FOUR REPORTS FROM ONE PLANT · MARCH — DECEMBER 2005

BK-450, TsDN-630, 200/20 and VS-23 gearboxes: thicker teeth, lower vibration

ROSAVA JSC, tyre manufacturing · reports approved by V. A. Shepelev, chief mechanical engineer of the plant; measurements by the chief mechanical engineer's service together with XADO LLC

Ukraine · treatment cycles February — December 2005 · reports dated 23 Mar, 12 Jul and 27 Dec 2005

PRODUCT

XADO revitalizants

revitalizant gel for transmissions and gearboxes · XADO Restorative grease for rolling bearings

TEST OBJECTS

Gearboxes of production line drives

BK-450 and TsDN-630-50-22 of the LOMK-800 line · 200/20 extruder · VS-23 rolling mill

DOCUMENT TYPE

Four technical reports by ROSAVA JSC, 2005

OBJECT	OPERATING TIME	WHAT WAS MEASURED	REPORT
BK-450 block gearbox, calender drive of the LOMK-800 line	**635 h**	tooth thickness (m = 9 mm), vibration at 12 points, drive current and power	27 Dec 2005
TsDN-630-50-22 gearbox, same LOMK-800 line	**635 h**	tooth thickness (m = 6 and 10 mm), vibration at 12 points, noise, drive current and power	27 Dec 2005
Main drive gearbox of the 200/20 extruder, tread section	**426 h**	tooth thickness (m = 5, 10 and 14 mm), vibration at 8 points, noise, current	23 Mar 2005
Main drive gearbox and support bearings of the VS-23 rolling mill, LOMK section	**486 h**	tooth thickness (along the chord h = 8 mm), vibration at 20 points, stator current	12 Jul 2005

All four units were treated in a single 2005 cycle without disassembly, through the oil system; measurements before treatment and after the operating time were taken with the same instruments.

What was repeated on all four gearboxes

↑ 0.15-0.7 mm

constant-chord tooth thickness on all four gearboxes

↓ 17-43 %

vibration displacement of bearing supports, 2.0-30.3 → 1.8-17.8 µm

↓ 5-31 %

current drawn by the drives, 16.0-208.0 → 11.0-197.0 A

Constant-chord tooth thickness — all four gearboxes

GEARBOX / GEAR PAIR	BEFORE, mm	AFTER, mm	GAIN, mm
BK-450, pinion of shaft No. 1	12.0-12.2	12.4-12.5	0.3-0.4
BK-450, pinions of shafts No. 2 and No. 3	11.4-11.8	12.05-12.4	0.55-0.7
TsDN-630-50-22, stage I gear wheel	8.2-8.3	8.4-8.45	0.15-0.25
TsDN-630-50-22, stage II gear wheel	14.0-14.2	14.25-14.35	0.15-0.3
200/20 extruder, stage I gear wheel	6.45-6.65	6.9-7.0	0.35-0.5
200/20 extruder, stage III pinion	12.6-12.75	12.95-13.2	0.3-0.5
200/20 extruder, stage IV pinion and gear wheel	18.3-18.8	18.8-19.3	0.4-0.5
VS-23 mill, gearbox wheel	10.0-10.3	10.3-10.5	0.2-0.4
VS-23 mill, gearbox pinion	11.4	11.65-11.7	0.25-0.3

ShZN-18 gear tooth caliper, measurement along the constant chord before treatment and after the operating time; tooth module ranges from 5 to 14 mm, therefore the gain is given in millimetres.

Vibration of bearing supports — comparison by object

OBJECT	POINTS	VIBRATION DISPLACEMENT, µm	REDUCTION
BK-450 block gearbox	12	4.3-30.3 → 3.9-17.8	24-50 %
TsDN-630-50-22 gearbox	12	8.2-15.8 → 4.4-17.8	5-34 %
200/20 extruder gearbox	8	2.0-3.0 → 1.8-2.5	5-24 %
Gearbox and support bearings of the VS-23 mill	20	3.8-26.1 → 2.3-15.5	23-48 %

SENDIG 911 vibrometer, up to three directions at each support; the column gives the typical range, the strongest points reach 67-71 %.

Current drawn by the drives

DRIVE	MEASUREMENT MODE	CURRENT, A	CHANGE
LOMK-800 line (BK-450 and TsDN-630-50-22)	operating, 30 rpm	208.0 → 197.0	−5.3 %
200/20 extruder	no load, 10 rpm of the output shaft	22.0 → 20.5	−6.8 %
VS-23 mill	no load, rotor current 120 A	16.0 → 11.0	−31.3 %

Standard ammeter and ATK 2200 clamp meter; the drive modes differ, so the relative changes are what can be compared. BK-450 and TsDN-630 are in the same drive train, the measurement is common to both.

Gearbox noise level — 200/20 extruder and TsDN-630-50-22

GEARBOX	NOISE LEVEL, dB	REDUCTION, dB
200/20 extruder, no load, 10 rpm	88.0 → 83.5	4.5
TsDN-630-50-22, three points, 30 rpm	90.0-92.0 → 89.0-90.5	1.0-2.0

Model 0024 sound level meter. The report names the cause of the noise on the extruder: chipped tooth tips on stage II and wear on the stage IV teeth.

What the plant's reports state

All four gearboxes were taken into work in a worn condition: for the TsDN-630-50-22 the commission assessed the wear of the gear drives as "over 70 %", the depth of tear-outs and scoring reached **2.5 mm**; on the 200/20 extruder one of the teeth of the stage I pinion shaft was completely worn away. The treatment was carried out through the oil system, without disassembly and without taking the lines out of production. Conclusions of the reports: "the tooth thickness increased by **0.15-0.3 mm** due to the formation of a metal-ceramic layer, and the average area of the contact patches on the working surface of the teeth is more than **60 %**" (TsDN-630-50-22); "in the tooth contact zone the damage and small pits disappeared" (BK-450). For the LOMK-800 line the report notes a reduction of the power drawn by the electric motor of **5.3 kW**, or **8.6 %**, — "despite the fact that during the repeat measurements the unit was running under a higher load".

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The results relate to the gear drives of production line drives at a tyre plant — BK-450 and TsDN-630-50-22 of the LOMK-800 line, the gearbox of the 200/20 extruder, the gearbox and support bearings of the VS-23 mill — at an operating time of 426-635 h after treatment; on other equipment and under other operating modes the figures may differ. The originals of the four ROSAVA JSC reports with signatures are provided in full. The treatment was performed by XADO LLC, whose representatives took part in the measurements together with the plant's chief mechanical engineer service.