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MAINTENANCE TIPS

Vibrating Screen Bearing Temperature: Normal Ranges and Warning Signs

Monitor vibrating screen bearing temperature for early failure detection. Normal ranges, alarm settings, and diagnostic procedures.

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Vibrating screen bearings operate under extreme conditions—high centrifugal forces, continuous oscillation, dust ingress, and elevated temperatures. Bearing failure is the most common cause of screen downtime in aggregate plants. Understanding normal temperature ranges and recognizing warning signs enables operators to prevent catastrophic failures through timely intervention.

Understanding Vibrating Screen Bearing Loading

Vibrating screen bearings face unique challenges that differentiate them from standard rotating equipment bearings:

Load Characteristics

LOAD TYPE	SOURCE	IMPACT ON BEARING
Centrifugal force	Exciter shaft unbalance	Primary radial loading, cyclic stress
Material weight	Bed depth on screen	Static and dynamic vertical load
Oscillating acceleration	Screen motion (3-7g typical)	Cyclic stress reversal every stroke
Gyroscopic effects	Angular motion of shaft	Additional moment loading on bearings

Operating Speed and Frequency

Screen exciter bearings typically operate at high speeds with continuous cyclic loading:

- **Exciter speed:** 850-1200 RPM depending on design
- **Stroke:** 4-12mm (half amplitude)
- **Load cycles per hour:** 51,000-72,000 complete reversals
- **Annual load cycles:** 300-500 million (assuming 6,000 operating hours)

This extreme cyclic loading explains why screen bearings require specialized designs and careful temperature monitoring.

Normal Operating Temperature Ranges

Temperature is the primary indicator of bearing health. Establishing baseline values and acceptable ranges enables early detection of developing problems.

Temperature Guidelines by Bearing Type

BEARING TYPE	NORMAL RANGE	ALERT LEVEL	ALARM LEVEL	SHUTDOWN LEVEL
Spherical roller (exciter)	50-70°C	80°C	90°C	100°C
Cylindrical roller	45-65°C	75°C	85°C	95°C
Pillow block (support)	40-55°C	65°C	75°C	85°C

Important considerations:

- Temperature limits apply to bearing outer ring, not housing surface
- Housing temperature is typically 5-15°C lower than actual bearing temperature
- Grease temperature limits (typically 120-150°C) set absolute maximum
- Ambient temperature variations must be factored into baseline

Temperature Rise Analysis

The difference between bearing temperature and ambient temperature (ΔT) provides more useful diagnostic information than absolute temperature:

TEMPERATURE RISE (ΔT)	CONDITION ASSESSMENT	RECOMMENDED ACTION
<30°C above ambient	Excellent - normal operation	Continue monitoring
30-40°C above ambient	Good - acceptable operation	Monitor trend closely
40-50°C above ambient	Caution - elevated loading	Investigate cause, increase monitoring
>50°C above ambient	Warning - abnormal condition	Reduce load, plan maintenance

Temperature Monitoring Methods

Infrared Temperature Measurement

Infrared thermometers and cameras are the most practical tools for routine bearing temperature checks:

Best practices for infrared measurement:

- Measure at same location each time for trend accuracy
- Mark measurement points with heat-resistant paint
- Measure perpendicular to surface, avoiding angles >30°
- Account for surface emissivity (steel ε ≈ 0.85-0.95)
- Avoid measuring through dust accumulation
- Take readings at consistent operating conditions

Infrared camera advantages:

- Visualizes temperature patterns across entire assembly
- Identifies hot spots indicating localized problems
- Enables comparison between bearings simultaneously
- Creates documentation for trend analysis

Continuous Temperature Monitoring

For critical screens, continuous monitoring with RTD or thermocouple sensors provides real-time protection:

SENSOR TYPE	ACCURACY	RESPONSE TIME	INSTALLATION
RTD (PT100)	±0.3°C	5-15 seconds	Drilled housing or surface mount
Thermocouple (Type K)	±1.5°C	1-5 seconds	Flexible installation options
Infrared sensor (fixed)	±2°C	Instant	Non-contact, dust-sensitive

Sensor mounting locations:

- **Ideal:** Drilled into housing with tip near outer race
- **Acceptable:** Surface-mounted with thermal paste
- **Not recommended:** Measuring housing surface without contact

Warning Signs of Bearing Deterioration

Temperature-Based Warning Signs

Temperature behavior provides critical diagnostic information:

TEMPERATURE BEHAVIOR	PROBABLE CAUSE	SEVERITY
Gradual increase over weeks	Progressive bearing wear, lubrication degradation	Moderate - plan replacement
Sudden spike during operation	Lubrication failure, contamination ingress	High - investigate immediately

TEMPERATURE BEHAVIOR	PROBABLE CAUSE	SEVERITY
Temperature doesn't stabilize	Over-lubrication, seal problem	Moderate - check grease quantity
One bearing significantly hotter than others	Localized problem with that bearing	High - bearing-specific issue
High temperature at startup that decreases	Over-lubrication churning	Low - reduce grease volume

Vibration Warning Signs

Temperature monitoring should be combined with vibration analysis for comprehensive condition assessment:

Vibration indicators of bearing problems:

- **Increased overall vibration:** General bearing deterioration
- **High-frequency bearing tones:** Defects on races or rolling elements
- **Spike energy increase:** Metal-to-metal contact, lubrication breakdown
- **Envelope spectrum defect frequencies:** BPFO, BPFI, BSF, FTF

Visual and Audible Warning Signs

Field observations that indicate bearing problems:

- **Grease leakage:** Seal failure or over-lubrication
- **Grease discoloration:** Black = contamination, brown/red = overheating
- **Unusual noise:** Grinding, clicking, squealing sounds
- **Housing vibration change:** Roughness felt on hand
- **Rust staining around seals:** Water or contamination ingress

Common Causes of Elevated Bearing Temperature

Lubrication-Related Causes

PROBLEM	TEMPERATURE EFFECT	DIAGNOSTIC CLUES	SOLUTION
Insufficient grease	High, increasing	Metal-to-metal noise, high vibration	Re-grease to proper level
Excessive grease	High at startup, may stabilize	Grease purging from seals	Reduce grease quantity
Wrong grease type	Elevated, erratic	Grease softening or separating	Flush and use correct grade
Contaminated grease	Gradually increasing	Gritty feel, discoloration	Flush and re-grease
Grease incompatibility	Variable, may spike	Grease hardening or liquefying	Complete flush required

Mechanical Causes

PROBLEM	TEMPERATURE EFFECT	DIAGNOSTIC CLUES	SOLUTION
Misalignment	One end hotter than other	Uneven wear pattern, seal damage	Realign exciter assembly
Excessive preload	Both bearings elevated	Short bearing life, high load	Check and adjust clearance
Insufficient clearance	High temperature, seizure risk	Thermal expansion binding	Verify proper bearing fit
Housing bore damage	Variable, unstable	Bearing creep, fretting marks	Repair or replace housing
Shaft damage	Hot spots, uneven	Vibration pattern changes	Check shaft condition

Operational Causes

PROBLEM	TEMPERATURE EFFECT	DIAGNOSTIC CLUES	SOLUTION
Overloading (deep bed)	All bearings elevated	Slow screening, carryover	Reduce feed rate
Underloading (surge feeding)	Temperature fluctuation	Screen bouncing excessively	Stabilize feed rate
High ambient temperature	Absolute temperature high	ΔT remains normal	Additional cooling or shade
Blocked discharge	Elevated from extra work	Material buildup visible	Clear discharge path

Lubrication Best Practices for Temperature Control

Grease Selection for Vibrating Screens

Vibrating screen bearings require specialized greases designed for high-load oscillating applications:

Grease specifications for screen bearings:

- **Base oil viscosity:** 150-220 cSt at 40°C
- **NLGI grade:** 2 (standard) or 1.5 (cold climate)
- **Thickener type:** Lithium complex or polyurea preferred
- **Operating temperature range:** -20°C to 150°C minimum
- **EP additives:** Required for high-load applications
- **Water resistance:** Good to excellent rating

Recommended grease types:

APPLICATION	RECOMMENDED TYPE	KEY PROPERTIES
High-temperature (>70°C)	Polyurea based	Excellent thermal stability
Heavy load, moderate temp	Lithium complex + EP	High load capacity
Wet environment	Calcium sulfonate complex	Superior water resistance

APPLICATION	RECOMMENDED TYPE	KEY PROPERTIES
Cold climate startup	Lithium complex NLGI 1.5	Low temperature pumping

Lubrication Quantity and Frequency

Proper grease quantity is critical—both too little and too much cause temperature problems:

Initial fill calculation:

```
Grease volume (grams) = 0.005 × D × B

Where:
D = Bearing outer diameter (mm)
B = Bearing width (mm)

Example for 22328 bearing (300mm × 102mm):
Volume = 0.005 × 300 × 102 = 153 grams
```

Re-lubrication interval calculation:

```
T = K × [(14,000,000 / (n × √d)) - 4D]

Where:
T = Re-lubrication interval (hours)
K = Correction factor (0.1 for vibrating screens)
n = RPM
d = Bearing bore diameter (mm)
D = Bearing outside diameter (mm)

Example for 22328 at 900 RPM:
T = 0.1 × [(14,000,000 / (900 × √140)) - 4×300]
T = 0.1 × [1,314 - 1,200] = ~11 hours

Note: This results in daily lubrication for many screen bearings
```

Re-lubrication quantity:

```
Grease per interval (grams) = 0.005 × D × B × 0.3
(30% of initial fill per interval)

For 22328: 153 × 0.3 = ~46 grams per day
```

Automatic Lubrication Systems

For critical screens or multiple units, automatic lubricators provide consistent greasing:

SYSTEM TYPE	ADVANTAGES	CONSIDERATIONS
Single-point lubricator	Simple, low cost, no power needed	Limited capacity, one bearing each
Progressive system	Reliable, positive displacement	More complex, requires monitoring
Dual-line system	Long distance, many points	Higher cost, more maintenance

Temperature Monitoring Program Implementation

Establishing Baselines

Effective monitoring requires established baseline values for each bearing:

1. **Document ambient conditions:** Record ambient temperature for each measurement
2. **Measure at consistent operating load:** Same feed rate, material type
3. **Record for minimum 2 weeks:** Build statistical baseline
4. **Calculate normal ΔT range:** Average and standard deviation
5. **Set alert thresholds:** Typically mean + 2 standard deviations

Monitoring Frequency

SCREEN CRITICALITY	MONITORING FREQUENCY	METHOD
Primary/critical screen	Continuous or every shift	Installed sensors or IR camera
Secondary screen	Daily	Handheld IR thermometer
Non-critical screen	Weekly	Handheld IR thermometer

Documentation and Trending

Recording requirements:

- Date and time of measurement

- Ambient temperature
- Each bearing temperature
- Operating conditions (feed rate, material)
- Any abnormal observations

Trend analysis indicators:

- Rising trend over days/weeks → plan replacement
- Sudden change from baseline → investigate immediately
- Increasing difference between bearings → localized problem
- Correlation with load or ambient → operational factor

Response Procedures for Abnormal Temperatures

Alert Level Response (80°C or 40°C ΔT)

- Increase monitoring frequency to every 2 hours
- Check lubrication condition and quantity
- Verify operating conditions are within specifications
- Review recent maintenance or changes
- Plan inspection at next scheduled stop

Alarm Level Response (90°C or 50°C ΔT)

- Reduce screen feed rate by 25-50%
- Monitor continuously for further increase
- Prepare for shutdown if temperature continues rising
- Order replacement bearing and components
- Schedule maintenance within 24-48 hours

Shutdown Level Response (100°C or 60°C ΔT)

- Stop screen immediately to prevent catastrophic failure
- Allow natural cooling—do not add cold grease

- Inspect bearing after cooling for damage assessment
- Replace bearing and investigate root cause
- Do not restart until problem is corrected

Systematic temperature monitoring combined with proper lubrication practices significantly extends vibrating screen bearing life and prevents costly unplanned shutdowns. The investment in monitoring equipment and operator training delivers substantial returns through improved reliability and reduced maintenance costs.

Topics: #Bearing Maintenance #Temperature Monitoring #Vibrating Screens

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