



TECHNICAL ACTS OF OJSC SEVGOK, AUGUST — OCTOBER 2001

BelAZ and Caterpillar gearboxes: teeth and axles gained metal over hundreds of operating hours

OJSC SevGOK (Northern Mining and Processing Plant), Haulage Shop No. 1 · acts approved by Technical Director A. E. Rakhmanov, signed by the shop commission

Kryvyi Rih, Ukraine · works 17.08 — 25.10.2001 under contract No. 2774 · acts dated 12.10.2001 and 25.10.2001

PRODUCT	OBJECTS	DOCUMENT TYPE
XADO technology repair and restoration works under contract No. 2774 · early-generation formulations	Planetary gearboxes of the drive line wheel motor of BelAZ 7512 No. 27 · right-hand final drive of Caterpillar 789	Two technical acts of OJSC SevGOK approved by the Technical Director, with the company seal

MACHINE	UNIT	SERVICE AFTER TREATMENT	ACT DATE
BelAZ 7512 No. 27 haul truck, Haulage Shop 1	Wheel-motor gearbox, two planetary rows	over 350 engine hours	25.10.2001
Caterpillar 789 haul truck, 120 t, Haulage Shop 1	Right-hand final drive, oil system shared with the rear axle	996 engine hours	12.10.2001

Measurements were taken on the very same marked parts — before the works and after service in the open pit.

What repeated on both gearboxes

↑ 4.2-4.5 % tooth thickness, 16.70-16.85 → 17.40-17.60 mm	↑ 0.30-0.90 mm bearing roller and axle bearing seat, 51.95 → 52.85 and 101.6 → 101.9 mm
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Gear mesh — body thickness of the marked tooth

PART AND MACHINE	BEFORE WORKS	AFTER SERVICE	CHANGE
Planet gear, BelAZ 7512 No. 27	16.70 mm	17.40 mm	+0.70 mm
Central gear shaft, BelAZ 7512 No. 27	16.85 mm	17.60 mm	+0.75 mm
Sun gear, Caterpillar 789	16.85 mm	17.60 mm	+0.75 mm

The same marked tooth was measured each time. On machines from two different manufacturers the initial size and the result coincided: 16.85 → 17.60 mm.

Bearing assemblies — diameters of the friction-pair parts

PART AND MACHINE	BEFORE WORKS	AFTER SERVICE	CHANGE
Roller of the large thrust bearing, BelAZ 7512 No. 27	51.95 mm	52.85 mm	+0.90 mm
Axle bearing seat, Caterpillar 789	101.6 mm	101.9 mm	+0.30 mm
Raceway in sun gear No. 1, Caterpillar 789	147.2 mm	146.6 mm	-0.60 mm
Raceway in sun gear No. 2, Caterpillar 789	147.2 mm	146.8 mm	-0.40 mm

The raceway is an internal surface: metal built up on it as well, so its diameter decreased. The bearing fit closed up from both sides.

Condition of the working surfaces

SURFACE AND MACHINE	BEFORE WORKS	AFTER SERVICE
Thrust bearing rollers, BelAZ 7512 No. 27	Cavities on more than 80 % of the surface	Cavities gone, traces of micro-cavities on 10 %
Planet gear teeth, BelAZ 7512 No. 27	Roughness and cavities on 40 % of the area	Appearance of a smooth ground surface
Bearing raceways in the gears, Caterpillar 789	Cavities on 70 % of the surface	Cavities gone on 90 % of the surface
Working surfaces of the marked teeth, Caterpillar 789	Roughness and cavities on up to 45 % of the surface	Defects gone on 90 % of the surface
Axle bearing seats, Caterpillar 789	Galling	Galling gone

SURFACE AND MACHINE	BEFORE WORKS	AFTER SERVICE
Rollers of the roller bearings, Caterpillar 789	Pitting	Surface cleared of pitting

Visual assessment. Before the works the surfaces could be cut with a smooth-cut file; after the service the file slides without leaving visible marks.

Findings of the OJSC SevGOK commissions

Before the works the parts of both gearboxes were worn: cavities on **40-80 %** of the surface of the teeth and of the bearing rollers, galling on the axle bearing seats, pitting on the roller bearings; the working surfaces "had no sufficiently hard surface layer, since they could be cut with a smooth-cut file". After the service the commissions recorded in the acts: "the working surfaces of the teeth and the rolling surfaces of the thrust bearing rollers acquired a hard metal-ceramic layer that cannot be cut with a smooth-cut file"; "a metal-ceramic layer formed on all friction pairs, the clearances in the friction pairs and their geometric dimensions were optimised, i.e. a weight gain of the rubbing parts of the friction pairs took place". The dimensional gain repeated on machines from two different manufacturers — not on a test bench, but in the open pit under full load.

XADO

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 The results relate to the planetary drive-line gearboxes of BelAZ 7512 and Caterpillar 789 haul trucks under the conditions of OJSC SevGOK; with other machinery and operating modes the figures may differ. In 2001 early-generation XADO formulations were used; the current product generation is revitalizants. The original acts with signatures and seals are published in full and available for download.