

Care and Handling of Rotors

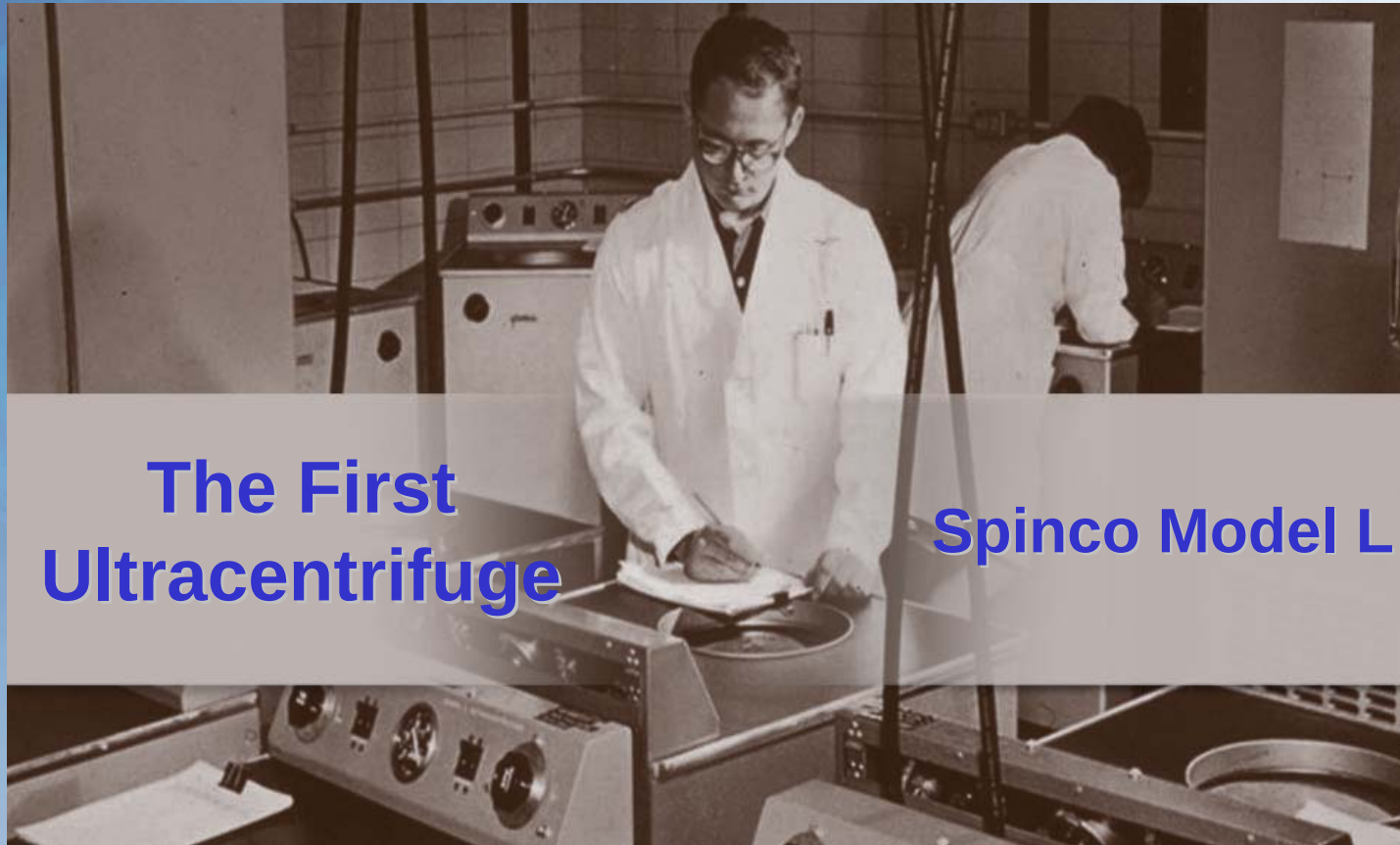
Today's Objectives

- **Help you to use centrifuge systems safely**
- **Ensure maximum life of your investment**
- **Avoid unbudgeted lab expenses**
- **Maximize experiment integrity**

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Centrifugation around since 1948



**The First
Ultracentrifuge**

Spinco Model L

There is a wide variety of centrifugation systems



Correct Rotor Use

Correct Rotor Use depends on Several Factors

- ✓ Use rotors only as part of approved systems
- ✓ Properly balance loads
- ✓ Understand sample density
- ✓ Correct attachment of rotor lids and buckets
- ✓ Proper use of tubes, adapters, accessories, and tools

Consult your Operators Manual



Use rotors only with Approved Systems

- Instruments and rotors are tested as a System (IEC-10-10-2)
- Only approved Rotor-Instrument Systems are proven to be safe
- Using non-approved components can result in
 - Instrument or rotor damage
 - Unbudgeted expense
 - Personal injury

The energy of an operating centrifuge is enormous . . .



- Situations such as this emphasize the importance of following centrifuge safety and rotor use and care procedures

Correctly Balance Rotor Loads

At $1,000,000 \times g$,
1 gram weighs 1,000 kg

Which Equals . . . The Weight of a Mini Cooper



For Ultracentrifuges...

- Balance opposing sample loads within 0.5 grams for fixed angle rotors
- Balance opposing sample loads within 0.2 grams for swinging bucket rotors

Consult your Operators Manual

For High Performance and Benchtop Centrifuges...

- Balance specification is instrument / rotor dependent
- Some rotors offer imbalance correction
 - 50 to 100 grams!

Consult your Operators Manual



Maximum Sample Density for Rotors Is...

**1.2 g/mL for most
rotors**

**1.7 g/mL for VTi and
NVT rotors**

Consult your Operators Manual
**for information on precipitating
gradients**

Any Guesses ??



A dark, textured background, possibly a deep purple or black surface. In the upper left, there is a metallic, cylindrical object, possibly a mechanical part or a tool, with a glowing orange light at its base. To the right of this object, there is a small, glowing orange ring or ring-like object. The overall scene is dimly lit, with the glowing elements providing the primary light source.

How About This One ??

Proper Rotor Handling

- **SW Rotors**

- Buckets: Inspect for proper attachment
- Handling: Hold SW rotors correctly
- Installation: Properly attach rotor to Spindle

- **Fixed Angle Rotors**

- Lid: Tighten correctly
- Installation: Properly attach rotor to Spindle



Proper Handling of SW rotors

INCORRECT

- Improper handling can lead to
 - Mishooked buckets
 - Disturbed gradients



Proper Handling of **SW** rotors

CORRECT

- Hold rotor with both hands



Proper Handling of **SW** rotors

Inspect Buckets Prior to the Run

- Mis-hooked buckets are the leading cause of rotor mishaps in Ultracentrifuges



Proper Handling of **SW** rotors

- Some rotors, such as the SW-32Ti, have simplified the bucket attachment process



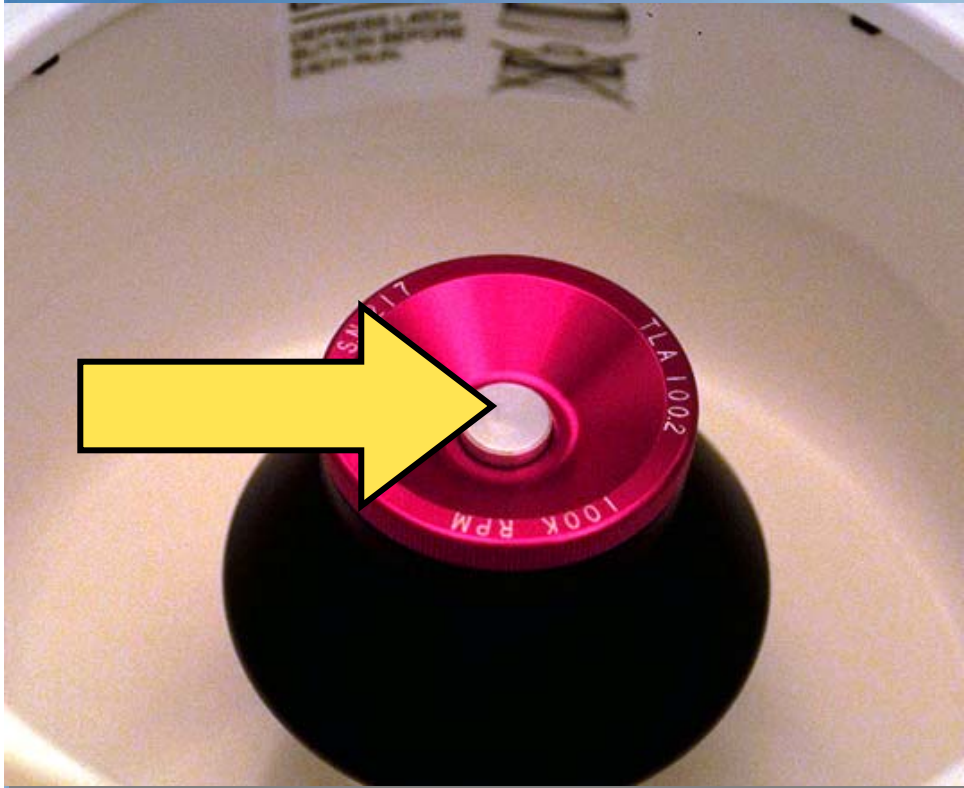
Lid Attachment: Optima Series





Rotor Attachment: Optima Series

- Place the rotor straight down onto the spindle
- The rotor is self locking



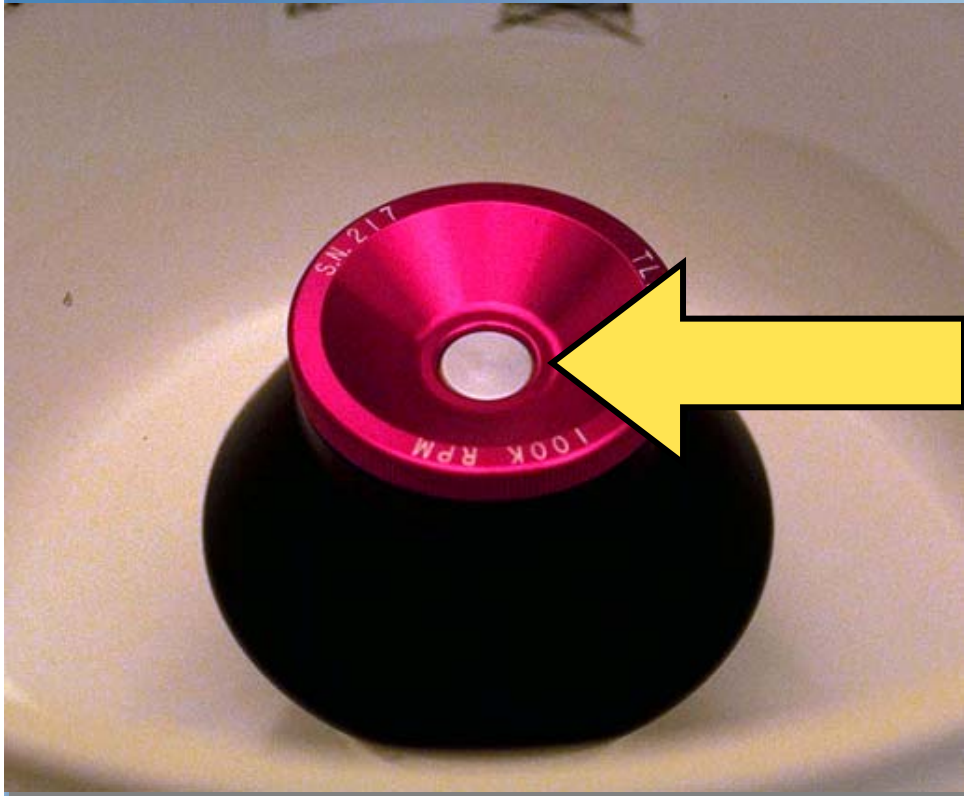
Rotor Attachment: TL Series

- For TL series rotors with buttons
- Place the rotor on the spindle



Rotor Attachment: TL Series

- Push the button to lock the rotor onto the spindle



Rotor Attachment: TL Series

- Check to ensure proper attachment
- Rotors without locking buttons are self-locking



Lid Attachment: Bio-safe Rotors

- For rotors with dual knobs:
- First, turn the lower knob clockwise to attach the lid to the rotor
- When the rotor is placed in the centrifuge, tighten the center knob clockwise



Rotor Attachment:

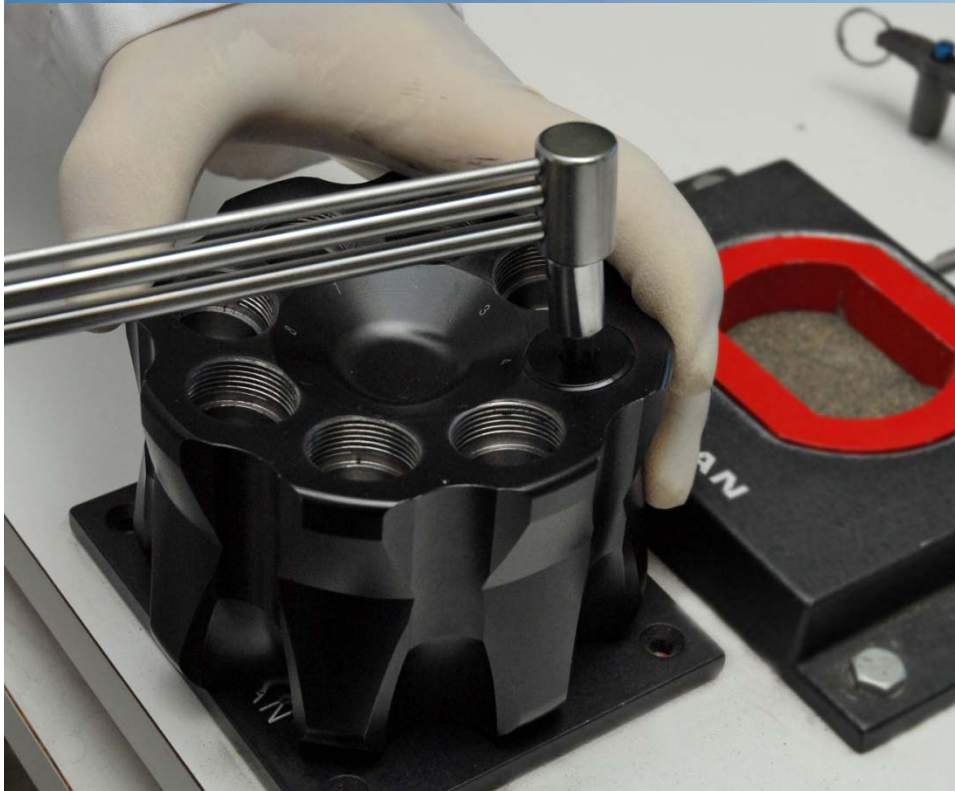
- For rotors with single knobs:
- When the rotor is placed in the centrifuge, tighten the knob clockwise
- The single knob locks the rotor to the spindle and attaches the lid to the rotor





Rotor Attachment:

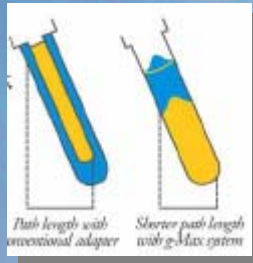
- Turn the locking handle clockwise to attach the rotor to the centrifuge spindle



Rotor Preparation: Vertical Rotors

- Consult the rotor manual for each vertical rotor for correct use of tools

Tubes, Bottles and Adapters



- A vast selection of tubes, bottles, adapters and other accessories are available for use in your centrifuge
- Consult the rotor manual for correct use of tubes, bottles, and adapters
- *Improper labware use is a leading cause of rotor mishaps*

Tubes, Bottles and Adapters

- Use only the tubes, bottles, and adapters listed in the rotor manual or Rotors and Tubes guides
- Third-party tubes and bottles may not handle the high g -forces of your centrifuges
- Be aware of proper filling levels and cap usage instructions





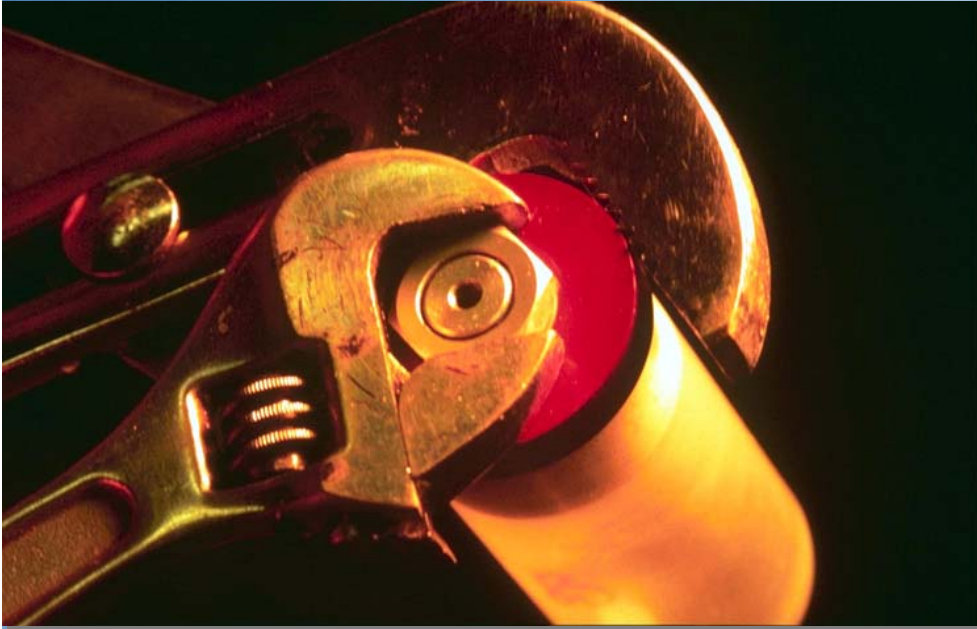
Proper Use of Tools

Proper Tools



- Consult your rotor manual for guidance on proper use of tools for rotors and tubes

Improper Tools



- Improper tool use can damage parts and cause a safety hazard for centrifuge users

Rotor Care and Maintenance

Proper Cleaning Utensils



BCI Rotor Cleaning Kit

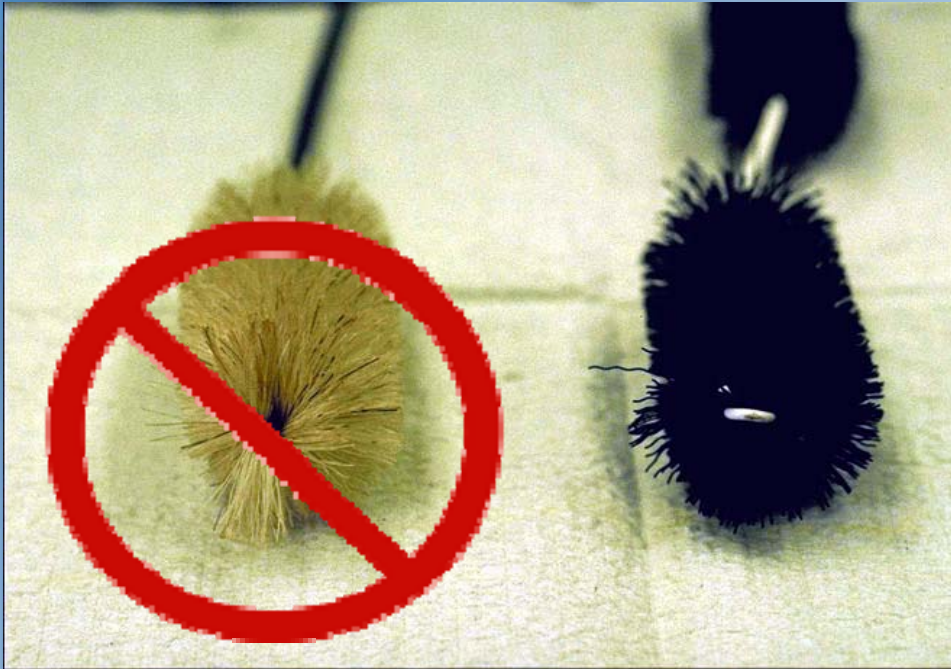
Cleaning procedure

- Wash rotor frequently – at least weekly
- Remove O-rings before washing
- Use mild detergent, such as Solution 555, and soft brushes (both are available in the BCI Rotor Cleaning Kit)
- Thoroughly rinse with distilled water
- Air-dry upside down
- Re-lubricate O-rings with vacuum grease
- Re-lubricate metal threads with Spinkote

Consult your Operators Manual



Proper Brushes



- Improper brushes can scratch and damage rotor tube cavities

Inspect Periodically

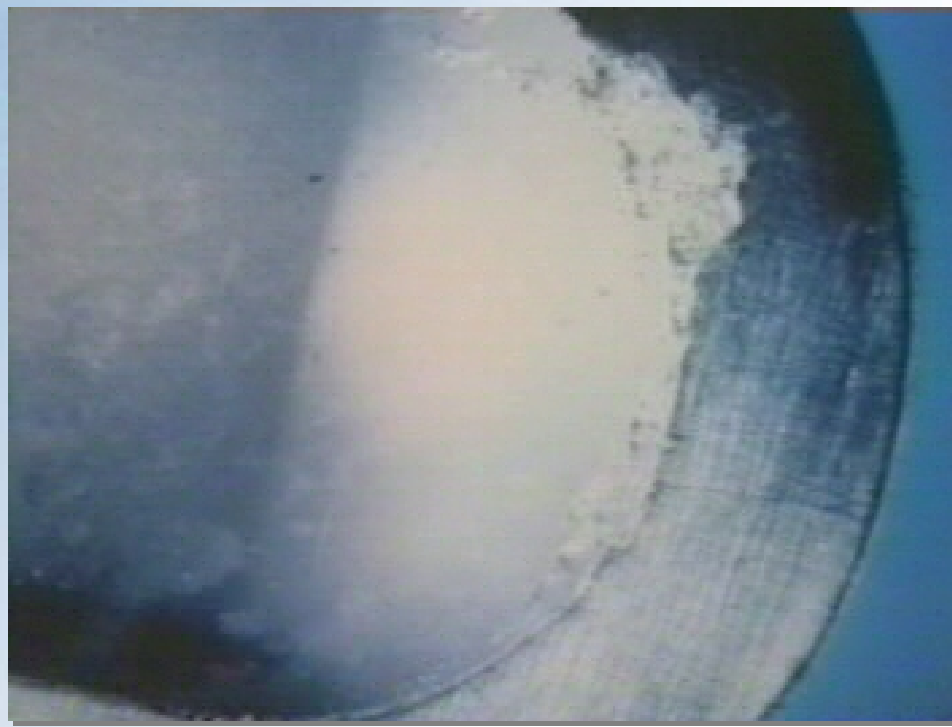
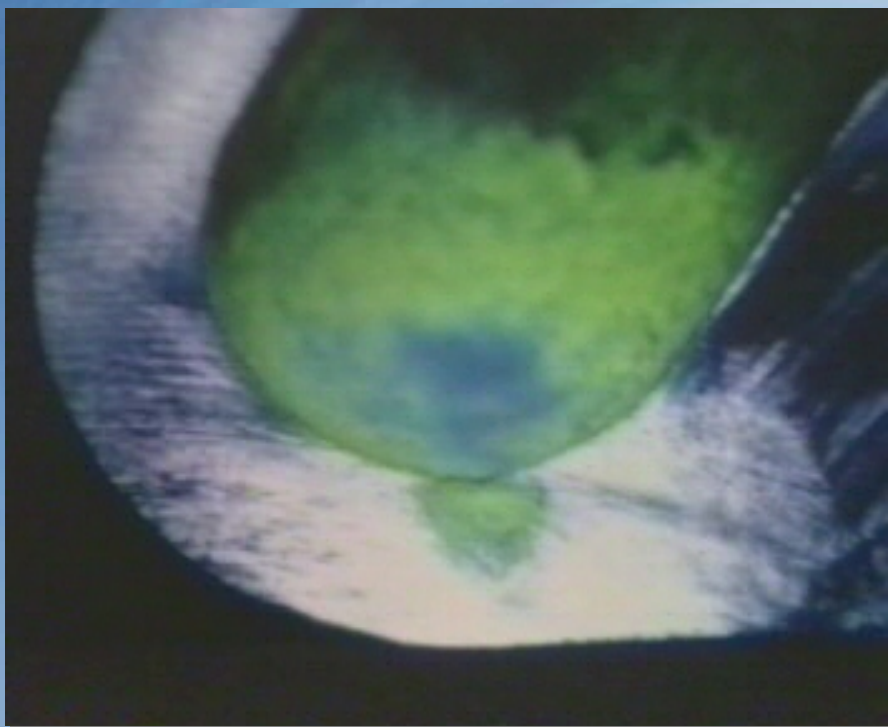
- Inspect rotor body and tube cavities
 - Pitting, rough spots, cracks or damage
 - White deposits may indicate stress corrosion
 - Discoloration
- Lubricate rotor and components as indicated in rotor manual
- Inspect O-rings for cuts, abrasions, or flattened areas; replace if damaged
- Inspect and replace overspeed disk if damaged
- Contact Field Service if you have questions

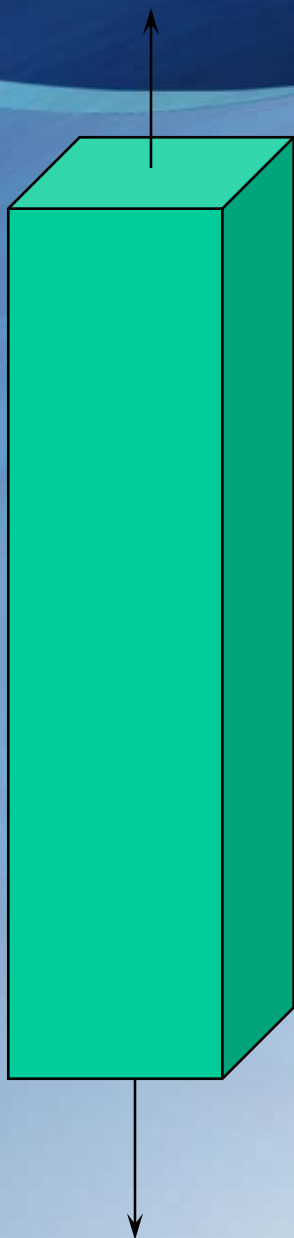
Consult your Operators Manual

Stress Corrosion

Over time, the combination of tensile load and environment creates stress corrosion, which significantly reduces the service life of the metal, specifically aluminum alloys.

CORROSION **can destroy aluminum rotors**





NO CORROSIVE ATTACK

LOAD = 6000 lbs

LOAD = 26,700 N

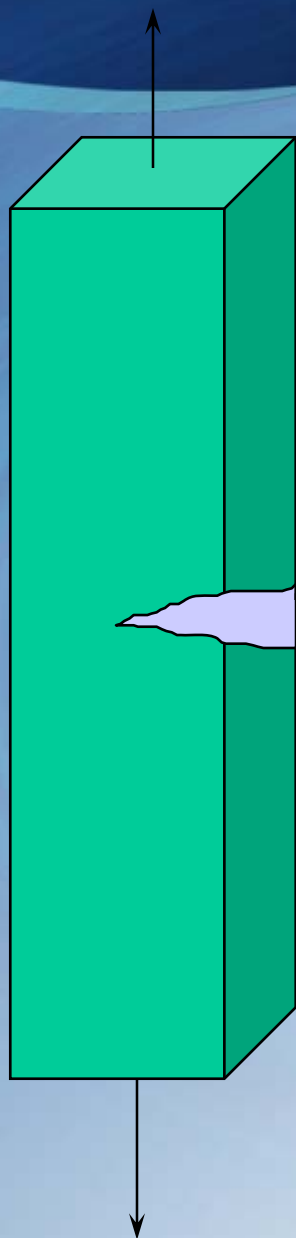
AREA = 1.00 sq in

AREA = $6.45 \times 10^{-4} \text{ m}^2$

STRESS = 6000 lbs/sq in

STRESS = $4.14 \times 10^7 \text{ N/m}^2$

STRESS = 41.4 MPa



CORROSIVE ATTACK

LOAD = 6000 lbs

LOAD = 26,700 N

AREA = 0.60 sq in

AREA = $3.87 \times 10^{-4} \text{ m}^2$

STRESS = 10,000 lbs/sq in

STRESS = $6.90 \times 10^7 \text{ N/m}^2$

STRESS = 69.0 MPa







Points to Remember

- Anodized aluminum is corrosion resistant, not corrosion proof
- Although titanium and carbon composite rotors are highly corrosion resistant, these rotors may have anodized aluminum components
- Consult chemical compatibility charts





Proper Lubrication is Important



- Periodically lubricate O-rings with vacuum grease
- Lubricate threaded portions of rotor with Spinkote
- Lubrication maintains vacuum sealing and enhances smooth operation of components

Consult your Operators Manual

Overspeed Disk Replacement



Overspeed Disk Replacement



Overspeed Disk Replacement



Overspeed Disk Replacement



Periodically Inspect Rotor Hub Pins



Decontamination

- Radioactive material
 - Use a cleaning agent that will not harm anodized aluminum
- Toxic or Pathogenic contamination
 - Follow appropriate procedures outlined by your Laboratory Safety Officer

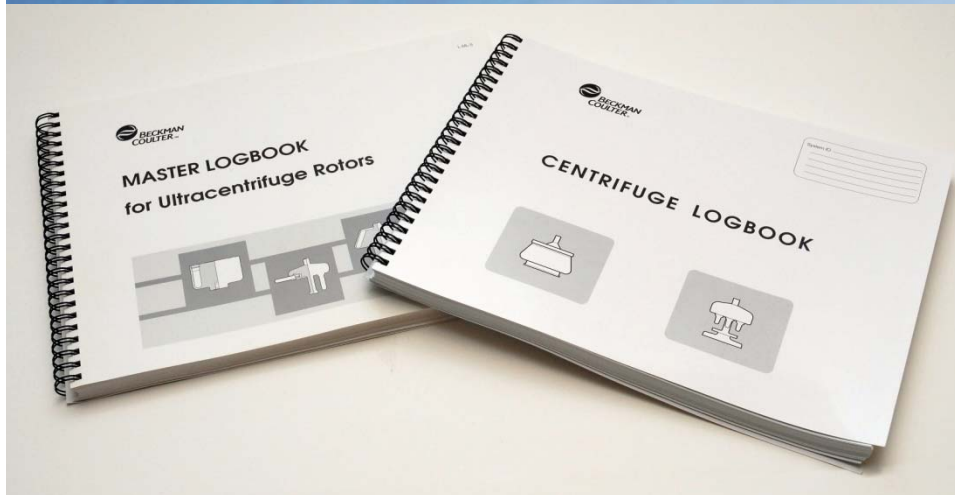
Sterilization

- Follow procedures outlined by your Laboratory Safety Officer
 - Most metal components can be autoclaved up to 1 hour at 121°C (up to 30 minutes for most composite rotors; see manual)
 - Cold methods – 70% ethanol, 6% hydrogen peroxide – can be used
 - ✓ Bleach may discolor anodized surfaces

Rotor Storage

- Store rotors upside-down to ensure that condensation does not collect in tube cavities
- Store rotors in a dry environment
- Remove all tube adapters from tube cavities before storage

Run Logging



- Run Logging is not required for warranty
- Using a logbook can help lab managers track rotor and instrument usage patterns

Rotor Care Review

- Use proper cleaning solutions
- Use proper cleaning brushes
- Use proper storage techniques
- Read the rotor instruction manual
- Ask your Field Engineer



Out-of-Warranty Rotors and Rotor Retirement

Rotor Life and Rotor Warranty

- Rotor life is not related to warranty period
- Rule-of-thumb rotor lifetimes
 - Optima Ultracentrifuge rotors
 - ✓FA and VTi rotors: 12 years
 - ✓SW rotors: 10 years
 - High Performance Centrifuge rotors
 - ✓JA rotors: 15 years

*When in doubt, consult with Service to
determine safe rotor usage*

After Sales Support

Field Rotor Inspection Program

- Check if available as part of your service agreement
- Ensures a long service life for your rotors
- Increases lab safety
- Minimizes lab down time
- Minimizes repair and replacement expenses

Rotor Inspection by Factory-Trained Inspectors

The inspector will

- Examine your rotors with non-destructive techniques
- Indicate possible repairs or modifications to run protocols
- Recommend rotor retirement based on condition, run cycles, or age
- Advise on care and handling techniques

What's In It For You?

- **Helps you use centrifuge systems safely**
- **Ensures maximum life of your investment**
- **Avoids unbudgeted lab expenses**
- **Helps assure experiment integrity**
- **Helps insure against loss of valuable sample and lab preparation time**

Any Questions ?

Thank You!

