GTB 300

MEASURING OF BEVEL GEARS with single-flank rolling method

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Technical data

Diameter of bevel gear, max.	300 mm
Diameter of spindle bore for wheel	60 mm
Diameter of spindle bore for pinion	60 mm
Mounting distance for wheel, max.	275 mm
Mounting distance for pinion, max.	250 mm
Hypoid offset range - optional	± 50 mm
Shaft angle - optional	0° - 180°
Rotations, max.	300 U/min
Measuring speed, max.	30 U/min
Load torque, max.	15 Nm
Weight of wheel, max.	20 kg
Weight of the machine	1 300 kg
Accuracy	DIN 3965 / Q1

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BEVEL GEAR

Main reuirements in gear production:

- DIN Quality
- Defined backlash
- Low level of noise / high lifespan
- Influence of assembly precission
- Contact pattern, V-H characteristics
- Where error comes from (pinion/wheel)

All these parameters are measured and checked by our single-flank inspection machine GTB300

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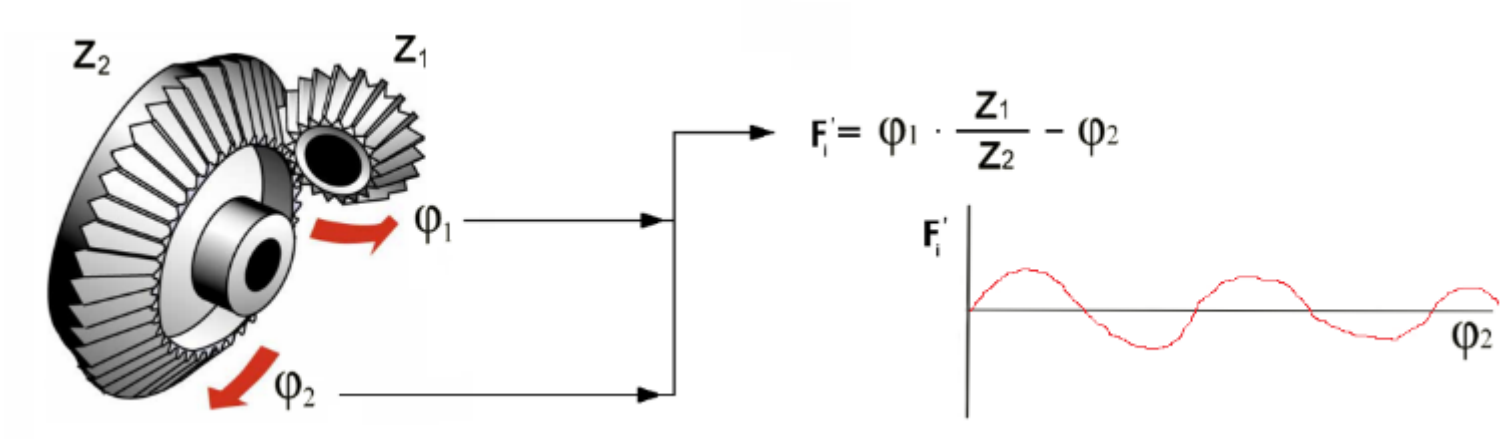
SINGLE-FLANK METHOD - PRINCIPLE



- Mounting distance during testing is static
- Left and righ flanks are tested separately
- Accurate rotary encoders
- Accuracy app. 1 second of arc (5 µrad) ~ 1 µm on diameter of 200 mm
- Deviations and tolereances in: DIN 3965, AGMA, ISO

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DEVIATIONS

Single flank deviations

F_i' - Tangential composite deviation

f_i' - Tooth to tooth composite deviation

f_l' - Longwave component

f_k' - Shortwave component

j - Backlash

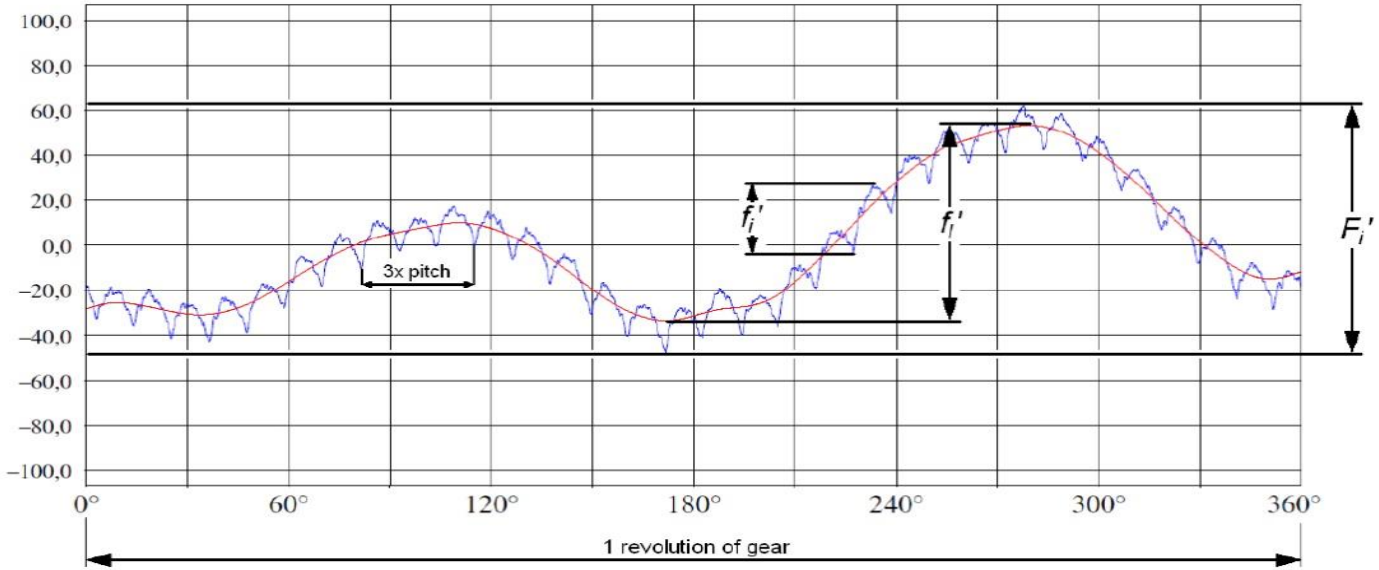
Pitch deviations of pinion and gear

F_p - Total pitch deviation

f_{pt} - Adjacent pitch deviation

f_u - Difference between adjacent pitches

F_r - Radial run-out



Contact pattern

V-H cycle

FFT Analyse

Roundness and eccentricity

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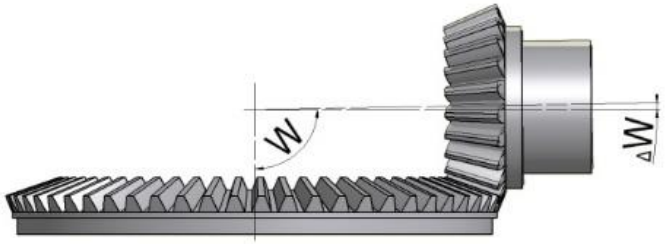
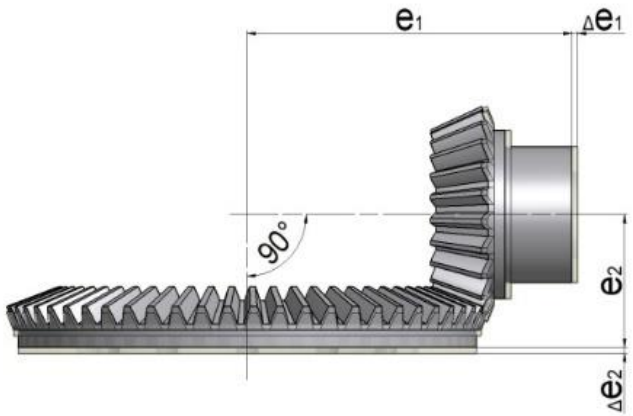
OTHER OPTIONS – INFLUENCE OF ASSMEBLY

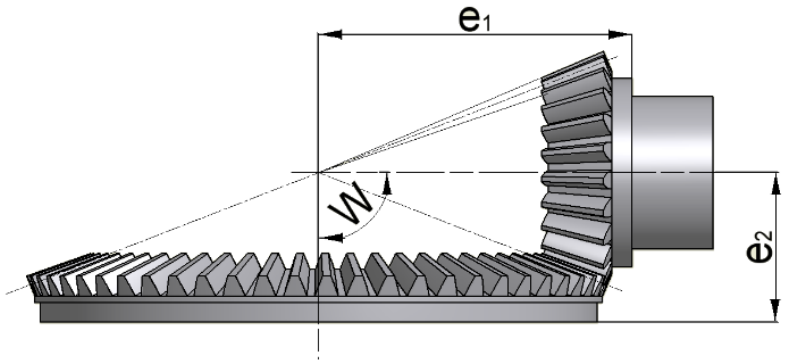
Angular displacement



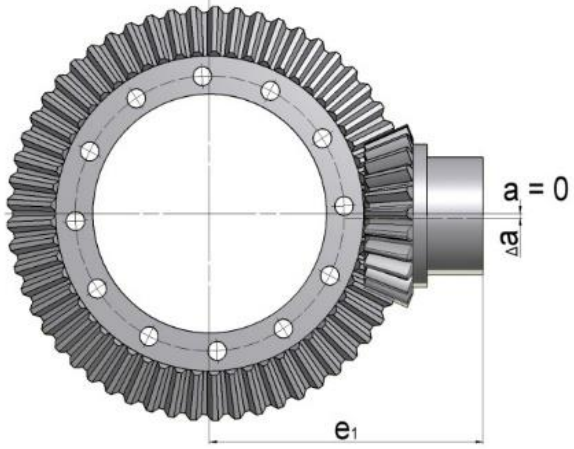
Mass installation



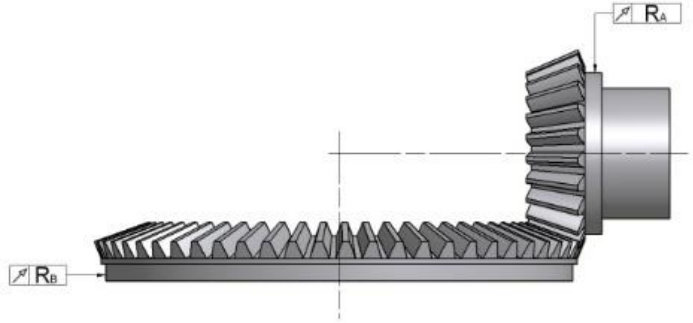
Correct possition



Hypoid offset



Concentricity



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MACHINE VARIANTS

GTB 300 HW – with hypoid offset (± 50mm) and variable shaft angle from 0° - 180 °

GTB 300 H – with hypoid offset (± 50mm) , fixed shaft angle to 90 °

GTB 300 W – without hypoid offset and variable shaft angle from 0° - 180 °

GTB 300 – without hypoid offset and fixed shaft angle to 90° for bevel gears,
or with angle adjustment to 180° for spur/helical gears

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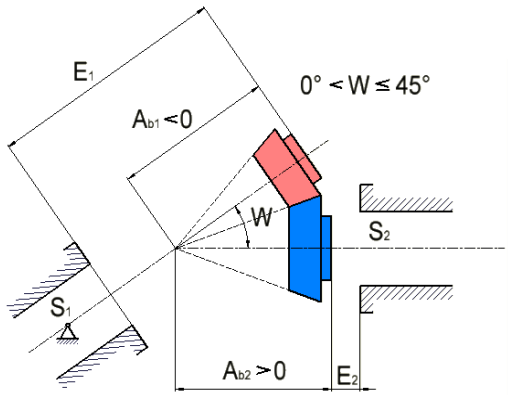
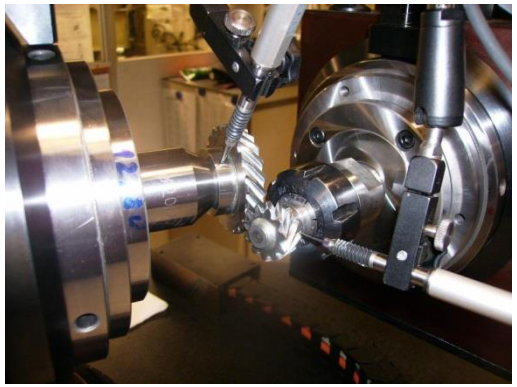
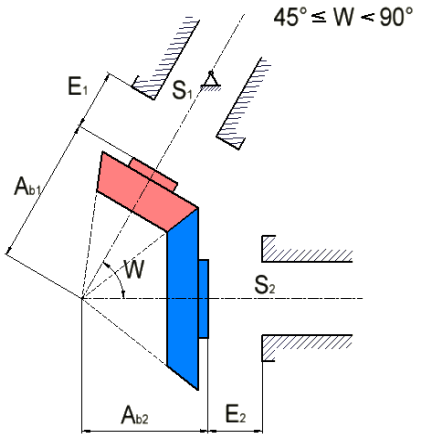
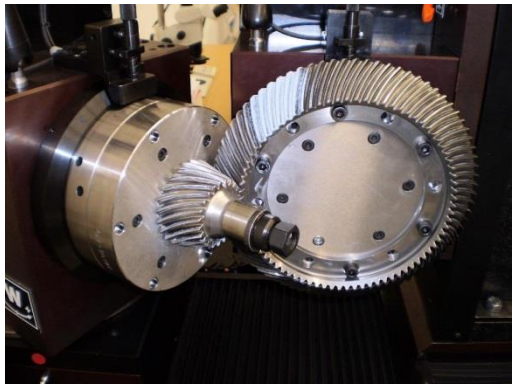
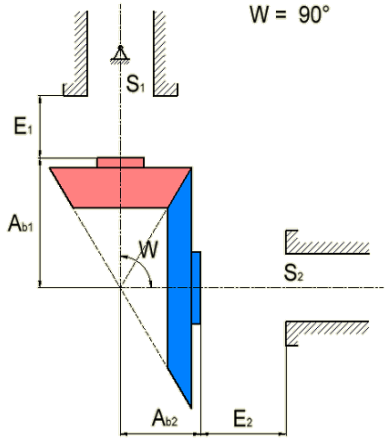
PRINCIPLE OF MEASURUNG – VARIABLE SHAFT ANGLE

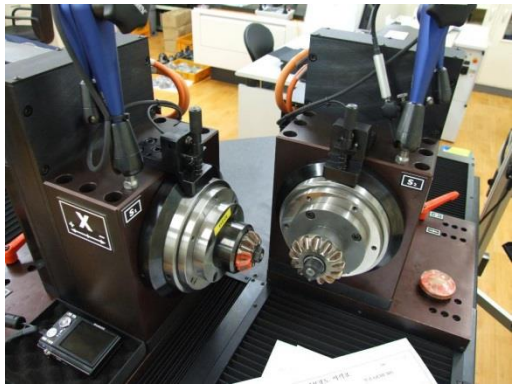


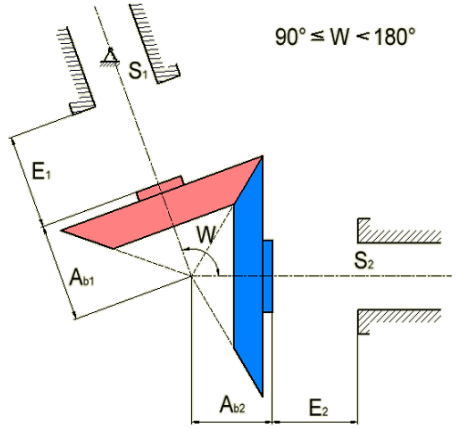


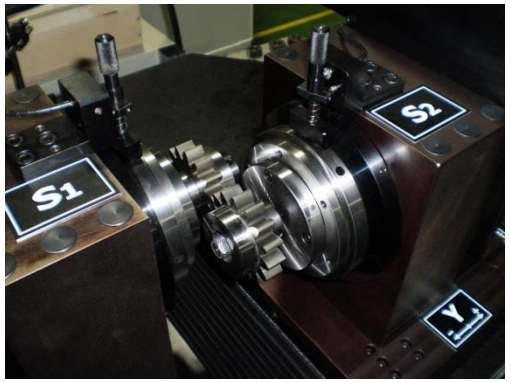












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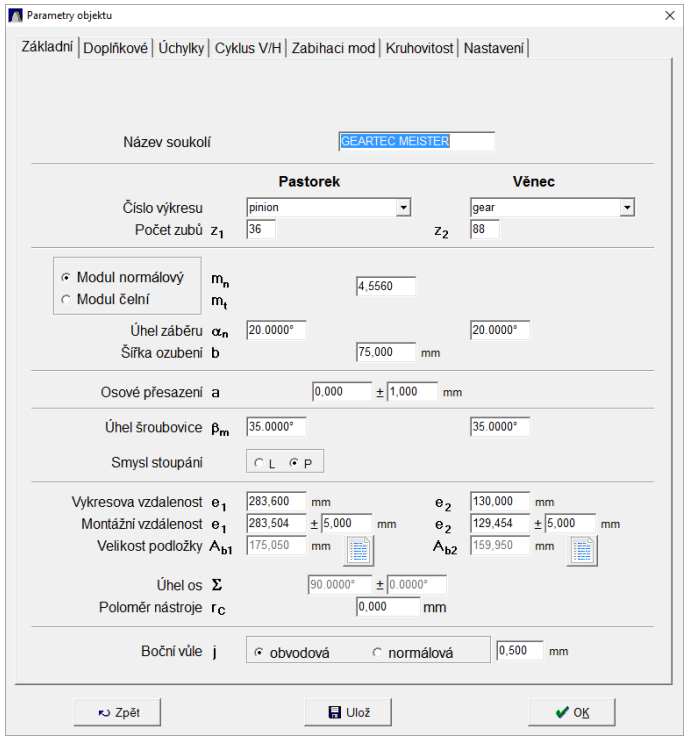
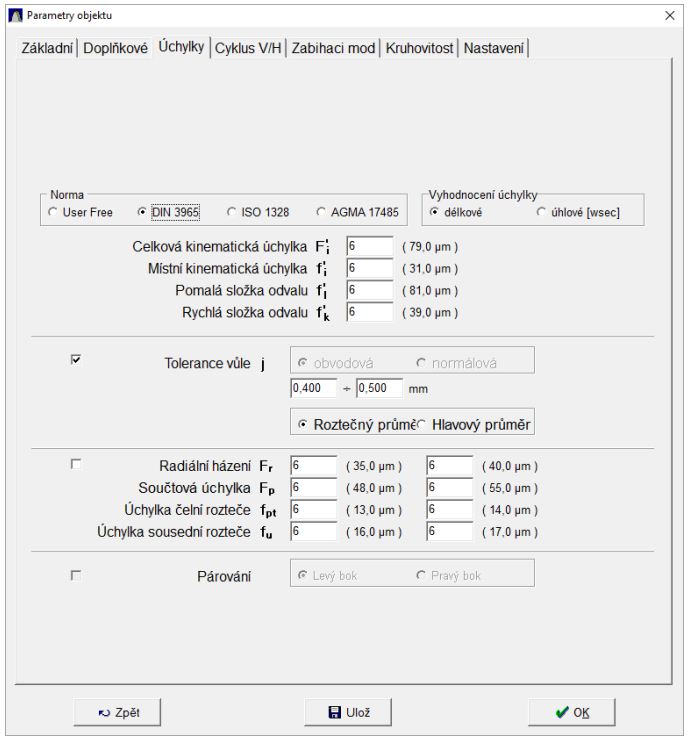
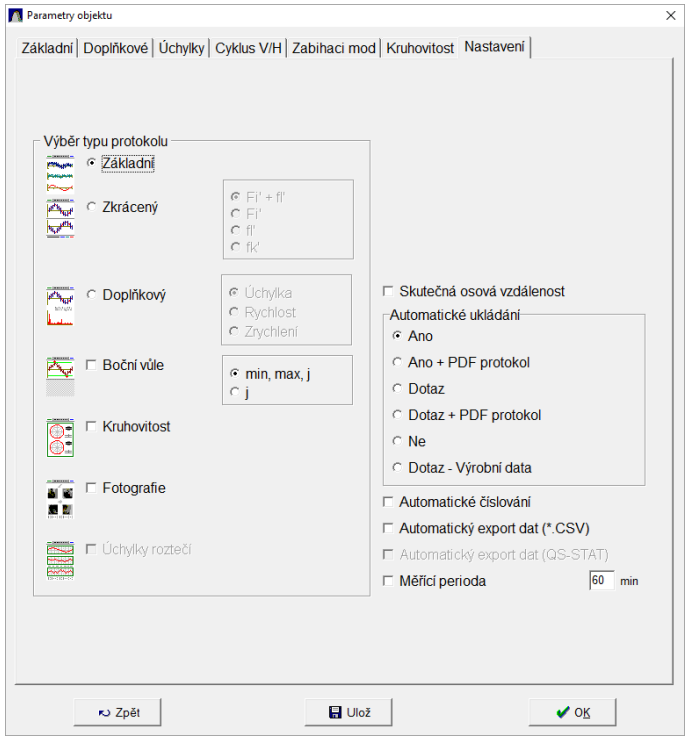
MEASURING APPLICATION







Measuring application is user-friendly requiring no special PC knowledge. It can communicate in many languages and runs under Microsoft Windows operation system.
All measured results are saved into local databank system. Time needed for preparing of measurement is shortened to minimum.

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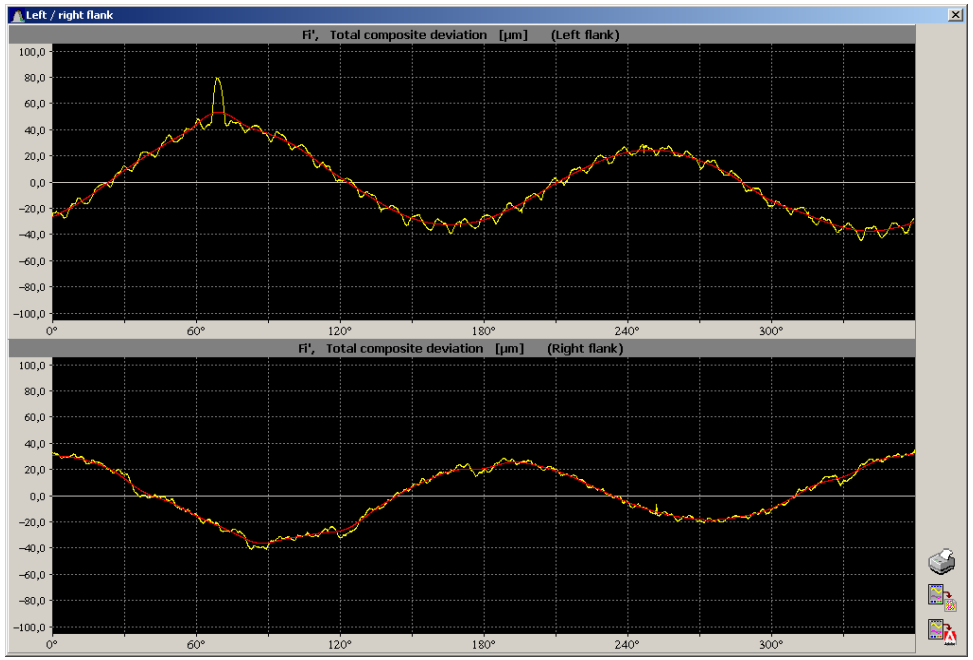
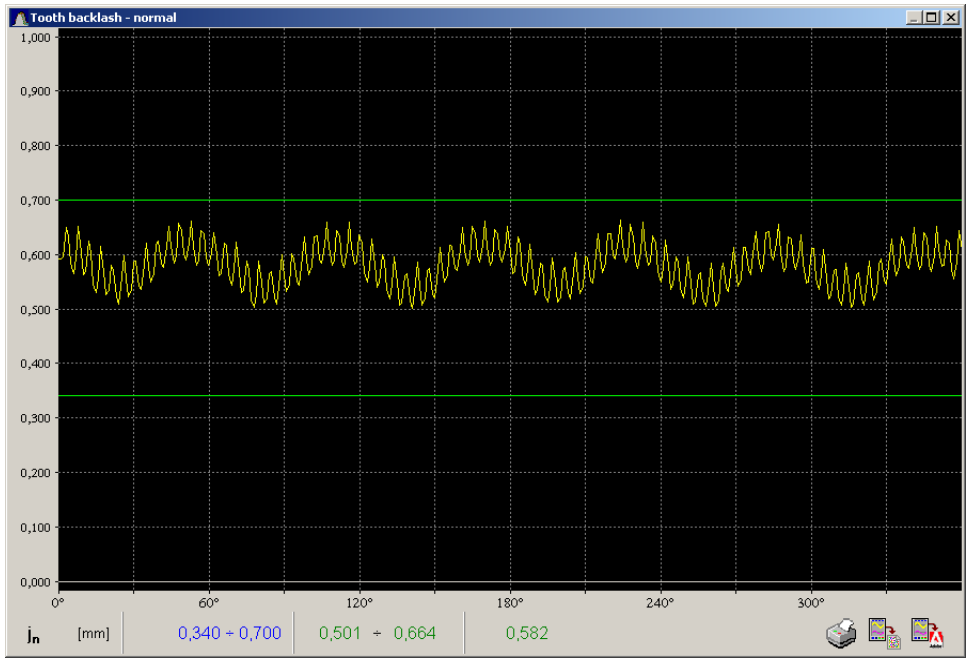
EXAMPLE





RUNOUT AND BUMP

- Diagram of single flank (left and righ flank), gear ratio 19/38
- Relatively large runout of pinion
- Tooth No 8 has a bump on the left flank

BACKLASH

- For one complete rotation of wheel
- Backlash in influenced by pinion runout
- It is also avalable to check value of backlash in a single position

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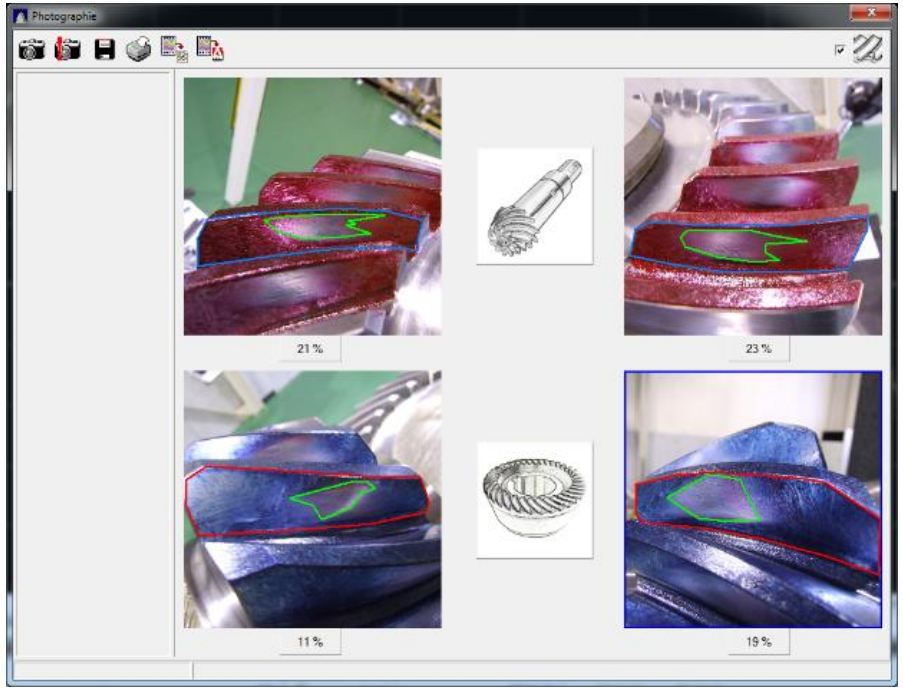
EXAMPLE



Single flank composite measurement, bevel gears

GTB 1250

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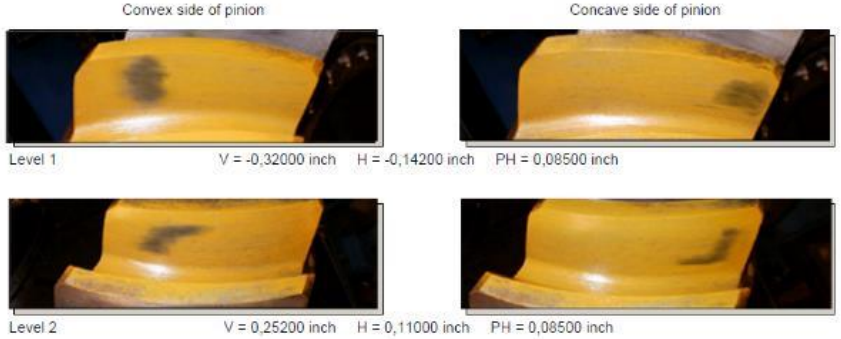
Pinion		246-6762	Wheel		246-6763	Measured revs	4
Number of teeth	z_1	29	Number of teeth	z_2	37	Serial No.	
Transverse module	m_t	22,038	Spiral angle	β_m	23.0000° /L	Contract No.	
Pressure angle	α_n	22.5000°	Hypoid offset	a	0,000 mm	Machine No.	
Spiral angle	β_m	23.0000° /R	Drawing distance	e_1	380,914 mm	Date	12.11.2009 09:47
Load torque		50,00 Nm	Drawing distance	e_2	331,400 mm	Checked by	
Measuring speed		20rpm	Shaft angle	Σ	89.9999°	Note	

V/H cycle



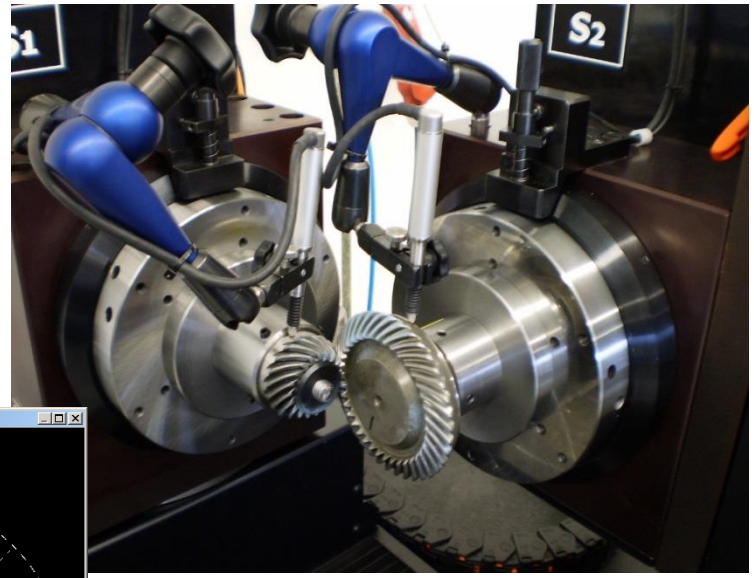
CONTACT PATTERN

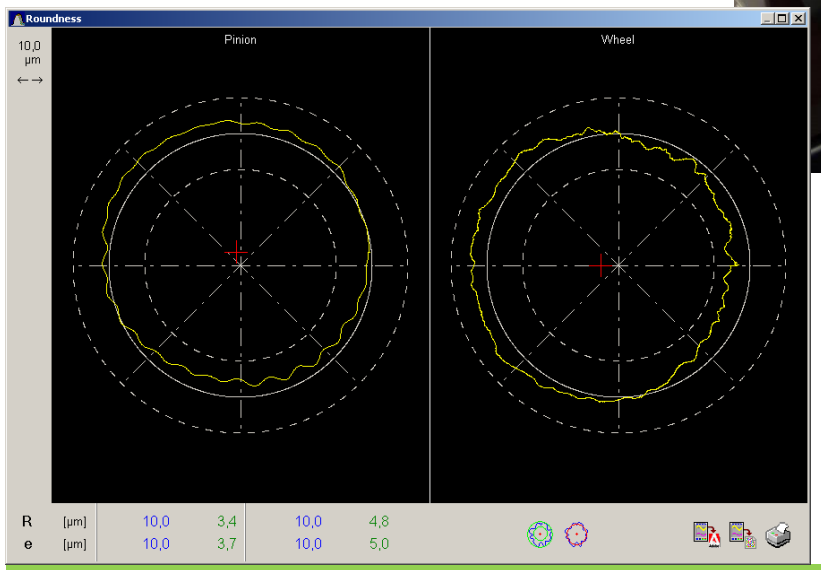
- Stored in a databank with measured resutls
- Ratio of contact pattern surface to total tooth surface in %

V-H CYCLE

- Digital image of contact pattern shown in more positions on pinion and wheel
- Fully automatic cycle

EXAMPLE





ROUNDESS AND ECCENTRICITY

- Measuring of roundness and eccentricity
- Measured eccentricty can be mathematically eliminated from measured results

FFT ANALYSE

- Analysis of measured data and its classification into frequiencies
- Noise analysis

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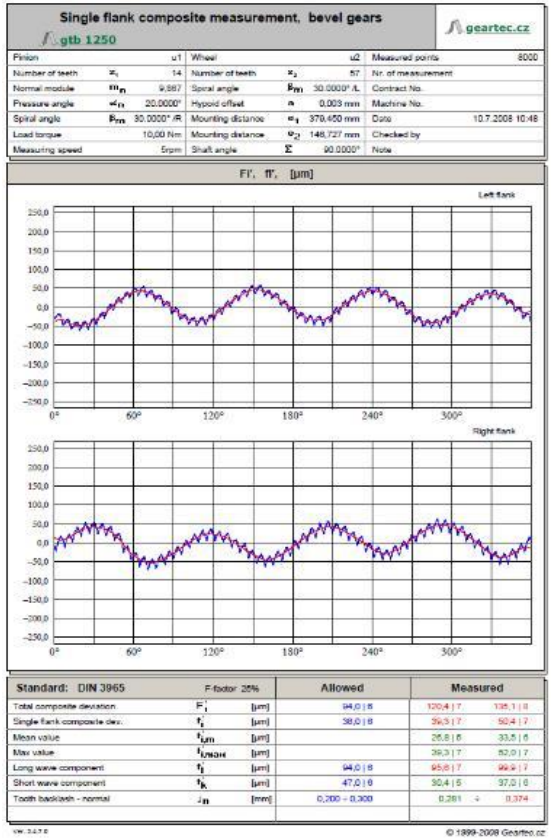
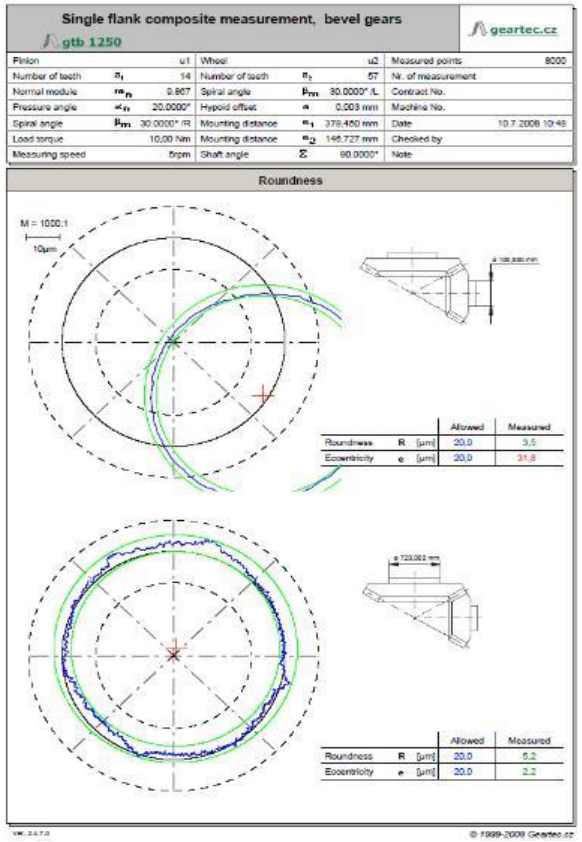
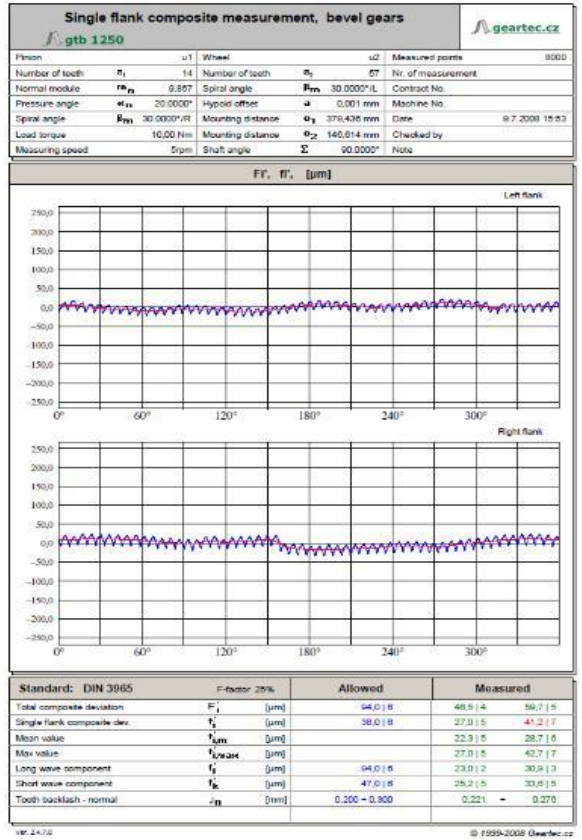
EXAMPLE





Meassured without runout compensation



Meassured with runout compensation

EXAMPLE

QUESTION: which gear causes big deviation on single flank results?

ANSWER: use our decomposition of single flank test

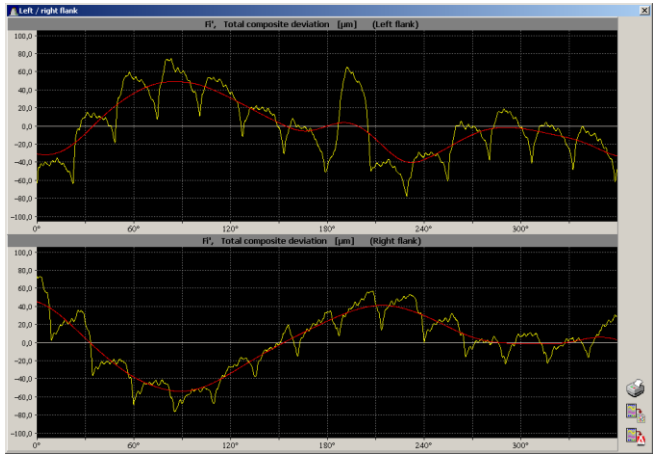
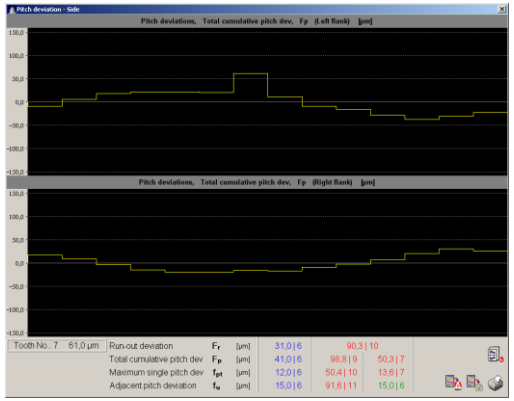
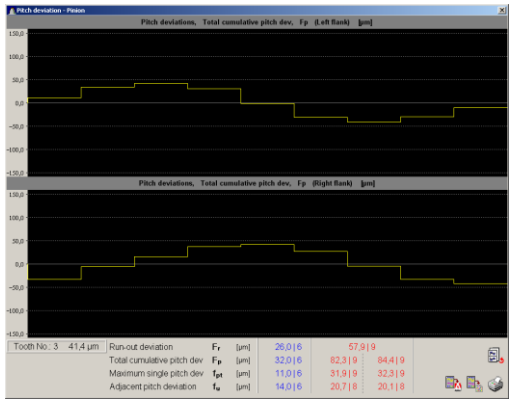


Diagram of single flank (left and right flanks are depicted)

Decomposition



Received diagram of deviations on wheel



Received diagram of deviation on pinion

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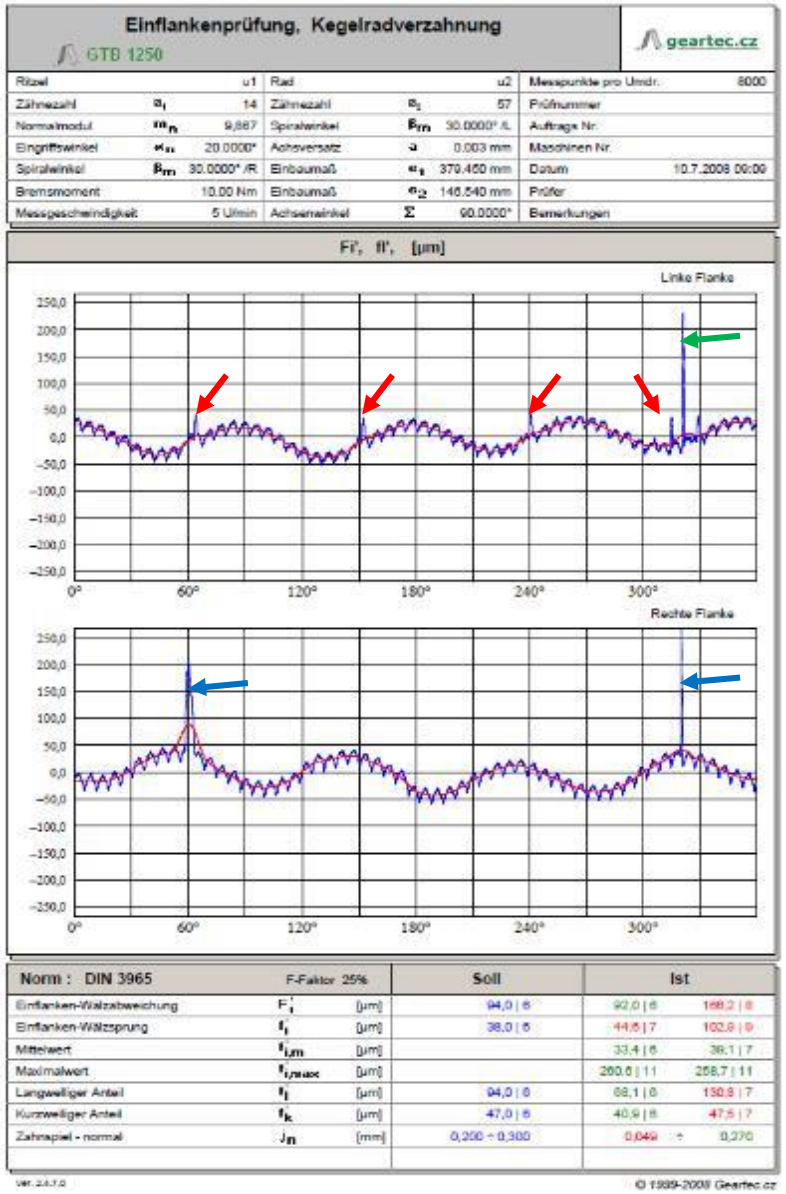
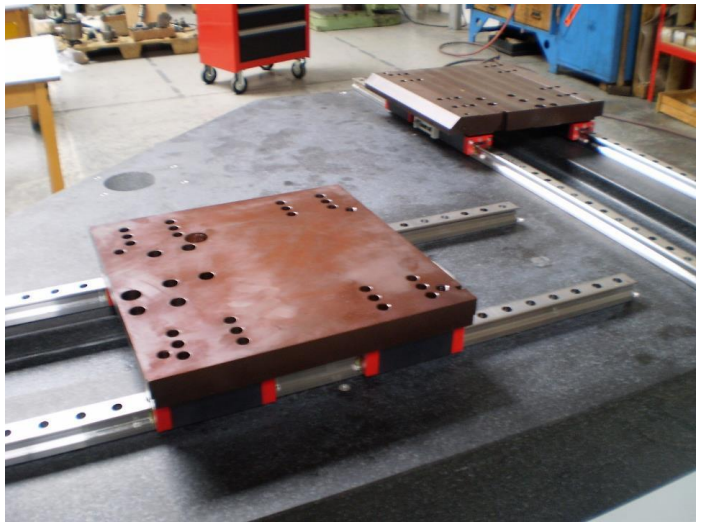
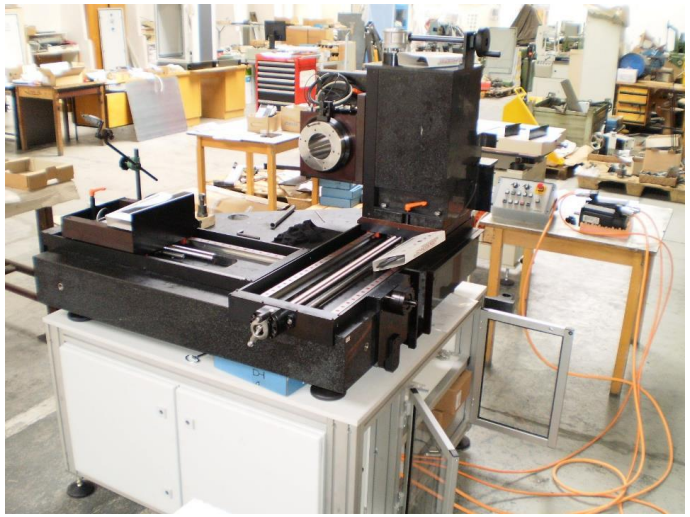
EXAMPLE

- Left flank pinion with radial run-out, red arows point to local damage on pinion,
- Left flank, green arrow points to local damage on wheel,
- Right flank, blue arrows point to local bumps on the right flank of the wheel



ASSEMBLY





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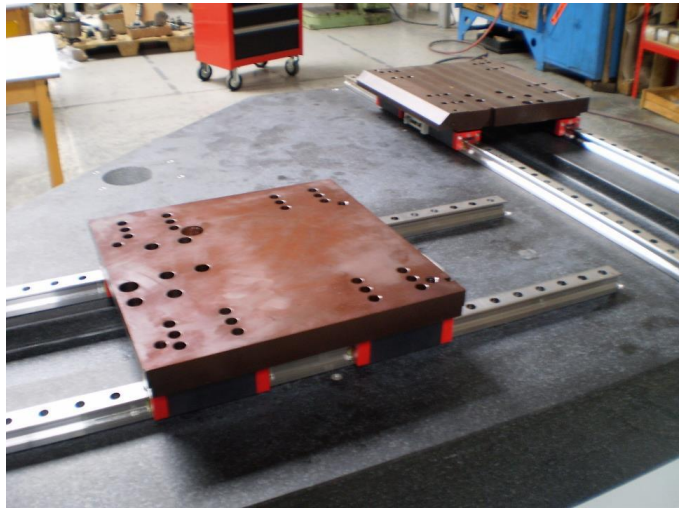
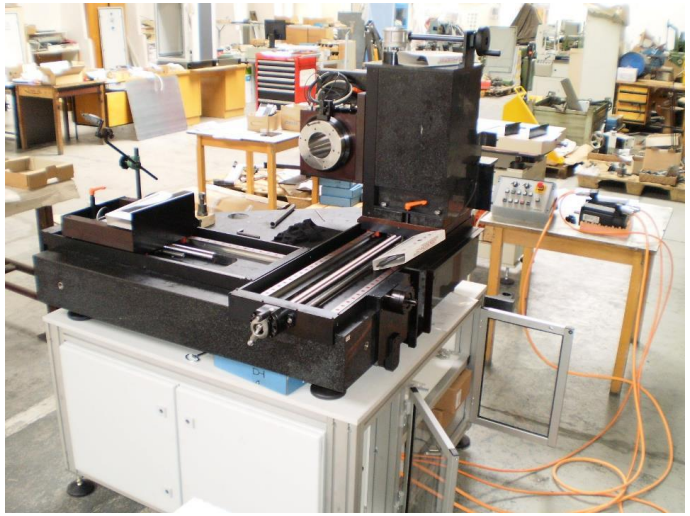
ASSEMBLY



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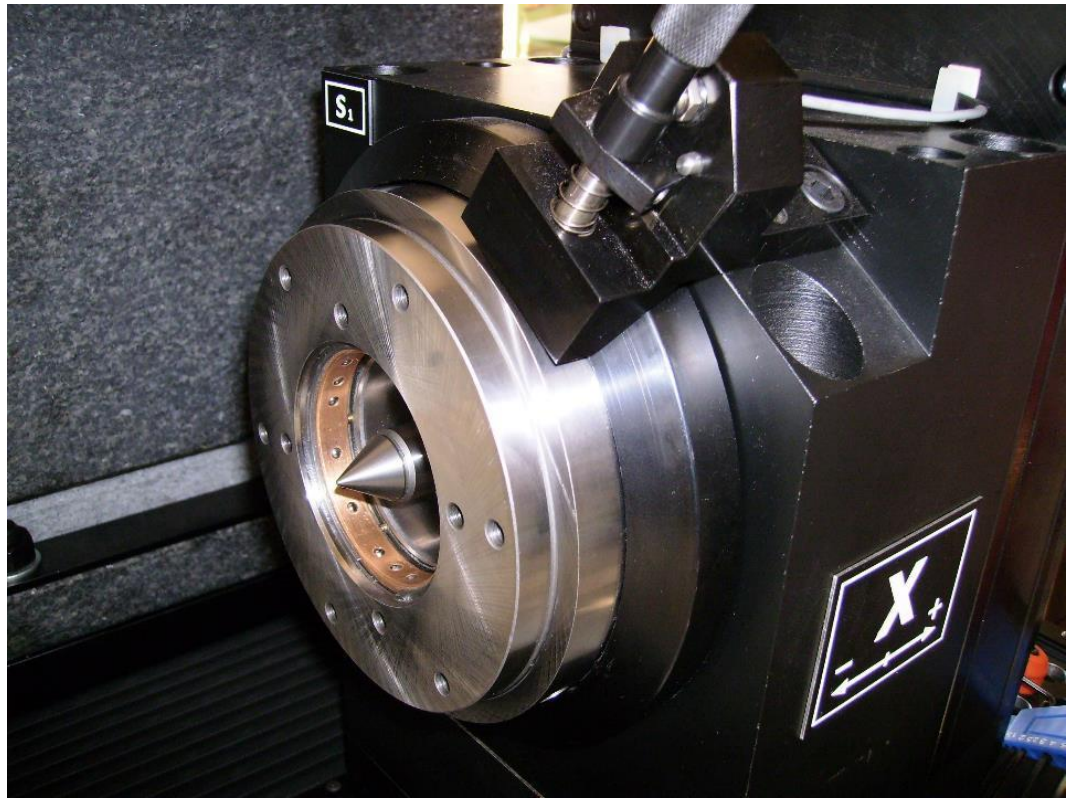
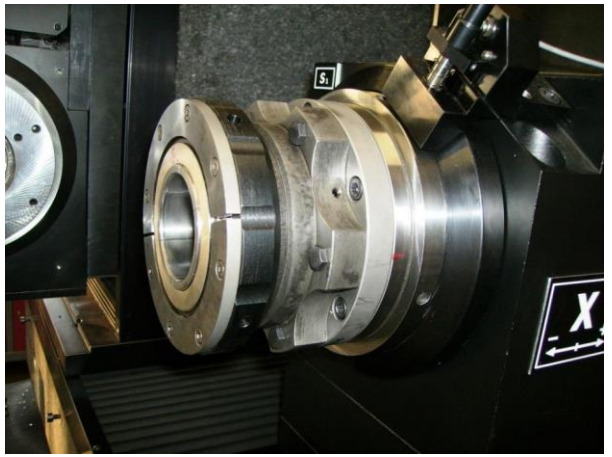
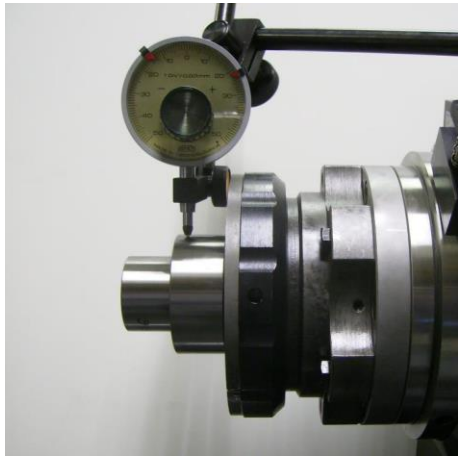
ASSEMBLY – SPINDLE BODIES FOR WHEEL AND PINION



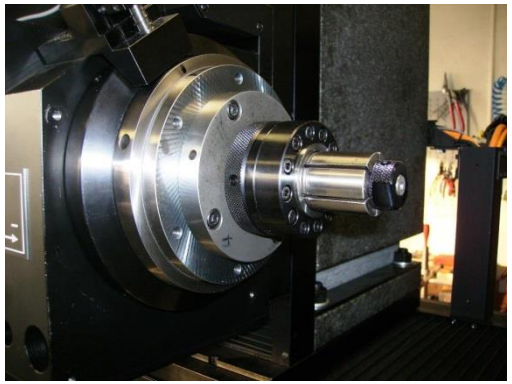
PINION – EXAMPLE OF CLAMPING FIXTURES

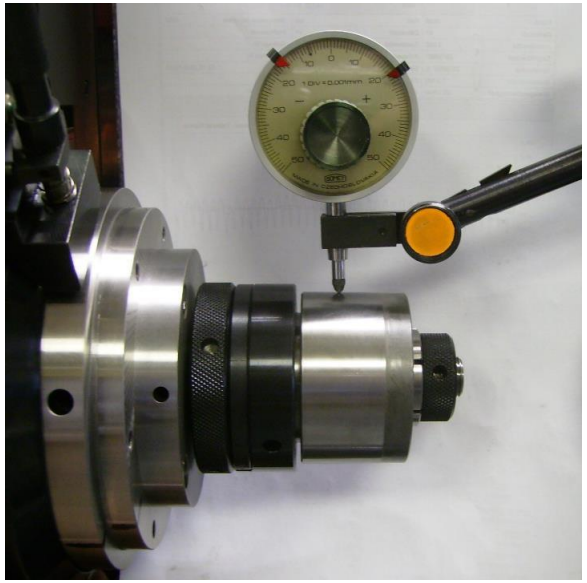




Clamping fictures – customs design

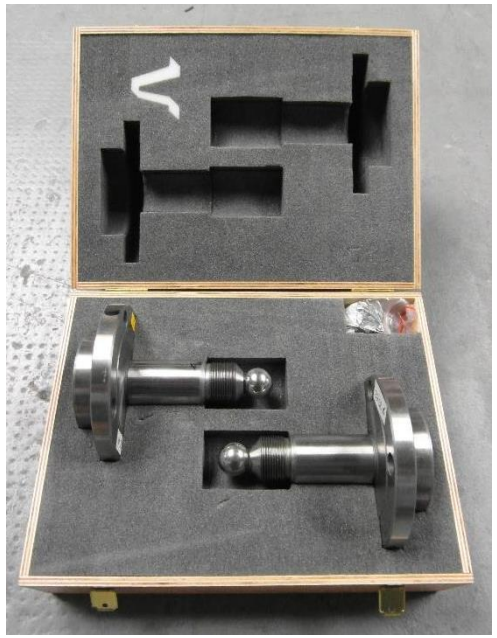
WHEEL – EXAMPLE OF CLAMPING FIXTURES

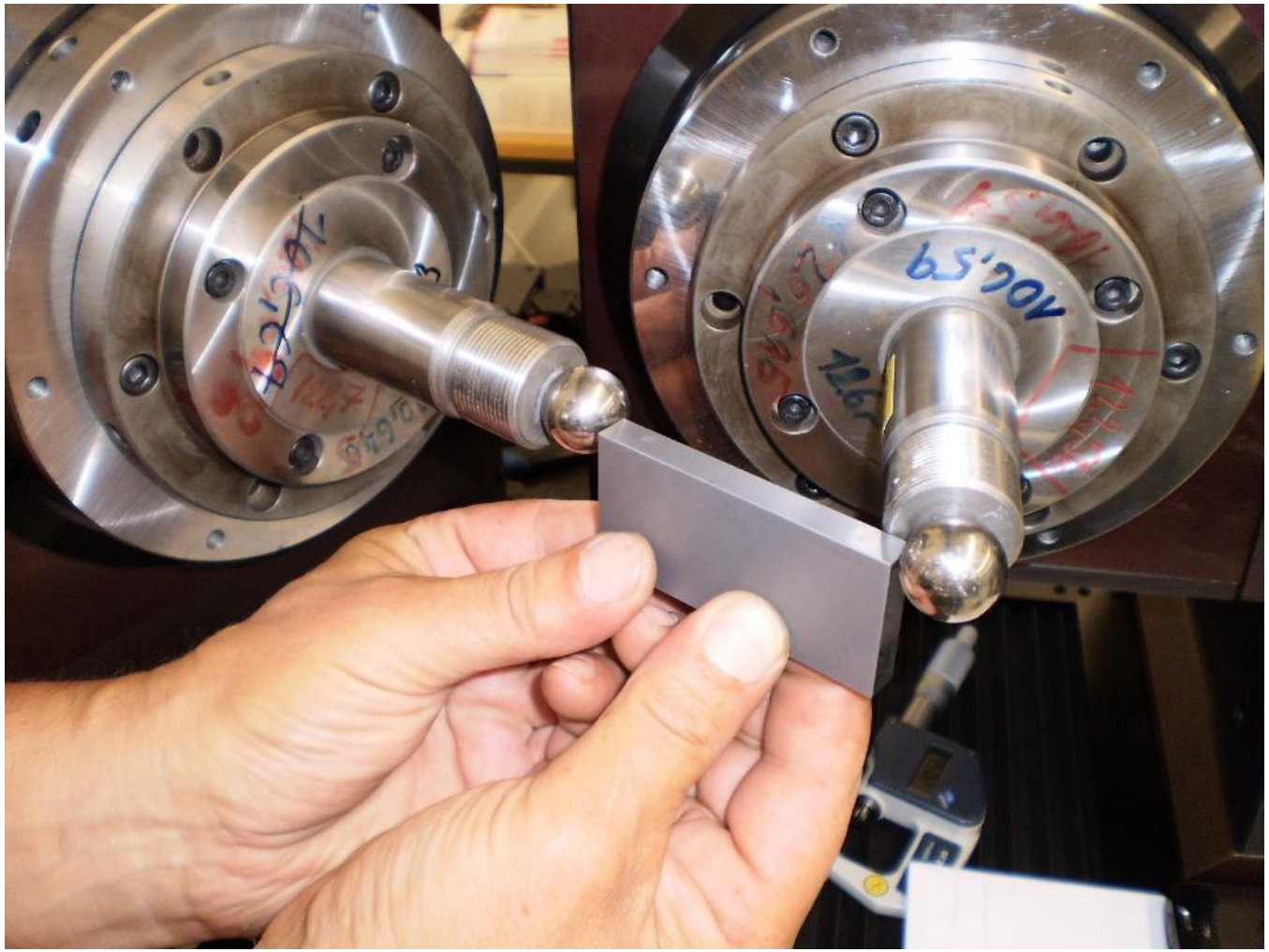




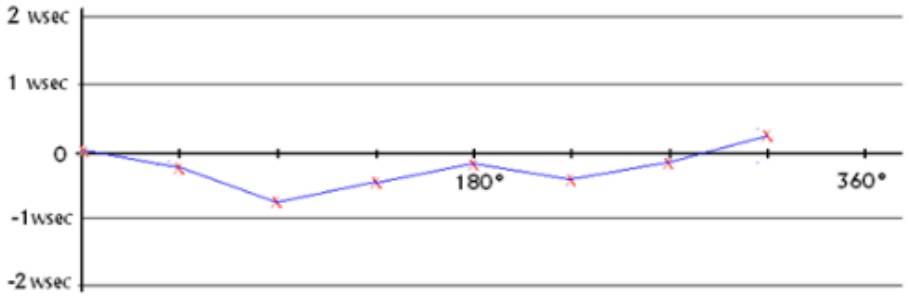
Clamping fictures – customs design

INSPECTION OF MACHINE GEOMETRY ACCURACY





INSPECTION OF ROTARY TABLE ACCURACY



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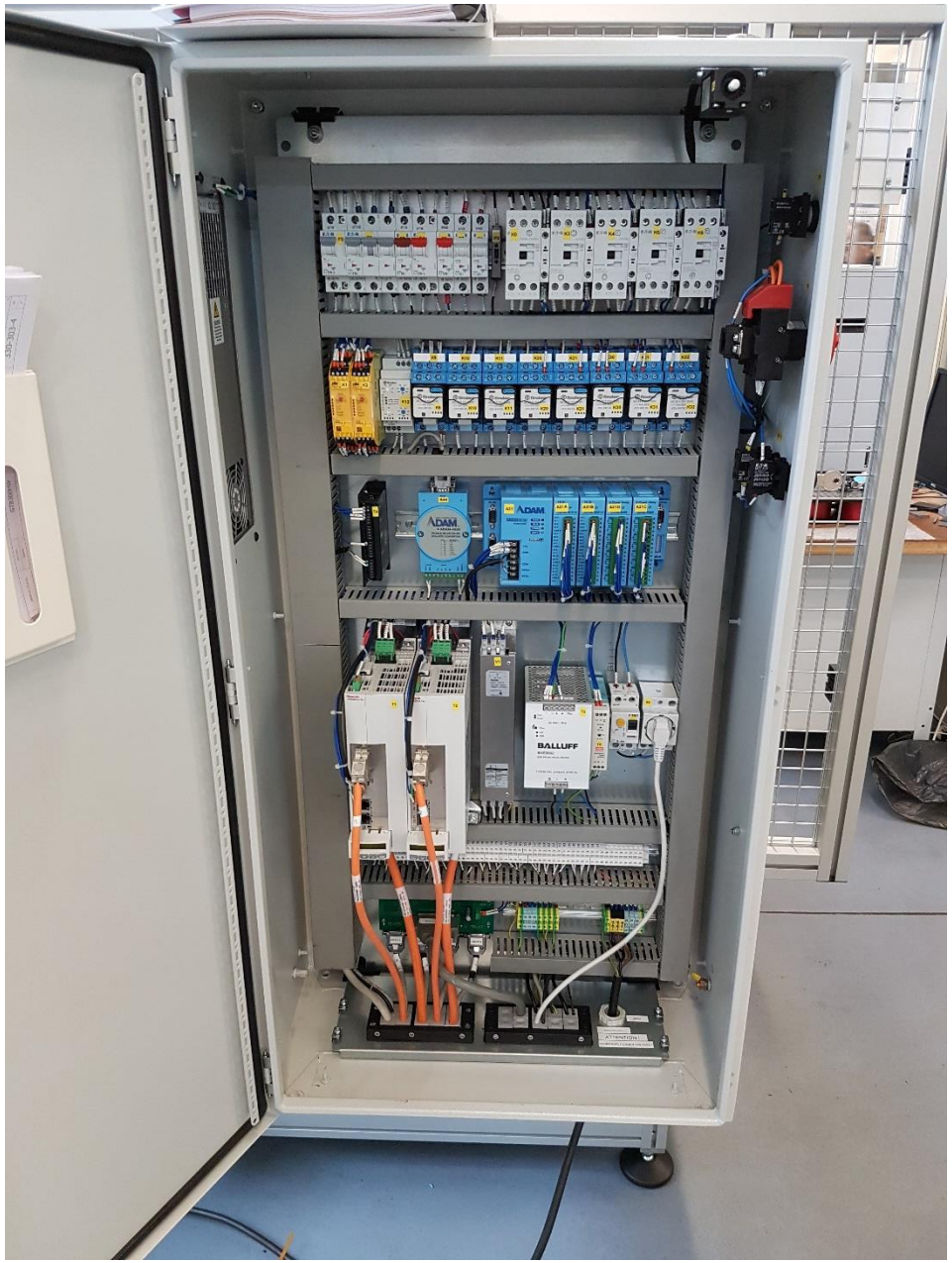
WIRING BOX

- Complete wiring box
- Quality products of EATON, SICK, PILZ …
- Air-conditioned, artificial LED light



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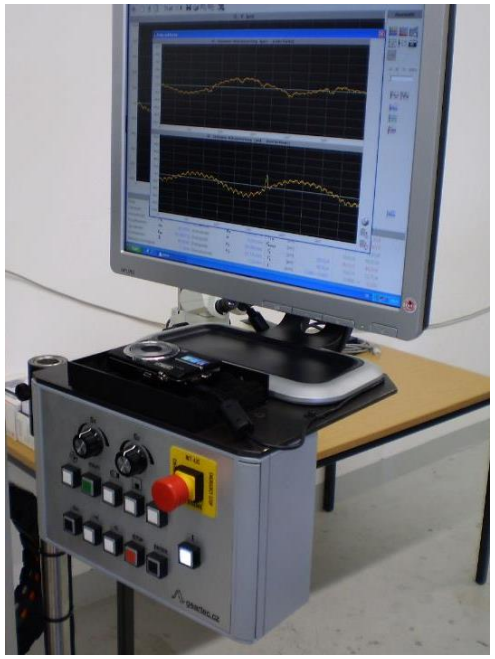
MANUAL PANEL



- Knob for continuos regualtion of motor revolutions in manual mode
- TOTAL STOP button
- Most of functionalities can be controlled on the panel

THANK YOU FOR YOUR ATTENTION

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