PLANT REPORT DATED 12.12.2002 · 526 HOURS OF SERVICE AFTER TREATMENT

Ural-2M herringbone gearbox: worn teeth regained metal, motor current dropped

OJSC Dnepropetrovsk Tube Rolling Plant, TVTs-2 shop · measurements — chief mechanic services and the plant electrical laboratory

Ukraine · report dated 12.12.2002 · service between measurements — 526 h of normal operation

PRODUCT

XADO revitalizant

in the report — XADO "restorative" lubricant

TREATED UNIT

Stage 2 gear drive

gear and pinion, m = 20 mm, Novikov gearing · stage 1 (m = 11.2 mm) left untreated

DOCUMENT TYPE

Report of OJSC Dnepropetrovsk Tube Rolling Plant

approved by the chief mechanic · six signatures of the commission

UNIT	CONDITION AT THE START OF TESTING	WHAT WAS MEASURED
Ural-2M gearbox, stage 2 — treated	Tooth wear over 30 % of thickness; scoring, chipping and pitting up to 4 mm deep	Tooth thickness of gear and pinion (m = 20 mm) before treatment and after service
Ural-2M gearbox, stage 1 — not treated	Standard lubricant, same gearbox, same operating hours	Tooth thickness of gear and pinion (m = 11.2 mm) — control group
Gearbox drive motor	Standard mill operation, tube drawing in 2 strands	Current draw at no load and under load

The stage 2 gear drive was isolated from the gearbox standard lubrication system and treated with the XADO compound; the gearbox was not disassembled.

Key results

↑ 0.4-0.6 mm

tooth thickness of stage 2 gear and pinion, on average over 526 h of operation

↓ 12.5 %

drive motor current under load, 440 → 385 A

Tooth thickness of the treated stage 2 — before treatment and after 526 hours of operation

PART · RIM · SECTOR	BEFORE, mm	AFTER, mm	GAIN, mm
Gear, left rim · S1	31.6-31.9	31.9-32.1	0-0.4
Gear, left rim · S2	31.4-31.6	31.8-32.3	0.3-0.9
Gear, left rim · S3	31.6-31.85	31.9-32.1	0.05-0.4
Gear, right rim · S1	31.35-31.8	31.8-31.9	0-0.45
Gear, right rim · S2	31.1-31.3	31.6-31.8	0.45-0.6
Gear, right rim · S3	31.05-31.25	31.6-31.9	0.55-0.7
Pinion, left rim · S1	22.8-22.9	23.2-23.4	0.4-0.5
Pinion, right rim · S1	23.15-23.4	23.7-24.0	0.45-0.8

ShZN-40 gear tooth caliper; the same marked teeth were measured before treatment and after 526 h. The table gives the mean tooth section at height h = 25 mm.

Control: stage 1 of the same gearbox, untreated

PART · RIM	BEFORE, mm	AFTER, mm	CHANGE ON THREE TEETH, mm
Stage 1 gear, right rim	19.0-19.1	18.6-18.7	−0.4 · −0.4 · −0.35
Stage 1 gear, left rim	18.7-18.8	18.75-18.9	+0.05 · +0.1 · +0.05
Stage 1 pinion	17.0-17.1	16.95-17.05	+0.05 · −0.05 · −0.15

Stage 1 (m = 11.2 mm) stayed on the standard lubricant and was not treated: same gearbox, same duty, same 526 h.

Drive motor current draw

OPERATING MODE	BEFORE TREATMENT	AFTER 526 H	CHANGE
Under load — tube drawing in 2 strands	**440 A**	**385 A**	**−12.5 %**
No load	**30 A**	**22 A**	**−26.6 %**

Measurements by the plant electrical laboratory: protocol No. 272 — before treatment, protocol No. 44 — after 526 h of operation.

Working surface of stage 2 teeth: inspection before and after

BEFORE TREATMENT	AFTER 526 HOURS OF OPERATION
Transverse scoring, chipping and pitting up to **4 mm** deep over the entire working surface of the gear and pinion teeth; tooth thickness wear over **30 %**	Damage depth decreased, ridges smoothed out, minor damage on the contact patches disappeared; the working surface levelled out and became smoother

Inspection by specialists of the plant technical services and representatives of XADO LLC during a scheduled gearbox shutdown.

Findings of the plant commission

The plant commission recorded in the report: before treatment the wear of the stage 2 teeth was found to be catastrophic — “tooth thickness decreased by more than **30 %**”, and over the entire working surface of the gear and pinion there were “transverse scoring, chipping and pitting up to **4 mm** deep”. After **526 hours** of normal operation, repeat measurements showed that “tooth thickness increased on average by **0.4-0.6 mm**”, while the motor current draw fell “at no load by **26.6 %** and under load by **12.5 %**”. The report concludes: “after treatment with the XADO revitalizant, not only was the catastrophic wear stopped, but a partial restoration of tooth thickness also occurred owing to the metal-ceramic layer that had formed”, which, in the commission’s estimate, extends the gearbox service life before overhaul “by at least **1.5×**”. The gearbox was neither disassembled nor taken out of service.

XADO

The results relate to the two-stage Ural-2M herringbone gearbox of a rolling mill and to its normal operating duty; on other units and duties the figures may differ. Geometry and current measurements were made by the plant services; the treatment was carried out by XADO LLC and Agrotekhkomplekt LLC, whose representatives were part of the commission. The original signed report is published in full and available for download.