Gear and spline inspection
according to certified standards

Gear and spline technology with service

pure perfection

FRENCO

Deutscher Kalibrierdienst (DKD)
Akkreditierungsstelle
vertreten im

Deutschen AkkreditierungsRat

Akkreditierung

Die Akkreditierungsstelle des **Deutschen Kalibrierdienstes** akkreditiert hiermit

FRENCO GmbH

Verzahnungstechnik, Meßtechnik

Jacob-Baier-Straße 3

90518 Altdorf

nach DIN EN ISO/IEC 17025: 2005 für Kalibrierungen im Bereich / in den Bereichen:

dimensionelle Größen

Bestandteil der Urkunde ist: Anlage 04 (2 Seiten), 2007-06-26

DAR-Registriernummer: DKD-K-27401
Akkreditiert im DKD seit: 2000-04-17

Braunschweig, 2007-06-26

Dr.-Ing. Wolfgang Bosch
Leiter der Akkreditierungsstelle

DEUTSCHER KALIBRIERDIENST
AKKREDITIERUNGSSTELLE

Deutscher Kalibrierdienst
Akkreditierungsstelle

DKD

Anlage 04
vom 2007-06-26 zur Akkreditierungsurkunde des Kalibrierlaboratoriums

Registriernummer:
DKD-K-27401
Seite 1 von 2

bei
FRENCO GmbH Verzahnungstechnik, Meßtechnik
Jakob-Baier-Straße 3
90518 Altdorf

Telefon: 09187 9522-0
Telefax: 09187 9522-40
E-Mail: frenco@frenco.de

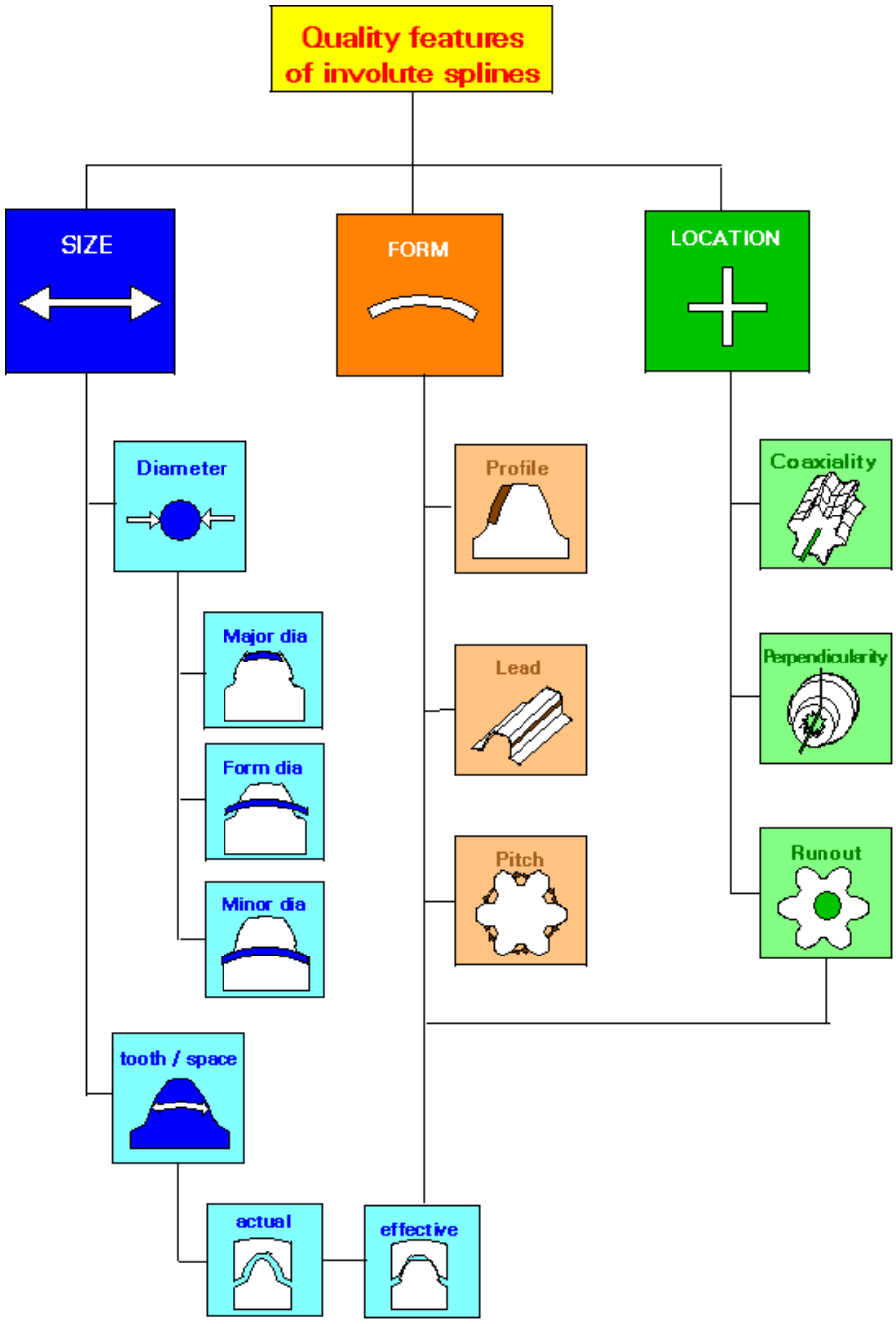
Leiter:	Dipl.-Ing. (FH) Jan Kühl
Stellvertreter:	Dipl.-Ing. (FH) Thomas Peter Werner Schiller
Akkreditierung seit:	2000-04-17

Messgrößen:
Evolventennormale
Flankenliniennormale
Teilung und Rundlauf
Maß über Messkreis

Permanentes Laboratorium

General Information

For everything concernig 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 is as a DKD – calibration station accredited. Now FRENCO is authorized to do a complete calibration of gears and spurs – and this as single calibration laboratory worldwide.



The Program

Quality manager	Jan Kühl	09187/ 9522-34	jk@frenco.de
Second quality manager	Werner Schiller	09187/ 9522-15	ws@frenco.de
Distribution/ 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 data by dint of standards and an existing drawing 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**
- **Electronic archiving of the measuring results at FRENCO**
- **New marking (additional charge)**
- **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 in accordance with the above mentioned persons (additional charge). The delivery time for DKD-calibrations is 10 weeks after the arrival at FRENCO.

Documentation

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

- the object data, the specified and the actual size and the final apprecitation 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:

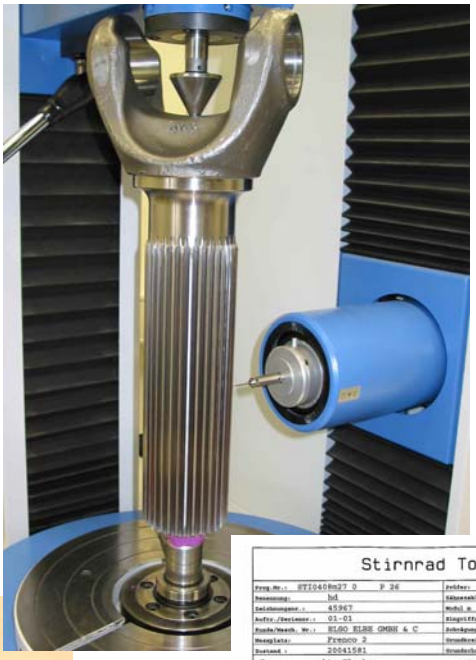
- inspection of the individual form on the measuring machine (profile, helix trace, pitch, runout)
- double flank gear rolling inspection on a FRENCO double flank gear rolling inspection machine. Thereby it is mandatory to provide the proper master gear.

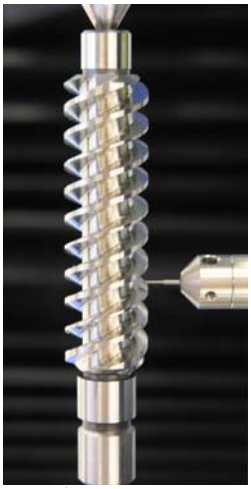
Within the individual form inspection as well external and internal gears and splines as involute, serration and stright sided gears and splines can be measured.

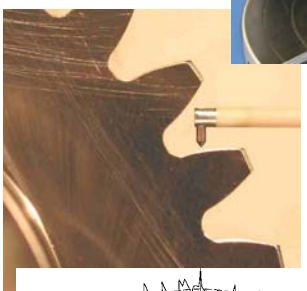
- **Max. diameter of the workpieces:** **360mm (worm gears 260mm)**
- **Max. length of workpieces:** **600mm**
- **Max. vertical measuring range:** **400mm**
- **Min. module:** **0,3 (0,2 external gears and splines)**

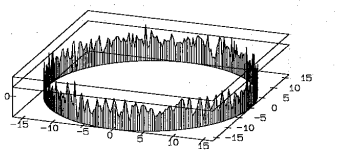
Additional measurements:

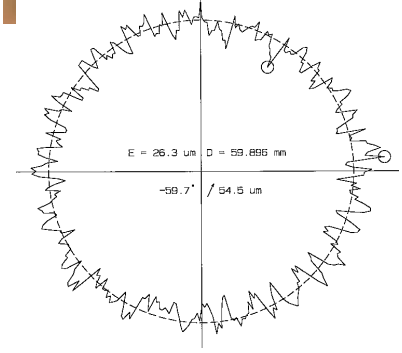
- Position of functional faces (circles, cylinder, plane faces etc.) referring to the axis of spline
- Topography of singular teeth, by measuring multiple profiles per tooth
- Roughness and contour measuremnets

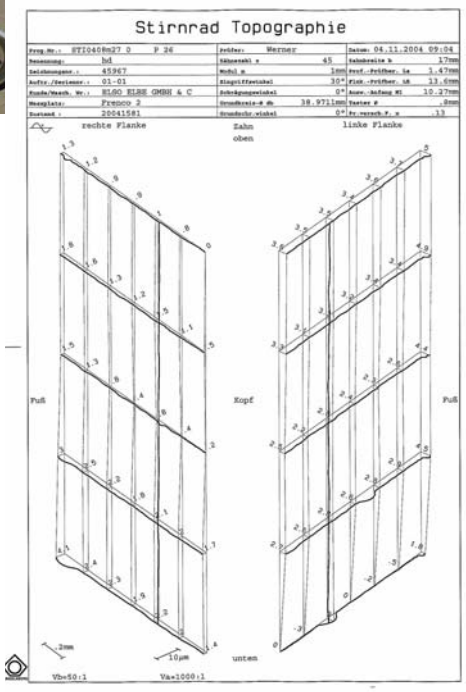












Online certificate

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.

DKD-calibration for artefacts…

The calibration laboratory of FRENCO is accredited by the DKD according to DIN/ISO 17025 for the calibration of all principal features (DKD-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 www.dkd.info/de/laboratorien.htm .

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.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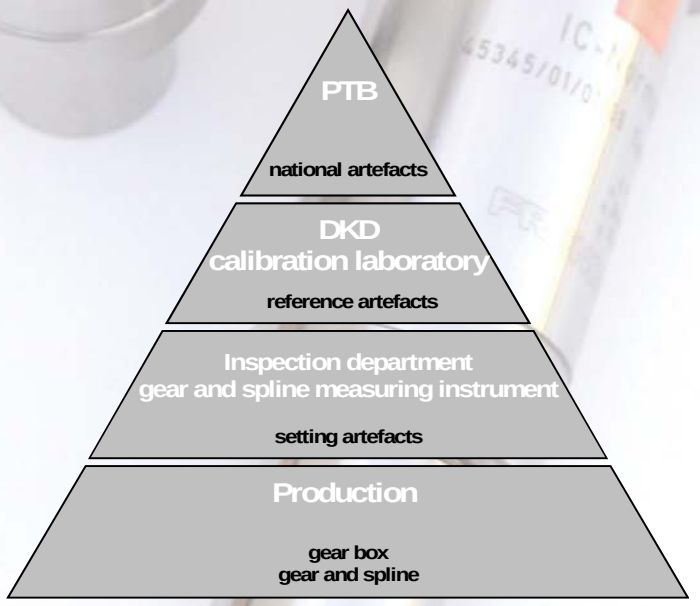
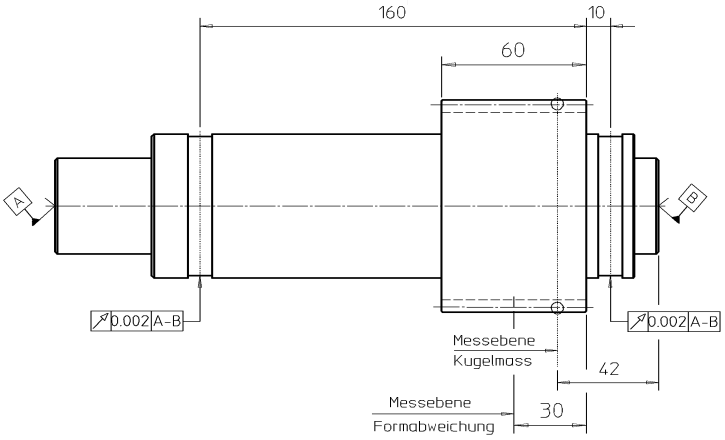
Traceability

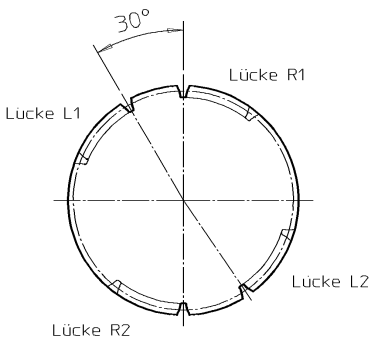


…and IC-artefacts

The smallest ascertainable measuring uncertainty depends on the size of the artefact. For DKD-calibrations it ranges asfollows:

	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: 1,1 µm	f_p: 0,9 µm	F_r: 1,1 µm
Size over measuring circles	DOB: 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 instrument. 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 T_{min}, C_{gk} and C_g, which are also an indicator for the quality of your measuring instrument, are listed on the certificate.

VDA Verband der Automobilindustrie

Qualitätsmanagement in der Automobilindustrie 5

Prüfprozesseignung

Uncertainty of the measuring instrument according to VDA 5

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

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UPM - Prüfzertifikat

Bestimmung u_{PM} nach VDA 5 (1.2003) zur Bestimmung der Prüfprozesseignung

09.05.2006

Bearbeiter: Jürgen Stellwag

Zg.-Nummer: 48466 Auftraggeber: ABCDEF

Teil-Nr.: 1 Auftragsnummer: 12345678

Typ: IVMF 1x1

Messpanne: Max= 25.8327 Min= 25.7877 **T= 0.045**

1. Schritt: Auflösung i.O.?

Auflösung: 0.002 Toleranz Werkstück: 0.045

Auflösung in %: 4.44% i.O Toleranzklasse: 11

2. Schritt: Einstellmeister u_{kal}

Messunsicherheit des Einstellmeisters lt. Prüfzertifikat: U= 2 µm

Zg.-Nummer: 48466-11-03-00 k=

(u_{ref}) **u_{Kal}= 1.00 µm**

3. Schritt: Wiederholgenauigkeit u_w

25 Wiederholmessungen am Kalibrierring mit Induktivtaster in µm :

1...5	0.0	-0.2	-0.1	-1.6	-0.1
6...10	-0.9	-1.5	-0.4	-1.9	-0.6
11...15	-0.6	-0.7	-0.9	-0.8	-0.4
16...20	-0.8	-0.9	-0.6	-0.6	-0.7
21...25	-0.8	-0.8	-0.7	-1.3	-1.0

s_n= 0.461049527

Auflösung Ind.-Tast: 0.0001

C_{gk} und C_g nach Bosch (Heft10):

Cg= 3.25

Cgk= 2.71

Verhältnis: Auflösung / s_n > 2 ? NEIN dann uw=sn

(u_g) **u_w= 0.46 µm**

4. Schritt: Systematischer Fehler der Messvorrichtung u_{sys}

Nr.	Sollwert in mm	Istwert in mm	Abweichung in µm
		Kugelmaß verringern:	
1	25.8327	25.8328	0.1
2	25.8327	25.8330	0.3
3	25.8327	25.8328	0.1
4	25.8327	25.8328	0.1
5	25.8102	25.8100	-0.2
6	25.8102	25.8100	-0.2
7	25.8102	25.8101	-0.1
8	25.8102	25.8100	-0.2
9	25.7877	25.7875	-0.2
10	25.7877	25.7876	-0.1
11	25.7877	25.7876	-0.1
12	25.7877	25.7876	-0.1

Abweichungen vom Referenzwert

Max. Abweichung der Messvorr.: **Fges= 0.3** (ohne Feinzeiger)

Faktor 0.58 (u_{BI}) **u_{sys}= 0.17 µm**

5. Schritt: Einfluss des Anzeigeinstruments u_{Ind}

Gesamtfehler des Feinzeigers lt. Kalibrierschein: 1.2 µm

Dies entspricht: 1.2 µm

Faktor 0.58 **u_{Ind}= 0.70 µm**

$$u_{PM} = \sqrt{u_{Kal}^2 + u_W^2 + u_{Sys}^2 + u_{Ind}^2}$$

u_{PM} = 1.39 µm

$$T_{min} = \frac{6 * u_{PM}}{G_{pp}}$$

G_{pp} = 0.2

T_{min} = 0.042

T>=Tmin? JA

09.05.2006 Prüfer: Unterschrift:

u_{Kal}

u_W

resulting of 25 repeated measurements

u_{Sys}

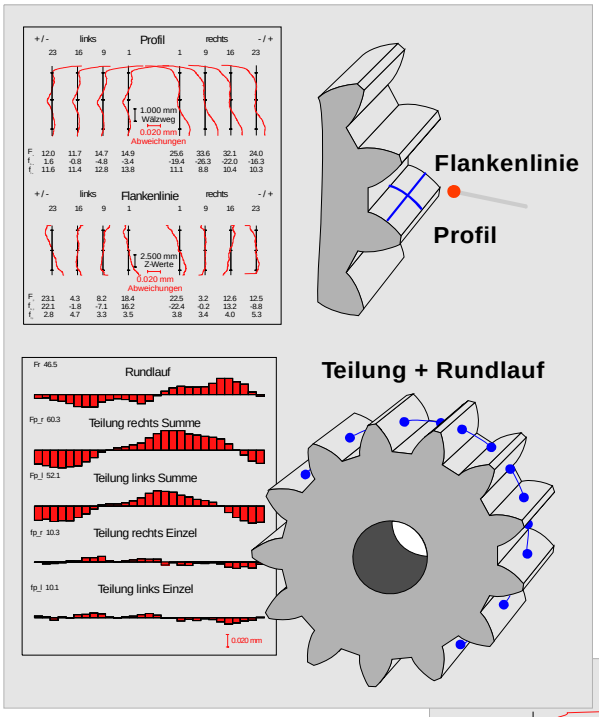
u_{Ind}

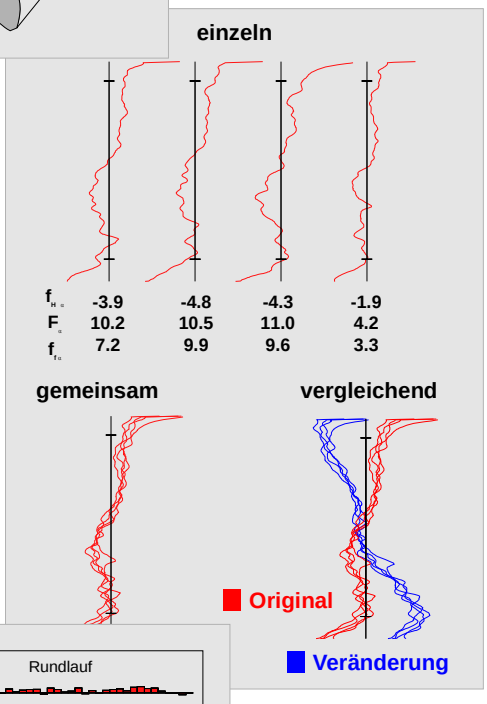
Deviation analysis

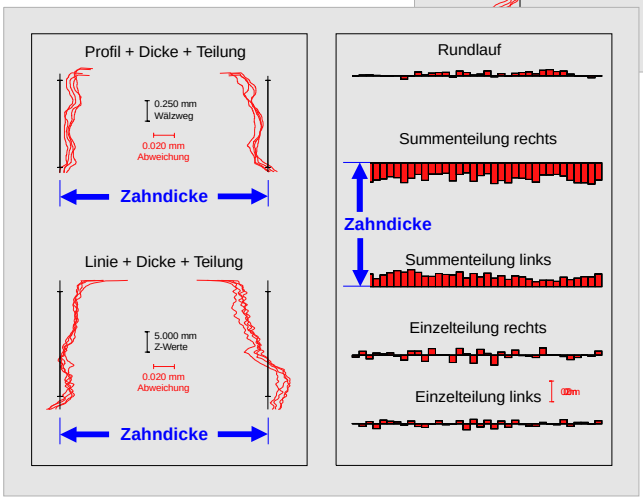
The measuring results are digitally filed and can be used in an analysis program for gears and splines. This program features:

- 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 manufactoring 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 Lines

Gear and spline high precision

Spline Gages
Master Gears, master wheels
Artefacts, masters
Profiled tools
Clamping systems
Gear and spline manufacturing

Instruments for size inspection Series V

Ball inserts and pins VRK
Instruments for rocking VA
Instruments with face stop VP
Indicating Gages VM
Variable 3-Disc Gages VD
Customized solutions VS

Rotation Measuring Systems

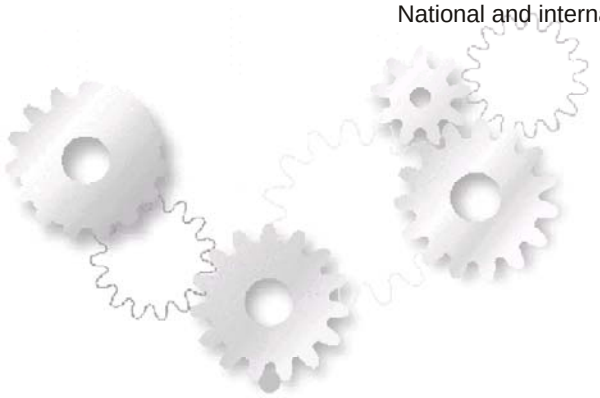
URM - K with balls and pins
URM - R with master wheels
EWP Single flank gear rolling
ZWP Double flank gear rolling
WS Gear Rollscan

Gear and spline inspection

DKD gear calibration
Gage wear inspection
Part inspections
Deviation analysis

Know-how transfer

Software for gear and spline calculating
Training, seminars and workshops
Consulting and calculations
Literature and documents
National and international standards



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Frenco GmbH
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Jakob-Baier-Straße 3
D 90518 Altdorf, Germany
Phone: +49 (0) 9187 9522 0
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E-Mail: frenco@frenco.de
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