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FIELD CASE STUDY | RAIL TRANSPORT | DIESEL ENGINE · COMPRESSOR

REPORT ON MEASUREMENTS OF LOCOMOTIVE OPERATING PARAMETERS

TEM 15 locomotive: diesel and compressor gained without teardown

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PRODUCT

XADO revitalizant compounds

full treatment cycle of the locomotive units and assemblies

TREATED OBJECT

TEM 15 shunting locomotive No. 166

D-49 diesel engine · KT-6 air compressor

DOCUMENT TYPE

Measurement report signed and stamped by the enterprise

UNIT	OPERATING TIME BETWEEN MEASUREMENTS	WHAT WAS MEASURED
D-49 diesel engine of TEM 15 locomotive No. 166	**470 h**	Compression and maximum combustion pressure per cylinder at three speed modes; block vibration at 12 points; fuel consumption at idle
KT-6 air compressor of the same locomotive	**470 h**	Pneumatic system filling time over three pressure ranges; housing vibration at 4 points; oil pressure in the lubrication system

Measurements before and after treatment were taken under identical conditions: oil temperature 63 °C, coolant 67 °C, vibration — at 250 rpm.

Key results

↑ 7-17 %

diesel cylinder compression, 560 rpm, 23-29 → 26-30 kgf/cm²

↑ 12.9 %

KT-6 compressor output when charging 7-8 kgf/cm², 35 → 31 s

↓ 55-69 %

vibration velocity at engine and compressor points, 3.2-6.3 → 1.1-3.1 mm/s

D-49 diesel engine — compression per cylinder

CYLINDER	320 RPM, kgf/cm²	560 RPM, kgf/cm²	760 RPM, kgf/cm²
I	22.0 → 24.0	23.0 → 27.0	32.0 → 33.0
II	22.0 → 24.0	24.0 → 26.0	28.0 → 30.0
V	25.0 → 26.0	28.0 → 30.0	30.0 → 32.0
VI	26.0 → 26.0	29.0 → 29.0	30.0 → 32.0
VIII	25.0 → 26.0	—	31.0 → 33.0

Valve unit KU 55201. The largest gain is in the cylinders with the lowest initial compression: the spread between cylinders narrowed and the row evened out.

D-49 diesel engine — maximum combustion pressure

CYLINDER	320 RPM, kgf/cm²	560 RPM, kgf/cm²	760 RPM, kgf/cm²
I	22.0 → 25.0	23.0 → 29.0	32.0 → 33.0
II	32.0 → 35.0	34.0 → 36.0	36.0 → 39.0
V	25.0 → 27.0	30.0 → 32.0	36.0 → 38.0
VI	26.0 → 28.0	36.0 → 36.0	38.0 → 40.0
VIII	48.0 → 48.0	48.0 → 48.0	52.0 → 50.0

Same instrument and same speed modes. According to the report's conclusions, combustion pressure rose by 2-6 kgf/cm² and compression by 1-4 kgf/cm².

KT-6 air compressor — pneumatic system filling and oil pressure

PARAMETER	BEFORE	AFTER
Pneumatic system filling from 7.0 to 8.0 kgf/cm²	35.0 s	31.0 s
Pneumatic system filling from 4.0 to 8.0 kgf/cm²	2 min 09 s	2 min 07 s
Pneumatic system filling from 0 to 8.0 kgf/cm²	4 min 18 s	3 min 56 s
Oil pressure in the compressor lubrication system	5.0 kgf/cm²	5.0 kgf/cm²

AGAT stopwatch and the standard pressure gauge, engine speed 250 rpm. According to the report's conclusions, compressor output increased by an average of 9 %.

D-49 diesel engine block vibration — 12 control points

MEASUREMENT POINT	VIBRATION VELOCITY, mm/s	VIBRATION DISPLACEMENT, µm
1 — vertical, front left side	3.51 → 1.69	66.7 → 46.2
2 — horizontal, front left side	4.38 → 3.05	72.9 → 65.3
3 — axial direction, front left side	4.03 → 1.17	34.1 → 32.8
4 — vertical, rear left side	3.42 → 1.54	74.4 → 57.7
5 — horizontal, rear left side	6.33 → 1.94	98.3 → 69.7
6 — axial direction, rear left side	3.22 → 1.06	70.6 → 38.1
7 — vertical, front right side	3.79 → 2.30	33.9 → 36.5
8 — horizontal, front right side	4.34 → 1.74	51.9 → 35.8
9 — axial direction, front right side	4.64 → 1.45	84.2 → 43.9
10 — vertical, rear right side	4.08 → 1.33	—
11 — horizontal, rear right side	5.69 → 2.14	101.0 → 75.7
12 — axial direction, rear right side	4.81 → 1.23	64.7 → 37.5

SENDIG 911 vibrometer, engine speed 250 rpm. Vibration velocity decreased at all 16 control points of the engine and the compressor.

KT-6 compressor housing vibration — 4 control points

MEASUREMENT POINT	VIBRATION VELOCITY, mm/s	VIBRATION DISPLACEMENT, µm
1 — vertical, front side of the block	**4.04 → 1.15**	**51.5 → 38.0**
2 — horizontal, front side of the block	**3.76 → 1.64**	**39.6 → 17.4**
3 — vertical, rear side of the block	**3.9 → 1.69**	**55.1 → 36.7**
4 — horizontal, rear side of the block	**3.82 → 2.61**	**51.2 → 28.7**

Measured with the same vibrometer and in the same mode as for the engine block.

Conclusions of the report

The commission of JSC «Rzhevsky Sakharnik», with the participation of a diagnostics engineer of XADO LLC, recorded the following after a full treatment cycle of the locomotive units and assemblies with XADO revitalizant compounds and **470 hours** of operation:

1. The maximum combustion pressure in the diesel engine cylinders increased by **2-6 kgf/cm²**, the compression value rose by **1-4 kgf/cm²**.
2. Fuel consumption at engine idle at position «2» of the driver's controller decreased by **4.8 %**.
3. Air compressor output increased as a result of the treatment by an average of **9 %**.
4. On repeated measurement at the control points of the engine and the compressor, the vibration level decreased or, at individual points, remained practically at the previous level. Throughout the three months between the measurements the locomotive stayed in the enterprise's shunting service.

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The results relate to a TEM 15 shunting locomotive with a D-49 diesel engine and a KT-6 compressor under the stated measurement modes; on other equipment and under different operating conditions the figures may differ. The original report signed and stamped by JSC «Rzhevsky Sakharnik» is published in full and available for download.