Centrifuge Use

Environmental Health & Safety

SOP No. 5.1

	Print Name	Initial	Title	Date
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PURPOSE

The purpose of the SOP is to provide guidance on the operation and maintenance of centrifuges. Each laboratory has different operations that may require the use of a centrifuge. This SOP offers general guidance in the operation, maintenance and spill response for centrifuge use. Laboratories should develop proper SOPs that cover the specific operations (e.g., rotor speed used) and material precautions for their centrifuge use.

NOTES

Centrifuges are commonly found in many types of laboratories. These instruments rapidly spin liquid samples to fractionate, precipitate, or simply separate products. Because of the high spin speeds associated with even the most basic centrifuges, safety precautions must be followed when using them. In most cases, incidents are caused by either operator error or rotor failure. Using a centrifuge with damaged parts can result in an imbalance and resulting incident or exposure.

Besides operating the centrifuge safely, precautions must also be taken to reduce the risk of centrifuge rotor failure. The two main causes of centrifuge rotor failure are corrosion of the rotor metal and metal fatigue. Rotor corrosion is caused by exposure to sample or cleaning materials that are incompatible with the rotor material, creating microcavities that weaken the rotor structure. Metal fatigue is caused over time by continued expansion and contraction of the rotor metal during and after spin cycles.

PROTECTIVE EQUIPMENT

A lab coat (barrier-style is best for biological work), eye protection and disposable gloves are the minimum requirements for manipulating chemical/biological materials. Additional PPE may also be necessary.

MATERIALS

Distilled water, 1% non-alkaline detergent solution, bottle brush and paper towels are needed for cleaning. An appropriate disinfectant may also be needed if using biological materials.

PRE-OPERATION PROCEDURE

1. Always check the rotor, overspeed disc, pins and spindle for cracks, dents or other malformations. Use a flashlight to check cavities if needed. If any part is damaged, DO NOT USE THE CENTRIFUGE!
2. Avoid using dirty/damaged rotors or other centrifuge parts as these can also create imbalances and spin disruptions. Clean rotor or other parts before use if needed.
3. Always operate the centrifuge according to manufacture guidelines, making sure that the top speed is kept well below the maximum rated speed for the instrument.
4. Always run swinging bucket rotors with all buckets, even if some are empty.
5. It is best to wait a few moments after initiating run to ensure the centrifuge is running properly.
6. Allow the centrifuge to come to a stop before removing samples. Never stop a spinning rotor with your hand.

Rotors

1. Use caution when moving rotors as some larger rotors can be extremely heavy. Ask for assistance if needed.
2. Some rotors require specific positioning on the spindle to "lock". Ensure the rotor is properly placed inside the centrifuge.
3. Always make sure the rotor is balanced with adequately filled sample containers, not overfilled. A centrifuge with an unbalanced rotor has the potential to cause major, even lethal injuries as well as expensive equipment damages, while under or overfilling can cause sample containers to fail, creating an exposure risk to personnel.
4. If centrifuging solids, it is prudent to weigh your samples to ensure a balanced rotor because different samples may have different masses.
5. If your rotor has a lid, make sure it is well-tightened to properly secure materials.

Containers

1. Use only sample containers specified by the manufacturer because different containers are rated for different speeds. DO NOT mix brands of centrifuge tubes between equipment.
2. Ensure your containers are rated for the desired speed.
3. Use adapters if needed (e.g., centrifuging conical tubes at an appropriate speed).
4. Always check for cracks, dents or other malformations before using a container. If a container is compromised, discard it and obtain a new container.
5. Do not overfill containers. Most containers have a fill line.
6. Cap containers securely before beginning run.
7. Discard one-time use containers after run.

BSL-2 Considerations

1. If the centrifuge is under vacuum, there must be a HEPA filter in place.
2. Centrifuge safety cups may also be required for some biological samples to prevent aerosolization of materials.

MAINTENANCE

To keep rotors in good condition, follow the guidelines below after a run:

1. Take everything out of the rotor.
2. Rinse the rotor with distilled water.
3. Clean with 1% non-alkaline detergent solution and a soft brush such as a bottle brush.
4. Let the rotor dry completely upside-down on paper towels.
5. Lubricate o-rings with vacuum grease and metal threads with metal-to-metal grease. These greases are generally provided by the manufacturer. Also keep pins and trunnions lubricated.
    a. O-rings should always be greasy and dark black.
    b. The surfaces of the rotor are coated with an anodizing agent so they will appear dark when in good condition. If you see metal shining through this coating, the rotor must be repaired before further use.
6. Store the rotor in an appropriate location such as a refrigerator, NOT back inside the centrifuge. If storing in a refrigerator or freezer, make sure the rotor is completely dry as remaining water can freeze inside the cavities creating an imbalance.
7. Have the rotors checked annually by a professional.

In addition to properly maintaining rotors, you must also keep track of how the rotor is used. Metal rotors de-rate over time and usage. For example, a brand-new rotor may be rated up to 20,000xg but de-rate to only 10,000xg after 5,000 uses. The user manual for the instrument will give you this information. Keep rotor logs documenting the time, setting, and quantity/type of material run for each cycle to make sure you are only using the centrifuge at the rated speed with compatible materials. Make sure that your tubes are rated for the correct brand and speed as well. Tubes that are rated for a different brand than specified for the rotor or rated for a lower speed than the rotor may fail.

EMERGENCY PRE-PLANNING

Should a spill occur inside of a centrifuge, adhere to the following steps:

1. Close the centrifuge lid and let sit for 20 minutes to allow aerosols within the centrifuge to settle.
2. While waiting, disinfect the exterior of the centrifuge with an appropriate cleaner or disinfectant. Allow for correct contact time if disinfecting. Follow with water or 70% ethanol if bleach was used.
3. Open the centrifuge carefully and remove any pieces of debris from the centrifuge interior using forceps and place in a solid container if chemically contaminated or biowaste bag.
4. Remove rotor and set aside for cleaning. It is prudent to set on top of paper towels or absorbent lab paper to avoid contaminating the work surface below. If biological materials are involved, it is prudent to disinfect the rotor in a BSC.
5. Absorb/cover the spill with paper towels.

6. Squirt disinfectant on towels and remaining interior of centrifuge using a laboratory soak bottle or pour disinfectant. Let sit for 20 minutes. Do not use a spray bottle as this can aerosolize contaminants.
7. Follow with DI-water if bleach was used, then 70% ethanol or isopropanol.
8. Dispose of all waste as biohazardous or chemical waste.

In the event of centrifuge or rotor failure, notify your supervisor and EHS immediately. An incident report https://www.depts.ttu.edu/ehs/about/docs/TTU-Student-Visitor-Incident-Report.pdf must be submitted to EHS.

Submit safety concerns or near-misses (i.e., almost incidents) to EHS using the SCAN report: http://www.depts.ttu.edu/ehs/about/scan.php

REFERENCES

Spills in a Centrifuge, Section B6.2.5 of the Biosafety Manual

AKNOWLEGEMENT OF PROFICIENCY

The individuals below have been trained and are competent in completing the above procedure.

Worker Name	Worker Signature	Date	Supervisor Initial	Date

ROTOR LOG

Log each use of the centrifuge. **Centrifuge must be de-rated after _____ uses.

Worker Name	Quantity/Type of Material	Time	Speed	Date

DECONTAMINATION LOG

Centrifuge must be decontaminated regularly to prevent buildup of materials.

Worker Name	Disinfectant	Date