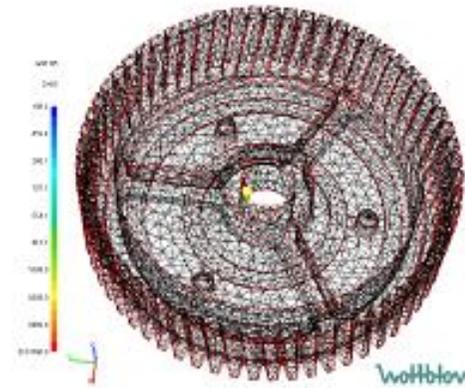


StarTool Gear Design & Manufacturing Capability



Sales /Engineering Department
Prepare by: Wu ZG
Date : 2017-11-5

Gear Capability with Plastic Solution

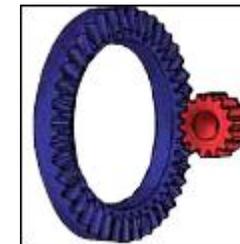
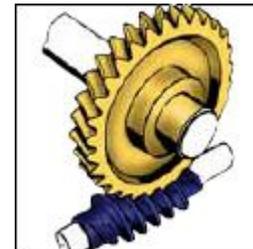
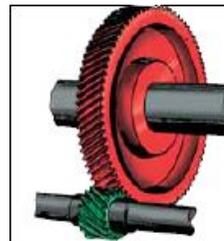
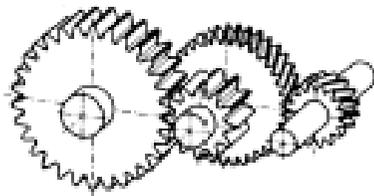
Engineering Capability and Service

1. In-house capability of gear profile design, meshing simulation & optimization;
2. Gear strength and life calculation, include design verification and optimization;
3. Noise reduction and metal replacement;
4. Working environment verification for plastic application;
5. Fast prototype tooling and multi-cavity high performance tooling;
6. Design of gear boxes and module assembly;
7. Gear profile equivalent calculation between AGMA, DIN, JIS and GB;



SKLMT

Partnership with State Key Lab of Mechanical Transmission for transmission system design and provide total solution for transmission application.

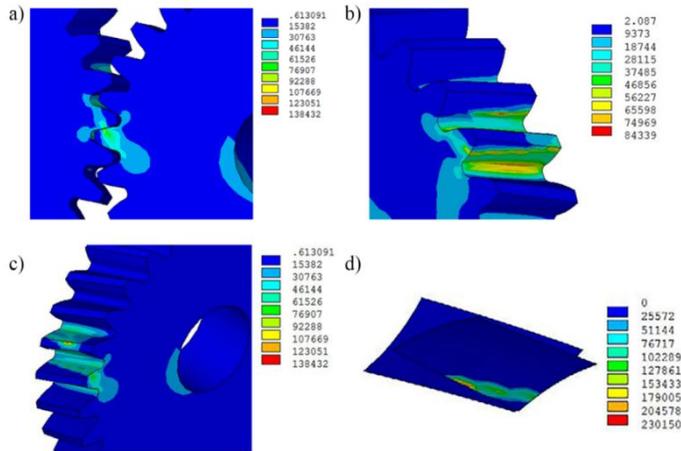


Gear Capability with Plastic Solution

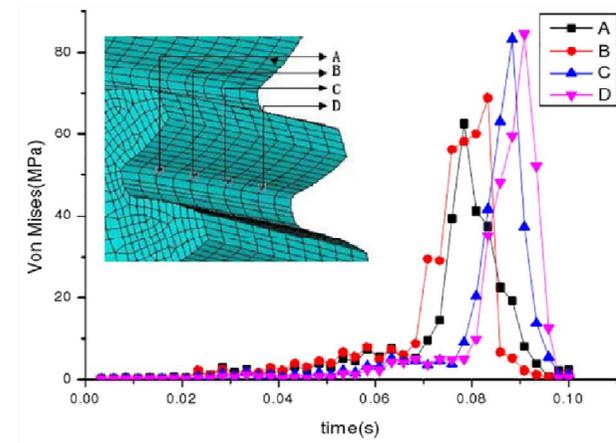


Engineering Capability and Service

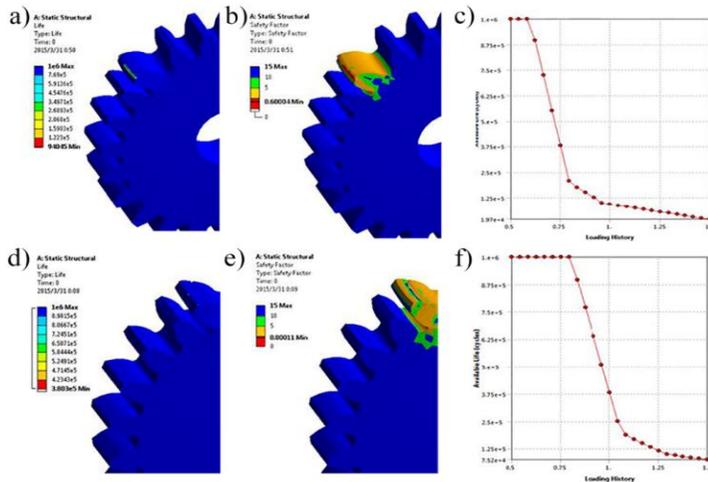
➤ FEA analysis and engineering capability:



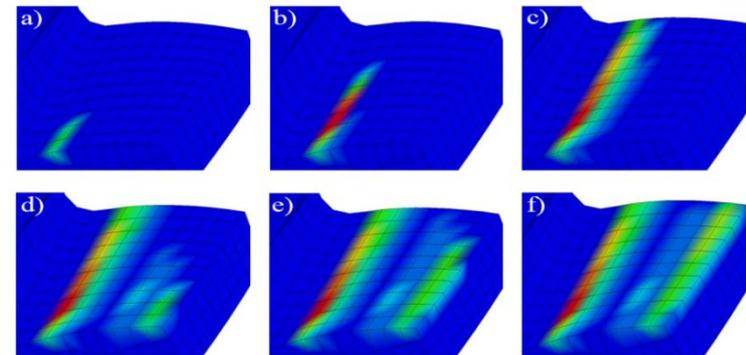
a) Meshing gear pair, b) driving, c) driven, d) stress



Stress distribution of root stress



Gear life time calculation: a-c before modification; d-f after modification

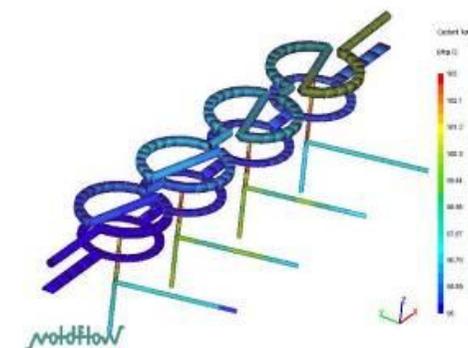
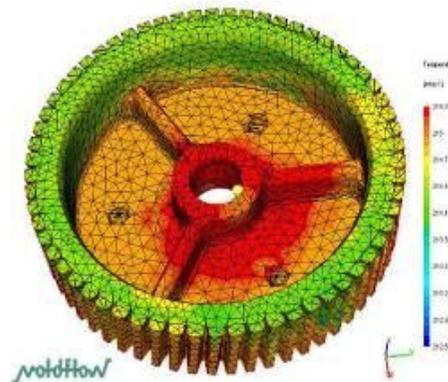
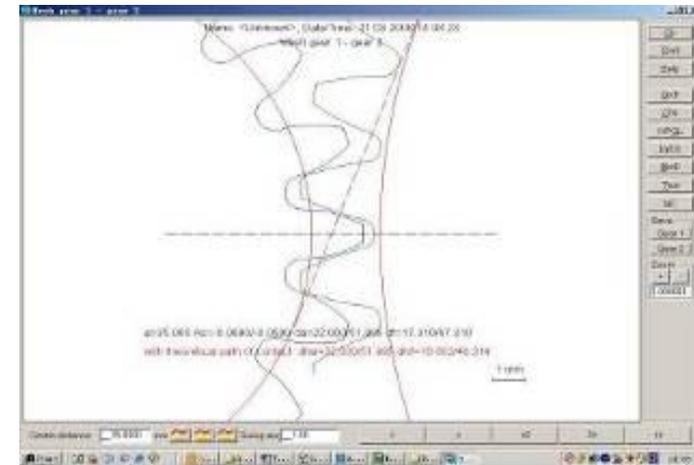


Temperature analysis for gear meshing

Gear Capability with Plastic Solution

Design of the Gear Profile

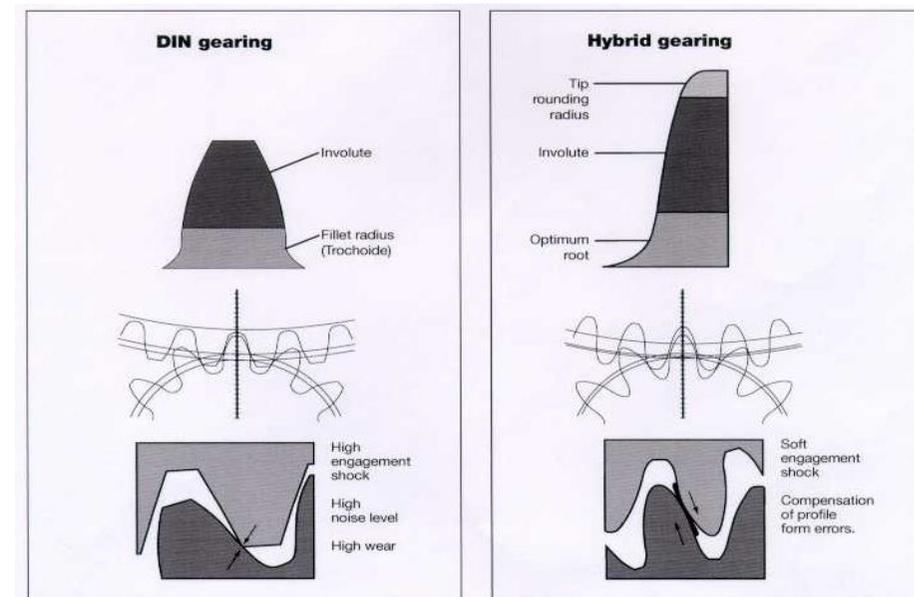
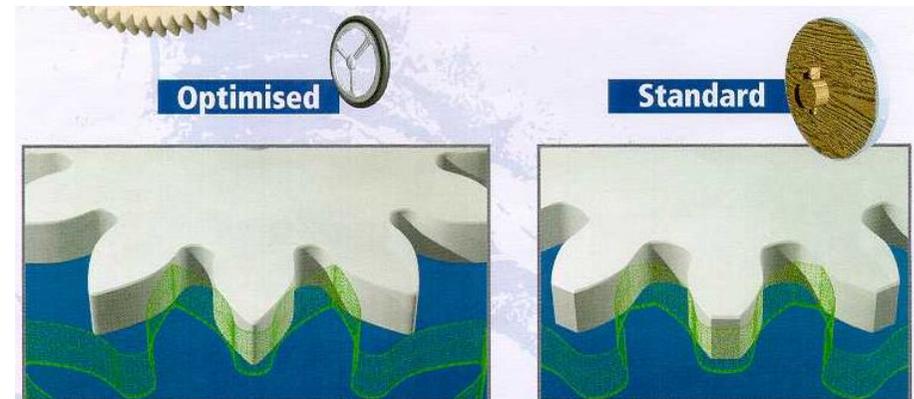
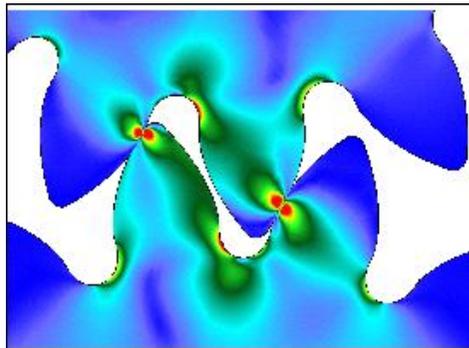
1. Gear Profile optimization and calculation
2. Strength calculation and material selection
3. Fast prototyping for design verification;
4. CAE analysis: Moldflow
5. Finite element analysis



Gear Capability with Plastic Solution

Noise Reduction

1. Hybrid Gear Profiles
Combination of Involutes and Cycloid gear profiles
2. Improvement of the tooth radius (tip and root)
3. Tooth high $> 2,5m$
4. Noise reduction, min. of 10%



Gear Capability with Plastic Solution

Engineering Resin Proposal

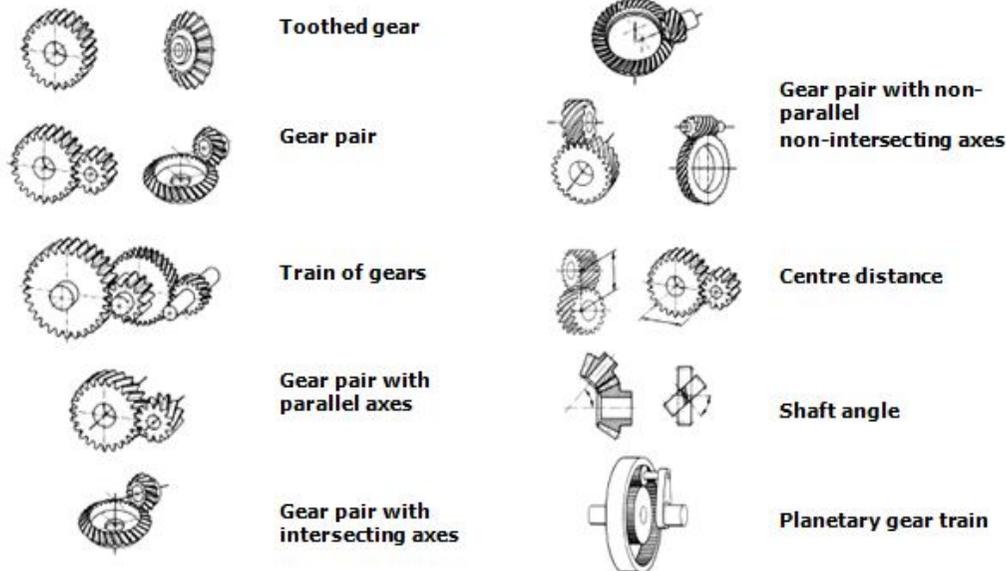
Selection of the suitable engineering plastic for the specific application:

1. Experience with crystalline and amorphous engineering materials:
POM (Homo- and Copolymers), PA66, PA46, PBT, LCP, PEI

2. Compounds with glass, carbon and PTFE

3. Experience with Elastomers

Desmopan (TPU – Bayer), Hytrel (TPE - DuPont) and Santoprene (up to 30° Shore A)

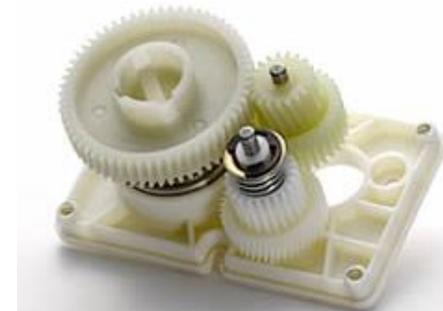
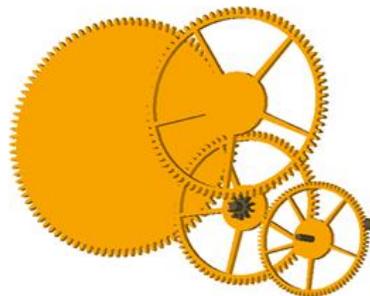


Gear Capability with Plastic Solution

Gear Tolerance

Based on the designed gear pair and selected material, the gear accuracy could reach:

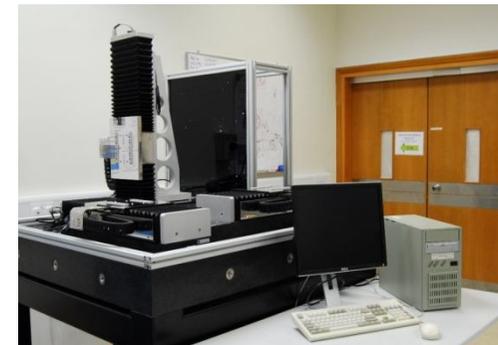
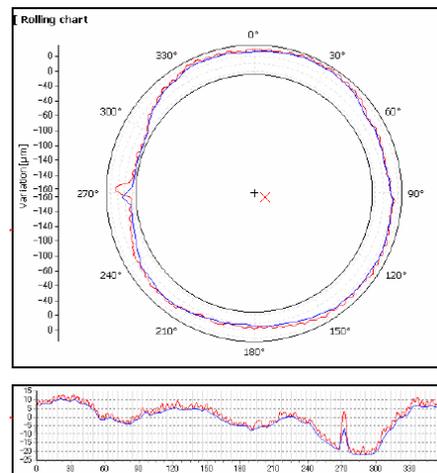
1. DIN class 8 (AGAM 9, JIS 3) {according DIN 58400($m < 1$) and DIN 867($m > 1$)}
module < 1 , pitch circle 25 mm
 $F_i'' - 60 \mu\text{m}$, $f_i'' - 22 \mu\text{m}$
Production with 8 and 16 cavity tools with $C_{pk}=1,33$
2. DIN class 7 (AGAM 10, JIS 1-2) (according DIN 58400 and DIN 867)
module < 1 , pitch circle 25 mm
 $F_i'' - 25 \mu\text{m}$, $f_i'' - 9 \mu\text{m}$
Production with 2 cavity tools with $C_{pk}=1,33$



Gear Capability with Plastic Solution

Measurements of the Gear Data

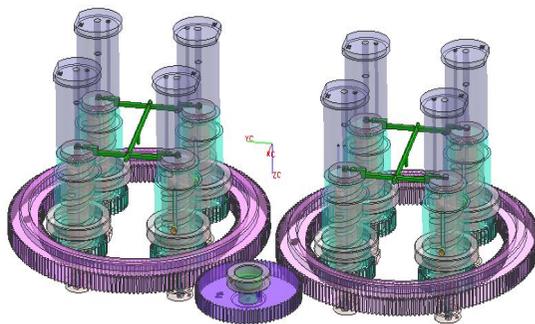
1. Single Gear measurement
 - ✓ Base tangent length, respectively the tooth thickness
 - ✓ Tip and root diameter
 - ✓ Dimension over the pins or ball
2. Composite measurement
 - Dynamic double flank test with a master Gear
3. Full profile measurement (current outsourced);



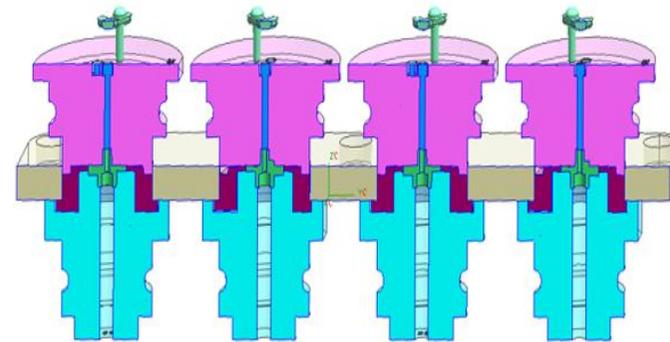
Gear Capability with Plastic Solution

In-house High Performance multi cavity tooling

1. High quality steel plates, with tool life up to 1M (practice 2M up to 3M);
2. Intensive cooling circuit;
3. Stable processes during the production;
4. Wire spark erosion rawness 0,15 - 0,18 μm ;
5. EDM spark erosion with rawness of 1,1 - 1,6 μm ;



Worm gear mold

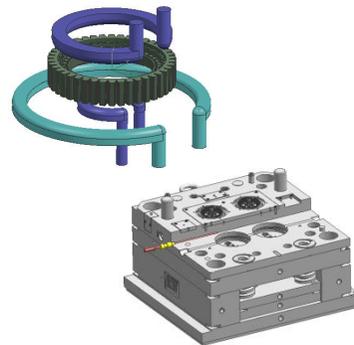


Helical Gear Multi-cav Tool

We build own tooling standards for prototype and production molds, with our in-house tool-making capability.

Gear Capability with Plastic Solution

Key factors for engineering plastic

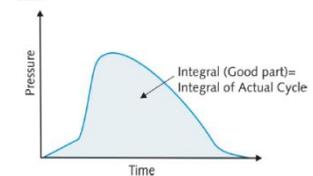
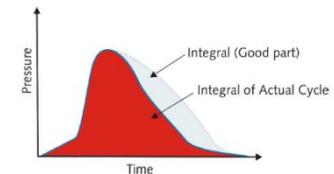


Material know-how and experience with engineering plastic

Precision tooling design and development capability

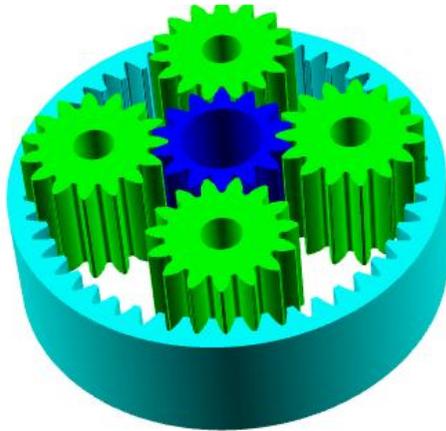
Process Development know-how for precision plastic parts

Close Loop Process Control technology and implementation



Gear Engineering & Development Cases

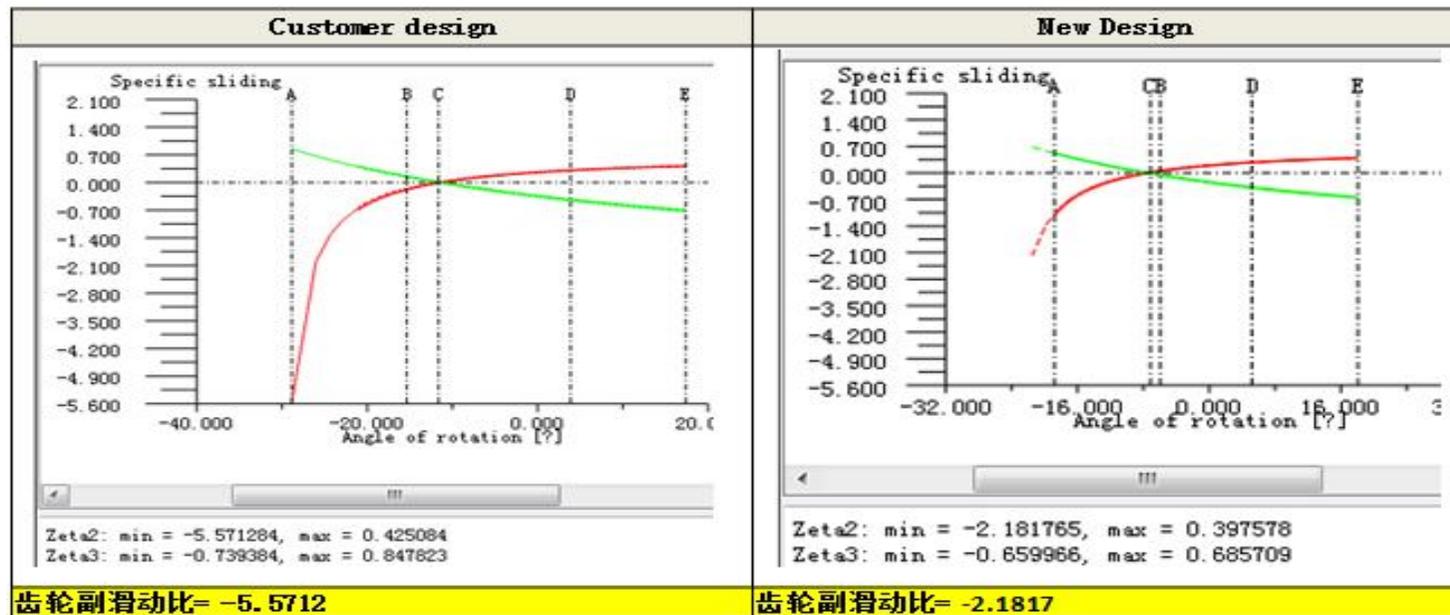
Planetary Gear for Metal Replacement



竞争对手齿轮滑动数据



新设计齿轮滑动数据



Gear Engineering & Development Cases

Gear Train Design with high temperature application

Valve Gear Box for automotive cooling system, with below requirement:

- Long term working temperature -40 -125 °C, with short term up to 135 °C
- Life testing (with load): 115 °C / 800h, -37 °C / 50h;
- High temperature testing (without load): one cycle: -40 °C/10min/ 125 °C/10min, total 1000 cycles;



Gear Train Design Model

Input 8Nmm

Output < 200Nmm
6r/min*850hrs=
300 K cycle



Plastic Samples



Assembly Parts

Do you have any further questions?



Do not hesitate to contact us, we are looking forward to being of your assistance

Sales & Engineering Department

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