

TEST REPORT · MACHINE SHOP, ZAPOROZHSTAL OJSC

16K20 lathe: accuracy and surface finish restored without disassembly

Zaporozhstal OJSC, machine shop · measurements taken by a commission of plant specialists · approved by V. V. Buryak, Engineering Director

Zaporizhzhia, Ukraine · treatment 31.01-18.06.2013 · report dated 08.08.2013 · total run 1280 h

PRODUCT

XADO revitalizant gel
for compressors and bearings ·
lubrication system of the
machine treated without
stopping production

TEST OBJECT

16K20 screw-cutting lathe
inv. No. 10512471 · spindle unit,
gearbox, lubrication system,
drive

DOCUMENT TYPE

Test report,
Zaporozhstal OJSC
signed by the plant commission
and the lead engineer of XADO
LLC

MACHINE UNIT**CONDITION BEFORE TREATMENT****WHAT WAS MEASURED**

Spindle unit

Increased radial clearance and axial
play of the spindle bearings

Bearing play, radial and face runout of
the spindle seat

Gearbox

Micro-damage on the contact patches
of the loaded gear wheels

Tooth thickness of the gearbox pinion
and the spindle gear at the
constant-chord height

Drive, electric motor

Machine in service in the machine
shop

Current, voltage and power on three
phases at idle and under load

Machine as a whole

Ovality of the turned surface 0.03
mm, roughness Ra 7.98 μm — class 4

Vibration at seven control points,
ovality and Ra of the test workpiece

The lubrication system was treated twice — an initial treatment and a repeat one; the 1280 h run is counted from the start of the first treatment.

Key results

↑ **0.05-0.15 mm**

gearbox tooth thickness, 5.8 → 5.9 and 6.0 → 6.15 mm

↓ **7.6 %**

power draw under load, 3.48-3.74 → 3.2-3.45 kW

↓ **59-89 %**

vibration velocity at control points, 1.23-1.71 → 0.10-0.70 mm/s

↓ **3.3-3.8×**

roughness of the turned surface Ra, 7.98 → 2.1-2.4 μm

Spindle accuracy and gearbox tooth geometry

PARAMETER	BEFORE TREATMENT	AFTER 1280 H	CHANGE
Axial play of the spindle bearings	0.05 mm	0.02 mm	−0.03 mm
Radial play of the spindle bearings	0.03 mm	0.015 mm	−0.015 mm
Radial runout of the spindle seat	0.03 mm	0.01 mm	−0.02 mm
Face runout of the spindle seat	0.01 mm	0.005 mm	−0.005 mm
Tooth thickness of the gearbox pinion, 3 teeth	5.8 mm	5.9 mm	+0.1 mm
Tooth thickness of the spindle gear, 3 teeth	6.0 mm	6.15 mm	+0.15 mm

Play and runout — ICh-10 dial indicator; tooth thickness at a constant-chord height of 3.0 mm with m = 3.5 — ShZN-18 gear tooth vernier caliper.

Power consumption of the machine drive on three phases

MODE AND PARAMETER	PHASE A	PHASE B	PHASE C
Current under load	9.81 → 8.9 A	10.1 → 9.2 A	9.95 → 9.0 A
Power under load	3.48 → 3.2 kW	3.74 → 3.45 kW	3.52 → 3.22 kW
Current at idle	7.83 → 7.05 A	7.65 → 7.1 A	7.76 → 6.98 A
Power at idle	2.92 → 2.6 kW	2.89 → 2.53 kW	3.01 → 2.67 kW

ATK2200 clamp meter. According to the conclusions of the report, in the loaded turning cycle the current fell by 9.6 % and the power by 7.6 %; at idle, by 9 % and 11 %.

Vibration at the control points of the headstock and the bed

MEASUREMENT POINT	VIBRATION ACCELERATION, m/s ²	VIBRATION VELOCITY, mm/s	VIBRATION DISPLACEMENT, μm
Front bearing, vertical	3.56 → 3.49	1.28 → 0.19	4.84 → 1.62
Front bearing, horizontal	8.8 → 3.69	1.53 → 0.7	4.25 → 3.22
Rear bearing, vertical	5.59 → 2.44	1.39 → 0.21	3.99 → 2.12
Bed at the rear bearing, horizontal	9.93 → 5.24	1.71 → 0.7	18.9 → 4.0
Bed at the rear bearing, axial	7.46 → 4.8	1.32 → 0.17	4.18 → 1.72
Bed, left support, horizontal	4.08 → 2.12	1.26 → 0.1	4.4 → 1.54
Bed, right support, horizontal	3.49 → 2.33	1.23 → 0.14	3.99 → 2.48

SENDIG 911 vibration meter, seven control points; the reduction was recorded at every point and for all three vibration quantities.

Test workpiece turned on the machine

PARAMETER OF THE TURNED SURFACE	BEFORE TREATMENT	AFTER 1280 H
Ovality of the turned surface	0.03 mm	0.01 mm
Surface roughness Ra	7.98 μm — class 4	2.1-2.4 μm — class 6

The workpiece was turned under identical conditions each time: 800 rpm, feed 0.15 mm/rev, depth of cut 1.0 mm.

Conclusions of the plant commission

The commission of specialists of Zaporozhstal OJSC, by final measurements after a total run of **1280 h**, established that: in the loaded turning cycle at fixed cutting conditions the current draw decreased by **9.6 %** and the power draw by **7.6 %**; the radial runout of the spindle decreased from **0.03 mm** to **0.01 mm**, and the axial play of the bearings from **0.05 mm** to **0.02 mm**; the vibration level "decreased at all control points by at least **56 %**, and at individual points of the spindle bearings the vibration parameters decreased by more than 2×"; the thickness of the control teeth on the gearbox gears increased by **0.05-0.15 mm**, and the contact patches of the loaded gear wheels "visually became smoother, without the micro-damage that was visible before the start of the treatment"; the roughness of the turned surface improved by 2 classes — from Ra **7.98 µm** to Ra **2.1-2.4 µm**. The treatment of the lubrication system with XADO revitalizant compounds was carried out without stopping the machine and without disassembling its units; in the assessment of the commission, the geometric parameters of the machine and the vibration level of the spindle bearings correspond to the accuracy parameters of a machine after a major overhaul.



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The results apply to the 16K20 screw-cutting lathe (inv. No. 10512471) of the machine shop of Zaporozhstal OJSC under the stated measurement conditions; on other equipment and under other conditions the figures may differ. The original report dated 08.08.2013 is published in full and available for download.