

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

### **1 PURPOSE**

To describe procedures for the safe operation and maintenance of the bench standing Sigma 3-16PK refrigerated centrifuge.

### **2 SCOPE**

This SOP applies to the use and maintenance of Sigma 3-16PK centrifuge by authorised CBE personnel within CBE laboratories. The centrifuge is used for separating substances or mixtures with a density of up to max 1.2g/cm<sup>3</sup>. The SOP covers the use of the centrifuge using the following designated rotors; swing-out rotor for sealable buckets (Cat.-No. 11180) and swing-out rotor for plate centrifugation (Cat.-No. 11222). This SOP does not cover the use of any other type of rotor with this centrifuge. Certified and hermetically sealed accessories (e.g. rotors, buckets or safety cups) **MUST** be used for applications involving the centrifugation of infectious, toxic or pathogenic material

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

#### **2.1 Hazards associated with use of centrifuge**

- 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.

#### **2.2 Safe Working Practices (also refer to Safety Note in Operator Manual)**

**Users MUST read all Precautionary Statements in Section 2 of the Operators Manual and should refer to the Guidelines in Annex 1 for further recommendations on the safe use of centrifuges.**

- (i) 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.
- (ii) The centrifuge should not be placed in a safety cabinet unless an operator protection factor (KI Discus) test has been carried out with it running in situ and it shown not to compromise operator protection.
- (iii) Always observe the start-up checks detailed in this SOP before using the centrifuge

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

- (iv) Do not centrifuge toxic, pathogenic or radioactive material without taking proper precautions for aerosol containment.
- (v) 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.
- (vi) Do not centrifuge materials capable of developing flammable or explosive vapours.
- (vii) Never attempt to slow rotor by hand.
- (viii) Only use the rotors and accessories specified by the manufacturer. If unsure of which rotor or tube to use, ask Responsible Person or call the manufacturer.
- (ix) Never exceed the maximum speed for the rotor. **NOTE:** The centrifuge is equipped with an automatic rotor identification system. The system performs an automatic rotor check after the start. If a rotor other than the preselected one is installed, the system will display the installed rotor and the pre-selection speed will be corrected if necessary.
- (x) **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.**
- (xi) Avoid overfilling tubes or bottles. .
- (xii) Place centrifuge vessels symmetrically so that the rotor is loaded evenly. Load vessels outside the centrifuge. Fill vessels carefully to same weight. Imbalances will result in increased wear of bearings.
- (xiii) 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 Laboratory Manager.
- (xiv) Do not open the door until the rotor stops spinning.
- (xv) Always check for spills. If you find one, clean the centrifuge and rotor thoroughly (Refer to SOP038).
- (xvi) Always clean the equipment after it is used with salts or corrosives.
- (xvii) 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.
- (xviii) When centrifuging infectious materials, use capped or sealed containers and aerosol containment sealable buckets

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

- (xix) 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.

### **3.RESPONSIBILITES**

#### **3.1. CBE Laboratory Personnel:**

- (i) Shall ensure that they are familiar with the centrifuge, its controls, requirements and emergency procedures by reference to this SOP, and the 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 Preventative Maintenance of Centrifuges Record (Section 6) and notify the Laboratory Manager/Responsible Person.
- (v) Shall complete the cleaning procedures as required and record in the relevant sections on the Preventative Maintenance of centrifuges Record (refer to section 6)

#### **3.2. The Responsible Person/Laboratory Manager:**

- (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:
  - information on the hazards and risks to health;
  - instruction in safe procedures;
  - 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 ensure that the centrifuge and rotors are properly installed and set properly according to the Operators Manual.
- (iii) Shall coordinate weekly maintenance duties to be performed by laboratory personnel (according to SOP004).
- (iv) Shall regularly review maintenance logs and investigate and reported alarms, adverse events or non-conformances associated with the centrifuge.

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

Location: CBE Laboratory Unit (H21/22)

- (v) 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 website).

### 4. EQUIPMENT AND MATERIALS

1. Sigma 3-16PK refrigerated centrifuge: Ser. No. 137665.
2. Rotors: Swing-out rotor (Cat.-No. 11180), Plate rotor (Cat.-No. 11222).
3. Centrifuge tubes: Corning plug seal cap, sterile, polypropylene, non-pyrogenic, RCF:9400xg, max 50mL (Fisher, CFT-643-021J).
4. 70% IMS for cleaning.
5. 2% Detergent solution (Neutracon).

### 5. PROCEDURE

#### 5.1 Pre-run checks

**NOTE: A record for the use of the centrifuge and the outcome of routine inspections MUST be maintained.** A safety inspection outlined below must be carried out before each use.

**NOTE: Lifetime of the Rotor:** After 10 years the rotors and accessories must be inspected by the manufacturers. The rotor must be scrapped if it has done 50,000 cycles for reasons of safety.

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

#### **Before each centrifuge run:**

- (i) 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.
- (ii) 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 Preventative Maintenance of centrifuges Record (Section 6), otherwise proceed as follows:

**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.

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman

Reviewed by: P.Hourd

Approved by: R/I.Temple

## Standard Operating Procedure

**SOP122**


Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

Location: CBE Laboratory Unit (H21/22)

- (iii) Make certain the rotor tie down nut is secure before starting the centrifuge. Check that the rotor is seated on the drive hub correctly.
- (iv) Inspect the supporting lugs on the rotor; lubricate if required (use Sigma grease Part no. 70 284).
- (v) Fill sample containers only within the range recommended by the manufacturer. Never fill sample containers when they are mounted in the centrifuge unless contained in a head specifically designed for this method of filling.
- (vi) Distribute the load symmetrically around the rotation assembly so that it is evenly balanced and complies with the manufacturer's instructions in this respect. Always consider all components when balancing.
- (vii) 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.
- (viii) Follow the manufacturer's instructions for starting and (where the control is not automatic) for increasing the speed of rotation.
- (ix) Make certain the rotor tie down nut is secure before starting the centrifuge. Check that the rotor is seated on the drive hub correctly.
- (x) 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

### 5.2 Inserting and removing the rotor

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

- (i) Open the centrifuge by pressing the illuminated lid key 
- (i) Unscrew rotor tie-down screw from the motor shaft (anticlockwise).
- (ii) Lower the rotor straight down onto the motor shaft.
- (iii) Tighten the rotor tie-down screw clockwise with the supplied rotor wrench. In doing so, hold the rotor at its outer rim.
- (iv) Once a day or after approx. 20 cycles the rotor must be removed and then re-inserted. This ensures a proper connection between rotor and shaft.

#### 5.2.1 Placing the tubes in the swing-out rotor

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman

Reviewed by: P.Hourd

Approved by: R/I.Temple

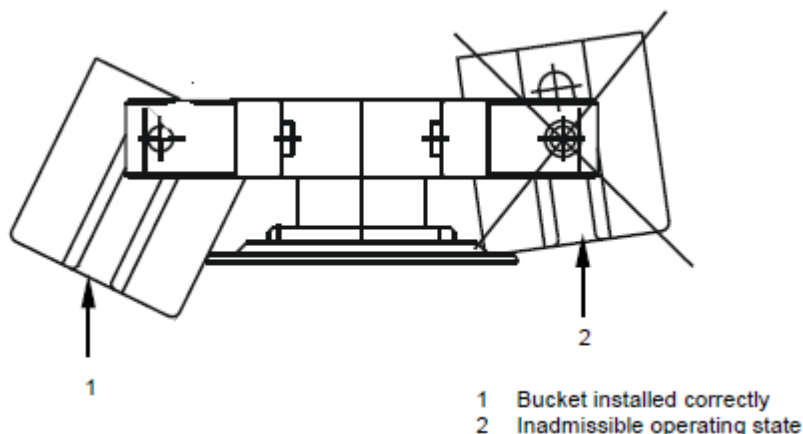
## Standard Operating Procedure

**SOP122**

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

Location: CBE Laboratory Unit (H21/22)

- (i) Swing out rotor (part number: 11180) takes a maximum of 1100g in each of the four buckets. Maximum speed permitted is 4700rpm
- (ii) 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
- (iii) Avoid contaminating the outside of a sealed bucket. Never fill sample containers when they are mounted in the centrifuge.
- (iv) Place the buckets correctly on the trunnions, at a slight angle, pointing into the middle. ALWAYS insert all four buckets to ensure correct running of the centrifuge



- (v) 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.

### 5.2.2 Placing plates in the plate holder rotor

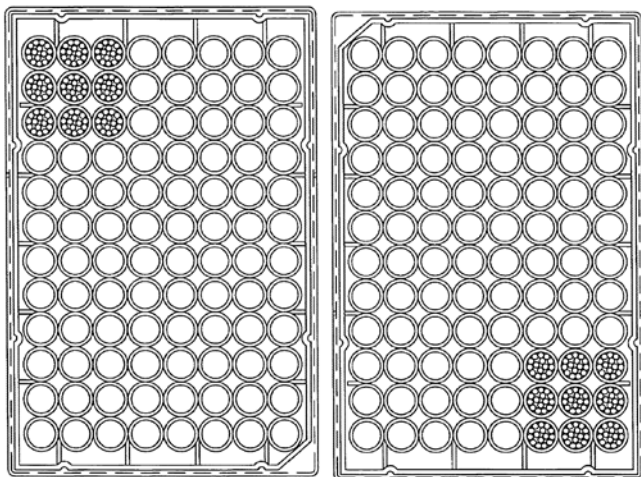
- (i) Each plate holder takes a maximum of three plates, up to a total of 600g. The maximum speed permitted with the rotor (part number: 11222) is 3000rpm
- (ii) Place plates in holders so that they are diametrically (diagonally) balanced, not mirror images of each other, i.e.:

## Standard Operating Procedure

SOP122

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

Location: CBE Laboratory Unit (H21/22)



- (iii) Insert the holders into the rotor, ensuring that the holders fit correctly into the trunions. Always use both holders

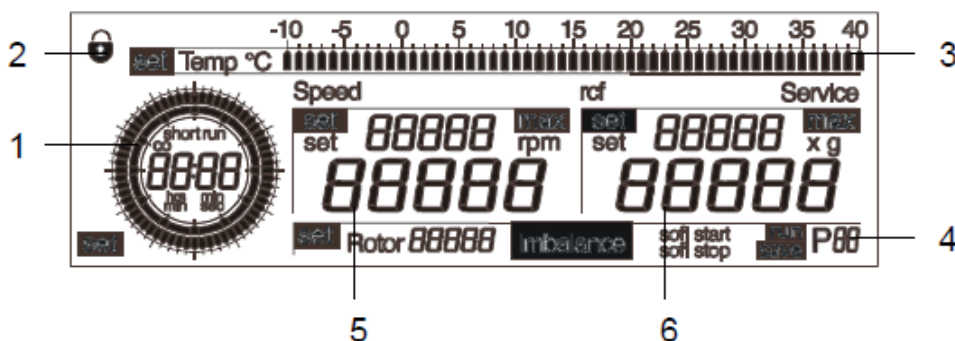
### 5.3 Display/ program options



- 1 Start key
- 2 Time display
- 3 Temperature scale
- 4 Speed display
- 5 RCF display
- 6 Lid key
- 7 Stop key
- 8 Display for rotor, deceleration curve and programs
- 9 Rotary knobs

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

Location: CBE Laboratory Unit (H21/22)



The centrifuge display has the following display fields:

- 1 Time field
- 2 "Lock" symbol for lockdown
- 3 Temperature field
- 4 Field for rotor selection, imbalance indication, run mode, and program selection
- 5 Speed field
- 6 RCF field

### 5.3.1 Setting the rotor

- (i) Turn the left rotary knob until "set" appears in front of the option "Rotor" on the display
- (ii) Select the option by pressing or turning the right rotary knob. "Set" will now flash.
- (iii) Turn the right rotary knob until the desired rotor number is displayed.
- (iv) Press the right rotary knob to confirm the input. If this is not done, the value will be automatically reset to the last setting.

### 5.3.2 Setting the time

- (i) Turn the left rotary knob until "set" appears in the lower left of the display
- (ii) Select the option by pressing or turning the right rotary knob. "Set" will now flash.
- (iii) Turn the right rotary knob until the desired duration is displayed.
- (iv) Press the right rotary knob in order to confirm the input. If this is not done, the value will be automatically reset to the last setting.
- (v) After 11:59 min, the display changes from "min:sec" to "hrs:min". The time can then be changed in steps of 10 minutes.



## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

- (vi) To change the time in steps of 1 second (instead of in steps of 10 seconds in the min:sec mode) or in steps of 1 minute (instead of in steps of 10 minutes in the hrs:min mode): Keep the stop key pressed while setting the desired runtime with the right rotary knob.
- (vii) To run in Short Run or Continuous Run mode see the user manual
- (viii) It is possible to change the runtime whilst the centrifuge is running

### 5.3.3 Setting the speed

- (i) To preselect a speed turn the left rotary knob until “set” appears in front of the parameter “Speed” on the display.
- (ii) Select the option by pressing or turning the right rotary knob. “Set” will now flash.
- (iii) Turn the right rotary knob until the desired value is displayed.
- (iv) Press the right rotary knob to confirm the selected value. If this is not done, the value will be automatically reset to the last setting.
- (v) When the maximum permissible speed of the rotor is reached, the “max” display lights up.
- (vi) It is possible to change the speed during the centrifugation run.
- (vii) To change the speed in steps of 1 rpm (instead of in steps of 100 rpm): Keep the stop key pressed while setting the desired speed with the right rotary knob.

### 5.3.4 Setting the RCF value

- (i) To preselect the RCF value turn the left rotary knob until “set” appears in front of the parameter “rcf” on the display.
- (ii) Select the option by pressing or turning the right rotary knob. “Set” will now flash.
- (iii) Turn the right rotary knob until the desired value is displayed.
- (iv) Press the right rotary knob to confirm the selected value. If this is not done, the value will be automatically reset to the last setting.
- (v) When the maximum permissible RCF value of the rotor is reached, the “max” display lights up.
- (vi) It is possible to change the RCF value during the centrifugation run.
- (vii) To change the speed in steps of 1 x g (instead of in steps of 10 x g): Keep the stop key pressed while setting the desired RCF value with the right rotary knob.

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

SOP122

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

Location: CBE Laboratory Unit (H21/22)

### 5.3.5 Setting the temperature

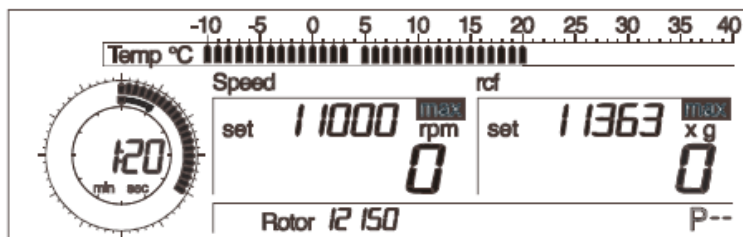
The temperature of the centrifuge is controlled by a refrigeration unit. Temperatures between -10 °C and + 40 °C can be preselected.

To preselect the temperature in steps of 1 °C:

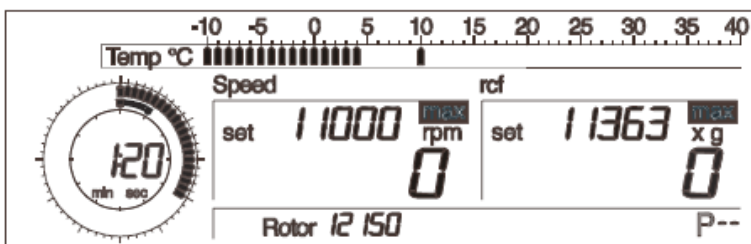
- (i) Turn the left rotary knob until "set" appears in the display field in front of the parameter "Temp".
- (ii) Select the option by pressing or turning the right rotary knob. "Set" will now flash.
- (iii) Turn the right rotary knob until the desired value is displayed.
- (iv) Press the right rotary knob to confirm the selected value. If this is not done, the value will be automatically reset to the last setting.

The temperature scale shows the actual temperature in the rotor chamber.

- If the selected temperature (= set temperature) is below the actual temperature, the set temperature will be represented by a flashing bar on the temperature scale.



- If the set temperature is above the actual temperature, it will be represented by one single bar on the temperature scale.



- If the set temperature and the actual temperature are identical, the line of bars of the scale will be shown completely.

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---


### 5.3.5.1 Using the Rapid cooling facility

Pre-cooling at a standstill may distort the measurement results and subsequently caused increased wear of the mechanical components. The rapid cooling protocol pre-cools the centrifuge rapidly under defined conditions.

- (i) Turn the left rotary knob until “run” appears in the display
- (ii) Select the option by pressing the right rotary knob. “Run” will now flash
- (iii) Turn the right rotary knob until “PrC” is displayed
- (iv) Press the right rotary knob or the start key to confirm the input. The display shows 1/3 of the maximum rotor speed and the corresponding RCF value. The runtime field indicates “cont” and the symbol “∞” for continuous run
- (v) The program will only be loaded if the actual temperature is above the set temperature
- (vi) The program runs until the set value is reached. Then, a sound signal is issued and the program that was set previously will be re-loaded

### 5.4 Starting and Stopping the Centrifuge

Once the rotor is in place, the main switch turned on and the lid closed the centrifuge can be started.

- (i) The centrifuge is ready for operation when the start key is illuminated.
- (ii) Press the start key in order to start a centrifugation run. 
- (iii) Once the pre-selected time has come to an end the centrifuge slows down, comes to a stop, opens the lid and emits an audible alarm

**NOTE:** Refer to the operators manual for procedures for emergency (manual) lid release.

### 5.5 Preventative Maintenance

#### 5.5.1. Rotor Care and Use

- (i) 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 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

- (ii) 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).
- (iii) 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.**

- (iv) Wipe drive surfaces prior to installing the rotor.
- (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) A service of the centrifuge is performed every 2 years. The report is filed in the equipment file.

### 5.5.2. 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.
- (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.

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

### 5.5.3. Routine Checks of Rotors and Accessories

#### **EVERY MONTH:**

- (i) This is the responsibility of the housekeeper as part of the housekeeping duties.
- (ii) 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.

- (iii) 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).
- (iv) Check the unit for atypical running noises.
- (v) Check that all screw connections are tight.
- (vi) Record the outcome of the operator inspection in the Preventative Maintenance of centrifuges Record (Section 6). Consult the Responsible Person/Laboratory Manager if any signs of wear and tear, damage or corrosion are detected

### 5.5.4. Centrifuge Cleaning

**CAUTION: Unsuitable cleaning agents or disinfecting procedures not recommended by the manufacturer may damage the centrifuge and its accessories.**

**NOTE:** Before any cleaning or decontamination process other than that recommended by the manufacturer is applied, the user should contact the Laboratory Manager and/or the manufacturer to ensure that the planned procedure does not damage the equipment.

- (i) Any liquid spilt in the centrifuge should be removed immediately (refer to SOP038).
- (ii) At the end of each day's use, 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

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

adaptors should be removed after use to allow adequate cleaning and drying. Ensure that the manufacturer's recommendations on cleaning materials are followed.

### **EVERY MONTH:**

- (i) This is the responsibility of the responsible person ( or any laboratory user if the centrifuge is in need of cleaning)
- (ii) Before cleaning, pull the mains plug
- (iii) Wipe the centrifuge casing, venting slots, the rotor chamber, the rotor and the accessories with mild (pH 6 to 8) detergent (e.g. Fisherbrand or Neutracon).
- (iv) During cleaning, make sure that cleaning liquids and especially organic solvents DO NOT come into contact with the drive shaft and the ball bearing (**WARNING: organic solvents may decompose the lubricant of the motor bearing and the drive shaft may block.**)
- (v) After cleaning, dry the holders with tissue. Add a spot of grease the size of a small grain of rice to the load-bearing bolts of the rotor and the buckets
- (vi) After completion of the routine clean, record the event the Preventative Maintenance of centrifuges Record. (Section 6). Consult the Responsible Person/Laboratory Manager if any signs of wear and tear, damage or corrosion are detected during the cleaning process.

**NOTE:** This procedure increases life time and reduces corrosion. Corrosion or resultant damages which are caused by insufficient care do not constitute a warranty claim.

### **5.5.5. Sterilization and Disinfection of Rotor Chamber and Accessories**

Where a spill or leak is detected within the centrifuge, the centrifuge **MUST** be disinfected immediately. The procedure will depend upon the risk group of the agent involved (refer to the Risk assessment). If there is reason to believe that a breakage may have occurred whilst the centrifuge was running, adopt the procedure in SOP038.

**NOTE:** The centrifuges and the accessories consist of different materials. Before using detergents or decontamination agents other than those recommended by the manufacturer is applied, the user should contact the Laboratory Manager and/or the manufacturer to ensure that the planned procedure does not damage the equipment.

#### **If autoclaving:**

- (i) Check the cleaning records for the centrifuge rotor **BEFORE** autoclaving. The rotor **MUST NOT** be autoclaved more than 10 times.

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

- (ii) Check Operator's Manual to make sure that individual materials are resistant to this steam treatment and for recommended sterilisation cycles.
- (iii) Notify the Laboratory Manager and record the action in the Preventative Maintenance of centrifuges Record, refer to section 6.

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.

### 5.5.6. Glass Breakage

In case of glass breakage all glass particles must be carefully removed. Rubber inserts must be carefully cleaned or replaced. If a problem has occurred, the following must be considered:

- Glass particles in the rubber cushion will cause glass breakage again.
- Glass particles in the centrifuge chamber will cause metal abrasion due to the strong air circulation. This dust will not only pollute the centrifuge chamber, the rotor and the material to be centrifuged but also damage the surfaces of the accessories, the rotors and the centrifuge chamber.

To completely remove the glass particles and the metal dust from the rotor chamber:

- (i) Grease the upper part of the centrifuge chamber.
- (ii) Then rotate the rotor for 5 minutes at a moderate speed. The glass and metal particles will now collect at the greased part and can easily be removed with a cloth together with the grease. If necessary repeat this procedure.

### 5.6 Centrifuge Malfunction/Faults

- (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**

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

- (ii) All problems and corrective actions should be recorded in the Preventative Maintenance of centrifuges Record (Section 6).
- (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 website). **NOTE:** A 'Declaration of decontamination', available in the Operators Manual may also be required.

### 5.7 Centrifuge or 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 other 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.

## 6. DOCUMENTATION

The following records are outputs of this SOP:

- 6.1. QS-FORM-003 Preventative Maintenance of centrifuges Record
- 6.2. QS-FORM-006 Centrifuge decommissioning checklist
- 6.3. QS-FORM-009 Generic equipment decontamination certificate

These records shall be filed in the Equipment File and stored in the CBE Office or otherwise archived for future review or retrieval.

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------



## Standard Operating Procedure

**SOP122**

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

Location: CBE Laboratory Unit (H21/22)

### 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 to act on 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 BS 5345 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 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman

Reviewed by: P.Hourd

Approved by: R/I.Temple

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

- 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 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 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

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 may 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 increases 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 useful and contains the following list of some causes of rotor failure.

1. Misplaced trunnions on MSE Minors
2. Use of wrong accessories e.g. with 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 above sample specific gravity of 1.2.
4. Powdered glass in rotor.
5. Failure to use speed restriction curves to avoid recrystallisation with CsC1 gradients.
6. Mis-hooked buckets on swinging bucket rotors.

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

## Standard Operating Procedure

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

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 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 of 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 BS 4402 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, C.H. Collins, Butterworths, Second Edition, 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. 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 ultra violet radiation, zephiran chloride, ethylene oxide gas and 70% ethanol (**except** cellulose)

---

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

**Standard Operating Procedure**

**SOP122**

---

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

---

Location: CBE Laboratory Unit (H21/22)

---

**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 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------

**Standard Operating Procedure**

**SOP122**

Title: Use and Maintenance of Sigma Refrigerated Centrifuge 3-16PK

Location: CBE Laboratory Unit (H21/22)

**SOP Version History**

Version Reviewed	Date Revised/ Reviewed	Revision Summary	New Version Number
001	15 <sup>th</sup> October 2012 Reviewed by C. Kavanagh	i) Transferred to the new lean template with minor formatting amendments ii) Removal of forms from the SOP. These are now on the CBE website. iii) Amendment to forms. The QS- Form 003 Preventative Maintenance of centrifuges now referenced in place of other inspection & cleaning forms. iv) 5.5.3 Added a statement to say that the housekeeper is responsible for the monthly centrifuge inspections v) 5.5.1 Added a statement to say that an annual service of centrifuges now occurs vi) 5.5.4 Added a statement to say that the responsible person will be responsible for the cleaning of the centrifuge unless it is required before.	002
002	26/06/18 J. Harriman	Reviewed SOP. Removed advice to transfer centrifuge to BSC in case of spillage (copy paste from micro centrifuge SOP?) – Not advised. Minor editorial changes. Changed service period to 2 years as opposed to annual.	003

Version 003

Effective Date: 26<sup>th</sup> June 2018

Review 26<sup>th</sup> June 2020

Written by: Victoria Workman	Reviewed by: P.Hourd	Approved by: R/I.Temple
------------------------------	----------------------	-------------------------