Aeris 3.2 MW Turbine

Operations & Maintenance Manual — Condition Monitoring Excerpt

Aeris Turbine Systems · Document ATS-OM-0342 · Revision G · Applies to Aeris 3.2 MW (A32-100 series) · Rated output 3,200 kW

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1. Scope of this excerpt

This excerpt covers the condition-monitoring subset of the full O&M manual: alarm code definitions, sensor threshold tables, scheduled inspection intervals, lubrication requirements, and fastener torque specifications for the drivetrain.

It does **not** cover commissioning, blade repair, electrical safety isolation, or tower and foundation inspection. Those procedures are in ATS-OM-0100 through ATS-OM-0339 and must be consulted before any physical intervention.

Thresholds in this document are **manufacturer limits**. They define what the equipment can tolerate. They do not define what an operator must do about an exceedance — dispatch decisions, response times and escalation belong to the operator's own performance standards, which take precedence where the two differ.

Revision G note. The measurement-validity floor was lowered from 40% to 30% of rated output in Sections 3 and 4, following field data showing that band-limited RMS velocity remains comparable down to 30% load on this platform. Readings between 30% and 40% load were previously discarded and are now valid for trending.

2. Alarm code reference

Alarm codes are grouped by subsystem. The severity column is the **manufacturer's** classification of equipment risk.

Code	Subsystem	Description	Severity
A104	Rotor	Rotor speed above rated for more than 60 s	Warning
A108	Rotor	Blade pitch asymmetry beyond 1.5 degrees	Warning
A115	Rotor	Pitch actuator response degraded	Advisory
A121	Rotor	Rotor imbalance detected	Warning
A203	Gearbox	Oil temperature above advisory threshold	Advisory
A206	Gearbox	Oil temperature above alarm threshold	Warning
A209	Gearbox	Oil particulate count above ISO limit	Advisory
A212	**Gearbox**	**Gearbox vibration above advisory threshold**	**Advisory**
A214	Gearbox	Gearbox vibration above action limit	Warning
A217	Gearbox	Gearbox vibration above trip limit	Critical
A221	Gearbox	Oil pressure below minimum	Warning
A228	Gearbox	Filter differential pressure high	Advisory
A302	Generator	Winding temperature above advisory threshold	Advisory
A305	Generator	Winding temperature above alarm threshold	Warning
A311	Generator	Bearing vibration above action limit	Warning
A318	Generator	Slip ring wear indicator	Advisory
A404	Nacelle	Yaw drive current imbalance	Advisory
A409	Nacelle	Nacelle vibration above action limit	Warning
A413	Nacelle	Anemometer disagreement between redundant units	Advisory
A421	Nacelle	Converter cabinet temperature high	Warning
A430	Nacelle	Emergency stop circuit open	Critical

Reading the codes. An *Advisory* alarm does not stop the machine and does not by itself require intervention; it marks a condition that should be trended. A *Warning* alarm indicates the component is operating outside its design envelope and will accumulate damage if the condition persists. A *Critical* alarm commands an automatic controlled stop and latches until manually reset by a qualified technician.

> ***The alarm code records where a measurement first crossed, not where it is now.*** *The controller raises a code at the moment a threshold is crossed and holds that code while the condition persists; it does* ***not*** *re-code to a higher alarm as the value continues to climb. A turbine still reporting* ***A212*** *— vibration above advisory threshold — may by now be reading well above the* ***action*** *limit.*

> *Never infer the current severity of a condition from the alarm code alone. Read the measured value against the threshold tables in Sections 3 and 4, and read the trend. The code tells you when the problem started; the measurement tells you how bad it has become.*

3. Vibration thresholds

Vibration is measured as RMS velocity in millimetres per second, band-limited 10–1000 Hz, sampled at the accelerometer mounted on each component's primary bearing housing.

Measurement validity. Readings are comparable against the limits below at any output **at or above 30% of rated** — that is, 960 kW or more on the 3,200 kW platform. Readings taken below 30% load are dominated by low-speed structural modes, are not comparable, and must not be trended against these limits.

Component	Advisory	Action limit	Trip limit	Alarm code at action limit
Gearbox (high-speed shaft)	3.5 mm/s	**4.5 mm/s**	6.0 mm/s	A214
Gearbox (intermediate shaft)	3.0 mm/s	4.0 mm/s	5.5 mm/s	A214
Generator bearing (drive end)	2.8 mm/s	3.8 mm/s	5.0 mm/s	A311
Generator bearing (non-drive end)	2.8 mm/s	3.8 mm/s	5.0 mm/s	A311
Main bearing	2.5 mm/s	3.5 mm/s	4.8 mm/s	A121
Nacelle structural	4.0 mm/s	5.5 mm/s	8.0 mm/s	A409

> ***The gearbox action limit is 4.5 mm/s RMS.*** *Sustained operation above this figure accelerates high-speed-shaft bearing wear and is the single most common precursor to gearbox replacement on this platform. Aeris Turbine Systems does not warrant gearbox life where the action limit has been exceeded for more than 30 cumulative days.*

Trending matters more than any single reading. A step change of more than 0.8 mm/s between consecutive weekly samples warrants investigation even when the absolute value remains below the action limit. A slow, monotonic rise across several weeks is the characteristic signature of progressive bearing degradation and should be treated as more serious than an isolated spike, which is more often a sensor or load artefact.

4. Gearbox lubrication temperature thresholds

Oil temperature is measured in the gearbox sump. Readings are valid after 30 minutes of continuous operation at or above **30% of rated output**.

Condition	Temperature	Alarm code	Equipment effect
Nominal operating band	55–70 °C	—	None
Design nominal	65 °C	—	Reference value
Advisory threshold	78 °C	A203	Oil oxidation rate approximately doubles
Alarm threshold	82 °C	A206	Additive package degrades; shortened oil life
Trip threshold	90 °C	A206 plus controlled stop	Risk of film breakdown and scuffing

Interpreting temperature against load. Sump temperature rises with load, so a reading must always be assessed alongside power output. A gearbox running at 79 °C at full rated output is behaving differently from one running at

79 °C at half load — the second indicates a developing loss of efficiency in the drivetrain, a lubrication fault, or a cooling circuit restriction, and should be investigated even though both readings sit at the same absolute value.

Where temperature **rises over a period during which load has fallen**, the divergence is itself the finding. Correlate it against the vibration trend for the same period: a rising temperature and a rising vibration on the same shaft, while output declines, is the classic progressive-bearing-wear signature on this platform.

5. Scheduled inspection intervals

Interval	Scope	Downtime
500 h	Visual nacelle inspection, leak check, filter differential reading	2 h
2,000 h	Oil sample for laboratory analysis, torque audit of drivetrain fasteners	4 h
6 months	Borescope inspection of gearbox high-speed stage	6 h
12 months	Full drivetrain alignment check, brake pad measurement, yaw drive service	12 h
24 months	Oil change, filter replacement, accumulator recharge	16 h
60 months	Generator bearing replacement, slip ring service	40 h

Intervals are whichever comes first — elapsed hours at rated operation, or calendar time. A turbine that has been curtailed or offline for an extended period still requires its calendar-driven inspections on schedule.

6. Lubrication schedule

Point	Lubricant	Quantity	Interval
Gearbox sump	ATS-Gear 320 synthetic (ISO VG 320)	380 L	24 months
Main bearing	ATS-Grease HT2 lithium complex	240 g	6 months
Generator bearings (each)	ATS-Grease HT2 lithium complex	45 g	6 months
Yaw gear teeth	ATS-Grease OG open gear compound	500 g	12 months
Pitch bearings (each)	ATS-Grease HT2 lithium complex	120 g	12 months
Blade bearing races	ATS-Grease HT2 lithium complex	180 g	12 months

Do not mix lubricant families. Where lubricant type is being changed, the system must be fully drained and flushed per procedure ATS-OM-0288.

7. Drivetrain fastener torque specifications

Fastener	Size	Torque	Notes
Gearbox-to-bedplate	M36	2,400 Nm	Tighten in diagonal sequence, two passes
Gearbox torque arm	M30	1,450 Nm	Verify bushing condition before torquing
Generator mounting	M24	760 Nm	Check alignment shims first
Coupling flange	M20	430 Nm	Replace bolts at every coupling service
Main shaft flange	M42	3,900 Nm	Hydraulic tensioner required
Yaw drive mounting	M20	430 Nm	—

All torque figures assume clean, lightly oiled threads at ambient temperature. Re-torque after the first 500 operating hours following any drivetrain intervention.

8. Safety notices

Never enter the nacelle while a Critical alarm is latched. The controller may attempt an automatic reset sequence that energises the yaw and pitch drives without local warning.

Vibration and temperature sensors are condition indicators, not safety devices. They must not be relied upon as the sole protection against drivetrain failure. Physical inspection at the scheduled intervals in Section 5 remains mandatory regardless of what the monitoring data shows.

Do not reset a latched alarm to clear a display. Every reset is recorded, and an unexplained reset obstructs later fault diagnosis.
