



INDUSTRIALHUB BD

RELIABILITY & ENGINEERING SERVICE PARTNER

VIBRATION ANALYSER & BALANCING TOOL

Choose, use and check vibration analysers and balancing tools for rotating machines.



How to use this guide

A visual guide to finding faults and balancing rotors in the field.

CONTENTS

03	Why measure and severity levels	12	Single-plane balancing
04	Amplitude, frequency, phase, spectrum	13	Two-plane and field tips
05	Sensors and mounting	14	Balancing problems
06	Choose the analyser	15	Gear faults and sidebands
07	Measuring points	16	Case study: gearbox failure
08	Fault signatures	17	Routes, trends, reports
09	Bearing diagnosis	18	Global brands and cross-reference
10	Fault finder	19	Global brand comparison
11	Balancing basics and grade	20	Request a quotation

1 · Learn

Pages 3 to 5

2 · Choose

Pages 6, 18 to 19

3 · Diagnose

Pages 7 to 10, 15 to 16

4 · Balance

Pages 11 to 14

5 · Plan

Pages 17 to 20



Tablet analyser and balancer



Handheld meter



Handheld analyser kit

Typical catalogue data and common practice. **GENERAL PRACTICE**

Why measure and severity

A change in how a machine shakes is the earliest warning of a fault. Overall velocity in mm/s RMS gives a quick verdict.



Check a fan on the route



Check a pump and motor

4 to 8 weeks

typical warning

3 axes

H, V and A

1 route

same points each time

SMALL MACHINES

up to 15 kW



MEDIUM MACHINES

15 to 300 kW



LARGE RIGID BASE

over 300 kW



VIBRATION VELOCITY, mm/s RMS

ZONE A

New. Good.

ZONE B

Fine to run.

ZONE C

Plan repair.

ZONE D

Act now.

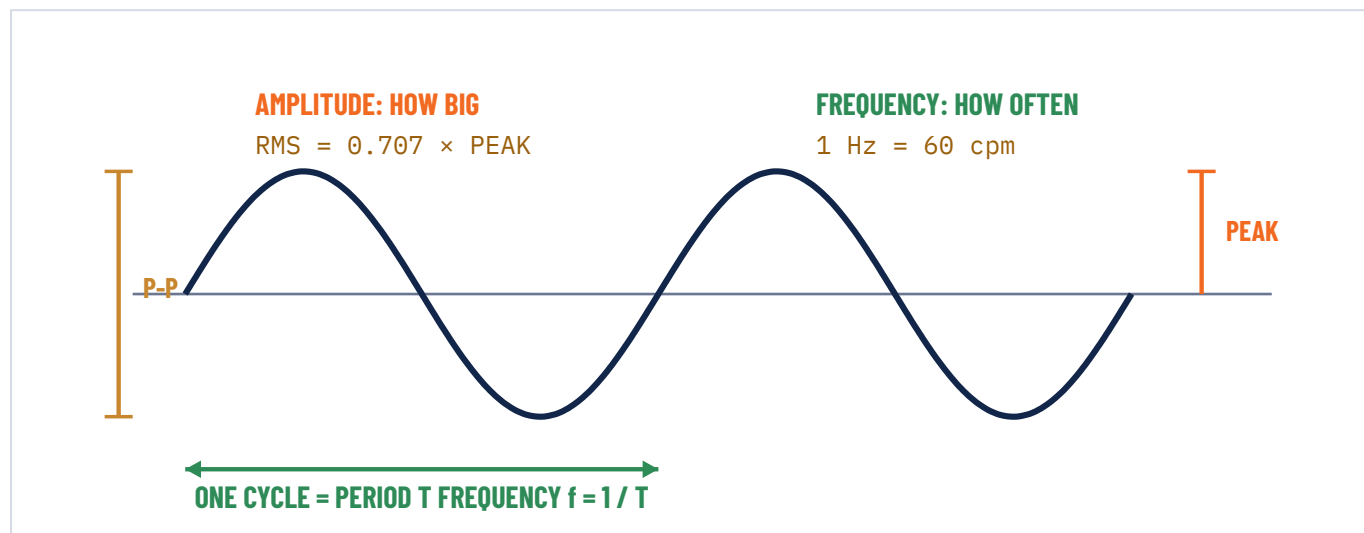
KEY NOTE • HOW IT WORKS

A rotating machine shakes at forces tied to its own parts. When wear, looseness or unbalance adds a new force, the vibration pattern changes before noise, heat or oil show it. Velocity in mm/s RMS tracks vibration energy, so compare it with the ISO 20816 class and with the machine's own healthy baseline, not with one number.

Common practice values. Use your machine class and maker limits. Fix what the data show, and leave healthy machines alone.

Basics and spectrum

Three numbers describe a vibration: how big, how often, and when. An FFT then splits the waveform into one line per frequency.



Amplitude

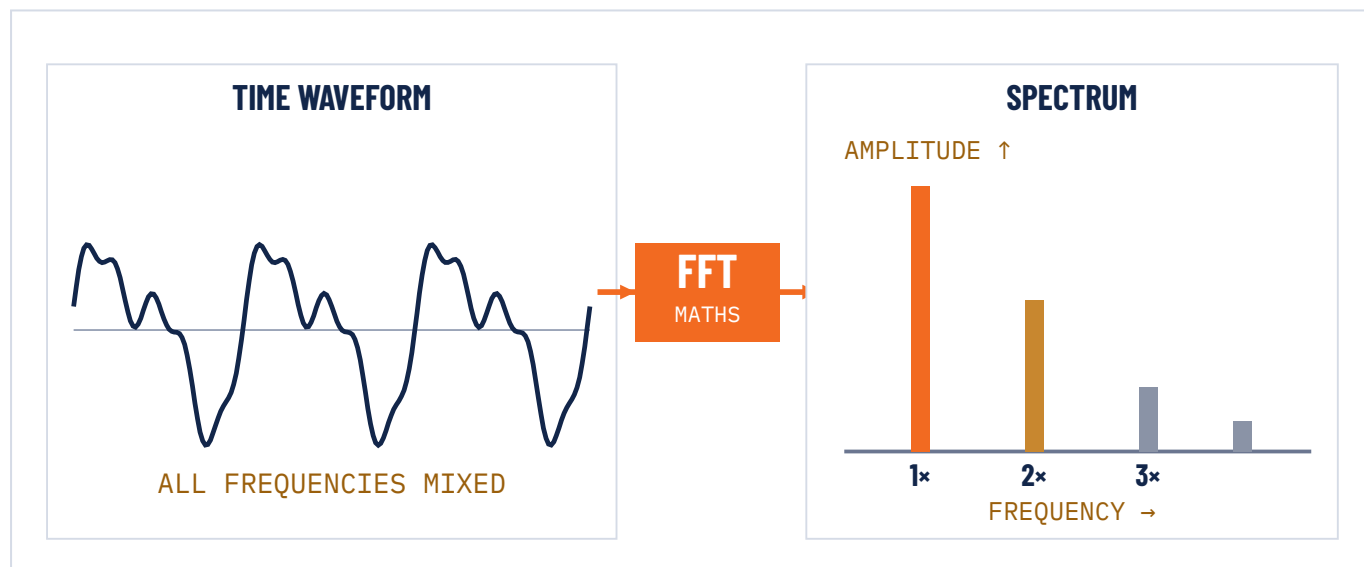
How big

Frequency

How often

Phase

When, against a mark



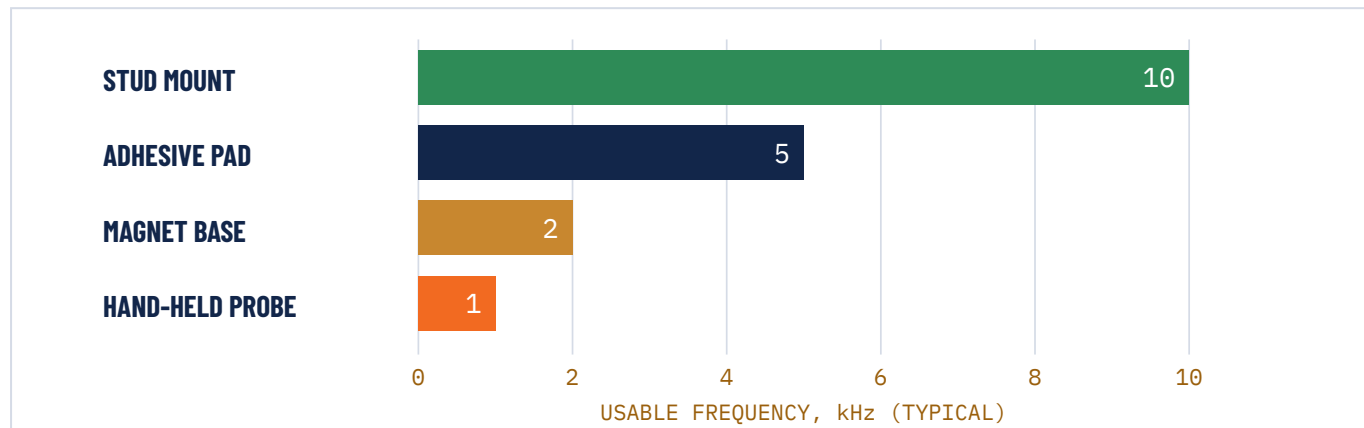
KEY NOTE · HOW IT WORKS

Amplitude tells how severe it is. **Frequency** tells which part causes it: 1× running speed points to unbalance, 2× to misalignment, high-frequency lines to bearings. **Phase** shows direction and separates unbalance from looseness. Use velocity for low frequency and acceleration for high.

Velocity for overall health. **Acceleration** for bearings and gears. **Resolution = $F_{max} \div \text{lines}$** : 1,000 Hz and 400 lines give 2.5 Hz per line.

Sensors and mounting

A firm, clean mount keeps the signal true.



Sensors, mounts and tablet



Detector with sensor



Optical tachometer

KEY NOTE • HOW IT WORKS

A loose or soft mount acts like a spring and cuts the usable frequency range, so bearing faults at high frequency disappear. Clean the spot, mount flat and square, and take every reading at the same point and direction (H, V, A) so trends compare like with like.

Stud or pad mount for the full range. Hand-held probe for a quick check.

Choose the right analyser

Eight checks pick the right analyser. Four typical types run from a quick meter to a full tablet.

1 Job

2 Channels

3 Frequency range

4 Speed input

5 Balancing

6 Display

7 Rugged case

8 Software



Meter



Handheld analyser kit



Tablet



Flagship

TYPICAL CATALOGUE DATA

Item	Meter	Pocket	Tablet	Flagship
Channels	1	1 to 2	2 to 4	Up to 4
Range	1 kHz	20 kHz	20 kHz+	40 kHz
Balancing	No	1 and 2 plane	1 and 2 plane	Guided
Special	Colour alarm	Envelope	Order, run-up	Touch, camera
Data	Optional	USB	Wi-Fi	Wi-Fi, cloud

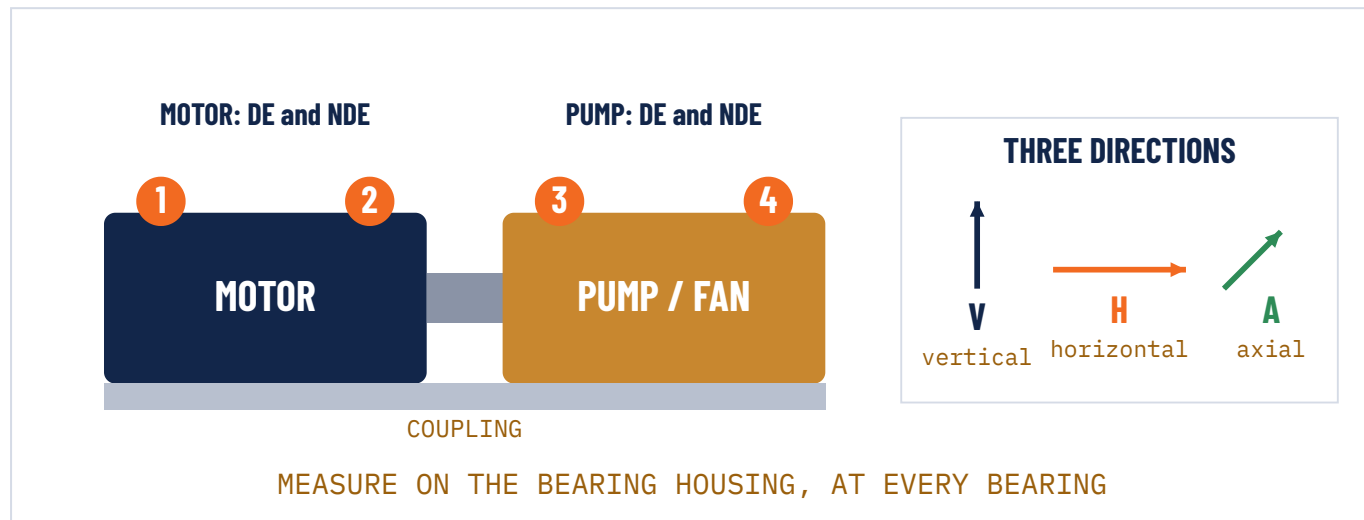
KEY NOTE • HOW IT WORKS

Channels: one is enough for routes; two give phase and two-plane balancing. **Range:** 1 kHz covers unbalance and misalignment; 20 kHz or more is needed for bearing and gear faults. **Speed input:** a tachometer is required for balancing and order analysis.

Meter finds it, analyser explains it, balancer fixes it. Check the datasheet: ranges and sensors differ by model.

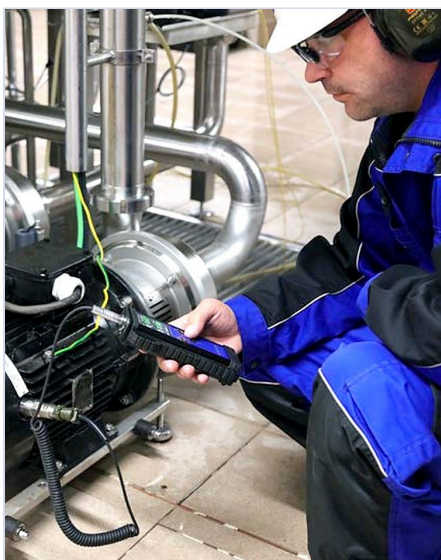
Measuring points

Measure every bearing in three directions.



1 Mark

Same spot each time



Sensor on the bearing

2 Mount

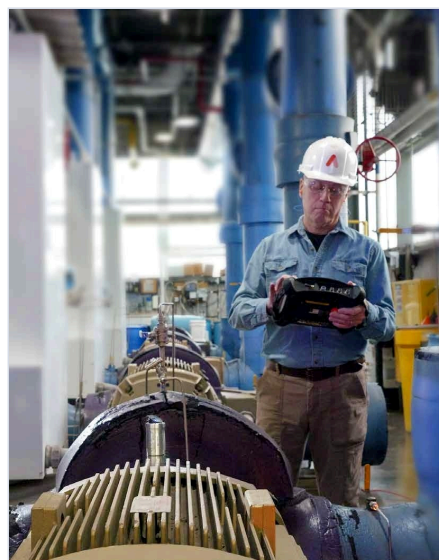
Flat, clean, firm



Read the tablet

3 Record

Speed, load, date



Check speed and load

KEY NOTE • HOW IT WORKS

Read each bearing housing in three directions: horizontal, vertical and axial. Horizontal is usually the softest, so unbalance shows highest there. A high axial reading points to misalignment or a bent shaft. Measure as close to the bearing load zone as you can, at the same speed and load every time.

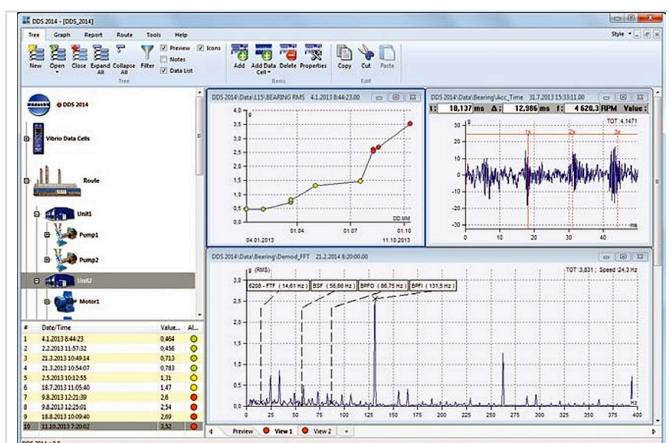
Same speed, same load every time.

Fault signatures

Each fault leaves a pattern. Read frequency first.



Fault	Spectrum	Direction
Unbalance	1×	Radial
Misalignment	2×	Axial
Looseness	Harmonics	One direction
Bearing	High frequency	Envelope lines



Compare spectra over time



Phase and level on the tablet

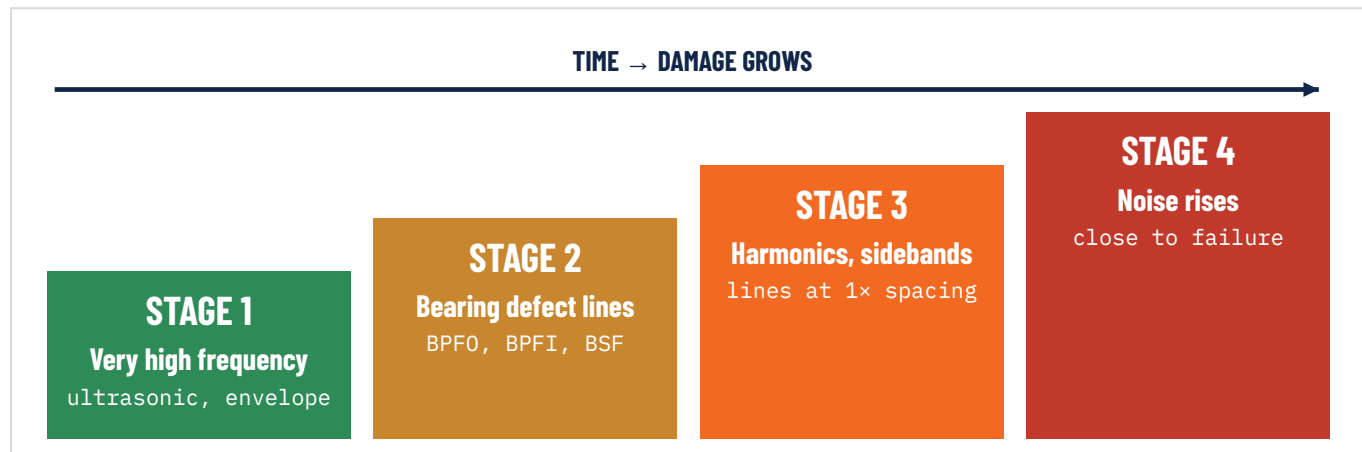
KEY NOTE • HOW IT WORKS

1× high with steady phase is unbalance. 2× high, with strong axial 1×, is misalignment. Many harmonics and a raised noise floor mean looseness. Sidebands around a line show modulation, from gears or a bearing. Confirm every diagnosis with phase before you act.

1× is not always unbalance. Check phase first.

Bearing diagnosis

A bearing fault starts at high frequency and works down.



Name	Fault
BPFO	Outer race
BPFI	Inner race
BSF	Ball or roller
FTF	Cage



Envelope spectrum



Tablet with sensor ports

KEY NOTE • HOW IT WORKS

Bearings fail in stages: first high-frequency and envelope energy, then defect lines (BPFO, BPFI, BSF, FTF) set by the bearing geometry, then harmonics and sidebands, and last noise and heat. The earlier you catch it, the more weeks you have to plan the change.

Use the exact bearing numbers from the analyser database.

Fault finder

Find the symptom. Follow it to the first action.



Measure



Compare



Decide

FIND THE FAULT

Symptom	Cause	Action
High 1x, radial	Unbalance	Balance
High 2x, axial	Misalignment	Align
Many harmonics	Looseness	Tighten
High-frequency noise	Bearing wear	Lubricate, replace
Gear mesh sidebands	Gear wear	Check teeth and oil

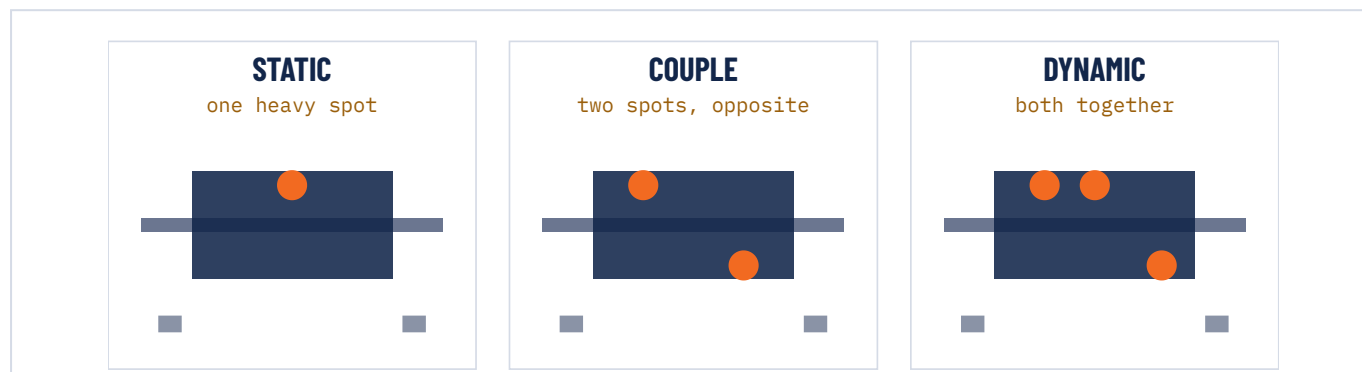
KEY NOTE • HOW IT WORKS

Work from the symptom. Note the dominant line, check its harmonics, then verify with phase and a second reading. Fix the largest and cheapest cause first, since looseness and soft foot cost minutes, then re-measure to prove the level dropped.

Fix the biggest cause first.

Balancing basics and balance grade

Unbalance is a heavy spot that pulls the shaft once per turn. Balance grade G sets how well a rotor must be balanced.



Static

One spot

Couple

Two spots

Dynamic

Both: the usual case

Grade	Typical rotors
G 40	Wheels, crankshafts
G 16	Drive shafts
G 6.3	Pumps, fans, motors
G 2.5	Turbines, compressors
G 1	Grinders

$$U_{\text{per}} (\text{g}\cdot\text{mm}) = 9,549 \times G \times m \div n$$

m in kg, n in rpm

100 kg, 1,500 rpm

G 6.3

Permissible

≈ 4,010 g·mm

Per plane

≈ 2,000 g·mm

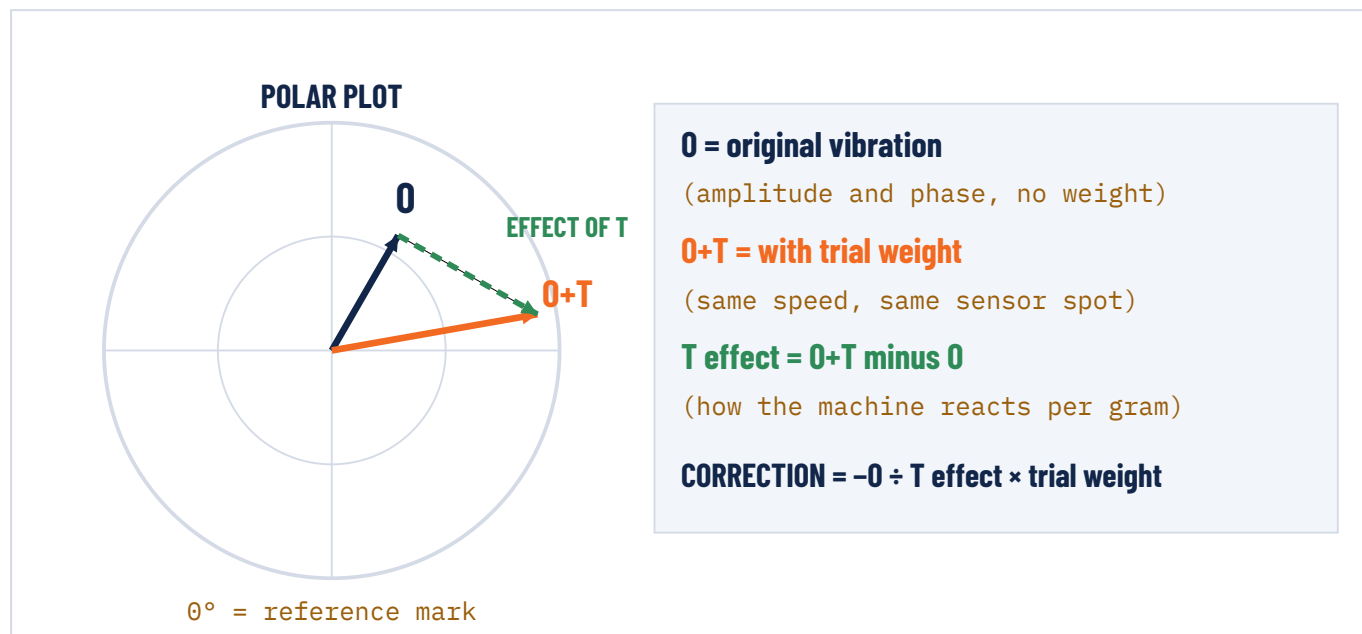
KEY NOTE · HOW IT WORKS

Static: one heavy spot, in phase at both bearings. **Couple:** two opposite spots, 180° out of phase. **Dynamic:** both, the usual case. Short, disc-like rotors can often be balanced in one plane; long rotors need two. The formula gives the permitted residual in g·mm.

Balance on the machine. It fixes what the shop cannot. Check your own standard, it may be tighter.

Single-plane balancing

Single-plane balancing suits narrow rotors such as fans.



1 Check first

Bearings, base

2 Mount

Sensor, mark

3 Run 1

Original reading

4 Trial weight

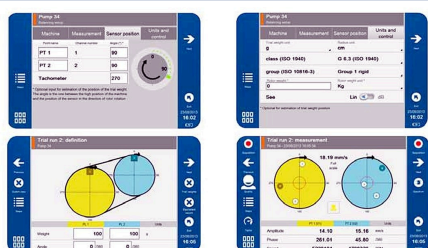
Known weight

5 Run 2

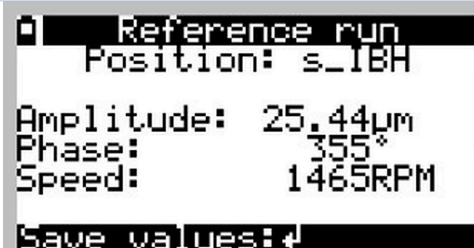
Reading changes

6 Correct

Fit the weight



Guided screens



Handheld analyser: reference run

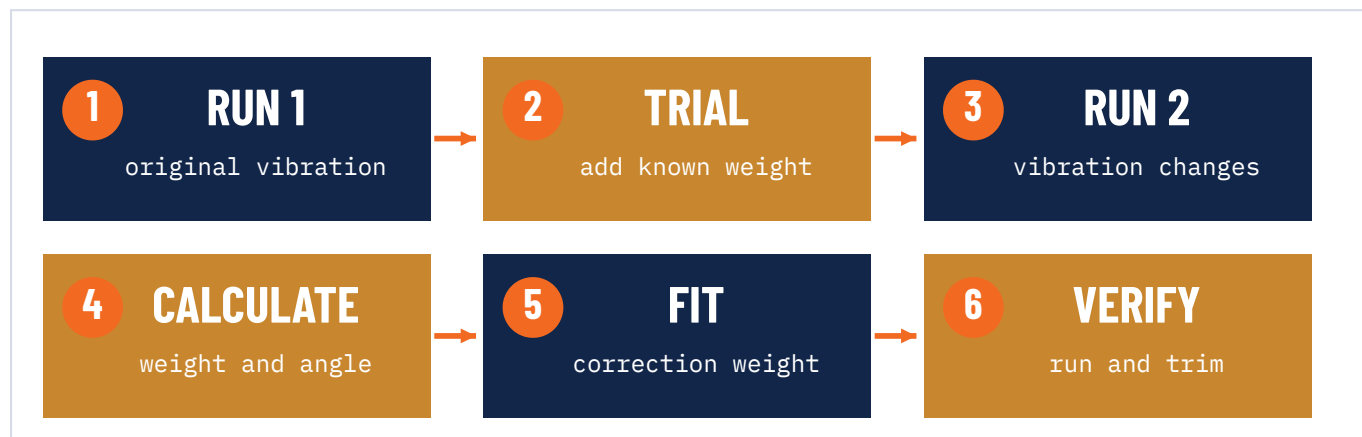
KEY NOTE · HOW IT WORKS

Measure the original vibration and phase, add a known trial weight, then measure again. The change in the vector shows where the heavy spot is and how big the correction must be. Fit the correction at the calculated angle, then trim until the level meets the balance grade.

Trial weight: aim for a 30° or 30 % change.

Two-plane and field tips

Wide rotors need two planes. The tablet calculates both weights.



$$\text{Trial weight} \approx 0.1 \times M \times g \div (r \times \omega^2)$$

100 kg, $r = 0.2$ m, 1,500 rpm gives about 20 g



Kit with analyser and cables



Sensors on the machine



Two-plane screen

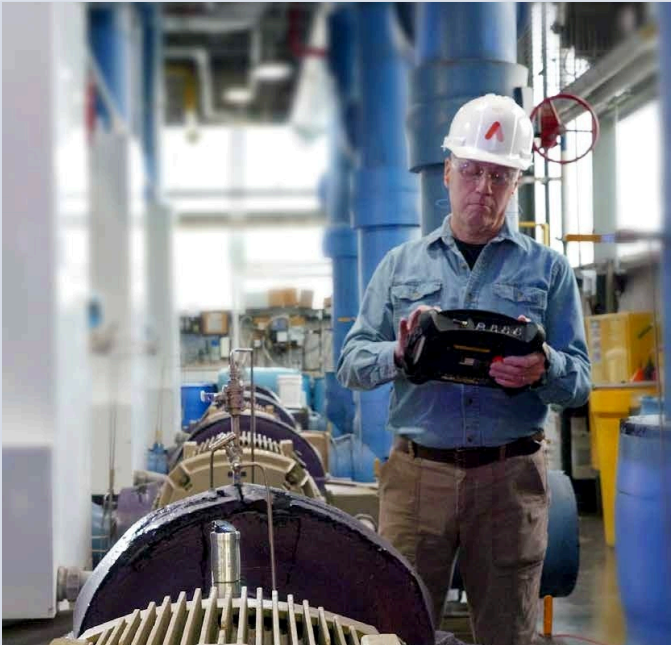
KEY NOTE • HOW IT WORKS

Use two planes when the rotor is long or the two bearings read different phase. The analyser solves both planes from one trial weight in each, so speed, sensor positions and the reference mark must stay the same for every run. A bad result usually means a run was not repeatable.

Order: original, trial in plane 1, trial in plane 2, calculate.

Balancing problems

Most balance jobs fail for a few simple reasons.



Mark and speed checked



Weights and kit ready

Symptom	Cause	Fix
Phase jumps	Loose or resonance	Tighten; avoid critical speed
No change	Weak sensor or mark	Check mark and direction
Returns	Buildup or bow	Clean; balance warm
Still high	Other fault	See page 10

BEFORE YOU LEAVE

✓ Weights locked	✓ Under limit	✓ Report saved
✓ Tools counted	✓ Guards on	✓ Handed over

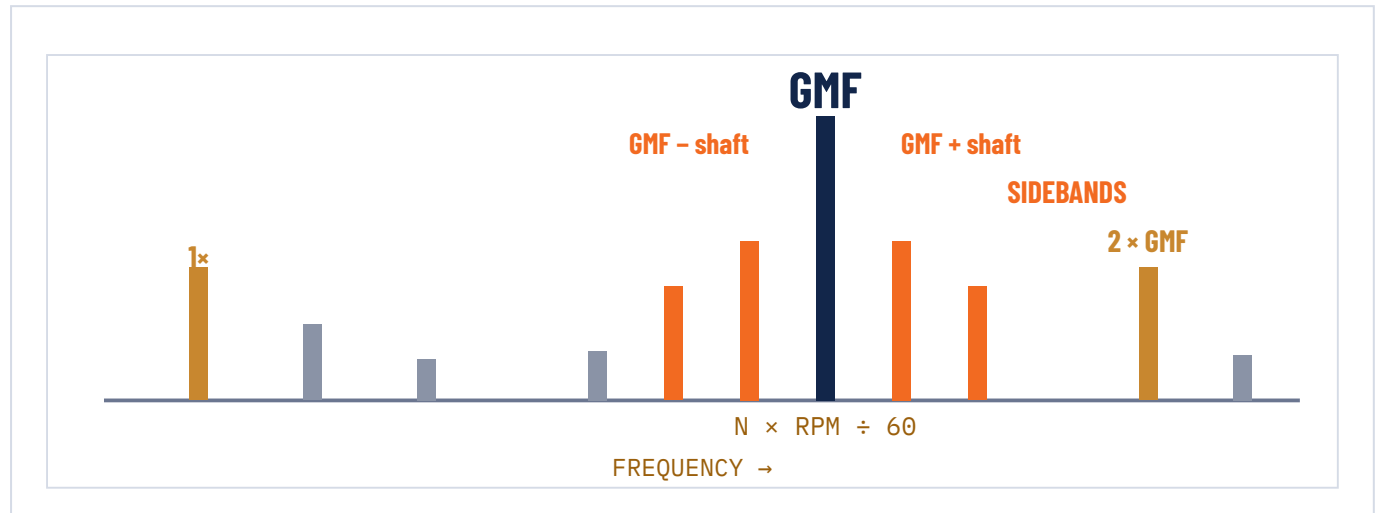
KEY NOTE • HOW IT WORKS

If the phase will not repeat, the cause is not unbalance alone: suspect resonance, looseness or a cracked foundation. Check the mark, sensor position and speed before you add more weight. If the reading returns after a week, look for build-up on blades or a bowed shaft.

Record final level, angle and weights.

Gear faults and sidebands

Gear faults show as sidebands around the mesh frequency.

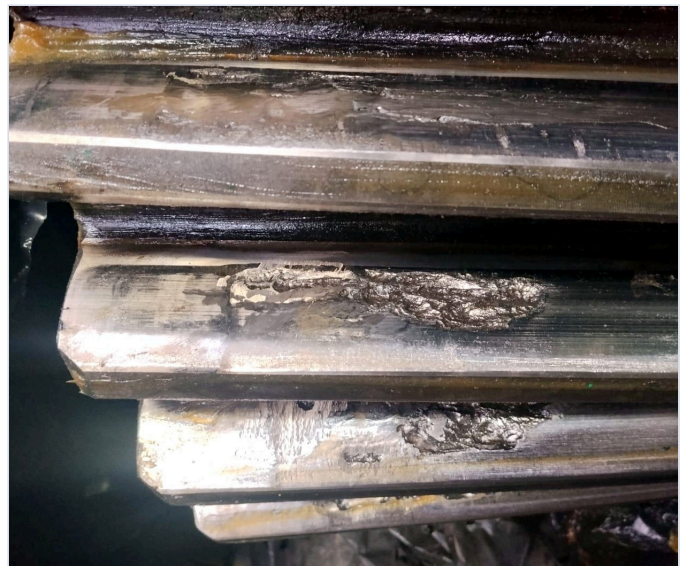


$$\text{GMF (Hz)} = N \times \text{RPM} \div 60$$

25 teeth at 1,500 rpm = 625 Hz



Check the contact band



Pitting and spalling

KEY NOTE • HOW IT WORKS

Gear mesh frequency (GMF) is the tooth count × shaft speed. Healthy gears show GMF with small sidebands. Wear, eccentricity or a cracked tooth raise sidebands spaced at the faulty gear's shaft speed. Trend GMF and the sidebands against baseline, because the sidebands rise first.

Never ignore sidebands. Trend them.

Case study: gearbox failure and causes

A steel plant main gearbox failed and the signs were ignored. Four checks then found the cause, and each was out of limit.

36 h

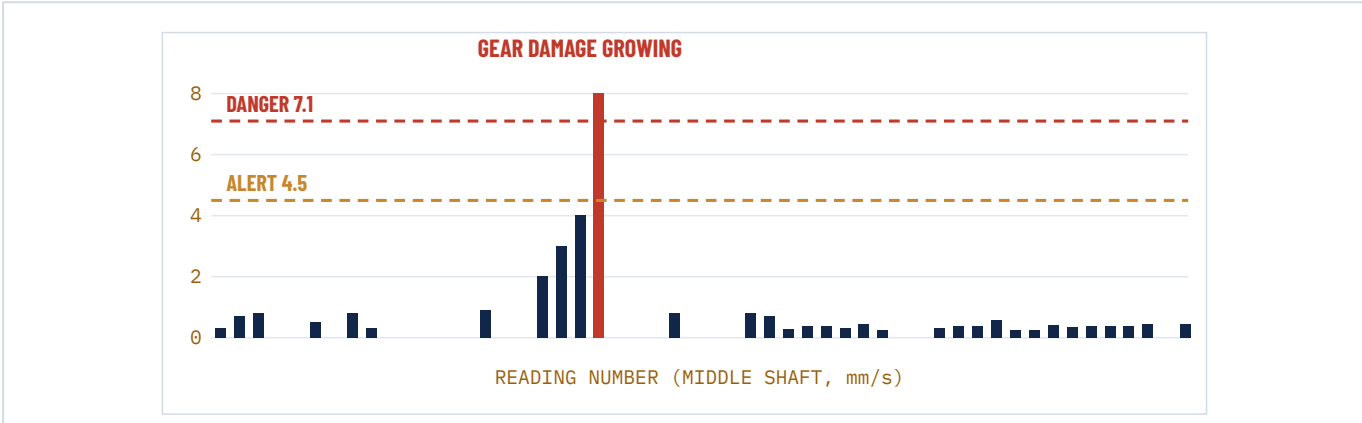
downtime

TK 70 M

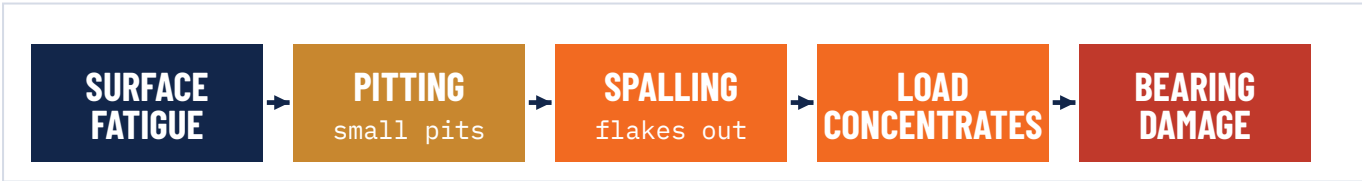
loss

45 → 82 °C

temperature



Check	Found	Should be
Oil	Fe over 300 ppm	Low Fe
Contact	35 % at heel	60 to 70 %
Backlash	0.75 mm	0.30 to 0.40 mm
Alignment	0.42 mm off	In tolerance



Fix

Reset backlash, align, new gears

Oil

EP oil, magnetic filter

Monitor

Weekly vibration, checklist

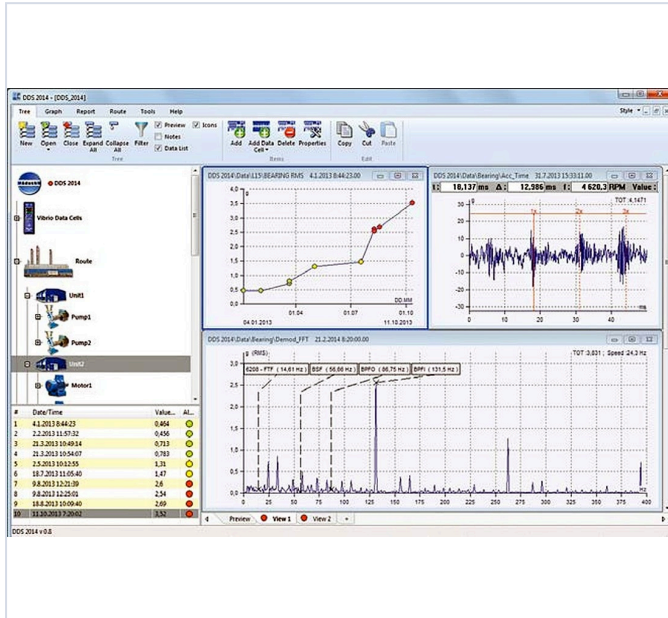
KEY NOTE · HOW IT WORKS

Reading the chart: each bar is overall velocity on the middle shaft. The rise past the alert (4.5) and danger (7.1) lines was the warning; weekly trending would have shown it weeks earlier. Iron over 300 ppm and 82 °C confirmed the damage.

Alert and danger levels were passed before the shutdown. Reactive repair costs 5 to 10 times more.

Routes, trends and reports

Repeat the same route, trend the numbers, report simply.



Trend and spectrum



Field data on a tablet

1 Route

2 Alarm

3 Trend

4 Report

Check	Interval
Oil return line	Daily
Vibration	Weekly
Oil flow	3 months
Teeth, oil analysis	6 months
Bearings	Yearly

KEY NOTE · HOW IT WORKS

Keep route points, speeds and units fixed so the trend is real. Set alert and danger levels from the machine's own healthy baseline, then tighten them after a few months. Act on the trend and on repeat alerts, not on a single reading.

Start small. Ten critical machines, monthly.

Global brands and cross-reference

Six global makers cover portable vibration analysis and field balancing. We help you match the job to the right maker and model, and cross-check offers on one technical basis.

SKF

MICROLOG ANALYZER GX • CMXA SERIES

Data collector and FFT analyser with 1 to 3 channels, 1-plane, 2-plane and static-couple balancing, and @ptitude Analyst software.

Fluke

810 VIBRATION TESTER • 818 / 205 FC METER

Diagnostic tester that points to the fault and suggests the repair. The 805 series is the quick screening meter.

Prüftechnik

VIBXPERT II • OMNITREND CENTER

Data collector with 1 or 2 channels, DC to 51.2 kHz, guided 1- and 2-plane balancing and route programmes.

Acoem

FALCON • WIRELESS BALANCER

Falcon: 4-channel portable analyser with Accurex AI and 1 to 4-plane balancing. Wireless Balancer: 2-plane synchronous, under 2 kg, works up to 20 m away.

FAG

DETECTOR III • TRENDLINE

Vibration meter, data collector and balancer in one. 1,600 measurement points and a bearing database of about 20,000 bearings.

Adash

A4900 VIBRIO M • A4300 VA3 PRO • A4500 VA5 PRO

From simple collector to 4-channel analyser with FASIT expert system, balancer module, Ex versions and free DDS software.

CROSS-REFERENCE RULE

Do not swap one maker for another on name or price. Match these points first, then compare the offers.

Instrument class	Channels	Frequency range	FFT lines	Balancing planes
Hazardous rating	Software	Sensors and cables	Calibration	Warranty and support

Maintenance team

Start from the job: machine type and speed, the fault to find, balancing, and whether the area is classified. Cross out the tools that miss one of these, then shortlist on page 19.

We support solutions from recognized brands including SKF, Fluke, Prüftechnik, Acoem, FAG and Adash, subject to technical suitability, product availability, and specific customer requirements.

Global brand comparison statement

Six makers on the six points that decide most selections. Use it to shortlist by job, then ask each supplier for the full data sheet.

MAJOR KEY POINTS

	SKF Microlog GX	Fluke 810	Prüftechnik VIBXPERT II	Acoem Falcon	FAG Detector III	Adash VA3 Pro
Class	Collector and FFT analyser	Diagnostic tester	Collector and balancer	Analyser, collector, balancer	Collector and balancer	Analyser and collector
Channels	1 to 3, by model	Triaxial sensor	1 or 2	4 plus trigger	Not stated	2 inputs plus tach; 3 with triaxial
Balancing	1-plane, 2-plane, static-couple	Not stated	1- and 2-plane, guided	1 to 4 plane (option)	Yes, activated by dongle	1 or 2 plane, balancer module
Hazardous area	ATEX / IECEx Zone 2 (certified kits)	Not stated	Not stated	ATEX Zone II, Ex ic IIC T4 Gc	Not stated	Ex version available
Software	SKF @ptitude Analyst	PC via mini-USB	OMNITREND Center	NEST	Trendline	DDS (free)
Best for	Routes, trends, balancing	Finding the fault on site	Route programmes with balancing	Wireless, AI diagnosis, multichannel	Entry level routes and balancing	Budget-friendly route and analysis

How maintenance and procurement use this page

Maintenance picks by job, speed and area class. Procurement then asks every supplier for the model and revision, kit contents, sensors and cables, software licence, calibration certificate, warranty, training and delivery time.

Not stated means the maker sheet we used does not list it. Ask for the current data sheet before you order. We support solutions from recognized brands including SKF, Fluke, Prüftechnik, Acoem, FAG and Adash, subject to technical suitability, product availability, and specific customer requirements.



REQUEST A QUOTATION

Send the machine type, speed, power, fault symptom and quantity. We reply with the right sensor, price and delivery time.

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★ WE STAY AFTER DELIVERY

AFTER-SALES SERVICE

- Commission and start up equipment
- Find faults and analyse failures
- Plan shutdowns and advise on repairs

★ 20 YEARS ON THE PLANT FLOOR

WHO LEADS US

- Erect, commission and revamp mills
- Operation, maintenance & shutdowns
- Troubleshoot and spares

WHAT WE SUPPLY AND SUPPORT

PARTS

- Analysers, balancers
- Sensors, tachos, mounts
- Cables, cases, software
- Training and service

SUPPORT

- Pick the right analyser
- Sensor and range advice
- Route and balance advice
- Quotation and delivery follow-up