical service provider. The user must furnish the Thermo Fisher Scientific technical service provider with a source of electricity (and, when applicable, with a source of water) that is in strict conformity with local codes and regulations. After installation, the integrity of the source(s) should be periodically verified by the user.

### Environmental Conditions

This instrument is designed to operate safely under the following conditions:

- Indoor use.
- Temperature: 5° to 40°C.
- Maximum relative humidity of 80% for temperatures up to 22°C.
- Maximum altitude: 2000 m.

Maximum performance is assured across the following ambient temperature range: 15°C to 25°C.

Place the centrifuge and its accessories in a clean, non-corrosive environment to avoid damage.

Install the unit leaving at least 30 cm (12 in.) clearance between its back and any obstruction, and between two adjacent machines, to allow subsequent placement of a vessel to collect condensates.

If the centrifuge is installed next to other equipment or next to a walkway, leave a space of 65 cm between equipment and 85 cm between the equipment and the walkway.

Centrifuges should be placed preferably in a room specifically intended for their use and therefore containing no other apparatus.

Walls and partitions that are within a distance of 1 metre should be strong enough to stop the centrifuge should there be a major accident (mobile partitions, single-width chipboard and plasterboard partitions without reinforcement are not strong enough).

The floor must be completely flat and strong enough to support the weight (346 kg) of the machine without creating or maintaining any vibrations. Vibrations may be caused by variations during centrifugation. See also following chapter for positioning the damping feet.

There are no set minimum specifications on the type of floor required as there are many technical factors to be taken into account, such as:

- Composition of the different layers of the floor,
- How the floor is joined to the wall,
- Structures supporting the floor,
- Positions and weights of loads already on the floor,
- Loads already existing on support structures.

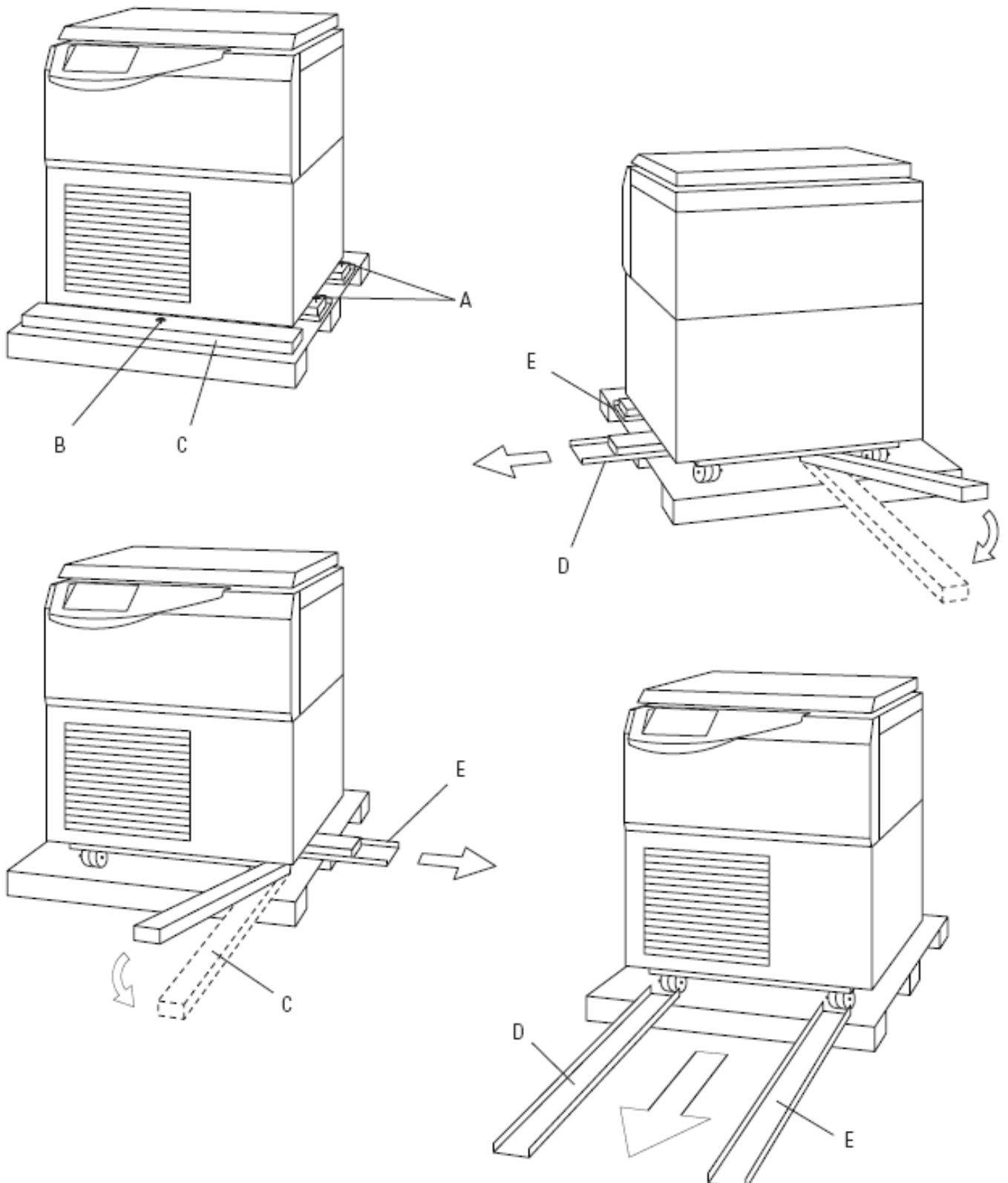
The machines must be positioned so that they can be moved easily to enable regular access for maintenance.

This centrifuge should only be installed in a work area that is lighted to the requirements of the local labor code.

The IEC 1010-2-020 standard relative to laboratory centrifuges recommends the user:

- To mark out a clearance envelope 30 cm 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.

Chapter 4  
Installation





Read the following instructions carefully before installation. During manipulation, never put your hand underneath the machine.

- Remove staples with a screwdriver.
- Remove both anchor bolts (A) using the 19 mm spanner/wrench supplied in the tool box.
- Remove the front anchor bolt (B).
- Using the prop (C) as a lever:
  - Remove the wooden beam and portable ramp (D) by lifting the machine at the back.
  - Remove the wooden beam and portable ramp (E) by lifting the machine at the right hand side, towards the front.
- Ensure that the ramps (F) are perpendicular to the pallet and in line with the wheels.

2 people are needed to unload the machine: 1 person at the front of the centrifuge to guide and brake the machine as it comes down from the pallet, a second person behind to guide the machine onto the ramps.

## Electrical Requirement

The electrical supply circuit must conform to currently applicable regulations. The Jouan **KR4i** centrifuge is delivered without an electrical plug; this must be connected by a qualified engineer, trained by Thermo Fisher Scientific, according to the following conductor colour code:

- Blue: neutral, brown: phase, yellow/green: ground

Depending on the equipment part number, the electrical supply should be:

230 V $\pm$ 10 %	50 Hz 25 A max.
208 / 230 V	60 Hz 25 A max.

Remember that in order to respect the electrical safety standards related to protection of operators against indirect contact, the supply of power to the instrument must be via a power socket fitted with a protection device ensuring automatic cut-off in the case of an insulation fault.

A supply fitted with a circuit breaker of the correct rating complies with this requirement. It is also recommended that different machines be connected to a circuit breaker that is situated outside the room.



It must be immediately possible to identify the plug of the machine, which must also be easy to reach by the user.

It must be immediately possible to identify the plug of the machine, which must also be easy to reach by the user.

Concerning the electrical supply to the centrifuge, there must be a circuit breaker outside the room where the centrifuge is installed that can be used to interrupt the power supply to the centrifuge in case of emergency.

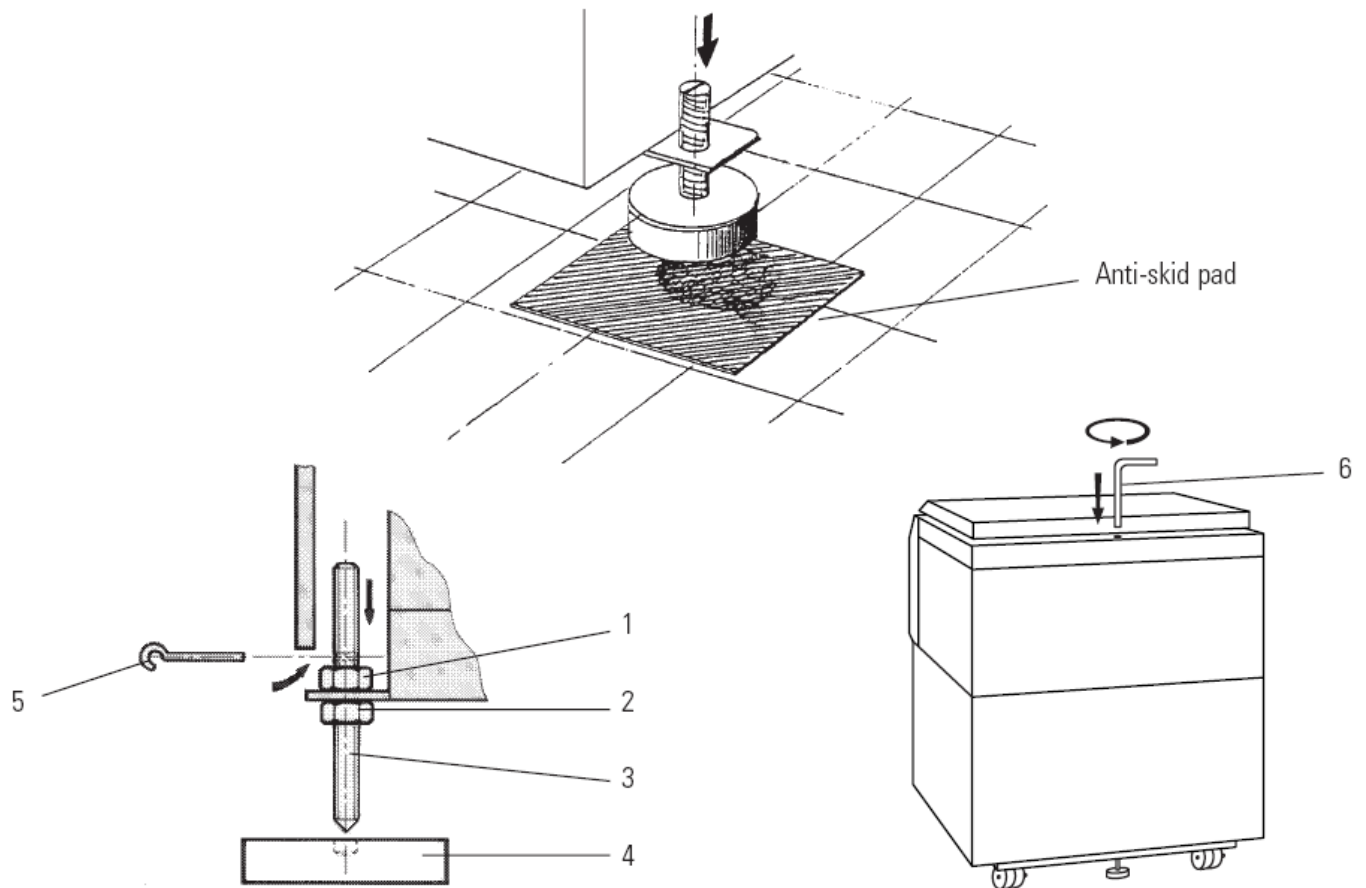
The IEC 1010-2-020 standard relative to laboratory centrifuges recommends the user:

- To provide an emergency stop switch enabling the mains power to be cut in the case of a malfunction. This switch should be placed at a safe distance from the centrifuge, preferably in a different room from that in which the centrifuge is situated.

## Positioning

### The 2 front feet

- Put the damping foot (4) under the screw of the foot (3).
- Clean the floor beneath the feet of the machine with a clean, dry cloth (or paper hand towel).
- Remove the protective film from the adhesive face of the pad.
- Centre the pad in line with the foot and stick it to the floor.
- Press firmly on the whole surface of the pad to ensure a good adherence.
- Using the tool (5) set the foot screw in position and turn the nut (2), until the castors are raised 0.5 to 1 cm above the ground.
- Then lock the screw by tightening the nut (1).



**Figure 4-1.** Positioning the Jouan **KR4i**

**The rear foot**

- Using the 17 mm box spanner (6) proceed as for the front feet.
- Set the centrifuge straight on its feet using the spirit level provided with the machine.

**For centrifuges equipped with water-cooled condensers (cat. nos. 11178161 and 11178163)**

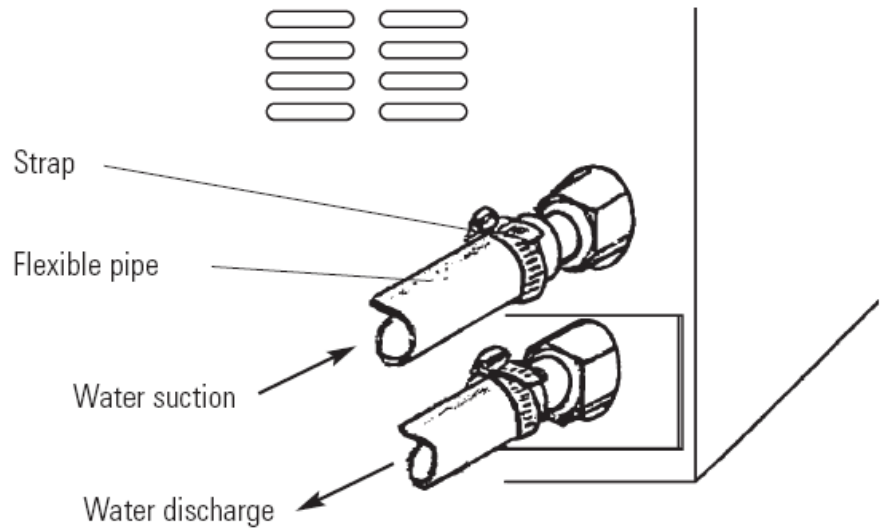
**Water supply specifications:**

- Pressure: 2 to 4 bars
- Flow:  $\geq 250$  liter/min
- Temperature: between 12°C and 20°C

**Proceed as follows:**

- Position the machine on its feet (see previous instructions)
- Connect the water pipes (inside diameter: 12 mm). See Figure 4.2.
- Tighten the connection on with strap to ensure water proofness





**Figure 4-2.** Water Cooled Connection

## Lid Opening - Manual Lid Unlocking

The Jouan **KR4i** is equipped with a double locking safety device which stops the machine starting if the lid is not completely closed and prevents lid opening before the end of rotation.

When the centrifuge is switched on, wait until display returns to the stand-by mode then pull forwards the latch lever located on the right hand side of the unit: the lid is automatically unlocked and opens.



In the case of a mains power cut, opening of the lid is prevented by the lid locking safety device. It is recommended to wait for the mains to be switched back on so that this safety device enables the lid to be unlocked.

During rotation, the slightest leak from a sample is enough to create aerosols. Rotation of the rotor can only be detected when the machine is switched on. Opening the lid manually if the rotor is still rotating, would disperse the aerosols in the environment.

Rotating parts are also a risk as these could come in contact with the user or be ejected. There is particularly high risk of injury if:

- The user tries to manually stop the rotor,
- Any object falls inside the centrifugation chamber.

### Manual lid opening procedure

If the machine has stopped because of a mains power cut, the rotor could still be rotating. Wait 10 minutes before opening the lid. In spite of the absence of noise, the rotor could still be rotating when you need to open the lid manually.



Manual lid unlocking must only be done by someone informed of the danger and of the necessary precautions to be undertaken.

Even in the case of a mains power cut, always set the mains switch to the OFF position before carrying out this operation.

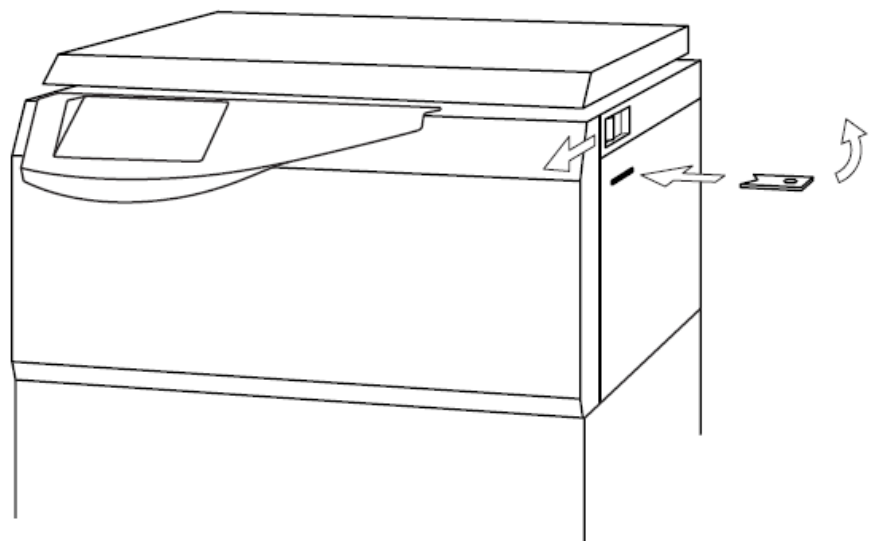
- Insert the unlocking device into the hole on the top right of the instrument by piercing the protection sticker.
- While pressing down on the unlocking device, pull the lid lever forward.
- The lid opens upwards automatically.

The protection sticker must be replaced after it has been pierced (cat. n° 85241911: 230 V/50 Hz, cat. n° 85241912: 208 V/60 Hz).

It is recommended that manual lid opening operation be performed only by specially trained individuals who are authorized by the Lab Manager. The person responsible for the laboratory whenever the centrifuge is being used should strictly control the use of the manual lid unlocking tool.



Only use the manual lid opening procedure in case of power failure or failure of the electrical lid lock system, and then only with the main switch in the OFF position.



**Figure 4-3.** Manual Lid Opening

## Inspection

Before installation, the rotor should be thoroughly inspected for corrosion and cleanliness.

Chemical and stress corrosion will eventually lead to disruption of the rotor with potential severe damage to the centrifuge.

Particles stuck inside the pockets can cause breakage of tubes and lead to major imbalance and / or loss of sample and contamination.

Check that the central hole of the rotor and the drive spindle are clean and undamaged. Remove any particles with a soft cloth.

Refer to chapters 5.9 and 5.10.

## Rotor Installation



Rotor installation must only be undertaken by qualified and authorized personnel trained by Thermo Fisher Scientific. Never lift a rotor by its windshield.

The rotors and buckets used with the Jouan **KR4i** are very heavy. When handling these accessories, take appropriate precautions to prevent back or other skeleto-muscular injury.

Ensure that the rotor is attached properly to the drive shaft, and that the windshield lid is attached properly to the rotor. Any failure to do so may prevent the rotor/buckets from operating properly.

The lid delivered separately from the rotor:

### Windshielded Rotors RP4 - RP6 - RC6, With Lid

The rotor packing contains:

- a rotor,
- grease for the trunnions and shaft,
- a user's manual.

The lid packing contains:

- a rotor lid,
- a lid locking device,
- an Allen key,
- a special screw for rotor fastening,
- an instruction sheet, for assembling the lid locking device.
- Check cleanliness of the motor drive shaft and rotor hub.
- Apply a light film of grease to the motor shaft.

- Note the collar position on the shaft and on the rotor; two indicators on the rotor label sticker allow localization of the collar groove.
- Pick up the rotor by two opposite arms and place it on the shaft, ensuring shaft and hub alignment. Position the rotor gently, despite its weight. The rotor slides freely onto the drive shaft.
- Apply a light film of grease to the tip of the trunnions.
- Adjust the lid locking device as mentioned in the instructions.
- Position the rotor lid on rotor, verify that the lid locking device locks on to the rotor.

**Winshielded Rotors RP4 - RC6 -  
RP6, Without Lid Unshielded  
Rotor RHK4B**

The packing contains:

- a rotor,
  - grease for trunnions and shaft,
  - an instruction sheet.
- 
- Check cleanliness of the motor drive shaft and rotor hub.
  - Apply a light film of grease to the motor shaft.
  - Note collar position on the shaft and the groove on the hub.
  - Pick up the rotor by two opposite arms and place it on the drive shaft, ensuring shaft and hub alignment. Position the rotor gently, despite its weight. The rotor slides freely onto the drive shaft.
  - Position the washer and the bolt and screw clockwise with the wrench supplied.



Never tighten the rotor bolt without the washer.

**All Rotors/Winshielded Rotors  
RP4 - RP6, With LID/RHK4B**

- Apply a light film of grease to the tip of the trunnions.
- 
- Ensure that the accessories are correctly fitted and balanced.
- Check that the rotor is fully locked onto the drive shaft.
  - Check that the rotor lid fittings are screwed on tightly.
  - Check that there is no water nor other liquid in the base of the windshield.
  - Check that all of the buckets are in place and that they swing freely.
  - Check that there are no empty transfusion liners in the buckets.

**Rotors P40 - P60 - C60 - HK4B**

Use only rotors and buckets specifically designed for the Jouan **KR4i**. Please contact us for information on P40, P60, C60 and HK4B rotors.

## Power Off Operation

The full power off of the Jouan **KR4i** centrifuge is obtained by disconnection of the power cord from the mains supply.



Immediately after disconnection and for a duration of not longer than a minute, voltage remains on centrifuge line cord connectors. Do not touch for at least a minute.



## Chapter 5 Using the Product

### Handling of Transfusion

It is essential to understand the precautions, risks and limitations of use to achieve the best performance and highest safety with the instrument and its accessories.

### Accessories



The information given below is succinct. Please refer to the manual specific to the use of centrifuges in blood transfusion centres (Cat N°. 89001172).

Liners are consumable items which must be replaced after several hundred runs according to their condition.

Liners with partition must be loaded symmetrically about the partition.

The load on one side must never exceed the load on the other side by more than 100 g under risk of permanent damage to the liner. Bags filled with water can be added if necessary to balance the load.

Supple liners are available for existing users. New users are advised to use the semi-rigid liners which are easier to manipulate.

#### Liner with partition

Place a blood bag in each compartment. The two bags must have approximately the same mass such that the centre of gravity of the filled liner is in line with the partition. This ensures a horizontal attitude during rotation which guarantees correct centrifugation in the bags. When the number of bags to be centrifuged is insufficient to fill all compartments, complete the load with dummy bags filled with water.



Hit the base of the liner on the bench-top to make the bags drop well down and ensure that they touch the bottom of the liner.

Never centrifuge such a liner loaded with only one bag. This creates the risk of a bad separation of products and could provoke a deformation or even a rupture of the central wall.



Never centrifuge an empty liner because there is a risk of deformation.

#### Liner without partition

Load the two blood bags into the liner simultaneously.

Hit the base of the liner on the bench-top to make the bags drop well down and ensure that they touch the bottom of the liner.

At the end of the centrifugation, unload the two bags simultaneously in order to avoid resuspension of the products.

Never centrifuge such a liner loaded with only one bag. This creates the risk of a bad separation of products. Never centrifuge an empty liner because there is a risk of deformation.

#### Filter bag liner

Place bags in each side of the liner, leaving the filters outside. Hit the base of the liner on the bench-top to make the bags drop well down and ensure that they touch the bottom of the liner.

Insert the filters, one after the other, by sliding them between the bags until they sit on the support mounted on the partition. Insert the tubing such that it cannot escape from the liner and bucket during centrifugation.



Never centrifuge such a liner loaded with only one bag. This creates the risk of a bad separation of products and could provoke a deformation or even a rupture of the central wall.

Never centrifuge an empty liner because there is a risk of deformation.

## Balancing The Load

When installing tubes into each bucket insert, be certain that the samples are distributed symmetrically. Swing-out rotors should be loaded with a full compliment of buckets to maintain correct balance and safety for the rotor.



Use only centrifuge-rated glass or plastic ware, tubes, vials or bottles. Although the Jouan **KR4i** can compensate for an imbalance of more than 50 grams, sample containers should be balanced to avoid any long-term effects of vibration and assure good sample separation. If you intend to use old accessories on a new centrifuge, please contact your Thermo Fisher Scientific representative for advice.





A major imbalance can seriously damage the rotor and the centrifuge.

Never put liquid directly into the buckets.

Refer to the guide on the use of refrigerated centrifuges in blood transfusion.

## Controls and Indicators

The mains switch is located on the lower left side of the front panel.

The control system includes:

- A dot-matrix graphic LCD screen, able to display numbers, letters, and special characters in addition to animated graphics.
- Eight keys, surrounding 2 sides of the screen, have their functions determined according to the name displayed on the adjacent part of the screen.

Not all keys are necessarily operational at any one time and more than one key can operate the same function when the name of the function is displayed across a wide area of the screen next to these keys.

- In addition, a standard numeric keypad (0 to 9 and CE, clear entry) enables parameter values to be keyed in directly when required.

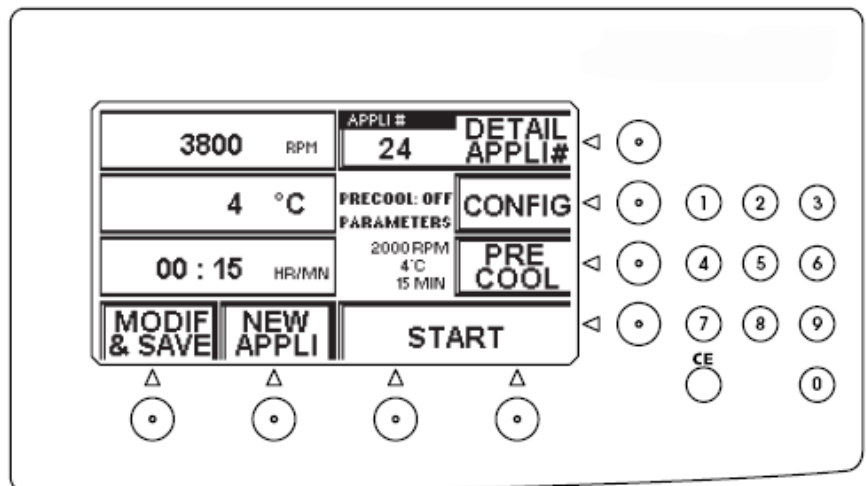


Figure 5-1. Control Panel

Certain key functions are very common: others are found only on a dedicated screen. They operate as follows:

KR4i	
+	Increases the value of the indicated parameter. Sustaining pressure on the key causes a rapid increase.
+/-	Changes the arithmetical sign of the current figure (from positive to negative or vice versa).
-	Decreases the value of the indicated parameter. Sustaining pressure on the key causes a rapid decrease.
▽	Moves the highlight bar down a list in order to make a selection.
△▽	Moves the s indicator from one parameter to another to allow values to be altered.
ABOUT INTEGRAL	Shows a graphical representation of the integral, together with values calculated from the previous run (where possible).
ACC	Enables the acceleration rate to be altered between the 10 choices from 0 (slowest) to 9 (fastest)
BASIC DISPLAY	Switches the display from the fully detailed run screen to the basic run screen with 3 fundamental parameters.
BRK	Enables the braking rate to be altered between the 10 choices from 0 (weakest) to 9 (strongest).
CONFIG	Provides access to fundamental set-up choices, such as language selection.
DETAILS	Gives access to those parameters associated with the indicated parameter.
DISPLAY APPLI #	Displays all preselected values of the program whose basic parameters are on screen.
END MODIF	Returns to the original run screen after temporary values have been entered.
END PROG	Returns to the stand-by screen, keeping currently selected values in volatile memory ready for use but not in permanent memory for later recall.
ENTER	Returns to a previous screen, memorizing all changes in parameter values.
ESC	Returns to a previous screen, without memorizing any changes in parameter values.
EXPAND DISPLAY	Switches the display from the basic run screen to the detailed run screen which displays all parameters.
HOLD	Selects continuous operation for the time parameter value.

KR4i	
MAX	Directly chooses the highest possible speed or “g” force taking into account the selected rotor and radius (cannot operate without prior rotor selection).
MODIF & SAVE	Enables parameter values to be changed and saved if the current application has not been already saved.
MODIF(Y)	Enables parameter values to be changed (Values changed during a run other than PRE COOL will not be memorized).
MORE INFO	Provides a more detailed explanation of the current parameter, e.g., definition of the integral value.
NEW APPLI	Gives access to the selection of new parameter values starting from a set of default values.
NONE	Selects “NO PASSWORD PROTECTION” when memorizing an application.
PRE COOL	Starts a predetermined precooling cycle (2000 rpm, 4°C, 15 min). During this cycle all other programming facilities are operational.
RADIUS	Enables the effective radius of a selected rotor to be modified in order to allow for the use of an adaptor or to select a boundary at which a set “g” force can be applied.
ROTOR	Lists the available rotors from which a selection can be made with their capacity and performance.
SAVE APPLI	Allows the current set of parameter values (complete or incomplete) to be stored in one of 32 memories, with or without an individual password.
SCROLL APPLI #	One press displays all parameter values of next used memory. Continued presses will display the values for all memorised applications. Also acts as application (program) selection key.
START	Starts the run
STOP	Stops the run, overriding any programmed time or integral.

**Note** If the instrument remains switched on, but not used, then 5 minutes after the end of the last run the screensaver operates. The backlight is extinguished although the display can still be read. Press any key to light up the screen then continue with normal operation.

# Use

**Introduction** The VIDEOset graphics based control software is designed to combine power with simplicity. VIDEOset includes on-screen guidance and intuitive programming.

The screens presented in this manual could differ slightly according to the version of the software.

Those who use this centrifuge must be well trained according to the instructions in this manual and according to the rules of the institution where the centrifuge is used. It is the responsibility of the purchaser to ensure that users are trained.

This centrifuge should only be used in a work area that is lighted to the requirements of the local labor code.

**Switching On** Immediately after switching on, the screen displays the Thermo Fisher Scientific logo, then the stand-by screen is displayed showing the number of the last application program used and its basic parameters.

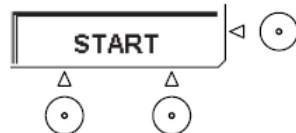
**Precooling** A keypress on CE will cause the display of the value of the actual temperature of the air in the bowl to the left of the set value during the time that the CE key is pressed.

If the operator wishes to precool the bowl and rotor, he simply selects PRE COOL having installed the rotor, and the Jouan **KR4i** runs according to the pre-set values which are indicated on the stand-by display.

The display now indicates PRECOOL ON. The remaining precool time, real temperature and the dynamic rotation symbol are displayed.

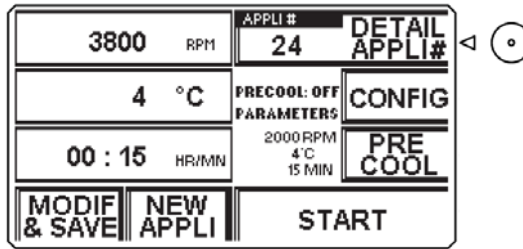
Uniquely, during a PRECOOL run, it is possible to access all programming facilities. The precool run can be halted at any time using the STOP keys

**Standard Use** If the program which is currently displayed is the one desired, press a START key to run the program.

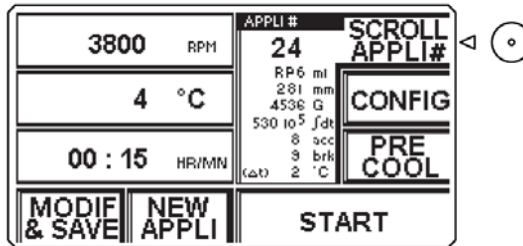


Otherwise, another program can be recalled either by selecting the program number directly on the keyboard or by pressing Detail Appli # which first shows all details of the current program, then Scroll Appli # (same key) to scroll through the memorized application programs whose parameters are thus indicated on the screen.

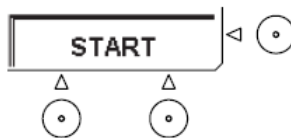
Sustained pressure on the key causes rapid scrolling.



STANDBY SCREEN



Once the required program is displayed, simply press a START key to run the program.

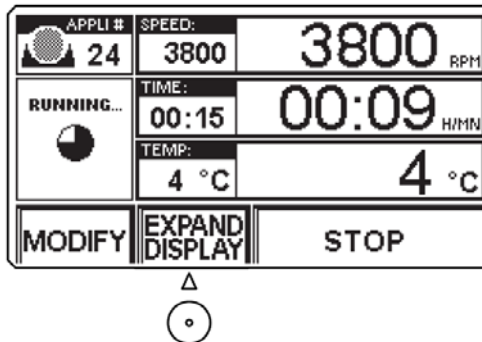


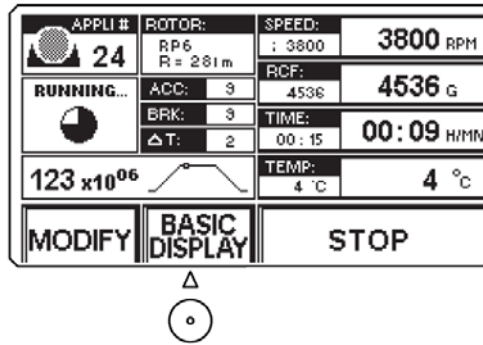
During a run, the basic screen displays the 3 basic parameters with both set and live values.

A keypress on Expand Display presents a detailed screen showing all possible run parameters and the values of those selected, both set and live. A keypress on Basic Display returns the basic screen.

**Note** If the radius has not been defined by selecting a rotor (and possibly modifying its radius to allow for the use of an adaptor) the screen will not display the RCF.

It is impossible to call up a program or parameter from the keyboard.





Basic Screen During a Run

### Programming Of Parameters

#### Basic parameters - speed, temperature, time

The values of the 3 basic parameters, usually speed, temperature and time, are quickly introduced after selecting New Appli the stand-by display to show the simple programming screen.

Speed is indicated by a flashing arrowhead ▷. Use the keypad to write a new speed value (if required).

Move to temperature using Δ▽. Use the keypad to write a new temperature value. If required, use the +/- to change the sign of the value.

Move to time using Δ▽. Use the keypad to write a new time value (if required). HOLD is achieved by entering a value of 0 min.

After making the required modification(s), either select End Prog to return to the stand-by screen, ready to run but without storing the values, or select Save Appli to store the values first.

**Note** If they had been programmed previously, RCF could replace speed and integral could replace time in the basic parameter menu.

**Note** In either case, the new values are held in a buffer memory (identified by - -) where they remain until the next time End Prog or New Appli is used.

#### Advanced parameters

A) Speed related: RCF, acceleration, braking, rotor, radius

To program any of the speed related parameters, select DETAILS from the simple programming screen when the flashing cursor ▷ indicates SPEED. A screen appears with the speed related parameters and the flashing arrowhead indicates RCF.

A value can be input via the keypad so long as a rotor has already been selected. (No selection of rotor makes it impossible for the software to control by “g” force since this is directly linear with the

radius of the base of the sample tube from the centre of the drive axis) To choose a rotor, select ROTOR and use  $\nabla$  to move the cursor down.

the list of rotors to that which will be used. If an adaptor will be used in the rotor select RADIUS and use the - & + keys to choose the effective radius and select ENTER. During operation with - & + the dynamic radius arrow moves and the related RCF is changed in real time.

If the user wishes to modify the acceleration and/or braking rates, he selects ACC or BRK and uses the - & + keys to choose the rate(s) indicated on the dynamic graphic screen Select ENTER to return to the speed related parameter screen.

After selection of ROTOR (and maybe RADIUS, ACC, BRK) the operator has the option to select MAX. Without requiring any knowledge on the part of the operator, selection of MAX causes the instrument to program the top speed of the rotor and the related RCF allowing for actual radius.

After all the required parameter changes for this screen have been made, select ENTER to save the changes and return to the simple programming screen (which could indicate control by RCF).

B) Temperature related: Temperature compensation ( $\Delta T$ ), negative temperature

On the simple programming screen, use  $\Delta\nabla$  to move the flashing arrowheads to indicate the temperature, then select DETAILS.

The flashing arrowhead indicates  $\Delta T$  (For an explanation of  $\Delta T$ .

Use the keypad to input a value and then (if required) the +/- key to change the mathematical sign of the value.

Alternatively, the user has the choice of directly selecting one of the most popular operating temperatures (4, 20 or 37°C) and/or using +/- to introduce a negative value.

If wished use  $\Delta\nabla$  to first indicate temperature selection then select the temperature. Select ENTER to return to the simple programming screen.

C) Time related: Integral, hold

On the simple programming screen, use  $\Delta\nabla$  to move the flashing arrowheads to indicate the time then select DETAILS.

The flashing arrowhead indicates integral selection. For more information on integral select About integral and also More info for an accurate definition.

Select ESC/ESC to return to the time / integral screen. If this application has just been used, VIDEOset will indicate the recently totalled integral value.

Selection of ENTER will return the user to the simple programming screen but with control by integral instead of time, ensuring the highest possible run-to-run reproducibility.

**Note** This will only be possible if a rotor has already been selected, the integral value being linked to the 'g' force which is calculated from the centrifugation radius of the rotor.

Alternatively, use  $\Delta \nabla$  to indicate time and enter a value or press HOLD for operation with no time limit. Selection of ENTER makes a return to the simple programming screen.

To use the modified parameter changes without permanently storing them select End Prog.

During a run controlled by the integrator, the preset value for time will indicate REPROducible, the integral value will count down and the timer will count up the corresponding time.

#### Saving an Application Password Protection

From the simple programming screen select Save Appli (if the flashing cursor  $\triangleright$  is on temperature, it will be necessary to select  $\Delta \nabla$  to make Save Appli reappear). The application save screen appears, proposing the next available empty memory. If required, use  $\triangleleft$  and  $\triangleright$  to review other memories whose application program parameter values are indicated at the right hand side of the screen.

Select ENTER to save the application in the indicated file. The user is offered the opportunity to enter an individual password for this application (accepts 0 to 9999 inclusive, via the keypad, then select ENTER) or to select NONE for no password protection to save the application.

If the user chooses to store his application in a used but unprotected memory, the old values will be replaced by the new values. If he chooses to store his application in a used but protected memory he must first enter the password to gain access, to the memory. In both cases he can password protect the new application.

**Note** The Save Appli function will only operate if one or more parameter values have been modified.

#### Overriding Password Protection Erasing A Program

The unit is delivered without any passwords installed. The use of a password prevents easy overwriting of a protected application program.





We suggest that you write down the password in case you forget it.

In the case of problems there is a special procedure to enable the protection to be overridden. This same procedure is used to clear one or more memories to eliminate unwanted applications.

After Save Appli has been selected, the file screen is displayed.

To eliminate the password protection and erase a program use the ◀ and ▶ keys to move to the required memory (closed file icon) and select CE. Use ◀ / ▶ and CE to clear any other memories. Moving the cursor back over selected memories will then show them to be EMPTY as indicated in the right hand side of the screen. Now either select ESC to return to the standby screen or ENTER to save the modified application in the indicated file memory. The user can decide whether or not to password protect the new protocol which can now be stored in this memory.

#### To Modify A Program

A) From the stand-by screen

With an application program on the stand-by screen, select Modif New.

Now alter program parameters exactly as in programming a New Appli.

To SAVE select Save Appli from the simple programming screen and continue as under 5.4.6. A new memory will be proposed. To save in the original memory (erasing original values) use ◀ or ▶ to move the cursor and enter the password if requested.

B) During a run

From the basic or detailed run display, select MODIFY. The three main control parameters (speed or RCF/ temperature/time or integral) will be displayed together with the current set values. Use △▽ to move the cursor ▶ to the parameter to be modified and enter the value via the keypad.

Select End Modif to return to the original run screen. Values modified during a run cannot be stored (such a randomly modified run would be impossible to reproduce) but remain in the volatile memory until the end of the run.

**Note** It is not possible to modify the integral value during a run.

**Configuration** The Jouan **KR4i** can be configured to operate in set ways. To set up the instrument, select CONFIG from the stand-by screen.

A) Language programming

Having selected CONFIG, the screen highlights LANGUAGE SELECTION then select ENTER.

Select 1 for ENGLISH or 2 for FRENCH.

The stand-by screen will be displayed in the selected language.

B) Selection of refrigeration stand-by

Having selected CONFIG use  $\nabla$  to highlight STAND-BY REFRIGERATION ON/OFF then select ENTER.

Choose 1 for active refrigeration during stand-by and 2 for refrigeration OFF during stand-by.

C) CQCS option (see following page)

D) Timer configuration

Select 1 to program hours/minutes. Select 2 to program minutes/seconds.

E) Service

A special code, reserve

**CQCS Option** Your centrifuge can be equipped with the CQCS Centrifugation Quality Control System.

This system allows the traceability for centrifuges, the products and the operators and follows the historical use of each instrument. It is thus also considered as a veritable maintenance tool.

With versions 3.0 and later, it is possible to transfer the centrifugation run data from up to 32 centrifuges to a PC.

CQCS ensures traceability of samples by a system of twin bar code readers. This system includes two principal stages.

1<sup>st</sup>stage: Association Support / Sample

This stage concerns the identification of supports (liners) and samples (blood bags) using a bar code reader connected to the PC (see the BB-CQCS manual).

2<sup>nd</sup>stage: Association Support / Centrifuge

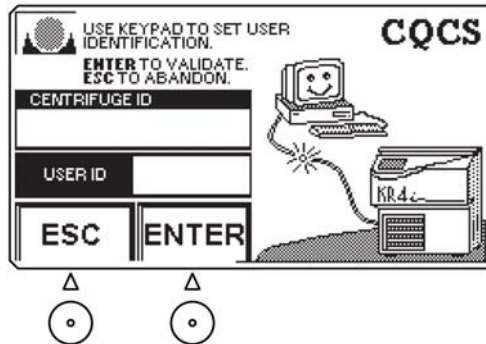
This stage concerns the identification of the supports (liners) during their insertion into the centrifuge using a bar code reader connected to the centrifuge. This stage is carried out after filling and balancing the supports, ready to load them.

To activate this option, select CONFIG from the stand-by screen. Select CQCS, using V to display it in inverse video and press ENTER.

Enter the centrifuge serial number in the Jouan **KR4i**.

To do so, select the CQCS option in the CONFIG menu, then press START.

On the operator code display, press the top right hand side key to configure the serial number.

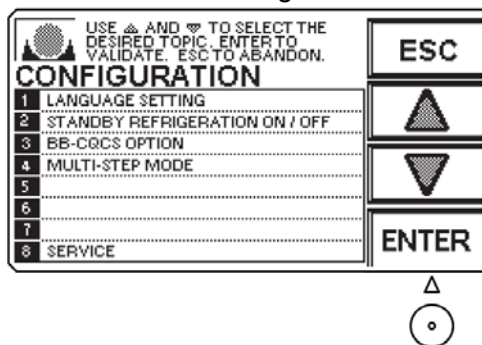


Enter the first 4 numbers of the serial number on the digital keyboard and validate with ENTER. These first 4 numbers must stand between 1000 and 9000 non-inclusive (for example 3990).

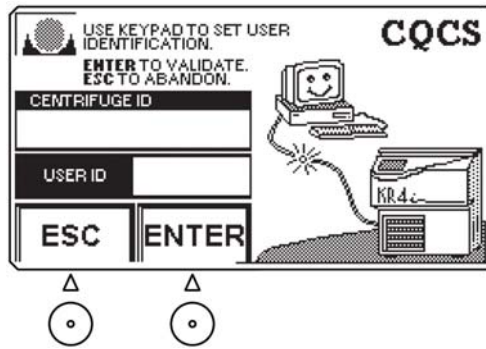
Then enter the last 4 numbers of the serial number on the digital keyboard and validate with ENTER. These last 4 numbers must stand between 0 and 10000 non-inclusive (for example 2103).

Press ENTER to validate the complete serial number.

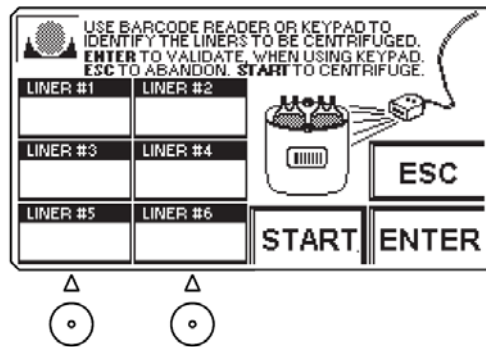
The serial number registered in this example is 39902103.



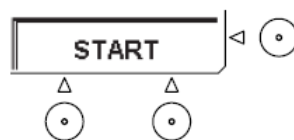
If necessary, enter the Operator Code via the keyboard (the ENTER or ESC to abort).



After the identification of the liners by the PC, identify the liners to be centrifuged by the Jouan **KR4i** using the bar code reader on the centrifuge. Read the ID of the first support then press ENTER. Continue up to the last support (a maximum of 6 for CQCS V3.0).



Select START to start the run.



For instructions on operating the CQCS application, please refer to the CQCS user manual (cat n°. 89000821).

## Acceleration

The Jouan **KR4i** centrifuge allows a choice of 10 different acceleration rates, thus permitting variation of the time for the centrifuge to attain the desired speed.

If the centrifuge is used for blood transfusion purposes, the choice of an intermediate acceleration rate allows optimal blood bag positioning in the buckets, thus limiting the risk of bursting and formation of wrinkles. Moreover, to carry out selective separations, such as separation of platelets, it is possible to improve the results by adjusting the acceleration rate.

The table below shows approximate acceleration times according to rotor type and maximum speed.

Curve		0	1	2	3	4	5	6	7	8	9
Threshold		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
RP4 without lid 4000 rpm	cylindrical buckets	7 min	6 min	6 min	5 min	5 min	4 min	4 min	3 min	3 min	2 min
	N4C + 1600 ml bottle (d=1,0)	10 sec	40 sec	0 sec	40 sec	10 sec	40 sec	10 sec	30 sec	0 sec	40 sec
RP4 with lid 4250 rpm	cylindrical buckets	7 min	6 min	6 min	5 min	5 min	4 min	4 min	3 min	3 min	2 min
	N4C + 1600 ml bottle (d=1,0)	10 sec	30 sec	0 sec	40 sec	10 sec	40 sec	0 sec	30 sec	0 sec	40 sec
RP6 with lid 3800 rpm	N6T buckets + polypr. liner without partition	7 min	6 min	6 min	6 min	5 min	4 min	4 min	3 min	3 min	2 min
	+ triple bags (d=1,0)	20 sec	40 sec	10 sec	0 sec	20 sec	50 sec	10 sec	40 sec	10 sec	50 sec
RP6 with lid 4250 rpm	N6T buckets + polypr. liner without partition	7 min	6 min	6 min	5 min	5 min	4 min	4 min	3 min	3 min	2 min
	+ triple bags (d=1,0)	10 sec	40 sec	10 sec	50 sec	20 sec	50 sec	10 sec	40 sec	10 sec	50 sec
RC6 without lid 4300 rpm	N6C buckets + adaptor for bottle	7 min	6 min	6 min	6 min	5 min	4 min	4 min	3 min	3 min	3 min
	+ 1000 ml bottle (d=1,0)	20 sec	50 sec	20 sec	0 sec	30 sec	50 sec	20 sec	50 sec	20 sec	0 sec
RC6 with lid 4900 rpm	N6C buckets + adaptor for bottle	7 min	7 min	6 min	6 min	5 min	5 min	4 min	4 min	3 min	3 min
	+ 1000 ml bottle (d=1,0)	40 sec	0 sec	30 sec	20 sec	40 sec	10 sec	40 sec	0 sec	30 sec	10 sec
RHK4B 3300 rpm	NHK4B buckets + stainless steel	6 min	6 min	5 min	5 min	4 min	4 min	3 min	3 min	2 min	2 min
	trays + LKB trays (3.8 kg per liner)	40 sec	0 sec	30 sec	20 sec	40 sec	10 sec	30 sec	0 sec	30 sec	10 sec

The above values are given as a guide for the indicated load and nominal operating voltage (230 V). These values can change if the voltage and/or the load are different.

## Braking

The Jouan **KR4i** centrifuge allows a choice of 10 braking profiles which combine both rate and speed threshold.

Braking goes through two phases, as follows:

- Standard braking: is applied from set point speed to the operator-programmed speed threshold.
- Programmed braking from speed threshold to 0 r.p.m.

Curve		0	1	2	3	4	5	6	7	8	9
Threshold		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
RP4 without lid 4000 rpm	cylindrical buckets	18 min	11 min	7 min	5 min	5 min	3 min	2 min	2 min	2 min	2 min
	N4C + 1600 ml bottle (d=1,0)	20 sec	50 sec	50 sec	40 sec	50 sec	20 sec	40 sec	20 sec	20 sec	0 sec

## Chapter 5

### Using the Product

Curve		0	1	2	3	4	5	6	7	8	9
Threshold		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
RP4 with lid 4250 rpm	cylindrical buckets N4C + 1600 ml bottle (d=1,0)	20 min 40 sec	12 min 50 sec	8 min 30 sec	6 min 20 sec	4 min 50 sec	3 min 40 sec	3 min 0 sec	2 min 40 sec	2 min 40 sec	2 min 20 sec
RP6 with lid 3800 rpm	N6T buckets + polypr. liner without partition + triple bags (d=1,0)	24 min 20 sec	16 min 0 sec	10 min 30 sec	7 min 50 sec	6 min 10 sec	4 min 20 sec	3 min 40 sec	3 min 10 sec	3 min 0 sec	2 min 30 sec
RP6 with lid 4250 rpm	N6T buckets + polypr. liner without partition + triple bags (d=1,0)	29 min 30 sec	18 min 50 sec	12 min 20 sec	9 min 10 sec	7 min 0 sec	5 min 20 sec	4 min 30 sec	4 min 0 sec	3 min 40 sec	3 min 20 sec
RC6 without lid 4300 rpm	N6C buckets + adaptor for bottle + 1000 ml bottle (d=1,0)	19 min 40 sec	12 min 10 sec	8 min 10 sec	6 min 10 sec	4 min 30 sec	3 min 20 sec	3 min 0 sec	2 min 40 sec	2 min 20 sec	2 min 10 sec
RC6 with lid 4900 rpm	N6C buckets + adaptor for bottle + 1000 ml bottle (d=1,0)	23 min 50 sec	15 min 0 sec	10 min 0 sec	7 min 20 sec	5 min 70 sec	4 min 30 sec	3 min 50 sec	3 min 30 sec	3 min 10 sec	3 min 0 sec
RHK4B 3300 rpm	NHK4B buckets + stainless steel trays + LKB trays (3.8 kg per liner)	14 min 30 sec	9 min 20 sec	6 min 0 sec	4 min 20 sec	3 min 10 sec	2 min 20 sec	2 min 0 sec	1 min 40 sec	1 min 30 sec	1 min 30 sec

The above values are given for the indicated load and nominal operating voltage. These values change if the voltage and/or the load are different.

## Integration

Setting centrifugation parameters consists of determining the time during which the sample is submitted to the selected centrifugal acceleration.

### Centrifugal acceleration and duration

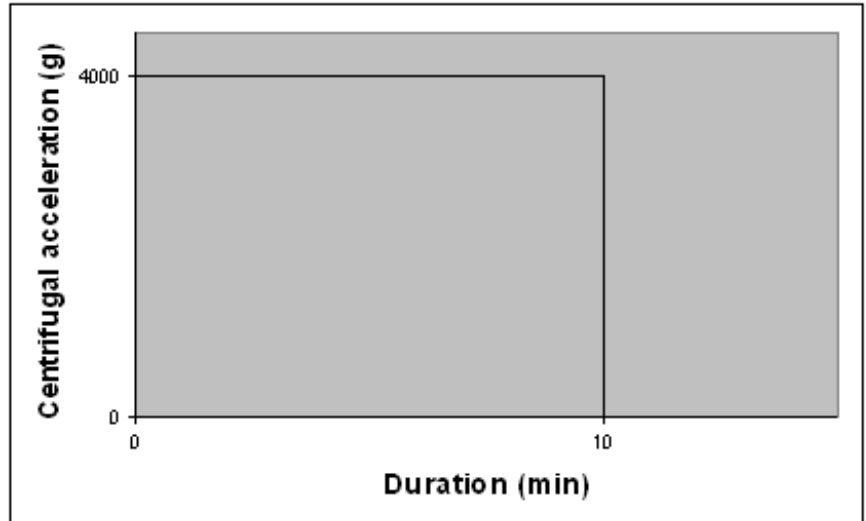
In practical terms, centrifugal acceleration is set in terms of motor rotation speed (rpm). A given rotation speed corresponds to centrifugal acceleration which is directly proportional to the centrifugation radius, in keeping with the following equation:

$$\text{Number of g Acceleration} = 1.118 \times \frac{R}{\text{Centrifugation radius (mm)}} \times \frac{N^2}{\text{Speed in thousands of rpm}}$$

For example, a given separation may be described as obtainable by centrifuging the sample in a given machine (which determines the accessory, thus the centrifugation radius) for 10 minutes (duration) at 4000 x g (R.C.F.)

Theoretically, if the centrifuge instantly attains the set point speed and brakes instantly, and if the requested speed attained is constant, reproducibility of results is guaranteed from one centrifugation to the next.

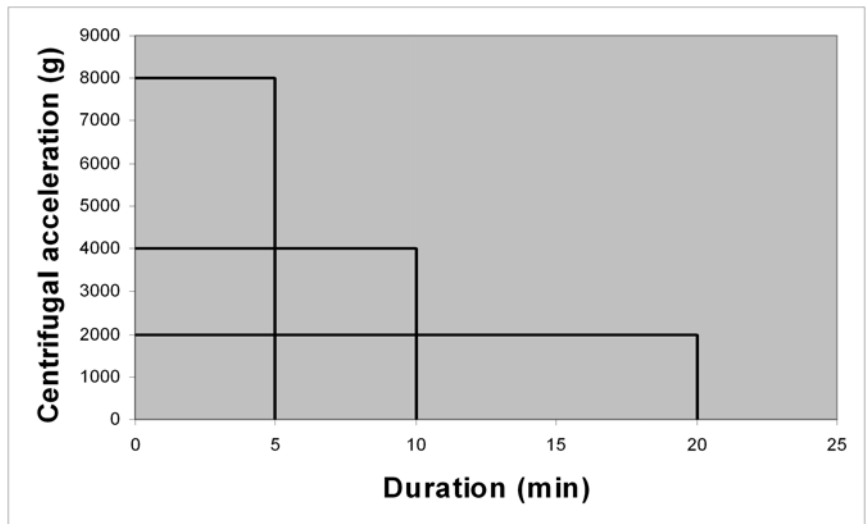
The centrifugation curve is as follows:



**Figure 5-2.** Ideal centrifugation integral curve

It is thus obviously equivalent to centrifuge a sample at 4000 g during 10 minutes as to centrifuge it at 2000 g for 20 minutes (or 8000 g for 5 minutes).

In other words, centrifugations yield the same results when the product: DURATION X CENTRIFUGAL ACCELERATION remains constant. This product corresponds to the area of the curve.

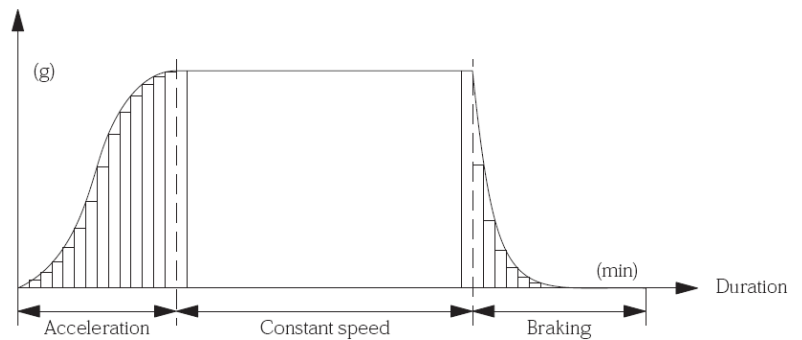


**Figure 5-3.** Equivalent centrifugation integral curves

### Integral of the curve

The integral of the curve is the value of its area. The area represents the total amount of separating force applied to the sample. Under the previous conditions, calculation of this integral is very simple. In reality, the centrifugation curve appears as follows:

Centrifugal acceleration



**Figure 5-4.** Actual centrifugation integral curve

The integral of this curve is calculated by adding the elementary areas obtained by calculating the product (elementary time interval x acceleration applied during this time interval).

The curve of two successive centrifugations for which the same speed and duration are applied are not identical. Indeed, according to sample weight, temperature, atmospheric moisture in the chamber, mains voltage fluctuations and motor wear, the acceleration rate, as well as constant speed phase, may vary.

When constant speed durations are very limited or very long, the previously described fluctuations may give rise to 5 to 10% variations in value of the integral. The quality of the resultant separations is sometimes considerably modified, as for example when preparing sub cellular fractions.

Integration control allows suppression of the effect of the various potential fluctuations. Indeed, rather than programming a given duration of centrifugation, it is possible to set the desired value of the integral for a given speed or centrifugal acceleration level (R.C.F.).

Upon attainment of that value, the centrifuge braking phase is started automatically.

The centrifuge calculator always provides values of the centrifugation integral over time. Thus, the optimization of centrifugation and determination of integrals to be entered is considerably simplified.

### Using the Integrator

During a series of runs using the timer as usual, at the run end select MODIFY,  $\Delta \nabla$ ,  $\Delta \nabla$  (time), DETAILS. The instrument will display the value of the integral measured automatically during the run. Note this value together with the sample identities. When the samples from the various runs have been analysed, note those which had the best results and look up the recorded integral value.



Reprogram the run memory by choosing MODIFY,  $\Delta\nabla$ ,  $\Delta\nabla$  (time), DETAILS then write the value of the integral, then save the program by choosing ENTER, SAVE PROG as usual. Now the centrifuge will automatically make small adjustments to the time (slightly longer for high loads, poor balancing etc.). In this way, the identical total separating force will be supplied to all samples.

The only differences in results will be due to the samples, not to the centrifugation. The use of the integrator is strongly recommended for blood platelet separation.

## Refrigeration System

The Jouan **KR4i** is equipped with a refrigeration system which allows the rotor chamber temperature to be controlled at a lower level than the ambient temperature. The measured value of air temperature in the bowl is displayed and the temperature is controlled by the microprocessor which controls the cooling unit.

The operator can use the temperature compensation setting so that the sample temperature is more accurately controlled according to the user request by measuring the difference between the sample temperature obtained during the run and the set value.

The cooling unit of the Jouan **KR4i** has either an air cooled condenser or a water cooled condenser.

### Air cooled condensor

Accumulation of dust on the condensor fins will seriously reduce the refrigeration power. Every 3 months, disconnect the unit from mains, remove the front panel and clean the condensor with a vacuum cleaner and a brush.

### Water cooled condensor

In this configuration, the unit is provided with a water pressostat which controls the input of fresh water. Cold water (10°C and less) as well as warm water (25°C and more) reduce the efficiency of the cooling group.

### Determination of the temperature compensation value ( $\Delta T$ )

To determine the temperature compensation value ( $\Delta T$ ) to be programmed, carry out a run as normal with  $\Delta T = 0^\circ\text{C}$  (no compensation applied). At the end of the run, measure the sample temperature with a thermometer.

If, for example, the set temperature was 4°C and the measured temperature is 7°C, then program the  $\Delta T$  as 3°C for future runs. Leave the protocol temperature at 4°C. The centrifuge will control the air at 1°C. The air temperature will be measured independently (1°C) then the value of  $\Delta T$  will be added (here, 3°C) to give the displayed temperature of the sample (4°C).

In the case where an elevated temperature has been selected and the measured temperature attained at the run end is below the set value (e.g. set value 30°C, attained value 28°C) then enter a negative value for  $\Delta T$  (here,  $\Delta T = -2^\circ\text{C}$ ).

## Caution

The following precautions must be observed by the operator:

- Ensure that the accessories are correctly fitted and balanced.
- Check that the rotor is fully locked onto the drive shaft.
- Check that the rotor lid fittings are screwed on tightly.
- Check that there is no water nor other liquid in the base of the windshield.
- Check that all of the buckets are in place and that they swing freely.
- Check that there are no empty transfusion liners in the buckets.
- Do not attempt to override the lid interlock system.
- Do not try to open the lid until display returns to the stand-by mode shown when machine is switched on.
- Use only a properly grounded mains power socket.

Special attention is required to the following:

- Installation of the unit: proper ventilation, levelling of the centrifuge.
- Accessory handling: rotor, buckets.
- Cleaning of the accessories, of the rotor chamber, lubrication of the trunnions.
- Centrifuge ware: shape, material and quality of the vessels must be in accordance with the performance of the centrifuge.
- Load balancing.
- Samples: cleaning of the accessories is particularly necessary when using corrosive products in the samples (saline, acids, bases).
- Ensure that the set point speed is not more than the maximum speed inscribed on either the rotor or the buckets.

## Rotor and Accessory Precautions

Thermo Fisher Scientific rotors made of aluminium alloy are designed to operate at their rated RCF for many years. With careful use they will resist corrosion, lessening the possibility of excessive imbalance, disruption and subsequent damage to the instrument.

### Corrosion Information

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 an electrolyte liquid on the surface of the item. If these substances are allowed to remain on the surface the corrosion will almost certainly occur. This produces first a discoloration of the anodisation then pitting of the metal. Aluminium is a metal which easily reacts with ionic solutions. Anodisation produces a protective layer on the surface of the rotor.

Acidic and alkaline solutions sustaining their pH level will create problems of corrosion in aluminium rotors. Chlorides, present in salts or even in skin contact with the rotor are among the most aggressive and harmful substances commonly found in the laboratory.

The chemical products which are the origin of this corrosion do not necessarily originate from broken tubes - for example they could come from:

- Chemical vapors present in the laboratory which are dissolved in the residual humidity, in condensed water (refrigerated centrifuges) present at the base of the rotor pockets.
- Corrosive liquids originating from overfilled uncapped tubes (the liquid overflowing during centrifugation).
- Inserts, adaptors, racks, bottles whose exterior has been soiled by a chemical product or poorly rinsed after decontamination (with bleach, for example).

**Note** If the products are very corrosive, simply rinsing is insufficient. Residual traces dissolve little by little in the humidity present in the bottom of the pocket, in the condensed water (such as occurs when putting an ambient temperature insert in a cold rotor).



**Beware:** of the presence of solid particles beneath tubes, inserts, racks or adaptors. These particles are crushed by the centrifugal force and penetrate the protective, anodised layer of buckets and rotors, thus creating easy pathways for corrosion.

### Stress Corrosion

This term relates to the phenomenon of accelerated corrosion due to the effect of centrifugation 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 is on a microscopic scale it is even more dangerous than a macroscopic scale since it is invisible.

During centrifugation, chemicals responsible for corrosion are also submitted to the tremendous “g” force which pushes them against the alloy. This close contact facilitates the chemical reaction which occurs much faster than in a static situation. Moreover, centrifugal

force is very directional thus corrosion under stress creates, with a very small amount of corrosive product, straight microscopic fissures. Each centrifugation run makes the chemical migrate further and further.

A fissure, although it is microscopic, is a cut 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.

As accessories are designed with high levels of safety, rupture does not occur as soon as the first microfissures are produced.

Depending upon 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 by a small amount of corrosive product does not disrupt the accessory but makes it mechanically weaker and weaker until it disrupts due to both centrifugal effort and number of cycles.

Because stress corrosion is largely invisible, it is essential that rotors are scrutinised regularly paying particular attention to susceptible parts such as the base of the pockets, the outer edges and the base of the rotor. If fissures are suspected, it is forbidden to use the rotor until it has been examined by a specialist.

### Cleaning



Users must not use cleaning or decontamination methods different from those recommended without first having verified that these methods do not risk damaging the instrument or its accessories, and obtained prior authorization from the manufacturer.

Ideally, rotors should be washed after every use but at least weekly in warm water containing a few drops of mild non alkaline detergent (domestic washing up liquid is ideal) and EVERY TIME AFTER A SPILLAGE HAS OCCURRED.

Do not forget to wash the core of the rotor which comes into contact with the drive spindle.

Each pocket of the rotor must be washed thoroughly using a small nylon brush.

**DO NOT USE METAL WIRE BRUSHES.**

Once the rotor is clean, rinse it in running water, preferably distilled.

Dry the rotor with a soft absorbant non-woven cloth or tissue. Drying may be finished off with warm air jet (e.g. a hair dryer).

**MAKE CERTAIN THAT THE POCKETS ARE WELL DRIED.**

For swing-out rotors, be sure to clean the grease from the trunnions and replace it with a small amount of fresh grease. This will ensure that the buckets swing freely.

The vast majority of apparent imbalance problems arise from the failure of the user to clean and grease the trunnions and not from instrument error.

Pay particular attention that no deposit remains in the bottom of the pocket because the pressure of a flask or tube from above during centrifugation will significantly increase the chances of corrosion.

NEVER LEAVE A DAMP ROTOR ON A METAL SURFACE, PARTICULARLY STAINLESS STEEL because an electrochemical reaction could take place with the aluminium or magnesium in the rotor.

#### **Contamination Hazard**

Our centrifuges are likely to be used in medical research where hazardous substances, including radioactive chemicals, are frequently found (see also Biological risks).

ALWAYS USE THE APPROPRIATE DECONTAMINATION PROCEDURES WHERE THE ROTOR IS EXPOSED TO THESE CHEMICALS.

Dangerous substance: It is recommended that the user takes all the necessary precautions when centrifuging substances known for their toxicity or radioactivity or when they are contaminated by microbiological pathogens, notably material of Risk Group II as identified in the "Laboratory Biosafety Manual" edited by the World Health Organisation:

Centrifugation of Risk 2 microorganisms and materials:

- 1. Centrifuge tubes and specimen containers for use in the centrifuge should be made of thick-walled glass or of plastic and should be inspected for defects before use.**
- 2. Tubes and specimen containers should always be securely capped.**
- 3. The interior of the bowl should be inspected daily for staining or soiling at the level of the rotor. If this is evident then the centrifugation protocols should be re-evaluated.**
- 4. Angle heads should not be used in microbiology except in special, high-speed centrifuges. With ordinary angle heads, some fluid, even from capped tubes, may be ejected because of the geometry of the machine.**
- 5. Except in ultracentrifuges and with small prothrombin tubes, a space of at least 2 cm should be left between the level of the fluid and the rim of the centrifuge tube.**

Examples of commonly used techniques are outlined below. The information is given as a guide only. It is the responsibility of the owner to use the most suitable procedure. The rotor should always be completely disassembled before being subjected to heat and after external chemical cleaning. Seals, tubes and plastic components should be decontaminated.

### **Disinfection**

Alcohol (70% ethanol or isopropanol) applied for 10 minutes is ideal for bacteria and viruses. Autoclave rotors for 20 minutes at 120°C to destroy micro-organisms. Rotor lids must be disassembled from rotor bodies. 'O' rings, autoclaved separately, should be replaced when deformed.

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

Hypochlorite "bleach" used at 0.1% concentration with 10 minutes immersion is effective against bacteria, spores and viruses but, as an oxidizing agent, is corrosive to metal alloys and must be thoroughly rinsed off and dried. It should never be used if there is surface damage to the rotor. Note that the black colour on the surface of the rotor will be gradually washed out if the rotor is regularly autoclaved or bleached. This does not necessarily denote a degradation in the anodization.

Formalin (37% formaldehyde in water) in contact for 10 minutes has a similar effect to chlorine bleaches. Rotors should be thoroughly rinsed under running water for 5 minutes to remove all traces of formalin then dried completely. **NOTE: FORMALDEHYDE IS TOXIC.**

Gluteraldehyde 2%, sold under many brand names such as Cidex and Glutarex, requires total immersion for 10 minutes to ensure sterility. Thorough rinsing and drying is essential to protect users.

**CAUTION: GLUTERALDEHYDE BUILDS UP TO A TOXIC LEVEL IN THE FATTY TISSUES OF THE BODY.**

Phenols are very corrosive and should never be used.

### **Radioactive decontamination**

We recommend that all radioactive contamination be referred to your Radioactivity Safety Officer. Rotors may be decontaminated by a mixture of equal volumes of:

- a) Distilled water,
- b) SDS diluted to 10%,
- c) Ethanol diluted to 70%.

The rotor should then be rinsed with ethanol followed by distilled water and then dried completely. Thermo Fisher Scientific makes no claims as to the effectiveness of proprietary brands of decontaminating solutions.

**Preventative Maintenance**

In the interests of prolonging metallic accessory life it is advisable to smear the pockets with a silicone based grease such as SILICONE GREASE 500 from KF or to use a LANOLIN based grease. Thermo Fisher Scientific is able to supply cans of Anti Corrosion Spray, catalogue N° 11175399, whose propellant drives out water-based moisture and leaves a protective lanolin film on the surface.

**Storage of Rotors**

It is strongly recommended that rotors not in use should be stored upside down on a non-metallic grid or other support which allows free movement of air. Any moisture contained in the pockets will then be eliminated by gravity and evaporation. If the rotors are to be stored for a long period then we advise that they are dried perfectly and greased with silicone grease.

High speed rotors are frequently preconditioned by storing in a cold room or refrigerator. This tends to advance the onset of corrosion. We recommend, therefore, that such rotors are stored (dismantled) sealed inside plastic bags from which the air has been evacuated.

# Chemical Compatibility Table for Rotors, Tubes and Accessories

S = Satisfactory

D = Discoloration but OK

P = Pure chemical OK

M= Moderate resistance

U = Unsatisfactory

X = Explosion risk !!!

O= No information

d = Less resistance if T > 50°C

t = Unsatisfactory if T >50°C

Material	Aluminium	Buna N	Cellulose acetate butyrate	Cellulose Nitrate	Delrin	Kynar	Noryl	Nylon	Polyallomer (= PPCO) *	Polycarbonate	Polyethylene	Polypropylene	Polysulfone	Stainless steel	Teflon	Tefzel	Titanium	Viton A	Velox
Acetaldehyde	S	U	U	U	O	O	O	O	M	U	M	M	O	S	S	M	S	U	O
Acetamide	O	O	O	O	O	O	O	O	S	U	S	S	S	O	O	O	O	O	O
Acetic Acid (5%)	S	M	S	S	M	S	S	S	S	S	S	D	S	S	S	S	S	M	S
Acetic Acid (20 %)	S	O	O	O	O	O	O	O	S	M	S	S	S	O	O	O	O	O	O
Acetic Acid (60%)	S	U	U	U	U	S	S	M	S	U	M	D	S	S	S	S	S	U	S
Acetic Acid (80 %)	S	O	O	O	O	O	O	O	S	U	St	S	M	O	O	O	O	O	O
Acetic Acid (Glacial)	S	U	U	U	U	S	O	O	S	U	M	D	M	S	S	S	S	U	S
Acetic Anhydride	S	O	O	O	O	O	O	O	Sd	U	U	Sd	U	O	O	O	O	O	O
Acetone	S	U	U	U	M	M	O	U	S	U	S	M	U	S	S	M	S	U	M
Acetonitrile	O	O	O	O	O	O	O	O	Mt	U	S	Mt	U	O	O	O	O	O	O
Acetylene	S	O	O	O	O	O	O	O	S	O	S	S	U	O	O	O	O	O	O
Adipic Acid	O	O	O	O	O	O	O	O	S	S	St	S	S	O	O	O	O	O	O
Alanine	S	O	O	O	O	O	O	O	S	S	U	S	U	O	O	O	O	O	O
Allyl Alcohol	O	O	U	O	S	O	O	U	O	S	S	S	O	O	S	S	S	O	S
Aluminium Chloride	O	O	S	S	O	S	O	S	S	S	S	S	O	U	S	S	S	O	O
Aluminium Fluoride	O	O	O	O	O	S	O	S	S	U	S	S	O	O	S	O	S	O	O
Aluminium Hydroxide	S	O	O	O	O	O	O	O	S	Mt	Sd	S	S	O	O	O	O	O	O
Aluminium Nitrate	M	O	O	O	O	O	O	O	S	O	O	S	O	O	O	O	O	O	O
Aluminium Sulphate	S	O	O	O	O	O	O	O	Sd	O	S	Sd	O	O	O	O	O	O	O
Amino Acids	S	O	O	O	O	O	O	O	S	S	S	S	S	O	O	O	O	O	O
Ammonia	S	O	O	O	O	O	O	O	S	U	S	S	Sd	O	O	O	O	O	O



Chapter 5  
Using the Product

Material	Aluminium	Buna N	Cellulose acetate butyrate	Cellulose Nitrate	Delrin	Kynar	Noryl	Nylon	Polyallomer (= PPCO) *	Polycarbonate	Polyethylene	Polypropylene	Polysulfone	Stainless steel	Teflon	Tefzel	Titanium	Viton A	Velox
Ammonium Acetate	O	O	O	O	O	O	O	O	S	S	S	S	O	O	S	S	S	O	O
Ammonium Carbonate	S	U	S	S	O	S	O	S	S	O	S	S	S	S	S	S	S	O	S
Ammonium Chloride	M	O O	O	O	O	O	O	O	St	O	St	St	O	O	O	O	O	O	O
Ammonium Hydroxide (10%)	O	S	U	O	O	O	O	S	D	U	S	D	S	S	S	S	S	S	S
Ammonium Hydroxide (conc)	O	U	U	O	O	O	O	S	D	U	S	D	O	S	S	S	S	U	U
Ammonium Oxalate	O	O	O	O	O	O	O	O	Sd	S	S	Sd	S	O	O	O	O	O	O
Ammonium Phosphate	U	O	O	O	O	O	O	O	S	M	S	S	O	O	O	O	O	O	O
Ammonium Sulphate	S	S	O	O	U	O	O	S	S	S	S	S	O	S	S	S	S	O	O
Ammonium Sulphide	O	O	O	O	O	S	O	O	S	U	O	S	O	O	S	O	O	O	O
n-Amyl Acetate	S	O	O	O	O	O	O	O	Sd	U	Sd	Sd	U	O	O	O	O	O	O
Amyl Alcohol	S	M	U	O	S	O	O	S	S	S	S	S	O	O	S	S	S	M	S
Amyl Chloride	S	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Aniline	S	O	O	O	O	S	O	O	U	O	S	M	O	O	S	S	S	O	O
Aqua Regia	U	U	U	O	U	O	O	O	U	U	U	U	O	O	S	S	S	M	M
Barium Chloride	U	O	O	O	O	O	O	O	S	O	S	S	O	O	O	O	O	O	O
Barium Hydroxide	U	O	O	O	O	O	O	O	S	O	S	S	O	O	O	O	O	O	O
Barium Sulphate	S	O	O	O	O	O	O	O	S	O	St	S	O	O	O	O	O	O	O
Benzaldehyde	S	O	O	O	O	O	O	O	Sd	Mt	S	Sd	M	O	O	O	O	O	O
Benzene	S	U	P	O	M	O	O	S	U	U	U	U	U	S	S	S	S	S	M
Benzoic Acid, Sat	St	O	O	O	O	O	O	O	Sd	Sd	S	Sd	M	O	O	O	O	O	O
Benzyl Acetate	O	O	O	O	O	O	O	O	Sd	Mt	S	sD	U	O	O	O	O	O	O
Benzyl Alcohol	S	U	U	O	M	O	O	U	U	U	U	U	O	O	S	S	S	S	O
Boric Acid	U	O	O	O	O	O	O	O	S	U	Sd	S	U	O	O	O	O	O	O
Bromine	U	O	O	O	O	O	O	O	U	Mt	U	U	U	O	O	O	O	O	O
Bromobenzene	U	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Bromoform	U	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Butadiene	S	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Butane	S	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
n-Butanol	S	S	U	O	S	O	O	U	O	M	S	S	M	O	S	S	S	S	S
n-Butyl Acetate	S	O	O	O	O	O	O	O	S	U	S	S	U	O	O	O	O	O	O
Butylene	S	O	O	O	O	O	O	O	O	O	S	O	O	O	O	O	O	O	O
Butyl Chloride	O	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Butyric Acid	S	O	O	O	O	O	O	O	U	Mt	U	U	S	O	O	O	O	O	O

**Chapter 5**  
Using the Product

<b>Material</b>	<b>Aluminium</b>	<b>Buna N</b>	<b>Cellulose acetate butyrate</b>	<b>Cellulose Nitrate</b>	<b>Delrin</b>	<b>Kynar</b>	<b>Noryl</b>	<b>Nylon</b>	<b>Polyallomer (= PPCO) *</b>	<b>Polycarbonate</b>	<b>Polyethylene</b>	<b>Polypropylene</b>	<b>Polysulfone</b>	<b>Stainless steel</b>	<b>Teflon</b>	<b>Tefzel</b>	<b>Titanium</b>	<b>Viton A</b>	<b>Velox</b>
Caesium Acetate	M	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Caesium Bromide	M	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Caesium Chloride	M	O	S	S	O	O	O	O	S	S	S	S	S	S	S	S	S	O	O
Caesium Formiate	M	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Caesium Iodide	M	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Caesium Sulphate	M	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Caesium Trifluoroacetate	M	O	M	U	O	O	O	O	S	S	S	S	S	M	S	O	O	O	O
Calcium Carbonate	U	O	O	O	O	O	O	O	S	O	St	S	O	O	O	O	O	O	O
Calcium Chloride	M	S	S	O	S	O	O	S	S	M	O	D	S	S	S	O	S	S	S
Calcium Hypochlorite	M	U	O	O	M	S	O	S	S	M	S	S	S	U	S	O	S	S	S
Calcium Sulphate	M	O	O	O	O	O	O	O	S	O	St	S	O	O	O	O	O	O	O
Carbazole	O	O	O	O	O	O	O	O	S	U	S	S	U	O	O	O	O	O	O
Carbon Sulphide	S	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Carbon Tetrachloride	X	U	S	S	M	S	O	S	U	U	U	U	S	M	S	S	S	S	S
Cedarwood Essence	O	O	O	O	O	O	O	O	U	St	U	U	M	O	O	O	O	O	O
Chlorine, dry	M	O	O	O	O	O	O	O	St	Sd	St	St	O	O	O	O	O	O	O
Chlorine, moist	U	O	O	O	O	O	O	O	Mt	Sd	St	Mt	O	O	O	O	O	O	O
Chloroacetic Acid	U	O	O	O	O	O	O	O	Sd	Mt	S	Sd	U	O	O	O	O	O	O
p-Chloroacetophenone	O	O	O	O	O	O	O	O	S	U	S	S	U	O	O	O	O	O	O
Chlorobenzene	O	O	U	U	O	S	O	O	U	U	U	U	O	O	S	O	S	O	O
Chloroform	X	U	M	S	M	S	O	U	U	U	U	U	U	S	S	M	S	S	S
Chlorosulphonic	M	O	O	O	O	O	O	O	M	O	M	M	O	O	O	O	O	O	O
Chromic Acid (5%)	U	O	O	O	O	O	O	O	S	M	S	S	O	O	O	O	O	O	O
Chromic Acid (10%)	M	U	U	U	U	S	S	O	S	M	S	S	U	U	S	S	S	S	M
Chromic Acid (50%)	U	U	U	S	U	S	O	O	D	U	S	S	U	U	S	S	M	S	M
Cinnamon Essence	O	O	O	O	O	O	O	O	U	St	U	U	M	O	O	O	O	O	O
Citric Acid (10%)	S	S	S	O	M	S	S	M	S	S	S	S	S	S	S	S	S	S	S
Copper Nitrate	U	O	O	O	O	O	O	O	S	O	S	S	O	O	O	O	O	O	O
Copper Sulphate	U	O	O	O	O	O	O	O	S	O	St	S	O	O	O	O	O	O	O
Croesol	S	O	O	O	O	S	O	U	S	U	S	S	O	O	S	M	S	O	O
Cyclohexane	S	O	O	O	O	O	O	O	Mt	Sd	Mt	Mt	U	O	O	O	O	O	O
Cyclohexanol	S	O	U	O	O	O	O	S	S	M	S	S	O	O	S	O	S	O	O
Cyclohexanone	O	O	O	O	O	O	O	O	Mt	U	U	U	U	U	O	O	O	O	O
Cyclopentane	O	O	O	O	O	O	O	O	Mt	U	U	U	U	U	O	O	O	O	O
Decane	O	O	O	O	O	O	O	O	Mt	Mt	Mt	Mt	Sd	U	O	O	O	O	O

Material	Aluminium	Buna N	Cellulose acetate butyrate	Cellulose Nitrate	Delrin	Kynar	Noryl	Nylon	Polyallomer (= PPCO) *	Polycarbonate	Polyethylene	Polypropylene	Polysulfone	Stainless steel	Teflon	Tefzel	Titanium	Viton A	Velox
Dextran Sulphate	M	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Diacetone	S	O	U	O	O	O	O	O	S	O	S	S	O	O	S	O	S	O	O
Diacetone Alcohol	S	O	O	O	O	O	O	O	S	O	S	S	O	O	O	O	O	O	O
o-Dichlorobenzene	O	O	O	O	O	O	O	O	Mt	U	Mt	Mt	U	O	O	O	O	O	O
p-Dichlorobenzene	O	O	O	O	O	O	O	O	Mt	U	Mt	Mt	U	O	O	O	O	O	O
Dichloroethane	O	U	U	U	S	O	S	S	U	U	U	U	O	O	S	S	S	S	M
Dichlorophenol	O	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Diethylamine	S	O	O	O	O	O	O	O	St	U	U	St	Sd	O	O	O	O	O	O
Diethyl Benzene	O	O	O	O	O	O	O	O	U	Mt	U	U	U	O	O	O	O	O	O
Diethylene Glycol	S	S	S	S	S	S	O	U	S	S	S	S	S	O	S	S	S	S	S
Diethylene Glycol Ethyl Ether	O	O	O	O	O	O	O	O	S	Mt	S	S	M	O	O	O	O	O	O
Diethyl Ether	S	O	O	O	O	O	O	O	U	U	O	U	O	O	O	O	O	O	O
Diethyl Ketone	S	O	U	U	M	O	O	U	U	U	M	M	O	O	S	M	S	O	M
Dimethylacetamide	O	O	O	O	O	O	O	O	S	U	St	S	U	O	O	O	O	O	O
Dimethylformamide	S	O	O	O	O	O	O	O	S	U	S	S	O	O	S	M	S	O	O
Dimethylsulphoxide	S	O	O	O	O	O	O	O	S	U	O	S	O	S	S	M	S	O	O
Dioxane	S	U	U	O	M	S	O	O	M	U	M	M	O	O	S	S	S	U	O
Diphenyloxide	S	O	O	O	O	O	O	O	U	O	O	U	O	O	O	O	O	O	O
Dipropylene Glycol	O	O	O	O	O	O	O	O	S	Sd	S	S	S	O	O	O	O	O	O
Distilled Water	S	S	S	S	S	O	S	S	S	S	S	S	S	S	S	S	S	S	S
Ethanol (50%)	S	S	S	S	M	S	S	U	S	M	S	S	S	S	S	S	S	S	S
Ethanol (95%)	S	S	U	U	M	S	S	U	S	U	S	S	S	S	S	S	S	S	S
Ethyl Acetate	M	U	U	U	M	S	O	U	M	U	S	U	U	O	S	S	S	U	M
Ethyl Benzene	O	O	O	O	O	O	O	O	Mt	U	St	Mt	U	O	O	O	O	O	O
Ethyl Benzoate	O	O	O	O	O	O	O	O	Sd	M	S	Sd	U	O	O	O	O	O	O
Ethyl Butyrate	O	O	O	O	O	O	O	O	St	U	St	St	U	O	O	O	O	O	O
Ethyl Chloride	S	O	O	O	O	O	O	O	St	U	St	St	U	O	O	O	O	O	O
Ethylene Chloride	S	O	O	O	O	O	O	O	St	U	St	St	U	O	O	O	O	O	O
Ethylene Glycol	S	S	S	S	S	S	O	U	S	S	S	S	S	O	S	S	S	S	S
Ethylene Oxide	O	O	O	O	O	O	O	O	M	Mt	M	M	S	O	O	O	O	O	O
Ethyl Ether	S	O	U	U	O	O	O	O	M	U	M	M	O	O	S	M	S	O	O
Ethyl Lactate	O	O	O	O	O	O	O	O	O	S	St	S	S	M	O	O	O	O	O
Ethyl Malonate	O	O	O	O	O	O	O	O	O	S	Mt	S	S	M	O	O	O	O	O
Fatty Acids	S	O	O	O	O	O	O	O	O	Sd	Sd	Sd	S	O	O	O	O	O	O

Chapter 5

Using the Product

Material	Aluminium	Buna N	Cellulose acetate butyrate	Cellulose Nitrate	Delrin	Kynar	Noryl	Nylon	Polyallomer (= PPCO) *	Polycarbonate	Polyethylene	Polypropylene	Polysulfone	Stainless steel	Teflon	Tefzel	Titanium	Viton A	Velox
Ferric Chloride	U	S	O	O	M	S	S	S	S	O	S	S	O	U	S	S	S	S	S
Ferric Nitrate	M	O	O	O	O	O	O	O	S	O	St	S	M	O	O	O	O	O	O
Ferric Sulphate	S	O	O	O	O	O	O	O	S	O	S	S	O	O	O	O	O	O	O
Ficoll Paque	M	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Fluorine	M	O	O	O	O	O	O	O	Mt	Sd	St	Mt	U	O	O	O	O	O	O
Fluorhydric Acid (10%)	U	U	M	M	U	S	O	S	S	M	S	S	S	U	S	S	U	O	S
Fluorhydric Acid (50%)	U	U	U	U	U	S	O	O	S	U	S	S	M	U	S	S	U	M	U
Formaldehyde (20%)	S	O	O	O	O	O	O	O	S	Sd	S	S	Sd	O	O	O	O	O	O
Formaldehyde (40%)	M	M	O	S	O	S	S	S	S	S	S	D	S	S	S	S	S	S	M
Formaldehyde (50%)	S	O	O	O	O	O	O	O	S	Sd	S	S	Sd	O	O	O	O	O	O
Formic Acid (100%)	S	M	U	O	U	S	S	U	S	M	S	S	O	U	S	S	S	U	S
Freon TF	U	O	O	O	O	O	O	O	Sd	Sd	Sd	Sd	Sd	O	O	O	O	O	O
Fuel Oil	O	O	O	O	O	O	O	O	Sd	Sd	Mt	Sd	Sd	O	O	O	O	O	O
Glucose	S	O	O	O	O	O	O	O	S	O	S	S	O	O	O	O	O	O	O
Glutaraldehyde	O	O	O	O	O	O	O	O	Sd	Sd	S	Sd	Sd	O	O	O	O	O	O
Glycerine	S	O	O	O	O	O	O	O	S	S	S	S	S	O	O	O	O	O	O
Glycerol	S	O	O	S	O	S	S	O	S	S	S	S	S	S	S	S	S	O	O
Heptane	S	O	O	O	O	O	O	O	M	O	S	M	O	O	O	O	O	O	O
Hexane	S	O	O	O	O	O	O	O	S	O	M	S	O	O	O	O	O	O	O
Hydrazine	O	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Hydrochloric Acid (5%)	U	O	O	O	O	O	O	O	S	S	S	S	S	O	O	O	O	O	O
Hydrochloric Acid (37%)	U	O	O	O	O	O	O	O	Sd	U	S	Sd	S	O	O	O	O	O	O
Hydrochloric Acid (50%)	U	U	U	U	U	S	S	O	M	U	S	M	O	U	S	S	S	M	S
Hydrochloric Acid (conc.)	U	U	U	O	U	O	O	O	S	U	O	S	O	U	S	S	S	O	S
Hydrofluoric Acid (10%)	U	U	M	M	U	S	O	S	S	M	S	S	S	U	S	S	U	O	S
Hydrofluoric Acid (50%)	U	U	U	U	U	S	O	O	S	U	S	S	M	U	S	S	U	M	U
Hydrogen Peroxide (3%)	S	M	S	S	S	O	S	S	S	S	S	D	S	S	S	S	S	S	S
Hydrogen Peroxide (100%)	S	U	S	S	U	O	S	O	S	S	S	D	S	S	S	S	U	M	M
Iodine, Crystals	S	O	O	O	O	O	O	O	Mt	U	U	Mt	U	O	O	O	O	O	O
Isobutyl Alcohol	O	M	U	O	S	O	O	U	S	S	S	S	O	O	S	S	S	S	S
Isopropyl Alcohol	O	M	U	U	S	O	S	U	S	M	S	S	M	O	S	S	S	S	S
Isopropylbenzene	O	O	O	O	O	O	O	O	Mt	U	Mt	Mt	U	O	O	O	O	O	O
Kerosene	S	O	O	O	O	O	O	O	Sd	S	Mt	Sd	St	O	O	O	O	O	O
Lactic Acid (20%)	O	S	O	O	O	O	S	O	S	S	S	S	S	S	S	S	S	S	S
Lactic Acid (100%)	O	S	O	O	O	O	O	O	S	S	S	S	O	S	S	S	S	S	S

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Using the Product

Material	Aluminium	Buna N	Cellulose acetate butyrate	Cellulose Nitrate	Delrin	Kynar	Noryl	Nylon	Polyallomer (= PPCO) *	Polycarbonate	Polyethylene	Polypropylene	Polysulfone	Stainless steel	Teflon	Tefzel	Titanium	Viton A	Velox
Lead Acetate (aq.)	U	O	O	O	O	O	O	O	S	S	St	S	O	O	O	O	O	O	O
Lemon Essence	U	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Lime, (conc.)	M	O	O	O	O	O	O	O	S	U	S	S	S	O	O	O	O	O	O
Magnesium Chloride	M	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Magnesium Hydroxide	U	O	U	O	O	S	S	O	S	U	S	S	O	O	S	O	S	O	O
Magnesium Nitrate	M	O	O	O	O	O	O	O	S	O	Sd	S	O	O	O	O	O	O	O
Magnesium Sulphate	S	O	O	O	O	O	O	O	S	O	St	S	O	O	O	O	O	O	O
Manganese Salts	M	O	S	O	O	O	O	O	S	O	S	S	O	O	S	O	S	O	O
Mercury	O	O	O	O	O	O	O	O	S	U	S	S	S	O	O	O	O	O	O
Methanol (100%)	S	S	U	U	M	S	O	U	S	M	S	D	S	S	S	S	S	U	S
Methyl Acetate	S	O	O	O	O	O	O	O	M	U	M	M	U	O	O	O	O	O	O
Methyl Alcohol (100%)	S	S	U	U	M	S	O	U	S	M	S	D	S	S	S	S	S	U	S
Methyl Butyl Ketone	O	O	O	O	O	O	O	O	O	U	O	O	O	O	O	O	O	O	O
Methyl Ethyl Ketone	S	U	U	U	M	M	O	U	S	U	S	S	U	O	S	M	S	U	M
Methyl Isobutyl Ketone	St	O	O	O	O	O	O	O	S	U	S	S	U	O	O	O	O	O	O
Methyl Isopropyl Ketone	O	O	O	O	O	O	O	O	U	U	S	U	U	O	O	O	O	O	O
Methylene Chloride	X	U	U	U	S	S	O	U	U	U	M	U	U	S	S	S	S	M	U
Mineral Oil	O	O	O	O	O	O	O	O	Mt	U	Mt	Mt	Mt	O	O	O	O	O	O
Nickel Chloride	U	O	O	O	O	O	O	O	S	O	St	S	O	O	O	O	O	O	O
Nickel Salts	M	S	S	O	O	O	O	S	S	S	S	S	O	S	S	S	S	S	S
Nickel Sulphate	U	O	O	O	O	O	O	O	S	S	St	S	O	O	O	O	O	O	O
Nitric Acid (10%)	M	U	S	S	U	S	S	M	D	S	S	S	S	D	S	S	S	S	S
Nitric Acid (20%)	U	O	O	O	O	O	O	O	S	Sd	S	S	St	O	O	O	O	O	O
Nitric Acid (50%)	M	U	M	M	U	S	S	M	D	M	M	M	O	D	S	S	S	S	M
Nitric Acid (95%)	M	U	U	O	U	O	O	U	M	U	U	M	U	S	S	S	S	U	U
Nitric Acid (conc.)	St	O	O	O	O	O	O	O	U	U	Mt	U	U	O	O	O	O	O	O
Nitrobenzene	O	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Octane	O	O	O	O	O	O	O	O	S	Sd	S	S	Sd	O	O	O	O	O	O
Octyl Alcohol	S	O	O	O	O	O	O	O	O	O	S	O	O	O	O	O	O	O	O
Oleic Acid	S	U	S	S	S	S	O	S	S	S	S	S	S	S	S	S	S	M	S
Orange Essence	S	O	O	O	O	O	O	O	Mt	M	Mt	Mt	M	O	O	O	O	O	O
Oxalic Acid	M	M	S	S	O	S	O	S	S	S	S	S	S	S	S	S	M	S	S
Oxygenated Water (20%)	S	O	O	O	O	O	O	O	S	S	S	S	S	O	O	O	O	O	O
Oxygenated Water (50%)	S	O	O	O	O	O	O	O	S	S	S	S	S	O	O	O	O	O	O
Oxygenated Water (90%)	S	O	O	O	O	O	O	O	S	S	S	S	S	O	O	O	O	O	O

Chapter 5

Using the Product

Material	Aluminium	Buna N	Cellulose acetate butyrate	Cellulose Nitrate	Delrin	Kynar	Noryl	Nylon	Polyallomer (= PPCO) *	Polycarbonate	Polyethylene	Polypropylene	Polysulfone	Stainless steel	Teflon	Tefzel	Titanium	Viton A	Velox
Ozone	O	O	O	O	O	O	O	O	Sd	Sd	S	Sd	S	O	O	O	O	O	O
Paraffin	S	O	O	O	O	O	O	O	S	O	S	S	O	O	O	O	O	O	O
Pentane	S	O	O	O	O	O	O	O	U	O	U	U	O	O	O	O	O	O	O
Perchlorethylene	S	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Perchloric Acid	X	O	O	O	O	O	O	O	St	U	St	St	U	O	O	O	O	O	O
Perchloric Acid (10%)	U	O	O	O	U	S	O	O	S	U	M	M	O	U	S	S	S	S	S
Perchloric Acid (70%)	X	O	O	O	O	O	O	O	M	U	M	M	U	O	S	S	O	O	O
Petrol	S	O	O	O	O	O	O	O	St	M	St	St	M	O	O	O	O	O	O
Phenol (5%)	S	U	O	O	U	S	O	U	M	U	S	M	U	S	S	S	U	S	U
Phenol (50%)	U	O	O	O	O	O	O	O	U	U	U	U	U	O	S	M	O	O	O
Phenol, crystals	U	O	O	O	O	O	O	O	St	U	St	St	U	O	O	O	O	O	O
Phenol, liquid	U	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Phenyl Ethyl Alcohol	O	O	U	O	O	O	O	S	S	O	S	S	O	O	S	O	S	O	O
Phosphoric Acid (10%)	O	M	S	S	U	S	S	O	S	S	S	S	S	S	S	S	O	S	S
Phosphoric Acid (conc.)	O	U	M	M	U	S	O	O	S	U	S	S	S	M	S	S	M	S	U
Picric Acid	S	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Pine Oil	O	O	O	O	O	O	O	O	Sd	St	St	Sd	M	O	O	O	O	O	O
Potash, conc.	U	O	O	O	O	O	O	O	S	U	S	S	S	O	O	O	O	O	O
Potassium Bromide	U	O	O	O	O	O	O	O	S	S	S	S	O	O	O	O	O	O	O
Potassium Carbonate	M	O	S	S	O	S	S	S	S	U	S	S	O	S	S	S	S	O	O
Potassium Chlorate	M	O	S	S	O	S	S	S	S	S	S	S	O	S	S	O	S	O	O
Potassium Chloride	U	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Potassium Hydroxide (5%)	U	M	S	M	U	O	O	S	S	U	S	S	S	S	S	S	M	S	S
Potassium Hydroxide (conc.)	U	M	U	U	U	O	O	O	S	U	S	S	O	S	S	S	U	M	U
Potassium Nitrate	S	O	O	O	O	O	O	O	S	O	S	S	O	O	O	O	O	O	O
Potassium Permanganate	S	O	O	O	O	O	O	O	S	S	S	S	D	O	S	S	O	O	O
Propane Gas	S	O	O	O	O	O	O	O	U	St	U	U	M	O	O	O	O	O	O
Propionic Acid	O	O	O	O	O	O	O	O	Sd	U	M	Sd	S	O	O	O	O	O	O
Propyl Alcohol	S	O	O	O	O	O	O	O	S	O	St	S	O	O	O	O	O	O	O
Propylene Glycol	S	O	O	O	O	O	O	O	S	Sd	S	S	S	O	O	O	O	O	O
Propylene Oxide	O	O	O	O	O	O	O	O	S	St	S	S	S	O	O	O	O	O	O
Pyridine	U	O	O	O	O	O	O	O	M	U	S	M	O	O	O	O	O	O	O
Resorcinol, Sat'd., Sol	O	O	O	O	O	O	O	O	S	Sd	S	S	U	O	O	O	O	O	O
Rubidium Bromide	M	O	O	O	O	O	O	O	S	S	O	S	O	O	O	O	O	O	O

Chapter 5  
Using the Product

Material	Aluminium	Buna N	Cellulose acetate butyrate	Cellulose Nitrate	Delrin	Kynar	Noryl	Nylon	Polyallomer (= PPCO) *	Polycarbonate	Polyethylene	Polypropylene	Polysulfone	Stainless steel	Teflon	Tefzel	Titanium	Viton A	Velox
Saccharose	U	O	O	O	O	O	O	O	S	S	S	S	S	O	O	O	O	O	O
Salicylic Acid, Sat	O	O	O	O	O	O	O	O	S	Sd	S	S	S	O	O	O	O	O	O
Serum	S	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Silver Acetate	O	O	O	O	O	O	O	O	S	Sd	S	S	S	O	O	O	O	O	O
Silver Nitrate	U	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Sodium Acetate	S	O	O	O	O	O	O	O	S	Sd	S	S	S	O	O	O	O	O	O
Sodium Bisulphate	M	O	S	S	O	S	S	S	S	S	S	S	O	S	S	O	S	O	O
Sodium Borate	M	O	O	O	O	O	O	O	S	S	Sd	S	O	O	O	O	O	O	O
Sodium Bromide	U	O	O	O	O	O	O	O	S	S	O	S	O	O	O	O	O	O	O
Sodium Carbonate (2%)	M	S	S	S	S	S	S	S	S	S	S	D	O	S	S	S	S	S	S
Sodium Chloride (10%)	S	S	S	S	S	O	O	S	S	S	S	S	S	S	S	S	M	S	S
Sodium Chloride (Sat'd.)	S	S	O	O	S	O	O	S	S	O	S	S	O	S	S	S	S	S	S
Sodium Hydroxide (>1%)	U	M	S	S	U	S	O	S	S	U	S	S	S	S	S	S	S	S	S
Sodium Hydroxide (10%)	U	M	U	U	U	S	O	S	S	U	S	S	S	S	S	S	S	S	S
Sodium Hydroxide (conc.)	U	M	U	U	U	O	O	O	M	U	S	M	O	S	S	S	M	U	U
Sodium Hypochlorite (5%)	M	M	S	S	U	S	S	S	D	S	S	S	S	M	S	S	S	S	S
Sodium Iodide	M	O	O	O	O	O	O	O	S	S	O	S	O	O	O	O	O	O	O
Sodium Nitrate	S	O	O	O	O	O	O	O	S	O	Sd	S	O	O	O	O	O	O	O
Sodium Sulfate	S	O	O	O	O	O	O	O	Sd	O	Sd	Sd	O	O	O	O	O	O	O
Sodium Sulphide	S	S	S	O	O	S	O	S	S	U	S	S	O	S	S	S	M	S	S
Stearic Acid	S	O	O	O	O	O	O	O	S	Sd	S	S	S	O	O	O	O	O	O
Sulphuric Acid (10%)	M	U	S	S	U	S	S	S	S	M	S	S	S	U	S	S	S	S	S
Sulphuric Acid (20%)	U	O	O	O	O	O	O	O	Sd	Sd	S	Sd	S	O	O	O	O	O	O
Sulphuric Acid (50%)	U	U	U	U	U	S	S	U	S	S	S	S	S	U	S	S	M	S	M
Sulphuric Acid (conc.)	U	U	U	U	U	S	O	U	D	U	M	D	U	M	S	S	U	S	U
Sulphuric Anhydride, dry or moist	S	O	O	O	O	O	O	O	S	Sd	S	S	S	O	O	O	O	O	O
Tetrachloroethane	M	O	O	O	O	O	O	O	M	O	O	M	O	O	O	O	O	O	O
Tetrachlorethylene	O	O	O	O	O	O	O	O	U	O	S	U	O	O	O	O	O	O	O
Tannic Acid	M	O	O	O	O	O	O	O	S	O	Sd	S	O	O	O	O	O	O	O
Tartaric Acid	M	O	O	O	O	O	O	O	S	Sd	S	S	S	O	O	O	O	O	O
Tetrahydrofuran	S	O	O	O	O	O	O	O	U	U	U	U	U	O	S	S	O	O	O
Thionyl Chloride	O	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Toluene	S	U	P	S	M	S	O	U	U	U	U	U	U	S	S	S	M	M	S
Trichlorethylene	S	U	O	O	O	S	O	U	U	U	U	U	U	U	S	S	M	S	M

Material	Aluminium	Buna N	Cellulose acetate butyrate	Cellulose Nitrate	Delrin	Kynar	Noryl	Nylon	Polyallomer (= PPCO) *	Polycarbonate	Polyethylene	Polypropylene	Polysulfone	Stainless steel	Teflon	Tefzel	Titanium	Viton A	Velox
Trichloroacetic Acid	U	O	O	O	O	O	O	O	Mt	Mt	Mt	Mt	S	O	O	O	O	O	O
1,2,4 - Trichlorobenzen	O	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Trichloroethane	S	U	S	O	M	S	O	S	U	U	U	U	M	O	S	S	S	S	S
Triethylamine	O	O	O	O	O	O	O	O	U	O	O	U	O	O	O	O	O	O	O
Triethylene Glycol	O	O	O	O	O	O	O	O	S	Sd	S	S	S	O	O	O	O	O	O
Tris Buffer (neutral)	S	O	O	O	O	O	O	O	S	S	S	S	S	O	S	S	O	O	O
Trisodium Phosphate	O	O	S	O	M	O	O	S	S	O	S	S	O	O	S	S	S	S	O
Triton X-10	S	O	O	O	O	O	O	O	S	S	S	S	S	O	S	M	O	O	O
Turpentine	S	O	O	O	O	O	O	O	Sd	Mt	St	Sd	U	O	O	O	O	O	O
Undecyl Alcohol	O	O	O	O	O	O	O	O	Sd	Sd	St	Sd	M	O	O	O	O	O	O
Urea	M	O	S	S	S	O	O	S	S	S	S	S	S	S	S	S	S	O	O
Urine	O	O	S	O	S	O	O	S	S	S	S	S	O	O	S	S	S	O	O
Vinylidene chloride	O	O	O	O	O	O	O	O	U	U	U	U	U	O	O	O	O	O	O
Xylene	S	U	P	O	M	S	O	U	U	U	U	U	U	S	S	S	S	S	M
Zinc Chloride	M	S	S	O	O	O	O	S	S	S	S	S	S	M	S	S	S	S	S
Zinc Hydrosulphite	U	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Zinc Sulphate	U	O	O	O	O	O	O	O	Sd	O	S	Sd	O	O	O	O	O	O	O

\* Polypropylene Copolymer

This table is intended as a guide only because of the difficulty in quantifying, cross-checking and monitoring the results under different conditions of temperature, pressure and purity relating to the solvents and samples dissolved therein. It is strongly recommended that you carry out your own trials, particularly before protracted work periods

## Machine Alarms

N°	Message	Description	Action
1	TACHOMETER FAILURE (error code 0)	Speed measured at value other than zero when the centrifuge is powered up.	Wait for the motor to stop and the lid to unlock, before trying to restart the machine
2	TACHOMETER FAILURE (error code 1)	No signal from the tachometer	Contact Thermo Fisher Scientific technical service
3	TACHOMETER FAILURE (error code 2)	Variation of tachometer signal is too sharp.	Contact Thermo Fisher Scientific technical service
4	TACHOMETER FAILURE (error code 3)	Inconsistent tachometer signal	Contact Thermo Fisher Scientific technical service



## Chapter 5

### Using the Product

N°	Message	Description	Action
5	POWER FAILURE	Motor slip abnormally high	Contact Thermo Fisher Scientific technical service
6	LID UNLOCKED	Attempt to start the centrifuge while the lid is open	Close the lid completely and try again to start the centrifuge. If the problem persists, contact Thermo Fisher Scientific technical service
7	LID UNLOCKED	Warning, this is a major problem: The lid has been opened while the rotor is in motion.	Wait for the rotor to come to a complete stop. If problem persists, contact Thermo Fisher Scientific technical service
8	IMBALANCE	Buckets/samples are not balanced.	Wait until the rotor has stopped and the lid has been unlocked. Rebalance the samples, then try to start the run again. If problem persists, contact Thermo Fisher Scientific technical service.
9	MOTOR OVERTEMPERATURE	Motor temperature is too high	Contact Thermo Fisher Scientific technical service
10	CHAMBER OVERTEMPERATURE	Bowl temperature is higher than 43°C	May be because the ambient temperature around the centrifuge is too high. Verify that the centrifuge is installed far enough away from heat sources and that there is enough space around the machine to allow proper ventilation. If problem persists, contact Thermo Fisher Scientific technical service.
	COMMUNICATION FAILURE	(only if the centrifuge is in CQCS mode) The centrifuge has not received a request from the supervisor PC for over 2 minutes.	Verify that the supervision application is active on the supervisor PC.

**Safety** At any time when the instrument is able to detect and inform the operator of a fault condition the screen will display a special message from among the following.

**Imbalance:** Important vibrations which can damage the accessories, the unit and the samples have been detected. The cause is the bad balancing of the inserts. As soon as the motor stops, open the centrifuge and redistribute the samples to produce an equal weight on diametrically opposite sides of the rotor and, for swing-out rotors, on each side of the trunnion for each bucket.

Using the grease supplied ensure that the trunnions are regularly lubricated removing the old grease first with a clean tissue.

**Note** Never mix buckets from different sets on the same rotor. If the message persists, call an engineer.

**LID unlocked:** Displayed if the lid was not correctly shut. The instrument will inform you to close it correctly in order that it can start the requested run.

**Tachometer failure:** Displayed when an unrealistic speed situation is detected.

For example, if the measured speeds in two sequential measurement steps are very different, or if a power cut occurred or if the unit was switched off momentarily during a run, in which case speed

would be detected immediately upon switch-on. If speed is readable (certainly true in the later case) its real value will be displayed and in every case a TIME OUT safety lock will be applied, preventing the user from opening the lid for a set period after the speed reaches zero, or at least effects this lock-out period in the case of no detected speed.

**Motor overtemperature:** When using the centrifuge in bad conditions (e.g.: motor failing) a sensor detects an overtemperature in the motor and the run is automatically stopped.

**Chamber overtemperature:** When using the centrifuge in bad conditions or if the refrigeration system is failing, the chamber temperature can seriously increase depending on the speed level and the heat can damage the samples. At 45°C the run is automatically stopped.

Other safety features are also included in the centrifuge. There is no corresponding message but these features ensure safe use of your centrifuge:

- overspeed safety
- current limitation
- armour plating

## Operational Limitations

**Caution:** The Jouan **KR4i** Centrifuge is not explosion proof.

Using this centrifuge with explosive samples is entirely at the user's own risk. The use of inflammable or explosive materials or materials which give a violent chemical reaction is strictly forbidden.

## Expected bucket life

### Mechanical strength

Centrifuge buckets are manufactured from aluminium alloys of high mechanical strength and elasticity. During centrifugation their own mass and most importantly the load that they contain submit them to a stress load varying from some hundreds of kilograms to several tons. This stress varies according to the total mass and increases considerably with speed: it doubles with a speed increase of only 41%.

It is therefore essential to rigorously respect the limits of speed and load indicated in the instructions and even on the accessories themselves.

Exceeding these limits causes weakening followed by a total rupture of the metal.

**Mechanical fatigue      The phenomenon**

This normal physical phenomenon appears when a mechanical force is applied and relaxed repeatedly. The accumulation of alternate application and releasing of force (as in the number of runs) translates after a given number of runs into a very rapid reduction in mechanical strength. The item can no longer resist the same force as at the start of its life. If the force is applied repetitively with same intensity, it will rupture.

It is this phenomenon of excessive fatigue which is used when repeatedly bending and unbending a piece of wire or plastic in order to break-it.

Each centrifugation run is a fatigue run for the buckets.

**Bucket lifetime**

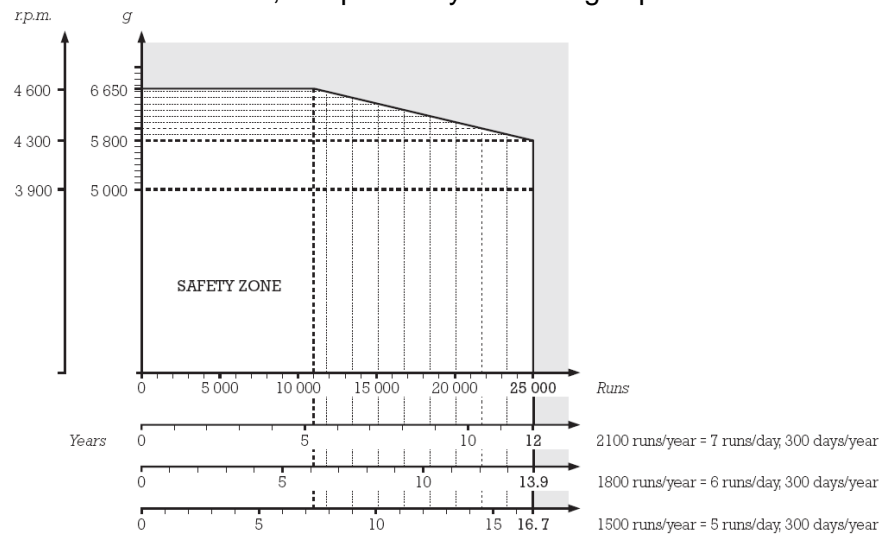
Rotors and buckets are marked with maximum lifetime ratings (in years and max number of cycles). In no case should these accessories ever be used past the lifetime for which they are rated. Ignoring the ratings exposes the user to serious danger

**Remarks:** The graphs show that „soft spin“ runs such as for obtaining PRP and for platelets from the buffy coat (up to 1500 x g or about 2200 rpm) do not incur any fatigue. So the number of runs carried out at low speed is not counted in the total for the calculation of the lifetime of the buckets.

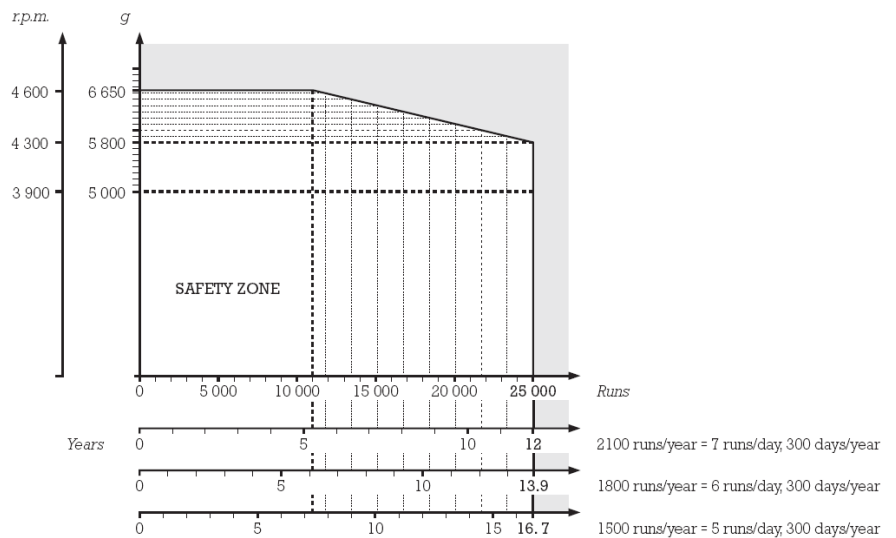
**Corrosion**

The above graphs have been established from tests carried out on samples of metal in perfect condition and over a period of many hours.

As the usable lifetime of the buckets is several years, it is important to take into account the wear due to corrosion, to which the buckets may have been submitted, independently of the fatigue phenomenon.



**Figure 5-5.** P6 Liners (11178112) In KR4.22



**Figure 5-6.** P4 LINERS (11178074) IN KR4.22

**Electrical risks**

High voltage is present behind the panels of the Jouan **KR4i**. It is not necessary for the user to intervene inside the machine. Only qualified technicians are authorized to do this. Do not remove these panels unless the centrifuge has been first disconnected from the power outlet.

**Improper**

- Never spin a rotor or its accessories at more than the maximum speed, indicated in chapter 3.
- Do not attempt to override the lid interlock assembly.
- Use only accessories designed for use in the Jouan **KR4i**.

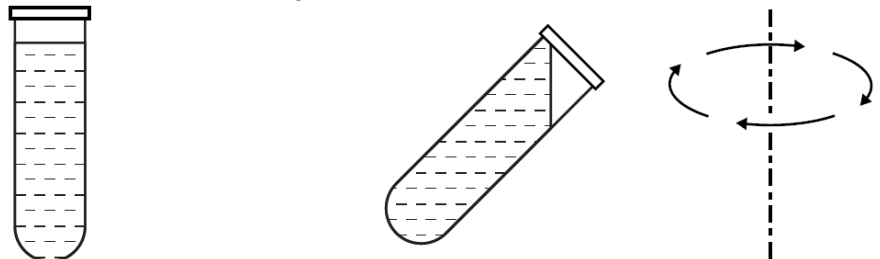
- Load the rotor only in the recommended way and do not spin higher than the speed indicated on the rotor and accessories. As the centrifuge starts to spin, an improperly loaded rotor could cause enough force to damage the drive shaft and the rotor chamber.

**Biological risks**

By the action of the turbulence created in the bowl a centrifuge is an aerosol generator. In the case of products presenting a biological risk you must take suitable precautions to prevent or reduce this risk and also train operators in the use of this instrument and its accessories in the context of their applications.

The following information should be given to all users including those persons using the equipment infrequently:

- A ventilated centrifuge (without built-in refrigeration) permanently exhausts into the room air which has passed through its bowl while a refrigerated (or thermostated) centrifuge contains a relatively sealed bowl. Thus the risks from the spread of aerosols are minimized in a refrigerated centrifuge and significant in a ventilated centrifuge.
- Aerosols are produced naturally when using uncapped tubes or bottles. They are also produced when a container deforms or breaks provoking a smaller or greater sample leak. We draw your attention to the use of tubes used in angle rotors. Even if the liquid level does not touch the cap when in a static state, it could do so during centrifugation and leak. You should therefore follow the instructions of the tube supplier concerning the fill level and sealing of the tube.



Once a biological risk is known or suspected, samples should be placed in a sealed container. Should such containers not be available, sealed accessories should be used such as buckets or angle rotors with sealed lids. Sealed rectangular buckets (11178140) are certified by CAMR - Porton Down for their containment efficiency. Unsealed buckets (11178138) are sealed if fitted with lid (11178216).

- Duration of aerosol presence: when aerosols are created in a centrifuge bowl they persist in the air for a period of 3-5 minutes after the rotor stops moving. Indeed, the action of opening the lid itself provokes the dispersion of aerosols in the environment.

- When an elevated risk of aerosols or of breakage is perceived the accessories should be handled using gloves and opened in an environment ensuring the protection of the operator (safety cabinet, glove chamber, wearing a mask...), even if they are apparently sealed.
- Those who use or service this equipment must wear appropriate personal protective gear given the type of solutions being centrifuged.

#### **Dangerous substances:**

It is recommended that the user takes all the necessary precautions when centrifuging substances known for their toxicity or radioactivity or when they are contaminated by microbiological pathogens (notably material of Risk Group II as identified in the „Biological Safety Manual for Laboratories“ edited by the World Health Organisation). See also chapter „contamination hazard“.

## Chapter 6 Maintenance



It must be immediately possible to identify the plug of the machine, which must also be easy to reach by the user.

Users must not use cleaning or decontamination methods different from those recommended without first having verified that these methods do not risk damaging the instrument or its accessories, and obtaining prior authorization from the manufacturer.

Users must use the adequate protection needed for the cleaning product used in each case.

Please note that no maintenance performed by the user requires the user to open the panels to expose the internal components of the centrifuge.

All service (other than routine service that can be performed by the user) must be performed by qualified technicians trained by Thermo Fisher Scientific.

### Daily Cleaning

Daily cleaning is not required, except in the event of glass breakage or a large amount of spillage in the rotor chamber or fairing.

If you wish to clean the control panel:

- Turn off the centrifuge,
- Clean with a moist sponge and a soap product and rinse with a moist sponge. Dry with a lint-free cloth. To disinfect, if required, use 70% alcohol.

### Weekly Cleaning

- a. In the event of spillage between the chamber and the windshield, clean the rotor chamber with a detergent and water only. First, apply a mild water/detergent solution to a clean rag. Then use the rag to remove all traces of the spill from the bowl of the centrifuge and from the outside of the windshield if necessary. Next, take a clean rag and apply the mild water/detergent solution to it. Reclean the surfaces of the bowl and the windshield with this rag. Next, take a dry rag and remove all traces of the solution from the surfaces.
- b. The rotors and buckets should be washed with warm water (at <math><50^{\circ}\text{C}</math>) and a mild soap or detergent (for example: a household detergent for handwashing).

Rinse the rotor thoroughly with (preferably distilled) water. Dry the rotor or bucket, and preferably with hot compressed air store upside down.

- c. The Jouan **KR4i** centrifuge is equipped with a drainage hose, attached to the rotor chamber to enable rinsing the chamber when required.

To rinse and drain, operate the unit at 3000 rpm, at 20°C temperature for 1 minute.

## Periodic Preventive Maintenance

The following preventive maintenance procedures are required for the Jouan **KR4i** centrifuge:

- Ensure that the positioning instructions, as described in chapter 2.5, are always carried out (horizontability, anti-skid pads, castor positioning).
- Check the condition of all accessories (rotors, buckets, inserts, sealed lids).
- Check earth continuity protection (when undertaking any intervention inside the machine).

## Suggested Template for Annual Centrifuge Safety Inspection

### Visual verification of equipment

#### Stability

- Is the centrifuge level?
- Is the centrifuge stable?
- Is the centrifuge sitting firmly on the floor?
- Is the rotor firmly attached to the shaft?
- Is the seal between the bowl and motor attached?

#### Protective Elements

- Is the tachometer port plug in place?
- Are the lid lock latches in place?
- Are the lid lock eyes in place?
- Is the imbalance detector in place?
- Is the motor fixed firmly in place?
- Are the lid springs and hinges in place?
- Is the lid lock electrical system in place?
- When the lid is locked, is the bowl sealed?
- Are the external panels firmly attached?



**Condition of materials**

- Rotor
- Buckets
- Lid/bowl seal
- Bowl/motor seal
- Motor struts
- Lid latches
- Drive shaft
- Plastic bucket adapters
- Feet
- Dust on the condenser filter?
- Foreign objects in the bowl?
- Foreign objects in the windshield?
- Water in the bowl drain?

**Condition of electrical connections**

- Control panel attachments
- Attachments to power source, condensor, locks, switches, etc.
- Grounding and power cord

**Functional verification of  
equipment**

**Presence and function of safety systems**

- Lid lock switch
- Lid must not open while rotor is moving
- Machine must not start while lid is open
- Lid open detection system

**Abnormalities during use?**

- Noises
- Vibrations
- Temperature effects
- Abrupt impacts

**Function of automatic/manual shutdown systems**

- Imbalance shutdown
- Lid open shutdown
- Stop button shutdown
- Overtemperature shutdown

### Verification of adjustments

- Circuit breaker shutdown

### Condition of springs

- Lid lock springs
- Lid support springs

### Recognition of abnormal play in mechanical systems

- Lid opening process
- Motor/bearings

### Condition of pieces susceptible to wear

- Bearings
- Carriers, adapters, linersa
- Buckets
- Rotors

### Adjustment of 'end of run' systems

- Lid lock mechanisms
- Lid open detector

### Verification of condition of indicators

### Condition of measurement systems

- Tachometer
- Other measurement systems (temperature, etc.)

### Condition of displays

- Read-outs
- Indicator lights

## Rotor Removal



Changing the type of rotor on the Jouan **KR4i** must be carried out by qualified and authorised personnel, given the adjustment of overspeed control necessary for the type of rotor installed. Please consult your Thermo Fisher Scientific supplier for any operations of this nature.

- Changing the type of rotor on the Jouan **KR4i** must be carried out by qualified and authorized personnel, given the adjustment of overspeed control necessary for the type of rotor installed. Please consult your Thermo Fisher Scientific supplier for any operations of this nature.
- Using the wrench supplied, remove the rotor mounting screw.
- Use the hub-puller supplied: place its screw above the top of the motor shaft.
- Tighten the puller screw clockwise until the rotor is pulled out completely (use wrench supplied if necessary).
- To reinstall the rotor, refer to section 4.7.

This operation must only be done by trained and qualified staff.

The Jouan **KR4i** and buckets used with the Jouan **KR4i** are very heavy. When handling these accessories, take appropriate precautions to prevent back or other skeleto-muscular injury.

#### Fuse Replacement

Changing of fuses must not be carried out by the operator but by a qualified engineer who will diagnose the fault before replacing the fuses.

Fuses:		
Main pcb	T 5 x 20, 160 mA	26387014
Supply pcb	F1 T 5 x 20, 63 mA	86001807
Supply pcb	F2 T 5 x 20, 250 mA	34000207

## LID Opening - Manual LID Unlocking

See chapter 4



## Chapter 7 Disposal of Product

The following disposal recommendations are valid for the machine (or its accessories) at the end of its useful life, or the parts that must be disposed of because they are worn out or degraded during use.

Prior to disposal, the machine and accessories must be decontaminated.

In this respect the user is required to submit a decontamination certificate, completed and signed, to the company or persons who are in charge of disposal.

The elements of the product that may become noxious during the life of the product are the following:

- Electric batteries and accumulators situated in the front panel of the machine among the other electrical and electronic components,
- Oil in the compressor of the refrigeration system,
- Refrigerant.

Disposal of these elements must be in accordance with applicable regulations and recommendations defined by the relevant regulatory bodies. In addition, these elements must be disposed of differently based on the different noxious substances they contain (possibly by a specialized disposal company).



## Annex A **Warranty conditions**

The warranty period begins on the day of delivery. During the warranty period, the centrifuge will be repaired or replaced at no charge if production or material defects can be demonstrated.

The prerequisite for warranty claims is that

- the centrifuge is used for the purpose intended as described in this operation manual
- and that installations, enhancements, adjustments, alterations or repairs are carried out only by persons authorized by Thermo Fisher Scientific.
- to perform the regularly required maintenance and care.

Warranty conditions



## Annex B Declaration of conformity

### Great Britain

**WEEE Conformity** This product is subject to the regulations of the EU Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96. It is marked by the symbol opposite. Thermo Fisher Scientific has entered into agreements with recycling and disposal companies in all EU Member States for the recycling and disposal of this device. For information on recycling and disposal companies in Germany and on the products of Thermo Fisher Scientific, which fall under the RoHS Directive (Restriction of the use of certain hazardous substances in electrical and electronic equipment), please visit the website [www.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS)

### Deutschland

**WEEE Konformität.** Dieses Produkt unterliegt den Bestimmungen der EU-Richtlinie für Elektro- und Elektronik-Altgeräte (WEEE-Richtlinie 2002/96). Es ist durch das nebenstehende Symbol gekennzeichnet. Thermo Fisher Scientific hat mit Verwertungs- und Entsorgungsbetrieben in allen EU-Mitgliedstaaten Vereinbarungen zur Wiederverwertung oder Entsorgung dieses Gerätes getroffen. Angaben zu Verwertungs- und Entsorgungsbetrieben in Deutschland sowie Informationen zu Produkten von Thermo Fisher Scientific, die unter die RoHS-Richtlinie fallen (engl. Restriction of the use of certain hazardous substances in electrical and electronic equipment: „Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten“), finden Sie im Internet unter [www.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS)

### France

**Conformité DEEE** Ce produit est soumis aux dispositions de la directive UE pour les déchets d'équipements électriques et électroniques (directive DEEE 2002/96). Ceci est caractérisé par le symbole ci-contre. Thermo Fisher Scientific a signé des conventions avec les entreprises de recyclage et d'élimination dans tous les pays membres de l'UE en ce qui concerne le recyclage ou l'élimination de l'appareil. Indications concernant les entreprises de recyclage et d'élimination en Allemagne et informations sur les produits de Thermo Fisher Scientific, qui sont concernés par la directive RoHS (angl. Restriction of the use of certain hazardous substances in electrical and electronic equipment: « Restriction de l'utilisation de certaines substances dangereuses dans les équipements électriques et électroniques »), que vous pouvez consulter sur Internet à l'adresse [www.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS)

### España

**Conformidad con WEEE.** Este producto cumple con las disposiciones de la Directiva europea sobre equipos eléctricos y electrónicos usados (Directiva WEEE 2002/96). Ello se indica con el

símbolo al margen. Thermo Fisher Scientific tiene firmados acuerdos con varias empresas de reciclaje y eliminación de residuos de todos los estados miembros de la U.E. respecto a la reutilización y la eliminación de este aparato. Para obtener información sobre las empresas de reciclaje y eliminación de residuos en Alemania, así como sobre los productos de Thermo Fisher Scientific afectados por la Directiva RoHS (del inglés „Restriction of the use of certain hazardous substances in electrical and electronic equipment“ - „Restricción de ciertas sustancias peligrosas en aparatos eléctricos y electrónicos“), visite la página Web [www.thermo.com/WEEE-RoHS](http://www.thermo.com/WEEE-RoHS)

## Italia

**Conformità RAEE.** Questo prodotto è soggetto alle disposizioni della direttiva CE sui rifiuti di apparecchiature elettriche ed elettroniche (Direttiva RAEE 2002/96). È contrassegnato tramite il simbolo a lato. Thermo Fisher Scientific ha preso accordi con aziende per la valorizzazione, smaltimento e trattamento in tutti gli stati membri della UE per il riutilizzo o smaltimento e trattamento di questi dispositivi. Indicazioni su aziende per la valorizzazione, smaltimento e trattamento in Germania così come informazioni su prodotti di Thermo Fisher Scientific, che rientrano sotto la direttiva RoHS (in ingl. Restriction of the use of certain hazardous substances in electrical and electronic equipment: „Restrizione dell'uso di determinate sostanze pericolose negli apparecchi elettrici ed elettronici“), sono disponibili su Internet sotto [www.thermo.com/WEEE-RoHS](http://www.thermo.com/WEEE-RoHS)

## Nederland

**AEEA-conformiteit.** Dit product is voorwerp van de bepalingen van de EU-richtlijn betreffende afgedankte elektrische en elektronische apparatuur (AEEA-richtlijn 2002/96. Dit wordt aangeduid door het symbool hiernaast. Thermo Fisher Scientific is met afvalverwerkende bedrijven in alle EU-Lidstaten overeengekomen om dit apparaat te recyclen of veilig te verwijderen. Gegevens over de afvalverwerkende bedrijven in Duitsland evenals informatie over producten van Thermo Fisher Scientific, die onder de RoHS-richtlijn vallen (engl. Restriction of the use of certain hazardous substances in electrical and electronic equipment: „Beperking van het gebruik van bepaalde gevaarlijke stoffen in elektrische en elektronische apparaten“), vindt u op het Internet terug onder [www.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS).

## Portugal

**Conformidade com a Diretiva Europeia REEE.** Este produto está sujeito às determinações da Diretiva Europeia de Resíduos de Equipamentos Elétricos e Eletrônicos (Diretiva REEE 2002/96). Isto é caracterizado pelo símbolo ao lado. Thermo Fisher Scientific A fechou um acordo com todas as empresas de reciclagem e de eliminação de resíduos em todos os Estados-Membros da UE para que o produto seja reciclado ou eliminado. Quaisquer informações sobre as empresas de reciclagem e de eliminação de resíduos na Alemanha, bem como sobre produtos da Thermo Fisher Scientific, que estão sujeitos à Norma RoHS (em inglês: „Restriction of the use of certain hazardous substances in electrical and electronic equipment“) „Restrição do Uso de Substâncias Nocivas nos equipamentos elétricos e eletrônicos“ podem ser encontradas no site [www.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS)

Declaration of conformity

## DECONTAMINATION INFORMATION CERTIFICATE

Complete and attach to equipment *BEFORE* servicing

(instructions on reverse)

**(PLEASE PRINT)**

DECONTAMINATION

CERTIFIED BY \_\_\_\_\_ TITLE/POSITION \_\_\_\_\_

PHONE \_\_\_\_\_ FAX \_\_\_\_\_ DEPARTMENT \_\_\_\_\_

INSTITUTION \_\_\_\_\_ ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

INSTRUMENT \_\_\_\_\_ SERIAL NUMBER \_\_\_\_\_

ROTOR \_\_\_\_\_ SERIAL NUMBER \_\_\_\_\_

PART \_\_\_\_\_ PART NUMBER \_\_\_\_\_

HAZARDOUS CONTAMINANTS(S) \_\_\_\_\_ DECONTAMINATION DATE \_\_\_\_\_

DECONTAMINATION METHOD(S) \_\_\_\_\_

DECONTAMINATION

CERTIFIER'S SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

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CERTIFIER'S SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

## INSTRUCTIONS

When an instrument that has been used with radioactive, pathogenic, or otherwise hazardous materials requires servicing by Thermo Fisher Scientific personnel either at the customer's laboratory or at Thermo Fisher Scientific facilities, the following procedure must be complied with to insure safety of our personnel:

1. The instrument or part to be serviced shall be cleaned of all blood and other encrusted material and decontaminated prior to servicing by our representative. No radioactivity shall be detectable by survey equipment.
2. A Decontamination Information Certificate shall be completed and attached to the instrument or part.

If an instrument or part to be serviced does not have a Decontamination Information Certificate attached to it, and, in our opinion, presents a potential radioactive or biological hazard, our representative will not service the equipment until proper decontamination and certification has been completed.

If an instrument is received at our Service facilities and, in our opinion, poses a radioactive or biological hazard, the sender will be contacted for instructions as to disposition of the equipment. Disposition costs will be borne by the sender.

Decontamination Information Certificates are included with these Operation Instructions. Additional certificates are available from your local technical or customer service representative. In the event these certificates are not available, a written statement certifying that the instrument or part has been properly decontaminated and outlining the procedures used will be acceptable.

**NOTE:** Thermo Fisher Scientific Service representatives will indicate on a Customer Service Repair Report if decontamination was required, and if so, what the contaminate was and what procedure was used. If no decontamination was required, it should be so stated.

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*E-mail Technical Service Representative for **Thermo Fisher Scientific** brand products at [techsupport.led.asheville@thermofisher.com](mailto:techsupport.led.asheville@thermofisher.com)*

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