

## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

### **1. PURPOSE**

The intent of this SOP is to describe the procedures for the use and maintenance of the centrifuges within the labs in the CBE and T208b in the Wolfson School

### **2. SCOPE**

This SOP applies to the operational and maintenance procedures for the following centrifuges

Sigma 3-15 Centrifuge (H23)  
Eppendorf 5804 Centrifuge ( H25)  
Sigma 3-16pk Centrifuge ( H22)  
Megafuge 16 Centrifuge ( H29)  
Sigma 3-16PK Centrifuge ( H27)  
Hereaus Biofuge Primo R, Thermo Scientific ( T208b)

Note: This is a generalised SOP, for specifics refer to the Operating Manual for the Centrifuge you are using.

### **SPECIAL NOTES: HEALTH & SAFETY**

#### **Hazards associated with the use of centrifuges**

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

#### **Safe Working Practices (also refer to Safety Note in the Operator Manuals for the Centrifuge you will be using)**

Users **MUST** read the safety notes and instructions, detailed in the Operators Manual for the safe use of these centrifuges.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

1. Ensure that the centrifuge is placed on a horizontal level surface and there is a clearance of at least 30 cm around the centrifuge when in operation. Make sure that hazardous materials are not stored or placed within this area and there is sufficient ventilation.
2. Always observe the start-up checks detailed in this SOP before using the centrifuge
3. Do not exceed the specified maximum speed or load for the rotor used. NOTE: Each time a centrifuging run is started, the centrifuge recognizes the rotor code of the installed rotor with the help of a sensor. This means that the nominal speed of the rotor cannot be exceeded.
4. Do not overfill containers. Remember that centrifugal forces drive the fluid up the outside tube wall for tubes used in fixed angle rotors. Use only the correct designated tubes for the rotor. Do not modify them to make them fit unless using attachments authorized by the manufacturer. NEVER USE GLASS CONTAINERS IN THE CENTRIFUGE.
5. Only use the rotors (heads) and accessories specified by the manufacturer. If unsure of which rotor or tube to use, ask Responsible Person or call the manufacturer.
6. The accessories and contents must be carefully balanced, and the load distributed symmetrically around the head and axis for each carrier before starting the centrifuge. The centrifuges each have an mechanical balance next to them for balancing of loads (Ohaus 1450-SD Instruction manual is on LEARN).
7. Buckets must be correctly located and properly seated in the rotor.
8. Before use, the lid must be closed and all externally securing devices firmly placed and fixed.
9. The centrifuge must be stopped by its timer or by pressing the Stop button — not by switching it off at the mains supply. The lid must not be opened until the rotor has come to rest. The rotation of the rotor should never be stopped by hand.
10. Do not centrifuge materials capable of developing flammable or explosive vapours.
11. Do not move the centrifuge during operation. Do not lean or rest against the centrifuge during operation.
12. Do not centrifuge substances which could damage or affect the mechanical strength of the material of the centrifuge, the rotor, or the buckets. See Operators Manual for details of chemical resistance to plastics.
13. Infectious, toxic, pathogenic, or radioactive material MUST be centrifuged in capped/sealed containers inside sealed buckets only .
14. Only use rotors which have been approved for the centrifuge (See Operators Manual). If you are unsure of which rotor or tube to use, contact the manufacturer.
15. Stay at the centrifuge until it is running smoothly. Shut the machine down immediately if there is any unusual noise or vibration. Report non-resolvable issues to the Responsible Person.
16. The bowl, rotor and accessories should be disinfected regularly to counter any contamination from aerosols and droplets. Always clean the equipment using 2 % detergent solution for cleaning. Do not use corroding or aggressive substances.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

---

Title: Use and Maintenance of Centrifuges

---

Location: CBE laboratories and T208b (Wolfson School)

---

17. Check that the replacement of time-expired components are made according to the manufacturer's Instructions - Do not use rotors or buckets which have exceeded their maximum operating life. Rotors and accompanying buckets have a maximum operating life of seven years.

### **3. RESPONSIBILITES**

#### **CBE Laboratory Users**

- i. Shall ensure that they are familiar with the centrifuge, its controls, requirements, and emergency procedures by reference to this SOP, and Manufacturer's Operating Instructions.
- ii. Shall be an experienced centrifuge user or will have received appropriate training. Before a new user is allowed to operate a centrifuge on their own, competence to operate the centrifuge must have been assessed by the responsible person or another experienced user.
- iii. Shall ensure that the centrifuge is suitable for the work they intend to carry out.
- iv. Shall record alarms, adverse events, non-conformances, or malfunction on the Weekly housekeeping log ( found outside each respective lab) and notify the Laboratory Manager / Responsible Person.
- v. Shall complete the cleaning procedures as required and record on the Housekeeping sheets
- vi. Shall ensure that the centrifuge and rotors are properly installed and set properly according to the Operators Manual.
- vii. Shall complete the maintenance/service/ cleaning procedures as required and record in the relevant sections on the Equipment Maintenance Record on door to respective laboratory.
- viii. If applicable, shall notify Responsible Person when there remains only three months prior to the end of the maximum operating life of the rotors, buckets, and lids. Date of production for rotors and accompanying buckets are engraved on the rotor/bucket in four-digit form (e.g. 10/98 October 1998).

#### **Responsible Person (RP)/Laboratory Manager (LM)**

- i. Shall ensure laboratory personnel are given suitable information, instruction, training or supervision in the safe use and maintenance of the equipment, providing the following:
  - a. information on the hazards and risks to health
  - b. instruction in safe procedures
  - c. training, where necessary; and effective supervision to ensure, so far as is reasonably practicable, that centrifuges are operated without risks to the health of employees and other persons, i.e. including students and visiting research workers
- ii. Shall coordinate weekly maintenance duties to be performed by laboratory personnel (according to SOP004).

---

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

- iii. Shall regularly review maintenance logs and investigate reported alarms, adverse events or non-conformances associated with the centrifuge.
- iv. Shall schedule servicing and preventative maintenance with authorized service representatives. External maintenance and servicing of the equipment can only be performed after it has been suitably disinfected (see SOP003) and a "Decontamination Certificate" has been issued (a proforma is available on the CBE LEARN page, please refer to section 6).

### **4. EQUIPMENT AND MATERIALS**

- 15ml or 50 ml centrifuge tubes.
- Rotors;- Swing Bucket rotor and Deep-well plate rotor
- Sealable buckets to go in the Swing bucket rotors
- Lids for the swing buckets, and the plate rotor.
- Adaptors for 15ml and 50ml centrifuge tubes
- Centrifuge pivot grease
- 70% IMs for cleaning
- 2% Detergent solution (Neutracon)

**Note-** Not all of the Centrifuges have a plate rotor- see 'User's Manual' for specifics.

### **5. PROCEDURE**

#### **5.1. Pre-run checks**

**NOTE:** A record for the routine inspections and cleaning **MUST** be Maintained on the Housekeeping sheets and equipment maintenance records.

A safety inspection outlined below must be carried out before each use.

**CAUTION:** Centrifuging can produce aerosols and therefore bio-hazardous material **MUST NOT** be centrifuged in open containers. Sealed containers provide initial protection but must be reinforced using sealed buckets or rotors, which reduce the hazard if the container collapses.

Before each centrifuge run:

- (i) Check that centrifuge has been inspected and serviced within the last 2 years ( see date on sticker) to ensure rotor has been checked.
- (ii) Inspect all the all safety relevant parts of the centrifuge i.e. rotor and accessories (e.g. cover seal, adapters and rotor tie down screw) for cleanliness and visible signs of damage, or wear, abrasion or discolouration or wear e.g. cracks, nicks, chemical degradation, pitting or corrosion.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

- (iii) Inspect buckets and centrifuge tubes for visible signs of damage, malformation, or wear (e.g. cracks, nicks, chemical degradation, pitting or corrosion).

**CAUTION:** If any sign of visible damage or wear is detected, DO NOT USE the centrifuge. Consult the Responsible Person and record the outcome of the inspection on the equipment maintenance record.

**NOTE:** Slight scratches and cracks can cause severe inner damage to the rotor materials, which are difficult to detect with the eye. If in doubt, DO NOT USE the rotor.

- (iv) Fill sample containers only within the range recommended by the manufacturer and avoid contamination outside the seal of a sealed head or sealed bucket. Never fill sample containers when they are mounted in the centrifuge unless contained in a head specifically designed for this method of filling.
- (v) Distribute the load symmetrically around the rotation assembly so that it is evenly balanced and complies with the manufacturer's instructions in this respect. If more than one sample container is placed in a bucket, use an appropriate insert to ensure their correct positioning. It is essential that balancing buckets carry an identical load and are filled with a liquid of density not grossly dissimilar to that being centrifuged. Always consider all components (e.g. inserts and trunnion rings) when balancing. The centrifuges each have a mechanical balance next to them for balancing of loads (Ohaus 1450-SD Instruction manual is on LEARN).
- (vi) Select a centrifuging speed up to the maximum recommended by the manufacturer according to the head and accessories to be used.
- (vii) Make certain the rotor tie down nut is secure before starting the centrifuge. Check that the rotor is seated on the drive hub correctly.  
**Note:** Not all centrifuges have a tie down nut, some have a button on the top of the rotor, which needs to be pressed down and the rotor lifted in order to remove the rotor. Make sure that the rotor is firmly pushed down. Try to lift the rotor to make sure that it is firmly attached before using.
- (viii) Make sure the bowl is dry and that the drive spindle is clean. In the event of condensation water formation, dry the centrifugal chamber by wiping out with an absorbent cloth
- (ix) Inspect the supporting lugs on the rotor; lubricate if required — use the pivot grease supplied by the manufacturer.
- (x) Inspect the packing rings for cleanliness and signs of damage

### 5.2 Mounting and dismounting the rotors

Each centrifuge has slightly different types of rotors, check the User Manuals for specifics about each rotor and its use.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

---

Title: Use and Maintenance of Centrifuges

---

Location: CBE laboratories and T208b (Wolfson School)

---

**Note:** It is not permitted to use any other rotor other than those designated by the manufacturer.

All the centrifuges have a swing bucket rotor, this is the one used for centrifuging 15ml and 50ml centrifuge tubes.

### 5.2.1. Mounting the rotor:

- (i) Open the centrifuge by pressing the illuminated lid key.
- (ii) Clean the motor axle and the rotor bores with a cloth before attaching the rotor.
- (iii) Lower the rotor straight down onto the motor shaft.
- (iv) Mount the rotor onto the motor axle and if applicable tighten the rotor nut by turning clockwise using the rotor key, or if the press release system, make sure that the rotor is firmly attached, and cannot be lifted up.

### 5.2.2 Dismounting the rotor:

Turn the rotor nut counter, clockwise using the rotor key, or press down the centre and holding with both hands lift the rotor straight up.

## 5.3 Loading the rotors

1. Distribute the load symmetrically in the inserts within the buckets so that the rotor is evenly balanced. It is essential that opposing buckets carry an identical load, and in particular are filled with a liquid of density not grossly dissimilar to that being centrifuged. Always consider all components (e.g. inserts and trunnion rings) when balancing. There should be no more than 100g difference between buckets next to each other.
2. Avoid contaminating the outside of a sealed bucket. Never fill sample containers when they are mounted in the centrifuge.
3. Place the buckets correctly on the trunnions at a slight angle, pointing into the middle. Always insert all four buckets to ensure correct running on the centrifuge.
4. Close the lid of the centrifuge by firmly pressing it down. Ensure that this is accompanied by a clicking sound. The lid will be locked once the centrifuge is put into operation

**NOTE:** The centrifuge must be corrected balance, to avoid centrifuge walking. The weight limits must also not be exceeded, as this can cause significant damage to the centrifuge and samples. See the User Manual for the weight limits for each type of rotor, and centrifuge tube and plate.

---

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey	Reviewed by: C.Kavanagh	Approved by: CCC K Smith
------------------------	-------------------------	-----------------------------

---

Title: Use and Maintenance of Centrifuges

---

Location: CBE laboratories and T208b (Wolfson School)

---

## 5.4 Adjusting the centrifuge parameters

Each centrifuge has parameters that can be changed. These include the speed, and length of spin. The centrifuges can be operated in G, RPM or RCF- some can switch between two of them usually G and RPM. **Check the Users Manual** to check how the parameters can be changed.

In general:

### Speed

Select RPM or G – there will be a button below the speed window that will let you switch between G and RPM- make sure that you select the correct one. There will also be buttons that allow you to increase and decrease the speed required.

### Run time

Under the time there will be 2 buttons that allow you to increase and decrease the time, make sure that you have the correct time selected.

## 5.5 Operating the centrifuge

**Note:** All the centrifuges have routine operation, check the Users Manual to check if they have continuous operation and short spin.

There are three ways to operate the centrifuge:

1. Routine operation
2. Continuous operation
3. Short-spin operation

For continuous and Short spin operation -see the user manual.

### 5.5.1 Routine operation

Routine operation involves using the centrifuge with the specific, pre-set parameters as defined by the user. Please refer to Operators Manual for an explanation on how to select the parameters.

(i) Once the desired parameters settings have been selected, press the "start/stop" button to begin centrifugation. When the run has started, the solid square symbol appears next to the rotation

---

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey	Reviewed by: C.Kavanagh	Approved by: CCC K Smith
------------------------	-------------------------	-----------------------------

## Standard Operating Procedure

**SOP088**

---

Title: Use and Maintenance of Centrifuges

---

Location: CBE laboratories and T208b (Wolfson School)

---

speed on the display, signifying the centrifuge is in operation. To display all pre-set parameters (for 2.5 seconds) during a run, press one of the parameter buttons ("speed" or "time").

**NOTE:** Automatic rotor recognition occurs at the beginning of each run. If the pre-set speed is greater than the maximum speed of the rotor in use, it is aligned to the maximum speed and the run is interrupted. "SPEED" appears in the display and the run must be restarted. Or the centrifuge will only run at the top speed it has, as it will not allow you to select the speed you require.

**NOTE:** The rotational speed and the radius for the rcf value will automatically be reset to the maximum permitted value for the rotor in use. If a run with a program has been started, the program number is automatically set to "0".

**NOTE:** During the run, all parameters can be modified by selecting the appropriate parameter and adjusting the value. They **MUST** be changed during the run and not during the braking phase. If changing the duration of the run the time elapsed is taken into account in the new value.

**NOTE:** During the run, the current rotational speed (or appropriate rcf value) and the remaining spin time in minutes appear on the display by default. The last minute is counted down in seconds.

**Stay at the centrifuge until it is running smoothly. Shut the machine down immediately if there is any unusual noise or vibration. Report non-resolvable issues to the Responsible Person.**

### 5.5.2 Emergency Procedures

#### Emergency Stop

If an emergency stop is required whilst the centrifuge is running:

- (i) Press the "start/stop" key once
- (ii) The centrifuge enters the braking phase
- (iii) Once at a standstill, the "open" button lights blue, press the button to open the lid.

#### Emergency release

In the event of a power failure, the magnetic lid latch cannot be activated; the emergency lid release can be activated manually:

- (i) Turn off the main green power switch located on the side of the centrifuge.
- (ii) Turn off the switch at the mains and remove the plug

---

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey	Reviewed by: C.Kavanagh	Approved by: CCC K Smith
------------------------	-------------------------	-----------------------------



## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

(iii) Wait until the rotor has come to a standstill (the rotor may continue spinning for up to eight minutes).

(iv) Insert the standard rotor key into the opening in the middle of the front part in the nut underneath and turn counter- clockwise. This disengages the lid allowing it to be opened

**NOTE:** Ensure that the rotor key is removed afterwards.

## 6 Preventative Maintenance

- i. Pre-run checks include daily inspection of the rotor chamber, rotor, and accessories before use.
- ii. Weekly safety checks must be done as part of weekly housekeeping tasks.
- iii. Refer to operator manuals for cleaning procedure. In brief, ensure the centrifuge is turned off, unplugged and all parts removed. Use warm water with neutral solvent (neutracon) and rinse with distilled water. Dry all parts with a soft cloth. Treat the entire surface of aluminum parts with anti- corrosion oil (including cavities). Treat the bold of the swing out rotor with bold grease.
- iv. For cleaning before and after use, use 1:50 Chemgene solution to wipe down all accessible surfaces, taking care not to remove the grease from the rotor bold and bucket hinges.
- v. Centrifuges must be inspected and serviced every 2 years by Centriservices.
- vi. Any maintenance should be recorded in the equipment maintenance record sheets on door to respective laboratories.

### 6.1 . Rotor Care and Use

EVERY MONTH:

This should be done by the responsible person for the equipment and recorded on the equipment maintenance that it has been done.

- i) Check all of the safety-relevant parts of the centrifuge i.e. rotor and accessories, for any visible signs of damage, wear/abrasion, malformation, or discolouration (e.g. cracks, corrosion). If visible damage of the surface, a crack, or corrosion, is detected the part (rotor, etc.) must be replaced immediately.

NOTE: Chemical reactions as well as stress-corrosion (combination of oscillating pressure and chemical reaction) can affect or destroy the metals. Hardly detectable cracks on the surface expand and weaken the material without visible signs.

- ii) If the rotor is not kept clean and chemicals remain on the rotor, corrosion will result. Moisture left for extended periods of time can also initiate corrosion. It is important that the rotor is left clean and dry after use. (Wash with mild detergent and warm water using a nylon bottle brush, if necessary). Dry the rotor thoroughly and store upside down with the cover and tubes removed.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

- iii) To avoid corrosion, do not expose aluminium rotor components to strong acids or bases, alkaline lab detergents, or salts (chlorides) of heavy metals (e.g., caesium, lead, silver or mercury).
- iv) Check that the centrifuge chamber, drive spindle, and tapered mounting surface of the rotor are clean and free of scratches or burrs.

CAUTION: Damaged rotors MUST NOT be used

- v) Make sure rotor, tubes, and spindle are dry and that the rotor is properly seated and secured to the drive hub. Do not operate the centrifuge without the appropriate rotor cover securely fitted with seals in place.
- vi) If the temperature of the chamber is below room temperature, pre-cool the rotor to the lower temperature before securing the rotor (this will minimize the chance of it seizing to the tapered spindle).
- vii) Never exceed the stated maximum speed for any rotor.
- viii) Balance the rotor to within the limits specified (take care that materials of similar densities are in opposite positions of the rotor).
- ix) Check the concentricity of the motor shaft:
  - Visual inspection: Slowly rotate the rotor by hand without the rotor fastening nut. If the motor shaft does not turn around on a perpendicular axis, the motor and motor shaft must be replaced.
  - Refit the rotor correctly after visual inspection (Refer to Operators Manual - Installation of Rotors and Accessories).
- x) Check the unit for atypical running noises.
- xi) Check that all screw connections are tight.
- xii) Rotors are checked and inspected every 2 years during the service.
- xiii) Record the outcome of the operator inspection in the Equipment Maintenance record on the door to respective laboratory. Consult the Responsible Person/Laboratory Manager if any signs of wear and tear, damage or corrosion are detected

### 6.2 Tube Care

- (i) Before use, tubes should be checked for cracks. The inside of cups should be inspected for rough walls caused by corrosion and adhering matter should be removed. Metal or plastic tubes (other than nitrocellulose) should be used whenever possible.
- (ii) Make sure each tube compartment is clean and corrosion free.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

---

Title: Use and Maintenance of Centrifuges

---

Location: CBE laboratories and T208b (Wolfson School)

---

- (iii) Tubes must be properly balanced in the rotor.
- (iv) Check compatibility of the tube material to the solvent medium (some solvents may cause the tubes to swell or crack in the rotor).
- (v) Never fill centrifuge tubes above the maximum recommended by the manufacturer.
- (vi) Use only correctly fitting tubes.
- (vii) NEVER put glass in the centrifuges

### 6.3 Centrifuge Cleaning

- (i) This is the responsibility of the responsible person. (or any laboratory user if the centrifuge is found to be in need of cleaning). All equipment maintenance or cleaning must be recorded on the equipment maintenance records on the door to the respective laboratory.
  - (ii) Any liquid spilt in the centrifuge should be removed immediately. Please refer to SOP038 Biological spill response.
- 
- At the end of each day's use of the centrifuge, clean (as below) and dry the inside of the centrifuge chamber, all parts of the rotation assembly and any head accessories used. In order to reduce corrosion, inserts and adaptors should be removed after use to allow adequate cleaning and drying. Ensure that the manufacturer's recommendations on cleaning materials are followed.
  - The centrifuge should be cleaned every month and/or after 200 hours use (this is indicated by a message displayed in the centrifuge panel)

#### EVERY MONTH:

- (i) Open the lid of the centrifuge and disconnect the main power plug.
- (ii) Unscrew the rotor with the rotor key provided and clean separately.
- (iii) Clean and dry the rotor and inside of the centrifuge with 70% IMS solution and 2% detergent solution (Fisher Brand)
- (iv) After cleaning with detergent, rinse the rubber seals in the rotor chamber with water and then lubricate with glycerine. This prevents the seals from becoming brittle.

---

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey	Reviewed by: C.Kavanagh	Approved by: CCC K Smith
------------------------	-------------------------	-----------------------------

## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

(v) Check the rotor, housing, and rotor bores monthly for residue and corrosion. Clean the rotor with 2% detergent solution (Fisher Brand). As a reminder, the message "clean rotor" appears in the display of the centrifuge three times after every 200 runs.

(vi) Lightly lubricate the buckets with the lubricant provided by the manufacturer (grease for pivots); although care must be taken to ensure that the buckets can still swing freely.

NOTE: Only neutral agents may be used for cleaning and disinfection.

NOTE: The rotor chamber should only be cleaned with moist absorbent paper.

### 6.4 Spill Response and sterilisation and Disinfection of centrifuge parts

NOTE: The centrifuges and the accessories consist of different materials and possible incompatibility must be considered. Before using detergents or decontamination agents, which have not been recommended by the manufacturer, the user should contact them to make sure that such procedure would not damage the centrifuge.

Where a spill, leak or breakage is detected within the centrifuge, the centrifuge **MUST** be disinfected immediately. The procedure will depend upon the risk group of the agent. If there is reason to believe that a breakage may have occurred whilst the centrifuge was running, adopt the following procedure:

- i) If centrifuge contamination is identified after the lid of the centrifuge is opened, carefully close the lid and turn off the centrifuge.
- ii) If centrifuge contamination is identified whilst the centrifuge is running, turn off the centrifuge.
- iii) In both cases **DO NOT** open lid as the bowl may contain an aerosol if the centrifuge tube or its seals have failed. **ADOPT THE FOLLOWING PROCEDURE:**
- iv) Wait at least 30 minutes before opening the lid to allow aerosol to settle.
- v) Place notice on the lid to alert others and notify Responsible Person.
- vi) Put on clean disposable gloves and full-face protection. Respiratory equipment may be required — seek advice from Responsible Person.
- vii) After 30 minutes, transfer the centrifuge to BSC only if the external surface is dry. If the external surface appears to be wet, wipe the external surface with virkon solution followed by 70 % IMS solution. **CAUTION: DO NOT EXPOSE METAL PARTS TO VIRKON FOR MORE THAN 10 MINUTES.**

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

- (viii) Carefully open the lid inside the BSC.
- (ix) Carefully retrieve any broken tubes with forceps and place in sharps container.
- (x) Remove the rotor, bucket, accessories, and the lid. If practicable autoclave (see next Section) or alternatively soak in Virkon solution for 10 minutes. Thoroughly wipe down with 70% IMS. Place the rotor back into the centrifuge after ensuring the rotor and the components are dry.
- (xi) Remove PPE and contaminated clothing. Place all contaminated PPE in an autoclave bag/container for decontamination (reusable items) or disposal as biohazardous waste.
- (xii) Wash hands and other potentially contaminated areas with soap and water.
- (xiii) Inform lab staff when clean-up is complete.
- (xiv) Inspect the centrifuge for defective and damaged components. Retain all components and debris for inspection. Do not use centrifuge or rotor again until authorised by the Responsible Person.

### 6.4.1 Autoclaving

Alternatively, rotors and accessory parts can be autoclaved (see operator manual); 20 minutes at 121 °C cycle.

Before Autoclaving:

- (i) Check the cleaning records for the centrifuge rotor BEFORE autoclaving. The rotor MUST NOT be autoclaved more than 10 times.
- (ii) Check Operator's Manual to make sure that individual materials are resistant to this treatment
- (iii) Notify the Laboratory Manager and record the action in the equipment maintenance records .

After the Autoclave cycle:

- (i) Check all of the safety-relevant parts of the centrifuge i.e. rotor and accessories, for any visible signs of damage, wear/abrasion, malformation or discolouration (e.g. cracks, corrosion).

**CAUTION:** The life of the accessories essentially depends on the frequency of autoclaving and use. Whenever the parts show changes in colour or structure or in the event of leaks etc., the affected accessories MUST be replaced.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

---

Title: Use and Maintenance of Centrifuges

---

Location: CBE laboratories and T208b (Wolfson School)

---

### 6.5 Centrifuge Malfunction

- (i) If any part of the equipment fails or malfunctions, including faults or defects, indicated by vibration, noise or by failure to operate, the user should contact the Laboratory Manager/Responsible Person. With permission of the Laboratory Manager or Responsible Person the user should consult the Operator Instruction Manuals to access fault finding, error displays and troubleshooting procedures.

**CAUTION: DO NOT ATTEMPT TO REPAIR THE CENTRIFUGE YOURSELF**

- (ii) All problems and corrective actions should be recorded in the Equipment Maintenance record.
- (iii) If the equipment fails to work or malfunctions and cannot be rectified according to troubleshooting procedures detailed in the Operator and Users Manuals the Laboratory Manager must be informed and the centrifuge must be tagged and locked-out or "Do Not Use" notice posted on the equipment. Contact the manufacturer for advice and coordinate with the Lab Manager for external maintenance and servicing.

NOTE: Centrifuges in need of repair should be tagged and locked-out (or "Not in Use" label applied) while awaiting service.

- (iv) External maintenance and servicing of the equipment can only be performed after it has been suitably disinfected (refer to SOP003 for further details) and a 'Decontamination Certificate' has been issued (a proforma is available on the CBE LEARN page ). NOTE: A 'Declaration of decontamination'; available in the Operators Manual may also be required. Permit to works should be used for external contractors.

### 6.6 Centrifuge/Rotor Decommissioning Checklist

- (i) If the centrifuge or rotor needs to be decommissioned, for example due to relocation or change of use, it is necessary to ensure no hazardous materials are left behind and that the unit has been decontaminated and made safe for future use or removal. A checklist that can be used to record that the centrifuge or rotor has been suitably decommissioned is provided in Section 6.
- (ii) On completion, the form should be forwarded to DSO, or another responsible person to request its disposal. If multiple items need to be disposed of together from the same room, it may be possible to use one form — as long as each item is listed and each has a "Safe for Disposal" sticker / note on it to confirm that appropriate cleaning/disinfecting has been carried out. A completed decommissioning checklist precludes the need for maintenance staff and contractors to be issued with a Laboratory Permit to Work.

---

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey	Reviewed by: C.Kavanagh	Approved by: CCC K Smith
------------------------	-------------------------	-----------------------------

**Standard Operating Procedure**

**SOP088**

---

Title: Use and Maintenance of Centrifuges

---

Location: CBE laboratories and T208b (Wolfson School)

---

**6. DOCUMENTATION**

The following records are outputs of this SOP:

- 6.2 QS- FORM-006 — Centrifuge decommissioning checklist
- 6.3 QS-FORM-009 Generic equipment decontamination certificate
- Weekly Housekeeping sheet
- Lab Equipment Maintenance Record.

These records will be filed in the equipment file or otherwise archived for future review or retrieval.  
The following records are outputs of this SOP:

---

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey	Reviewed by: C.Kavanagh	Approved by: CCC K Smith
------------------------	-------------------------	-----------------------------

**Standard Operating Procedure**

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

**SOP Version History**

<b>Version Reviewed</b>	<b>Date Revised/ Reviewed</b>	<b>Revision Summary</b>	<b>New Version Number</b>
001	18/11/22	Added a line regarding using mechanical scales for balancing the load for the centrifuge. Added under safe working practices point 6 and 5.1 point (v).Minor change by K.Sikand.	001

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey	Reviewed by: C.Kavanagh	Approved by: CCC K Smith
------------------------	-------------------------	-----------------------------



## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

### **Annex 1 : Safe Use of Centrifuges (Extracts from BS4402)**

Moving parts in centrifuges can reach very high kinetic energies. Breakage of a rotor or accessories inside the centrifuge releases large amounts of energy, and debris can be expelled at high speeds from the centrifuge; bodily movement of centrifuges for a distance of several metres can also occur in this situation.

Modern centrifuges must be designed and manufactured to British Standard BS 4402: 1982, Safety Requirements for Laboratory Centrifuges. This Standard is intended to ensure that the casing of the centrifuge will contain the debris of components which break inside it and to ensure that centrifuges are fitted with necessary interlocks and other safety devices.

**It is important that all users of centrifuges are properly trained in the safe use and maintenance of the equipment.**

Appendix B of BS 4402 gives advice on the use of centrifuges and part of it reads:

'RECOMMENDATIONS ON THE USE OF CENTRIFUGES'

#### **B.1 Recommendations applying to all centrifuges**

**B.1.1. Introduction:** When running, a centrifuge has considerable kinetic energy and even a small 'bench centrifuge' not complying with the requirement of this British Standard can expel debris, or even move bodily, for a distance of several metres in the event of mechanical failure. While considerable effort goes into the design and construction of centrifuges to try to minimise the hazards, sensible use is also important for the safety of operators and others in the laboratory.

**B.1.2 Installation:** It is essential that all centrifuges be fixed to the working surface, following the specifications and recommendations of the manufacturer for suitable fixings and fixing details. Care should be taken to ensure that the working surface and its substrate are strong enough to withstand the maximum forces of rotation and translation expected at the fixings in the event of a disruption of the rotation assembly (see instruction manual) A centrifuge may move abruptly in the event of such a disruption, in spite of the fixings, but the distance will be limited if the centrifuge is correctly fixed.

**B.1.3 Training of Operators:** Training in the operation of the centrifuge should be carried out by an experienced user or (by arrangement) by the manufacturer's representative, and should be given to all operators of the centrifuge before they are permitted to use the centrifuge.

**B.1.4 Precautions to be taken when using centrifuges:** Note: attention is also drawn to recommendations given in BS5345 and to the "User Guide for the Safe Operation of Centrifuges" published by the Institution of Chemical Engineers

**B.1.4.1.** Inspect each sample container and head accessory and all seals (if any) before filling. Reject any which are damaged or not authorised by the manufacturer, since such components could cause unsatisfactory sealing, breakage or jamming in the centrifuge head.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

- B. 1.4.2 Fill sample containers and head accessories only within the range recommended by the manufacturer and avoid contamination outside the seal of a sealed head or sealed bucket. Never fill sample containers when they are mounted in the centrifuge unless contained in a head specifically designed for this method of filling.
- B. 1.4.3 Distribute the load symmetrically around the rotation assembly so that it is evenly balanced and complies with the manufacturer's instructions in this respect. If more than one sample container is placed in a bucket, use an appropriate insert to ensure their correct positioning. It is essential that balancing buckets carry an identical load, and in particular are filled with a liquid of density not grossly dissimilar to that being centrifuged. Always consider all components (e.g. inserts and trunnion rings) when balancing.
- B. 1.4.4 Select a centrifuging speed up to the maximum recommended by the manufacturer according to the head and accessories to be used or to the recommended reduced speed if the sample has a high density (i.e. above 1200 kg/m<sup>3</sup>).
- B. 1.4.5 Follow the manufacturer's instructions for starting and (where the control is not automatic) for increasing the speed of rotation.
- B. 1.4.6 Allow the rotation assembly to come to rest before attempting to open the centrifuge lid. NEVER attempt to slow down a head by hand.
- B. 1.5 Maintenance
  - B. 1.5.1 any liquid spilt in the centrifuge should be removed immediately.
  - B. 1.5.2 At the end of each day's use of the centrifuge, clean and dry the inside of the centrifuge chamber, all parts of the rotation assembly and any head accessories used. In order to reduce corrosion, inserts and adaptors should be removed after use to allow adequate cleaning and drying. Ensure that the manufacturer's recommendations on cleaning materials are followed.
  - B. 1.5.3 periodically inspects the clean and dry rotation assembly for any signs of corrosion or mechanical defect. If such signs are seen, do not use it until advice has been obtained from the manufacturer or his representative
  - B. 1.5.4 it is advisable to have the centrifuge heads, buckets and accessories checked by the manufacturer's representative, at the recommended intervals.
- B. 1.6 Procedures after a disruption of the rotation assembly.
  - B. 1.6.1 Whenever a mechanical failure (other than the simple breakage of sample containers) of any part of the rotation assembly is suspected to have occurred, the procedure detailed in B. 1.6.2 to B.1.6.5 is the simplest procedure that should be followed. (For hazardous materials, a more extensive procedure applies.)
  - B. 1.6.2 Immediately isolate the centrifuge from the electrical supply. Do not attempt to open the centrifuge chamber until at least 30 minutes after all motion has ceased.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

SOP088

Title: Use and Maintenance of Centrifuges

Location: CBE laboratories and T208b (Wolfson School)

- B. 1.6.3 Avoid moving defective and damaged components, unless it is necessary for decontamination of hazardous materials, and in any event retain all components and debris for inspection by the manufacturer's representative.
- B. 1.6.4 Note all the details of the incident and any measures subsequently taken and inform the relevant authority of the laboratory.
- B. 1.6.5 Do not use the centrifuge or the rotation assembly again until the necessary repairs and replacements have been completed and the manufacturer's representative has given an assurance that its safety is not impaired.' The Appendix of BS 4402 goes on to deal with extra precautions required when centrifuging hazardous materials (see below).

### Rotors

It is essential that rotors are properly handled, used and maintained.

An ultracentrifuge rotor, for example, experiences 600,000 times the force of gravity. Each gram of it will effectively weigh over 600kg. Under these conditions a small flaw in part of it y lead to failure and the virtual explosion of the rotor within the centrifuge.

The centrifugal forces cause rotors to stretch. At low and normal speeds, the change of size is elastic and the rotor returns to its original size when stationary. At high or over speeds the elastic limit of the material may be exceeded and plastic deformation occurs. If this process recurs micro cracks may be formed and grow at high stress points within the rotor and subsequently cause catastrophic failure.

Corrosion of the rotor by moisture or chemicals greatly reduces the level of stress at which micro cracks form and grow. This increase the probability of early failure (by corrosion fatigue or stress-corrosion cracking). For these reasons it is essential to conform to the manufacturer's conditions on maximum rotor speeds and maximum running times, and to follow closely their cleaning and maintenance procedures

Useful advice on the care of rotors is given in the cited references. The publication Centrifuges by L.W. Price, University of Cambridge, is particularly use the following list of some causes of rotor failure.

1. Misplaced trunnions on MSE Minors
2. Use of wrong accessories e.g. i h horizontal rotors. In a laboratory where several makes of centrifuge are in use, it is possible to mix up accessories which are not interchangeable. Keep them separate.
3. Failure to reduce speed abo e specific gravity of 1.2.
4. Powdered glass in rotor.
5. Failure to use speed restriction curves to avoid re-cyrstallisation with CsC1 gradients.
6. Miss hooked buckets on swinging bucket rotors.

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey

Reviewed by: C.Kavanagh

Approved by: CCC  
K Smith

## Standard Operating Procedure

**SOP088**

---

Title: Use and Maintenance of Centrifuges

---

Location: CBE laboratories and T208b (Wolfson School)

---

7. Over speeding because de rated over speed disc not fitted.
8. Running badly corroded and weakened rotors or buckets, stress corrosion failure.
9. Loose lid on angle rotor.
10. Incorrect installation of rotor on drive shaft.'

### **Bench Centrifuges**

Although the kinetic energy attained by the components of bench centrifuges is lower than that involved in larger models their improper use can lead to dangerous failures.

Breakages of glass tubes or improper balancing can cause considerable vibration and 'wandering' of an unfixed centrifuge over the bench top. This may, in extreme cases, allow the mains cable to become wrapped around the centrifuge body with consequent strain and damage to the cable. The centrifuge may move completely off the bench-top to the floor. This may cause the chamber lid to open and the spinning rotor or buckets to be ejected at high speed.

A visual check should always be made to see that all tubes are filled to the same equal level and are not overfilled, that glass tubes are not cracked, and that a cushion is installed in each bucket.

### **Centrifuging Hazardous Materials**

Hazardous materials must be centrifuged in the proper type sealed container. The basic principle of safe containment is an air-tight, leak proof seal.

Most equipment is unsafe for the centrifuging of flammable materials. A sealed chamber is required, and the necessary design features are laid down in BS4402 which allows only approved centrifuges to be marked with 'sc' (sealed chamber).

Advice on sealed containers for centrifuging hazardous chemicals is given in BS 4402 and in the book by Price. These also mention biologically hazardous materials, and these are dealt with in greater detail in Laboratory-Acquired Infections, CH Collins, Butterworths, 2ndEdition 1988.

If pathogenic materials are used it may be necessary to sterilise parts of a centrifuge and its accessories. Price gives the following relevant advice.

---

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey	Reviewed by: C.Kavanagh	Approved by: CCC K Smith
------------------------	-------------------------	-----------------------------

## Standard Operating Procedure

**SOP088**

---

Title: Use and Maintenance of Centrifuges

---

Location: CBE laboratories and T208b (Wolfson School)

---

Before sterilising **always** remove and disassemble tube cap assemblies. Tubes and bottles for autoclaving should be separated from cap parts to avoid damage and deformation. Cellulose tubes cannot be autoclaved, and they may explode if autoclaving is attempted. Polyallomer tubes distort.

Polycarbonate containers with join seams should not be autoclaved and this method of sterilisation is possible only for seamless polycarbonate containers. Even then severe distortion will probably render the container useless. Cold sterilisation is recommended.

Cold methods of sterilisation that can be used on container materials include ultraviolet radiation, zephiran chloride, ethylene oxide gas and 70% ethanol (except cellulose)

**Remember that it is important to follow the manufacturer's instructions in all aspects of centrifuge use. Only trained persons should use centrifuges. If in doubt about the operation of a centrifuge - ask somebody else.**

---

Version 001

Effective Date: 08/06/2020

Review 08/06/2022

Written by: J. Bowdrey	Reviewed by: C.Kavanagh	Approved by: CCC K Smith
------------------------	-------------------------	-----------------------------