Ferrous debris monitoring
What causes metallic debris?

- Inadequate Lubrication 34.4%
- Contamination 19.6%
- Installation Errors 17.7%
- Overload 6.9%
- Storage & Handling Errors 2.8%

Source SKF USA
What causes metallic debris?

Bearings – Lubrication failure
What causes metallic debris?

Bearings - Spalling
What causes metallic debris?

Gears - Polishing

Contact surfaces become shiny

- Low risk
- Can reduce gear to gear friction
What causes metallic debris?

Gears – Moderate wear

Material is removed at contact face

- Medium risk
- Consider bearing/gear replacement
What causes metallic debris?

Gears – Excessive wear

Material uniformly worn away

• High risk
• Gear replacement required urgently
What causes metallic debris?

Gears – Initial pitting

Tiny particles worn off contact surface

- Medium risk
- Consider bearing/gear replacement
What causes metallic debris?

Gears – Heavy pitting

Significant wear from contact surface

- High risk
- Gear replacement required urgently
What causes metallic debris?

General wear
Overload conditions
Lubrication problems
Monitoring metallic debris.

**Fine Debris**
- Particles from bearings
- Particles from gears
- Typically 1-850µm

**Coarse Debris**
- Parts of bearing cages
- Sheered teeth
- Typically 0.5mm² upwards
Monitoring metallic debris.

Fine debris – trend analysis

Plot of fine debris build up against time (in Days)
Monitoring metallic debris.

Fine debris – trend analysis

Plot of fine debris build up against time (in Days)

1) Normal operation
Monitoring metallic debris.

Fine debris – trend analysis

Plot of fine debris build up against time (in Days)

1) Normal operation
2) Event occurs causing excessive wear
Monitoring metallic debris.

Fine debris – trend analysis

- Capture initial wear events early
  - Poor lubrication
  - Contamination
Monitoring metallic debris.

Coarse debris – Alarm condition

Plot of coarse debris build up against time (in Days)
Monitoring metallic debris.

Coarse debris – Alarm condition

Plot of coarse debris build up against time (in Days)

1) Normal operation
Monitoring metallic debris.

Coarse debris – Alarm condition

- Plot of coarse debris build up against time (in Days)
  1) Normal operation
  2) Event occurs
Monitoring metallic debris.

Coarse debris – Alarm condition

Failed bearing cage

Tooth broken off
Monitoring metallic debris.

Coarse debris – Alarm condition

• Capture catastrophic events
  • Overload conditions
  • Component failure
Monitoring metallic debris.

Capturing Debris

Magnetic Drain plug
Captures debris for inspection or analysis
Monitoring metallic debris.

Capturing Debris

Sample analysis
Captures debris from oil for full lab analysis

Ferrous debris in oil
Monitoring metallic debris.

Capturing Debris

Magnetic Drain Plug – Needs to be removed for inspection

Sample Analysis – Delay on lab turn around
example: Not available when at sea
Monitoring metallic debris.

Capturing Debris

Ferrous debris in oil
Monitoring metallic debris.

Spectrum SI-900 Sensors & Controls – Oil Debris Sensors
Monitoring metallic debris.

Spectrum SI-900 Sensors & Controls – Oil Debris Sensors

Multi-Channel Microprocessor driven “Smart” drain plug

- Fine Debris Channel - 0.01g to 0.5g
- Course Debris Channel - 0.5mm² to 368mm²

Sensitivity configurable by the user.
Monitoring metallic debris.

Spectrum SI-900 Sensors & Controls – Oil Debris Sensors

3 Channel Microprocessor driven “Smart” drain plug

- 4-20mA
- 0-5V and 0-10V
- J1939 CAN
Ferrous debris in oil

Wear debris particles

마모입자
Damage due to excessive play on the thrust bearings.
Ferrous debris in oil

SI-900 System Solution

Damage due poor lubrication

Ferrous debris in oil
Monitoring metallic debris.

Customer case study – Summary

• Call to action - thrust bearing problem
• Call to action - change lubrication

Not picked by customers vibration sensors.
Monitoring metallic debris.

Customer case study – Summary

• Planned inspection and down time
• Avoided line down situation