



Modern Lubrication Management and Lubricant/Plant Condition Management

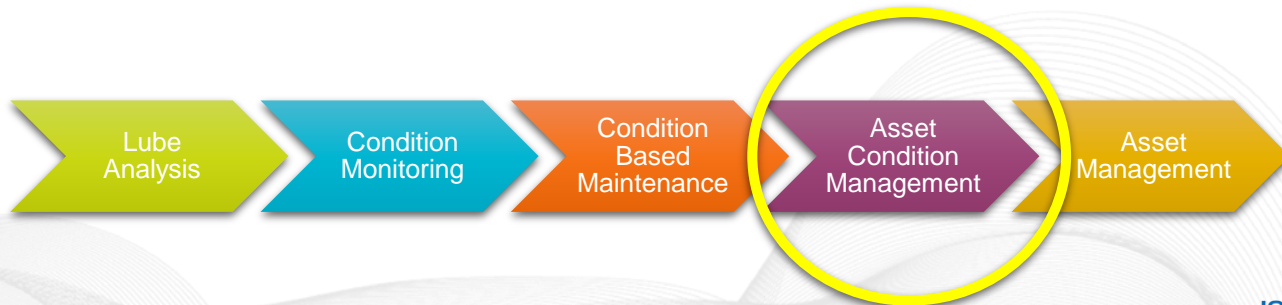
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2. Condition Monitoring
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5. Integration of the whole



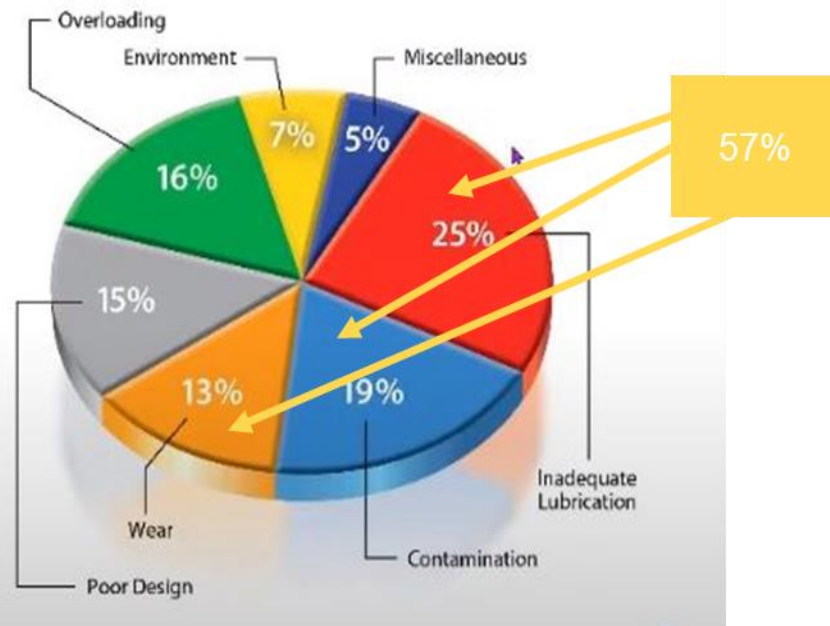
Rotating Parts - Failure Distribution – SKF Bearings

Lubricant-Related Cause - 57% of Time

What's Inadequate Lubrication?

- Wrong additive structure
- Acidic corrosive lubricant
- Poor additive health
- Washed out additives
- Incorrect relubrication cycle
- Wrong base stock for application

+Contamination control
+reduced wear



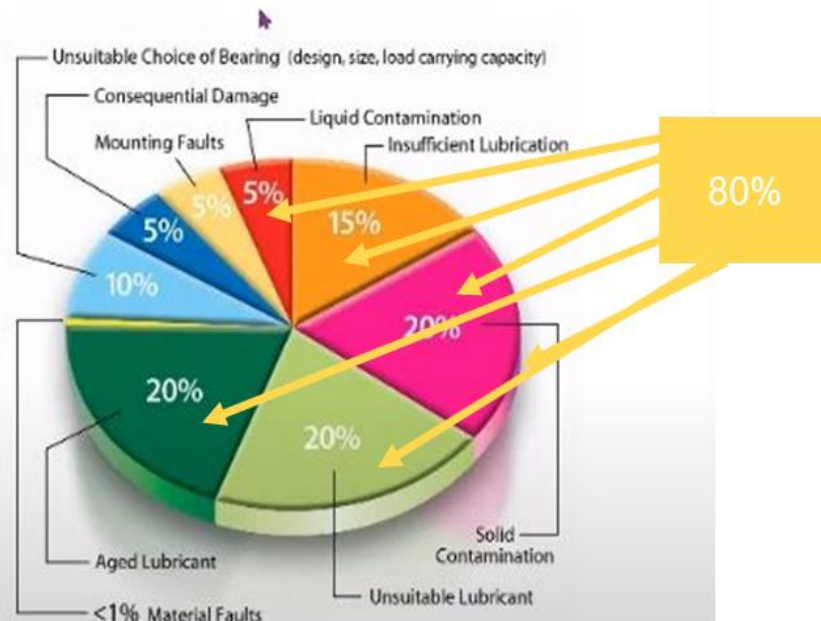
Rotating Parts - Failure Distribution – FAG Bearings

Lubricant-Related Cause - 80% of Time

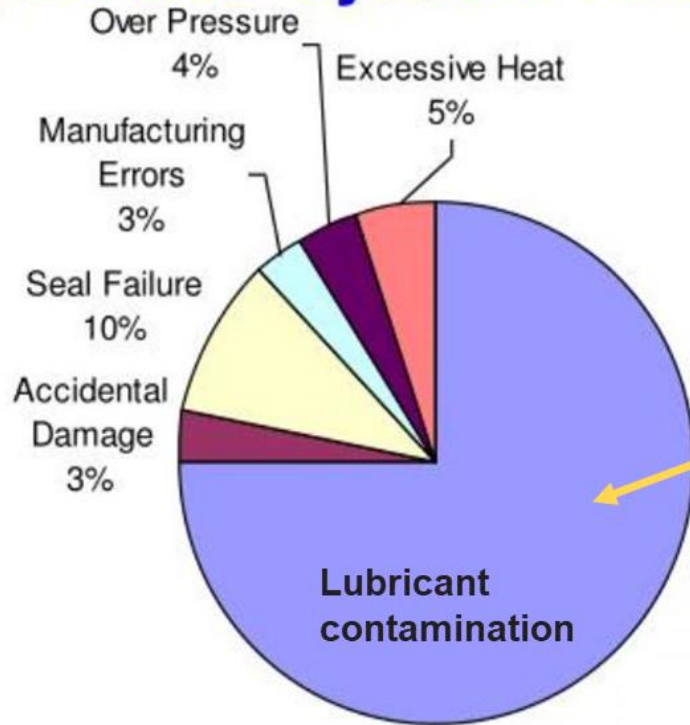
What's Insufficient Lubrication?

- Not enough oil volume
- Not enough grease volume
- Incorrect relubrication cycle
- Poor lubricant protective quality
- Wrong base stock for application

+Contamination control
+reduced wear
+ Poor lubrication management



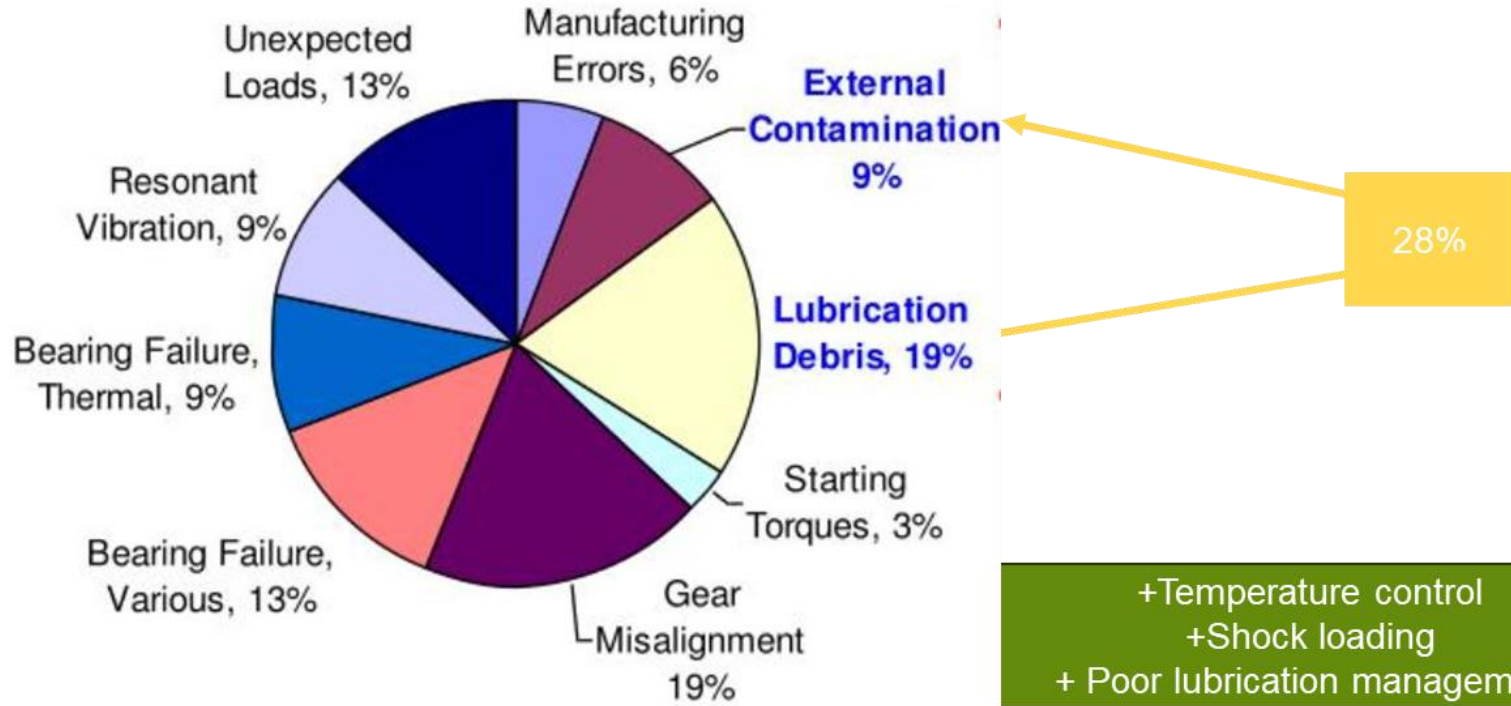
Hydraulic System Failure Modes

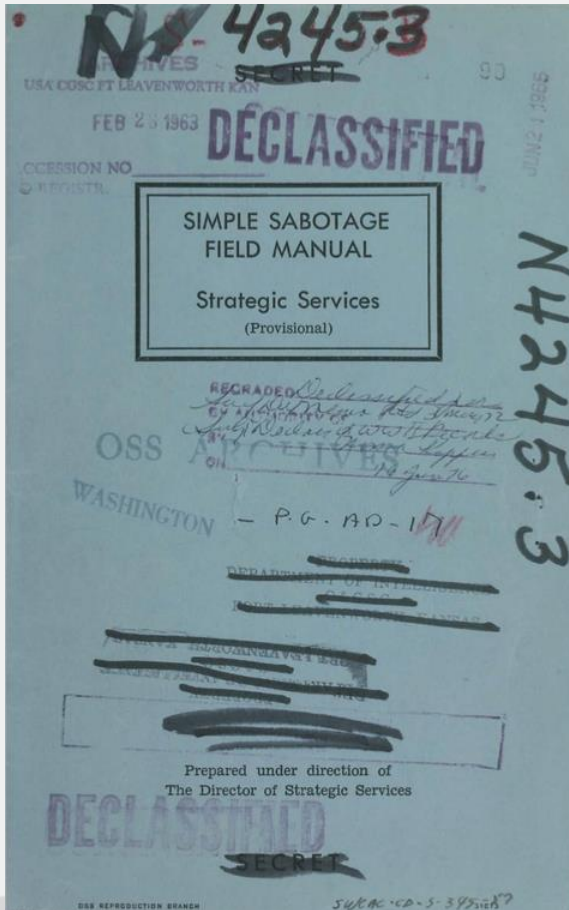


75%

Contamination e.g.
Wrong oil
Particulates
Water
Air
Oxidation products
Wear

Gear Box Failure Modes





Simple Sabotage Field Manual

by the Office of Strategic Services (Forerunner of the US CIA)

This historical document was originally published by the United States Office of Strategic Services (OSS; now the Central Intelligence Agency) in 1944, for use by OSS agents in motivating or recruiting potential foreign saboteurs.

It actively shows how to introduce issues that will significantly impact the reliability of machinery systems.

Many of which we are still doing (unknowingly) to this day!!!!

“Oil and lubrication systems are not only vulnerable to easy sabotage but are critical in every machine with moving parts. Sabotage of oil and lubrication will slow production or stop work entirely at strategic points in industrial processes.

- 1. Put metal dust or filings, fine sand, ground glass, emery dust (get it by pounding up an emery knife sharpener) and similar hard, gritty substances directly into lubrication systems. They will scour smooth surfaces, ruining pistons, cylinder walls, shafts, and bearings. They will overheat and stop motors which will need overhauling, new parts, and extensive repairs. Such materials, if they are used, should be introduced into lubrication systems past any filters which otherwise would strain them out.*
- 2. You can cause wear on any machine by uncovering a filter system, poking a pencil or any other sharp object through the filter mesh, then covering it up again. Or, if you can dispose of it quickly, simply remove the filter.*
- 3. If you cannot get at the lubrication system or filter directly, you may be able to lessen the effectiveness of oil by diluting it in storage. In this case, almost any liquid will do which will thin the oil, A small amount of sulphuric acid, varnish, water-glass, or linseed oil will be especially effective.*
- 4. Using a thin oil where a heavy oil is prescribed will break down a machine or heat up a moving shaft so that it will “freeze” and stop.*
- 5. Put any clogging substance into lubrication systems or, if it will float, into stored oil. Twisted combings of human hair, pieces of string, dead insects, and many other common objects will be effective in stopping or hindering the flow of oil through feed lines and filters.”*

Dirt, wear, contaminants, varnishes,
lacquers, water, air

Filters, strainers, breathers, tank design,
auto-lubes

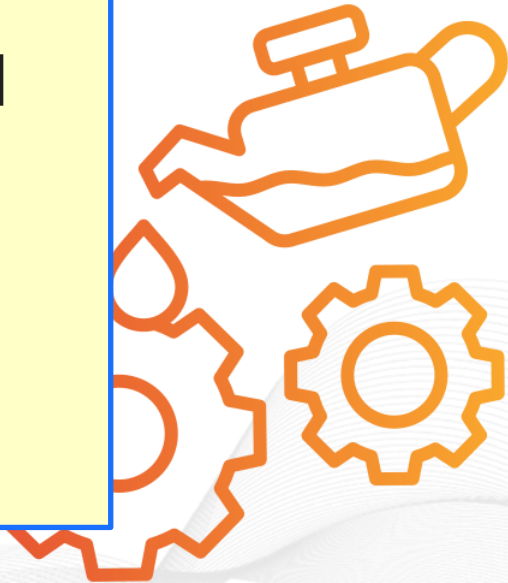
Poor storage, transfer, oil mixing, adding
other materials

Wrong oil, poor labelling, poor marking of
sample points, filler points drains etc.

What is lubrication and lubrication management?

We use the 5 Rs to illustrate the need to think about lubrication and its impact

Stores/Stock management
Colour coding
Equipment tagging
Training [Knowledge and skills]
Route Planning
Contamination Control
Lubricant Analysis
Condition-based lubrication
Waste management
Recycling



Latest Thinking Definitions

Asset Condition Management (ACM)

- Holistic approach to managing Asset Condition
- Fewer defects equals better performance

Condition Based Maintenance (CBM)

- Maintain On Condition, rather than on schedule
- More saves equated to better performance

Prescriptive Maintenance

- Adds AI recommendation for maintenance action

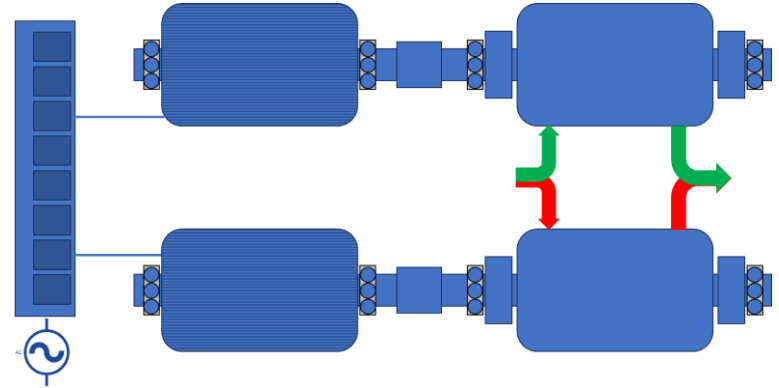
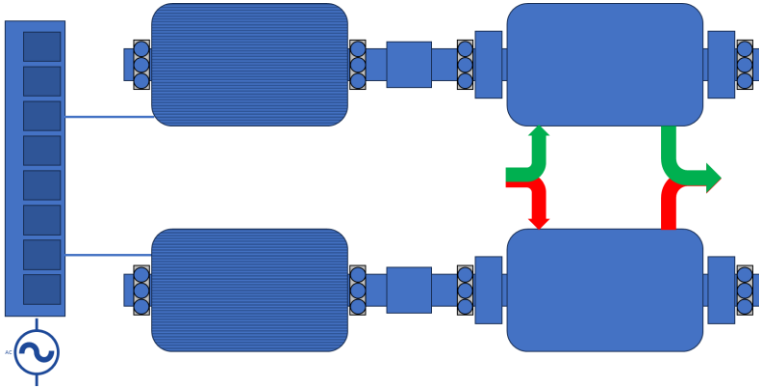
Predictive Maintenance

- AI enabled detection, diagnosis and prognosis

Condition Monitoring (CM)

- Processes and tools to monitor asset condition
- Online, wireless, manual & robotic

ACM for Rotating Machinery



Asset Condition Management

- Prevention of faults
- Defect Elimination
- Precision installation / maintenance
- Commissioning + FAT / SAT
- Mechanical condition
- Lubrication (5 R's)
- Pump Performance
- Containment (Seals)
- Electrical condition
- Energy efficiency
- ATEX / UL inspections
- CBM + Operator Care + [Preventive Maintenance]
- Testing of standby machine
- Troubleshooting & Root Cause Analysis

Condition Based Maintenance

- Early detection and repair of faults
- **Condition Monitoring** + Action
- Vibration
- [Lubricant Analysis]
- [Ultrasound]
- [Thermography]
- [Motor Current Signature Analysis]
- [Partial Discharge Testing]
- Online, wireless, manual & robotic data collection
- Trouble and Root Cause Analysis
- Includes Predictive / Prescriptive Maintenance

Lubrication Management Programme

Known areas of optimisation for improved performance

Lubricant
selection

Onboarding
of deliveries

Lubricant
transfers

Lubrication
at the asset

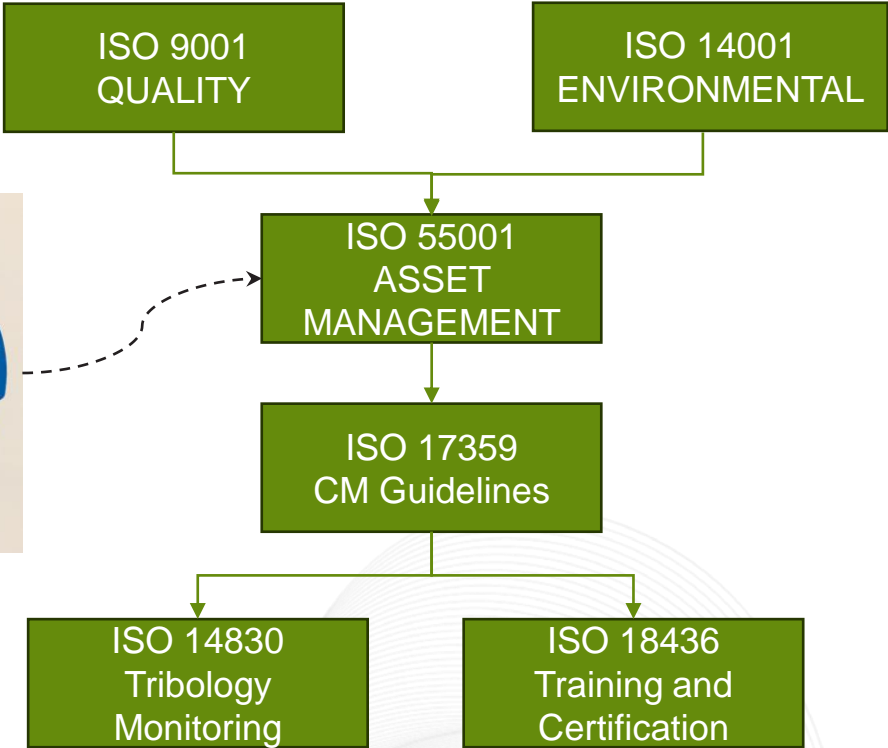
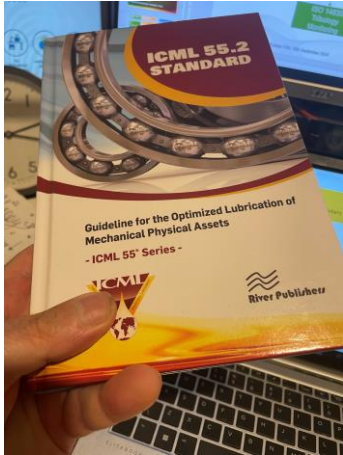
Life-cycle
management

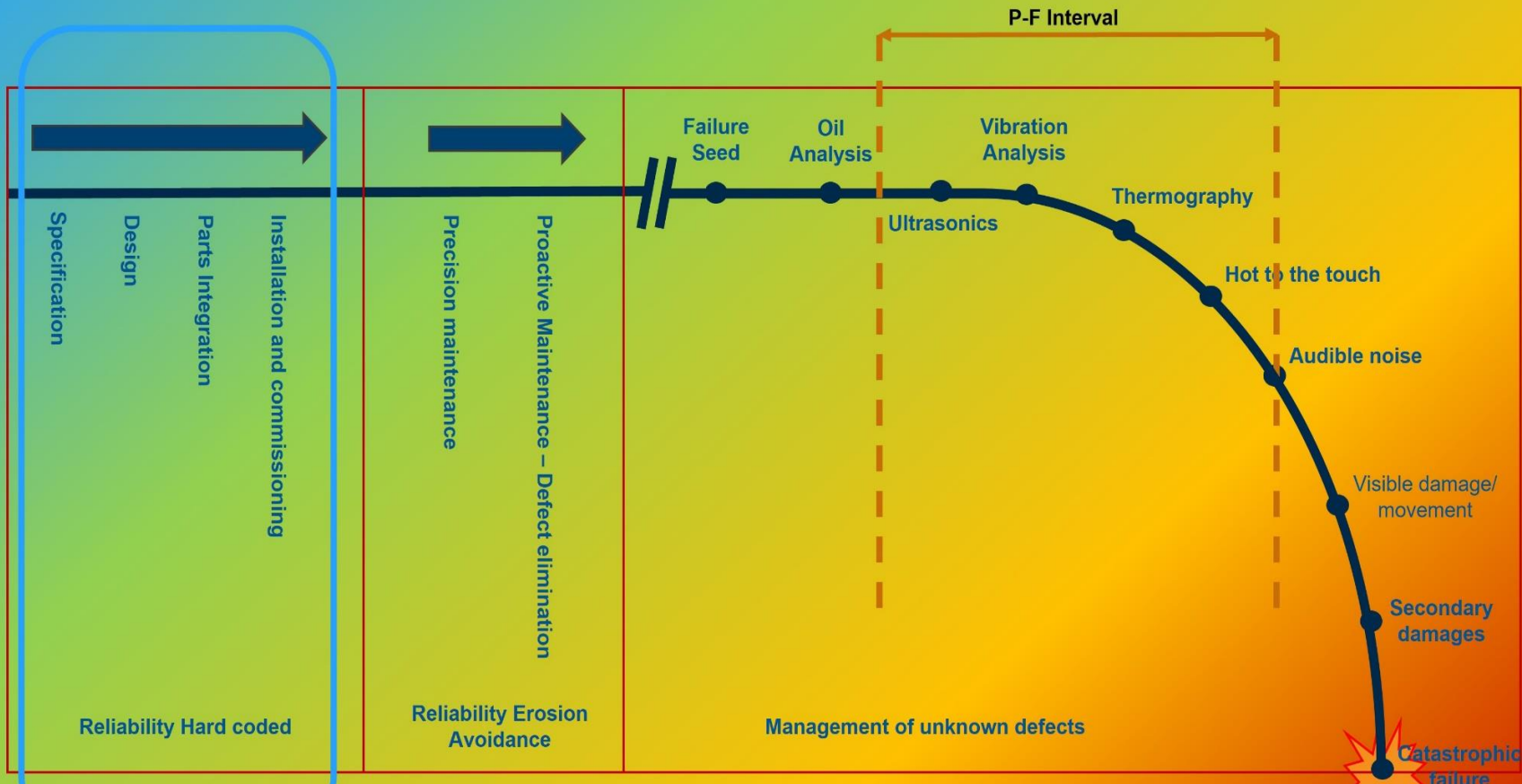
End of life
management

Waste
management

Methodical approach focussing on technical requirements to deliver optimum results efficiently

Hierarchy of Standards

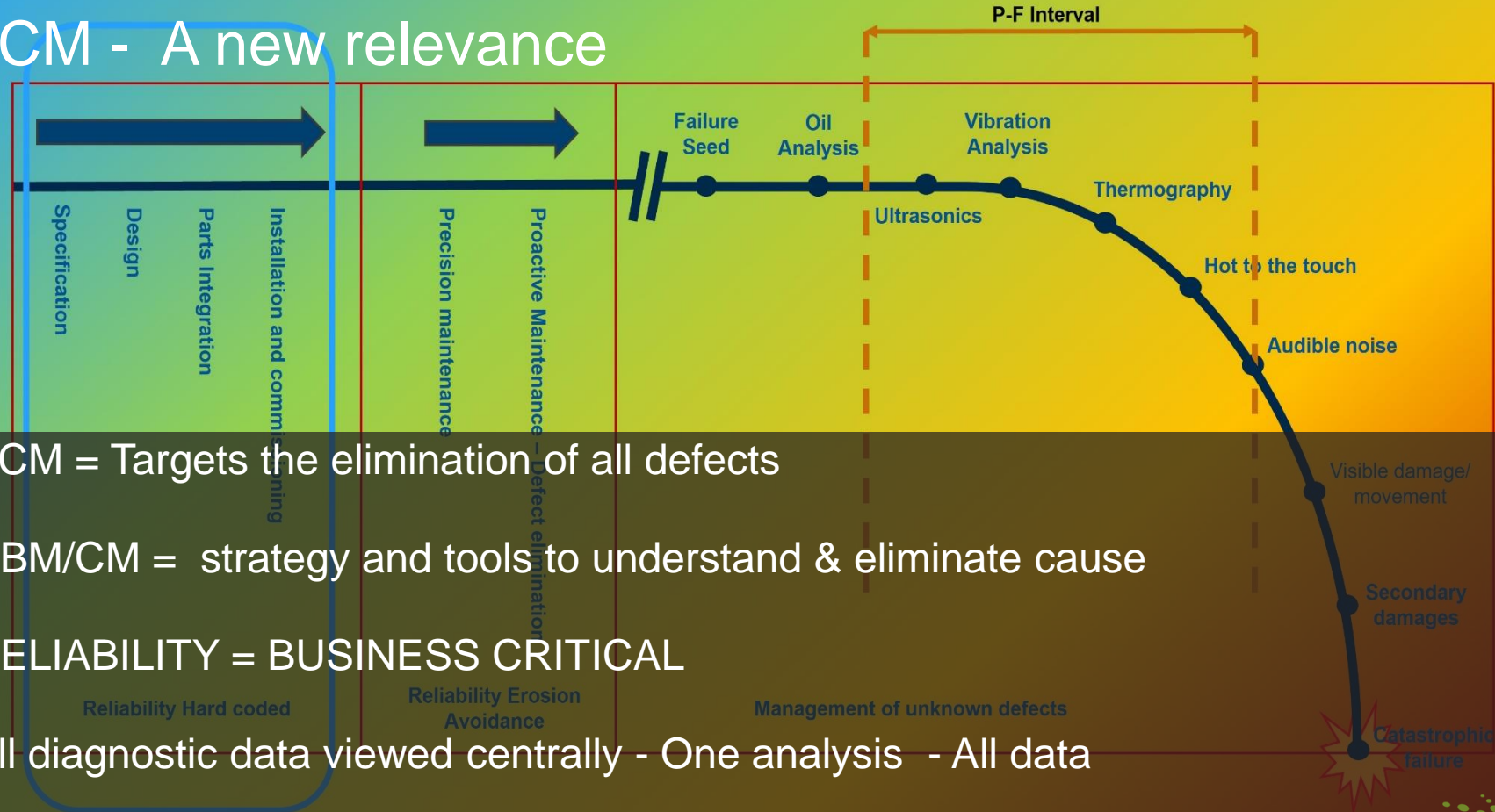




ACM - A new relevance



ACM - A new relevance



1. ACM = Targets the elimination of all defects
2. CBM/CM = strategy and tools to understand & eliminate cause
3. RELIABILITY = BUSINESS CRITICAL
4. All diagnostic data viewed centrally - One analysis - All data



Conclusion – in all and specifically in relation to lubrication

CM adds cost ► CBM adds value ► ACM maintains reliability

From 'Cradle to Cradle' - there are opportunities to increase ROI and avoid/eliminate unplanned events

- Focus on;
 - Design for maintainability
 - High quality installation and Commissioning
 - Basic housekeeping
 - Machinery Husbandry
 - Targeted CM and CBM
 - Elimination of all defects quickly
 - Root Cause Analysis (RCA) on all functional failures
 - Close out all RCA outcomes permanently and share the news
 - People – People - People





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