

COMMISSION PROTOCOL · TROYANOVO-3 MINE

KA218 gearbox and drive drum bearing: metal grew back, clearance narrowed

"Mini Maritsa-Iztok" EAD, Troyanovo-3 mine branch · commission: chairman eng. D. Cholakov, members T. Sotev, V. Kitanov · treatment carried out by "May" OOD

Mednikarovo, Bulgaria · gearbox treated 24.03.2004, bearing 31.03.2004 · repeat measurements 26.05.2004

PRODUCT

XADO gel and restorative grease

gel for transmissions and gearboxes — 3 stages of 2.330 kg per 700 l of oil · grease — 14 kg into the roller base plus 3 times 2 kg

TREATED OBJECTS

Bevel gearbox KA218 and drum bearing

station T6 — gearbox KA218-1000 kW/1216-F2 · station T1 — lower drive drum

DOCUMENT TYPE

Protocol of the commission of the Troyanovo-3 mine measurements before and after treatment in the presence of representatives of the mine and of "May" OOD

EQUIPMENT**CONDITION AND PARAMETERS BEFORE TREATMENT****WHAT WAS MEASURED**

Bevel gearbox KA218-1000 kW/1216-F2, station T6

Deliberately selected as the most worn: deep pitting on the gear wheel teeth, under load noisier than the three neighbouring gearboxes of the station

Tooth thickness with a gear tooth caliper, motor current, condition of the working surfaces

Lower drive drum, station T1

Spent grease, black in colour, with steel particles, backlash **0.65 mm**, strongly pronounced knock audible at **2 m**

Backlash with a play gauge, condition of the rollers and of the grease

Bevel pair and drive motor of the gearbox

Pinion $z=22$, gear wheel $z=99$, module **10.75 mm**, **980 / 260 rpm**; oil bath **700 l**

Motor current at no load and under load

Gel — into the oil bath of the gearbox: 3 stages of 2.330 kg, 6.990 kg in total per 700 l. Grease — into the base of the bearing rollers: 14 kg and three more times 2 kg.

Key results

↑ **0.20 mm**

gear wheel tooth thickness,
12.50-19.00 → 12.70-19.20 mm

↓ **30.8 %**

backlash of the drum bearing, 0.65
→ 0.45 mm

↓ **8.3 %**

gearbox drive current at no load, 36
→ 33 A

Station T6 gearbox: gear wheel tooth thickness

TOOTH ZONE	HEIGHT FROM THE TIP	BEFORE, mm	AFTER, mm	GAIN
158 mm from the face	5 mm	12.50-12.55	12.70-12.75	+0.20
158 mm from the face	8 mm	14.60-14.75	14.80-14.95	+0.20
158 mm from the face	11 mm	16.80-16.90	17.00-17.10	+0.20
158 mm from the face	14 mm	18.90-19.00	19.10-19.20	+0.20
40 mm from the face	5-14 mm	11.75-18.25	11.75-18.25	no change

Gear tooth caliper, three marked teeth at each height. The metal grew on the zone at the smaller-diameter side — where the pitting was concentrated.

Station T6 gearbox: pinion tooth thickness

TOOTH	BEFORE, mm	AFTER, mm	GAIN
Tooth 1	17.10	17.50	+0.40
Tooth 2	17.10	17.30	+0.20
Tooth 3	17.15	17.70	+0.55

Gear tooth caliper, measuring height 11 mm from the tooth tip, on the same marked teeth before and after treatment.

Bearing of the lower drive drum, station T1

PARAMETER	31.03.2004 — BEFORE	26.05.2004 — AFTER
Backlash	0.65 mm	0.45 mm
Bearing knock	Strongly pronounced, audible at 2 m	Faintly audible and only with the ear placed against the bearing housing
Vibration by ear	Light vibration recorded	No vibration recorded
Grease condition	Spent grease, black in colour, with steel particles	Colour and smell unchanged, no metal particles recorded

Backlash — with a play gauge, measured at **120°** from the vertical, before and after treatment at the same angle. Repeat check after **56 days** of normal operation of the drum.

Station T6 gearbox: load on the drive motor

MODE	BEFORE	AFTER	CHANGE
No load	36 A	33 A	-8.3 %
Rated load	39-51 A	36 A	below the previous range

Current measured in both regular operating modes of the station, before and after treatment.

Station T6 gearbox: condition of the gear wheel tooth working surfaces

TOOTH ZONE	24.03.2004 — BEFORE	26.05.2004 — AFTER
Middle part of the profile	Isolated pitting cavities 1-1.5 mm in diameter, 0.1-0.2 mm deep	Filling of the pitting cavities, formation of a visible XADO metal-ceramic layer
Start of the tooth at the smaller-diameter side	Severe pitting damage, cavities up to 3-5 mm in largest dimension, 2-3 mm deep	Partial closing of the pitting by the XADO layer
Operation under load	Noisier than the other three gearboxes of the station	Noise level dropped considerably

Inspection and noise assessment — by the commission of the mine, after removal of the gearbox top cover, on 24.03 and 26.05.2004.

Conclusion of the commission

The station T6 gearbox was selected as the most worn: deep pitting on the gear wheel teeth, cavities up to **3-5 mm** and **2-3 mm** deep. The bearing of the station T1 drum knocked loudly enough to be heard **2 m** away. Two months later — the cavities filled, a visible XADO metal-ceramic layer and a bearing clearance of **0.65 → 0.45 mm**. Commission of the Troyanovo-3 mine: "Treatment by XADO technology of the KA218-1000kW gearbox of shut-off station T6, specially selected for this purpose as heavily worn, made it possible to obtain a positive result. The restoration of the parts of the bevel gear transmission worn during operation led to a significant improvement of the working parameters of the gearbox: the vibration and noise levels were reduced, the load on the electric motor decreased and the condition of the teeth and bearings of the gearbox improved. The results obtained give full grounds to state that the use of XADO technology in heavily loaded machines will allow the service life to be increased significantly."



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The results relate to the bevel gearbox KA218-1000 kW/1216-F2 of station T6 and the bearing of the lower drive drum of station T1 at the Troyanovo-3 mine and to their operating conditions; on other equipment and in other modes the figures may differ. The original commission protocol is published in full and available for download.