

THE BEARING BOSS

JOURNAL BEARINGS IN TURBOMACHINERY

MOUNTING, MEASUREMENTS, REPAIR, FAILURE ANALYSIS & INSPECTIONS

CAPTAIN ROTOR HERO

Relax, Captain Rotor. We will mount, measure and inspect it right.

JOURNAL BEARING

THRUST PAD DEFENDER

Oh no... not this fussy bearing guy again!

MR. FAILURE

MOUNT RIGHT. MEASURE RIGHT. REPAIR SMART.

Khash, MLE, CLS, MLA III, MLT II, VIM, VPR

WHO SUPPORTS THE ROTOR?

MEET HEROES

Meet the heroes behind rotor stability!

Journal Bearing = Radial Support

Thrust Bearing = Axial Control

MR. JOURNAL BEARING

I support radial load.



I keep the rotor centered!

GENERAL THRUST

I control axial load.



I stop dangerous axial movement!

CAPTAIN ROTOR



I need both of you to stay stable!

Without us, the rotor becomes a troublemaker!



RADIAL SUPPORT. AXIAL CONTROL. ROTOR STABILITY.

Khash, MLE, CLS, MLA III, MLT II, VIM, VPR

NO OIL FILM = NO PEACE


WHY JOURNAL BEARINGS MATTER

1




In a journal bearing, the shaft should ride on **oil** – not on **metal**.

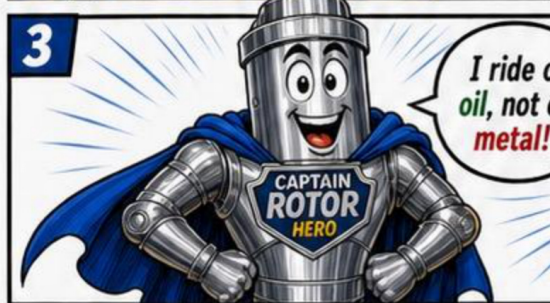
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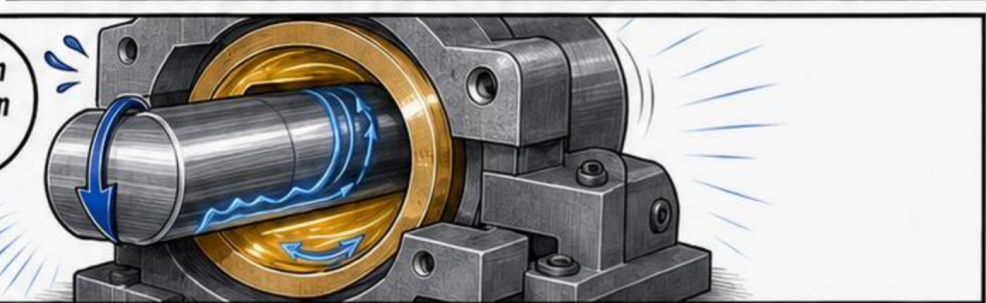
Hydrodynamic lubrication keeps metal apart!



3



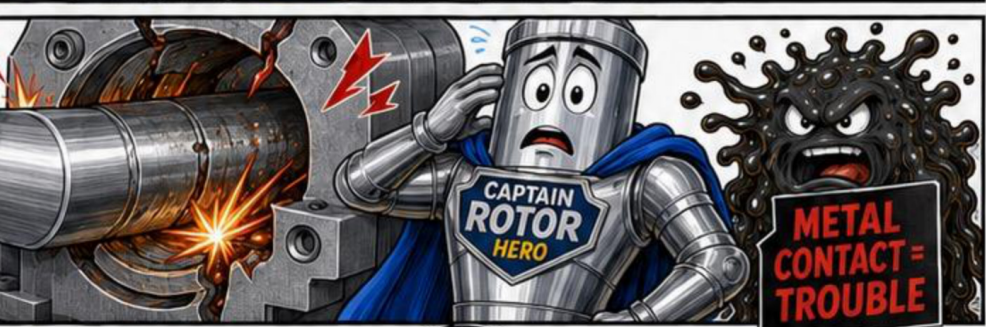
I ride on **oil**, not on **metal**!



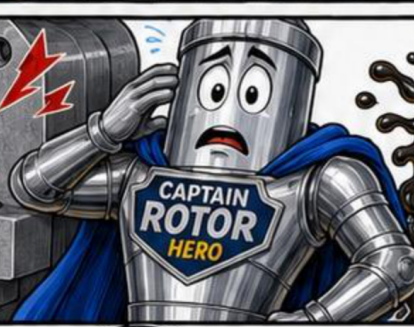
4



No oil film means **heat**, **wear**, and **instability**.



METAL CONTACT = TROUBLE




5



Stable oil film = stable machine.



SMOOTH FLOW. STRONG MACHINE. ZERO WORRIES.



THE SHAFT RIDES ON OIL – NOT ON METAL.

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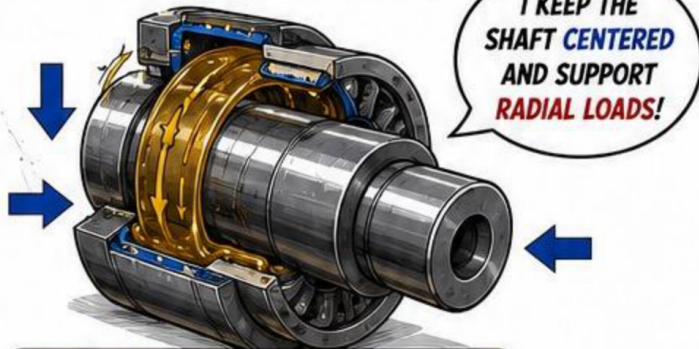
RADIAL vs AXIAL - JOURNAL vs THRUST BEARING

DIFFERENT LOADS. DIFFERENT MISSIONS.



JOURNAL BEARING (RADIAL BEARING)

- SUPPORTS **RADIAL LOADS** (PERPENDICULAR TO THE SHAFT)

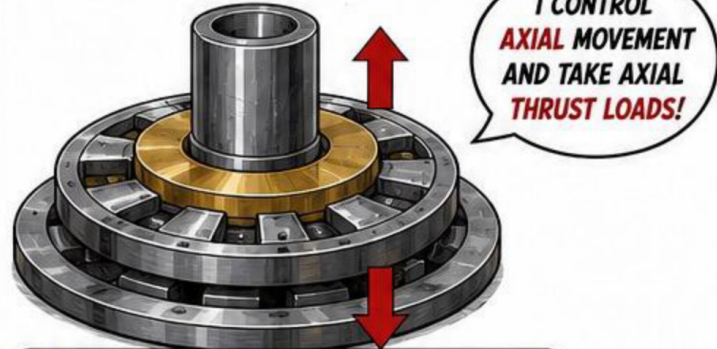


WHERE I WORK:

- TURBINE CASING BEARINGS
- COMPRESSOR BEARINGS
- PUMP BEARINGS
- GEARBOX BEARINGS

THRUST BEARING (AXIAL BEARING)

- HANDLES **AXIAL LOADS** (ALONG THE SHAFT)



WHERE I WORK:

- TURBINE THRUST BEARING
- COMPRESSOR THRUST BEARING
- PUMP THRUST BEARING

TOGETHER WE KEEP THE ROTOR STABLE!



WHAT HAPPENS IF WE FAIL?

RADIAL BEARING FAILURE

- VIBRATION INCREASES
- SHAFT RUNS OFF CENTER
- CONTACT, HEAT, DAMAGE

THRUST BEARING FAILURE

- AXIAL MOVEMENT
- ROTOR RUBS
- SEVERE DAMAGE



REMEMBER!



RESPECT THE LOADS.
MOUNT CORRECTLY.
INSPECT REGULARLY.
KEEP THE OIL CLEAN.
THAT'S HOW WE PROTECT THE MACHINE!

RIGHT BEARING. RIGHT LOAD. RIGHT CARE. LONG LIFE!

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KNOW THE PARTS BEFORE THE PROBLEM

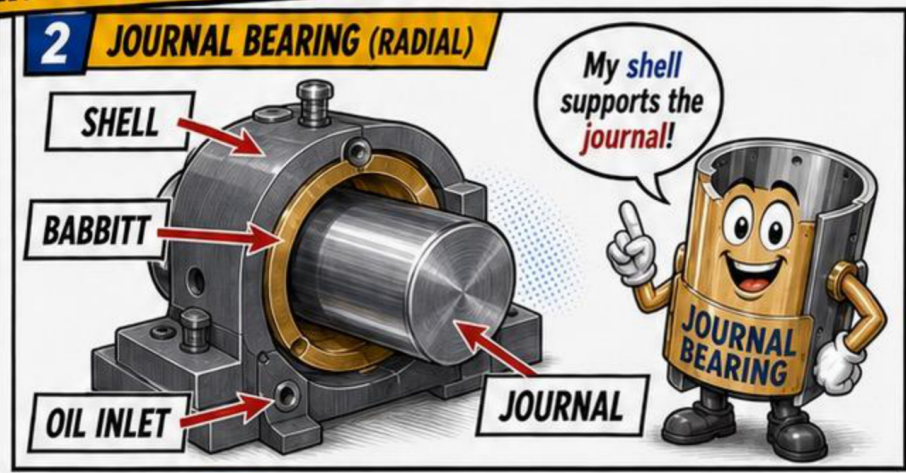
BEARING PARTS & TERMINOLOGY

1



If you cannot name it, you cannot inspect it well.

2 JOURNAL BEARING (RADIAL)



SHELL

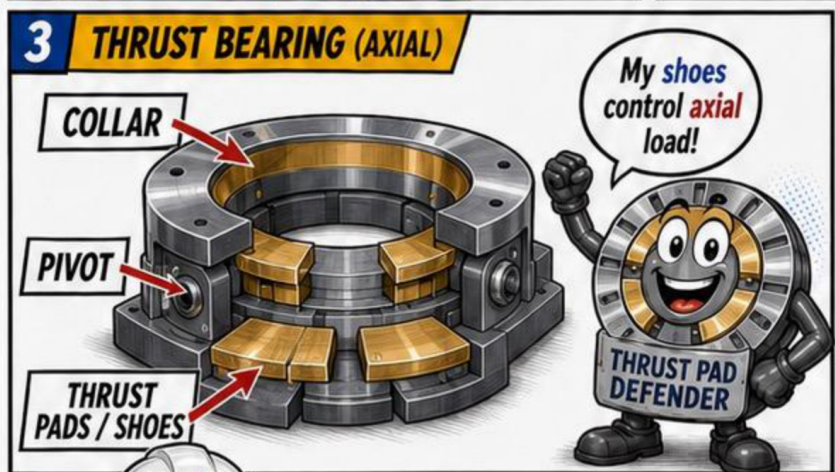
BABBITT

OIL INLET

JOURNAL

My shell supports the journal!

3 THRUST BEARING (AXIAL)



COLLAR

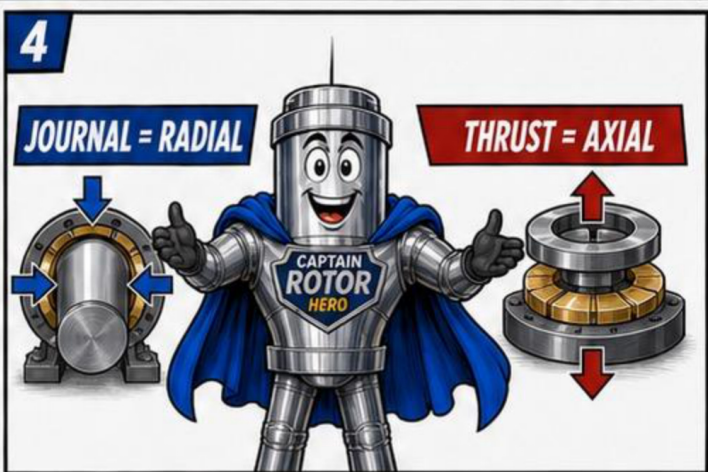
PIVOT

THRUST PADS / SHOES

My shoes control axial load!

THRUST PAD DEFENDER

4

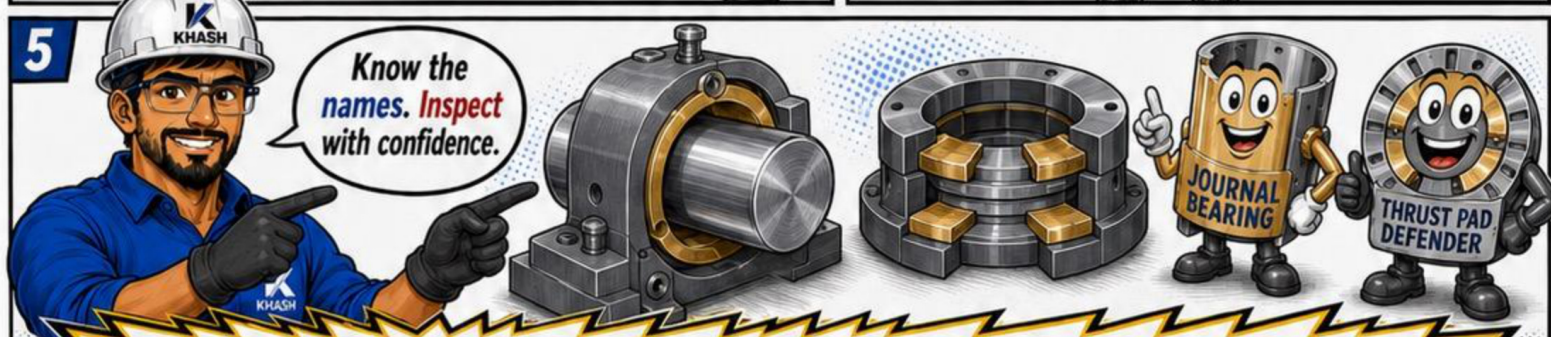


JOURNAL = RADIAL

THRUST = AXIAL

CAPTAIN ROTOR HERO

5



Know the names. Inspect with confidence.

JOURNAL BEARING

THRUST PAD DEFENDER

NAME IT. KNOW IT. INSPECT IT.

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A FEW MINUTES OF CHECKS CAN SAVE MONTHS OF DOWNTIME!

BEFORE MOUNTING DIRTY HANDS, DIRTY FUTURE

DO THE CHECKS NOW, NOT AFTER FAILURE!



TREAT ME RIGHT BEFORE YOU PUT ME IN SERVICE!

PRE-MOUNTING CHECKS – DON'T SKIP!

1 CLEANLINESS



EVERYTHING MUST BE CLEAN AND DRY. NO DIRT. NO METAL CHIPS. NO SHORTCUTS.

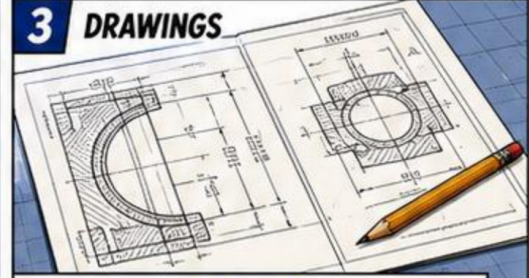


2 CORRECT PARTS



VERIFY PART NUMBERS. RIGHT SIZE. RIGHT TYPE. RIGHT MATERIAL.

3 DRAWINGS



CHECK THE DRAWINGS. KNOW THE DIMENSIONS, TOLERANCES & NOTES.

4 ORIENTATION MARKS



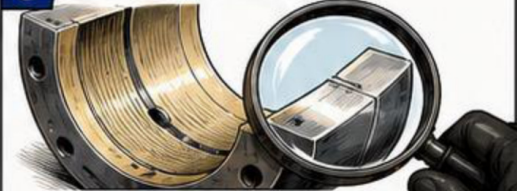
ALIGN MARKS CORRECTLY. TOP, BOTTOM, SPLIT LINE – EVERY DETAIL MATTERS.

5 OIL HOLES



CHECK OIL INLET HOLES. MAKE SURE THEY ARE OPEN, CLEAN & PROPERLY ALIGNED.

6 BABBITT CONDITION



INSPECT BABBITT SURFACE. NO CRACKS, LOOSE AREAS OR DISCOLORATION.

7 HOUSING CONDITION



CHECK HOUSING BORE. NO DAMAGE, NO BURRS, NO DISTORTION.

POOR PREPARATION = PREPARED FOR FAILURE!

I LOVE DIRTY PARTS, BAD HABITS & SHORTCUTS!

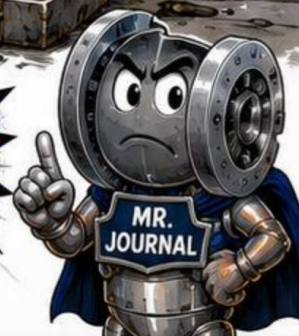


AND I LOVE EXPENSIVE FAILURES!

CONTAMINATION LOVES BAD WORKMANSHIP.



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MOUNT IT RIGHT OR REGRET IT LATER

JOURNAL BEARING MOUNTING DECIDES THE FUTURE.

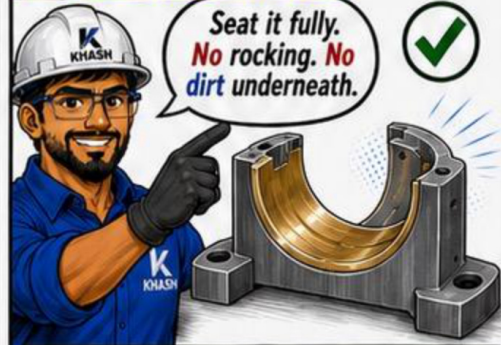
Mounting errors hide quietly — until startup.

Treat me right now, and I will support you later!



1 SHELL SEATING

Seat it fully. No rocking. No dirt underneath.



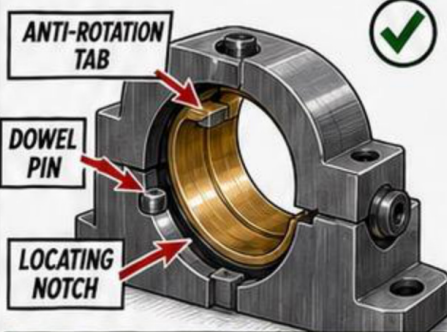
Good seating = good support.

2 LOCATING FEATURES

ANTI-ROTATION TAB

DOWEL PIN

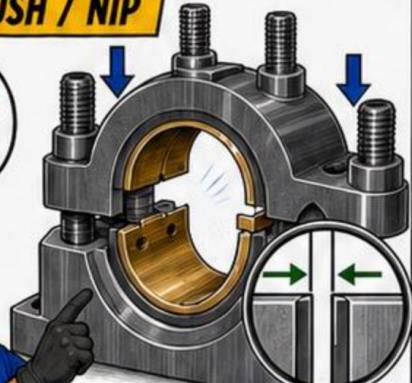
LOCATING NOTCH



Match every locating feature correctly.

3 CRUSH / NIP

Proper crush locks the shell in place.



Too little crush = movement risk.

4 FIT IN HOUSING

Correct fit prevents distortion and instability.



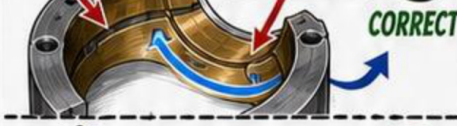
5 OIL GROOVE ORIENTATION

OIL INLET

OIL GROOVE



CORRECT



WRONG

Wrong groove position = wrong lubrication path.



6 ASSEMBLY SEQUENCE

Do not rush the sequence.



Clean. Align. Install. Verify. That's the way.

7 THE VILLAIN

Bad mounting today, expensive failure tomorrow!



Treat me right now, and I will support you later!



POOR MOUNTING CREATES FUTURE FAILURE.

Khash, MLE, CLS, MLA III, MLT II, VIM, VPR

AXIAL LOAD HAS NO MERCY

MOUNTING THE THRUST BEARING

Axial load has **no mercy**. Get the thrust bearing right!

I keep the thrust in check when mounted correctly!

GENERAL THRUST



1 PAD ORIENTATION

CORRECT ✓

LOAD SURFACE

WRONG ✗

Wrong way = wrong load!

2 EQUALIZING SYSTEM

Equalize the load!

Linked shoes share load evenly around the collar.

3 COLLAR CONDITION

GOOD ✨ ✓

Smooth, clean, no scores.

BAD ✗

A damaged collar damages confidence.

4 PIVOT SEATING

CORRECT ✓

Pivot fully seated and secured.

WRONG ✗

High pivot = misload risk!

5 CORRECT ASSEMBLY

- 1 Clean surfaces
- 2 Install shoes
- 3 Engage equalizer
- 4 Torque securely

Follow the steps. Build it right.

6 AXIAL DIRECTION AWARENESS

CORRECT AXIAL DIRECTION ✓

AXIAL LOAD

WRONG DIRECTION ✗

Know the axial direction! It decides who wins.

7 WHEN DETAILS ARE WRONG...

MR. MISTAKE

I flip pads, skip links, ignore pivots!

I cause uneven load...

Uneven load means heat, wear, and failure!

Don't let Mr. Mistake ruin your machine!

ONE WRONG PAD DETAIL CAN CHANGE LOAD SHARING.

Khash, MLE, CLS, MLA III, MLT II, VIM, VPR

MEASUREMENTS TELL THE TRUTH

CRITICAL MEASUREMENTS



No guessing.
Measure
everything
important.



Data today,
reliability
everyday!

1 SHAFT JOURNAL DIAMETER



Use a micrometer.
Check size and
tolerance.

Right size = right fit.
Too big or small = **problems.**

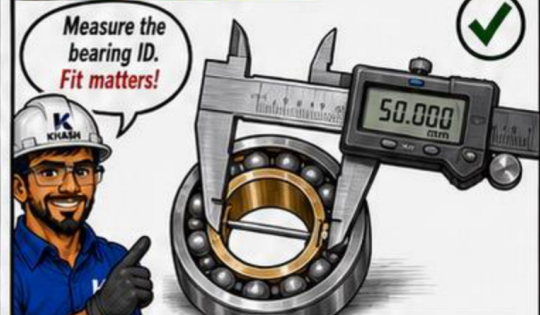
2 HOUSING BORE



Measure the
housing bore.
Use a bore gauge
or inside mic.

Clean and round bore
means stable support.

3 BEARING ID



Measure the
bearing ID.
Fit matters!

Correct ID = proper fit.
Loose or tight = **trouble.**

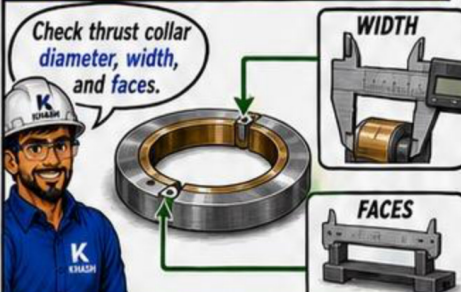
4 PAD THICKNESS



Measure pad
thickness at
several points.
Compare!

Even pads share load.
Thin pads fail early.

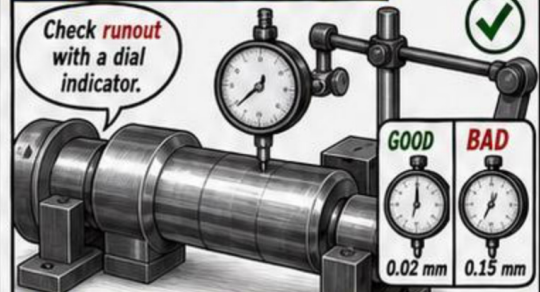
5 THRUST COLLAR DIMENSIONS



Check thrust collar
diameter, width,
and faces.

Correct dimensions =
proper location and life.

6 SHAFT RUNOUT



Check runout
with a dial
indicator.

Low runout = smooth operation.
High runout = vibration, wear, failure.



Skip the
measurements!
Go by *feel!*
It'll be fine!

WHAT HAPPENS NEXT...



Measure
first.
Fix less.
Win more!

NO GUESSING. MEASURE EVERYTHING IMPORTANT.

Khash, MLE, CLS, MLA III, MLT II, VIM, VPR



GET THE CLEARANCE RIGHT. GET RELIABILITY RIGHT!

CLEARANCE IS NOT JUST A NUMBER

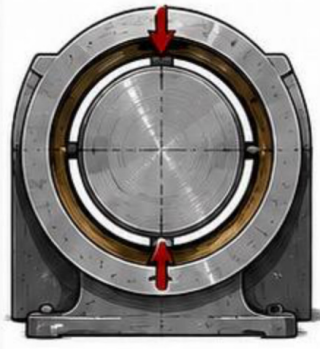
CLEARANCE = LIFE OF THE BEARING

THE RIGHT SPACE KEEPS ME COOL, STABLE AND STRONG!



1 RADIAL CLEARANCE

The clearance between the shaft (journal) and the bearing ID in the radial direction.

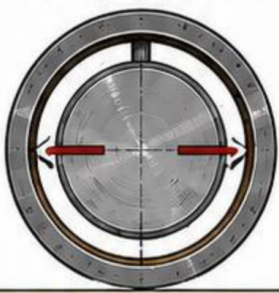


Too Tight:
Oil film breaks down. Heat up. Wear. Rub.

Too Loose:
Vibration. Noise. Early fatigue.

2 DIAMETRAL CLEARANCE

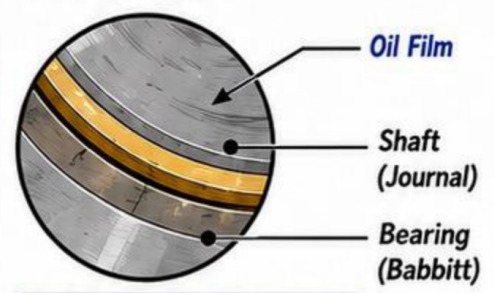
The total difference between bearing ID and shaft OD.



This creates the space for the **oil film** to build pressure and carry the load.

3 OIL FILM SPACE

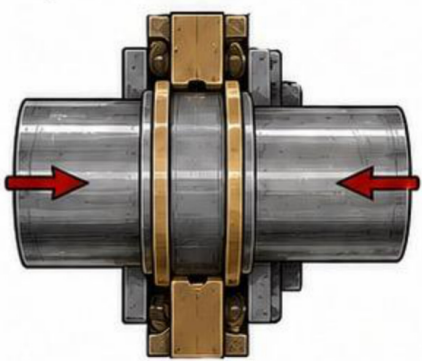
The thin film of oil that separates metal from metal.



This is where **magic** happens. No metal-to-metal contact when the oil film is stable.

4 THRUST FLOAT / AXIAL CLEARANCE

The movement allowed in the axial direction to prevent metal-to-metal contact.



Too Tight:
Rub. Heat. Damage to thrust pads and collar.

Too Loose:
Axial movement. Noise. Poor load sharing.

5 WHY TOO TIGHT OR TOO LOOSE IS DANGEROUS

TOO TIGHT

- Oil film collapses
- Metal touches metal
- Heat builds up
- Babbitt wipes
- Bearing fails fast



TOO LOOSE

- Oil film not stable
- Shaft moves & vibrates
- Increased wear
- Noise & cavitation
- Life goes kaput



THE RIGHT CLEARANCE = STABLE OIL FILM = SMOOTH OPERATION = LONGER LIFE!

"Too small, I rub. Too big, I dance."



BLUE CHECKS DON'T LIE

YOU CAN
GUESS LOADS.
OR YOU CAN
CHECK CONTACTS!

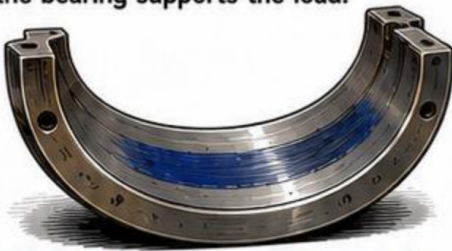
NO CHECK?
NO SUPPORT!
BIG FAILURE!

CONTACT CHECKS REVEAL THE REAL STORY.

MR.
DIRTY OIL

1 CONTACT PATTERN

The contact pattern shows where the bearing supports the load.



IDEAL PATTERN:

Centered both circumferentially and axially.

Not too wide. Not too narrow.
Even and smooth.



2 BLUEING CHECKS

Use *Prussian Blue* (engineer's blue) to check actual metal-to-metal contact.

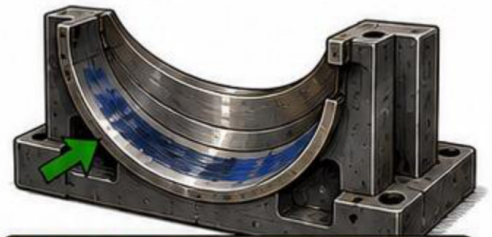


STEPS:

- Clean and degrease.
- Apply thin coat of blue.
- Assemble carefully.
- Rotate to normal position.
- Disassemble and inspect.

3 SEATING VERIFICATION

Check that the shell or pad is fully seated against the housing.



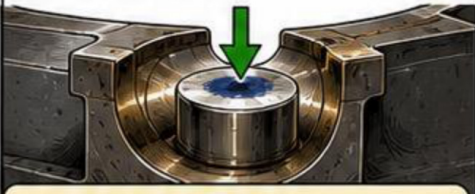
LOOK FOR:

- Full and even contact.
- No gaps at parting lines.
- No rocking or fretting marks.
- Proper alignment of splits.



4 PIVOT CONTACT

The pivot area must show clean, centered contact.



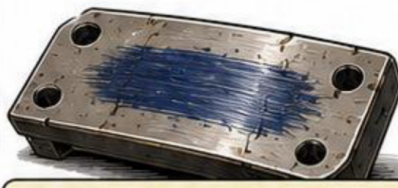
GOOD PIVOT CONTACT:

- Small, centered blue mark.
- No edge contact.
- Pivot moves freely without side load.



5 PAD LOAD CONTACT

For tilting pads, check the loaded area on the pad face.



GOOD LOAD CONTACT:

- Centered on pad face.
- About 60–80% of pad length.
- Smooth and even.
- Not all at one edge.



6 HOW TO VERIFY PROPER SUPPORT

All checks together confirm the bearing will support the load correctly.

- ✓ Shell is fully seated.
- ✓ Correct contact pattern.
- ✓ Pivots are centered.
- ✓ Pad load area is ideal.
- ✓ No tight spots, no gaps.
- ✓ Smooth rotation by hand.

**ALL CHECKS GOOD =
BEARING READY FOR DUTY!**

CHECK NOW.
SAVE LATER.
IT'S THAT
SIMPLE!

**GOOD CONTACT =
GOOD LOAD
DISTRIBUTION.**

BLUE
CHECKS
DON'T LIE!

CAPTAIN
TURBINE

CHECK CONTACT. CONFIRM SUPPORT. ENSURE RELIABILITY. THAT'S HOW CHAMPIONS RUN TURBINES!

WATCH THE MACHINE TALK

ROUTINE INSPECTIONS. BIG IMPACT.



GOOD INSPECTIONS CATCH SMALL PROBLEMS EARLY!



TREAT ME RIGHT, I'LL RUN ALL NIGHT!

1 TEMPERATURE

Monitor bearing metal temperature.



High temperature = low oil film or high load. **Investigate!**

2 VIBRATION

Monitor overall vibration trend and spikes.



Rising vibration = looseness, misalignment or bearing problem.

3 AXIAL POSITION

Check shaft axial position (thrust bearing indicator).



Out of range = thrust bearing trouble. Check before damage occurs.

4 OIL PRESSURE

Verify oil pressure at bearing inlet.



Low pressure = low protection. Stop and find the cause.

5 OIL FLOW

Check oil flow to each bearing.



Low or no flow = blocked line, bad restrictor or pump issue.

6 DRAIN TEMPERATURE

Monitor bearing drain temperature.



High drain temp = heat build-up. Something is not right.

7 VISUAL LEAKS

Inspect for oil leaks around bearings, seals and lines.



Leaks waste oil and allow air in. Fix small leaks before they grow.

8 ABNORMAL NOISE

Listen for unusual noise or changes.



Noise is a warning. Don't ignore what you hear.



TRENDS TELL THE STORY!

MACHINES ALWAYS SPEAK BEFORE THEY FAIL.

IGNORE ME TODAY... I BREAK YOU TOMORROW!



! OBSERVE. RECORD. TREND. ACT. PREVENT TODAY, PROTECT TOMORROW.



GOOD EYES
FIND PROBLEMS
BEFORE THEY
FIND YOU!

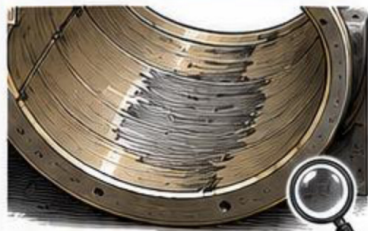
VISUAL INSPECTION DURING OVERHAUL LOOK LIKE A DETECTIVE

THE SURFACE KEEPS THE FAILURE STORY.



EVERY MARK
HAS A MEANING.
READ THEM
ALL!

1 BABBITT WIPE



LOOK FOR:

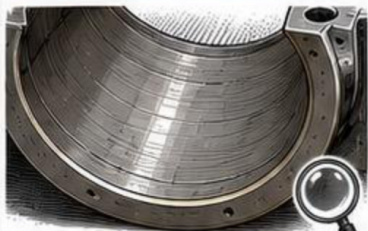
- Smears or torn babbitt.
- Material transferred.

MEANS:

- Overheating.
- Oil film breakdown.
- Severe rubbing.



2 SCRATCHES



LOOK FOR:

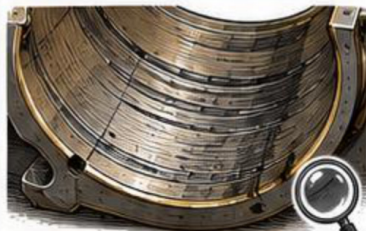
- Fine, shallow lines.
- Directional marks.

MEANS:

- Hard particles.
- Improper cleaning.
- Misalignment.



3 SCORING



LOOK FOR:

- Deep, continuous grooves.
- Metal displaced.

MEANS:

- Severe particles.
- Lack of filtration.
- Extended damage.



4 FATIGUE



LOOK FOR:

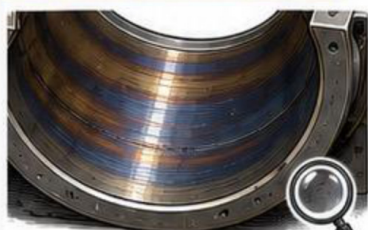
- Cracks or flaking.
- Spall areas.

MEANS:

- Cyclic stress.
- Poor support.
- Overload or shock.



5 DISCOLORATION



LOOK FOR:

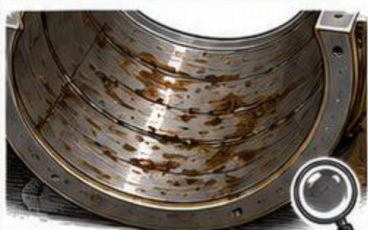
- Blue, brown, or black areas.
- Heat tint.

MEANS:

- Excessive heat.
- Thin oil film.
- Poor cooling or flow.



6 CORROSION



LOOK FOR:

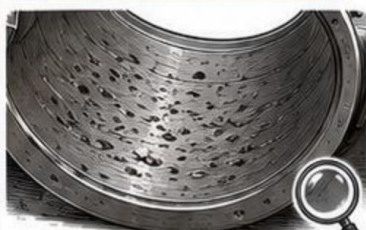
- Rust or oxidation.
- Pitting or dull areas.

MEANS:

- Moisture in oil.
- Acidic condition.
- Infrequent operation.



7 CAVITATION MARKS



LOOK FOR:

- Small pits like dimples.
- Honeycomb appearance.

MEANS:

- Low pressure zones.
- Oil breakdown.
- Vapor collapse.



8 EMBEDDED PARTICLES



LOOK FOR:

- Dark specks or particles.
- Hard material stuck in soft.

MEANS:

- Contamination.
- Poor filtration.
- Dirty assembly.



DON'T JUST LOOK.
UNDERSTAND WHAT
YOU SEE!

**THE SURFACE
KEEPS THE
FAILURE STORY.**



EVERY
MARK IS
A CLUE!

JOURNAL BEARING FAILURE MODES

WHEN RADIAL SUPPORT GETS ANGRY

KNOW THE MODE. STOP THE DAMAGE!

I support the rotor, but **not** bad practices.



1 WIPE

- Smeared babbitt.
- Oil film collapse.

2 SCORING

- Deep grooves.
- Hard particles.

3 OVERHEATING

- Heat tint.
- Poor cooling.

4 EDGE LOADING

- Load on one edge.
- Alignment issue.

5 MISALIGNMENT DISTRESS

- Uneven contact.
- Rotor not centered.

6 DEBRIS DAMAGE

- Embedded dirt.
- Surface attack.

7 OIL STARVATION

- Too little oil.
- Metal contact.

8 FATIGUE

- Cracks and flaking.
- Cyclic stress.



DON'T JUST FIX THE PART... FIX THE CAUSE!

**POOR PRACTICES
CREATE FUTURE FAILURE.**



SEE THE DAMAGE. FIND THE CAUSE. FIX THE PRACTICE.



Khash, MLE, CLS, MLA III, MLT II, VIM, VPR



I CARRY THE AXIAL LOAD. DON'T ABUSE ME!

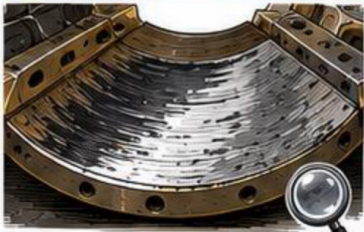
AXIAL TROUBLE STARTS HERE

THRUST BEARING FAILURE MODES



AXIAL LOAD IS REAL. TREAT IT RIGHT.

1 THRUST PAD WIPE

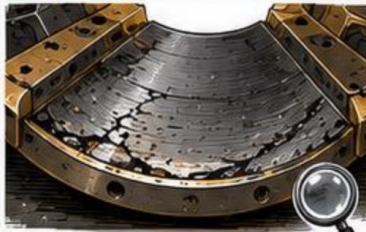


- CAUSES:**
- Babbitt smearing
 - Oil film collapse
 - Metal-to-metal contact

- RESULTS:**
- Rapid wear
 - Heat generation
 - Loss of clearance



2 OVERLOAD

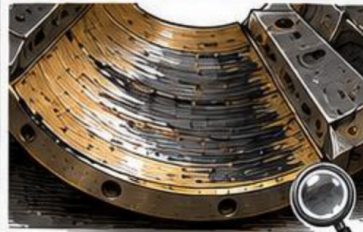


- CAUSES:**
- Excess axial force
 - Crushed babbitt
 - Rapid temperature rise

- RESULTS:**
- Pad deformation
 - Overheating
 - Bearing failure



3 MISALIGNMENT

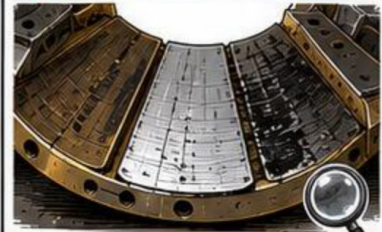


- CAUSES:**
- Shaft not aligned
 - Angular or parallel offset
 - Soft foot condition

- RESULTS:**
- Uneven contact pattern
 - Edge loading
 - Distorted load distribution



4 POOR LOAD SHARING



- CAUSES:**
- Unequal pad clearance
 - Incorrect pre-load
 - Uneven stiffness

- RESULTS:**
- One pad overloaded
 - Hot spots
 - Accelerated wear



5 OIL FILM COLLAPSE



- CAUSES:**
- Low oil pressure
 - High temperature
 - Contaminated oil

- RESULTS:**
- Metal contact
 - Severe heat
 - Bearing damage



6 COLLAR DAMAGE

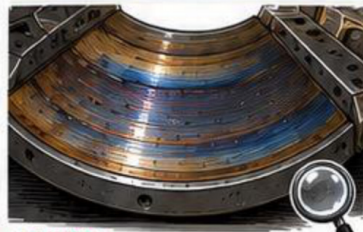


- CAUSES:**
- Axial movement
 - Hard contact
 - Debris infiltration

- RESULTS:**
- Scoring
 - Scratches
 - Surface distress



7 TEMPERATURE DISTRESS



- CAUSES:**
- Excessive operating temp
 - Poor cooling
 - Oil breakdown

- RESULTS:**
- Blueing / discoloration
 - Babbitt softening
 - Thermal degradation



I ONLY NEED ONE OVERLOADED PAD...



MR. FAILURE



RESPECT THE AXIAL LOAD—IT KEEPS YOU IN LINE!

THRUST FAILURES ARE OFTEN FAST AND EXPENSIVE.



INVEST IN ALIGNMENT, LUBRICATION & MONITORING!

GOOD DESIGN. PROPER OPERATION. CONSISTENT CARE.

THAT'S HOW THRUST BEARINGS WIN.

Khash, MLE, CLS, MLA III, MLT II, VIM, VPR

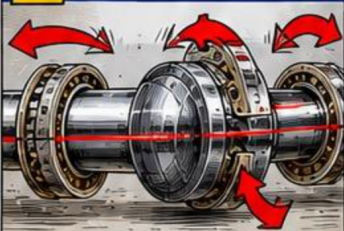
THE FAILURE IS THE EFFECT— **NOT THE CAUSE**

**FIND THE CAUSE,
FIX THE PROBLEM!**

Symptoms are easy.
Root causes are smart!

ROOT CAUSES OF THRUST & JOURNAL BEARING FAILURES

1 MISALIGNMENT



- Angular misalignment
- Parallel misalignment
- Edge loading

2 POOR OIL QUALITY



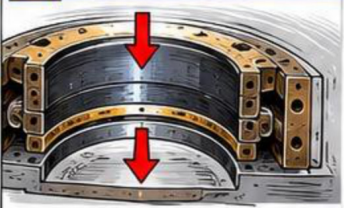
- Oxidation
- Sludge
- High TAN
- Aged oil

3 CONTAMINATION



- Solid particles
- Wear debris
- Dust / Silica
- Foreign matter

4 WRONG CLEARANCE



- Too tight
- Too loose
- Oil film collapse
- Heat & wear

5 OVERLOAD



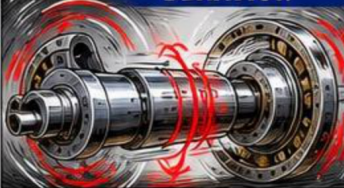
- Excess axial load
- High radial load
- Beyond design

6 ASSEMBLY MISTAKES



- Wrong fit
- Wrong torque
- Dirty parts
- Inadequate checks

7 UNSTABLE ROTOR BEHAVIOR



- Unbalance
- Looseness
- Critical speed
- Resonance

8 OIL WHIRL / WHIP INFLUENCE



- Fluid induced instability
- Vibration
- Oil whirl
- Oil whip

9 INSUFFICIENT OIL SUPPLY



- Low pressure
- Restricted flow
- Blocked orifices
- Pump problems

STOP!
Don't treat the symptom.
Find the cause.

**DO NOT STOP AT THE DAMAGE.
FIND THE CAUSE.**

Root cause solved today,
failures **prevented** tomorrow!

GOOD ANALYSIS. STRONG ACTION. RELIABLE MACHINES.

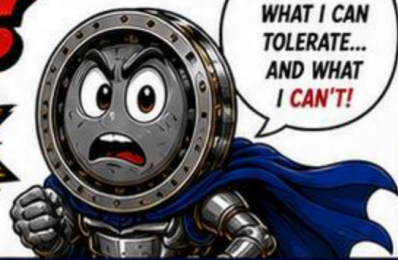
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MAKE THE RIGHT CALL. **DON'T GUESS!**

REPAIR OR REPLACE?

CAN THIS BE SAVED?



I'LL TELL YOU WHAT I CAN TOLERATE... AND WHAT I CAN'T!

DECISION POINTS FOR THRUST BEARING COMPONENTS

1 MINOR POLISH?



LIGHT RUBBING, NO DEEP SCORES, CLEARANCE IN SPEC.

✓ ACTION: POLISH
Light polish and return to service. Document and monitor.

2 RE-BABBITTING?



BABBITT WORN, BUT BASE METAL GOOD. WITHIN DIMENSION.

✓ ACTION: RE-BABBIT
Remove old babbitt, inspect, re-babbit to spec and finish.
! Not for heavily cracked or peened bases.

3 SCRAPE CORRECTION?



HIGH SPOTS, UNEVEN CONTACT PATTERN, CLEARANCE CORRECTION NEEDED.

✓ ACTION: SCRAPE
Scrape to achieve proper contact (70-80%) and correct clearance.
! Requires skilled technician.

4 PAD REPLACEMENT?



CRACKED, HEAVY SCORES, EDGE DAMAGE, OR OUT OF TOLERANCE.

✓ ACTION: REPLACE PAD
Replace individual pad. Verify load and alignment.
STOP Do not mix old and new pads.

5 COLLAR REPAIR?



MINOR SCORING OR WEAR, DIAMETER STILL IN SPEC.

✓ ACTION: REPAIR COLLAR
Polish or grind within limits. Remove sharp edges and burrs.
! If grooves deep or out of round, consider replace.

6 FULL REPLACEMENT?



SEVERE DAMAGE, OUT OF TOLERANCE, OR MULTIPLE COMPONENTS AFFECTED.

✓ ACTION: REPLACE ASSEMBLY
Replace pads, collar, or full bearing assembly as required.
STOP Do not risk a catastrophic failure.



REPAIR IS A SOLUTION. BUT ONLY IF IT'S THE RIGHT SOLUTION!

NOT EVERY DAMAGED BEARING IS SCRAP – BUT NOT EVERY ONE IS REPAIRABLE.



SAVE WHAT YOU CAN. REPLACE WHAT YOU MUST!

INSPECT. | **MEASURE.** | **EVALUATE.** | **DECIDE.** | **EXECUTE.**

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SMART REPAIR SAVES MACHINES

REPAIR DONE RIGHT IS STRONG, PRECISE & RELIABLE!

GOOD AS NEW—OR BETTER!

PROVEN METHODS. PRECISION RESULTS.

1 RE-BABBITTING



STRONG BOND. CORRECT THICKNESS. PROPER HARDNESS.

- Remove old babbitt completely.
- Clean, preheat & prepare base.
- Cast new babbitt to spec.
- Controlled cool down.

2 MACHINING



- Restore datum surfaces.
- Machine to final thickness.
- Achieve proper parallelism & flatness.

PRECISION MACHINING SETS THE FOUNDATION FOR ACCURACY.

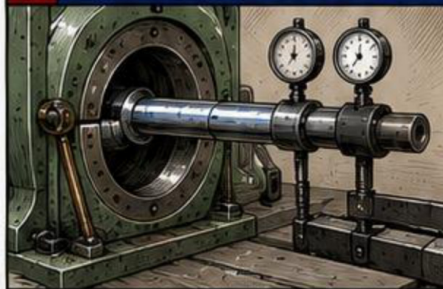
3 SCRAPING



- High spot removal with hand scraper.
- Develop proper contact pattern.
- Ensure even load distribution.

BLUE IS TRUE. SCRAPE FOR PERFECT CONTACT.

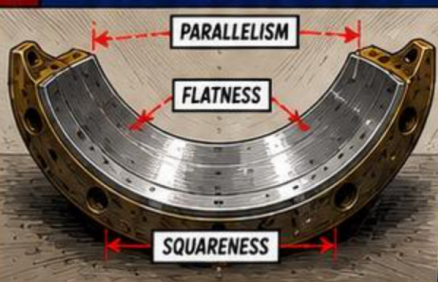
4 LINE BORING CHECKS



- Verify tunnel alignment.
- Check bore diameter.
- Confirm coaxiality with rotor.
- Correct if out-of-line.

ALIGNMENT IS CRITICAL. MEASURE. VERIFY. CORRECT.

5 RESTORING GEOMETRY



- Restore flatness & parallelism.
- Maintain correct clearances.
- Ensure concentricity & symmetry.

RIGHT GEOMETRY = SMOOTH OPERATION & LONG LIFE.

6 REPLACING PADS



- Remove worn or damaged pads.
- Install new pads or segments.
- Match part number & material.

WHEN IN DOUBT, REPLACE. DON'T COMPROMISE.

7 VERIFYING DIMENSIONS AFTER REPAIR

- Measure thickness.
- Check clearance.
- Verify parallelism.
- Confirm contact pattern.
- Document all results.



MEASURED. VERIFIED. READY TO PERFORM!

DO IT RIGHT. DO IT ONCE. DO IT TO LAST!

A REPAIR IS ONLY GOOD IF GEOMETRY AND FUNCTION RETURN.

RIGHT METHOD.

RIGHT GEOMETRY.

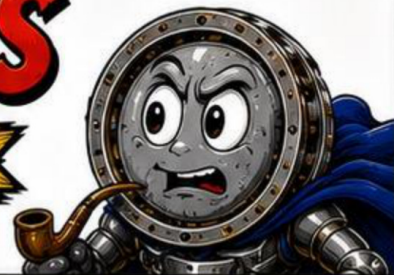
RIGHT FUNCTION.

RIGHT RESULT.

HOW KHASH INVESTIGATES

FAILURE ANALYSIS WORKFLOW

Every failure leaves clues.



1 INSPECT THE SURFACE

THE CRIME SCENE

LOOK FOR:

- Wipe
- Scoring
- Fatigue
- Corrosion
- Embedded particles

2 REVIEW TEMPERATURE & VIBRATION DATA

VIBRATION TREND

TEMPERATURE TREND

My vibration started rising weeks ago!

CAPTAIN ROTOR

3 CHECK OIL CONDITION

Don't forget to question me!

REVIEW:

- Cleanliness
- Water
- Viscosity
- Wear debris
- Oxidation

4 VERIFY DIMENSIONS

CHECK:

- Clearances
- Runout
- Collar dimensions
- Bearing geometry

5 REVIEW ASSEMBLY HISTORY

Who touched this machine last?

CHECK:

- Previous repairs
- Alignment history
- Bearing replacements
- Oil changes

6 IDENTIFY ROOT CAUSE

Now the pieces fit together.

ROOT CAUSE

- MISALIGNMENT
- CONTAMINATION
- WRONG CLEARANCE
- POOR LUBRICATION
- ROTOR INSTABILITY

7 RECOMMEND CORRECTIVE ACTIONS

- ✚ CORRECT ALIGNMENT
- 🗑️ IMPROVE OIL QUALITY & FILTRATION
- 🔧 RESTORE PROPER CLEARANCE
- 🛢️ ENSURE ADEQUATE OIL SUPPLY
- 📊 IMPROVE ROTOR STABILITY
- 🔩 FOLLOW BEST ASSEMBLY PRACTICES
- 📈 MONITOR & TREND CONDITIONS

MR. FAILURE

You found me!

Fix the cause. Prevent the repeat. Protect the machine.

MAIN LESSON:

FAILURE ANALYSIS IS A SYSTEM INVESTIGATION — NOT ONLY A SURFACE OPINION.

HEALTHY BEARINGS. HEALTHY ROTOR. HEALTHY MACHINE.

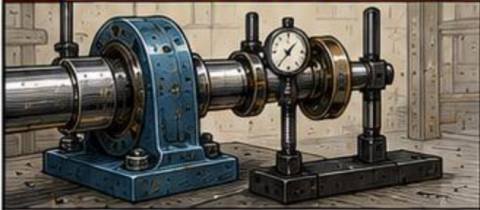
DO IT RIGHT.
KEEP IT RIGHT.
MAKE IT LAST!

KNOWLEDGE. PRECISION. CARE.
THAT'S HOW WE WIN.

THE
FINAL PAGE!

★★ THE RIGHT HABITS PREVENT THE WRONG OUTCOMES. ★★

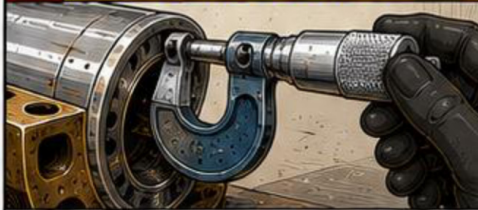
1 MOUNT RIGHT



- Clean everything.
- Check alignment.
- Follow torque specs.
- Respect the fits.

GOOD MOUNTING IS THE FIRST PROTECTION.

2 MEASURE RIGHT



- Check clearances.
- Verify runout.
- Measure, don't guess.
- Record your data.

YOU CAN'T MANAGE WHAT YOU DON'T MEASURE.

3 INSPECT RIGHT



- Look for early signs.
- Inspect surfaces.
- Check oil passages.
- Don't ignore small issues.

EARLY DETECTION PREVENTS BIG FAILURE.

4 ANALYZE RIGHT



- Don't stop at the damage.
- Find the root cause.
- Use data, not opinion.
- Learn and apply.

FIND THE CAUSE. ELIMINATE THE PROBLEM.

5 REPAIR SMART



- Choose the right repair.
- Follow proven methods.
- Restore geometry.
- Verify results.

SMART REPAIR RESTORES PERFORMANCE AND LIFE.

6 PROTECT THE MACHINE



- Good lubrication.
- Clean oil. Adequate flow.
- Stable operation.
- Continuous monitoring.

PROTECTION TODAY MEANS RELIABILITY TOMORROW.

BEARINGS DON'T JUST SUPPORT...
THEY PROTECT EVERYTHING!

JOURNAL AND THRUST BEARINGS
DO NOT FAIL RANDOMLY.
THEY FAIL FOR REASONS.
LEARN THE REASONS.
PROTECT THE MACHINE.

★★ KNOWLEDGE IS POWER. PRACTICE IS PROTECTION. CULTURE IS RELIABILITY. ★★

THANK YOU FOR JOINING KHASH ON THIS JOURNEY.
KEEP LEARNING. KEEP IMPROVING. KEEP TURBINES RELIABLE!

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MLT II, VIM, VPR

