

# EQUIPMENT RELIABILITY AND ENERGY SAVINGS

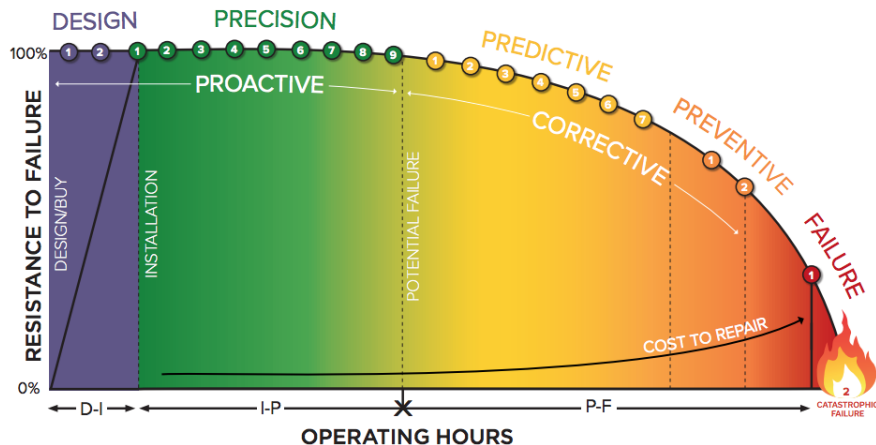


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# HOW FAILURE OCCURS

## D-I-P-F CURVE

(DESIGN-INSTALLATION-POTENTIAL FAILURE-FAILURE)



Attribution/Inspiration: The D-I-P-F curve was originally developed by Doug Plucknette, Certified Reliability Leader, Author, RCM Blitz (ISBN: 978-0-9838741-6-4) and further modified/evolved by Brian Heinsius, Certified Reliability Leader

### DESIGN/BUY

- 1 Design for Reliability (DFR)
- 2 Purchase for Purpose

### PRECISION

- 1 Precision Commissioning
- 2 Precision Installation
- 3 Defect Elimination
- 4 Precision Alignment and Balancing
- 5 Work Processes and Procedures
- 6 Asset Condition Management
- 7 Lubrication Reliability
- 8 Clean to Inspect (5S)
- 9 Operate for Reliability

### PREDICTIVE

- 1 Condition Directed Tasks
- 2 Ultrasound Testing (UT)
- 3 Fluid Analysis (FA)
- 4 Vibration Analysis (VIB)
- 5 Motor Testing (MT)
- 6 Infrared Imaging (IR)
- 7 Non Destructive Testing (NDT)

### PREVENTIVE

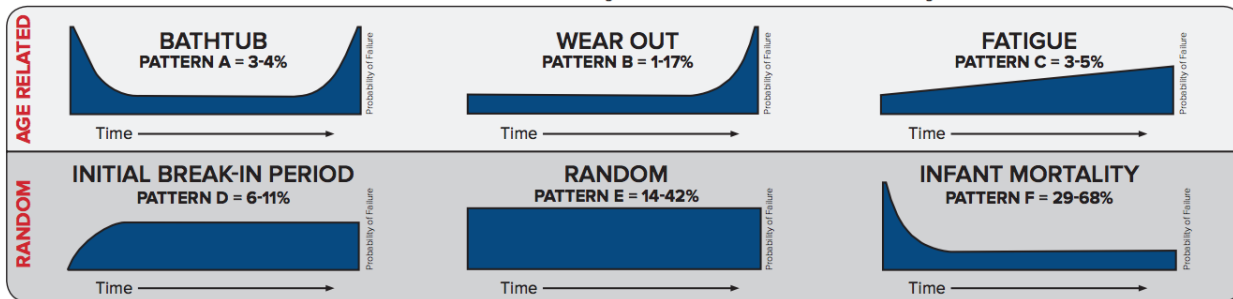
- 1 Time-Directed Tasks
- 2 Human Senses (audible noise, hot to touch, smell)

### FAILURE

- 1 Functional Failure
- 2 Catastrophic Failure

## FAILURE PATTERNS

Random failures account for 77-92% of total failures and age related failure characteristics for the remaining 8-23%.



Failure Pattern Percentage Sources: RCM by Nowlan and Heap, US Navy, Bromberg

# APPLICATION AREAS

## LEAK DETECTION

- Pressurized gas systems
- Heat exchangers
- Tanks and boilers
- Doors
- Valves

## ELECTRICAL INSPECTIONS

- Electrical cabinets
- Transmission lines & insulators
- Transformers
- Circuit breakers

*(DETECTING : Tracking, Arcing, Corona, mechanical looseness, current harmonics, voltage and current unbalance)*

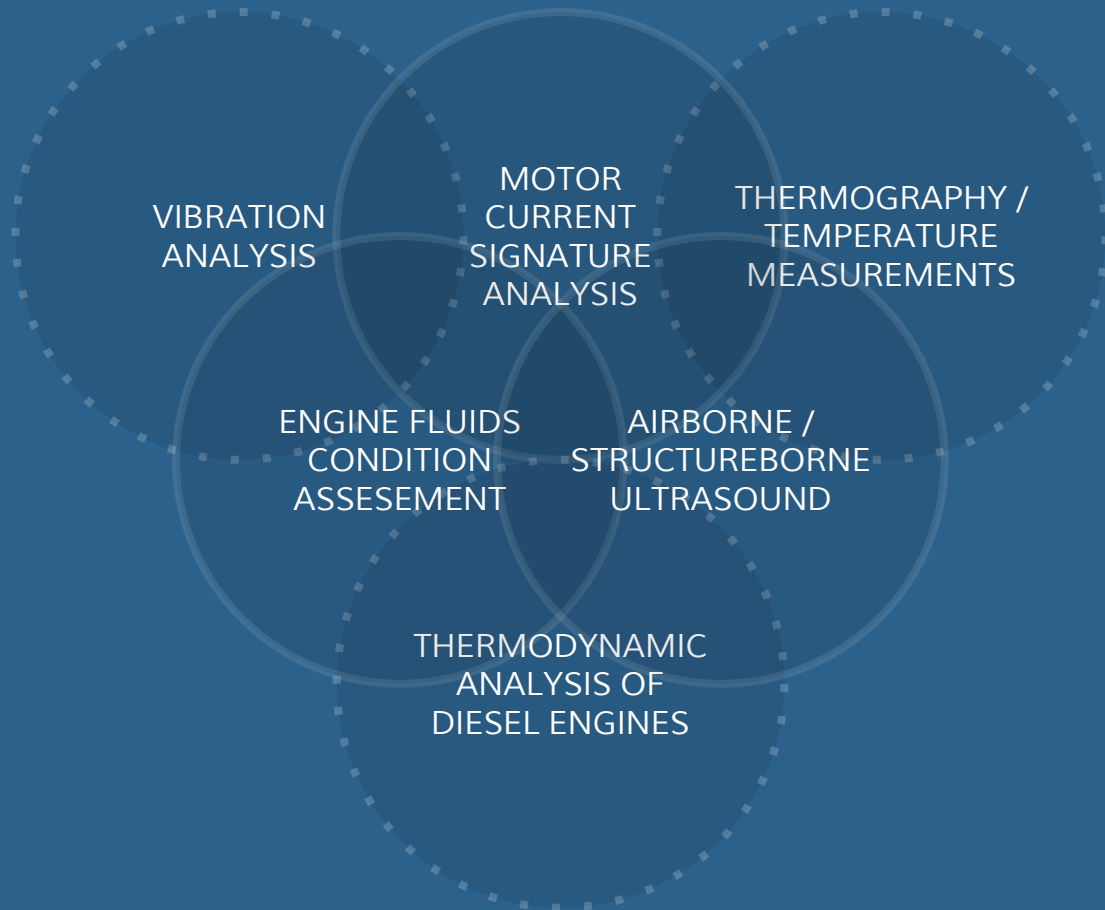
## MECHANICAL INSPECTIONS

- Bearing health
- Condition based lubrication
- Resonance
- Unalignment
- Unbalance
- Looseness
- Straightness and eccentricity of axial systems
- Condition of sealing
- Condition of machine fluids
- Cavitation

## THERMODYNAMIC ANALYSIS

- Reciprocating engines

# MEASUREMENT CAPABILITIES



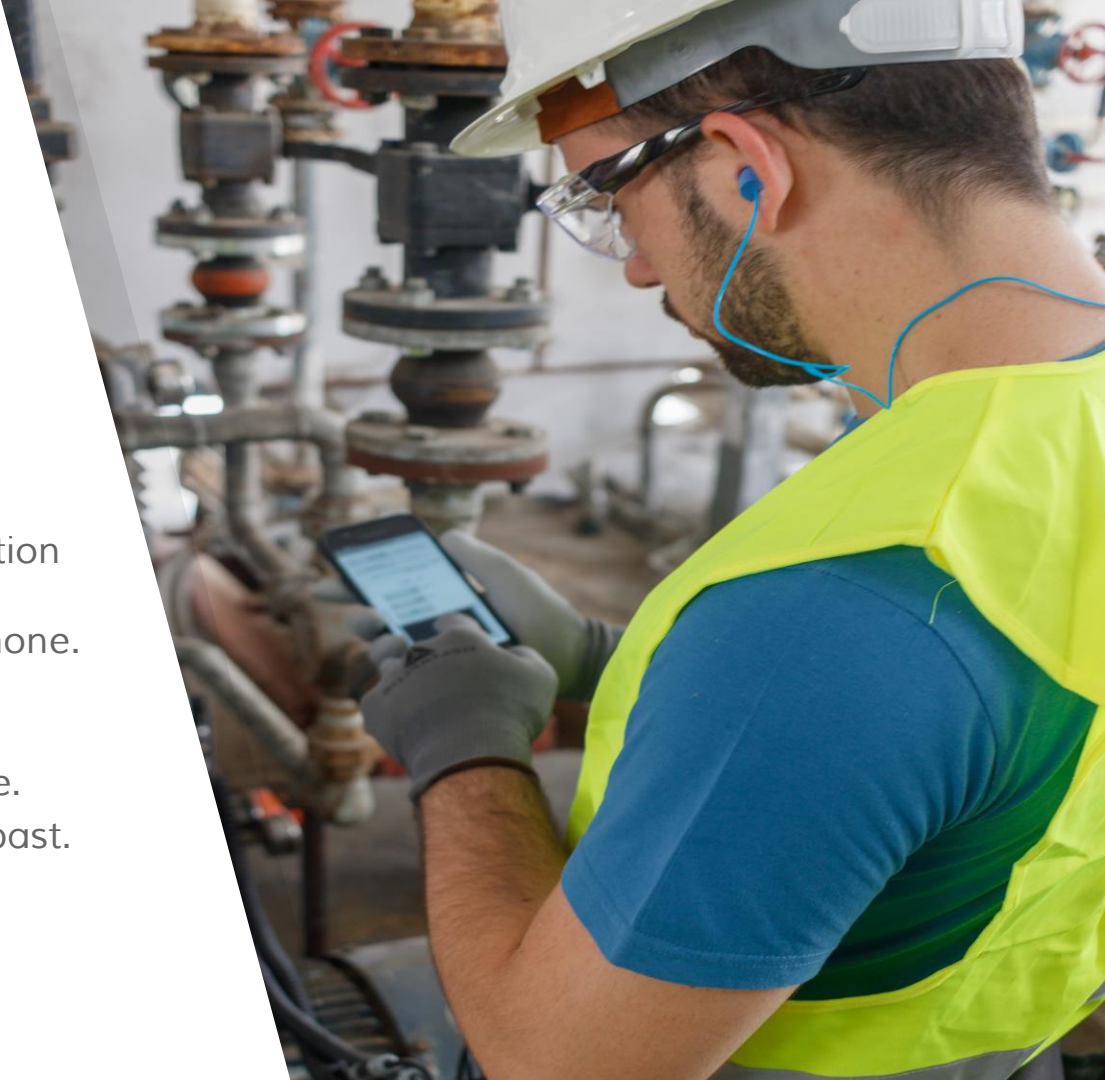
# WEARDC

- The platform incorporates a combination of sensors and a data collection device with a smartphone or tablet as the interface.
- Sensors from recognized manufacturers.
- IEPE Accelerometers, Ultrasound, and any 0-10V/4-20mA sensor (rotation speed, static and dynamic pressure, contact temperature, IR, humidity, voltage/current, force, torque)



# OPTICAL INSPECTIONS

- With the WEARDC One application anyone can perform optical inspections only with a smartphone.
- Reports are generated automatically and are available through our Mechbase software.
- Paper forms are a thing of the past.





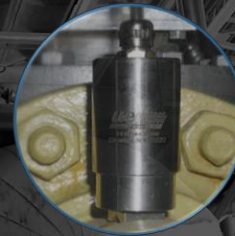
# THERMOGRAPHY MEASUREMENTS

- FLIR Thermal Cameras
- Image and temperatures sync with the cloud



# MAINTNODE

- Permanently installed sensors
- Continuous monitoring 24/7
- Modbus, CANBUS, OPC-UA
- Connect with OEE software





# MECHBASE SOFTWARE

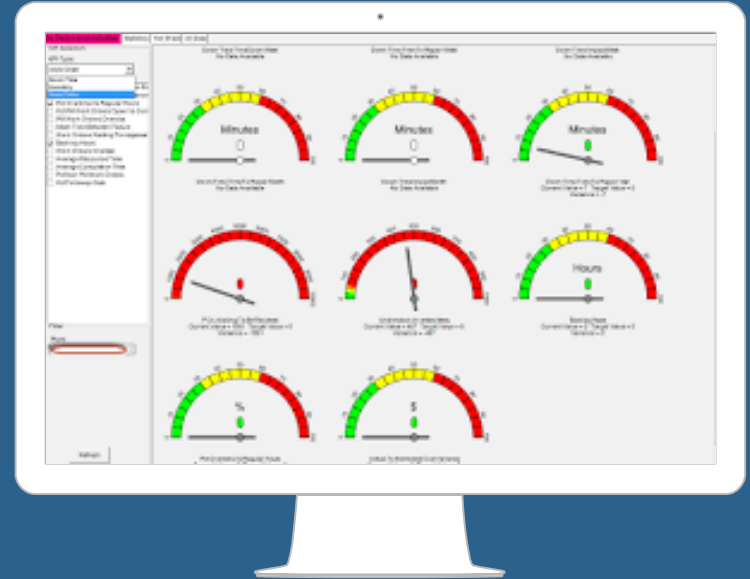
- Organize your assets with standardized formats
- Program routes
- Visualize machine health
- Analyze signals
- Statistical alarms



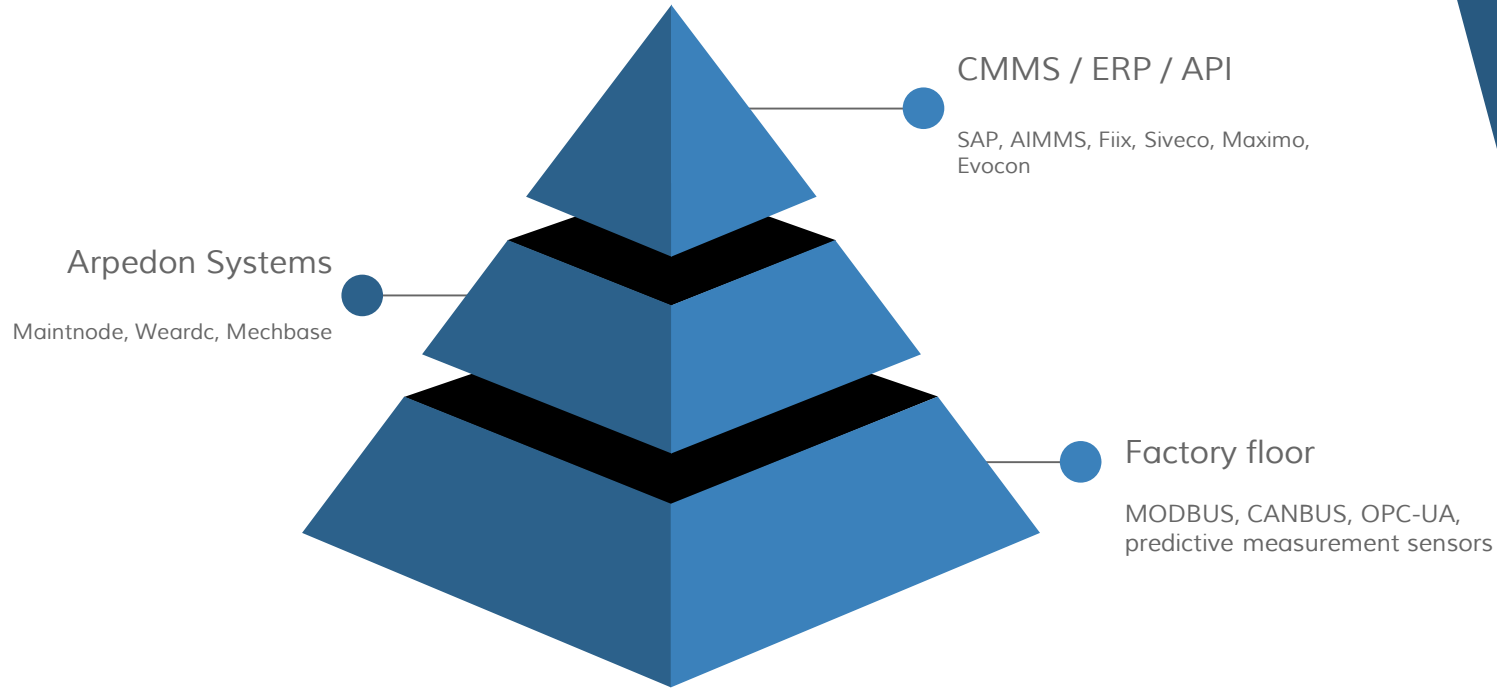
# INTERGRATING WITH CMMS & EXTERNAL SYSTEMS

Use the software you already know.

Work orders can be generated automatically on your CMMS software according to the condition of your assets.



# FROM PRODUCTION TO THE ERP



# ACTIVITIES

- **Design, construct and maintain Electromechanical installations**  
electrical, industrial ventilation, point dedusting, mist systems, deodorization, fire detection, CO detection, firefighting, energy savings
- **Complete diagnostic maintenance programs**  
criticality analysis, sensor and diagnostic device selection, measurement service, diagnosis
- **Precision maintenance**  
alignments, balancing, condition based lubrication, discovery-cost estimation and repair of pressurized gas leaks
- **Training**

