

ThermoFisher
S C I E N T I F I C

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Maximizing Your Investment Through Safe Rotor Use

Why is Rotor Care Important?

- Maximize your capital investment and extend equipment life
- Improve the safety of work space
- Maximize productivity with reduced down-time
- Ensure continues workflow without interruption



High Speeds = High Weight Per Cavity = **Increased Risk for Sample Loss**
Light Buckets + High Speed = Tremendous Pressure = **Increased Risk for Sample Loss**

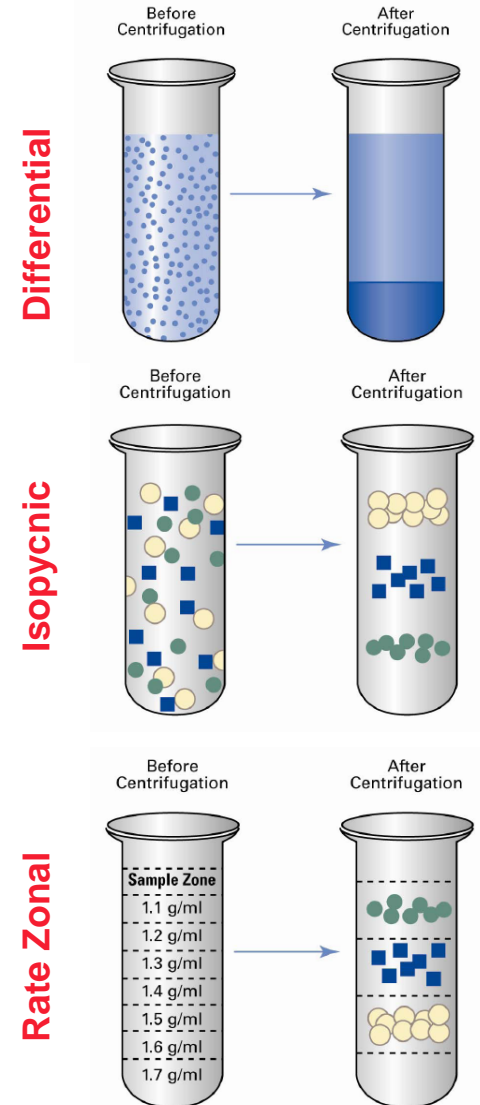
ROTOR FAILURES CAN BE PREVENTED!

What You Will Learn

- Centrifuge Basics
 - Class of Centrifuges
 - Types of Rotors
 - Rotor Materials
- Why is Rotor Care Important?
- Six Causes of Rotor Failure and Preventative Measures
 - Incorrect Loading or Balancing
 - Incorrect Attachment of Rotor Parts or to Drive
 - Consumable Failure
 - Overloading
 - Corrosion
 - Fatigue
- Summary

Centrifugation

- A process used to separate or concentrate materials suspended in a liquid medium.
- Particles separate on the basis of particle size and density.
- The end result is liquid (supernatant) and an aggregation of particles of a size large enough to separate at the programmed speed (pellet).
- Three types of centrifugation:
 - Differential (basic pelleting)
 - Isopycnic (separation based upon particle density)
 - Rate Zonal (separation based upon particle size)



Centrifuge Classes – Floor Models

- Ultraspeed
 - Up to 1,000,000 x g
 - Limited range of rotors and volumes for specific applications
- Superspeed
 - Up to 75,000 x g
 - Wide range of rotors up to 6 L capacities
- Lowspeed
 - Up to 7,333 x g
 - Small range of rotors specifically targeted at gross separation of large cells



Centrifuge Classes – Benchtop Models

- General Purpose Benchtop
 - Up to ~24,000 x g
 - Wide range of rotors with typical volume capacity up to 3 L
- Small and Clinical Benchtop
 - Up to ~5,000 x g
 - Limited range of rotors designed for basic clinical work
- Microcentrifuges
 - Up to ~24,000 x g
 - Small high speed centrifuge for use with 2.0ml or smaller microtubes such as PCR



Rotor Types

- **Fixed Angle** – primarily used for differential centrifugation
- **Swinging Bucket** – primarily used for gradient work
- **Vertical** – primarily used for isopycnic separations
- **Continuous Flow** – used for large volume batch separations



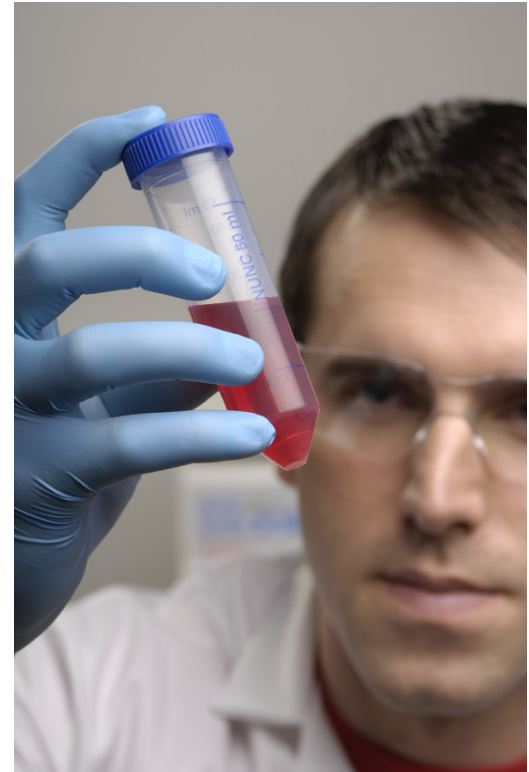
Rotor Materials

- Aluminum
 - Lightweight
 - Can withstand high g-forces and extreme temperature changes without premature fatigue
- Titanium Ultraspeed Rotors
 - Can withstand much higher g-forces than aluminum
 - Offer superior chemical and temperature change resistance
- Stainless Steel Rotors
 - Useful for some large volume rotors
- New Carbon Fiber Rotors
 - Lighter than aluminum or titanium
 - Have better chemical resistance and will not corrode when exposed to some regularly occurring laboratory corrosives such as CsCl

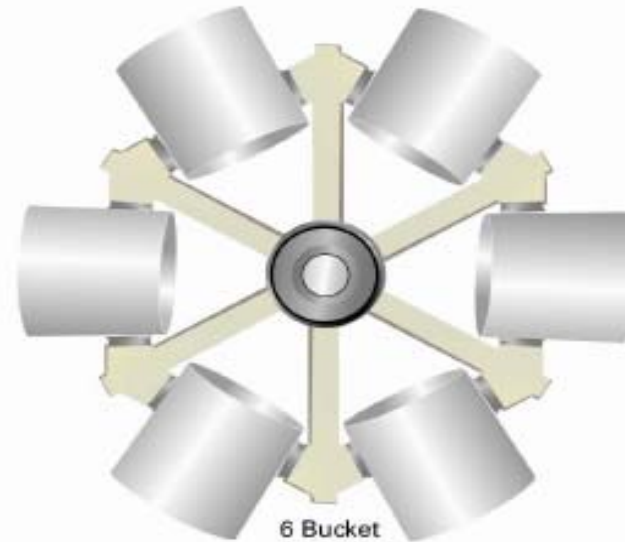
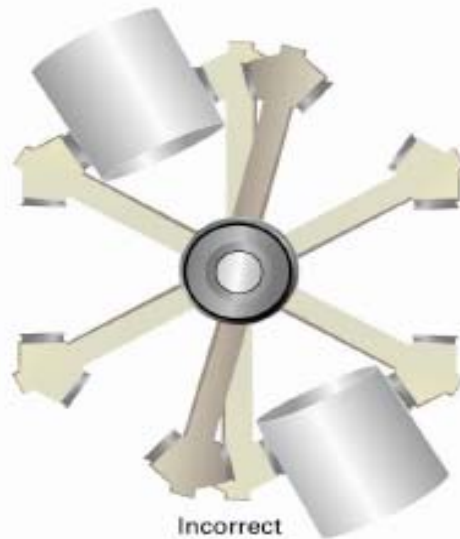


Six Causes of Rotor Failure

- 1 Incorrect Loading or Balancing
- 2 Incorrect Attachment
- 3 Consumable Failure
- 4 Overloading
- 5 Corrosion
- 6 Fatigue

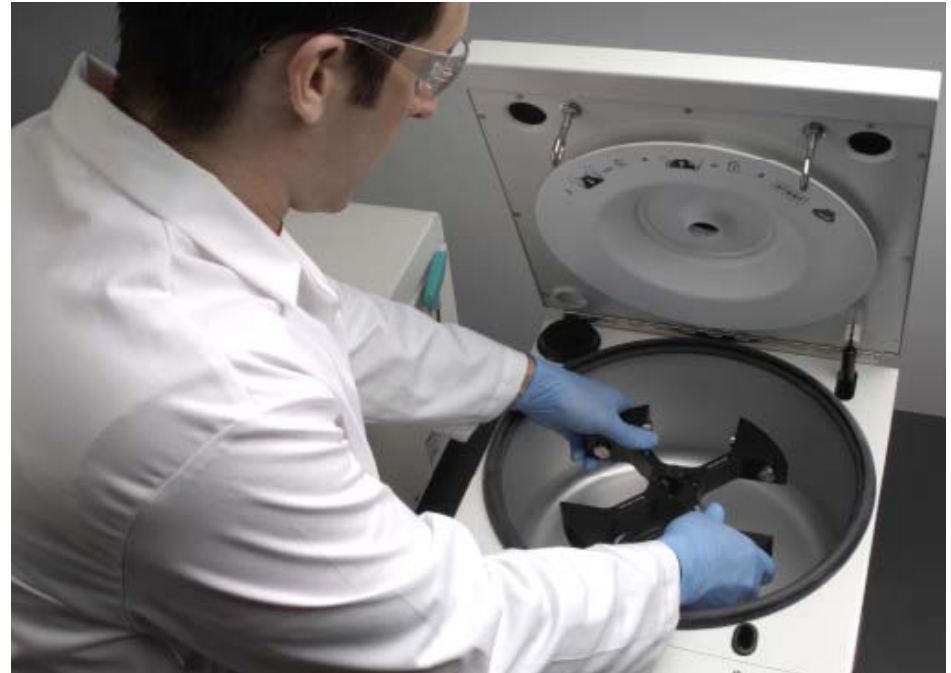


- Always run centrifuge with ALL buckets in place
- Always load buckets symmetrically
- Always balance adjacent and opposing loads within manufacturer's recommended tolerance



- **Attachment to Centrifuge**

- Superspeed rotors must be locked down to centrifuge drive by tightening the lock knob
- Lowspeed rotors must be fastened by locking pin
- General purpose, small benchtop, and micro-centrifuges must be fastened by locking nut or other mechanism as specified by manufacturer



Always double check that your rotor is locked down before pressing start !

- **Swinging Bucket Rotors**

- Buckets must be placed properly on the swinging arms
- Swinging bucket rotors must have all buckets in place
- Buckets should be cleaned and lubricated regularly to ensure a free swing out during the run



For swinging bucket rotors, gently swing out each bucket to ensure a free easy motion. Always double check before pressing start

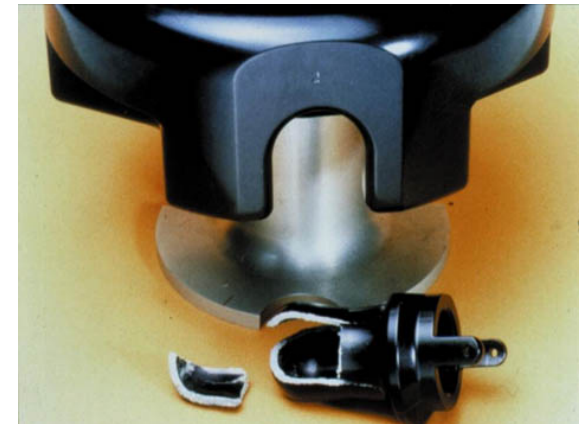
- Ensure you are not exceeding the maximum rated speed by the manufacturer
- Ensure consumable is chemically compatible with your sample
- Make sure you have all the parts and use according to the directions
- Know the history of shared consumables
- Inspect before every use and do not use if signs of wear are apparent
- Implement replacement program – consumables should be replaced regularly
- If in doubt contact manufacturer and verify proper use

Tube Ordering Information										
Cat. No.	Tube Vol. (ml)	Vol. Fill (ml)	Description	Qty.	Max. Speed (rpm)	Dims. Ø x L (mm)	Sealing Assembly Required:			Accessories Required:
							Cat. No.	Qty/ pkg	Description	
03945	6	5.7	PA Ultracrimp Tube	50	100,000	13 x 66	Included	50	Plug and Cap	45662 Rotor Cap, 03921 Tube Racks, 03920 Crimp Sealing Tool
01086	6	5.7	PET Clearcrimp Tube	50	100,000	13 x 66	Included	50	Plug and Cap	45662 Rotor Cap, 03921 Tube Racks, 03920 Crimp Sealing Tool
45660	6.5	5.8	PA Thin-Walled Tube	50	80,000	13 x 64	45801	1	Multipiece Titanium Assembly	52176 Tube Cap Vise, 52177 Tube Removal Tool
45661	6.5	5.8	PC Thin-Walled Tube	50	60,000	13 x 64	45801	1	Multipiece Titanium Assembly	52176 Tube Cap Vise, 52177 Tube Removal Tool

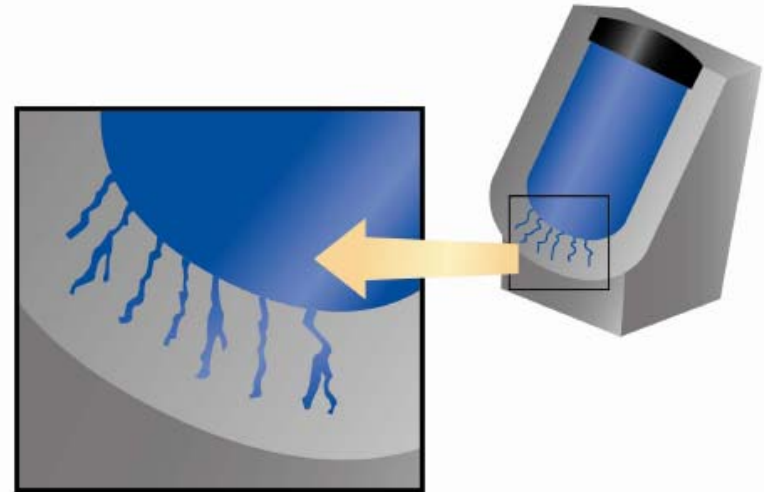
- All rotors are designed with a maximum load tolerance at the maximum speed
 - If the maximum load is exceeded then the maximum speed **MUST** be derated – **ALWAYS** check this in the manual and use the formula below

$$\text{Reduced Speed (rpm)} = \text{Maximum Rotor Speed (rpm)} \times \sqrt{\frac{\text{Maximum Compartment Mass}}{\text{Actual Compartment Mass}}}$$

- Ultraspeed swinging bucket rotors used for gradient work – density of sample should be verified against speed and temperature to prevent point load failure



- Surface corrosion - caused by long term exposure to moisture or chemicals
- Stress corrosion - surface corrosion that is allowed to propagate until microcracks are formed deep into the structure of the rotor
- How to prevent surface corrosion:
 - Clean rotors between every use
 - Thoroughly dry rotors between uses
 - Remove adapters between runs
 - Never use metallic objects to open or remove parts
 - Always use cleaning, disinfection and sterilization agents that are chemically compatible with the rotor



If your application is corrosive consider an alternative rotor material such as carbon fiber!

- Rotors are exposed to high g-forces and do wear out
- The molecular structure of the rotor changes as the metal elongates repeatedly – **eventually they will fail!**
 - Ultraspeed rotors have a recommended use and retirement span rated by the number of cycles or hours used
 - Superspeed rotors are warranted for 10 years and should be considered for retirement even if they are in good condition
 - All other rotors – the guidelines vary and should be verified before use
 - All rotors need to be retired – even when they appear to be in good appearance – metallic parts fatigue over repeated uses with no visible signs of wear

Have your rotors inspected regularly by a trained technician.

Summary – Be Smart, Be Proactive!

- Improve the life of your rotor and prevent damaging failures:
 - Balance properly
 - Attaching rotor and parts correctly
 - Proactively managing consumable use
 - Never overload
 - Prevent corrosion with best lab practices
 - Retire rotors



Improve your lab experience by preventing messy spills or catastrophic accidents that cause significant repair costs and loss of your precious samples!



Thank You.

For more information on Thermo Scientific Centrifuges,
Rotors and Accessories, please visit us at:

www.thermo.com/centrifuge

www.thermo.com/rotors