

TWO TECHNICAL REPORTS OF THE PLANT · 2006–2007

Gravel bowl gearboxes: teeth gained metal, quieter, more efficient

Tomakovskiy Expanded Clay Gravel Plant OJSC · reports approved by chief mechanical engineer S. G. Mironenko; measurements by chief power engineer R. S. Glushenkov and repair shop mechanic A. M. Verbovoy

Marganets, Dnipropetrovsk region, Ukraine · treatment 10.11–20.12.2006 · reports dated 20.12.2007

PRODUCT

XADO revitalizant
compounds

full treatment cycle without
disassembling the gearboxes

TEST OBJECT

Gearboxes of bowl drives
No. 1 and No. 2

inv. No. 04213036 and No.
04213035 · gravel mass mixing
units of a single line

DOCUMENT TYPE

Technical reports of the
plant
with signatures and seal

GEARBOX	TOOTH CONDITION BEFORE TREATMENT	RUN TIME TO MEASUREMENT	WHAT WAS MEASURED
Bowl drive No. 1 inv. No. 04213036	Pits at the tooth roots up to 1.5 mm , scoring and dents on the contact patches, metal squeezed out to the tooth tips	255 h	Tooth thickness, current and voltage, bearing support vibration
Bowl drive No. 2 inv. No. 04213035	Chains of pits up to 1.5 mm deep and up to 3.0 mm across the tooth width, longitudinal wear grooves up to 0.8 mm	260 h	Tooth thickness, current and voltage, bearing support vibration

Both gearboxes are two-stage: stage I bevel (m = 8 mm), stage II spur (m = 20 mm). Treatment was performed without disassembly, in regular operation.

Key results

↑ **0.1-0.5 mm**

tooth thickness over the constant chord on all four gear rims of both gearboxes

↓ **20.5 %**

no-load current draw, bowl drive No. 1, 44.0 → 35.0 A

↓ **26-80 %**

vibration displacement at the shaft bearing supports, 32-197 → 6-54 μm

Tooth thickness over the constant chord — gain by gear rim

GEAR RIM	BOWL DRIVE No. 1 (INV. 04213036)	BOWL DRIVE No. 2 (INV. 04213035)
Stage I bevel pinion	+0.25-0.30 mm	+0.30-0.50 mm
Stage I bevel wheel	+0.10-0.20 mm	+0.45-0.50 mm
Stage II spur pinion	+0.15-0.25 mm	+0.30-0.45 mm
Stage II spur wheel	+0.15-0.30 mm	+0.15-0.30 mm

Gear tooth caliper ShZN-18, measurements taken on the same numbered teeth before treatment and after the run time. Thickness increased on every one of the 38 teeth measured.

Drive power draw at no load

GEARBOX	MEASUREMENT	CHANGE
Bowl drive No. 1 (inv. 04213036)	Current 44.0 → 35.0 A at a voltage of 246 V	-20.5 %
Bowl drive No. 2 (inv. 04213035)	Per the report conclusion — due to reduced friction on the working surfaces of the parts	-15-22 %

Clamp meter ATK2200, 500 rpm. For bowl drive No. 2 the commission's estimate from the report conclusions is given, not a direct measurement.

Vibration displacement at the control points of the bearing supports

CONTROL POINT	BOWL No. 1: REDUCTION	BOWL No. 2: REDUCTION
Shaft No. 1, front support	21-30 %	60-92 %
Shaft No. 2, right support	6-40 %	60-88 %
Shaft No. 2, left support	18-34 %	52-90 %
Shaft No. 3, right support	19-33 %	77-87 %
Shaft No. 3, left support	23-34 %	69-83 %

Vibration meter SENDIG 911, no load at 500 rpm; the range covers three directions — vertical, horizontal and axial. A reduction was recorded in all 30 measurements.

Damage on the tooth contact patches

GEARBOX AND GEAR RIM	PIT DEPTH
Bowl No. 1 · stage I bevel pinion	0.5 → 0.15 mm
Bowl No. 1 · stage II spur wheel	1.5 → 0.5 mm
Bowl No. 2 · stage II spur pinion	0.7 → 0.3 mm
Bowl No. 2 · stage II spur wheel	1.5 → 0.4 mm

Assessed by visual inspection with photographic records before treatment and after the run time. On stage II of both gearboxes, the scoring and dents from hard particles had practically disappeared.

Conclusions of the plant commissions

For both gearboxes the commissions of Tomakovskiy Expanded Clay Gravel Plant OJSC recorded an increase in tooth thickness at all stages — by **0.1-0.35 mm** on bowl drive No. 1 and by **0.25-0.5 mm** on bowl drive No. 2 — "which makes it possible to restore mechanical wear and extend the service life of the gearbox gear train". The no-load power draw of the bowl drive No. 1 decreased by **20 %**. The vibration level decreased at all control points in the area of the bearing assemblies, "the size and number of mechanical defects on the contact patches of the gear trains decreased several times over". Both units entered treatment worn — with pits up to **1.5 mm** deep, scoring and metal squeezed out to the tooth tips. The commission separately states that the results achieved "will improve after the full treatment cycle has been completed", which amounts to at least **400 h** of run time.



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The results apply to the two-stage gearboxes of the bowl drives of gravel mass mixing units, treated without disassembly in regular operation; on other units and duty cycles the figures may differ. The measurements were performed by the plant's specialists together with a representative of XADO LLC. The original reports with signatures and seal are published in full and available for download.