NUS National University of Singapore	**Department of Physics National University of Singapore**	**Ref. No**	*SOP/001*
Standard Operation Procedure **Title: Sorvall ST 16R Centrifuge**		**Rev. No**	*003*
		Pages:	*9*
Lab: Nanomaterials & Devices Group			

Written by	Approved by	Issue date	Review date
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1. Purpose

The objective of this SOP is to provide guidelines to all the laboratory personnel on operating the Sorvall ST 16R centrifuge.

2. Scope

The procedure is applicable to all research staff, research students and technical staff working in the laboratory.

3. Responsibility

It is the responsibility of the PI in conjunction with the laboratory I/C to ensure that all research and technical staff and students are advised, prepared and trained.

3.1. Principal Investigator

The Principal investigator is responsible for the implementation of these guidelines and takes ownership of all research and technical staff, graduate and undergraduate students under his charge in ensuring that they will carry out their activities in a reasonably practicable manner. The PI has to ensure that all the above mentioned personnel are adequately advised, prepared and trained.

3.2. Staff / Students

All research and technical staff and graduate students are under the obligation to work and behave safely and are responsible for taking care of their own health and safety and not placing themselves or others at risk of injury

4. Personal protective equipment

At a minimum, safety glasses with side shields, long sleeved laboratory coats, chemically resistant gloves, and closed toed shoes should be worn. This is to be considered as minimum protection and must be upgraded if necessary.

5. Safety precautions

Ensure that the rotor comes to a complete standstill before opening the centrifuge lid.

6. Procedure

6.1. Switch on centrifuge

- Turn on the power switch on the back of the device. The device performs a self-check of its software.
    - When the centrifuge lid is closed the following display shows:

      ```
        0 0:00  -10  9  9 3608
      ```

      The speed and time displays read 0. The temperature indicator displays the current temperature inside the rotor chamber. The preset acceleration and braking curves and the selected bucket are also displayed.

    - When the centrifuge lid is open the following display shows:

      ```
      15000 1:30  -10  9  9 3608
      ```

      The speed and time displays show the preset values. The temperature indicator displays the current temperature inside the rotor chamber. The preset acceleration and braking curves and the selected bucket are also displayed.

- Press the OPEN key  . Warning: Do not reach into the crack between the lid and the housing. The lid is drawn shut automatically.

- Place centrifuge tubes into rotor. **Note: Ensure weight on rotor is balanced i.e. centrifuge tubes with equivalent mass are placed at opposite slots.**
- Close the lid by pressing down on it lightly in the middle or on both sides of it. One lock closes the lid completely. Note The lid should audibly click into place. Warning: Do not reach into the crack between the lid and the housing. The lid is drawn shut automatically.

6.2. Entering the parameters

The Sorvall ST 16R offers a total of 9 acceleration and 10 braking curves with which samples and gradients can be centrifuged.

- Set the parameters as required:

6.2.1. Acceleration curve

- Press the key  below the ACC display in order to open the acceleration profile selection menu. The display shows the message "Set acceleration".
- Select the profile by pressing the  key until the desired acceleration curve shows.

6.2.2. Braking curve

- Press the ▽ △ key below the DEC display in order to open the braking curve selection menu. The display shows the message "Set deceleration“
- Select the profile by pressing the ▽ △ key, until the desired braking curve shows.

6.2.3. Preselecting Speed/RCF

- Press the ▽ △ key below the “SPEED” display in order to open the speed / RCF value menu. The display shows the "RPM“ or the "RCF"-value depending on the display setting. Press the CHANGE key ⌃ to toggle between the two modes.
- Enter the desired value by pressing the ▽ △ key repeatedly, until the desired value shows. Note: If an extremely low RCF value has been selected, it will be corrected automatically if the resulting speed is less than 300 rpm.

Explanation of RCF Value

The relative centrifugal force is given as a multiple of the force of gravity g. It is a unitless numerical value which is used to compare the separation or sedimentation capacity of various devices, since it is independent of the type of device. Only the centrifuging radius and the speed come into play in it:

$$RCF = 11,18 \times \left(\frac{n}{1000}\right)^2 \times r$$

r = centrifuging radius in cm

n = Rotational speed in rpm

The maximum RCF value is related to the maximum radius of the tube opening.

Remember that this value is reduced depending on the tubes and adapters used.

This can be accounted for in the calculation above if required.

6.2.4. Running time preselection

- Press the key below the TIME display in order to open the runtime selection menu. The display shows the message "Set Time". Enter the desired runtime in H.mm.
- Enter the desired value by pressing the key repeatedly, until the desired value shows.

6.2.5. Continuous operation

- Press the START key  . During continuous operation, the centrifuge will continue running until you stop it manually.

6.2.6. Preselecting the temperature

You can preselect temperatures between -10 °C and +40 °C. To set the temperature, proceed as follows:

- Press the key below the TEMPERATURE display in order to open the temperature selection menu. The display shows "Set temp".
- Enter the desired value by pressing the key repeatedly, until the desired value shows.

6.2.7. Prewarming or precooling the centrifuge

For setting the pretemp value for the centrifuge proceed as follows:

- Press the key in order to open the temperature selection menu. The display shows the message "Set PreTemp".
- Enter the desired value by pressing the key repeatedly, until the desired value shows.
- The display shows the current temperature inside the rotor chamber.

- Press the START key  . The rotor chamber is cooled down or heated up to the preset temperature.
- Press the STOP key  . The display shows the current temperature inside the rotor chamber.

6.3. Saving programs

- Enter the program parameters.
- Press any of the program store keys for 4 seconds.

6.4. Centrifugation

6.4.1. Starting centrifuge program

- Press the START key  on the control panel. The centrifuge accelerates to the pre-set speed with the time display active.

  If the speed setting is higher than the maximum permissible speed or RCF-value for the particular rotor, then the display will show the message max. 4,700 rpm once the centrifuge has been started. Within 15 seconds you can apply this value by pressing the START key 

again, and the centrifuging program will continue. Otherwise the centrifuge will stop and you will have to enter a valid number. You cannot open the lid as long as the centrifuge is running.

6.4.2. Stopping the centrifugation program

6.4.2.1. With preset running time

- Usually the running time is preset and you only have to wait until the centrifuge stops automatically when the preset time limit expires.
- As soon as the speed drops to zero, the message END will appear in the display. By pressing the OPEN key  , you can open the lid and remove the centrifuge material. You can also stop the centrifuging program manually at any time by pressing the STOP key  .

6.4.2.2. Continuous operation

- If continuous operation is selected, you will have to stop the centrifuge manually. Press the STOP key

 on the control panel. The centrifuge will be decelerated at the designated rate. The message "END" will illuminate, and after pressing the OPEN key  , the lid will open and you can remove the centrifuged material.

7. Revision History

Date Revised	Revision No.	Author	Revision Summary
05.10.2018	002	Zhang Qi	
23.12.2021	003	Justin Zhou Yong	Adopted standard format. Revised SOP to include more details.