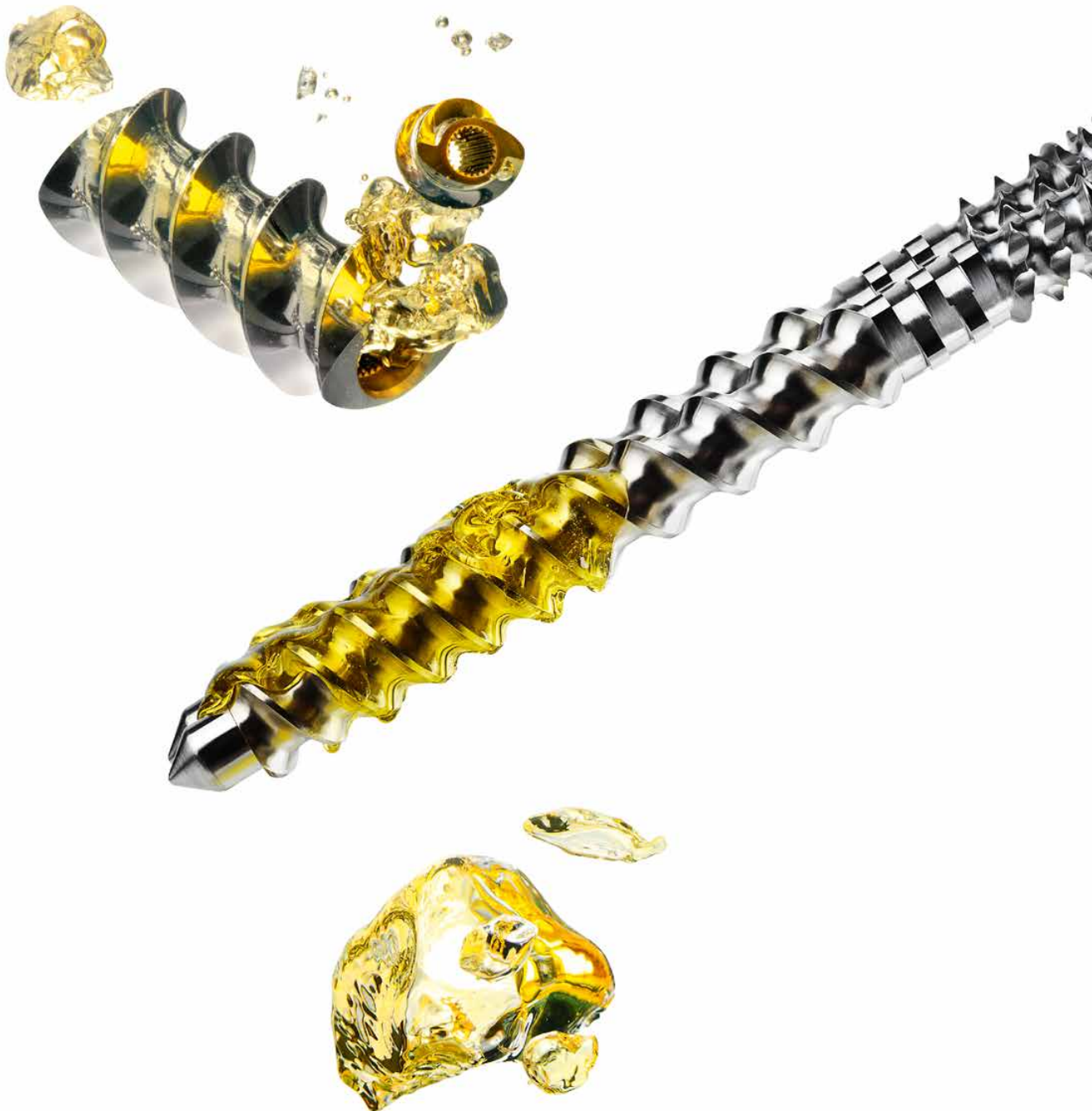


Leistritz

LEISTRITZ EXTRUSIONSTECHNIK GMBH

refreshing
extrusion
technology



ZSE MAXX

A Great Team - the Basis for Success

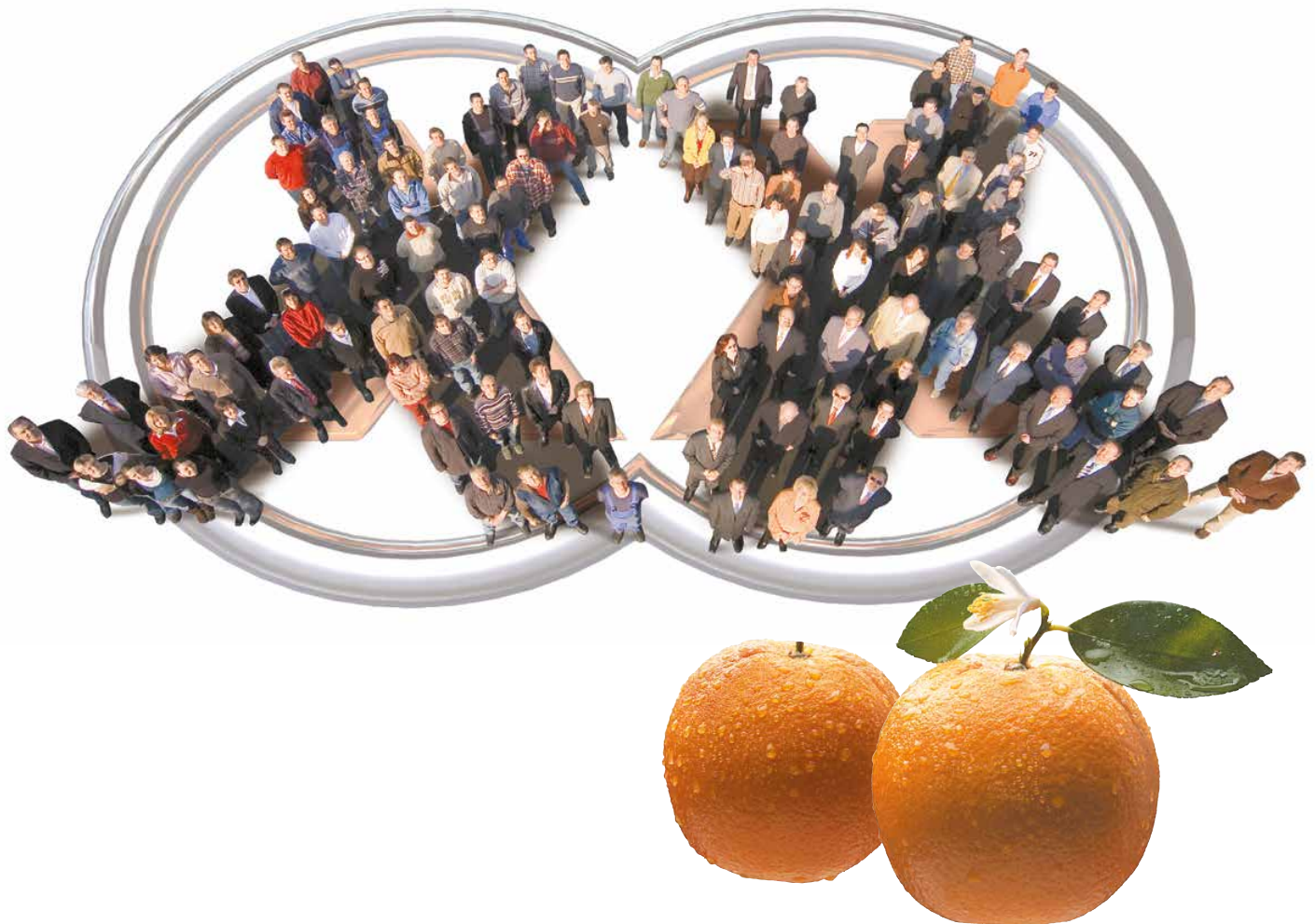
Leistritz Extrusionstechnik GmbH has established itself as one of the leading manufacturers of co-rotating twin screw extruders. This is facilitated by the latest technology and especially by the 150 employees worldwide - a team which stands behind its product.

For more than 50 years, the company has been building and optimizing twin screw extruders for the plastics technology as well as the pharmaceutical and food industries. Nürnberg plays an important role as headquarters. The heart of the extruder - the screws and barrels - are exclusively manufactured by Leistritz. Thus, constant high quality is guaranteed. This is mainly possible by the symbiosis of the various Leistritz product groups in terms of superior in-house metal machining technology, e.g. whirling and ECM (electro chemical machining).

In order to provide state-of-the-art turnkey extrusion systems, the overall concept and the logistics have to be right. A process flow based on the ISO 9001:2008 certification guarantees optimized procedures and fast communication channels. Long lasting partnerships with distributors and customers provide a trustworthiness and professional cooperation for complex requirements.

Leistritz customers benefit from a profound experience: The company plans, designs and produces individual extruders and turnkey extrusion lines for a wide variety of processes and applications.

A team which lives **XX** ...



Leistritz has established itself as the leading manufacturer for twin screw extruders worldwide. The only possible way to survive in this highly competitive market is by the continuous quest for innovation and by being receptive to the customer's needs. True to the motto „refreshing extrusion technology“ the ZSE MAXX series offers an innovative machine concept with partly revolutionary improvements which hitherto have been unique in the market:

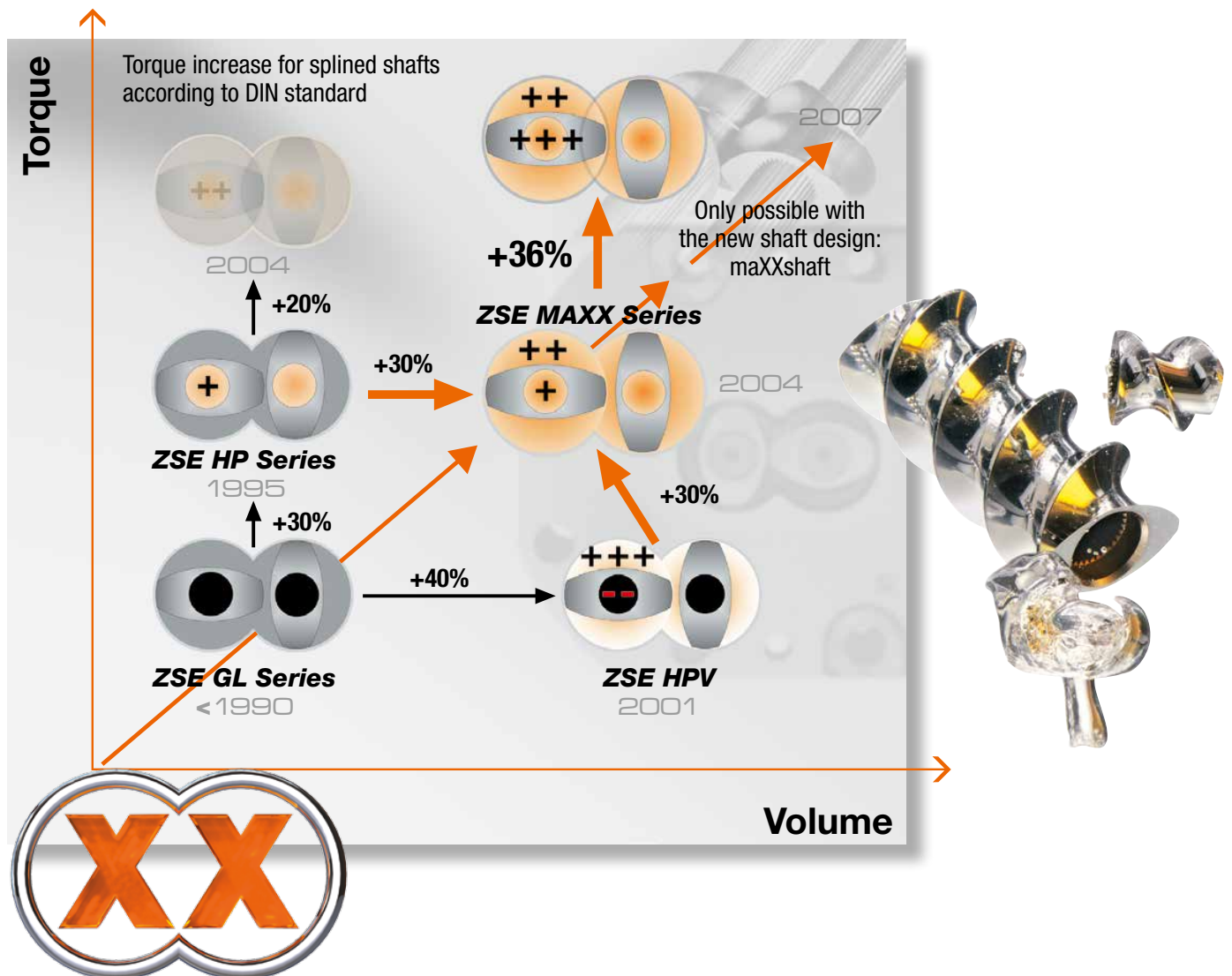
A special combination of high torque and high volume in ONE extruder.

The extruder user experiences a whole new degree of freedom: In the focus of the ZSE MAXX series is the increase of productivity, throughput and quality. In addition to that a significant expansion of the process window applies. All these are arguments that convinced the experts.

This product range opens the world of „productivity via flexible technology“. For production it means: more efficiency for securing the future.

As usual, the evidence is given in practical applications: This is why in our very well-equipped lab the machines are ready for trials.

High volume combined with a very high specific torque





ZSE MAXX - one machine for torque AND volume limited formulations



Now the poker game has an end

The ingenious combination of torque and volume in one machine is highly relevant in terms of process technology. A wide range of processes profits from the maximum adaptability of the ZSE MAXX. In the past, processors had to choose between a high volume and a high torque machine. Especially, against the background of the constantly faster market development they were confronted with a significant investment risk.

| | application | advantage | results |
|---|---|---|--|
| 1 | Compounding of shear sensitive and highly viscous products as well as fibre formulations e.g. PA+GF or PC+GF | Reduced melt temperature at the same screw speed | Increase of throughput by up to 50% |
| 2 | Compounding of various technical polymers e.g. PMMA, PET, PC | Increase of throughput by means of a higher screw speed at constant product quality | Increase of throughput by up to 30% |
| 3 | Dryblends Pigment paste Filler applications Additive concentrate | Increase of throughput by means of a higher screw volume and max torque | Increase of throughput by up to 30% |
| 4 | Premix formulations or hotfeed with additive-/pigment concentrates as well as filler applications | Higher formulation loading with fillers or pigments at the same throughput | Increase of filler or pigment content up to 10% |
| 5 | Degassing tasks with high monomer / humidity or other volatile components e.g. for ABS, PS, PET or wood compounds | Higher degassing efficiency by means of a larger melt surface | Degassing efficiency depending on application |

The ZSE MAXX Series offers maximum values for torque and volume in one system (OD/ID = 1.66).

By an optimized volume/torque ratio the throughputs increase significantly by up to 50 %. This is made possible by a splined shaft design - **maXXshaft** - that opens up new potentials.

The design allows for deeper screw channels at highest torques so that the free volume in the processing unit is increased by up to 30%. Consequently, **maXXvolume** is available for volume-restricted processes. Ratio of outer screw diameter to inner screw diameter:

OD/ID = 1.66

With this gear-generation for the whole MAXX series the torque has been increased very high. This is why this feature is rightly called **maXXtorque**. The specific torque of this series is:

15.0 Nm/cm³

Due to the increased throughput/energy ratio, the cooling capacity also had to be increased. With **maXX-cooling** up to 30% more cooling capacity is achieved by a sophisticated flow of cooling agent.

The modular barrel and screw system can be fully utilized due to a flexible machine design.

50% increase of throughput by means of:

maXXvolume

Increased free volume in the screw (OD/ID = 1.66)

maXXshaft

Very high total torque by new splined shaft design

maXXcooling

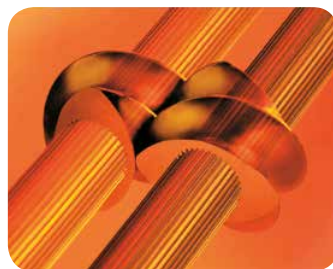
Up to 30% increased barrel cooling capacity by means of optimized flow of the liquid coolant through the barrel cooling bores

maXXtorque

Very high available specific torque with co-rotating twin screw extruders (up to 15.0 Nm/cm³)



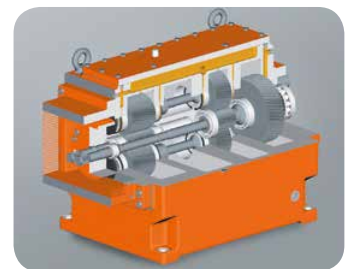
Increased screw volume at the same centreline distance like the ZSE HP series (orange = increase in volume)



Shaft profile with significant potential for the future



Optimized barrel cooling system with maintenance-free high-end valves



Extremely reliable and powerful co-rotating extruder gear box

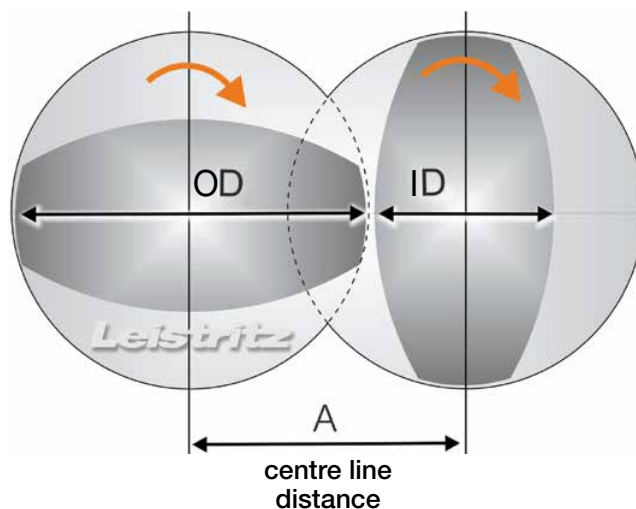
30% increase of throughput by means of increased volume



When running volume restricted processes, i.e. dryblends, pigment preparations, fillers or additive concentrates, the increased volume of the ZSE MAXX series has significant effect. The increased volume of up to 30% is realized with lower cut screw flights and larger external diameters.

Visualized:
Difference in volume of a ZSE 50 HP in comparison to a ZSE 50 MAXX

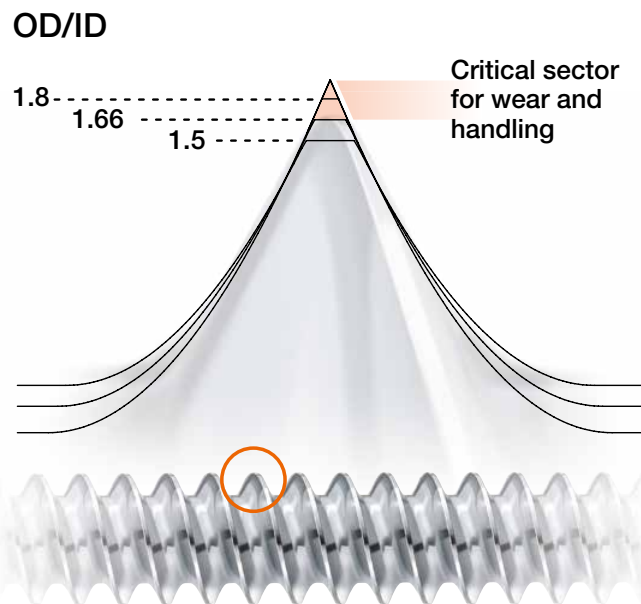
With an OD/ID of 1.66 Leistritz found the optimum ratio between high volume and energy input into the product. The shear effect is slightly smaller than of the ZSE HP machines. Nevertheless, it facilitates excellent dispersion. At the same time, high throughputs of many formulations with constant or even better quality can be achieved.



The geometry of screw elements in twin screw extruders are calculated by means of the so-called Erdmenger profile. Hence, the elements are subject to exactly defined geometrical specifications. The ZSE MAXX machines offer the best balance between deeper screw channels and technically sensible flight tips (see on the right).

The optimum in terms of process and material lies in the range between 1.5 and 1.66. The OD/ID ratio above 1.66 is critical, since it poses two problems:

1. The wear of thin screw flights is very high due to physical limits.
2. The handling of the screw elements with respectively thin screw flights becomes more and more difficult, since the screw flights become extremely sharp.



30% more cooling capacity for an expansion of the process window

ZSE MAXX extruders facilitate an increase in throughput of up to 50%. That implies: The energy balance in the processing unit is changed. Consequently, the cooling capacity partially has to be increased. Leistritz meets this claim with **maXXcooling**:

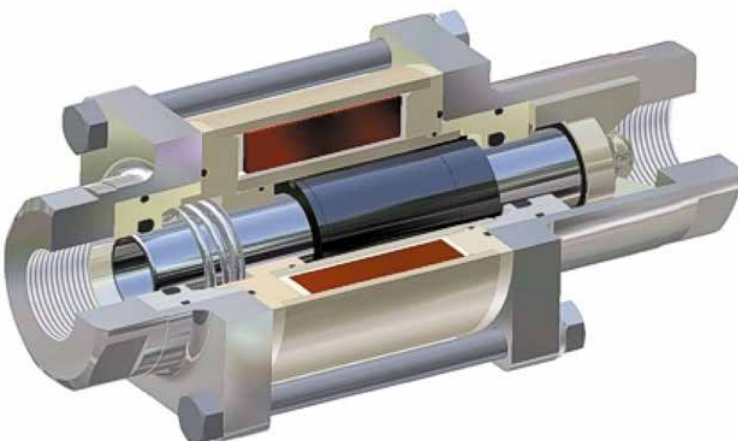
By doubling the in- and outlet in each barrel and by using a sophisticated cooling bore system, significantly more cooling agent can flow through the barrel. The

cooling capacity can be utilized ideally, because of the small distance between the cooling bores and the processing chamber as well as the counter flow principle.

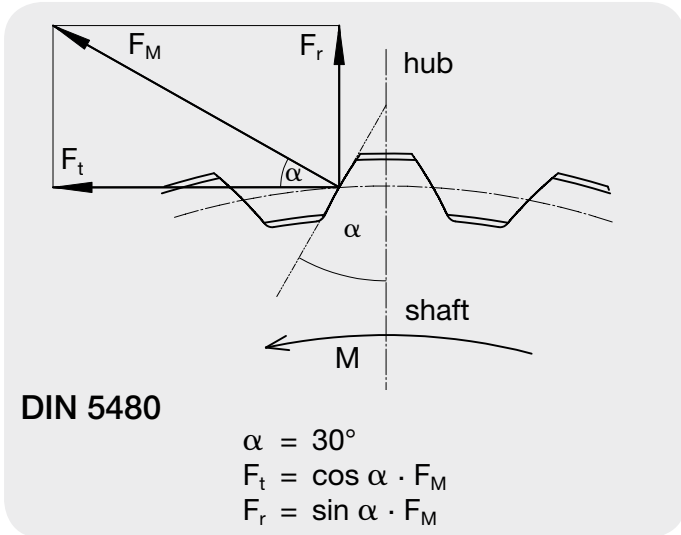
The processing unit is mounted on a functional carrier system with an integrated cooling pipe installation. The high-quality coax valves are assembled in the frames in a very space saving way.

Advantages of the coax valves:

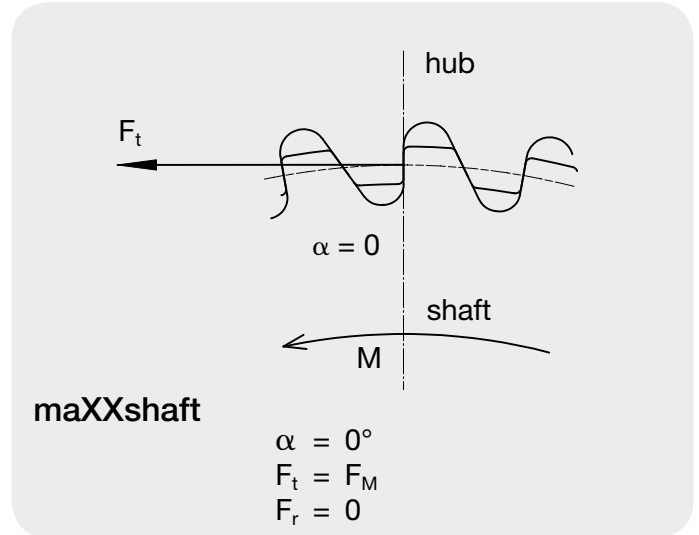
- long durability
- short closing speed
- compact construction
- maintenance-free
- backward pressure safe
- work from 0 bar upwards



For a long time, the standard involuted spline connection according to DIN 5480 had been first choice for screw elements and shafts. However, when transmitting extremely high torques the DIN 5480 spline profile meets its physical boundaries for thin-walled hubs. Thus, it was necessary to reconsider using the spline profile in order to further develop co-rotating twin screws. The result - **maXXshaft** - is amazing as well as simple: Since the power transmission in a co-rotating twin screw just needs to be carried out in one direction of rotation, the spline profile is changed to an asymmetric shape.



When transmitting torque, a radial tension evolves, which puts additional stress on the screw element. This means that the screw flights cannot be cut very low as otherwise the screw element would burst.



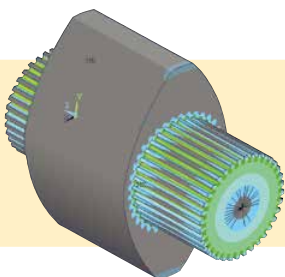
No additional radial tension arises, i.e. screw flights can be cut lower and - benefiting from the optimized shape stability - torque can even be increased.

When using an asymmetric spline profile, more splines can be placed around the shaft, i.e. the transmittable torque is higher than for a symmetric spline profile.

The handling of the maXXshaft connection is as easy as for the conventional involuted spline profile. Assembling the elements works perfectly. So the setup time of a ZSE HP and a ZSE MAXX are comparable.

Due to the asymmetric spline profile, the assembling position of the elements is given. Thus, no more mix-ups can occur. Especially for nonstandard elements, this is a particularly important aspect.

Consequently, reversed assembling of worn elements is not possible any more and protects the extruder from damages.



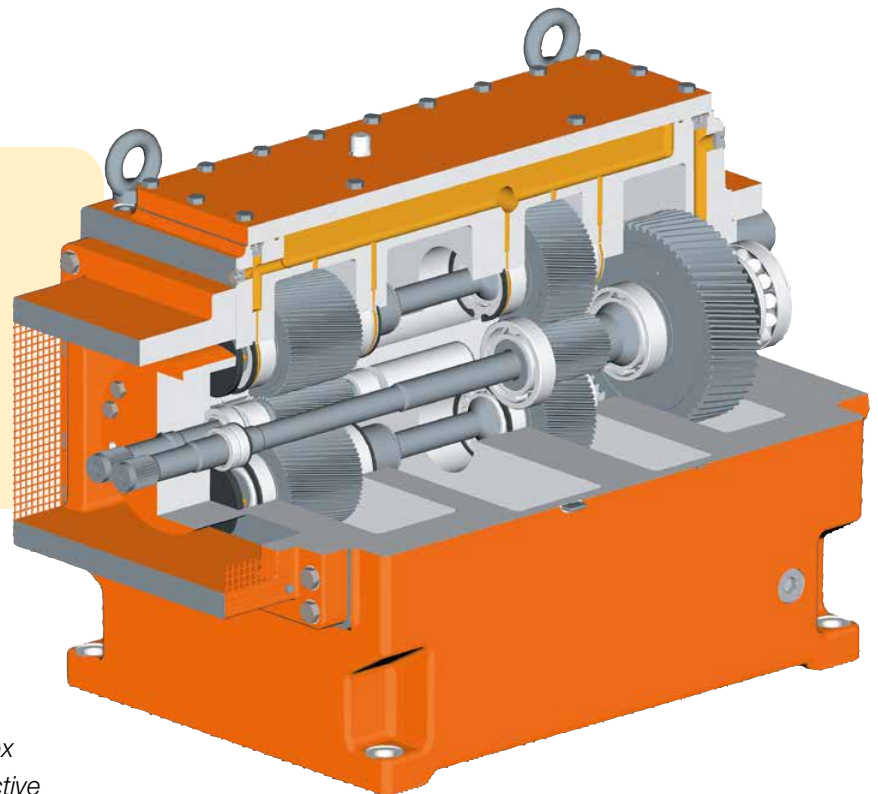
With elaborate 3D calculations and long-term stress testing, the new hub/shaft connection was checked thoroughly by independent institutes. The outcome: The new hub/shaft connection transmits maximum torque.

The gearbox is an important factor when talking about the availability of a twin screw extruder. The transmission gear with dual power distribution is a master piece of the German art of engineering. The extremely high-power density was reached by high-quality work-

manship, constant research and longterm know-how. It meets the extremely high Leistritz standards and convinces by maximum torque density at comfortable safety factors.

The advantages at a glance:

- thick-walled housing
- noise optimized by means of specially finished gears
- efficiency optimized lubrication system



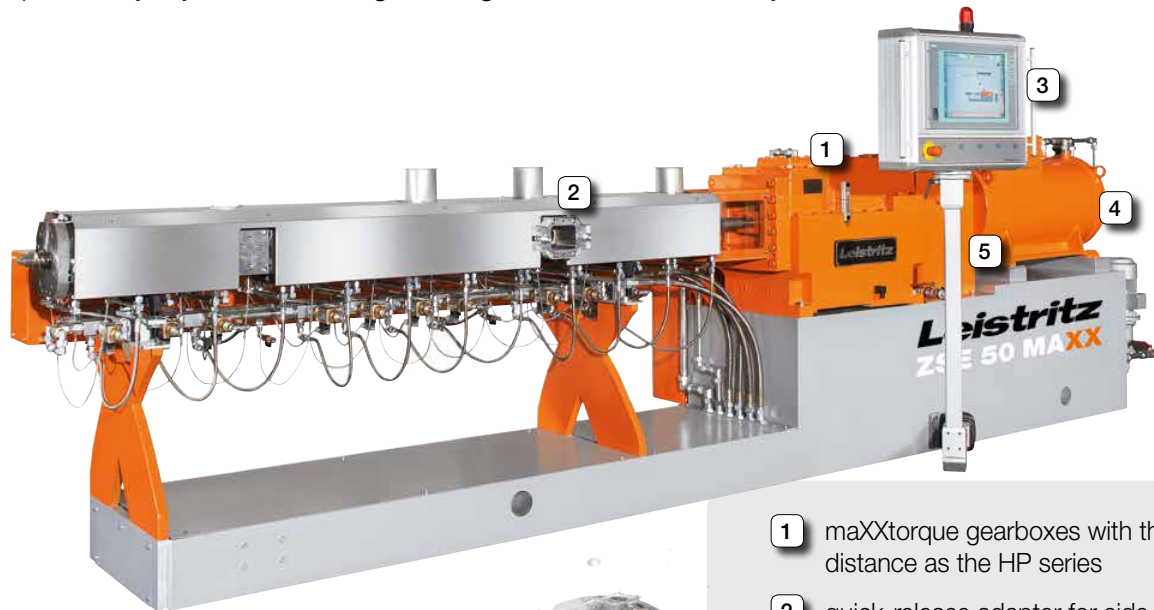
*maXXtorque gearbox
in a section perspective*

A sophisticated oil system ensures the best possible lubrication of all shafts and gears. With heavy duty oils, the lifetime of gearboxes is optimized and maintenance intervals maximized.

maXXtorque stands for an extremely powerful drive concept for co-rotating twin screws.



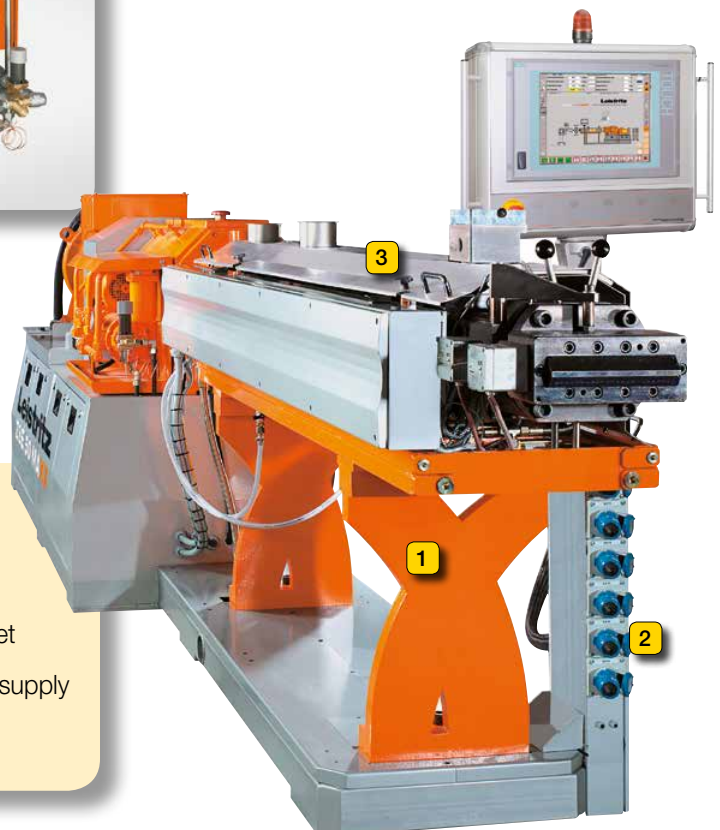
The whole machine concept is based on a platform construction. This facilitates a wide range of modules and a stronger extruder systemization. A further advantage: This way, the length of the processing unit can be changed quite easily. By this, the user gets a higher investment security.



- 1 maXxtorque gearboxes with the same centreline distance as the HP series
- 2 quick-release adapter for side feeder
- 3 extruder can be operated from four sides (left/right, front/back)
- 4 water-cooled drive
- 5 safety clutch



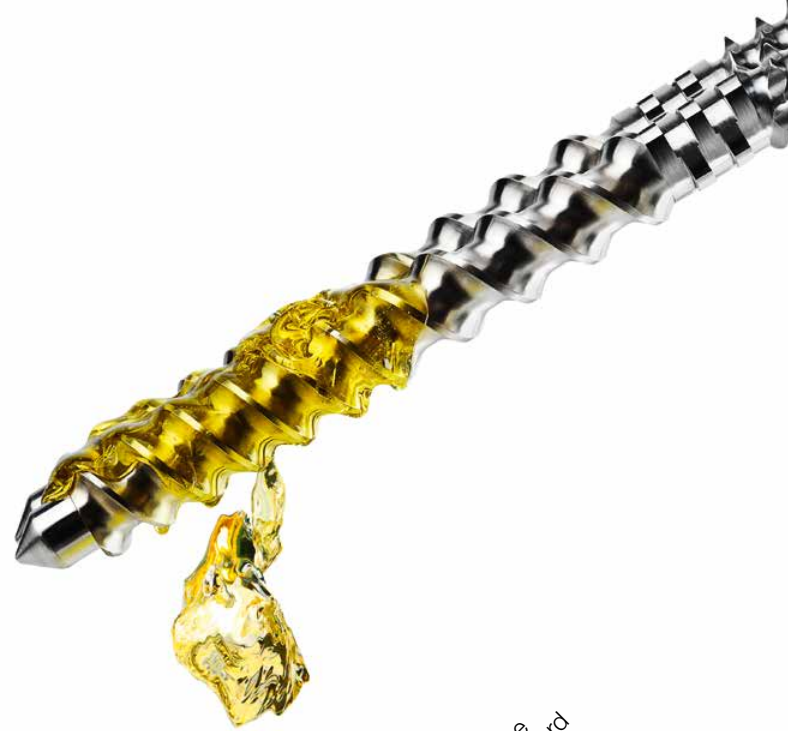
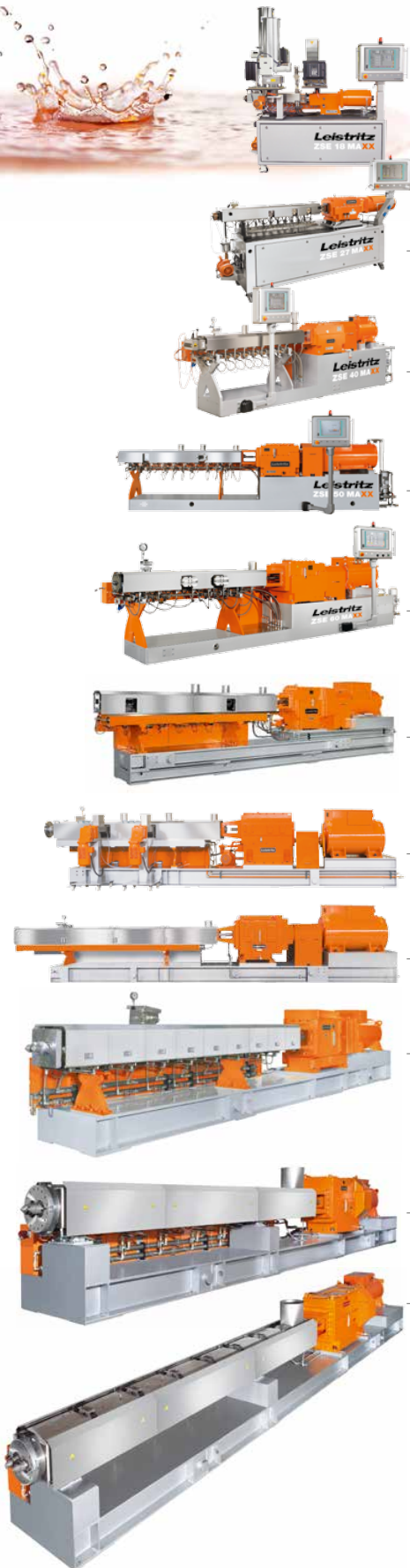
- 6 control cabinet system, placed directly at the machine (electricity supplies for drive, control and heating/cooling system)
- 7 oil system for gear lubrication



Especially for masterbatch production, Leistriz offers the following extruder design with optional features:

- 1 barrel support frame with integrated water in- and outlet
- 2 supplies for auxiliary equipment integrated in a central supply
- 3 water-cooled cover

The ZSE MAXX Series takes twin screw extrusion to a new dimension.



| Type | Screw Diameter OD (mm) | OD/ID | Spec. total torque (Nm/cm ²) standard | maXXtorque (Nm/cm ²) |
|------|---------------------------|-------|--|-------------------------------------|
| 18 | 18.5 | 1.66 | 11.0 | - |
| 27 | 28.3 | 1.66 | 11.0 | 12.5 |
| 40 | 41.4 | 1.66 | 11.0 | 15.0 |
| 50 | 51.0 | 1.66 | 11.0 | 15.0 |
| 60 | 61.6 | 1.66 | 11.0 | 15.0 |
| 75 | 77.0 | 1.66 | 11.0 | 15.0 |
| 87 | 89.4 | 1.66 | 11.0 | 15.0 |
| 110 | 113.1 | 1.66 | 11.0 | 15.0 |
| 135 | 138.7 | 1.66 | - | 15.0 |
| 160 | 158.9 | 1.66 | - | 15.0 |
| 180 | 178.8 | 1.66 | - | 15.0 |

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