

Gear and Spline Inspection according to certified standards
Gear and Spline Technology with Service

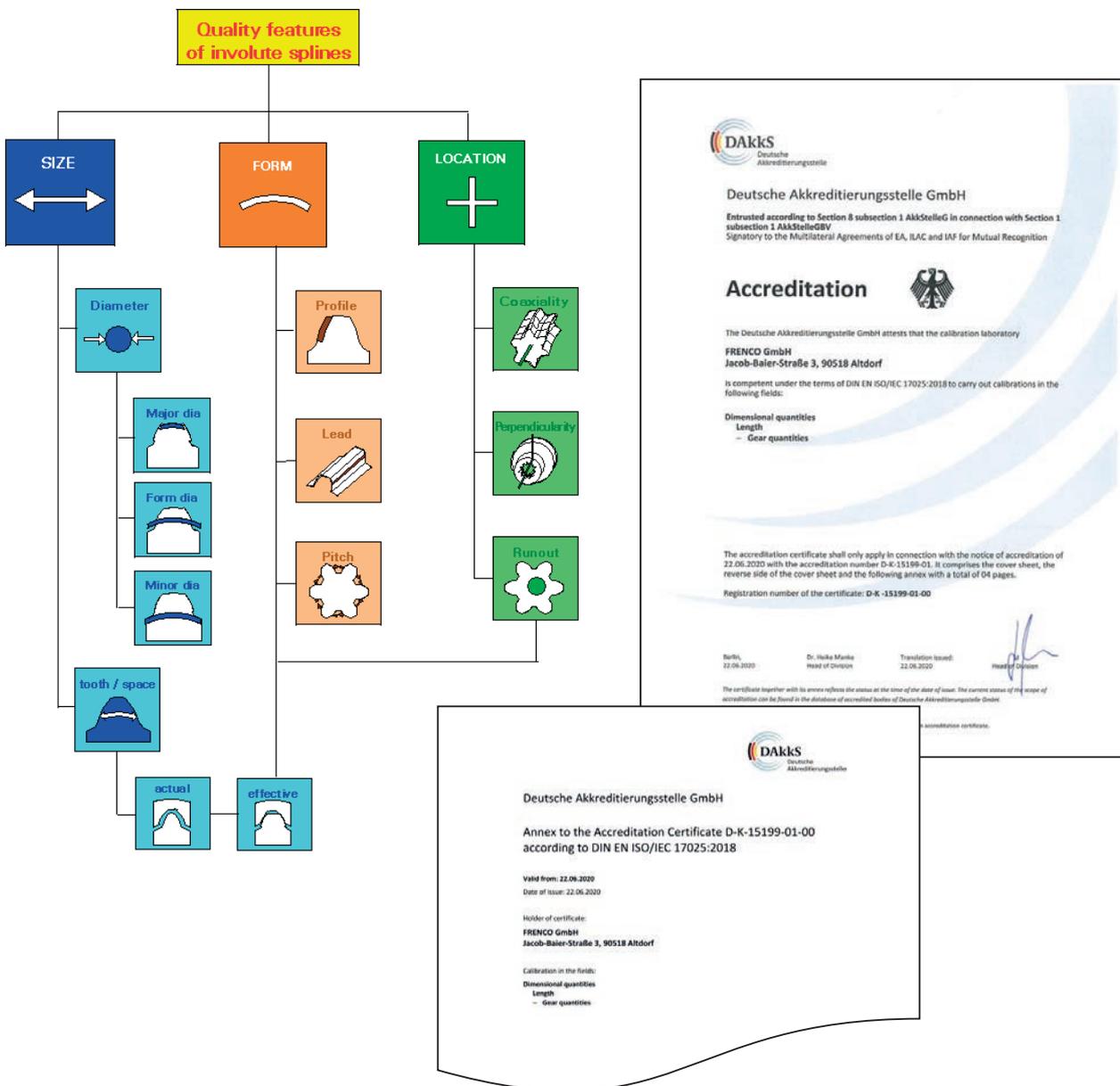
*pure
perfection*

FRENCO

General Information

FRENCO is the first address for gear and spline inspection in Germany. Our equipment enables us to measure nearly all types of gears and splines. A constant room temperature, best quality equipment and top qualified employees guarantee highest precision. The traceability to PTB (the national metrology institute of Germany) verified artefacts - from measuring pins to profile, tooth trace and pitch artefacts - ensure reliable measurement results.

FRENCO's calibration laboratory is awarded accredited conformity assessment body status by DAkkS in accordance with EN ISO/IEC 17025 (registration number D-K-15199-01-00). FRENCO is therefore entitled to calibrate cylindrical gears (all features) and issue a DAkkS calibration certificate. You will receive the most accurate DAkkS calibration throughout Germany.



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Alternate directors Jürgen Stellwag +499187/ 9522-615 js@frenco.de

Monitoring of Inspection Equipment

Scope of services

All measuring and inspection equipment for external and internal gearing, such as gauges, master gears, taper mounting mandrels, instruments for size inspection and others are inspected. Standard monitoring of inspection equipment conforms to the directive VDI 2618 sheet 1 and includes the following services:

- Verification of the number of items delivered
- Cleaning
- Demagnetisation
- Visual inspection for damage
- Determination of the gear and spline data by means of an existing drawing, or
- Determination of the gear and spline data by means of standards, or
- Creation of an inspection equipment drawing (additional charge)
- Removal of smaller damage on the gearing, whenever possible
- Size inspection of the gearing by hand with Abbe length measuring device or the length comparator
- Form inspection such as profile, tooth trace, pitch and radial runout on our measuring machines
- Issuing of an inspection certificate in German or English
- Electronic archiving of the measurement results at **FRENCO**
- Providing the measurement results online at www.frenco.de
- Re-marking (additional charge)
- Verification of workpiece design (on request)
- Packing in a rust protective foil

Note: If the measurement is terminated early due to detection of a feature outside the tolerance, the price will be reduced according to actual time and effort in the calibration laboratory.

Delivery time

Delivery is approx. 2 weeks from receipt of the inspection equipment or measurement items (in Altdorf). The delivery time can be reduced to 3 working days (surcharge). Please get in touch with one of the left mentioned contacts for more details. Delivery for DAkkS calibrations is approx. 10 weeks from receipt (in Altdorf). Shorter delivery times are also possible on request.

Documentation

An inspection certificate is issued for each inspection object. This includes:

- Inspection equipment data, nominal sizes, actual sizes and the overall evaluation on the first page.
- Depending on the delivery volume and type of instrument, the graph of the gear inspection centre including profile and tooth trace, pitch and radial runout on the inside pages.
- Explanation abbreviations, traceability and measurement uncertainties on the last page.

Delivery

We kindly ask you to send the measuring instruments to us free of charge and to ensure that the goods are packed accordingly in order to avoid damage. Goods will be returned ex works via parcel service. Please inform us, if required, of preferred carrier.

Workpiece Inspection

Workpieces gearing can be inspected in a number of ways:

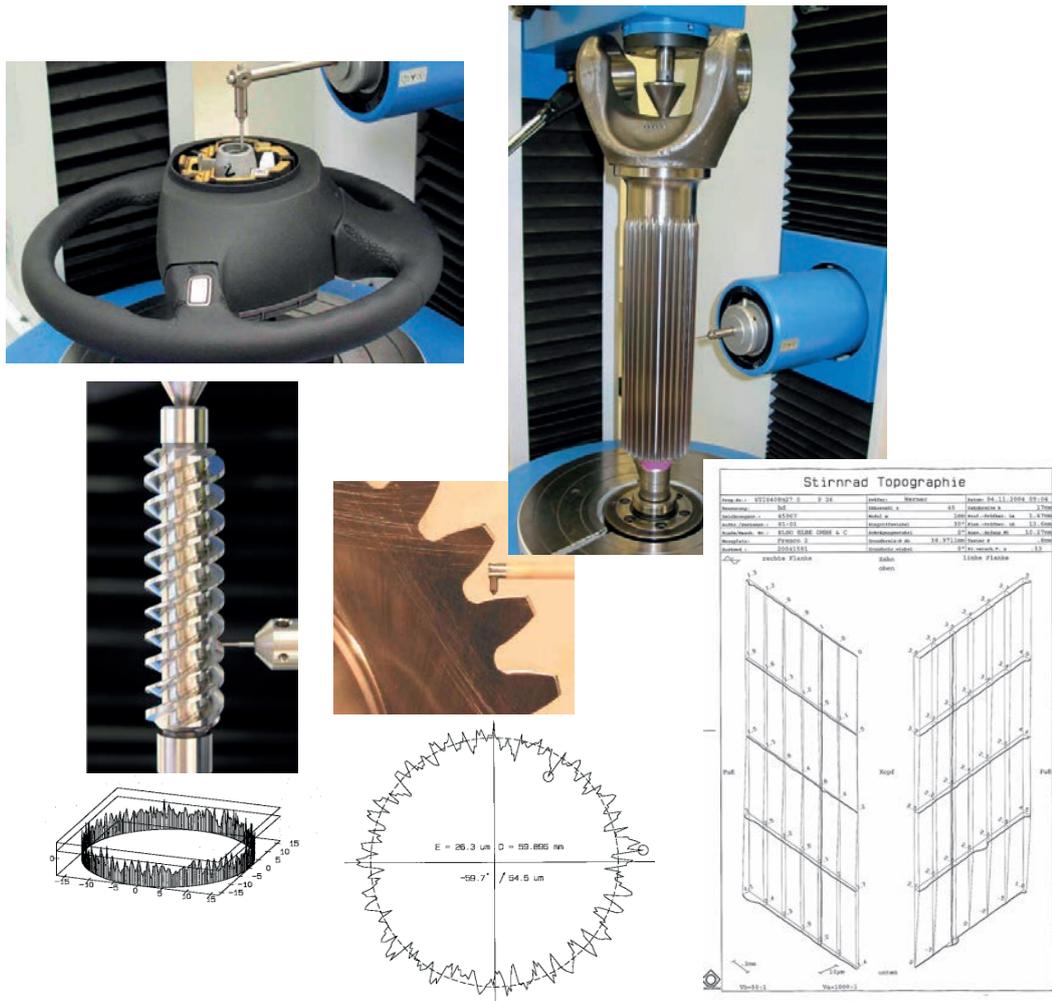
- Individual form inspection on gear measuring machines (profile, tooth trace, pitch and radial runout)
- Double flank gear test on a FRENCO gear tester. A master gear and clamping equipment is required.

Individual form inspection can be carried out on external and internal gears as well as involute, serration and straight-sided splines. We can inspect the following workpieces:

- **Max. diameter of workpiece:** 400 mm (worm gears 260 mm)
- **Max. length of workpiece:** 650 mm
- **Max. vertical measuring range:** 500 mm
- **Min. module:** 0.1 mm (0.3 mm internal gears)

Additional possible measurements:

- Position of functional faces (circles, cylinders, plan faces etc.) in reference to the gear/spline axis
- Topography of individual teeth or 'All-tooth-measurement'
- Roughness and contour measurements



Online Inspection Certificate

The screenshot shows the FRENCO website interface. At the top, there is a navigation bar with links for Home, Sitemap, T&C, Contact Us, Legal Notice, and a search box. Below this is a secondary navigation bar with links for About Frenco, Product Groups, Downloads (highlighted), News/Events, and DAMS. The main content area is titled 'Downloads' and features a large green arrow pointing down next to the FRENCO logo. To the right of the logo, the company's address is listed: FRENCO GmbH, Jakob-Baier-Straße 3, 90518 Ahdorf, Germany. Below the address, contact information for Jan Kühn, Quality & DAMS Manager, is provided, including phone, fax, and email addresses. The central focus is the 'Inspection certificate' download section, which includes instructions on how to use the form and a sample certificate. The sample certificate is titled 'Certificate new condition' and contains the following data:

name	sign	date	customer
Technician	j	06.08.2014	Customer X
order number	record id	drawing number	
20132725	162207	4711 00 11 08	
customer part no.	ind.11	serial part no.	
4711.001.054		08-01	
part name	Mastergear m1,2 - α20° - z41 - 018°44'23"R - B - DIN3970 - Sn = 1,8844		
*) The labelling on the master gear corresponds to the new condition.			
	size and tolerance [mm]	actual size [mm]	
major diameter	54.000 -0.030	53.978	

Below the sample certificate, there is a form for downloading a certificate. It includes input fields for 'Order number:' (with the value 20132725), 'Dataset ID:' (with the value 162207), and a 'Result of 3 - 18 =' field. A 'Download certificate' button is located at the bottom of the form.

The inspection certificates for inspection equipment and workpieces calibrated by FRENCO, can be downloaded in PDF format from our website. A detailed description can be found on www.frenco.de.

Note:

Before destroying the paper certificate, please save the record ID and order number. Without these the online certificate cannot be retrieved.



DAkKS Calibration of Artefacts...

FRENCO's calibration laboratory is awarded accredited conformity assessment body status by DAkKS in accordance with EN ISO/IEC 17025 (registration number D-K-15199-01-00) for all essential gear features.

Tooth trace artefacts and involute artefacts as well as pitch artefacts and artefacts for pitch, radial runout and dimension over measuring circle can be DAkKS calibrated.

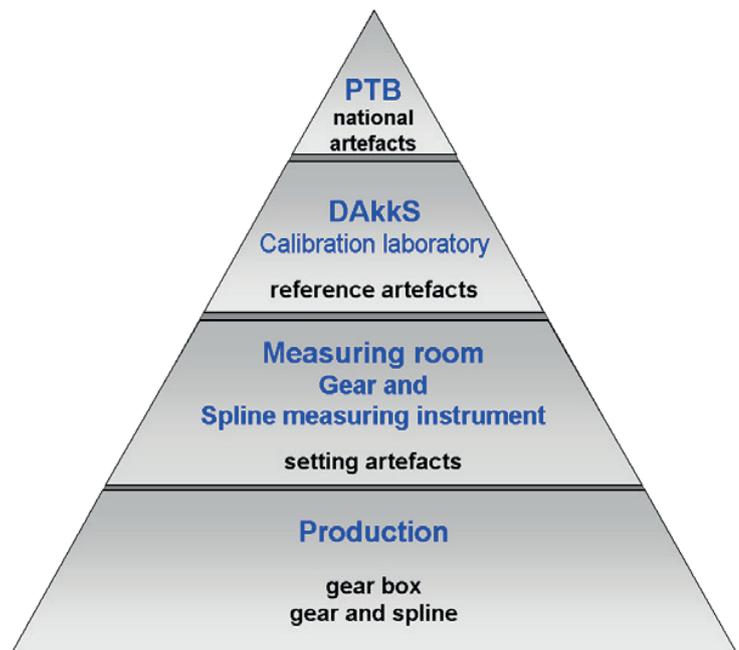
The accreditation is valid for the most commonly required measuring ranges. Details of the accreditation range can be found on www.dakks.de.

Artefacts which are outside this accreditation range can be factory calibrated.

The customer will receive a (DAkKS) calibration certificate (multiple pages) with explanations regarding the measuring method, information on the location determination of the measured item and of course with specification of the measurement uncertainties



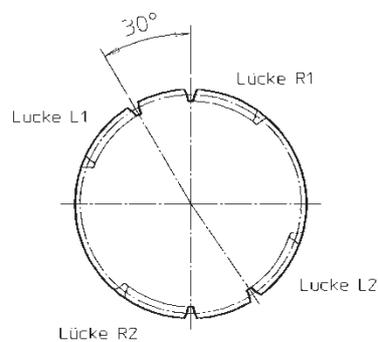
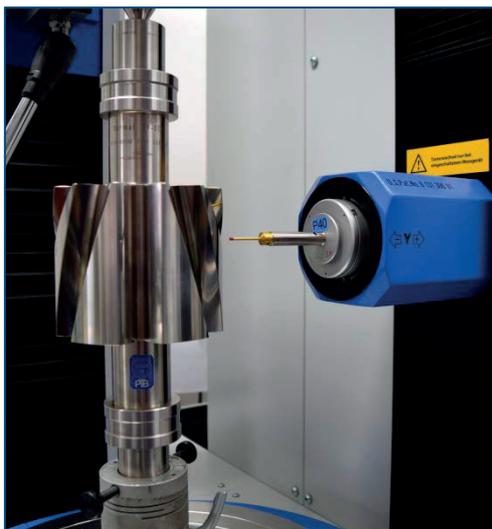
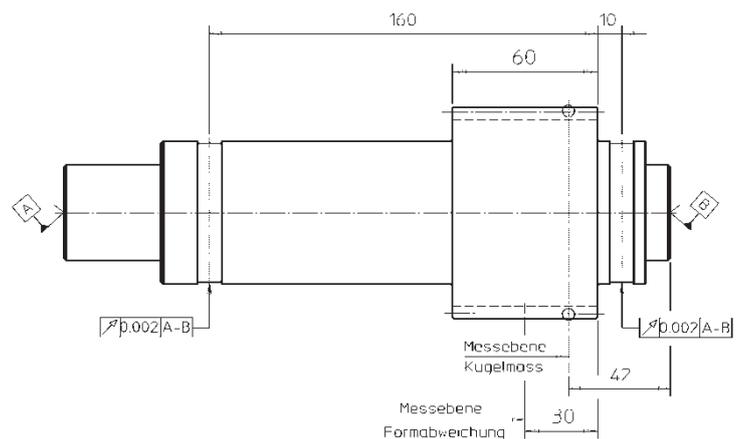
Traceability



... and IC Artefacts

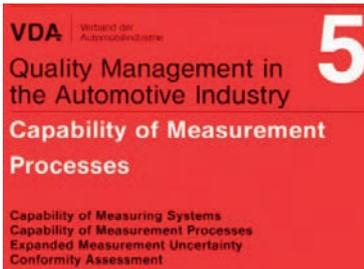
The smallest measuring uncertainty to be specified depends on the size of the artefact. Measuring uncertainty of DAkkS calibrations lies within the following range:

	U (k=2)	U (k=2)	U (k=2)
Profile	F_{α} : 1.1 – 1.8 μm	$f_{H\alpha}$: 0.9 - 1.6 μm	$f_{r\alpha}$: 0.6 μm
Tooth trace	F_{β} : 1.1 - 1.8 μm	$f_{H\beta}$: 0.9 – 1.6 μm	$f_{r\beta}$: 0.7 μm
Pitch/radial runout	F_p : 0.7 μm	f_p : 0.6 μm	F_r : 1.0 μm
Size over measuring circles	M_{dk} : 1.2 μm		



VDA-5 – Certificate for Measuring Instruments

On request FRENCO issues a VDA-5 certificate for all measuring instruments. This certificate is designed according to VDA 5 and contains the measuring uncertainty of the measuring system. It enables an easier determination of the measuring uncertainty of the inspection process in accordance with VDA 5, as the measuring uncertainty of the inspection instrument only has to be inserted. Moreover, parameters such as Q_{MS} , $TOL_{MIN-UMS}$, C_{gk} and C_g - which are also indicators for the gauge capability of an instrument - are listed on the certificate.



Uncertainty of the measuring system U_{MS} according to VDA 5

FRENCO GmbH Jakob-Baier-Strasse 3 90518 Altdorf Tel.: +49 9187 9522-0 Fax: -40 www.frenco.de

FRENCO		VDA-5 Certificate		27.09.2013
acc. to VDA 5 (2. Edition Update 2011)		Proof of Measurement System Capability		Inspector: Frenco Prüfer
Drawing No.: 61046 10 00 00	Part No.: 01	Type: VMF 1x1	Customer: Musterkunde	Order number: 20134711
U = 23,4025		L = 23,3483	TOL = 0,054	
%RE Resolution of indicator U_{RE}				
Resolution: 0,001 (=half scale division)				
Resolution RE in %: 1,8% i.O. => no ure				
if Resolution RE > 5 % than calculate U_{RE}				
		$U_{RE} = 0,00 \mu m$		
Calibration uncertainty U_{CAL}				
Measuring uncertainty of setting-master (ref. certificate):				
Drawing No.: 61046 11 03 00 Teil 01		$U_{CAL} = 2 \mu m$		
		$k_{CAL} = 2$		
$U_{CAL} = 1,00 \mu m$				
Repeatability on reference standard U_{EVR}				
25 repeat measurements on setting ring including probe [μm]:				
1...5	0,0	0,0	-0,1	-0,2
6...10	-0,1	-0,1	0,0	0,0
11...15	0,0	0,0	0,0	0,1
16...20	0,2	0,3	0,1	0,0
21...25	-0,1	-0,2	0,1	0,2
$s_g = 0,138$ C_g, C_{gk} without RE acc. to VDA 5 (2.2011.)				
Resolution of Probe: 0,0001 $C_g = 19,57$				
Proportion: Resolution / $s_g > 2$? yes, it follows $uw=sg$ 0,03 $C_{gk} = 19,50$				
$U_{EVR} = 0,14 \mu m$				
Uncertainty from linearity and bias U_{BI}				
Normal	Actual value x_{a0} in mm	Measurement x_g [mm]	Deviation [μm]	
x_{me1}	23,4025	23,4028	0,3	
x_{me2}	23,4025	23,4031	0,6	
x_{me3}	23,4025	23,4031	0,6	
x_{me4}	23,4025	23,4030	0,5	
x_{me1}	23,3754	23,3750	-0,4	
x_{me2}	23,3754	23,3753	-0,1	
x_{me3}	23,3754	23,3755	0,1	
x_{me4}	23,3754	23,3754	0,0	
x_{m1}	23,3483	23,3480	-0,3	
x_{m2}	23,3483	23,3478	-0,5	
x_{m3}	23,3483	23,3479	-0,4	
x_{m4}	23,3483	23,3478	-0,5	
$u_{BI} = 0,29 \mu m$				
Uncertainty form dial indicator U_{MS_REST}				
Dial indicator missing - set to "0": 0 μm -				
U_{MS_REST} has to be added by the customer! 0 μm				
factor 0.58 $U_{MS_REST} = 0,00 \mu m$				
Expanded uncertainty U_{MS}				
$U_{MS} = k \cdot \sqrt{U_{RE}^2 + U_{CAL}^2 + U_{EVR}^2 + U_{BI}^2 + U_{REST}^2}$ $U_{MS} = 2,10 \mu m$				
Capability ratio Q_{MS} $Q_{MS_max} = 20\%$ $Q_{MS} = 8\%$				
$Q_{MS} \leq Q_{MS_max}$? MS capable				
Minimum possible tolerance $TOL_{MIN-UMS}$				
$TOL_{MIN-UMS} = \frac{2 \cdot U_{MS}}{Q_{MS_max}} \approx 100\%$ $TOL_{MIN-UMS} = 0,021 mm$				



U_{RE}



U_{CAL}

U_{EVR}

Resulting from 25 repeat measurements (Incl. C_g and C_{gk})



U_{BI}



U_{REST}

27.09.2013 Inspector: Frenco Prüfer Signature



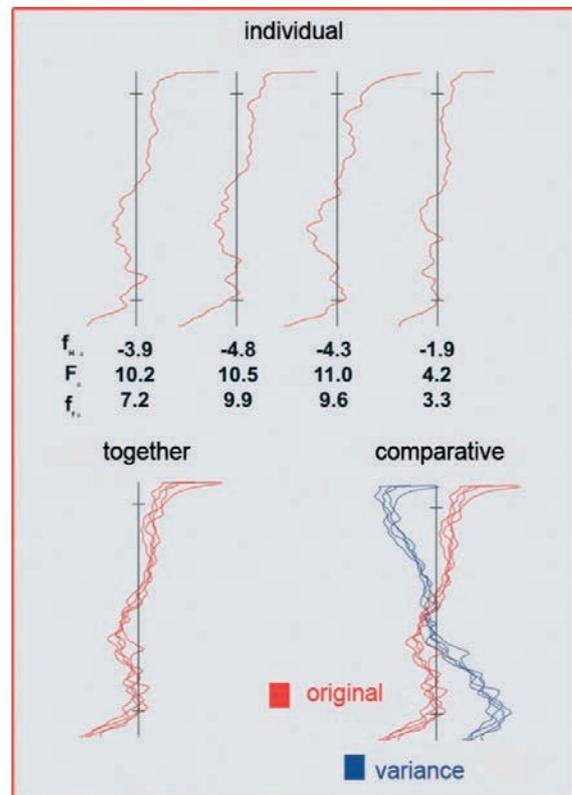
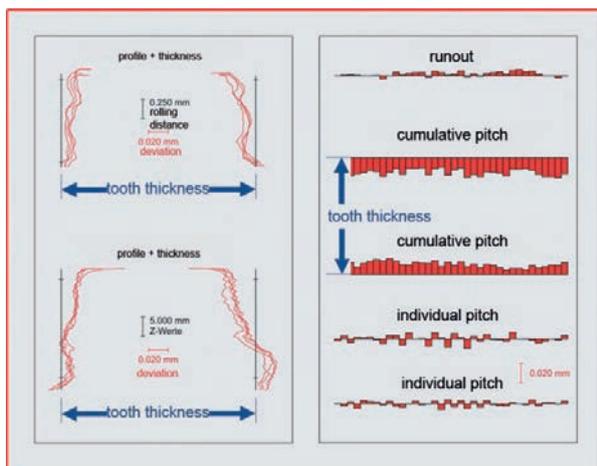
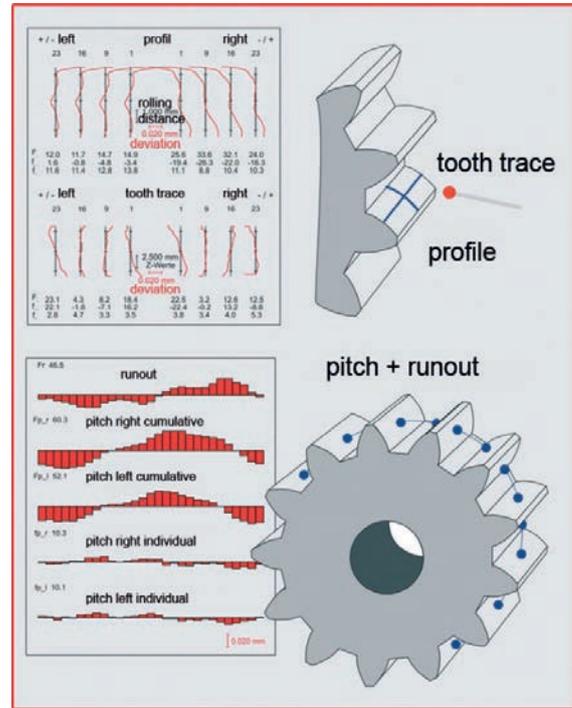
Deviation Analysis

The measuring results from gear measurements taken on-site are digitally filed and can be used in a gear and spline analysis program.

This program can be used to:

- change the position of axis
- overlay multiple measuring results for comparisons,
- select representations depending on the tooth thickness,
- correct machine settings (profile grinding),
- detect disturbances in the production process,
- simulate changes of the gear and spline data,
- generate new gear and spline data.

This analysis program helps to understand correlations, find reasons for and detect sources of faults. Moreover, it features the ability to change parameters quickly and interactively. The most important feature is, however, that the data output will be given in a way familiar to the user, as a measuring result.



'All-Tooth-Measurement' with REANY Evaluation

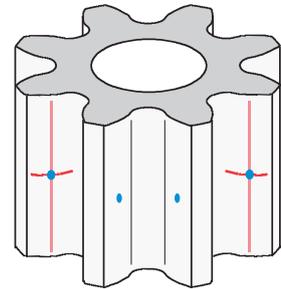
What is an 'all-tooth-measurement'?

An 'all-tooth-measurement' is defined here at FRENCO's as the capture of several profiles and tooth traces of **all** teeth. This means nearly the entire gear or spline is measured. The relation between the flanks is maintained, which is the main difference to topography, where individual teeth without any reference to each other are included.

What is a REANY evaluation?

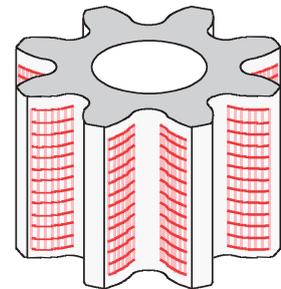
REANY is short for **reality analysis**. It is a novel evaluation method of topological deviations of the tooth flanks. This method allows, for example, an evaluation of dimensional deviations and pitch deviations along the entire face width. It is also possible to determine the positional deviation of the wheel axis, to eliminate deviations via the software and to receive an unprecedented wealth of information with just one single measurement.

Common Measurement

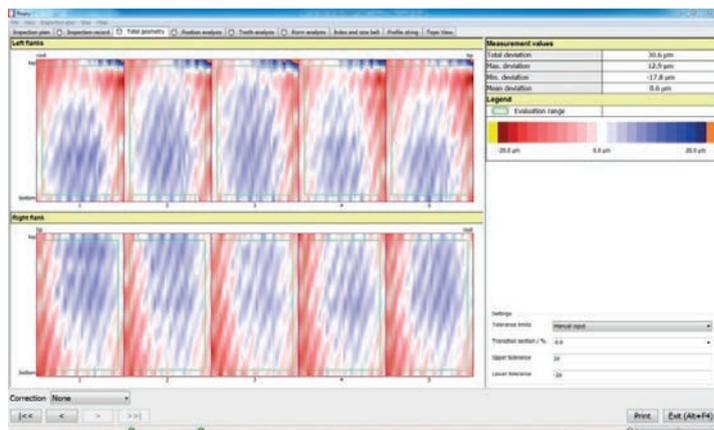


measured profile,
tooth trace
and pitch

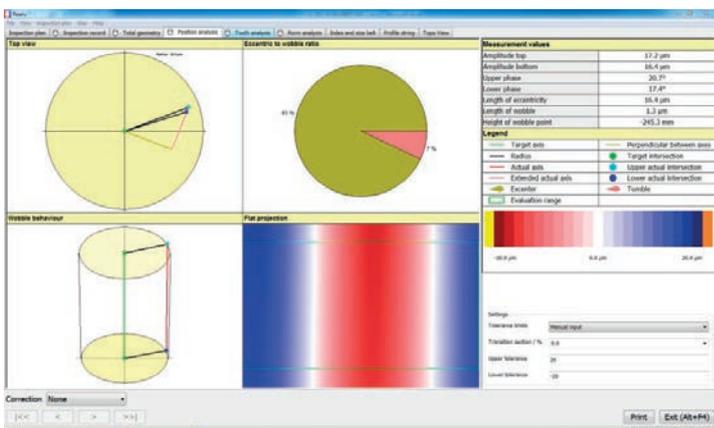
Measurement of all teeth



measured profile
and tooth trace



Topological deviations of all tooth flanks

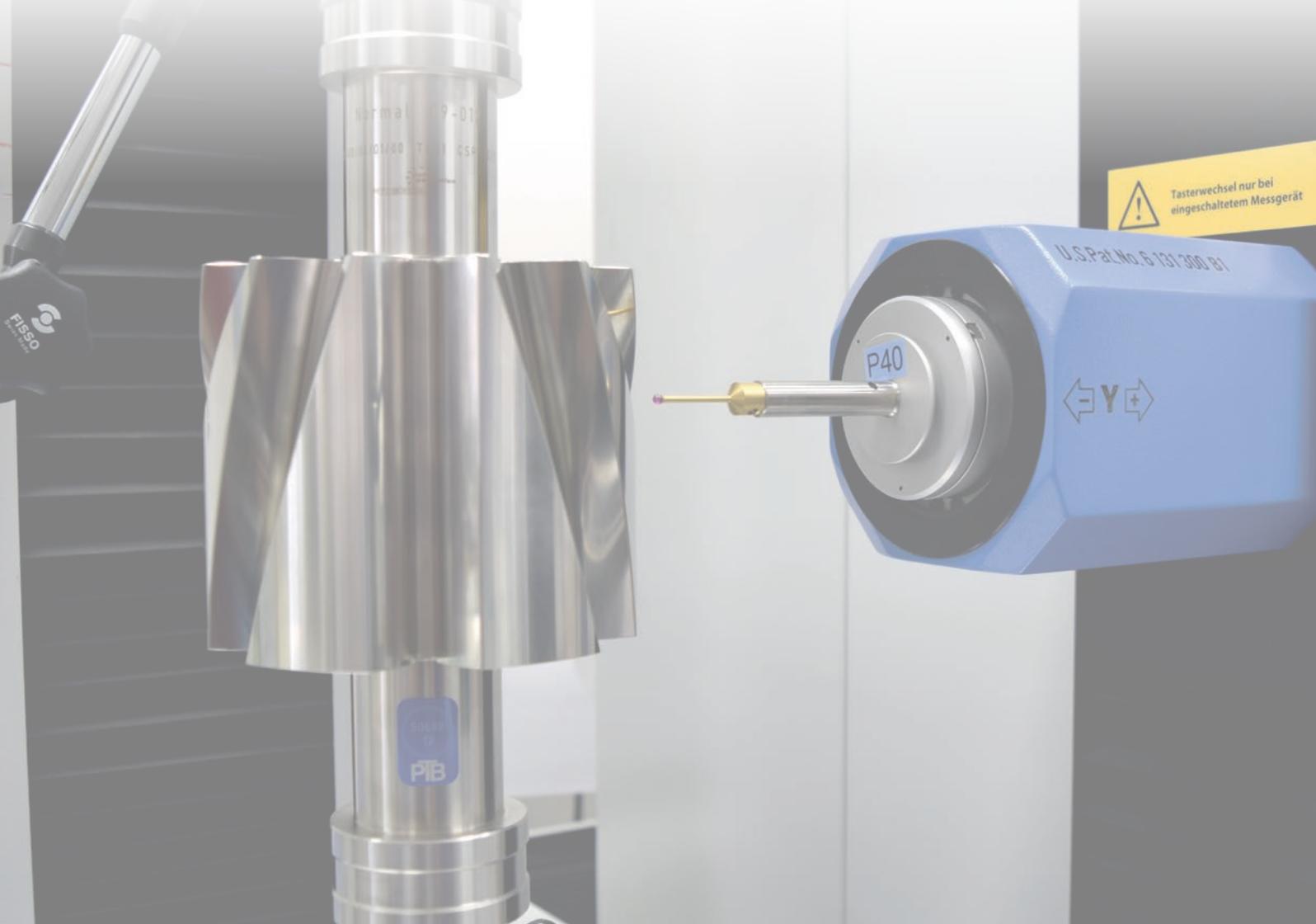


Eccentric or wobble? How big is the influence of the positional deviation? REANY will let you know

The long measuring time is worth every second!

A total error inspection, like a double flank gear rolling inspection, is often carried out in production environments. If parts are rejected a cause must quickly and precisely be identified. The usual sampling inspection soon reaches its limits and additional measurements are required. The long measuring time is worth every second, thanks to REANY. You will learn everything about the inspected item with brand new representations and possibilities.

Comprehensive and individual consultation is included when placing an order with FRENCO.



Pure Perfection. Since 1978.

Experience, competence and innovation in gear metrology.



Our Products:

Spline Gauges | Toothed Artefacts and Masters | Master Gears |
Tools and Clamping Systems | Size Inspection Instruments |
Double Flank Gear Inspection | Gear Flank Analyser | Universal
Measuring Machines | Rack Inspection Machines | Software

Our Services:

DAKKS Calibration | Gear and Spline Inspection |
Gear and Spline Manufacturing | Seminars | Service |
Support and Calculation

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