R&D; REPORT · LABORATORY TESTS OF XADO RVS

Liner, ring, crankshaft: a harder friction surface, lower wear and friction loss

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Kharkiv, Ukraine · report approved by the Vice-Rector for Research on 24.07.1998, embossed university seal

PRODUCT

XADO RVS

repair-and-restoration compound; referred to in the report as the RVS additive, blended into I-20 industrial oil and M10G1 engine oil

TEST OBJECT

Model ICE friction pairs

40Kh steel — Br.S30 bronze (crankshaft — plain bearing) · ChS cast iron — SChM cast iron (cylinder liner — compression ring)

DOCUMENT TYPE

University research and development report

FRICTION PAIR, SPECIMEN HARDNESS	WHAT IT MODELS	WHAT WAS MEASURED
40Kh steel (HRC 52) — Br.S30 bronze	Crankshaft — plain bearing	Wear rate, friction coefficient, microhardness of both surfaces
ChS cast iron (HB 210) — SChM cast iron (HB 252)	Cylinder liner — engine compression ring	Wear rate, friction coefficient, microhardness of both surfaces

2070 SMT-1 friction testing machine, ring-on-ring scheme per GOST 23.224-86: load 800 N, sliding speed 0.5 m/s; linear wear measured by the artificial datum method (GOST 23.301-78).

Key results

↑ 1.3-2.4×

microhardness of the cast-iron friction surfaces, 3000-3180 → 4280-7240 MPa

↓ 8-14 %

wear rate of the crankshaft — bearing pair, 87-117 → 80-100 µm/h

↓ 10-21 %

friction coefficient in the ICE pairs, 0.048-0.127 → 0.043-0.100

Crankshaft — plain bearing: 40Kh steel — Br.S30 bronze

PARAMETER	OIL	BASE OIL	OIL + XADO RVS
Wear rate, µm/h	I-20	**117**	**100**
Wear rate, µm/h	M10G1	**87**	**80**
Friction coefficient	I-20	**0.066**	**0.052**
Friction coefficient	M10G1	**0.048**	**0.043**
Microhardness of 40Kh steel, MPa	I-20	**5720**	**6420**
Microhardness of 40Kh steel, MPa	M10G1	**6840**	**7240**
Microhardness of Br.S30 bronze, MPa	I-20	**2540**	**2740**
Microhardness of Br.S30 bronze, MPa	M10G1	**2820**	**3020**

I-20 industrial oil (GOST 20779-75) and M10G1 engine oil under an identical load and speed mode; microhardness of the friction surfaces measured per GOST 9450-76.

Cylinder liner — compression ring: ChS cast iron — SChM cast iron

PARAMETER	OIL	BASE OIL	OIL + XADO RVS
Wear rate, µm/h	I-20	**10**	**8.7**
Wear rate, µm/h	M10G1	**9.2**	**8.4**
Friction coefficient	I-20	**0.127**	**0.100**

PARAMETER	OIL	BASE OIL	OIL + XADO RVS
Friction coefficient	M10G1	**0.11**	**0.10**
Microhardness of ChS cast iron, MPa	I-20	**3100**	**5140**
Microhardness of ChS cast iron, MPa	M10G1	**3180**	**4280**
Microhardness of SChM cast iron, MPa	I-20	**3000**	**7240**
Microhardness of SChM cast iron, MPa	M10G1	**3100**	**4350**

The hardest protective films recorded by the report were precisely those on the cast irons — the materials of the engine cylinder liner and compression ring.

Conclusions of the KhGADTU report

Section 4 of the report, “Conclusions and recommendations for implementation”, states:

1. The use of the RVS additive in the base mineral oils — I-20 industrial and M10G engine oil — reduces the wear rate of the materials by **8** to **14%** and mechanical friction losses by **10** to **21%**.
2. The use of the RVS additive in the base oil substantially intensifies the formation of protective wear-resistant films (secondary structures) on the friction surfaces. Particularly hard films form on cast irons (microhardness rises by **26%** to **59%**), then on steels — **11%** — and to a lesser degree on bronzes — **7%**.
3. The use of the RVS additive significantly shortens the running-in (break-in) time; this additive can serve as a running-in and modifying material. As a separate requirement, the report introduces stepped running-in: “a part, assembly or engine must be run in stepwise, from minimum loads up to operating loads”.

XADO

The results relate to model friction pairs (40Kh steel — Br.S30 bronze, ChS cast iron — SChM cast iron) on a 2070 SMT-1 friction testing machine in I-20 and M10G1 oils; the report itself states that transferring them to a specific assembly requires bench and in-service testing. RVS is an obsolete XADO designation for zero-generation compounds; the current product generation is revitalizants. The KhGADTU research report of 24.07.1998 is published in full and available for download.