

TECHNICAL REPORTS 2006–2021

ChME3 locomotives: diesel and compressor restored, the same units — again

PrJSC Zaporizhzhia Iron Ore Plant, railway shop · treatment and measurements carried out by plant commissions together with XADO LLC

Ukraine · reports from 11.09.2006 to 28.07.2021 · six locomotives, fourteen reports

PRODUCT

XADO revitalizant
compounds

treatment of the diesel oil and
fuel systems and of the
compressor oil system —
without disassembling the units

TEST OBJECT

ChME3 shunting
locomotives

No. 3719 · 3721 · 3722 · 4041 ·
4042 · 4370 · K6S310DR diesel
and K-2LOK-1 compressor

DOCUMENT TYPE

14 technical reports
of the plant's railway shop

LOCOMOTIVE	REPORT DATE	TREATMENT CYCLE	RUNNING HOURS BEFORE CONTROL MEASUREMENT
ChME3 No. 3719	2007	first	514 h
ChME3 No. 3719	05.08.2020	repeat	880 h
ChME3 No. 3721	12.06.2019	first	580 h
ChME3 No. 3721	28.07.2021	repeat	487 h
ChME3 No. 3722	15.05.2007	first	547 h
ChME3 No. 3722	11.11.2015	repeat	412 h
ChME3 No. 3722	01.08.2018	third	388 h
ChME3 No. 4041	May 2007	first	472 h
ChME3 No. 4041	01.08.2018	repeat	412 h
ChME3 No. 4042	11.09.2006	first	585 h

LOCOMOTIVE	REPORT DATE	TREATMENT CYCLE	RUNNING HOURS BEFORE CONTROL MEASUREMENT
ChME3 No. 4042	24.09.2008	repeat	537 h
ChME3 No. 4042	11.11.2015	third	533 h
ChME3 No. 4042	05.08.2020	fourth	600 h
ChME3 No. 4370	12.06.2019	first	540 h

The locomotives were treated in regular service, without being taken out for repair; control measurements were taken after 388-880 hours of operation.

What was repeated on every unit

↑ 11-20 %

cylinder compression, 16-33 → 22-36 kgf/cm²

↑ 9-17 %

peak combustion pressure, 20-49 → 29-50 kgf/cm²

↓ 10-23 %

air system charging time by the compressor, 30-73 → 26-55 s

↓ 36-45 %

engine block vibration velocity, 0.9-11.3 → 0.4-9.1 mm/s

K6S310DR diesel: cylinder compression, kgf/cm²

LOCOMOTIVE AND REPORT DATE	BEFORE TREATMENT	AFTER	GAIN
No. 4042 · 11.09.2006	24-32	26-36	13 %
No. 3719 · 2007	23-26	27-28	14 %
No. 3722 · 15.05.2007	26-28	28-30	8 %
No. 4041 · May 2007	20-24	22-30	18 %
No. 4042 · 24.09.2008	24-26	24-30	12 %
No. 3722 · 11.11.2015	20-25	32-34	52 %
No. 4042 · 11.11.2015	25-31	30-36	11 %
No. 3722 · 01.08.2018	20-32	30-35	20 %
No. 4041 · 01.08.2018	16-27	29-34	39 %

LOCOMOTIVE AND REPORT DATE	BEFORE TREATMENT	AFTER	GAIN
No. 3721 · 12.06.2019	25-32	28-34	9 %
No. 4370 · 12.06.2019	21-26	28-32	25 %
No. 3719 · 05.08.2020	26-33	30-36	12 %
No. 4042 · 05.08.2020	24-30	29-35	19 %
No. 3721 · 28.07.2021	24-30	27-32	11 %

Measured with a KU 5501 maximeter on a warmed-up engine. Compression runs up against the factory nominal: the more worn the cylinder was, the larger the gain.

K6S310DR diesel: peak combustion pressure, kgf/cm²

LOCOMOTIVE AND REPORT DATE	BEFORE TREATMENT	AFTER	GAIN
No. 4042 · 11.09.2006	30-40	34-44	13 %
No. 3719 · 2007	26-34	32-38	16 %
No. 3722 · 15.05.2007	34-40	36-40	5 %
No. 4041 · May 2007	26-40	30-44	12 %
No. 4042 · 24.09.2008	26-49	29-49	6 %
No. 3722 · 11.11.2015	24-32	36-49	54 %
No. 4042 · 11.11.2015	30-41	32-44	10 %
No. 3722 · 01.08.2018	20-48	30-50	10 %
No. 4041 · 01.08.2018	20-39	37-48	33 %
No. 3721 · 12.06.2019	25-41	30-46	9 %
No. 4370 · 12.06.2019	23-40	30-45	17 %
No. 3719 · 05.08.2020	33-45	36-49	9 %
No. 4042 · 05.08.2020	27-40	36-46	18 %
No. 3721 · 28.07.2021	26-40	29-45	10 %

The same instrument and the same modes as for compression: combustion pressure rises in step with the restored sealing of the cylinders.

K6S310DR diesel: block vibration velocity, mm/s

LOCOMOTIVE AND REPORT DATE	BEFORE TREATMENT	AFTER	REDUCTION
No. 4042 · 11.09.2006	7.3-11.3	3.3-9.1	45 %
No. 3719 · 2007	2.2-3.9	1.1-1.4	60 %
No. 3722 · 15.05.2007	4.5-5.7	2.2-3.5	40 %
No. 4041 · May 2007	2.2-4.1	1.0-1.9	59 %
No. 4042 · 24.09.2008	2.1-4.7	1.2-3.6	34 %
No. 3722 · 11.11.2015	1.5-3.6	0.8-2.3	43 %
No. 4042 · 11.11.2015	1.8-3.9	1.1-2.2	45 %
No. 3722 · 01.08.2018	1.1-1.4	0.7-0.9	41 %
No. 4041 · 01.08.2018	0.9-1.0	0.4-0.7	39 %
No. 3721 · 12.06.2019	3.8-5.1	2.1-3.7	31 %
No. 4370 · 12.06.2019	4.0-6.0	1.3-3.8	48 %
No. 3719 · 05.08.2020	1.1-4.2	0.8-2.6	36 %
No. 4042 · 05.08.2020	1.2-3.3	1.1-3.1	21 %
No. 3721 · 28.07.2021	4.9-9.9	2.2-6.0	39 %

SENDING 911 vibrometer, six points on the engine block at idle: even cylinder operation is a direct consequence of the evened-out compression.

K-2LOK-1 compressor: air system charging time, s

LOCOMOTIVE AND REPORT DATE	CHARGING	BEFORE	AFTER	REDUCTION
No. 4042 · 11.09.2006	7 → 8 kgf/cm ²	30	29	3 %
No. 3719 · 2007	7 → 8 kgf/cm ²	35	31	11 %
No. 3722 · 15.05.2007	7 → 8 kgf/cm ²	30	28	7 %
No. 4041 · May 2007	7 → 8 kgf/cm ²	36	32	11 %
No. 4042 · 24.09.2008	7 → 8 kgf/cm ²	30	27	10 %
No. 3722 · 11.11.2015	7 → 8 kgf/cm ²	36	26	28 %

LOCOMOTIVE AND REPORT DATE	CHARGING	BEFORE	AFTER	REDUCTION
No. 4042 · 11.11.2015	7 → 8 kgf/cm ²	41	33	20 %
No. 3722 · 01.08.2018	7 → 8 kgf/cm ²	54	43	20 %
No. 3721 · 12.06.2019	7 → 7.6 kgf/cm ²	25	20	20 %
No. 4370 · 12.06.2019	7 → 8 kgf/cm ²	52	41	21 %
No. 3719 · 05.08.2020	7 → 8 kgf/cm ²	34	31	9 %
No. 4042 · 05.08.2020	7 → 8 kgf/cm ²	53	35	34 %
No. 3721 · 28.07.2021	7 → 8 kgf/cm ²	73	55	25 %

Stopwatch and the locomotive's standard pressure gauge. Charging time is the working measure of compressor output: fewer seconds mean more air delivered.

What the commissions recorded

Fourteen reports of the railway shop are signed off with one and the same conclusion: cylinder compression and peak combustion pressure rose, engine and compressor vibration fell, compressor output increased — and all of this without disassembling the units and without taking the locomotive out of service for repair. The 2008 report on locomotive No. 4042: «the compression value has evened out across practically all cylinders, which makes it possible to eliminate crankshaft imbalance during engine operation», and applying the technology «makes it possible to increase the service life of these units by at least **1.5×** without stopping the locomotive for repair». The 2015 report on No. 3722 records a compression gain of **9 to 14 kgf/cm²** on a machine that before treatment delivered **20-25 kgf/cm²**. The weightiest argument is the depot's own decisions: five of the six locomotives were treated a second time, and No. 4042 four times between 2006 and 2020.

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The results apply to ChME3 shunting locomotives with the K6S310DR diesel and the K-2LOK-1 air compressor under the conditions of the railway shop of an iron ore plant; on other equipment and in other operating modes the figures may differ. The originals of all fourteen reports, with the signatures and stamps of the enterprise, are published in full and available for download.