

Title of WTCHG Guidance Note:

Risk Assessment & Guidance on the use of Laboratory Centrifuges

Cross Ref. to University of Oxford Policy Statement:

Introduction

This document outlines the risks associated with the type of Centrifuge equipment currently used within the Centre and includes guidelines that must be followed to ensure the safety & health of all operators .

What types of Laboratory Centrifuges are in use?

See *Appendix A*

Responsibilities

All **Users** must ensure they are fully aware of the risks associated with working with Centrifuge equipment & understand the appropriate actions to be taken before they start using the equipment.

Group Heads must ensure that appropriate supervisor is appointed to provide suitable and sufficient training.

Group Heads must ensure that the above is implemented and that on an annual basis an inspection of the equipment is undertaken and the findings given to the H&S Officer.

NOTE: This guideline should be read in conjunction with the equipment's 'User Guide'.

Hazards

The significant risks are from:

- Mechanical failure of rotating parts (often violent).
- Contact with rotating parts.
- Sample leaks causing aerosols, stress corrosion, contamination.
- Sample imbalance causing machine movement / walking (or stress failure of component parts).
- Fire or explosion.
- Health (contact with contaminated components / vapours).

The most likely incidents to occur are from exposure to the user of hazardous substances from spills & leakages. By following the guidelines set out below, this can be controlled so that the associate risk to the user is minimal.

In exceptional circumstances though, the most serious incident that could occur, would be the rotor separating from the spindle and smashing into the side. This could occur, but is only likely following incorrect usage. Even it does occur; the centrifuges used are built so as to contain any incident. However correct usage is paramount and strict training is required in the following procedures.

Control Measures

- Access to the rotor assembly whilst it is in motion must be prevented by means of an interlock on the lid.
- The access lid of the centrifuge must be strong enough to withstand any internal impact that may occur should a breakage in the rotor assembly or bucket occur during use. The lid should contain the contents of the rotor assembly and bucket surviving any such impact.
- Centrifuges must never be operated above the maximum recommended speed.
- All blood and pathogenic samples must be spun in sealed secondary containers.
- Any undue noise or vibration during the operation of a centrifuge must be investigated immediately. A competent person should be called to diagnose and correct the fault before it is put to further use (***The first point of contact should be lab-support, who will advise as to the level of competence required***)
- The supervisor of a research group (e.g. Group Head) that use centrifuges must ensure that all users are properly instructed in the correct use of the apparatus.
- **A record of usage must be kept for all high-speed centrifuges.**

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- The manufacturer's recommendation for cleaning and where necessary for decontamination should be closely followed.
- All centrifuges must receive regular maintenance by a competent person, including a check on the rotors and buckets. Records must be kept of all maintenance work whether such work is carried out in-house or not. (*Details on the level of checks required are given below*).

In General

Log Books & Maintenance

- You **must** complete the user log for all ultracentrifuges; high speed centrifuges and super speed centrifuges. This is essential where manufacturers' rotor derating systems apply (reducing maximum speed) to prevent rotor fatigue and other mechanical hazards. Each user log entry must include the User's Name; Date of Use; Sample Description; Number of Runs; Run Time; Run Speed & Rotor Serial Number.
- If you find a centrifuge is experiencing problems &/or maintenance is required, take it out of service immediately by disconnecting from the power source and clearly marking it **DO NOT USE**. Notify lab-support@well.ox.ac.uk to ensure the appropriate service engineer is contacted.
- Maintenance & Service for all high-speed centrifuges must only be carried out by competent individuals, namely the manufacturer's service engineer.
- For all general-purpose low-speed centrifuges and microcentrifuges, a routine inspection program must be set up by each group. A record must be kept of annual inspections to identify any non-compliance. The following questions should be asked for each centrifuge used by a group.
 - Is there a list of trained users?
 - Do inter-locks appear satisfactory? I.e. can the rotor be accessed while it is in motion?
 - Are the correct rotors used with each specific centrifuge?
 - Are there signs of damage to the rotors or chamber?
 - Are there signs of contamination on the rotor or in the chamber?
 - Are samples being loaded correctly and have they been balanced before use?
 - Has the instrument been electrically tested within the last 12 months?
 - Is the instrument used for biologically hazardous material such as Blood, Hazard Group II organisms or high-risk cell lines or primary cells? If so is the instrument regularly decontaminated and is it affixed with a Biohazard symbol?
 - Is the instrument used for radioactive? If so is the instrument regularly decontaminated and is it affixed with a Trefoil symbol?
- Always ensure the rotor & centrifuge is cleaned and left in readiness for the next user. If the rotor is not kept clean and chemicals remain on the rotor, stress corrosion will result. Also, any moisture left for an extended time can initiate corrosion. It is important that the rotor is left clean and dry. (Wash with mild detergent (see user manual for guidance – but certainly not corrosive substances) and warm water (careful use of manufacturers kits may be necessary). Dry the rotor thoroughly and store upside down with the cover and tubes removed.

User Guidance

Know what you are doing before you start

- Always check your user manual for specific requirements as well as load limitations and speed, before using a Centrifuge for the first time or changing rotors etc.
- If you are not absolutely certain on how to operate the instrument safely, you **must** refer to the user manual, and/or ask your supervisor/H&S Officer or lab-support for assistance.

Plan ahead

- Always plan your work and ensure centrifuges are booked, rotors are clean, chambers are cooled, lids are available etc. way in advance of when you actually need to use them. Leaving things to the last minute often increases the risk of incorrectly setting up the instrument.

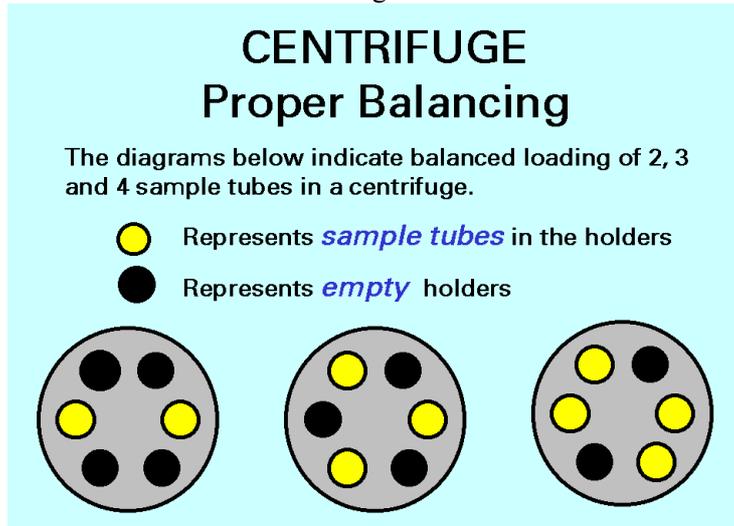
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Set up the instrument correctly

- Never operate a centrifuge near highly flammable material or where vibration could cause items to fall off near-by shelving.
- The centrifuge must always be secured and stable before use. Ensure all suction cups (benchtop models), wheel brakes (floor models) etc. are in place before starting. Movement of the instrument can damage parts and injure users.
- Never operate the rotor unless it is symmetrically loaded throughout the rotor and balanced. Care is required to achieve this and the manufacturers user guide should be consulted for tolerance on balance.



Use the correct rotor

- Use only rotors appropriately designed for the instrument in use. Check the user manual before commencing.
- Examine the rotor, its lid and seals for cleanliness and damage (a build-up of chemicals from spillage's may cause a tube to jam in the rotor or cause corrosion that could lead to a rotor failure). Damaged rotors must not be used and should be reported to lab-support@well.ox.ac.uk immediately. Dirty rotors must be cleaned before use (see maintenance above).
- Never exceed the maximum recommended speed for the rotor.
- Rotors have a finite life and often the maximum speed of some high-speed rotors, is lowered as their life progresses (this is known as derating). Ensure you are aware of any required derating by consulting the manufacturers user guide.
- Do not operate the centrifuge without the appropriate rotor cover securely fitted and its seals in place.

Ensure the samples are prepared correctly

- The maximum and minimum levels on centrifuge tubes must be adhered to at all times – see manufacturer instructions for details.
- Never fill centrifuge tubes above the maximum density weight recommended by the manufacturer. Ensure samples of similar density are in opposite positions on the rotor.
- Check compatibility of tube material to solvent medium (some solvents may cause the tubes to swell or crack in the rotor).
- Always use sample tubes or bottles designed for the particular rotor being used
- Ensure sample tubes are capped, where required, and that any buckets used are correctly fitted with their lids. This will prevent any aerosol release.
- Plastic centrifuge tubes should be used whenever possible to minimise breakage. However plastic centrifuge tubes should only be used once after ultracentrifugation, as they are liable to crack.

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- Nitrocellulose tubes should only be used when clear (without discoloration) and flexible. It is advisable to purchase small lots several times a year rather than one large lot. Storage at 4°C extends the shelf life. Nitrocellulose tubes must not be used in fixed angle rotors.
- Tubes to be used in fixed angle rotors must never be filled to the point that the liquid is in contact with the lip of the tube when it is placed in the rotor, even though the meniscus will be vertical during rotation. When the tube lip is wetted, high G force drives the liquid past the cap seal and over the outside of the tube.
- If biohazardous material or radioactive material is to be centrifuged, the instrument must be affixed with warning signs before commencing. All appropriate lids must be used and secured at all times. Opening of vessels containing biologically hazardous material must take place in Class II Microbiological Safety Cabinet. Opening of vessels containing radioactive material must take place in approved areas only.
- Clean up spills immediately (use appropriate PPE if necessary).
- Do not use chemicals that are explosive, highly flammable or have vigorous chemical interaction without observing the appropriate safety precautions to minimise risk of vapour build-up.

When operating the Centrifuge:

- Ensure the rotor has reached the required speed and appears to working correctly before leaving it unattended.
- If it is to spin unattended and specifically overnight, ensure that information stating the user, time of starting/finishing, contact details, required speed are attached and clearly visible.
- Never lean or place anything on top of the centrifuge whilst it is in motion.
- Never attempt to open the lid of a centrifuge or slow the rotor by hand or open the lid while rotor is in motion as serious injuries may be incurred. If this is possible the centrifuge must be taken out of use immediately.
- If vibration occurs or unusual noises develop, stop the run immediately, wait until the rotor stops and check the load balances. If there are any signs of problems, remove the power supply, assign a label 'Do not Use' and contact lab-support@well.ox.ac.uk.
- In event of a power failure, do not try to open the lid to retrieve samples for at least one hour. After the rotor has stopped, follow the instructions in the manual for recovery of the samples.

Afterwards:

- Check again that the rotors & chamber are clear of damage and spills.
- Clean as detailed above and leave to dry for the next user.
- If you need to remove the centrifuge from a cold room, leave it for at least 3 hours at room temperature before using it again. This will prevent any condensation build up, which could damage the components.
NOTE: the use of any electrical equipment in a cold room is discouraged.

Manual Handling

Rotors for large floor standing centrifuges can weigh up to 20Kg and care should be taken when handling them.

Ideally large rotors should be stored at waist height adjacent to the centrifuge to minimise carrying distance.

If in doubt ask for assistance.

Emergency Procedures

In the event that an incident or accident related to centrifugation occurs:

- Turn off the centrifuge and disconnect it from the power source.
- Notify others in laboratory and evacuate accordingly.

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- Notify your supervisor, H&S Officer or lab-support@well.ox.ac.uk
- Refer to relevant COSHH assessment for any hazardous material used.
- Refer to local Radiation Rules for any radiochemical used.

Further Information

If you have any difficulties while using any of the Centrifuges within the HWBGM, then please contact lab-support@well.ox.ac.uk for further advice.

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Appendix A – Current Centrifuges in Use within the Centre.

Ultracentrifuges

Beckman Optima L-90K Ultra

Beckman Ultracentrifuge Optima TL

High Capacity/High-Speed/Super Speed/Floor Mounted

Beckman Avanti J20

Beckman Avanti J30

Beckman J2-MC

Beckman J6-MC

Sorvall RC5B

Hettich Rotanta 46R

Jouan CR422

General Purpose/Benchtop/Microcentrifuges

Beckman Allegra 6

Beckman Allegra 21

Beckman GPR

Beckman GS-6R

Eppendorf 5410

Eppendorf 5412

Eppendorf 5415

Eppendorf 5416

Eppendorf 5417

Eppendorf Minispin

Heraeus Biofuge 13

Heraeus Biofuge fresco

Heraeus Biofuge Pico

Heraeus Labofuge 400

Heraeus Megafuge 1.0

Heraeus Megafuge 2.0R

Hettich EBA12

Hettich Mikro20

IEC Centra-M

IEC Micromax

Labimpex MicroCentrifuge SD220

MSE MicroCentaur

Shandon Cytocentrifuge

Sigma1-13