

EQUIPMENT RELIABILITY AND ENERGY SAVINGS

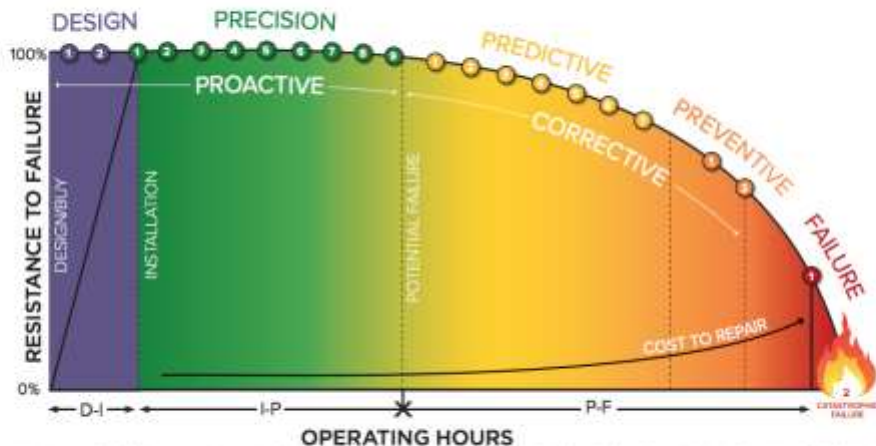


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HOW FAILURE OCCURS

D-I-P-F CURVE

(DESIGN-INSTALLATION-POTENTIAL FAILURE-FAILURE)



Attribution: Inspiration: The D-I-P-F curve was originally developed by Greg Puckett, Certified Reliability Leader, Austin, RCM after 2500+ 579-9-0820116-6 and further modified/developed by Brian Hennessey, 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

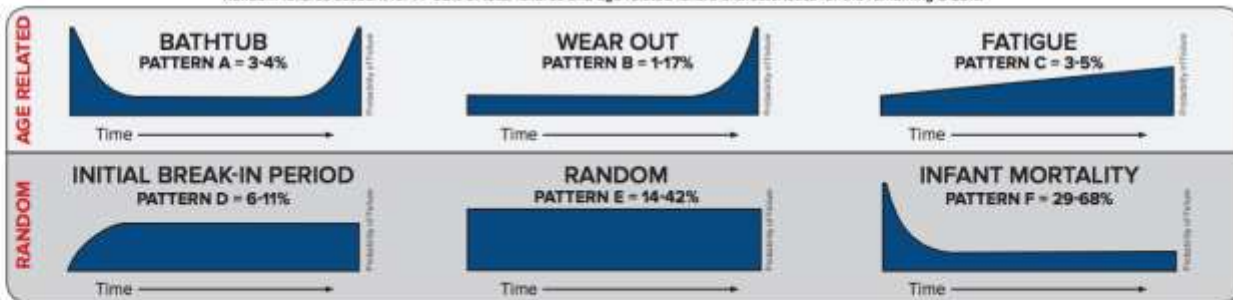
- 1 Time-Directed Tasks
- 2 Human Senses (audible noise, hot to touch, smell)

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 Howden and Inago, US Navy, Starbuck



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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)

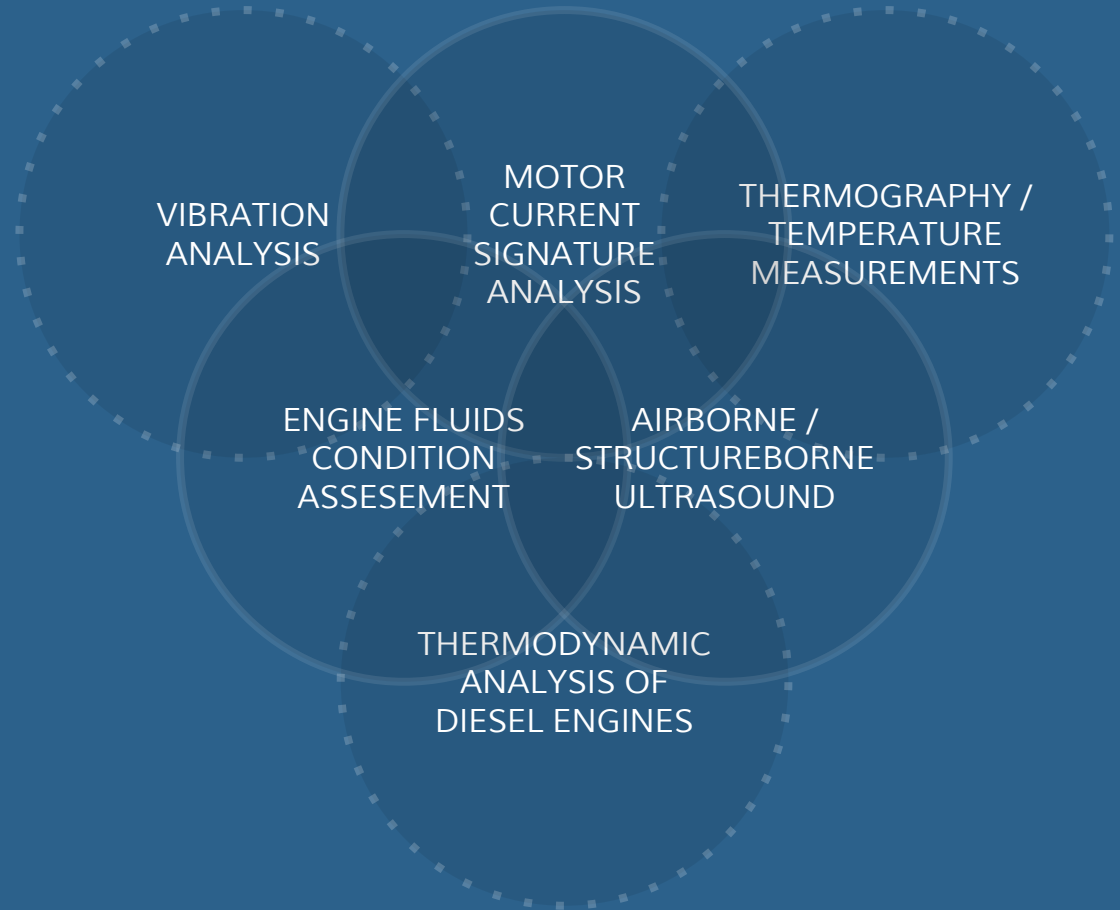
MECHANICAL INSPECTIONS

- 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



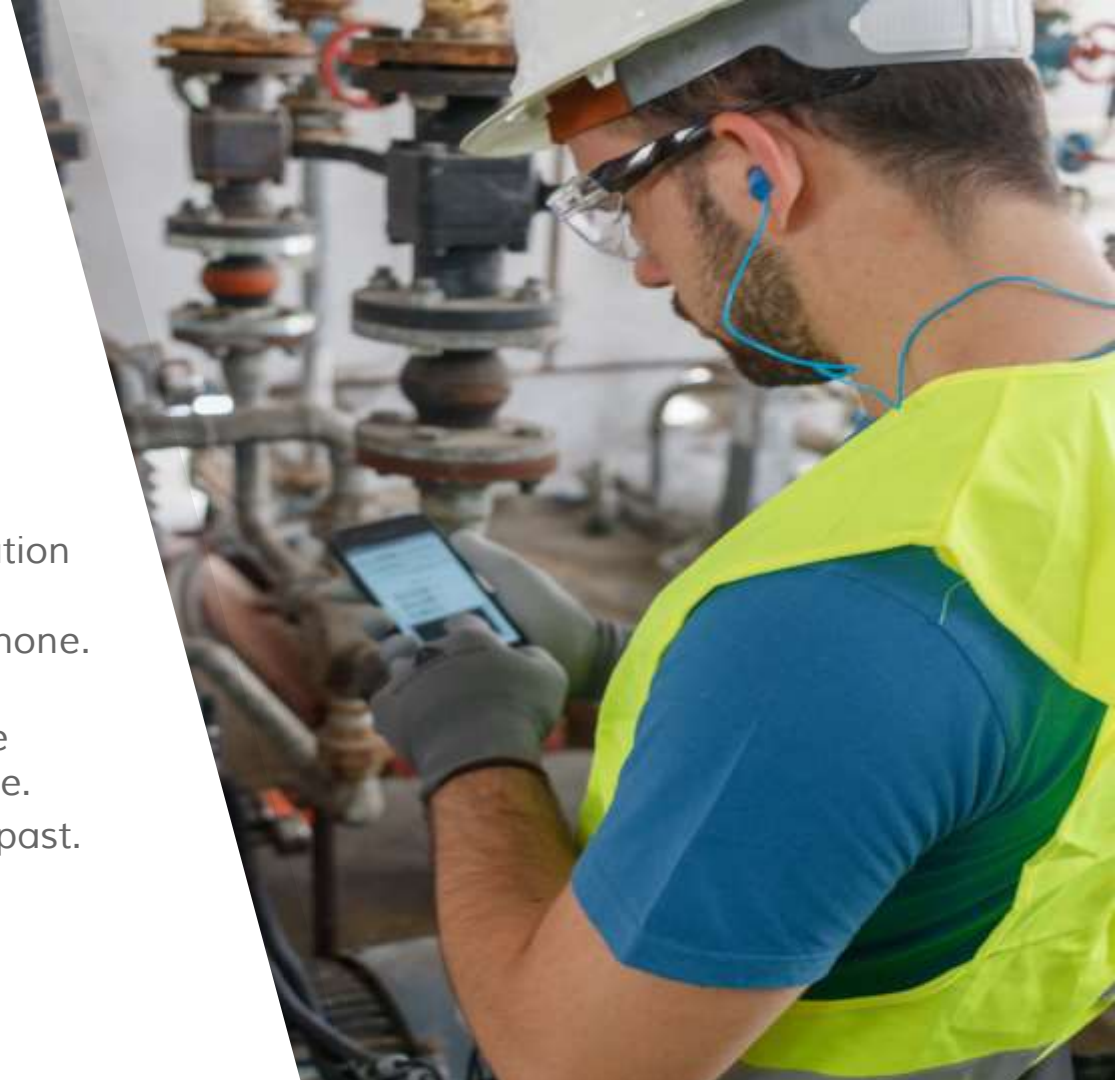
WEARDC

- 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.



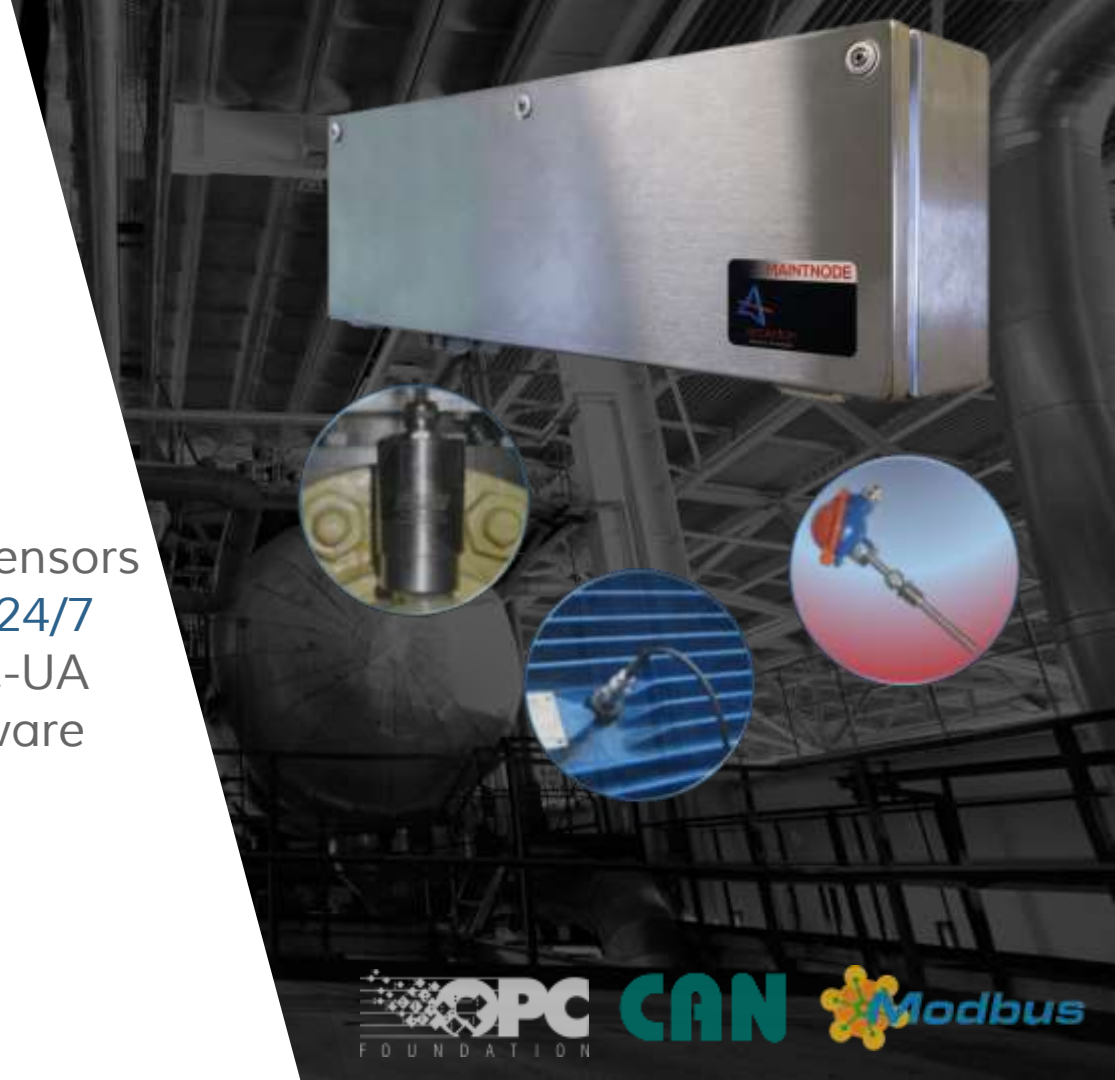
THERMOGRAPHY MEASUREMENTS

- 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

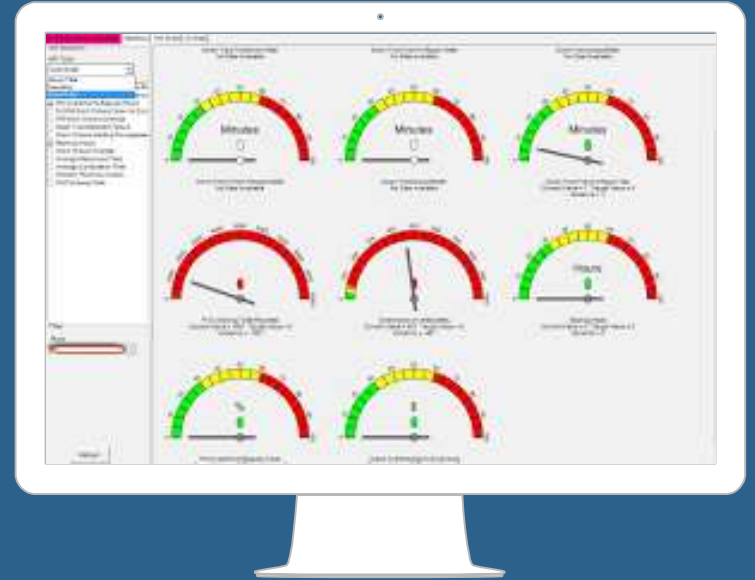
- Organize your assets with standardized formats
- Program routes
- Visualize machine health
- Analyze signals
- Statistical alarms



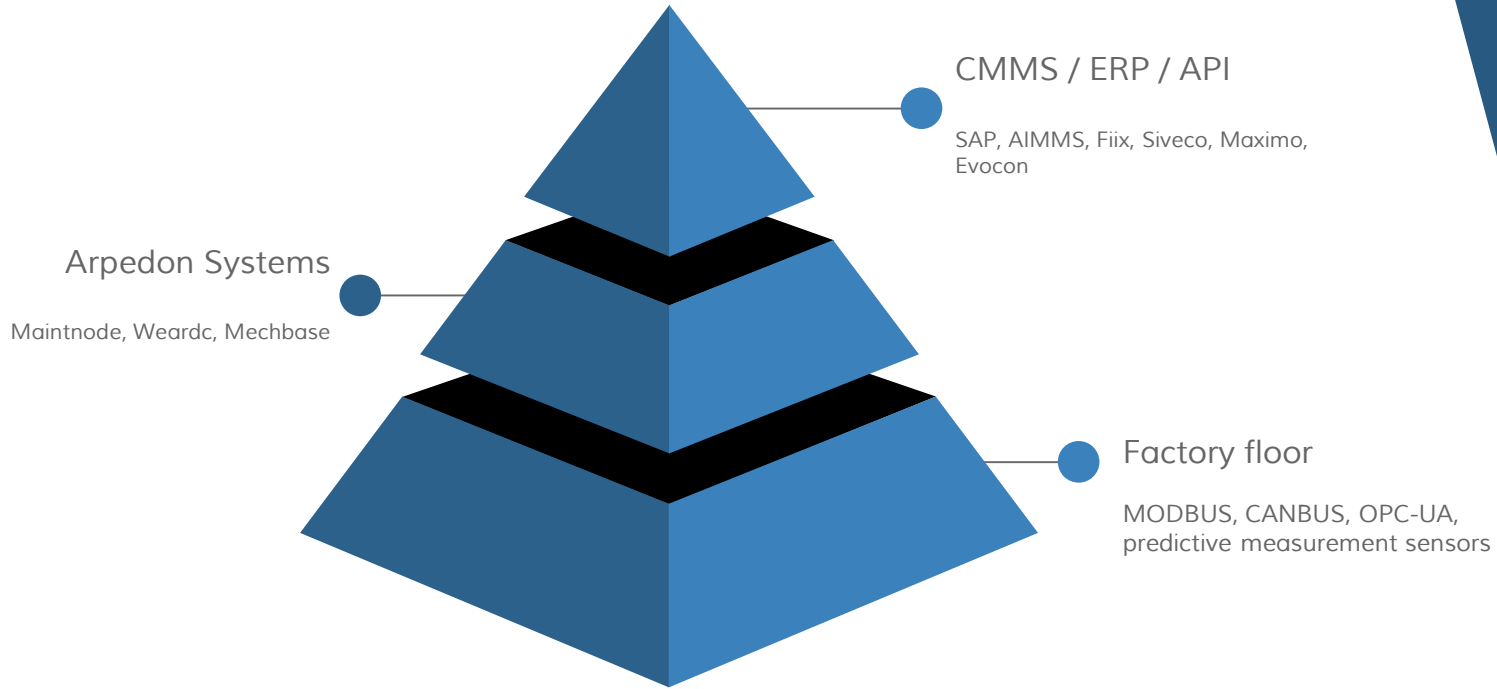
INTERGRATING WITH **CMMS &** **EXTERNAL SYSTEMS**

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**
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**

