

## CERTIFICATES OF TREATMENT RESULTS · 2002–2004

# ChS-2 and ER1 gearboxes: tooth thickness grew, the gain holds for years

Main Locomotive Department of Ukrzaliznytsia · Dnipropetrovsk and Nikopol locomotive depots,  
Prydniprovskaya Railway

Prydniprovskaya Railway, Ukraine · treatment May–June 2002 · control measurements November 2002  
— July 2004

**PRODUCT**

XADO gel (revitalizant)  
single fill into the gearbox oil  
bath · 0.185 l per unit on ChS-2 ·  
0.066 l on ER1

**OBJECTS IN THE SERIES**

ChS-2 electric locomotives  
and ER1 electric trains  
traction gear drives of the  
wheel-motor units, operated on  
the regular schedule

**DOCUMENT TYPE**

Certificates of treatment  
results  
under XADO Technology®  
signed by depot commissions  
(chief engineer, chief  
technologist, deputy head for  
repairs), company seals

| MACHINE                           | TREATED UNITS                                             | MILEAGE AFTER TREATMENT | CERTIFICATE DATE |
|-----------------------------------|-----------------------------------------------------------|-------------------------|------------------|
| ChS-2 electric locomotive No. 377 | 6 wheel-motor units — traction gearboxes                  | 85 039 km               | 12 Nov 2002      |
| ChS-2 electric locomotive No. 055 | 6 wheel-motor units — traction gearboxes                  | 73 510 km               | 19 Mar 2003      |
| ChS-2 electric locomotive No. 033 | 6 wheel-motor units — traction gearboxes                  | 87 450 km               | 17 Apr 2003      |
| ER1 electric train, section No. 1 | 4 wheel-motor units — traction gearboxes, axle-box liners | 179 249 km              | 17 Dec 2003      |
| ER1 electric train, section No. 3 | 4 wheel-motor units — traction gearboxes, axle-box liners | 177 933 km              | 17 Dec 2003      |

| MACHINE                                                | TREATED UNITS                | MILEAGE AFTER TREATMENT | CERTIFICATE DATE |
|--------------------------------------------------------|------------------------------|-------------------------|------------------|
| ChS-2 electric locomotive No. 377 — repeat measurement | the same 6 wheel-motor units | 238 451 km              | 13 Jan 2004      |
| ChS-2 electric locomotive No. 377 — third measurement  | the same 6 wheel-motor units | 323 457 km              | 17 Jul 2004      |

Each machine was treated once, the gel poured into the gearbox oil bath. Locomotive No. 377 was measured three times: the depot came back to it two years running.

# Key result

**↑ 0.3-0.8 mm**

gear wheel tooth thickness, 13.05-16.15 → 13.85-16.60 mm

# Gear wheel tooth thickness — machine by machine across the series

| MACHINE                           | MILEAGE    | BEFORE TREATMENT, mm | AFTER THE RUN, mm | CHANGE, mm |
|-----------------------------------|------------|----------------------|-------------------|------------|
| ChS-2 electric locomotive No. 377 | 85 039 km  | 14.70-16.00          | 15.05-16.50       | +0.30-0.65 |
| ChS-2 electric locomotive No. 055 | 73 510 km  | 14.80-16.15          | 15.15-16.50       | +0.15-0.60 |
| ChS-2 electric locomotive No. 033 | 87 450 km  | 14.80-15.90          | 15.60-16.55       | +0.50-0.80 |
| ER1 electric train, section No. 1 | 179 249 km | 13.05-14.80          | 13.85-15.45       | +0.45-0.85 |
| ER1 electric train, section No. 3 | 177 933 km | 14.10-14.25          | 14.95-15.00       | +0.75-0.90 |

Measured on five teeth of every wheel; the measuring height differs for ChS-2 and ER1, so between the two machine types it is the gain that is comparable, not the absolute thickness.

## ChS-2 electric locomotive No. 377: three measurements over two years and 323 thousand km

| DATE OF MEASUREMENT           | MILEAGE AFTER TREATMENT | TOOTH THICKNESS, mm | GAIN OVER INITIAL, mm |
|-------------------------------|-------------------------|---------------------|-----------------------|
| 16 May 2002, before treatment | —                       | <b>14.70-16.00</b>  | initial measurement   |
| 12 Nov 2002                   | <b>85 039 km</b>        | <b>15.05-16.50</b>  | <b>+0.30-0.65</b>     |
| 13 Jan 2004                   | <b>238 451 km</b>       | <b>15.05-16.60</b>  | <b>+0.25-0.70</b>     |
| 17 Jul 2004                   | <b>323 457 km</b>       | <b>15.00-16.60</b>  | <b>+0.20-0.70</b>     |

The gel was poured in once, on 16 May 2002. All three control measurements were taken on the same six wheels and the same five teeth of each wheel.

## Working surfaces of the teeth: what was there and what came out

| MACHINE                           | BEFORE TREATMENT                                                                                                                                                 | AFTER THE RUN                                                                              |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| ChS-2 electric locomotive No. 377 | Clusters of pitting cavities up to <b>6 mm</b> across and up to <b>0.7 mm</b> deep; scratches and cavities up to <b>2 mm</b> across and up to <b>0.4 mm</b> deep | Cavities and scratches filled in, the contact patches are a smooth polished surface        |
| ChS-2 electric locomotive No. 055 | Fine scratches and cavities on the contact patches                                                                                                               | Still visible through the metal-ceramic layer that has formed, but no longer felt by touch |
| ChS-2 electric locomotive No. 033 | Pitting cavities across the whole contact patch, up to <b>3 mm</b> across and <b>0.6-0.8 mm</b> deep                                                             | Cavities and scratches gone, the surface has taken on the look of a smooth polished one    |
| ER1 electric train, section No. 1 | Transverse grooves across the full tooth width, up to <b>1.1 mm</b> ; scratches <b>0.1-0.4 mm</b> ; pitting up to <b>3 mm</b> across and <b>0.4 mm</b> deep      | Scratches, dents and cavities gone, the contact patches are a smooth polished surface      |
| ER1 electric train, section No. 3 | Longitudinal grooves up to <b>0.7 mm</b> ; scratches and dents <b>0.2-0.6 mm</b> ; pitting up to <b>4 mm</b> across and <b>0.5 mm</b> deep                       | Cavities and scratches gone, the contact patches are a smooth polished surface             |

The sizes and depths of the defects are given as measured before treatment.

# What the depot commissions put on record

The certificates are signed by the locomotive depot commissions, and the same thing is recorded on every machine. For the ER1 electric train: «the tooth thickness of the gear wheels increased by **0.45mm** to **0.85 mm**... In the contact patch zone of the gear wheels the scratches, dents and pitting cavities present before treatment have disappeared. The contact patch surfaces have taken on the appearance of a smooth polished surface». On ChS-2 locomotive No. 377 the observation ran for two years: «After a run of **323457 km** the tooth thickness attained is on the whole retained... On the contact patches of all the teeth a metal-ceramic layer is visually noticeable, which has removed all the fine cavities and scoring on the working surface of the teeth». Gear drives that had been running with pitting up to **0.8 mm** deep and grooves up to **1.1 mm** gained metal after a single fill of gel into the oil bath — without dismantling the wheel-motor unit.

---

**XADO**

© XADO. All rights reserved.

The results relate to the traction gear drives of the wheel-motor units of ChS-2 electric locomotives and ER1 electric trains of the Prydniprovskaya Railway; on other units, duty cycles and types of equipment the figures may differ. The original certificates bearing the depot commission signatures and seals are published in full and available for download.