



XADO RVS TEST REPORT · DEPARTMENT 34

D100/D80 diesel friction pairs and gear drives: metal grows, friction falls

Malyshev Plant State Enterprise, Department 34 — wear resistance laboratory · head of department: Dr. Sc. (Eng.), Prof. A. P. Lyubchenko · approved by the chief engineer of the plant
Kharkiv, Ukraine · 1998 report

PRODUCT	TEST OBJECT	DOCUMENT TYPE
XADO RVS 0.2 % (by weight) in M14V2, TSZp-8, I-20A oils · for unlubricated pairs — kerosene with 30 % of the compound	Friction pairs of D100 and D80 locomotive diesels and of gear drives crankshaft-bearing shell · liner-piston ring · gear pairs of gearboxes · steel – M1 copper without lubricant	Wear resistance laboratory report of Malyshev Plant State Enterprise

MATING PAIR	SPECIMENS AND LUBRICANT	WHAT WAS MEASURED
Crankshaft-bearing shell	VChM cast iron roller — A020-1 block, M14V2 oil	Wear and friction coefficient, two periods of 10 hours
Liner-piston ring	Laser-hardened liner cast iron — chrome-plated ring, M14V2 oil	Wear over 10 hours, run-in ability and load capacity
Gear pairs of gearboxes	Carburised 20Kh2N4MA steel and austempered 35KhS steel, TSZp-8 and I-20A oils	Wear in rolling with slip, load 2.0 kN
Steel – M1 copper pair	Normalised alloy steel — M1 copper, running without lubricant	Friction forces under stepped loading 0.2–1.2 kN

Every mating pair was tested in parallel with control specimens of the same materials in the same oils without the compound.

Key results

↓ **5.6×**

piston ring wear over 10 hours,
0.0089 → 0.0016 g

↑ **0.0020 g**

mass of the gear-pair roller of
dissimilar hardness, wear 0.0009 →
gain 0.0020 g

↑ **25 %**

load capacity of the liner–ring pair,
400 → 500 kg

↓ **50 %**

friction coefficient of the
crankshaft–bearing shell pair, 0.026 →
0.013

Crankshaft–bearing shell pair: M14V2 oil, 20 hours

PARAMETER	M14V2 OIL WITHOUT COMPOUND	M14V2 + XADO RVS
VChM cast iron roller, second 10 hours	wear 0.0013 g	gain 0.0003 g
A020-1 block, second 10 hours	wear 0.0003 g	gain 0.0004 g
Friction coefficient at the 20th hour	0.026	0.013

SMTs-2 friction machine, sliding speed **1.3 m/s**; gravimetric method, VLA-200 analytical balance, accuracy **10⁻⁴ g**.

Liner–piston ring pair: wear and load capacity

PARAMETER	M14V2 OIL WITHOUT COMPOUND	M14V2 + XADO RVS
Piston ring wear over 10 hours	0.0089 g	0.0016 g
Friction coefficient at 200 kg	0.17	0.13
Friction coefficient at 300 kg	0.20	0.12
Friction coefficient at 400 kg	0.25 — pre-scuffing condition	0.12
Friction coefficient at 500 kg	—	0.11

MTVPD friction machine, **30 min** hold at each step; the untreated pair reached a pre-scuffing condition at **400 kg**.

Gear contacts: rolling with slip

MATERIAL PAIR AND LUBRICANT	WITHOUT COMPOUND	WITH XADO RVS
Dissimilar hardness: 20Kh2N4MA — 35KhS, I-20A oil — mass of the 35KhS steel roller	wear 0.0009 g	gain 0.0020 g
Equal hardness: 35KhS — 35KhS, TSZp-8 oil — roller wear	0.0063 g	0.0063 g

Slip **20 %**, total load **2.0 kN**. The report notes a **2.5×** change in the wear of the carburised steel in the pair of dissimilar hardness.

Steel – M1 copper pair without lubricant: stepped loading

LOAD	REDUCTION OF FRICTION FORCES AFTER XADO RVS TREATMENT
0.2 kN	27 %
0.4 kN	54 %
0.6 kN	51 %
0.8 kN	23 %
1.0 kN	10 %

Treatment — running-in in kerosene with **30 %** of the compound, **30 min**, then washing and drying; the instrument scale is not decoded in the report, so the relative change is given.

Conclusions of the report of Department 34 of the Malyshev Plant

2. The effectiveness of using the additive to motor oils has been established, with the aim of reducing friction forces and speeding up the run-in of the main parts of engine friction units /shaft-bearing shell, liner-piston ring/.
3. It has been obtained that adding the RVS compound noticeably reduces the wear of gear drives when pairs of materials of unequal strength are running.
4. Tests of material pairs treated with RVS under sliding friction without lubricants showed a substantial **/10 to 54%/** reduction of the friction forces of the treated surfaces compared with the untreated ones.
5. We consider it necessary to carry out extended pilot-industrial tests of the RVS additive under production conditions: locomotive engines of the D100 and D80 types — with the aim of reducing run-in time and cutting fuel consumption during factory running-in of engines; gearboxes and other friction units of process equipment — with the aim of restoring the dimensions of worn parts, preventing wear and reducing electric power consumption. A draft order has been prepared.



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The results refer to specimens of materials of the friction units of D100 and D80 locomotive diesels, of gear drives and of the steel – M1 copper pair, tested on SMTs-2 and MTVPD friction machines in the stated modes; in service the figures may differ. RVS is an obsolete XADO designation for the zero-generation compounds; the current product generation is revitalizants. The original report with signatures and seal is published in full and available for download.