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INDUSTRIAL CASE | MECHANICAL ENGINEERING | COMPRESSOR UNIT

REPORT ON MEASUREMENT OF OPERATING PARAMETERS · GORLOVSKIY MACHINE-BUILDING PLANT JSC

Compressor 4M10-120/9: less power draw and vibration even after an overhaul

Gorlovskiy Machine-Building Plant JSC, compressor section · measurements: chief power engineer V. A. Pankov, head of the PSU section V. V. Moskovskiy, foreman of the compressor section A. I. Saltevskiy · approved by: deputy chief engineer for new technology A. F. Medvedev

Gorlovka, Ukraine · report dated 27.02.2006 · repeat measurements at 405 h of running time after the full treatment cycle

PRODUCT

XADO revitalizants

full treatment cycle of the compressor oil system, without disassembling the unit

TEST OBJECT

Reciprocating air compressor 4M10-120/9

inv. No. 33007 · in service · had undergone a major overhaul before treatment began

DOCUMENT TYPE

Plant report signed by the commission and stamped

EQUIPMENT	CONDITION AT THE START OF MEASUREMENTS	WHAT WAS MEASURED
Air compressor 4M10-120/9, inv. No. 33007	In service; a major overhaul of the compressor was carried out immediately before the treatment	Power draw, stator and rotor current, oil pressure and temperature, vibration at 5 points, noise at 4 stages

The operating mode for the "before" and "after" measurements is identical: discharge air pressure of 6.0 kgf/cm² and rotor current of 240.0 A were unchanged in both measurements.

Key results

↓ 6 %

power draw under load, 648.0 → 609.0 kW

↓ 2.4 %

stator current of the electric motor, 62.0 → 60.5 A

↓ 52-79 %

vibration velocity at the measurement points, 2.05-7.38 → 0.684-3.55 mm/s

Power consumption and the compressor oil system

PARAMETER	BEFORE	AFTER	CHANGE
Power draw under load	648.0 kW	609.0 kW	**−39.0 kW (−6 %)**
Stator current	62.0 A	60.5 A	**−1.5 A (−2.4 %)**
Rotor current	240.0 A	240.0 A	no change
Discharge air pressure	6.0 kgf/cm²	6.0 kgf/cm²	no change
Oil pressure	2.4 kgf/cm²	2.5 kgf/cm²	**+0.1 kgf/cm²**
Oil temperature	62.0 °C	60.0 °C	**−2.0 °C**

Standard instrumentation of the compressor unit; the "after" measurements were taken at 405 h of running time and in the same compressor operating mode.

Vibration at the compressor measurement points

MEASUREMENT POINT	VIBRATION ACCELERATION, m/s²	VIBRATION VELOCITY, mm/s	VIBRATION DISPLACEMENT, µm
No. 1 casing · vertical	4.55 → 1.65	2.05 → 0.684	22.4 → 7.62
No. 1 casing · horizontal	7.54 → 4.42	6.55 → 3.44	104.0 → 85.5
No. 1 casing · axial	7.55 → 1.7	3.54 → 0.907	24.5 → 13.2
No. 2 casing · vertical	8.28 → 1.81	3.95 → 1.07	45.7 → 31.5
No. 2 casing · horizontal	8.45 → 4.89	7.35 → 3.43	112.5 → 78.7
No. 2 casing · axial	8.56 → 1.95	4.25 → 0.985	41.5 → 9.39
No. 3 casing · vertical	5.46 → 1.68	4.85 → 0.686	39.2 → 8.13
No. 3 casing · horizontal	9.52 → 5.42	7.38 → 3.55	104.6 → 77.5
No. 3 casing · axial	7.45 → 1.67	4.87 → 0.791	82.4 → 9.85
No. 4 casing · vertical	7.14 → 1.97	5.2 → 1.09	75.8 → 10.9
No. 4 casing · horizontal	8.47 → 5.17	6.28 → 3.42	157.2 → 87.2
No. 4 casing · axial	7.56 → 1.75	4.65 → 0.996	112.8 → 17.9
No. 5 foundation · vertical	4.38 → 1.12	3.35 → 0.866	87.5 → 16.8

MEASUREMENT POINT	VIBRATION ACCELERATION, m/s²	VIBRATION VELOCITY, mm/s	VIBRATION DISPLACEMENT, µm
No. 5 foundation · horizontal	7.85 → 1.39	4.25 → 0.696	96.4 → 10.5
No. 5 foundation · axial	6.55 → 2.94	4.08 → 2.08	77.5 → 45.0

"Sendig-911" vibration meter: points No. 1-No. 4 on the compressor casing, No. 5 on the foundation. A reduction was obtained at all 15 points for all three quantities.

Noise level at the compressor stages

MEASUREMENT POINT	BEFORE	AFTER	CHANGE
Point No. 1 · stage IV	94.0 dBA	91.0 dBA	**−3.0 dBA**
Point No. 2 · stage III	93.0 dBA	90.0 dBA	**−3.0 dBA**
Point No. 3 · stage I	93.0 dBA	90.5 dBA	**−2.5 dBA**
Point No. 4 · stage II	94.0 dBA	91.0 dBA	**−3.0 dBA**

Sound level meter model "0024", measurements taken at each of the four compressor stages.

Economic effect as calculated by the plant

INDICATOR	VALUE
Reduction in power draw	**39.0 kW**
Compressor operating time fund (6 months per year)	**1584 h**
Electricity saved per season	**61 776 kWh**
Plant electricity tariff	**0.2644 UAH/kWh**
Monetary saving per season	**16 334 UAH**
Payback of the treatment under normal operation	no more than **3.5 months**

The calculation was made by the plant using its own tariff and the compressor operating time fund; Ukrainian prices of 2006.

Conclusions of the plant commission

The commission of Gorlovskiy Machine-Building Plant JSC recorded: as a result of treating the compressor with XADO technology, the noise level decreased by **2-3 dBA**, and the vibration level at all measurement points decreased on average by **2.7×**. The substantial improvement of these operating parameters of compressor 4VM10-120/9 "even after the major overhaul carried out on this compressor before the treatment began indicates the formation of optimal clearances between parts, which in turn makes it possible to extend the service life until the next major overhaul by at least **2×**". Repeat measurements after the full treatment cycle and a total running time of **405 hours** established that the power draw at identical compressor operating modes decreased by **6 %**, or by **39.0 kW**. The payback of the treatment costs is no more than **3.5 months** of compressor operation in normal service.

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The results relate to the reciprocating air compressor 4M10-120/9 under the operating conditions of Gorlovskiy Machine-Building Plant JSC; on other equipment and in other operating modes the figures may differ. The economic calculation is given according to the tariff and the operating time fund of the plant (Ukraine, 2006). The original report with signatures and stamp is published in full and available for download.