

COMMISSION REPORT, SE «PRYDNIPROVSKA ZALIZNYTSIA» · 2006–2009

ChME3 locomotives: diesel and compressor save fuel two years in a row

SE "Prydniprovskia Zaliznytsia", Dnipropetrovsk locomotive depot (TCh-8) · report approved by the deputy head of the railway; the commission included the railway's locomotive service, the depot and the "Locomotives" chair of DNUZhT named after Academician V. Lazaryan

Dnipropetrovsk, Ukraine · treatment 12.2006 – 01.2007 · control measurements 08.2007, 06.2008, 04.2009 · report dated 05.05.2009

PRODUCT

XADO gel revitalizant
engine — 3.0 l in three stages ·
compressor — 0.020 l per 4.5 l
of KS-19 oil · traction gearboxes
— 0.72 l for KMB 1–6

TEST OBJECT

ChME3 shunting
locomotives
K6S310DR engines · K-2LOK-1
compressors · traction
gearboxes of wheel-motor units
KMB 1–6 · axlebox bearings

DOCUMENT TYPE

Commission report
SE "Prydniprovskia
Zaliznytsia"
signatures of eight commission
members, three stamps

LOCOMOTIVE	CONDITION AT START OF OBSERVATION	TREATED ASSEMBLIES
ChME3 No. 3954	Released from PR-3 scheduled overhaul on 10.11.2006, K6S310DR engine 411/008/1063	Engine, K-2LOK-1 brake compressor, traction gearboxes of KMB 1–6, axlebox bearings
ChME3 No. 2004	PR-3 on 10.11.2006, K6S310DR engine No. 411/009/866 after KR-2 major overhaul	Engine, K-2LOK-1 brake compressor, traction gearboxes of KMB 1–6, axlebox bearings

Treatment was applied immediately after the PR-3 scheduled overhaul: the test checked how the assemblies hold post-overhaul parameters over 2 years 3 months of service.

Key results

↑ **7.7-15.4 %**

cylinder compression, ChME3 No.
2004, 26-30 → 30-32 kgf/cm²

↓ **7-12 %**

daily fuel consumption, 1023-1055 →
899-960 kg per locomotive

↑ **16 %**

compressor output, air system charging
36 → 31 s

K6S310DR engines — cylinder pressure and lubrication system pressure

PARAMETER	LOCOMOTIVE	BEFORE TREATMENT	AFTER TREATMENT
Cylinder compression, notch 0	No. 2004	26-30 kgf/cm ²	30-32 kgf/cm ²
Cylinder compression, notch 8	No. 2004	30-35 kgf/cm ²	35-36 kgf/cm ²
Maximum combustion pressure, notch 8	No. 2004	73-82 kgf/cm ²	78-88 kgf/cm ²
Cylinder compression, notch 0	No. 3954	26-30 kgf/cm ²	28-30 kgf/cm ²
Oil pressure at the engine outlet	No. 2004	3.0 kgf/cm ²	4.3 kgf/cm ²

Maximeter KU 55201, pressure gauge MTPSd-100-OM2/160 of accuracy class 1.5, assessment per TsT-0042. Compression is capped by the factory rating: bringing the cylinders to one level is the limit of what is achievable.

Fuel consumption — three cycles of dedicated rheostatic tests

LOCOMOTIVE	PARAMETER	BEFORE TREATMENT	AFTER TREATMENT
No. 3954	Daily fuel consumption	1055.4 kg	899.0-960.1 kg
No. 3954	Hourly consumption, notch 8	299.3 kg/h	258.6-268.7 kg/h
No. 2004	Daily fuel consumption	1023.4 kg	930.7-944.1 kg
No. 2004	Hourly consumption, notch 8	272.7 kg/h	240.0-250.2 kg/h
No. 2004	Hourly consumption, notch 3	62.0 kg/h	52.3 kg/h

HST-CX-150 electronic scales (50 g resolution), volumetric-gravimetric method on the depot rheostat bench; daily consumption calculated by the method of Prof. A. Z. Khomych with a budget of 23 h per day.

K-2LOK-1 brake compressors — output and oil pressure

PARAMETER	LOCOMOTIVE	BEFORE TREATMENT	AFTER TREATMENT
Air system charging 7–8 kgf/cm ² , notch 0	No. 2004	36 s	31 s
Air system charging 7–8 kgf/cm ² , notch 3	No. 2004	26 s	21 s
Air system charging 0–8 kgf/cm ² , notch 3	No. 2004	3 min 50 s	3 min 17 s
Oil pressure in the compressor	No. 2004	3.8 kgf/cm ²	4.4 kgf/cm ²
Air system charging 7–8 kgf/cm ² , notch 3	No. 3954	30.7 s	26.8 s
Oil pressure in the compressor	No. 3954	3.2 kgf/cm ²	3.7 kgf/cm ²

"Agat" stopwatch No. 5040: a shorter charging time means higher output. According to the report, compressor service life was extended approximately 1.8×.

Running gear and bearings — measurement at teardown after 2 years 3 months

ASSEMBLY	WHAT THE MEASUREMENT SHOWED
Gearing of the traction gearboxes of KMB 1–6 (No. 2004)	Tooth thickness 13.2–14.5 mm , loss over the period 0.00–0.03 mm ; working surfaces smooth, pits and scratches filled in by the metal-ceramic layer
Axlebox roller bearings (No. 2004)	Radial clearances 0.27–0.37 → 0.20–0.35 mm , within tolerance; the raceways of the rings and the rollers are covered with a metal-ceramic layer
Main and connecting-rod bearings of the engine (No. 3954)	Oil clearances: main 0.260 → 0.243 mm , connecting-rod 0.223 → 0.192 mm

Measured with a feeler gauge set during teardown at the scheduled overhaul; tooth thickness at height $h = 4.8$ mm at three points on each pinion and each gear wheel.

Commission conclusions

The commission of SE «Prydniprovskia Zaliznytsia» recorded: the calculated and experimental results of operating the test locomotives showed that the average daily saving of diesel fuel by a ChME3 shunting locomotive after treatment of its mechanical subsystems with special XADO revitalizants, over more than two years, amounts to **58-127 kg**, on average about **90 kg**; the annual effect is about **30 tonnes** of fuel. The positive influence was determined along two lines: through an increase in the indicated efficiency of the engine owing to improved technical parameters of the cylinder-piston group, and through an increase in mechanical efficiency owing to reduced friction forces — including in the brake compressor, the main fan and the gearboxes, which were revitalized simultaneously with the engine. The lion's share of the positive influence falls on mechanical efficiency. The XADO technology can objectively be counted among modern innovative implementations, which already today is able to deliver a real economic effect.



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The results apply to ChME3 shunting locomotives with the K6S310DR engine and the K-2LOK-1 compressor under the conditions of the Dnipropetrovsk locomotive depot; with other equipment and other operating modes the figures may differ. The original report with signatures and stamps is published in full and available for download.