Master gears for all requirements

Highest standard - technically perfect
General Information

Master gears enable you to carry out single and double flank gear rolling inspections as part of an integrated process within production - thus saving you both, time and money. The qualities of master gears are defined in DIN 3970:2010-04.

The most relevant issues can be summarized as follows:

- Area of application from module 0.2 mm
- Division into three accuracy classes, A, B and C
- Definition of a wear limit for the monitoring of measuring instruments (1.5 x new condition) and regulations for the regrinding procedure
- Master gears must have a clocking band
- Tooth flank modifications are possible
- Definition of tolerances for the tooth thickness
Quality

The following table shows the accuracy classes A, B and C of DIN 3970 in comparison to those of the DIN 3962/3963.

<table>
<thead>
<tr>
<th>Verzahnungsqualität nach DIN 3962/3963</th>
<th>Genauigkeitsklasse nach DIN 3970 (NEU)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>$F_a$</td>
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<tr>
<td>5</td>
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<td>4</td>
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<td>3</td>
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<td>2</td>
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The quality class A of master gears is mainly needed to inspect work pieces of tolerance class DIN Q4 and Q5. Quality A cannot always be manufactured.

The quality class B of master gears is mainly needed to inspect work pieces of tolerance class DIN Q6 and Q7. This is the quality standard for uncoated master gears.

The quality class C of master gears is mainly needed to inspect work pieces of tolerance class DIN Q8 and higher. This class is the quality standard for coated master gears.

Application example: double flank gear rolling inspection
Product Overview

Standard

- Quality class B or C
- Chrome steel CSP (low-corrosion)
- Base body in accordance with DIN 3970
- Uncoated, no modifications

Extras

- Quality class A
- High alloyed powder steel SX
- Tip chamfers
- TiN or TiCN coated (Quality class B or C)
- Modifications

Special

- Master worms, master pinion gears
- Internal master gears
- Customized base bodies
- Modules smaller than 0.3 mm
- Special coatings
**Standard**

Going by the name “pure perfection”, all master gears are state-of-the-art.

Short delivery times for master gears in standard quality - plus test certificate.

- **Quality class B**
  - With pitch and helix being the two critical parameters, both are more accurate than Q3

- **Gauge steel CSP (low-corrosion)**
  - Low-corrosion material, coating (optional)

- **Base body according to DIN 3970**
  - The sizes are defined in DIN 3970 – with the clamping equipment being available, the master gears are of excellent value

- **Uncoated, no modifications**
  - ... yet of the highest quality – including a test certificate from our accredited DAkkS laboratory
Optional extras

“pure perfection” – with optional extras to your requirements

Longer lifetime due to coating, protection of the test surfaces due to tip chamfers, modifications and much more. Useful options for many applications.

- **Quality class A**
  - For tolerance classes DIN Q4 and Q5
- **According to other standards like AGMA, ISO**
- **High alloyed powder steel SX**
  - Increased lifetime - even uncoated
- **Tip chamfers**
  - Impact protection for high-precision surfaces
  - Improved running properties
- **TiN, TiAlN or TiCN coated - quality class B or C**
- **Modifications**
- **Special pressure angles**
Tip Chamfers

Tip chamfers improve running characteristics and protect the master gear against damage. The damage is not usually detected during the monitoring process of inspection equipment and can be quite “sneaky”.

Without tip chamfer

With tip chamfer

The sharp edge of the tip diameter touches first while the flank contact is running in. Tip chamfers serve to break this edge so that no damage can arise on the master gear.

Coatings

Coatings protect the surface against wear. The coating is much harder than any steel and also more wear resistant. At the same time, the layer serves as rust protection.

As the coating process has to be carried out at high temperature, the base material to be coated must be suitable. The standard version of FRENCO’s master gears are made of material (CSP) that can be coated.

TiN coated

TiAlN coated
Modifications

Modifications are desired deviations of profile or helix from the ideal shape.

In the case of master gears, this is usually accomplished as an adaptation of the specimen modifications.

Modifications can be symmetric or asymmetric in relation to the left or right flank.

**Helix modifications**

<table>
<thead>
<tr>
<th>Helix angle deviation</th>
<th>symmetric</th>
<th>asymmetric</th>
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<table>
<thead>
<tr>
<th>Helix crowning</th>
<th>symmetric</th>
<th>asymmetric</th>
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<table>
<thead>
<tr>
<th>Combination of both</th>
<th>symmetric</th>
<th>asymmetric</th>
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**Profile modifications**

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Nearly all modifications and their combinations are possible.

However, the manufacturing demands rise sharply for asymmetrical helix modifications in particular.
Special

Master racks, master gear worms, master pinion gears for rack measuring devices, internal helical master gears and setting masters – as long as our manufacturing technology can do it, we can do it!

- quantity: 1 – that’s what we are used to
- coated or uncoated
- „pure perfection“ quality with test certificate

Just contact us!

Master gear worms

Internal helical master gears

Master pinion gears

Master racks
Wear measurement

The inspection of master gears contains the measurement of the total profile, the helix, the total runout, the total pitch and the single pitch deviation on a high precision inspection machine. Additionally the bore and the major diameter are measured.

Due to very small tolerances, master gears are not rejected until the tolerance is exceeded by more than the measuring uncertainty. This principle is also used for wear inspection to make sure that functional master gears are not rejected because of the measuring uncertainty.

Master gears will slowly wear during their usage. That’s why it is necessary to check them periodically. This wear inspection is to be carried out on the same conditions as the inspection of a master gear in the new condition, provided that the allowed single deviations may increase to the limit of the next lower quality level. The inspection during usage should be made at intervals of 25% of the estimated service life.

FRENCO offers wear inspections of master gears.
Regrinding Procedure

Master gears wear during their usage. Often worn master gears can be reground. This service is offered by FRENCO. Detailed information about the procedure is available on request.

FRENCO suggests the following tolerances of wear:

**One quality level** for total runout and total pitch deviation.

**Two quality levels** for total profile, total helix and single pitch deviation.
Frenco Product Range

High Precision Gears and Splines
Gear and Spline Gauges
Master gears, Master wheels
Artefacts, Masters
Punches, Dies & Electrodes
Profiled Clamping Systems
Gear and spline manufacture

Instruments for Size Inspection Series V
VRK  Measuring Pins and Balls
VA  Gauges, Rocking Type
VP  Gauges with Face Stop
VM  Gauges, Gear & Spline Profiles
VD  Circumferential Backlash Measuring Instrument
VS  Customised solutions

Rotation Measuring Systems URM
URM - K with Balls and Pins
URM - R with Master Wheels
EWP  Single flank gear roll inspection
ZWP  Double flank gear roll inspection
WS  Gear roll scan

Gear & Spline Inspection
DAkkS - Calibration
Monitoring of Inspection Equipment
Workpiece Inspections
Analysis of Deviations

Know-how Transfer
Software
Training, Seminars, Workshops
Consulting and Calculations
Literature and Documentations
National and International Standards

Frenco GmbH
gear + spline technology
Jakob-Baier-Straße 3
D 90518 Altdorf, Germany
Phone: +49 (0) 9187 9522 0
Fax: +49 (0) 9187 9522 40
Mail: frenco@frenco.de
Internet: www.frenco.de