Oerlikon Graziano is a leader in the manufacturing of bevel gears applying all the technologies available on the market today.

Oerlikon Graziano has three modern and specialised plants for crown wheels & pinions (CWP) production (Sommariva Perno and Porretta - north of Italy; Delhi - India).

Both Gleason and Oerlikon – Klingelnberg (Palloid method included) technologies are available at OG's facilities: continuous and not continuous indexing methods are widely used for more than 250 different bevel sets.

Oerlikon Graziano has the technology to cut the parts (soft stage – before heat treatment) in wet and dry condition that correspond to the traditional way of machining (wet) and to the most updated method using Carbide tools (dry – Power Cutting). HSS and Carbide blades can be accommodated on sharpening machines in order to have the full process in house (coating is an outside source but still within Oerlikon Group through Oerlikon Balzers).

Oerlikon Graziano can machine parts (after heat treatment) by applying grinding and/or lapping process. The most updated machines are available: Gleason 200G/275G, Gleason 800, Oerlikon WNC50 (for Semicompleting); Gleason 600HTL and Oerlikon L50.

Oerlikon Graziano also has Gleason technology to cut straight gears (i.e. for diff housing applications) in both Coniflex and Revacycle methods. Furthermore net forged straight gears can also be supplied if required.

It is remarkable that UMC sets (ground only) can be accommodated on all the Gleason grinding machines in order to have a very fine tuning of the microgeometry in view of noise and durability optimization.

For static inspection of the parts Oerlikon Graziano has CMM (Zeiss) running with G-Age and Komet software. For matching inspection Oerlikon Graziano has several Gleason testers and three Single Flank testing equipments for objective analysis (transmission error is a standard parameter used both at the prototypes stage and in mass production environment).

Especially for the lapped sets and because of the heat treatment influence (distortions) Oerlikon Graziano has an internal procedure that allows to monitor continually the consistency of the process and to develop the desired contact pattern. A specific and well trained team works daily to develop new jobs and to assist production in case of any kind of quality issue.

Even if the bevel sets are one of the core product of the company since a long time ago it is remarkable that Oerlikon Graziano has been dispatching more than half million sets every year since 2000.

<table>
<thead>
<tr>
<th>lapped sets</th>
<th>ground sets</th>
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</thead>
<tbody>
<tr>
<td>max gear o.d.</td>
<td>20&quot; (508 mm)</td>
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</tbody>
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Powershift units

Clutch Housings:

- All most used technologies available to produce clutch housing: Flow Forming, Grob ruling, Broaching plus Laser or EB Welding.

<table>
<thead>
<tr>
<th>Currently available broached splines on Oerlikon Graziano production:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitch Diameter [mm]</td>
</tr>
<tr>
<td>Module</td>
</tr>
<tr>
<td>Number of teeth theorical</td>
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</table>

Powershift units:

- Oerlikon Graziano is able to design, develop and test complete Powershift units. Supplying the complete powershift unit gives great advantages to the Customer:
  - Geometries and functionality of every clutch are controlled 100% before delivery on a final hydraulic test bench; the Customer receives a product which is ready to be assembled on its machines.
  - Only one p/n to handle instead of several components.
  - Less space required in the Customer’s warehouse.
  - Any problem can be detected on the clutch itself and not at transmission level, resulting in costs and time saving for the end customer.

EBW: Electron Beam Welding

EBW is a simple concept to join, melt and harden a variety of metals with technical and cost advantages. It is based on beam coming out from a fix gun that provides a precisely and controlled heat source with exceptional power density, flexibility and dimensionally repeatable with low distortions. The components to be welded have to be demagnetised and then loaded on a rotating spindle in vacuum chamber with specially designed tooling; with easy modifications obtained by electronic or optic change the beam can be adjusted to reach particular characteristics of positioning, texturing and hardening.

Advantages of EBW:
- Material is cleaner
- Largest depth of welding (up to 15mm)
- Material is less distorted
- Cycle time reduction
- Reliability & repeatability of the process
- Extremely competitive

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Synchronizers

Markets
- Oerlikon Graziano produces more than 800,000 synchronizers for passenger cars, trucks, tractors, construction machines.
- Oerlikon Graziano is recognised as the worldwide leader in synchronizers for agricultural tractor’s applications.

Materials and sizes
- All friction materials are available to suit the specific requirements of our Customers: bronze, molibdenum, sinterised bronze, carbon...
- Oerlikon Graziano has a wide range of synchronisers from Ø 62 mm to Ø 170 mm. Oerlikon Graziano has also developed single, double and triple cone solutions; so Oerlikon Graziano can offer its Customers the best solution with reduced investments and short lead time.

R&D
Full Design and Testing capability to develop the best solution for the specific Customer’s application and the most strict requirements:
- Design: preliminary layout study, performance analysis, virtual validation (linear and non linear FEM analysis, contact FEM analysis, ITI-SIM dynamic simulation).
- Specific test benches for: friction materials, synchronizer assembly, complete gearbox, vehicle tests, shiftability, low temperature tests, endurance test, fatigue test.

Continuous development
New products are continuously developed to attend the more and more challenging demands from the markets:
- new Servo – Synchronizer concept for trucks and off-highway applications
- modular design Double Cone 162 / 170 for heavy applications currently under development
- long life synchronizer design for new high performance and low emissions transmissions concepts
- triple cone 90/95/100 with low module teeth to prevent double bump and to improve shift comfort.

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