Master Gears for all Requirements

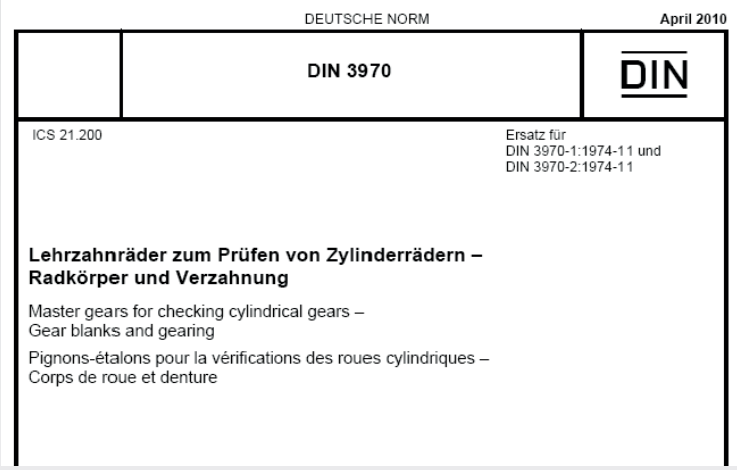
Highest standard - technically perfect

pure perfection

FRENCO

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.



DEUTSCHE NORM April 2010

DIN 3970

DIN

ICS 21.200

Ersatz für
DIN 3970-1:1974-11 und
DIN 3970-2:1974-11

Lehrzahnräder zum Prüfen von Zylinderrädern – Radkörper und Verzahnung

Master gears for checking cylindrical gears – Gear blanks and gearing

Pignons-étalons pour la vérifications des roues cylindriques – Corps de roue et denture

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 can be agreed on customer request
- 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.

Gear tooth quality as in DIN 3962	A					B					C				
	F_α	f_p	F_p	F_r	F_β	F_α	f_p	F_p	F_r	F_β	F_α	f_p	F_p	F_r	F_β
5															
4															
3															
2															

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 high-er. Standard accuracy for coated master gears are classes B and C.

Note: The classes of DIN 3962 and DIN 3963 correspond approximately to the classes of the new ISO 1328-1.

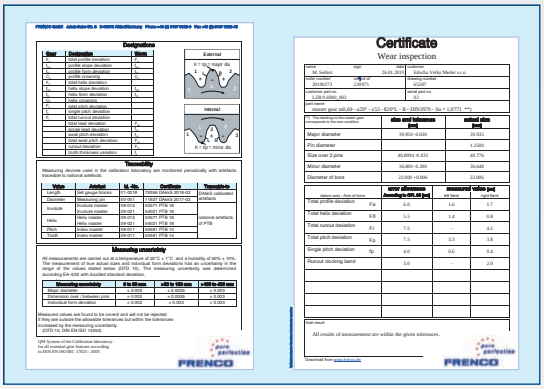
Products

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 according to DIN 3970
  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 la-boratory



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.

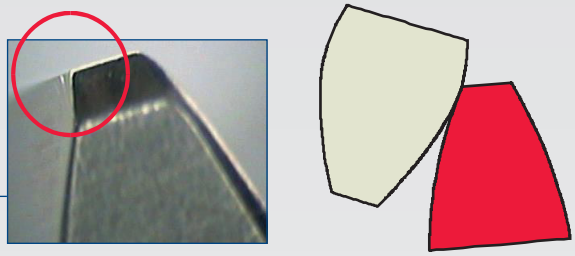
- Quality class A according to DIN 3970
  For tolerance classes DIN Q4 and Q5
- According to other standards like AGMA, ISO
- High alloyed powder steel SX
  Increased lifetime - even uncoated
- Tip chamfers
  Impact protection for high-precision surfaces
  Improved running properties
- TiN, TiAlN or 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”.

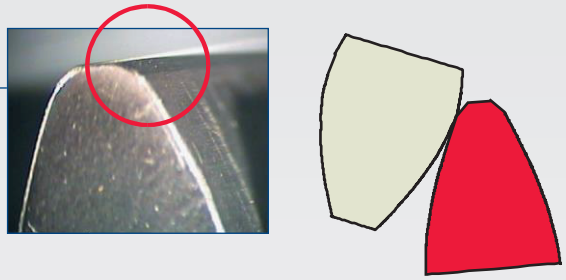
Without tip chamfer

The sharp edge of the tip diameter touches first while the flank contact is running in.



With tip chamfer

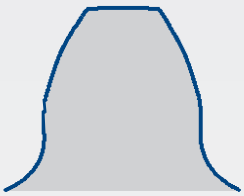
Tip chamfers serve to break this edge so that no damage can arise on the master gear and the measurement is reliable.



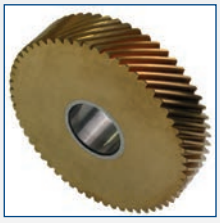
Coatings

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.



TiAlN coated



TiN coated

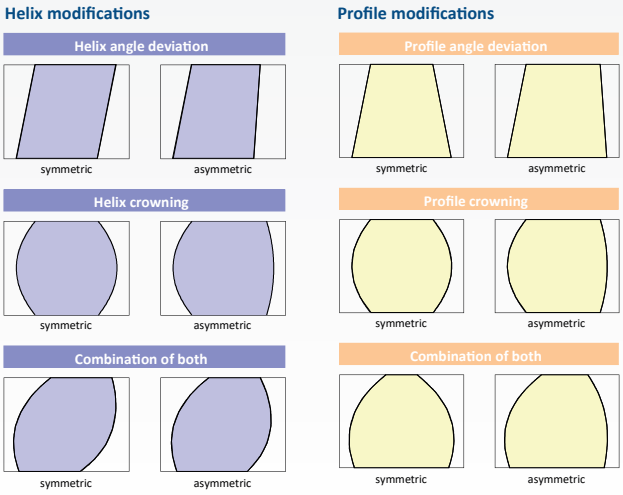
Modifications

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.

Nearly all modifications and their combina-tions are possible.

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



Special

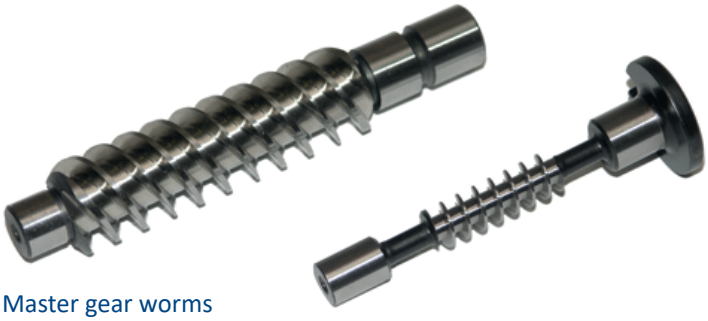
Master racks, master gear worms, master pinion gears for rack measuring devices, internal helical master gears and setting masters – as long as our manufacturing technology can do it, we can do it!

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

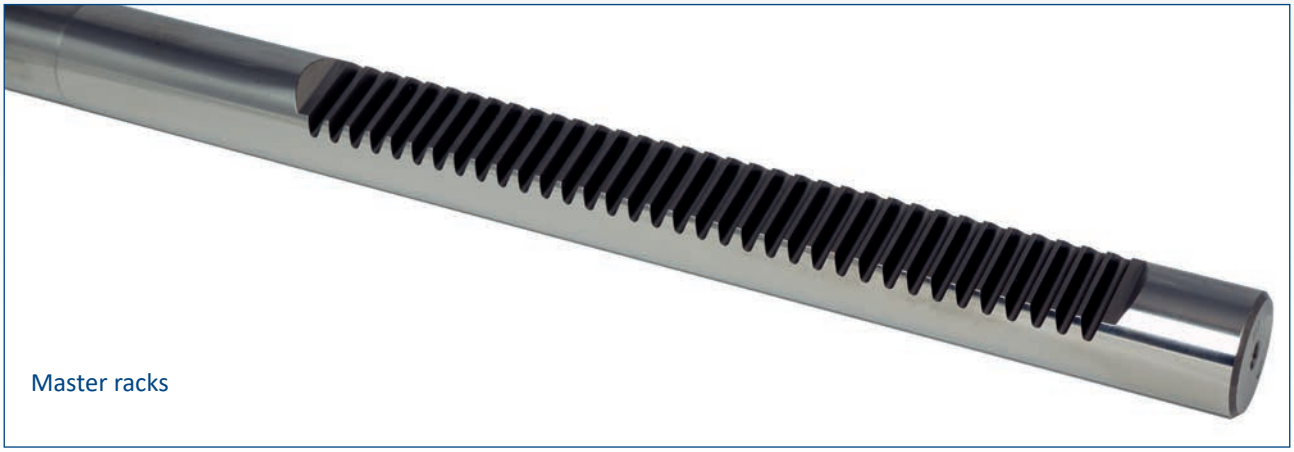
Just contact us!

Master pinion gears

Internal helical master gears



Master gear worms



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.

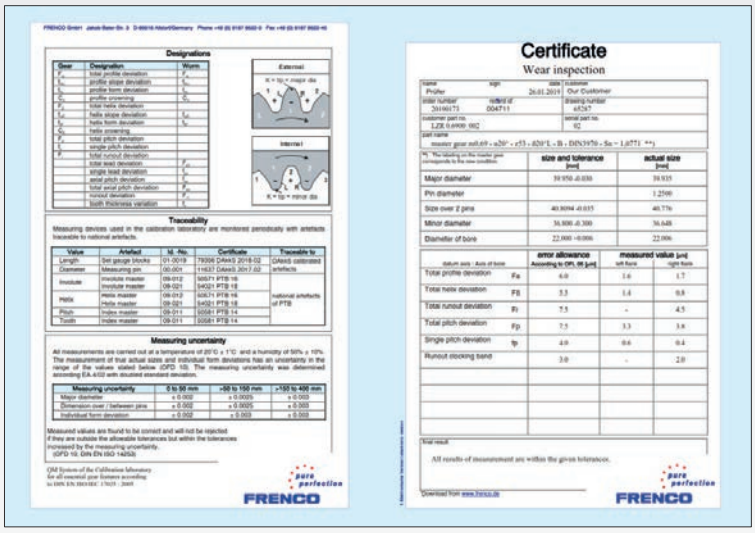
Even the uncertainties of high precise inspection machines are big in relation to very small tolerances. Therefore master gears are not rejected until the tolerance is exceeded by more than the measuring uncertainty. This principle is also used for wear inspection to make sure that functional master 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 1.5 times of new conditions or in line with tolerance limits of the gage drawing. The inspection intervals during usage should be made at of 25% of the estimated service life.
FRENCO offers wear inspections of master gears.

designation

traceability

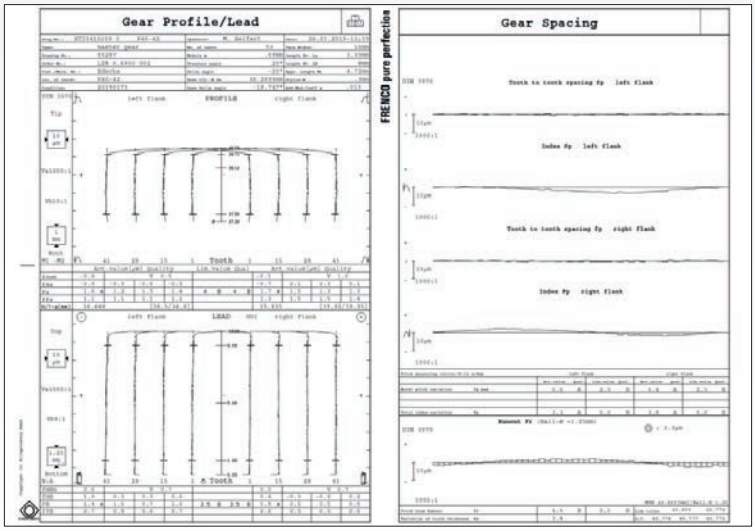
measuring uncertainty



error allowance/ dimensions

form deviations

profile and helix deviations



index deviation

runout deviation/ tooth thickness

Regrinding Procedure

Master gears wear depends on their intensity of usage, of hardness, the surface und the quality of the workpieces being inspected.

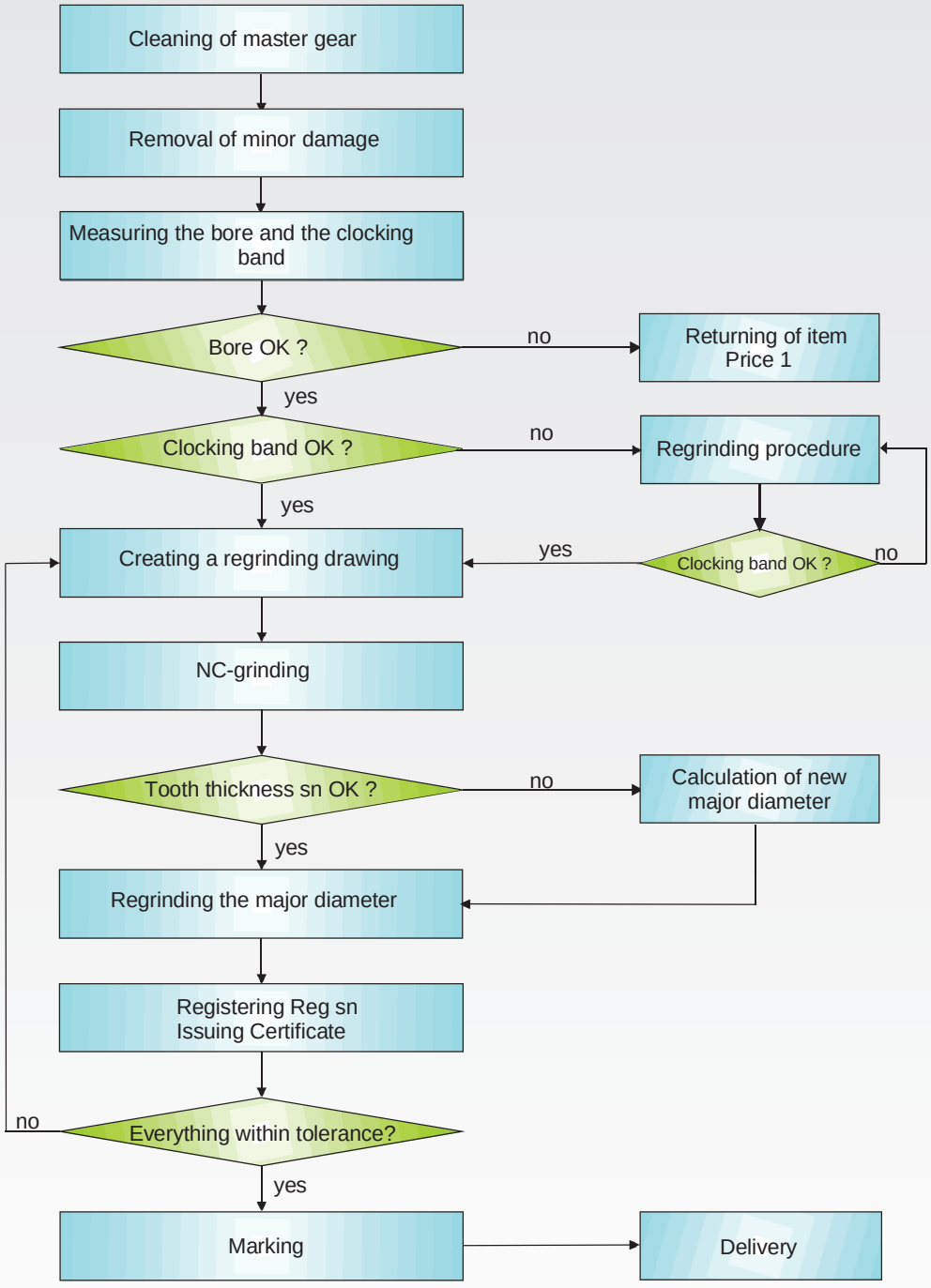
Often worn master gears can be reground if the is enough material between the minor form diameter and the base diameter and if there is enough material on the tooth thickness. DIN 3970:2010 describes rules for reworking.

The flow chart for rework service at Frenco is shown right next.

Compared to new master gears for reworked master gears cost saving is about 20% for the same quality conditions.

Master gears shall be reground if parameters exceed 1.5 times tolerances of new conditions.

Coated master gears can be reground and reworked as well.



pure perfection

FRENCO

Pure Perfection. Since 1978.

Experience, competence and innovation in gear metrology.

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