



Gear and Spline Inspection according to certified standards

Gear and spline
technology with service

pure
perfection



Deutsche Akkreditierungsstelle GmbH

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV

Signatory to the Multilateral Agreements of
EA, ILAC and IAF for Mutual Recognition

Accreditation



The Deutsche Akkreditierungsstelle GmbH attests that the calibration laboratory

Frenco GmbH, Verzahnungstechnik, Messtechnik
Jakob-Baier-Straße 3, 90518 Altdorf

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out calibrations in the following fields:

Dimensional Quantities
Length
- Gear Quantities

The accreditation certificate shall only apply in connection with the notice of accreditation of 07.03.2012 with the accreditation number D-K-15199-01 and is valid until 06.03.2017. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 4 pages.

Registration number of the certificate: **D-K-15199-01-00**

Braunschweig, 07.03.2012


Dr. Michael Wolf
Head of Division

This document is a translation. The definitive version is the original German accreditation certificate.
See notes overleaf.



Deutsche Akkreditierungsstelle GmbH

Anlage zur Akkreditierungsurkunde D-K-15199-01-00
nach DIN EN ISO/IEC 17025:2005

Gültigkeitsdauer: 07.03.2012 bis 06.03.2017

Urkundeneinhaber:

Frenco GmbH, Verzahnungstechnik, Messtechnik
Jakob-Baier-Straße 3, 90518 Altdorf

Leiter:

Stellvertreter:

Dipl.-Ing. (FH) Jan Köhl
Dipl.-Ing. (FH) Thomas Peter
Jürgen Stellwag

Akkreditiert als Kalibrierlabor seit: 17.04.2000

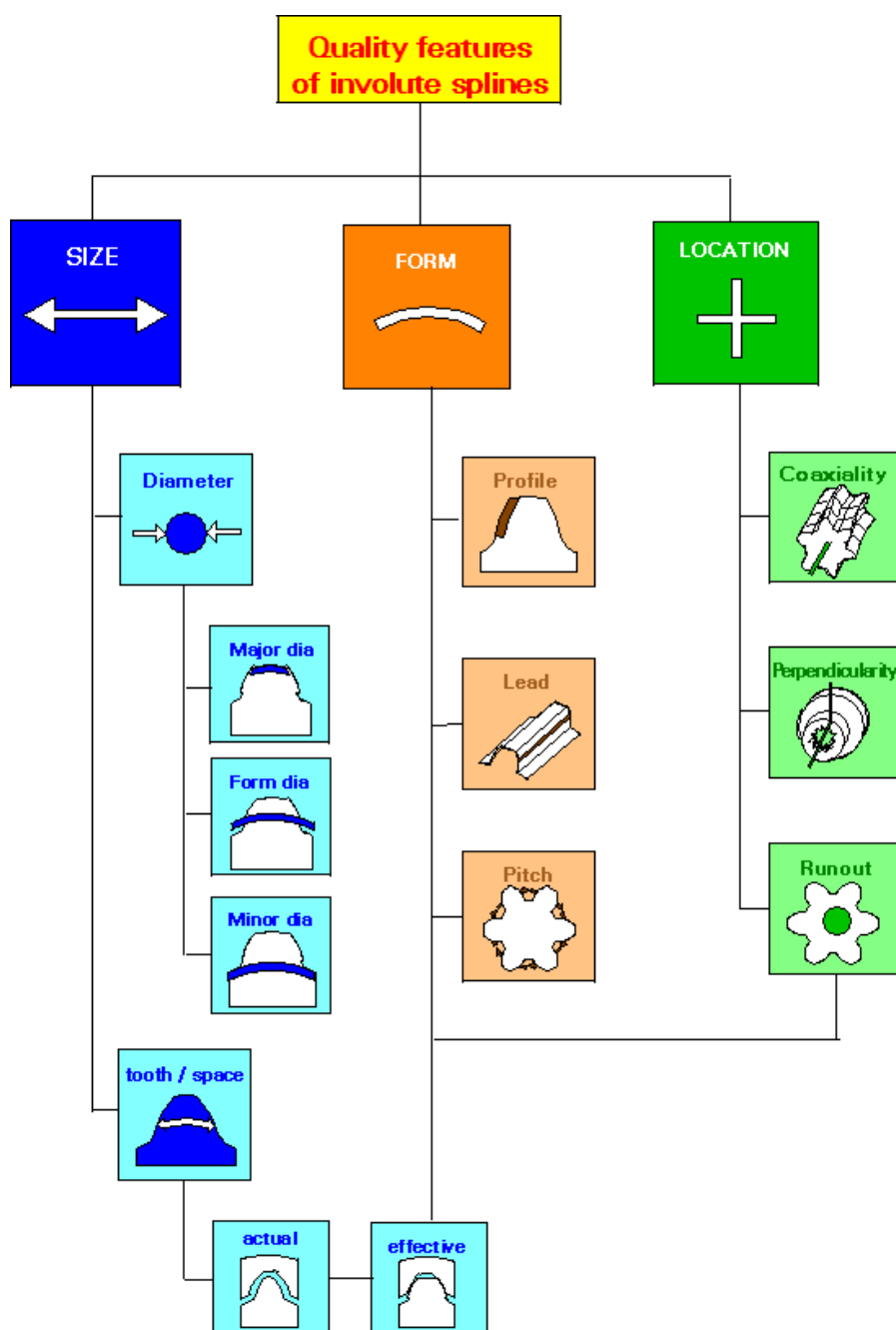
Kalibrierungen in den Bereichen:

Dimensionelle Messgrößen
Länge
- Verzahnung

General information

For everything concerning gear and spline measuring FRENCO is the first adress in Germany. With our equipment we are able to measure nearly all kinds of gear. A constant room temperature and top qualified employees guarantee highest precision. The traceability to PTB certified artefacts ensure a reliable appreciation of the measuring results. The FRENCO calibration laboratory has been accredited according to EN ISO/IEC 17025 (Registry No. D-K-15199-01-00) by the „Deutsche Akkreditierungsstelle“.

Now FRENCO is authorized to do a complete calibration of gears and spurs – You get the DKD calibration with the smallest uncertainty in germany.



The program

Wear measurement

Page 5

Inspection of parts

Page 6

Online certificate

Page 7

DAKKS-calibration

Page 8

VDA-5 -certificate

Page 10

Deviation analysis

Page 11



Quality manager

Jan Kühl

09187/ 9522-34

jk@frenco.de

Second quality manager

Jürgen Stellwag

09187/ 9522-15

js@frenco.de

Thomas Peter

09187/ 9522- 80

tp@frenco.de

Disribution/offers

Heinz Hasenkopf

09187/ 9522-11

hh@frenco.de

Ursula Chwalka

09187/ 9522-30

uc@frenco.de

Wear measurement

Scope of services

All kinds of measuring instruments and measuring equipment for internal and external gears and splines like gages, master gears, one flank taper arbor, instruments for size inspection and others are tested. The standard wear measurement according to the directive VDL2618 sheet 1 includes the below listed services:

- **Checking the delivered number of pieces**
- **Cleaning**
- **Demagnetisation**
- **Optical check on damages**
- **Determination of the gear and spline according to an existing drawing or**
- **Determination of the gear and spline data by dint of standards or**
- **Creation of a drawing (additional charge)**
- **Remedy of small defects at the gear and spline**
- **Size inspection of the gear and spline by hand with Abbe-length measuring instrument or length measuring comparator**
- **Inspection of form like profile and helix trace pitch and runout on our measuring machines**
- **Issue of an inspection certificate in english or german language**
- **Electronic archiving of the measuring results at FRENCO**
- **Availability of measuring results online at www.frenco.de**
- **New marking (additional charge)**
- **Check of gage-design according to a workpiece (if required)**
- **Packing in a rust protective foil**

Note: If the wear measurement has to be aborted due to a size being out of tolerance, costs will be reduced accordingly.

Delivery time

The delivery time is about 2 weeks after the arrival of the objects to be tested at FRENCO. The delivery time can be shortened down to 3 working days in accordance with the above mentioned persons (additional charge). The delivery time for DAkkS-calibrations is 10 weeks after the arrival at FRENCO. Shorter delivery time on request.

Documentation

For each measured object a inspection certificate is issued, which contains:

- the object data, the specified and the actual size and the final appreciation on the front page
- depending on the scope of the order the diagrammed measuring results of the inspection machines with profile and helix trace, pitch and runout on the inner pages
- an index of the used abbreviations, the traceability and the measuring uncertainty on the back page.

Delivery

We ask you to send the measuring instruments for FRENCO free of charge in a for measuring instruments reasonable packing. The delivery from FRENCO back to you is carried out by a parcel service (on request by one of your choice).

Inspection of parts

The gear and spline on workpieces can be inspected in different ways:

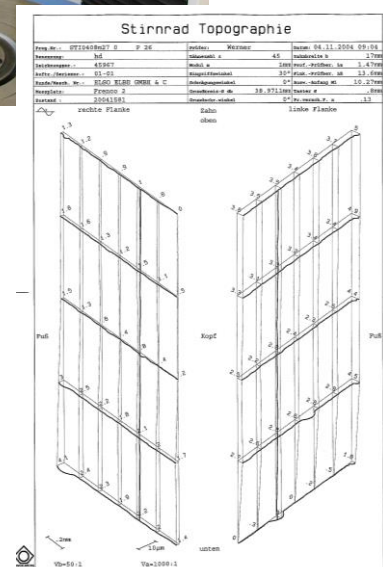
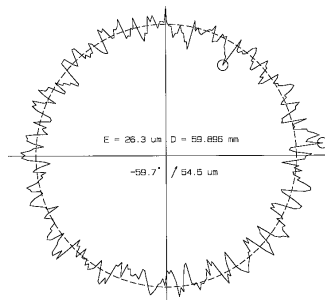
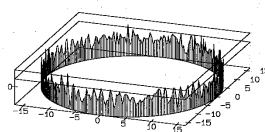
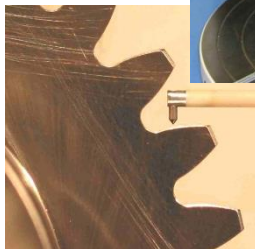
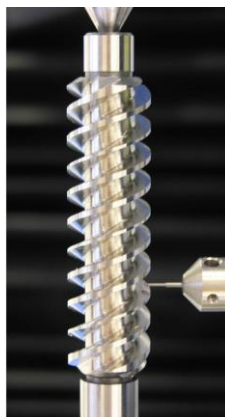
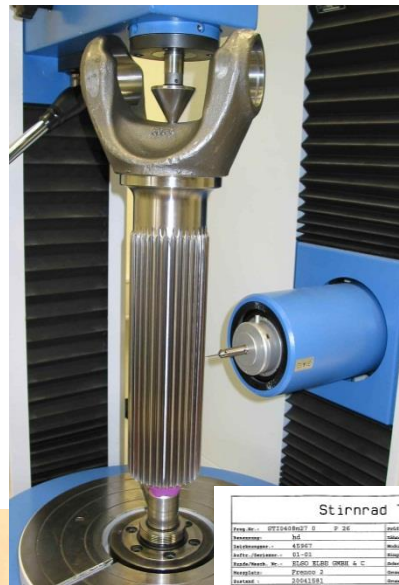
- inspection of the individual form on the measuring machine (profile, helix trace, pitch, runout)
- double flank gear rolling inspection on a FRENCO double flank gear rolling inspection machine. Thereby it is mandatory to provide the proper master gear.

Within the individual form inspection as well external and internal gears and splines as involute, serration and stright sided gears and splines can be measured.

- **Max. diameter of the workpieces:** 400mm (worm gears 260mm)
- **Max. length of workpieces:** 650mm
- **Max. vertical measuring range:** 500mm
- **Min. module:** 0,3 (0,2 external gears and splines)

Additional measurements:

- Position of functional faces (circles, cylinder, plane faces etc.) referring to the axis of spline
- Topography of singular teeth, by measuring multiple profiles per tooth
- Roughness and contour measurements



Online certificate

The screenshot shows the FRENCO website interface. At the top, there is a navigation bar with links: // Home // Sitemap // AGB // Kontakt // Impressum, followed by flags for Germany and a search bar. Below this is a secondary navigation bar with links: // Über Frenco // Produktgruppen // Download // Aktuelles/Termine // DAKS. The main header area features the 'pure perfection FRENCO' logo on the left, a large green download arrow icon in the center, and contact information on the right: 'Anschrift: FRENCO GmbH, Jakob-Baier-Strasse 3, 90518 Altdorf, Deutschland'. A left sidebar contains a list of links: Demosoftware, Remote Support, FGI pro, Zollhinweis - PDF, **Prüfzertifikate - PDF**, and Prospekte - PDF. The central content area is titled 'Prüfzertifikat' and contains the following text: 'Hier können Sie Ihr Prüfzertifikat als PDF herunterladen. Geben Sie dazu bitte Auftragsnummer (8-stellig) und Datensatz-ID (5 oder 6-stellig) des Prüfzertifikats ein. Um ein Beispiel-Zertifikat anzuzeigen, verwenden Sie die vorgegebenen Nummern.' Below this text is a sample 'Prüfzertifikat' form. The form has a title 'Prüfzertifikat' and a subtitle 'Prüfmittelüberwachung'. It contains a table with fields for Name, Unterschrift, Datum, Kunde, Stellung, Auftragsnummer, Zeichnungsnummer, Identifizierung, and Lfd. Teilnummer. The 'Auftragsnummer' is 20078888 and the 'Datensatz-ID' is 92387. Below the table is a section for 'Prüfung' with details about a 'Lehrzahnrad' and a table for 'Solimaß' and 'Istmaß'. At the bottom of the form, there are input fields for 'Auftragsnummer: 20078888' and 'Datensatz-ID: 92387', and a 'Datei suchen' button. On the right side of the main content area, there is contact information for the 'Ansprechpartner': Jan Kühn, Leiter Qualitätsmanagement, with phone and fax numbers and an email address.

Prüfzertifikat

Hier können Sie Ihr Prüfzertifikat als PDF herunterladen. Geben Sie dazu bitte Auftragsnummer (8-stellig) und Datensatz-ID (5 oder 6-stellig) des Prüfzertifikats ein.

Um ein Beispiel-Zertifikat anzuzeigen, verwenden Sie die vorgegebenen Nummern.

Prüfzertifikat

Prüfmittelüberwachung

Name	Unterschrift	Datum	Kunde
Stellung	-	28.11.2007	MUSTERMANN
Auftragsnummer	Datensatz-ID	Zeichnungsnummer	
20078888	92387	44277	
Identifizierung	Lfd. Teilnummer		
Id. 5434	01		
Prüfung			
Lehrzahnrad m1.5 x α20° x z52 x 81.5°R - Q4 - DIN3970 Sn=2.3588			
* Der Kopfkreis-Dm ist entsprechend dem Istmaß der Zahndicke korrigiert und entspricht nicht der Ursprungszeichnung.		Solimaß [mm]	Istmaß [mm]
Kopfkreis-Durchmesser		83.419 -0.035	83.403

Auftragsnummer: 20078888 Datensatz-ID: 92387

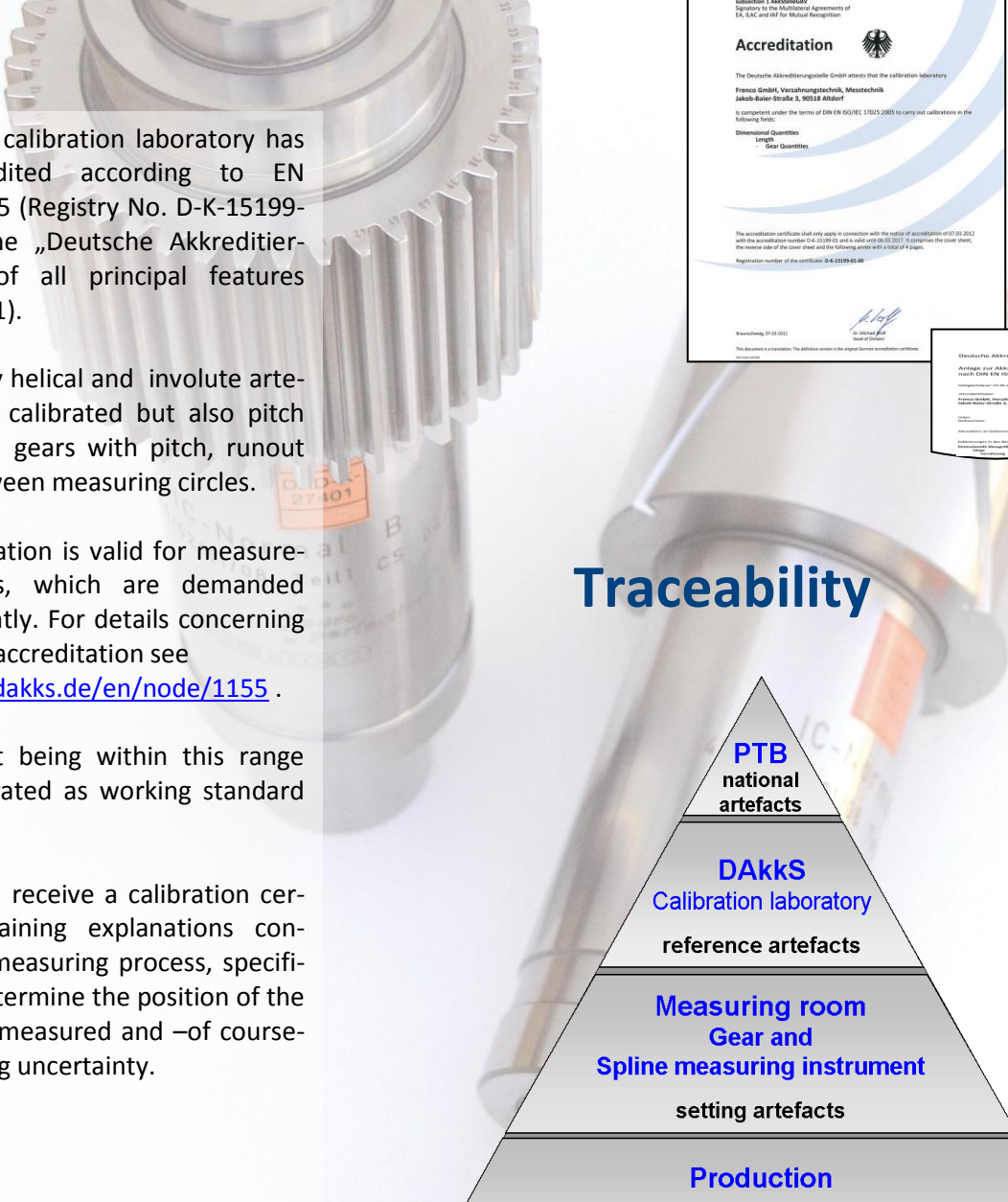
Datei suchen

Ansprechpartner
Jan Kühn
Leiter Qualitätsmanagement
Tel. +49 (0) 9187 9522-34
Fax +49 (0) 9187 9522-40
Jan.Kuehl@frenco.de

Every customer can retrieve the certificate for all wear inspections and inspections of parts calibrated by FRENCO from our homepage as pdf-file. A detailed description can be found on our homepage www.frenco.de.

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






The FRESCO calibration laboratory has been accredited according to EN ISO/IEC 17025 (Registry No. D-K-15199-01-00) by the „Deutsche Akkreditierungsstelle“ of all principal features (D-K-27401).

Thus not only helical and involute artefacts can be calibrated but also pitch artefacts and gears with pitch, runout and size between measuring circles.

This accreditation is valid for measurement ranges, which are demanded most frequently. For details concerning our range of accreditation see <http://www.dakks.de/en/node/1155>.

Artefacts not being within this range can be calibrated as working standard calibration.

As result you receive a calibration certificate containing explanations concerning the measuring process, specifications to determine the position of the object to be measured and –of course– the measuring uncertainty.



Dakks
Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH
Entertained according to Section 8 subsection 1 AkkStellG in connection with Section 1 subsection 1 AkkStellG
signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

Accreditation


The Deutsche Akkreditierungsstelle GmbH attests that the calibration laboratory
Fresco GmbH, Versaformtechnik, Messtechnik
Jakob-Bauer-Straße 2, 90535 Altdorf
is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out calibrations in the following fields:

Dimensional Quantities
Length
Gear Quantities

The accreditation certificate shall only apply in connection with the notice of accreditation of 07.03.2012 with the accreditation number D-K-15199-01 and is valid until 06.03.2017. It comprises the cover sheet, the notice side of the cover sheet and the following sheets with a total of 4 pages.
Registration number of the certificate: D-K-15199-01-00

Braunschweig, 07.03.2012
Dr. Michael Müller
Head of Office

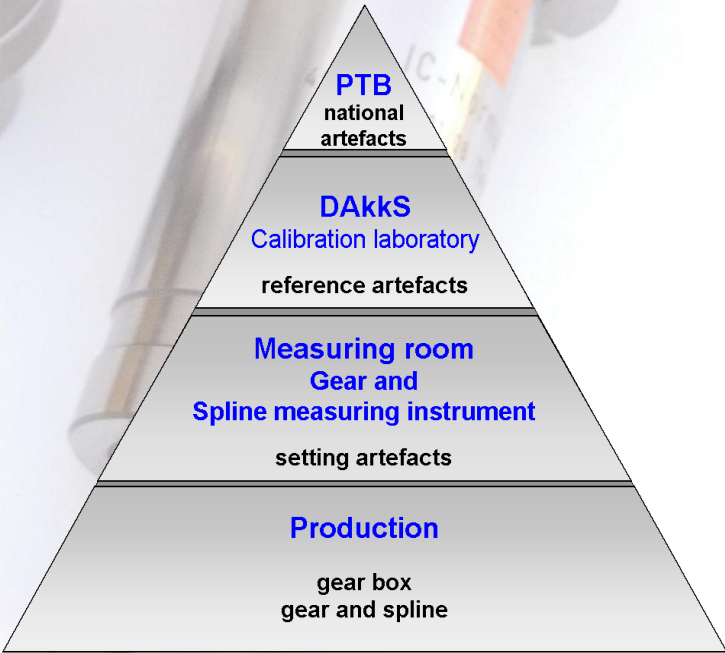
This document is a translation. The addition version is the original German accreditation certificate.
Date of issue: 07.03.2012



Deutsche Akkreditierungsstelle GmbH
Anlage zur Akkreditierungsurkunde D-K-15199-01-00
nach DIN EN ISO/IEC 17025:2005

Accreditation number: D-K-15199-01-00
Accreditation scope: in the field of metrology
Measurement quantities: Dimensional quantities, Gear quantities
Measurement methods: Calibration
Measurement standards: Calibration standards, Gear standards
Measurement uncertainty: Calibration uncertainty, Gear uncertainty
Measurement results: Calibration results, Gear results
Measurement uncertainty: Calibration uncertainty, Gear uncertainty
Measurement results: Calibration results, Gear results

Traceability



PTB
national
artefacts

DAKks
Calibration laboratory
reference artefacts

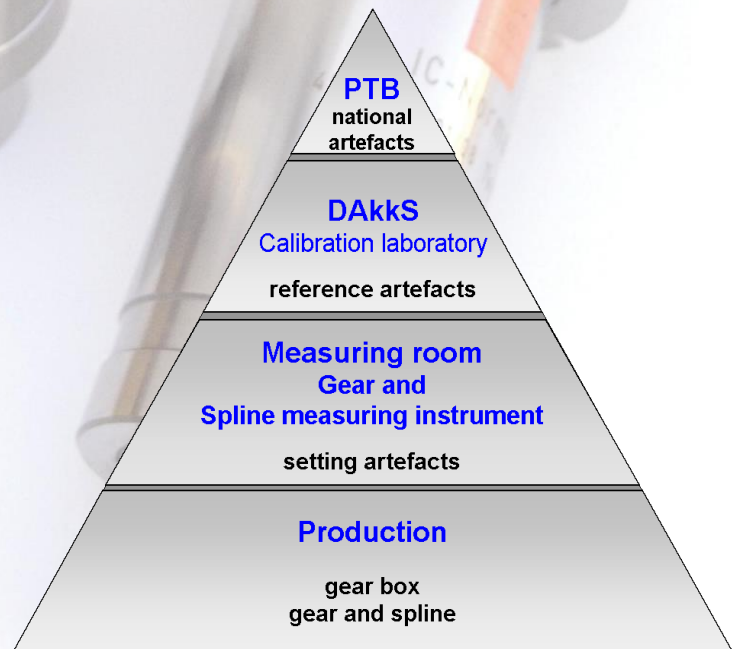
Measuring room
Gear and
Spline measuring instrument
setting artefacts

Production
gear box
gear and spline

Thus not only helical and involute artefacts can be calibrated but also pitch artefacts and gears with pitch, runout and size between measuring circles.

Artefacts not being within this range can be calibrated as working standard calibration.

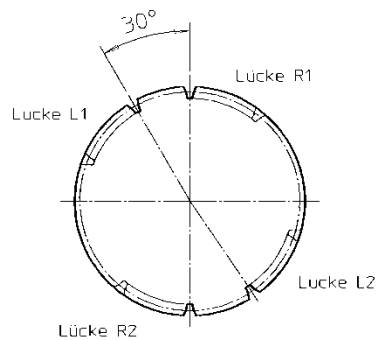
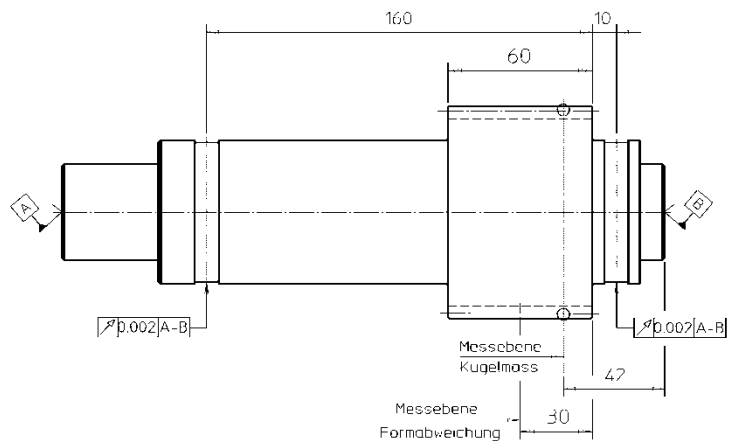
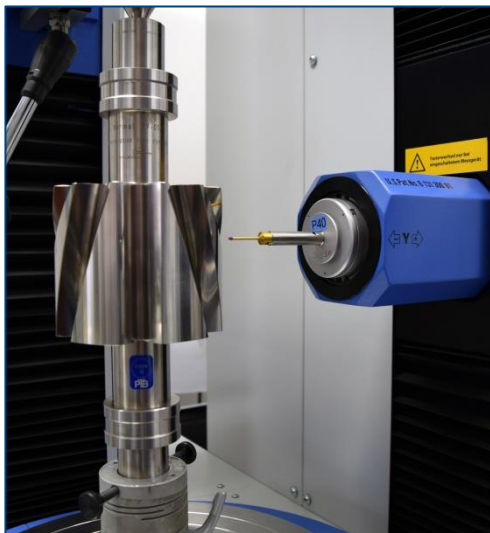
As result you receive a calibration certificate containing explanations concerning the measuring process, specifications to determine the position of the object to be measured and –of course– the measuring uncertainty.



... and IC-artefacts

The smallest ascertainable measuring uncertainty depends on the size of the artefact. For DAkkS-calibrations it ranges as follows:

	U (k=2)	U (k=2)	U (k=2)
Profile	F_{α}: 1.5 - 2.3 μm	$f_{h\alpha}$: 1.0 - 2.0 μm	$f_{f\alpha}$: 1.0 μm
Helix	F_{β}: 1.7 - 2.3 μm	$f_{h\beta}$: 1.3 - 2.1 μm	$f_{f\beta}$: 1.0 μm
Pitch/runout	F_p: 0.7 μm	f_p: 0,6 μm	F_r: 1,0 μm
Size over measuring circle	M_{dK}: 1,5 – 1,9 μm		



u_{PM} – Certificate for measuring instruments of series V

On request FRENCO issues an u_{PM} - certificate for all measuring instruments of the series V (instruments for size inspection). This certificate is laid out according to VDA 5 and contains the measuring uncertainty of the measuring system. That eases the determination of the measuring uncertainty of the inspection process according to VDA 5, because the value of the measuring uncertainty just has to be applied. Moreover characteristic values like Q_{MS} , $TOL_{MIN-UMS}$, C_{gk} and C_g , which are also an indicator for the quality of your measuring instrument, are listed on the certificate.



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

FRENCO		VDA-5 Certificate		16.02.2012	
acc. to VDA 5 (2. Edition Update 2011)		Inspector:		Werner Klapetek	
Proof of Measurement System Capability					
Drawing No.: 58510 10 00 00	Customer: Musterkunde	Part No.: 01	Order number: 20110815		
Type: AVMF 1x1	U= 28.0240	L= 28.0000	TOL= 0.024		
%RE Resolution of indicator u_{RE}					
Resolution: 0.001 (=half scale division)					
Resolution RE in %: 4.2% 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.: 58510 10 03 00 01					
$u_{CAL} = 1.00 \mu m$					
Repeatability on reference standard u_{EVR}					
25 repeat measurements on setting ring including probe [μm]:					
1...5	0.0	0.1	0.1	0.0	0.1
6...10	0.1	0.1	0.1	0.1	0.1
11...15	0.0	0.1	0.1	0.2	0.2
16...20	0.1	0.1	0.1	0.1	0.1
21...25	0.1	0.1	0.1	0.1	0.1
$s_g = 0.045$ C_g, C_{gk} without RE acc. to VDA 5 (2011):					
Resolution of Probe: 0.0001					
Proportion: Resolution / $s_g > 2$?					
yes, it follows $u_{EVR} = 0.03$					
$u_{EVR} = 0.03 \mu m$					
Uncertainty from linearity u_{LIN}					
Normal	Actual value x_m in mm	Measurement [mm]	Deviation [μm]		
x_{mi1}	28.1569	28.1570	0.1		
x_{mi2}	28.1569	28.1572	0.3		
x_{mi3}	28.1569	28.1573	0.4		
x_{mi4}	28.1569	28.1572	0.3		
x_{mm1}	28.1267	28.1257	-1.0		
x_{mm2}	28.1267	28.1259	-0.8		
x_{mm3}	28.1267	28.1260	-0.7		
x_{mm4}	28.1267	28.1257	-1.0		
x_{mi1}	28.0966	28.0967	0.1		
x_{mi2}	28.0966	28.0967	0.1		
x_{mi3}	28.0966	28.0966	0.0		
x_{mi4}	28.0966	28.0967	0.1		
				$u_{LIN} = 0.51 \mu m$	
Uncertainty form dial indicator u_{MS_REST}					
Maximum error fo from certificate: 0.82 μm BM-373406					
Effectively error quantity: 0.82 μm					
factor 0.58					
$u_{MS_REST} = 0.48 \mu m$					
Expanded uncertainty U_{MS}					
$U_{MS} = k * \sqrt{u_{RE}^2 + u_{CAL}^2 + u_{EVR}^2 + u_{LIN}^2 + u_{REST}^2}$					
$U_{MS} = 2.44 \mu m$					
Capability ratio Q_{MS}					
$Q_{MS_max} = 20\%$					
$Q_{MS} = \frac{2 * U_{MS}}{TOL} * 100\%$					
$Q_{MS} \leq Q_{MS_max} ?$ MS capable					
Minimum possible tolerance $TOL_{MIN-UMS}$					
$TOL_{MIN-UMS} = \frac{2 * U_{MS}}{Q_{MS_max}} * 100\%$					
$TOL_{MIN-UMS} = 0.024 mm$					

u_{RE}



u_{CAL}



u_{EVR}

aus 25 Wiederholmessungen
(inkl. C_g und C_{gk})

u_{LIN}



u_{REST}



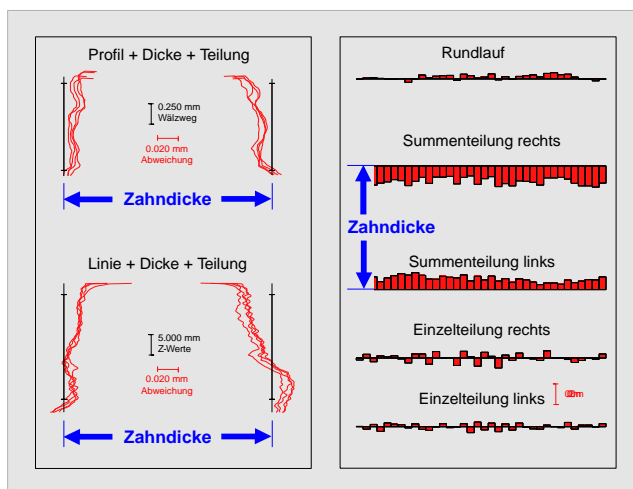
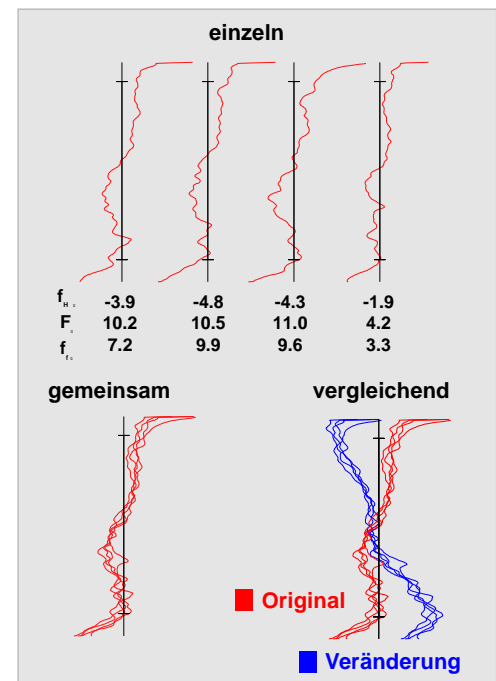
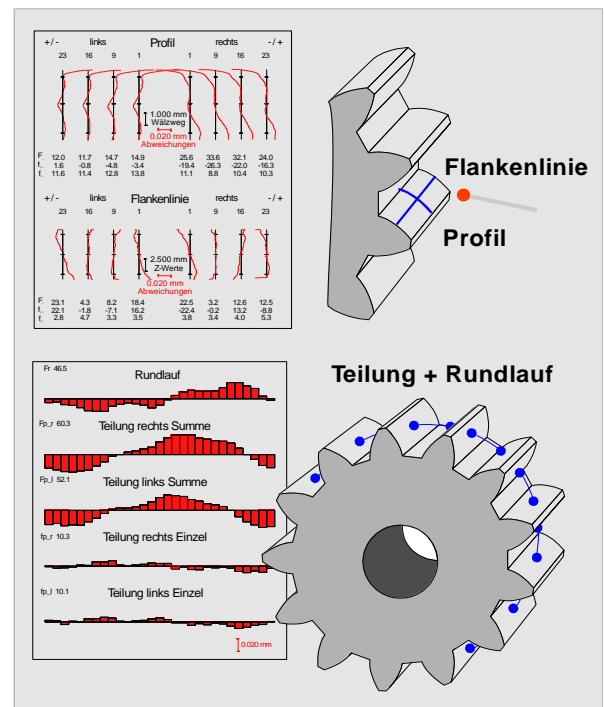
Deviation analysis

The measuring results are digitally filed and can be used in an analysis program for gears and splines.

This program features:

- Changes of the position of axis
- Multiple measuring results can be overlaid for comparisons
- Display depending on the tooth thickness
- Correction of the settings of the manufacturing machine (profile grinding)
- Detection of disturbances in the production process,
- Simulation of changes of the datas of gears and splines
- Generation of new data of gear and spline

This analysis program helps to understand correlations, to appreciate disturbances and to detect failure causes. Moreover it features the possibility of a quick change of gear and spline data and many different ways of display them. The most important feature is, that the print of the analysis is like a measuring result and so the user can immediately understand it.



Frenco product range



High precision gears and splines H

Gear and spline gauges
Master gears, master wheels
Artefacts, masters
Punches, dies & electrodes
Profiled clamping systems
Gear and spline manufacture



Rotation measuring systems R

Measuring systems with measuring circles
Multiple inspector
Gear flank analysing
Linear gear flank analyser rack
Gear flank analyser
Double flank gear roll inspection



Instruments for size inspection series V

Measuring pins and balls
Gauges, rocking Type
Gauges with face stop
Gauges, gear & spline profiles
Circumferential backlash measuring instrument
Customized solutions



Gear & spline inspection P

DAkkS- calibration
Monitoring of inspection equipment
Workpiece inspections
Analysis of deviations



Know-how transfer K

Software
Training, seminars, workshops
Consulting and calculations
Literature and documentations
National and international standards



FRENCO

Frenco GmbH
gear + spline technology

Jakob-Baier-Straße 3
90518 Altdorf, Germany

Tel.: +49 (0) 9187 - 95 22 0
Fax: +49 (0) 9187 - 95 22 40
E-Mail: frenco@frenco.de

