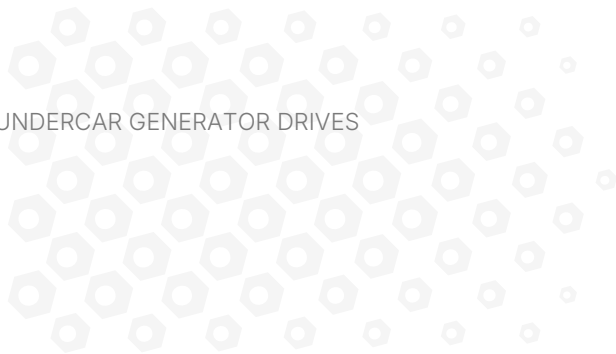




INSPECTION REPORTS OF 2002 AND 2003

TRKP and EUK-160-1M drives: tooth grew back without teardown and still holds 18 months later

Odesa Railway, Odesa-Glavnaya passenger car depot (LVChD-3) · reports signed by the depot commission and approved by the passenger service of Odesa Railway

Odesa, Ukraine · contract No. OD/L-02-334-NYu of 03.04.2002 · treatment 24.05–22.10.2002 · measurements 22.10.2002 and 01–03.12.2003

PRODUCT

XADO materials

XADO gel for gearboxes · XADO restorative grease · treatment without disassembly, no cars taken out of service

TREATED OBJECT

Undercar generator drives

100 TRKP gearboxes and 140 EUK-160-1M · control measurements on 40 TRKP gearboxes with factory numbers

DOCUMENT TYPE

Two reports of the Odesa-Glavnaya depot with signatures and seals

REPORT DATE**OBJECTS MEASURED****TIME AFTER TREATMENT****WHAT WAS MEASURED**

22.10.2002

40 TRKP gearboxes with factory numbers, cars of the LVChD-3 assigned fleet

350–400 h of operation

Tooth thickness of gear wheel and pinion, surface condition

04.12.2003

The same 40 TRKP gearboxes; EUK-160-1M drives, bearings, splined joints, MAV couplings

1 year 1 month – 1 year 6 months

Tooth thickness, condition of surfaces and backlash, service life of units

240 drives of the fleet treated without disassembly: 100 TRKP gearboxes and 140 EUK-160-1M, May–October 2002. Control tooth measurements — on 40 TRKP gearboxes.

What repeated across the whole sample

↑ **0.25-0.30 mm**

tooth thickness at 2.24 mm depth, 3.70-3.90 → 4.00-4.10 mm

↑ **2.1-3.0×**

service life of TRKP gearbox bearings, 6-7 → 14-18 months

↑ **1.8-2.6×**

service life of cardan shaft splined joints, 7-8 → 18 months

Tooth thickness of gear wheel and pinion — 40 control TRKP gearboxes

STAGE	TOOTH THICKNESS AT 2.24 MM DEPTH	COATING BUILD-UP
Before treatment, May–July 2002	3.70-3.90 mm	initial condition
Operating time 350-400 h , report 22.10.2002	4.00-4.10 mm	+0.25 mm on average, 0.10-0.40 mm across gearboxes
Service 1-1.5 years , report 04.12.2003	thickness held, no tooth wear found	+0.30 mm on average

Measured per the Repair Rules at 2.24 mm depth from the tooth tip: drawing size 4.15 mm, reject limit 3.66 mm. Build-up obtained on all forty gearboxes.

Service life of drive units in operation

UNIT	BEFORE TREATMENT	AFTER TREATMENT
Bearings No. 32311 and No. 309 of the TRKP drive gearbox	seizure after 6-7 months — the main cause of drive failure	1.2-1.5 years in service without replacement, condition serviceable
Splined joints of the cardan shaft of the EUK-160-1M drive	wear, spalling and fracture of splines after 7-8 months	not a single failure over the whole observation period
Bearings No. 216 and No. 116 of the MAV clutch coupling	seizure — the main cause of drive failure	not a single failure over 1.5 years of service
Teeth of the bevel gearbox of the EUK-160-1M drive	tooth fractures were recorded by the depot	no fractures registered in 1.5 years after treatment

Service lives of the units — from the failure statistics of the Odesa-Glavnaya depot. Per the conclusion of the report of 04.12.2003, the service life of these units grew about 3×.

Condition of the units at inspection

WHAT WAS INSPECTED	BEFORE TREATMENT	AT THE CONTROL INSPECTION
Working surfaces of gear wheel and pinion teeth	chipping, pitting, scoring, scratches	smooth, free of chipping and scoring, covered with a thin metal-ceramic layer
Tooth roots and chipped areas	open defects of the working surface	filled in, contact area of the gear wheels increased
Backlash in bearings and splined joints	found	absent, bearings fully serviceable

The inspection was carried out by the depot commission — before treatment and again on 01–03.12.2003, together with the control measurements.

Findings of the depot commission

The commission of the Odesa-Glavnaya depot recorded in the report of 22.10.2002: "on the contact surfaces of the pinion and wheel teeth a build-up of metal-ceramic coating occurred, averaging 0.25 mm, the tooth thickness approached the drawing parameters, the roots and chipped areas were filled in, the contact area of the gear wheels increased". Before treatment these same surfaces had chipping, pitting and scoring, and there was backlash in the bearings. After a year of service the measurements were repeated: the layer had not worn off but grown — by 0.30 mm on average, there is no tooth wear, backlash is absent. Conclusion of the report of 04.12.2003: the treatment "led to an increase in the operational reliability of the drives by at least 3×, through extending the service life of the main units (bearings, gear wheel teeth, splined joints, etc.), and to improved traffic safety".

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The results apply to the gearboxes and drive units of undercar generator drives of the TRKP and EUK-160-1M types on passenger cars of the Odesa-Glavnaya depot; with other units and operating modes the figures may differ. The originals of the reports of 22.10.2002 and 04.12.2003 with signatures and seals are published in full and available for download. The treatment was performed by an official dealer of the XADO concern — Pridneprovskaya Transportnaya Kompaniya LLC.