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Wind turbine Condition Monitoring
Key Data For Asset Management Systems

15.10.2020 – ICCI2020 Digital Fair

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Delivering wind solutions since 2004

OEM agnostic turbine capability

- Experience with turbines of +15 OEMs
- Kinematics from +40 turbine models

QUICK FACTS

9	Facilities in nine countries
53	Technical training centers worldwide
60	Over 60 years of innovation
600	Over 600 patents
1,200+	System 1 customers worldwide
10,000	Overspeed detection systems sold since 1994
32,000+	Protecting over 32,000 wind turbines globally
100,000+	Rack monitoring systems installed
6,000,000+	Installed sensor monitoring points

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Increased performance

Informed priorities

Drive focus and ROI

50% Reduction in maintenance cost

55% Reduction in unplanned machine failures

30% Increase in machinery availability

60% Reduction in mean time to repair

30% Reduction in spare parts cost

30% Increase in plant machinery life

70% Reduction in maintenance breakdowns

90% Reduction when process data was combined with predictive maintenance data

25% Increase in Production

40% Reduction in downtime

Basic System Architecture

Asset Management Systems

Farm Server

Bently Nevada Data Services

System 1 Farm Client

Network Connection

Ethernet Switch

Wind Turbine 1

Up Tower

Switch

60M500

Accelerometers

WTG2

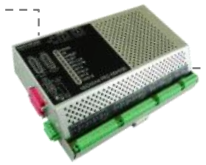
WTG199

One farm server can accommodate up to **200 wind turbine monitors**

Wind Turbine 200

Up Tower

Switch



60M500

Accelerometers

Condition monitoring – Gearbox driven wind turbines

Wind turbine condition monitoring of gearbox-driven turbines

Most onshore wind turbines consist of 3 main components that are monitored with the 60M100:

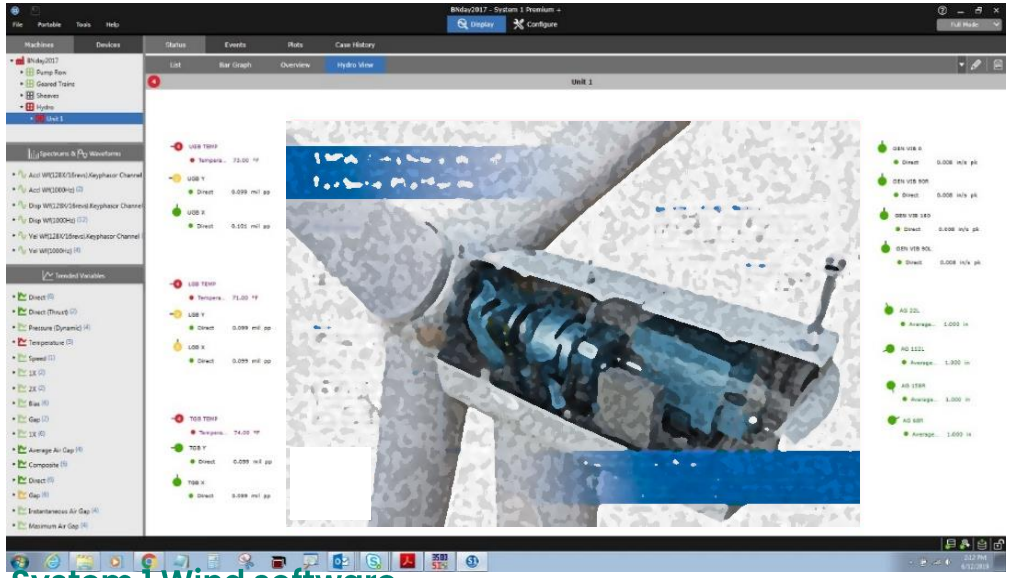
1. **The main bearing** -Most turbines have 1 or 2 main bearings. Typically, each main bearing has 1 accelerometer.

2. **The gearbox** -Typically, the gearbox has 3-5 accelerometers, with 3 accelerometers being standard.

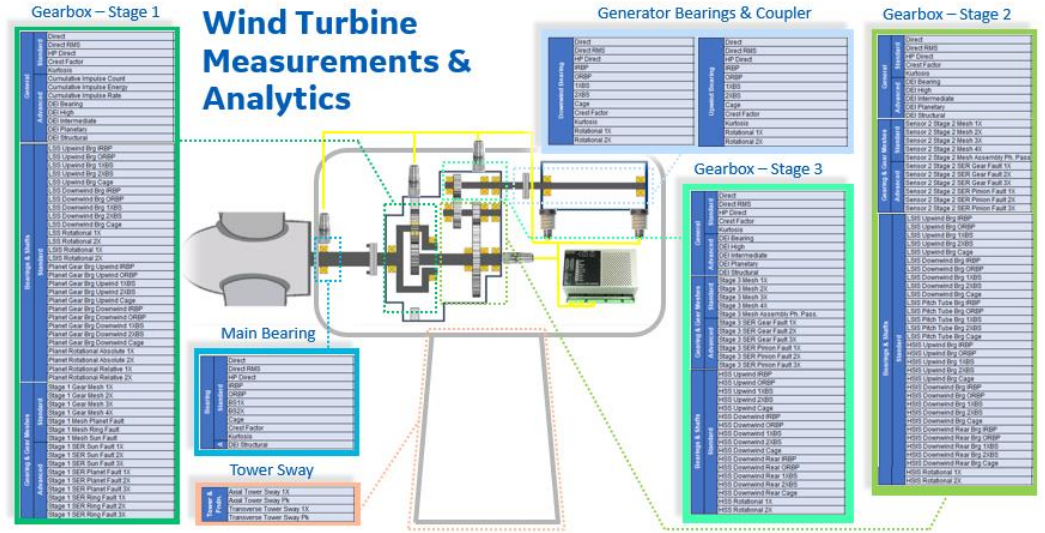
3. For onshore applications, the 2 **generator** bearings are monitored. Each generator bearing has one accelerometer.

Additional machine operating data, such as temperature and lubrication oil reports, can be integrated at the CMS layer for a comprehensive overview.

Configuration and display is provided by System 1 Wind software.

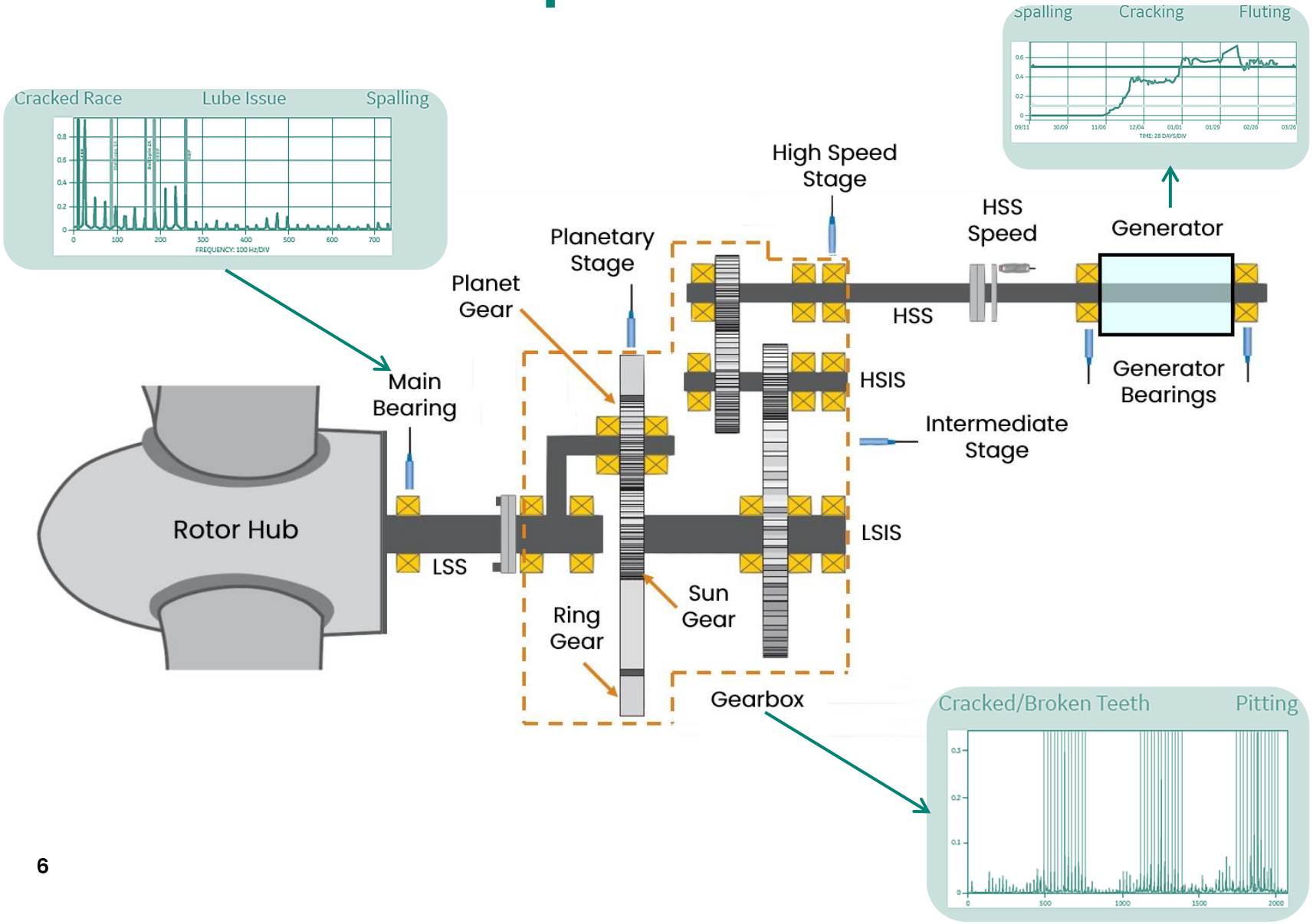


System 1 Wind software



Gearbox-driven CMS instrumentation

Drivetrain Components Monitored



The CMS design of a typical onshore turbine drivetrain would include the installation of:

- 6 accelerometers,
- 6 cables,
- 1 60M500 monitor,
- 1 tachometer*

**part of control system*

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Benty Nevada Condition Monitoring instruments

Benty Nevada Protection, Control & Condition Monitoring instruments

3rd Party Instruments via Modbus

Control & Process Historian systems via Modbus & OPC

Web & Fleet Views

S1

f(x)

Performance
Decision Support & Analytics

OPC-UA
Alarm Events
Scalar Data
Dynamic Data

Asset Management Systems

Control & Process Historian systems via OPC

S1

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System 1 Demo - System 1* Wind

File Tools Help

Display Configure

Full Mode

Machines Devices

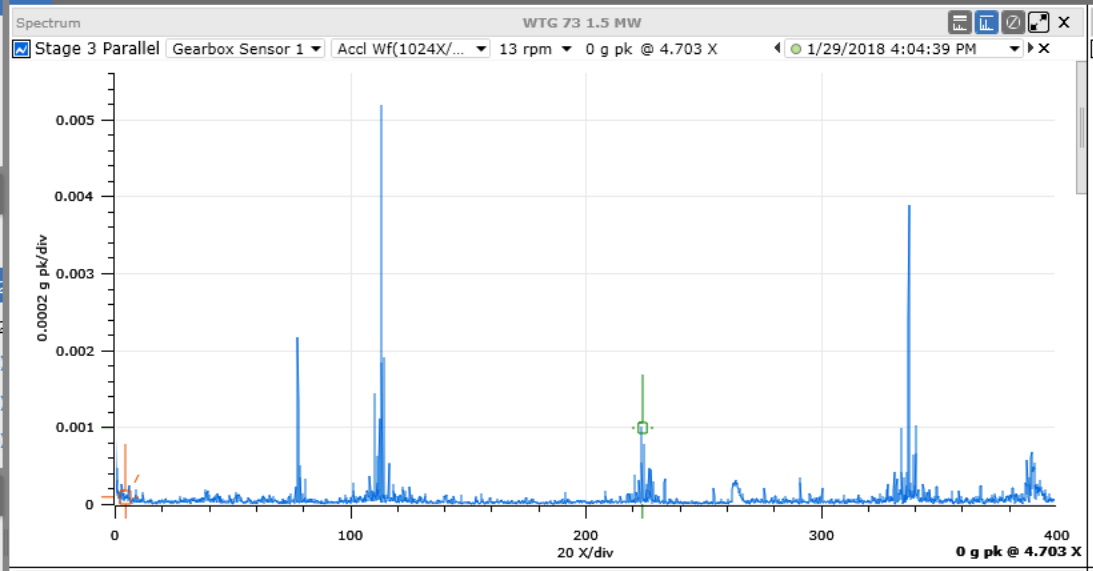
Status Events Plots Case History

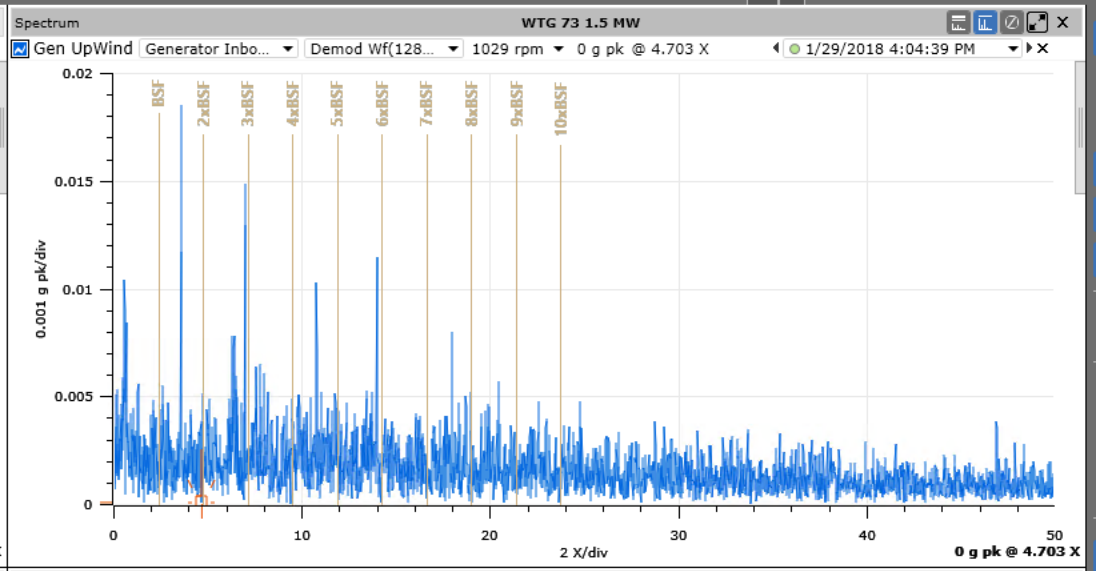
System 1 Demo
- WTG 73 1.5 MW
  - Main Bearing
  - 3-Stage WTG GB
  - Generator
  - Controller Channel
  - WTG 73 Modes

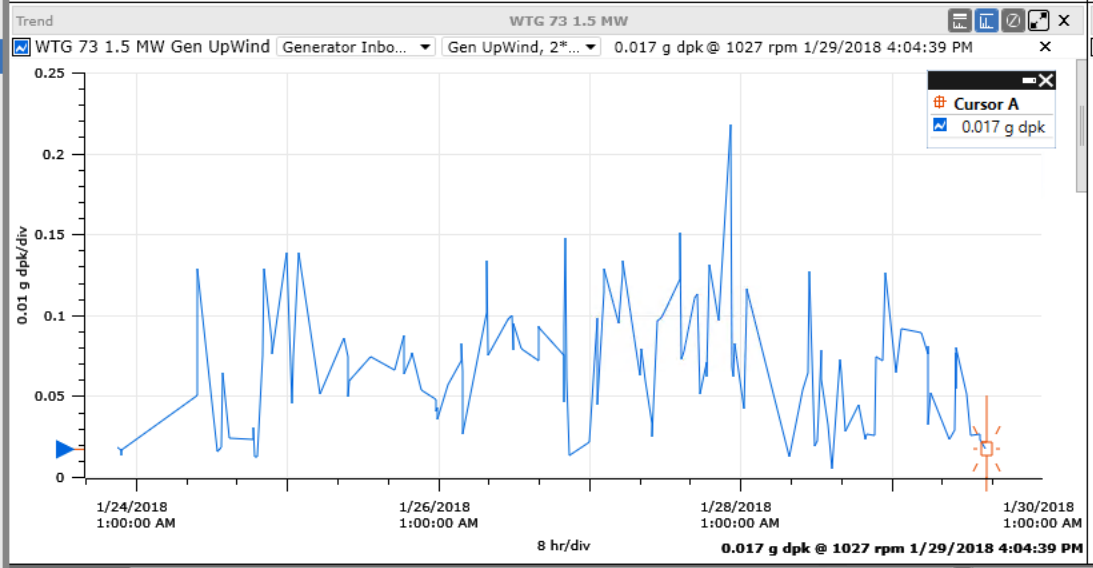
Spectrums & Waveforms
- Accl Wf(10000Hz) (6)
- Demod Wf(128X/64revs).Speed Channel 2
- Demod Wf(256X/32revs).Speed Channel 2
- Accl Wf(128X/64revs).Speed Channel 2 (2)
- Accl Wf(256X/32revs).Speed Channel 2 (1)
- Accl Wf(1024X/8revs).Speed Channel 2 (3)

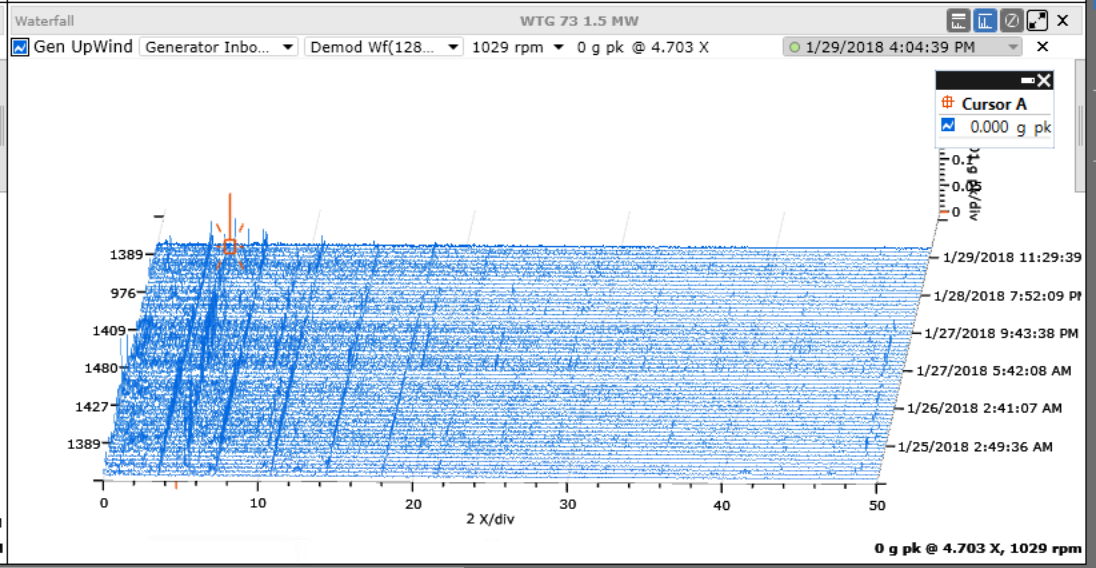
Trended Variables
- Gen DnWind, 2* BSF (1)
- Gen DnWind, Cage (1)
- Gen UpWind, 2* BSF (1)
- Gen UpWind, Cage (1)
- HSIS, HSIS Dnwind Rear, 2* BSF (1)
- HSIS, HSIS Dnwind Rear, Cage (1)
- HSIS, HSIS Dnwind, 2* BSF (1)
- HSIS, HSIS Dnwind, Cage (1)
- HSIS, HSIS Upwind, 2* BSF (1)
- HSIS, HSIS Upwind, Cage (1)
- HSS, HSS Dnwind Rear, 2* BSF (1)
- HSS, HSS Dnwind Rear, Cage (1)
- HSS, HSS Dnwind, 2* BSF (1)
- HSS, HSS Dnwind, Cage (1)
- HSS, HSS Upwind, 2* BSF (1)
- HSS, HSS Upwind, Cage (1)
- MB UpWind, 2* BSF (1)

Overview (BOP) Trend - Waterfalls Trends & Dynamics









9/23/2017 12/22/2017 3/22/2018 6/20/2018

4 H D W M Y CV

1 of 2

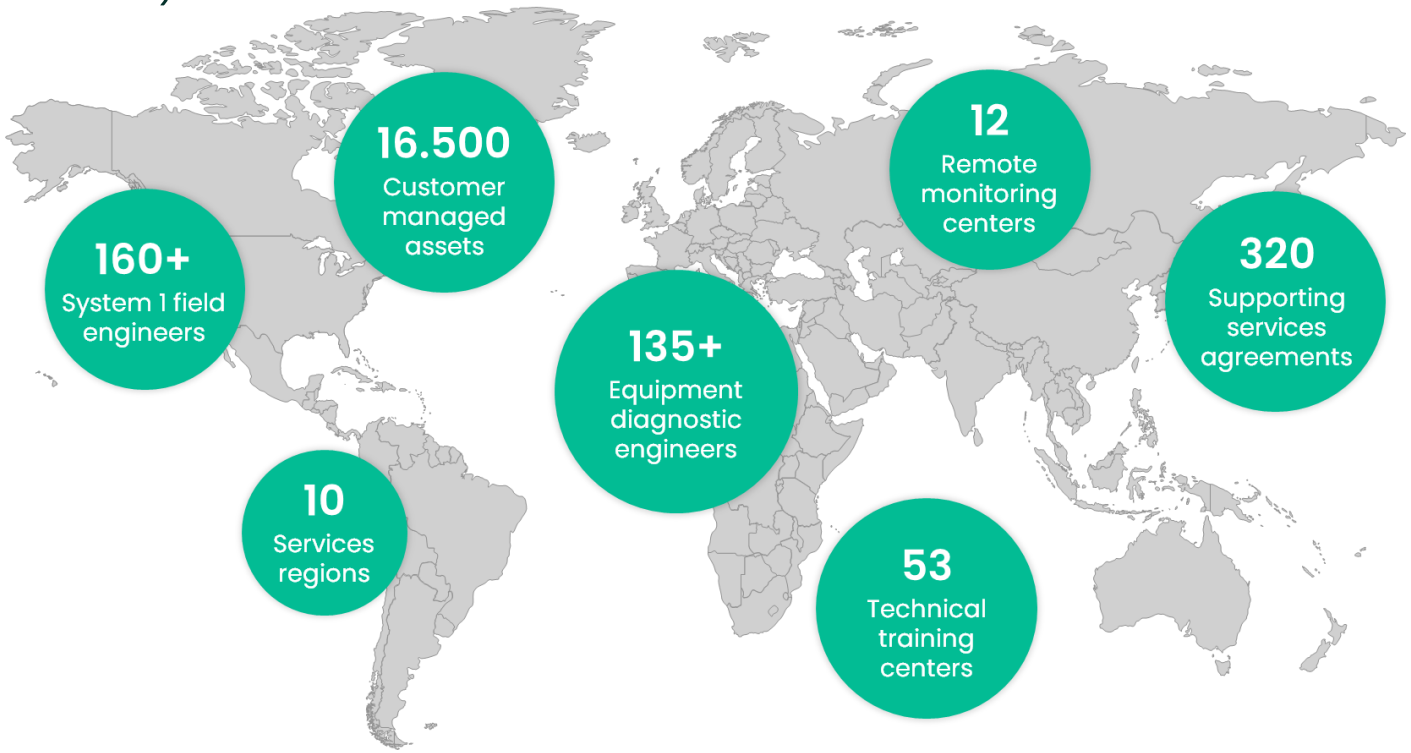
Adding Values to our Customers with our Service

Global Footprint…

• 500+ Bently Nevada Service Employees covering all regions

Diverse Skills Mix…

- New installs, retrofits, HW and SW, on-site or hosted
- Machinery Diagnostics, Software Implementation,
- Asset condition reports, recommendations from experienced engineers
- 24/7 Remote Monitoring and Service Support Agreements
- Over 60 Defined Skills…2600+ Certifications
- Training… Continual Update with 40-50 Internal Courses annually (400+ Customer)



Our Goals

- Comprehensive Training
- Proactive Analytics
- Expert Advisory Services
- Protection & Monitoring
- Machinery Diagnostics

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