Vibration Survey Report — CWRU OR021@6_0

Analysis timestamp: 2026-07-22T23:01:34 UTC

Executive Summary

The committed diagnosis for **CWRU OR021@6_0** is a **bearing outer-race fault (BPFO)**, assessed with **high confidence**. The dominant spectral peak on the radial (y) axis sits at 107.53 Hz — within 0.21% of the computed BPFO of 107.3 Hz — and is flanked by ±1× shaft-frequency sidebands, forming a textbook outer-race fault signature. ISO 20816 severity is unrated — ISO severity requires velocity data: velocity was not measured in this reading, so no severity rating can be established. A broadband velocity measurement (mm/s RMS, 10–1000 Hz, per ISO 20816) is required to establish the severity rating — see **Severity & Coverage** and **Recommended Follow-up Measurements**.

Machine Details

Field	Value
Machine	CWRU OR021@6_0
Type	Motor
Location	—
Sensor / MAC	CWRU-OR021@6_0
ISO group / support	2 / rigid
ISO threshold source	ISO 20816-3:2022 — Group 2, rigid support
Running speed	1,796.0 rpm (29.93 Hz shaft frequency)
Overall vibration	Not assessable — velocity not measured
Bearing model	Not specified
Bearing geometry	9 balls, ball Ø 7.94 mm, pitch Ø 39.04 mm, contact angle 0°

Severity & Coverage

What was assessed: Fault detection from the spectral and envelope evidence. The bearing outer-race finding stands entirely on that spectral evidence and is unaffected by the absence of a velocity measurement.

What was not assessed: ISO 20816 severity is unrated — ISO severity requires velocity data. The severity rating that places a machine in a vibration band is a velocity judgement; because velocity was not measured in this reading, it cannot be established. A broadband velocity measurement (mm/s RMS, 10–1000 Hz, per ISO 20816) is required to establish the severity rating. See **Recommended Follow-up Measurements**.

Data Quality

Gate verdict: WARN.

All structural checks passed. One check requires attention:

Check	Status	Detail
units_plausibility	**WARN**	Velocity not measured — ISO severity not assessable (acceleration-only reading)

All other applicable checks (configuring, msg_type, acceleration_data_validity, machine_running, msg_type_motion, startup_transient, startup_window, metadata_completeness) returned **pass**. The data-quality warning does not invalidate the spectral fault detection; it is reflected as a −0.5 confidence factor in the bearing RCA (see Diagnosis).

Diagnosis

Bearing outer-race fault (BPFO) — severity: unrated — ISO severity requires velocity data — confidence: high

The analysis committed to a **bearing outer-race fault (BPFO)** at **high confidence**.

The BPFO for this bearing geometry was computed at **107.3 Hz** at the measured shaft speed of 1,796.0 rpm. The dominant peak on the radial y-axis was observed at **107.53 Hz** (rank 1, amplitude 0.383 g), a match of **0.21%** — well within the ±3% acceptance window. The 1× shaft component appears as the rank-2 peak at 29.90 Hz (0.336 g). The rank-3 peak at 137.42 Hz corresponds to the upper sideband (BPFO + 1× shaft), and the lower sideband at 77.63 Hz was also identified, confirming shaft-rate modulation of the outer-race tone — a hallmark of a localised outer-race defect.

No BPFO harmonic (2× BPFO 214.6 Hz) was committed as present.

Confidence factors:

Factor	Effect
BPFO peak matched on a radial axis	+1.0
Bearing tone on the expected radial axis	+0.5
BPFO is the dominant (rank-1) peak on y	+1.0
Frequency match within 0.21% of computed BPFO	+1.0
±1× shaft sidebands present (2 found)	+1.0
Data-quality warnings present on this reading	−0.5

The net evidence supports a **high** confidence classification.

Evidence Table

Finding	Axis	Computed (Hz)	Observed (Hz)	Match	2× harmonic	Sidebands (Hz)
Bearing outer-race fault (BPFO)	y	107.3	107.53	0.21%	Not present	77.6, 137.4

Computed bearing fault frequencies at 1,796.0 rpm (29.93 Hz):

Frequency	Value (Hz)
BPFO (Ball Pass Frequency, Outer Race)	107.30
BPFI (Ball Pass Frequency, Inner Race)	162.10
BSF (Ball Spin Frequency)	70.55
FTF (Fundamental Train Frequency)	11.92

Trend Summary

No historical data points are available for this machine. Trend regression and z-score anomaly detection could not be performed; this reading represents the first data point on record. Establishing a baseline history (minimum 30 readings per the machine configuration) will enable statistical anomaly detection and trend monitoring going forward.

Also Considered

No differential (set-aside) candidates were raised during this analysis. The bearing outer-race fault was the sole candidate and was committed directly.

Recommended Follow-up Measurements

1. **Velocity measurement per ISO 20816 (10–1000 Hz broadband, mm/s RMS)** *(Priority: **high**)* — Establishes the ISO 20816-3 severity zone. Severity cannot be assessed from this reading — velocity was not measured (acceleration-only) or was outside a plausible range — while fault detection from the spectral/envelope evidence is unaffected. *Trigger: ISO severity not assessable — velocity not measured.*

Recommendations

1. **Plan bearing replacement** at the next available maintenance window. The outer-race fault signature is strong (rank-1 dominant peak, tight frequency match, confirmed shaft-rate sidebands) and high confidence has been committed.
2. **Monitor closely** until replacement can be scheduled. Increase measurement frequency to track any amplitude growth in the BPFO peak and its sidebands.
3. **Obtain a broadband velocity measurement** (mm/s RMS, 10–1000 Hz) at the next inspection to establish the ISO 20816-3 severity rating and prioritise the maintenance timeline accordingly.

Limitations & Confidence Notes

- **ISO 20816 severity is unrated** — ISO severity requires velocity data. This reading was acceleration-only; no velocity measurement was available to establish a severity band under ISO 20816-3 (Group 2, rigid support).
- **No trend history available.** Statistical z-score anomaly detection and trend regression require a streaming baseline; no prior history points exist for this machine. Findings rest solely on the single-reading spectral evidence.
- **Data-quality warning present.** The units_plausibility check returned WARN (acceleration-only reading). This is reflected as a −0.5 deduction in the confidence scoring but does not invalidate the spectral fault detection.
- **No bearing model number on record.** Fault frequencies were computed from the raw geometry (9 balls, ball Ø 7.94 mm, pitch Ø 39.04

mm, contact angle 0°); no manufacturer model string was available to cross-reference.

DRAFT – prepared by automated analysis, pending analyst review.