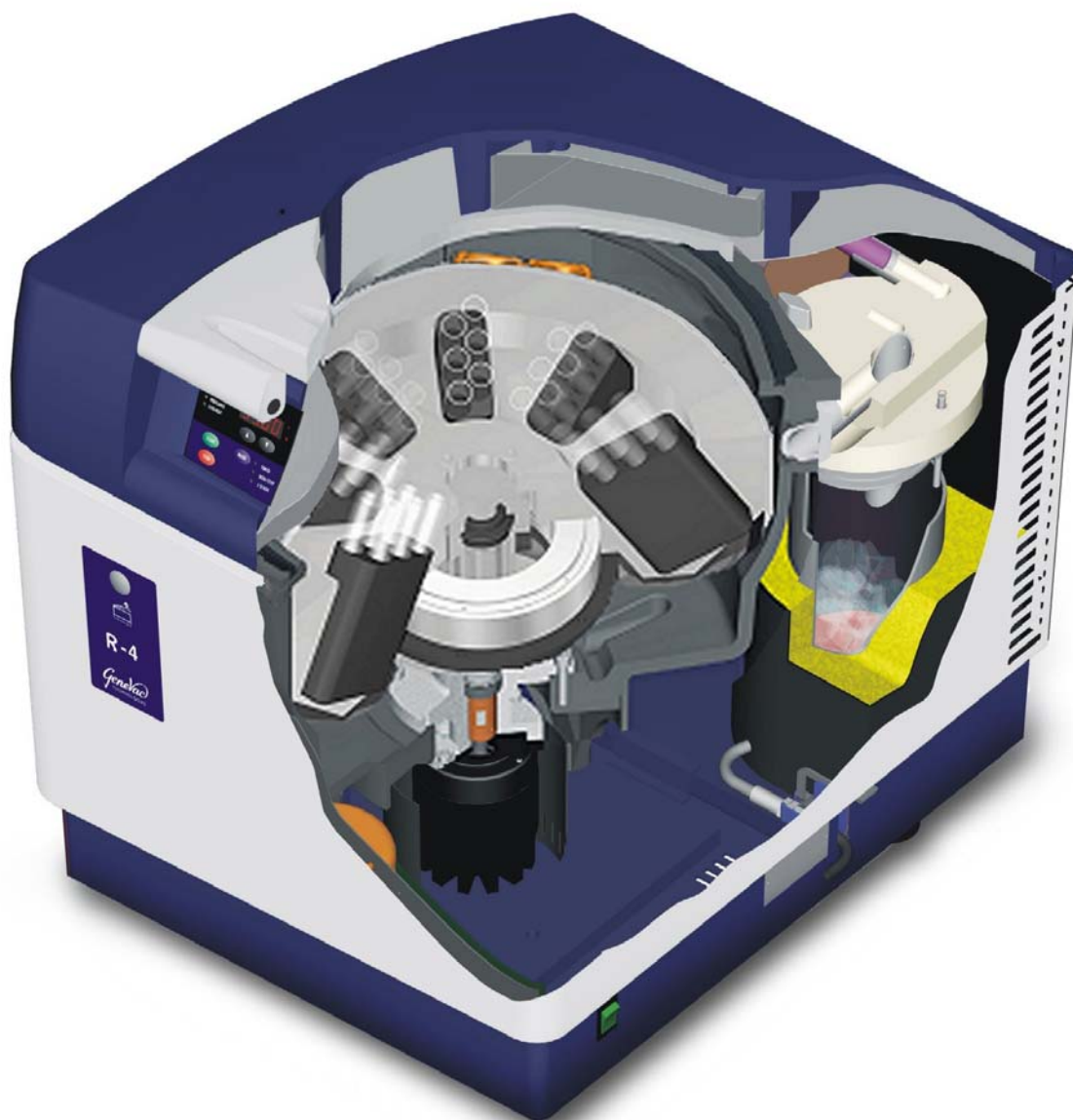


# The Genevac R4 Evaporation System



## User Manual

Issue 1-4 – June 2008

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These instructions are subject to change without notice.

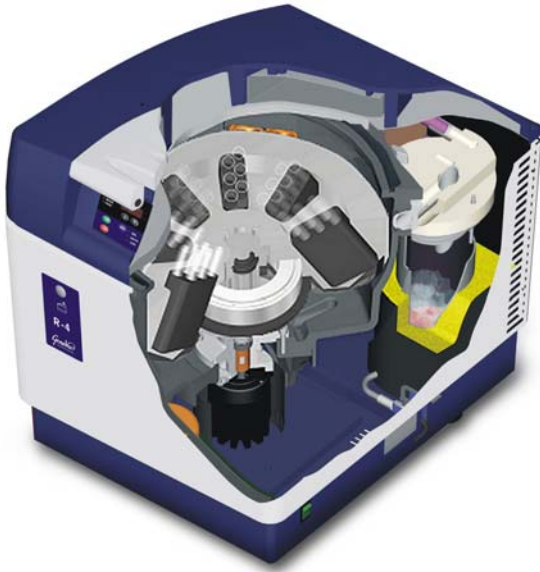
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These operating instructions should be read before you use the Genevac R4 Evaporating System.

Keep them near the system for easy reference.

Your attention is drawn in particular to Section 4 Safety.



## 1 Introduction

The Genevac R4 range of evaporation systems are state-of-the art and represent a significant step forward in evaporation technology for the R&D laboratory.

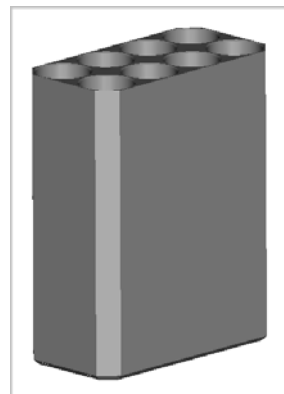
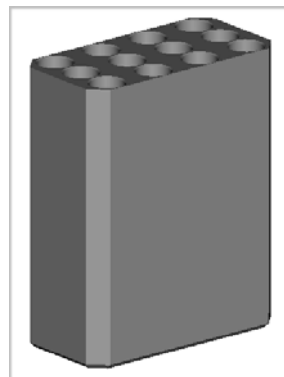
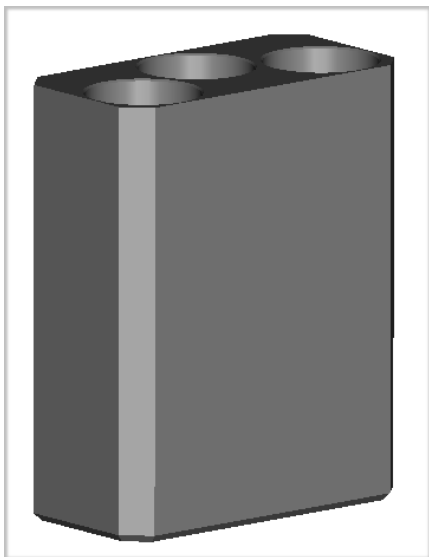
Drawing on extensive experience in the drug discovery field, the R4 systems are designed to provide very high performance coupled with ease of use.

As you will discover, the system is simple to set up, easy to operate and very flexible.

The status of the system is displayed and controlled on a single keypad, display module indicating the run time, the vacuum, rotor temperature and chamber temperature on digital displays.

Simple to use up-down controls enable the run time, rotor and chamber temperatures to be set in an instant and single push buttons set the other functions.

This manual will guide you through the start up requirements, set up needs and operation of the system to facilitate the most efficient procedure to protect your product's integrity and to ensure optimum performance at all times.



## 1.1 Safety

The following safety symbols are used throughout this manual.

The definitions and scope of each symbol is as described below.

### WARNING



**THIS SYMBOL WILL INDICATE HAZARDS THAT CAN LEAD TO SERIOUS MATERIAL DAMAGE OR POTENTIAL SERIOUS INJURY.**

### Caution



**This symbol will give information about hazards that can be harmful to your health or lead to material damage.**

### Note



This symbol will give information about technical requirements which if not followed, can lead to malfunctions, inefficiency and reduced productivity.

### **Genevac and the ATEX Directive:**

Please note that it remains the responsibility of the user to consider any solvents being evaporated within the context of the ATEX directive. The presence of solvents on the list above indicates only that they will not damage the system. If further information is required, please contact your Sales Representative or visit <http://www.genevac.com/>

### **Genevac Evaporators and Combustible Solvents**

Please note it remains the responsibility of the user to consider safety when evaporating any combustible solvents and ensure the system is placed in a well ventilated environment. Genevac's position regarding evaporation of such solvents, particularly with respect to the European ATEX directive, is available on our website or from your local sales representative.



**IMPORTANT**  
**THIS SYSTEM MUST BE**  
**EARTHED – SEE PAGE 18**

**2 System description**

The basic R4 Evaporation System is comprised of an evaporation chamber and rotor.

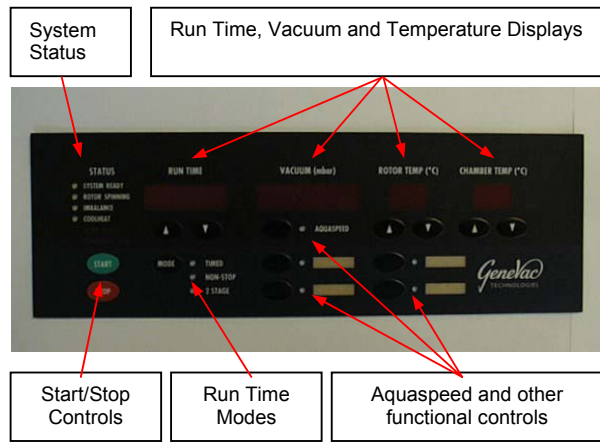
The diagram below shows the R4, combined with the in-built cryopump-condenser unit.

Vacuum is provided by the unique, corrosion proof Genevac CVP vacuum vapour pump (although other types of vacuum pumps can be used).

The control of chamber, bucket and sample temperature, vacuum ramping rate, chamber pressure, rotor speed and run time are all handled by an onboard microprocessor.

The display-keypad enables the user to change the parameters quickly and easily and displays the status of the system in an uncomplicated and easily assimilated manner.

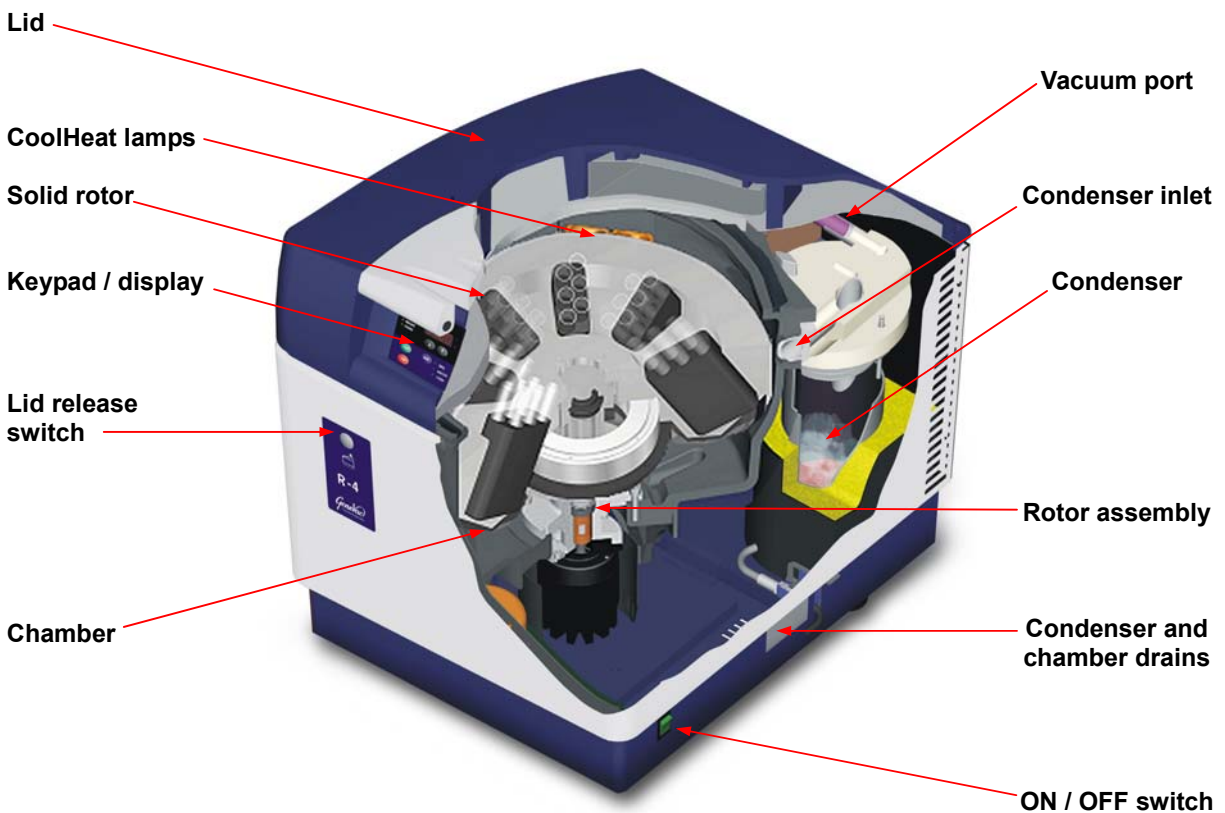
Each R4 is fitted with an Autobalance unit. Inside which, there is a number of loose balls that can move freely in a raceway. When an imbalance occurs, the balls will automatically strive to find the positions that neutralize the imbalance. The balls place themselves to act as counterweights.



The R4 incorporates the RotoGuard infrared temperature detection system, which monitors and controls the maximum temperature of the sample rotor.

The system also incorporates the Aquaspeed control system to increase the evaporation rates with water and aqueous solvent mixtures.

When selected, Aquaspeed controls the system pressure to prevent water from freezing and thus increases evaporation rate.



### 3 Scope of delivery and installation

You will have purchased your system with or without the option of commissioning by Genevac personnel and possibly, without the option of a Genevac vacuum pump and integral condenser.

Reference will be made in the following notes to the installation procedures required to cover these options.



On delivery, it is advisable to unpack your system at the point of receipt, to ease the movement of the component parts to the point of use.

#### 3.1 Checking the delivery



Check the contents of the delivery as soon as possible against the delivery note and notify Genevac Ltd immediately of any missing or damaged parts. (Refer to section 10 for contact details).

#### 3.2 Arranging commissioning

If your system is to be delivered separately, Genevac Ltd will contact you prior to the delivery, to agree a date to commission your system.

#### 3.3 Training



Commissioning will normally include training in the basic operation of the System. Further in house training is recommended to fully exploit the flexibility of the system.



**THE R4 EVAPORATOR MUST NOT BE OPERATED BY PERSONNEL WHO LACK THE TRAINING OR PROFESSIONAL EXPERIENCE TO COMPREHEND THE HAZARDS THAT CAN ARISE WHEN USING THE SYSTEM.**

Personnel without such training require thorough instruction. These operating instructions should form the basis of this instruction.

#### 3.4 Positioning the evaporator

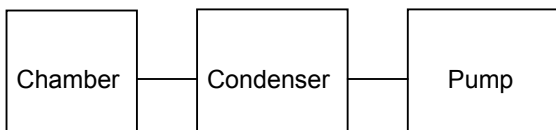


**POSITION THE EVAPORATOR AT LEAST 300 MM AWAY FROM THE EDGE OF A BENCH AND THE SAME DISTANCE CLEAR OF BREAKABLE OBJECTS OR AREAS WHERE ENTRAPMENT COULD OCCUR.**



**REFER TO PARAGRAPH 9 “LOCATION AND MOUNTING CONSIDERATIONS FOR EVAPORATORS FITTED WITH AUTOBALANCE”.**

**GENEVAC SHOULD BE CONSULTED FOR ADVISE ON ANY OTHER POSITIONAL REQUIREMENTS.**



### 3.5 Fitting a remote condenser (Optional)

The connecting relationship of the chamber, condenser and vacuum pump is as shown.

The connection for your remote condenser is located at the rear of the evaporator.

Connect your condenser to the evaporator chamber using a suitable Kline flange fitting.



It is recommended that a heated inlet tube is used to connect the chamber to the evaporator, to prevent solvent from condensing in the tube.

Please consult Genevac Sales for details of the range of heated inlet tubes available.

### 3.6 Fitting a vacuum pump

If your evaporator has an integral condenser, the connection for your vacuum pump is located at the rear of the evaporator.

Connect your vacuum pump to the evaporator using a suitable connecting pipe and Kline flange fitting.

If a Genevac pump has been supplied with your evaporator, the connecting pipe, fittings and power control lead will also be included.

Connect the power and control lead between the pump and the socket on the rear of the chamber.



**If a Genevac pump has been supplied, it must have an adequate supply of cooling air and the hot outlet must have at least 300 mm of space beyond the hot air grille in the pump base.**

**It should not be placed in a cupboard without special precautions to ensure adequate cooling.**

**Consult Genevac Service for advice in such cases.**

#### 4 Safety



**BEFORE OPERATING THE SYSTEM, IT IS IMPORTANT THAT THE FOLLOWING NOTES ARE READ TO ENSURE THAT THE IMPLICATIONS TO THE SAFETY OF PERSONNEL OPERATING THE SYSTEM AND FOR THE PROTECTION OF SAMPLE INTEGRITY ARE UNDERSTOOD.**

Samples in the chamber are subjected to accelerations of up to 500G.

The following precautions should therefore always be observed.

##### 4.1 Safe loading of rotor

Your system will operate with up to 350g of imbalance, BUT it is still important to load the solid rotor in systematic manner to ensure that this level is not exceeded.

Always try to load the rotor in a symmetrical and balanced manner.

If an odd number of full sample holders are to be loaded, then an empty sample holder is to be loaded to offset the imbalance condition, examples are shown opposite of acceptable loading configurations.

Rotate the rotor by hand after loading and check that all tube holders are correctly located before starting a run and before re-starting an interrupted run.

Do not load tubes into sample holders other than those types that have been approved by Genevac Ltd.

Do not use sample holders that have not been supplied with system without consulting Genevac Service.



**Genevac Ltd will accept no responsibility for any loss or damage incurred by improperly or excessively loaded rotors.**



## 4.2 Maintenance

Regular inspection and maintenance of the sample holders should be performed at least monthly. The following inspection routine is mandatory following any tube breakage or solvent spillage. Never use wet holders or rotors in an evaporator.

Inspection:



Visually inspect holders each month. Debris should be cleaned off, especially any in the sample holder wells as this may lead to glassware breakage. The number one cause of repeat glassware breakage is glass fragments from a previously broken tube. Sometimes the sample sticks the glass fragments to the inside of a holder well, and can be difficult to remove. Residual solvent / sample - should be cleaned off.

Superficial surface damage (e.g. scratches) will not affect the performance of a sample holder. If there is structural damage (a bend or deformation) of any part of a rotor or holder - do not use - contact Genevac for evaluation.

Cleaning:

Loose dirt or debris can be removed using a brush and / or airline. Adhered dirt / debris or sample / solvent residue should be cleaned off using methanol or acetone, soak sample holders if required. Holders should then be washed in clean water and fully dried before use.



### 4.3 Lid operation

The lid is secured by an electromechanical catch that is activated automatically to lock the lid.

Press the button on the front panel of the evaporator to release the catch.



Note that you will be unable to open the lid whilst the rotor is rotating.

Lift the lid past 45 degrees to ensure that it remains in the open position.



Note that when the lid is near its closed position, it is designed to close under its own weight.

### 4.4 Sample traceability

Each solid rotor has a label that indicates the cassette location.

Whilst this will aid loading, it is recommended that a separate log is kept of sample position when dissimilar products are loaded.

Alternatively, use a suitable label to identify the samples.

Note that labels can affect performance.

### 4.5 Limitations of use

Your R4 evaporating system is **unsuitable** for use under the following circumstances:

- With strong mineral acids such as HCl and HBr at any concentrations.
- **EVAPORATING DIETHYL ETHER AND SIMILAR LOW AUTO-IGNITION SOLVENTS WITHOUT A GENEVAC INERT GAS PURGE SYSTEM FITTED TO THE EVAPORATOR AND PUMP.**
- For use as a pressure vessel.





## 5 Getting started

The following notes describe the basic start up, set up and run instructions for your R4 evaporating system.

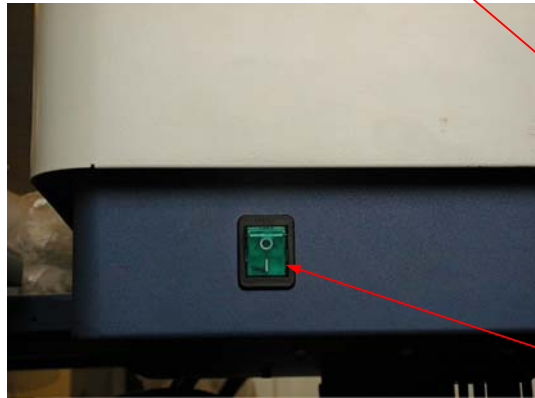
If a Genevac vacuum pump is fitted, the chamber is powered from the pump and so it is only necessary to connect the pump to a suitable mains power supply.

### 5.1 How to switch on the pump

Connect the pump to the mains and switch on the mains.

Switch the pump mains switch on as shown.

The pump will not be ready for use until the green ready light on the front panel is illuminated (Approx 7 minutes) – but power is available to the evaporator.



### 5.2 How to switch on the evaporator

Switch the mains switch on as shown.

**ALL** LEDs will light to check operation.

The **READY** light will be illuminated in red, to indicate that there is power to the evaporator.

Press **START** to power up the evaporator.

The vacuum pump and the condenser will start after a short delay.



The **READY** light will remain red until the pump and condenser have reached their operating temperature.

Amber indicates that the pump has reached its operating temperature but that the condenser has not yet reached its operating temperature.

The system is ready for use when the **READY** light is illuminated green.

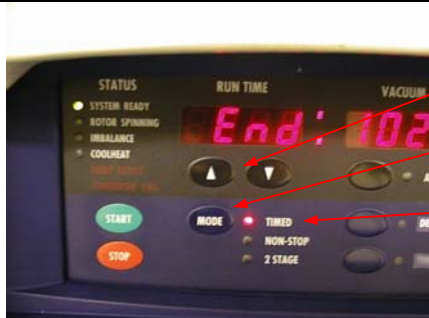
On power up, the **RUN TIME**, **VACUUM**, **ROTOR TEMP** and **CHAMBER TEMP** will be illuminated.



### 5.3 Using the keypad

The R4 keyboard controls and displays have been designed for ease and simplicity in use.

**Using and setting the timer**



During a run the **RUN TIME** can display either the elapsed time, **E** or the remaining time, **R**.

Press the up and down keys simultaneously, to toggle between the elapsed and remaining times.

The timer has three different modes that are accessed by pressing the **MODE** key.

The selected mode will be illuminated.

**Using the TIMED mode**

The **TIMED** mode is used when a predetermined run duration is required with CoolHeat.

The duration can be modified at any time prior to or during a run.

To set the run duration in **TIMED** mode use the up and down keys to input the desired run time.

Coarse setting is achieved by holding down either key.

Fine setting is achieved by pressing either key once.

A maximum time of 99 hours 59 minutes and a minimum time of 1 minute can be set. Elapsed or remaining time can be displayed in this mode.

**Using the NON-STOP mode**

The **NON-STOP** mode will run continually with the CoolHeat facility enabled, until the **STOP** key is pressed.

This mode is particularly useful if the evaporation time for a particular solvent or solvent mixture is not known. Only elapsed time is displayed in this mode.

**Using the 2 STAGE mode**

The **2 STAGE** mode is used when the CoolHeat facility is required for a predetermined period.

After this period has elapsed, the CoolHeat facility will be disabled and the system will continue to run at full vacuum until the **STOP** key is pressed. Elapsed or remaining time can be displayed during the first stage of this mode, but only elapsed time during the second stage.



This mode is particularly useful for lengthy evaporation times, when it may be necessary to run the system overnight.



**Since the CoolHeat facility will be disabled after the predetermined period, sample temperature may reach the temperature to which the chamber has been set.**

**The VACUUM Display**



The vacuum display indicates the absolute pressure of the system in millibar (mbar).

As the vacuum pump evacuates the system, the value will continually change, until the full vacuum capability of the pump is reached.

The key below the vacuum display enables the AQUASPEED function.

**Using the AQUASPEED function**

AQUASPEED has been developed to significantly improve system performance when evaporating water or water mixtures. It limits the system pressure to 8 mbar,

Press the AQUASPEED key to select this facility, the lamp will illuminate.

This function can also be used simultaneously with the optional DRI-PURE facility.

**Using the Rotor temperature control**



The maximum rotor temperature is monitored and controlled by the RotoGuard infrared temperature detection system.

The setting of this control determines the temperature at which the CoolHeat lamps are disabled.

For instance, if the temperature is set at 30°C, the CoolHeat lamps will be turned off when RotoGuard senses a temperature of 30°C.



Note that from power up, this control defaults to the previous settings.



To change the setting, press both keys simultaneously and the SET prompt will flash.

Use the up and down keys to set the required rotor temperature.

Hold the key down for coarse setting or press once for fine setting.

The value will be accepted and the display will revert to ACTUAL after a short period.

Press either key to display the set temperature at any time.

The display will automatically revert to the actual setting after a short period.

The temperature setting can be changed during a run using the same procedure.

**Using the Chamber temperature control**

This control displays and controls the temperature of the chamber.



If this is set above ambient, prior to a run, the run will not start until the chamber temperature has preheated to the set value.

Preheating will be indicated by the point between hours and minutes on the RUN TIME display flashing.

To change the setting, press both keys simultaneously and the SET prompt will flash.

Use the up and down keys to set the desired chamber temperature.

Hold the key down for coarse setting or press once for fine setting.

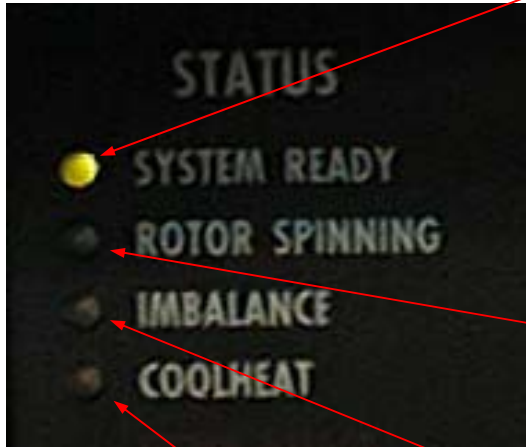
The value will be accepted and the display will revert to ACTUAL after a short period.

Press either key to display the set temperature at any time.

The temperature setting can be changed during a run using the same procedure.



The STATUS indicators



The status of the system is indicated by the row of lamps on the far left of the display.

When switched ON, the **SYSTEM READY** lamp will be red and all other lamps will be off.

On pressing the **START** key, the displays will be illuminated and the **SYSTEM READY** lamp will remain red until the pump and condenser are ready.

Note that from cold, the Genevac vacuum pump will take approximately 10 minutes to reach operating temperature.

When the run commences (after preheat if required), the **ROTOR SPINNING** lamp will be illuminated green.

Note that the lid will not open whilst the rotor is rotating.

If an excessive out of balance is detected by the system, the red **IMBALANCE** lamp will be illuminated, flash and the run terminated.



In such cases, press the STOP button after the rotor stops, this shuts down the evaporator.

Correct the source of the imbalance.

The CoolHeat indicator lamp will be illuminated when the lamps are on.

Using Condenser



5.4 Condenser defrost

**The R4 is fitted with an Automatic Drain Valve, ensure that the chamber drain is connected to a suitable container.**

**Manual Defrost:**

Press the DEFROST button (to initiate the defrost cycle). The lamp will illuminate green. On completion of defrost cycle the lamp will turn red.

DEFROST and DRAIN can be terminated at any time by pressing the DEFROST button.



**During Manual Defrost the rotor should not be spinning or heated.**

**Automatic Defrost**

When the AUTO DEFROST button is pressed, the R4 is capable of continuous unattended operation.

Once the condenser is full the following will occur:

If the current run is a TIMED run and within 30 minutes of the end, then the run will end as normal:

The rotor will stop, lid lock release will be activated and the condenser will enter the DEFROST and DRAIN cycle.

If the run is a NON STOP or TWO STAGE run or the run has more than 30 minutes remaining, then the automatic DEFROST and DRAIN cycle will commence.

When the DEFROST and DRAIN cycle has completed, the run will continue.

Using the DRI-PURE feature

5.5 Dri-Pure

**DRI-PURE** combines a high rotational speed with a gradual reduction of vacuum over a predetermined period, at the end of which the full vacuum capability of the vacuum pump comes into effect.

This feature is particularly useful in preventing bumping, (the violent boiling of solvents), resulting in solvents and compounds being expelled, which is a source of cross contamination of samples.

Bumping can also cause products to be deposited on the glass lenses of the CoolHeat lamps, which eventually results in breakages.

To select this feature press the **DRI-PURE** key, the lamp will illuminate.

Note that during the **DRI-PURE** cycle, which is approximately 40 minutes, the CoolHeat function will be disabled.



### **6 Technical data**

#### **Controls**

Temperature control range	Ambient to 60°C
Temperature Accuracy	+/- 2.5°C
Temperature control resolution	1°C
Temperature control	Infrared pyrometer
Temperature control range	0°C to + 60°C
Chamber temperature range	Ambient to 45°C
End of run	Run timer/continuous

#### **Mechanical data**

Max rotor speed	1300 standard
Max rotor speed	1800 Dri-Pure
Max Force	300-500G
Drive system	Direct
Operation imbalance	350g
Max load (swing rotor)	8 x 1.0 kg @ 500G
IR lamps number	2
Weight	120 kg

#### **Vacuum system**

Pressure display/resolution	0 -1200 mbar/1.0 mbar
Pressure control (Aquaspeed)	8 mbar
Dri-Pure	Yes
System ultimate vacuum	0.5 mbar (CVP 100 pump)
Auto vacuum vent valve	Yes
Vacuum chamber	Cast aluminium with corrosion proof coating
Inert gas purge	External option

#### **Condenser data**

Condenser temperature	-40°C
Vacuum condenser capacity	2.0 litres
Condenser level detector	Yes
Condenser chamber	Stainless steel
Condenser drain valve	Automatic Stainless steel and PTFE

#### **Dimensions**

W x D x H (lid closed)	535 x 640 x 578 mm
H (lid open)	950 mm
Chamber diameter	458 mm

#### **Electrical**

Power supply	230V, 50Hz, single phase, 9A 208V, 60 Hz, single phase, 9A
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**7 EC Declaration of Conformity**

**We Genevac Limited**

Declare that this product:

**Series II Evaporating System**

Complies with the relevant Essential Health and Safety Requirements of the European Machinery Directive (89/392/EEC as amended by 91/368 EEC and 93/44/EEC). The EMC Directive 89/336/EEC and the Low voltage Directive 73/23/EEC.

Conformity is demonstrated by compliance with the following specifications:-

**EN 292 parts 1 & 2:1991**, Safety of Machinery - Basic concepts, general principles for design

**EN 60204-1:1998**, Safety of machinery– Electrical equipment of machines-Pt 1 General Requirements

**EN 249: 1992**, Safety of machinery– Safety distances to prevent danger zones being reached by upper limbs.

**EN 1088: 1996**, Safety of machinery. Interlocking devices associated with guards. Principles of design and selection.

**EN 1050: 1997**, Safety of machinery. Principles of risk assessment.

**BS EN 50082: 1998**, Electromagnetic compatibility- Generic immunity standard.

**BS EN 61010-2-020: 1995**, Safety requirements for electrical equipment for measurement, control and laboratory use. Particular requirements for laboratory centrifuges.

**8 Safety**



**WARNING!**

**THIS SYSTEM MUST BE EARTHED**

**THIS EVAPORATOR IS A SAFETY CLASS 1 PRODUCT ACCORDING TO IEC CLASSIFICATION. IT MUST NEVER BE USED WITH ANY INTERRUPTION TO THE SAFETY EARTH CONDUCTOR. IT IS AN INSTALLATION CATEGORY II PRODUCT AND IS INTENDED TO OPERATE FROM A NORMAL SINGLE-PHASE SUPPLY.**

**THIS EVAPORATOR HAS BEEN DESIGNED TO BE USED IN A POLLUTION DEGREE 1 ENVIRONMENT (NO POLLUTION, OR ONLY DRY NON-CONDUCTIVE POLLUTION).**

**ANY MAINTENANCE OR REPAIR OF THIS PRODUCT SHALL BE CARRIED OUT BY GENEVAC PERSONNEL (OR APPROVED REPRESENTATIVES OF GENEVAC) USING ONLY APPROVED SPARE PARTS**

**9 LOCATION AND MOUNTING CONSIDERATIONS FOR EVAPORATORS FITTED WITH AUTOBALANCE**

The performance of Genevac's autobalance can be affected by the resonant characteristics of the bench or trolley on which the evaporator is mounted. Therefore, it is important that evaporators fitted with autobalance are mounted either on a heavy stiff laboratory bench or on a Genevac Series II evaporator trolley. In addition, it is a requirement that evaporators fitted with autobalance are bolted to the bench or trolley. The five mounting feet on all systems are provided with a M10 female thread for this purpose.

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**(1) 914 267 2211**

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**10 Useful information**

If you need to contact Genevac for assistance, use either the telephone or fax Hotlines given.

It will always help Genevac Service if you have the serial numbers at hand for the components of your system

If you need to contact Genevac Sales for information on Service Contracts or products, use the telephone or fax Hotlines given.

Alternatively, Email or visit our web site.