ZSE MAXX SERIES
Co-rotating twin screw extruders
**ZSE MAXX TWIN SCREW EXTRUDER**

Convincing benefits

Leistritz is one of the worldwide leading manufacturers of twin screw extruders. It is only possible to offer a fully developed product range by means of constant innovations and an open ear for the requirements of the users.

The ZSE MAXX series is a extruder series that offers an ideal combination of high torque and large volume in ONE machine.

This opens up a great degree of freedom for users: increased throughputs and a significant expansion of the process window are arguments that have convinced experts. This product range opens up the world of “Increased productivity through flexibility”. For production, this means more efficiency, thus ensuring a sustainable future.

While previously, a choice needed to be made between a high-volume or high-torque machine, now virtually every application can be run on a ZSE MAXX twin screw extruder.
**maXXtorque**

More output for higher operating safety

Great demands are made on the gearbox of a twin screw extruder. With the relatively close axial distance of the two extruder screws, it has to transmit very high torque and counteract high backward pressure forces. Leistritz thus uses an extremely powerful drive concept for its twin screw extruders. The transmission gear with dual power distribution is a masterpiece of German engineering. The extremely high power densities were achieved by high-quality workmanship, constant research and long-standing know-how. It satisfies the very demanding requirements and convinces by a maximum torque density.

**THE GEARBOX ADVANTAGES AT A GLANCE:**
- thick-walled housing
- highest degree of efficiency
- noise-optimized by means of specially finished gears
- continuous lubrication to avoid churning losses
- optimized service life through the use of high-performance oils
- for certain extruder sizes: the torque can be measured on drive shafts

![high-torque gearbox](image)

energy-efficient, water-cooled three-phase AC motor

safety clutch offers protection for the gearbox against the very high flywheel masses of the drive motor.

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**maXXshaft**

More splines for a better torque transmission

For a long time, the standard involuted spline connection according to DIN 5480 was the first choice for screw elements and shafts. However, when transmitting extremely high torques, the DIN 5480 spline profile comes up against its physical limits for thin-walled hubs. For this reason it was necessary to reconsider the spline profile in order to further develop co-rotating twin screw extruders. The result - maXXshaft - is both amazing and simple: Since the power only has to be transmitted in one direction with a co-rotating twin screw, the spline profile is changed to an asymmetric shape.

**ADVANTAGES OF THE ASYMMETRIC SPLINE SHAPE:**
- The arrangement of several splines with the same root width allows very high torque to be transmitted.
- Errors can be reduced by a set direction of assembly.

![DIN 5480](image)

A radial tension ($F_r$) is generated when transmitting torque, which puts additional stress on the screw element. This means that the screw flights cannot be cut too low as the screw element would otherwise burst.

![maXXshaft](image)

No additional radial tension ($F_r$) arises, i.e. the screw flights can be cut lower and - benefiting from the optimized shape stability - torque can be further increased.
**maXXcooler**

More cooling capacity for a larger process window

ZSE MAXX twin screw extruders allow an increased throughput of up to 50 % compared to predecessor models. This means that the energy balance in the processing unit changes and calls for an increased cooling capacity in some cases. This is why Leistritz has doubled the inlets and outlets for each barrel and developed a sophisticated cooling bore system to allow much more liquid coolant to flow through the barrel, which facilitates increased cooling capacity.

The cooling capacity is fully utilized on account of the short distance between the cooling bores and processing chamber as well as the counterflow principle. The processing unit is held by a functional carrier system with integrated cooling pipe installation. The high-quality coax valves are assembled in the frame in a very space-saving way.

**WHY COAX VALVES?**
- long service life
- short closing times
- compact design
- maintenance-free
- backward pressure-safe
- work from 0 bar upwards

**maXXvolume**

More throughput by means of increased volume

When running volume-restricted processes such as dry-blends, pigment preparations, fillers or additive concentrates, the increased volume of the ZSE MAXX extruders can be fully used. With an OD/ID of 1.66, Leistritz has found the optimum ratio between high volume and effective energy input into the product. The shear effect in the ZSE MAXX machine is slightly smaller compared to predecessor models, nevertheless, it facilitates excellent dispersion. At the same time, higher throughputs with an identical or even better quality can be achieved for many formulations.

With lower cut screw flights and larger external diameters, an increase in volume and thus improved throughputs of up to 30% are possible.
The extrusion process is energy-intensive. In order to reduce energy costs, operators aim for both high throughputs and an optimum energy utilization. Leistritz can offer a number of solutions in this field.

**Energy-efficient drives**

The energy flows in a twin screw extruder cannot be transported 100% into the product. The majority of the energy is mainly introduced into the melt via the drive and thus via the screws. Leistritz uses energy-efficient, water-cooled high-torque drives as a standard solution here.

**Optimum OD/ID**

An optimum screw diameter ratio plays an important role in the energy feed. The ZSE MAXX twin screw extruders with their high OD/ID achieve better mixing properties with a lower energy input. In a residence time study, a ZSE MAXX machine (OD/ID = 1.66) and a predecessor model (OD/ID = 1.5) were compared with the same and a slightly modified screw geometry.

**Insulating the processing unit**

However, it is not only drive energy that is required to provide the energy needed for melting at low speeds. Energy also enters the process through the barrel heating. Leistritz offers insulations for processing units to reduce the heat-up times and to use the barrel heating even more efficiently.
MODULAR SCREW SYSTEM

The heart of the extruder

Leistritz offers a wide choice of screw geometries that can be combined in a large number of variations. Generally, there are conveying, kneading and mixing elements. The competence of the Leistritz process engineers enables them to create an optimum screw design for the respective application. Depending on the geometry, various screw elements are placed and fixed on the screw shaft which has a spline profile.

KB (kneading block)
- standard element in 30°, 45°, 60° and 90° design for melting, dispersing and incorporating fillers
- The most important parameter is the offset angle between the kneading block disks and kneading block thickness (determines the energy input and melting capacity).
- improved kneading effect thanks to re-conveying KB elements

GFM (co-rotating conveying element, mixing)
- grooved screw element
- main job: distributive mixing
- typical use: incorporation of glass fibers and liquids into the polymer matrix, wetting of pigments
- improved mixing effect thanks to re-conveying GFM elements
- low energy input

GFF (co-rotating conveying element, non-self-wiping)
- typically with a big pitch (has the largest free volume of all screw elements)
- primarily used in the feeding zone
- used for conveying solids (materials with a low bulk density can be added in higher quantities)
- hardly any energy input

GFA (co-rotating conveying element, intermeshing)
- self-cleaning element with the Erdmenger profile
- used for conveying, degassing and building up pressure
- various pitches depending on the intended use and material to be processed

The design of the correct screw geometry is the alpha and omega for a stable process. Our process engineers are experts in this field.

<table>
<thead>
<tr>
<th>Material code</th>
<th>Material code</th>
<th>Material code</th>
<th>Material code</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSA100</td>
<td>Nitrided steel</td>
<td>0.4</td>
<td>&gt;750HV</td>
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<tr>
<td>VSA200</td>
<td>Hot work steel</td>
<td>through hardened</td>
<td>59±1</td>
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<td>VSA400</td>
<td>Stainless steel</td>
<td>through hardened</td>
<td>57±2</td>
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<td>VSA401</td>
<td>CrV-HIP material</td>
<td>through hardened</td>
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<td>VSA501</td>
<td>CrNbV-HIP material</td>
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<td>Hastelloy/Stellite</td>
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<td>45±5</td>
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<tr>
<td>VSA503</td>
<td>WC material</td>
<td>through hardened</td>
<td>1,450HV</td>
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</table>

OVERVIEW OF MATERIALS FOR SCREW ELEMENTS:

- Very high abrasion resistance
- Standard corrosion resistance
- Remarks: on request
MODULAR BARREL SYSTEM

Extensive portfolio

The processing unit must naturally also have a modular structure in accordance with the screw geometry. Leistritz offers barrels with various openings and inserts for material feeding, degassing and venting for the optimum interaction with the extruder screws. Depending on the size of the machine, these are either flanged together or connected with tie rods.

The optimum combination of cooling and heating is one of an extruder's essential quality characteristics. It plays a very important role so that every process can be adequately run. Each barrel hereby has a separate heating/cooling zone that can be heated or cooled as required.

<table>
<thead>
<tr>
<th>Material code</th>
<th>Material</th>
<th>Thickness (mm)</th>
<th>Hardness (HRC)</th>
<th>Protection against Abrasion</th>
<th>Protection against Corrosion</th>
<th>Comment</th>
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<tr>
<td>VSA00</td>
<td>Nitrided steel</td>
<td>0.4</td>
<td>&gt;750HV</td>
<td>very high</td>
<td>very high</td>
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<td>VSA200</td>
<td>Hot work steel liner</td>
<td>through hardened</td>
<td>58+2</td>
<td>8</td>
<td>8</td>
<td>standard</td>
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<tr>
<td>VSA301</td>
<td>M395x steel liner</td>
<td>through hardened</td>
<td>57+2</td>
<td>8</td>
<td>8</td>
<td>standard</td>
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<tr>
<td>VSA402</td>
<td>CN70V/HIP liner</td>
<td>through hardened</td>
<td>60+2</td>
<td>8</td>
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<td>on request</td>
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<tr>
<td>VSA503</td>
<td>NiCrB-HIP liner</td>
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<td>60+2</td>
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</tbody>
</table>

OVERVIEW OF MATERIALS FOR BARREL ELEMENTS:

Example: barrel with liner

BARREL HEATING/COOLING

Heating cartridges are used to heat the barrel in the fastest and most effective way. They enable:

- short heat-up times
- quick melting and wetting
- energy savings
- heating inside the barrel in contrast to heating bands or angular heaters
- more efficient spare part administration

Example: barrel with liner

heating cartridges
cooling bores
bore for temperature sensor
ZSE MAXX SERIES
System for maXXimum possibilities

The very high specific torque (up to 15 Nm/cm³) and the large volume (OD/ID = 1.66) in one extruder – this is what has distinguished the ZSE MAXX twin screw extruder in the market for over a decade. This enormous adaptability of the ZSE MAXX series provides the user with a processing advantage: A large range of processes can be covered with one ZSE MAXX twin screw extruder.

<table>
<thead>
<tr>
<th>Type</th>
<th>Screw diameter OD (mm)</th>
<th>OD/ID</th>
<th>Spec. torque density (Nm/cm³) up to max.</th>
</tr>
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<tbody>
<tr>
<td>18</td>
<td>18.5</td>
<td>1.66</td>
<td>11.0</td>
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<tr>
<td>27</td>
<td>28.3</td>
<td>1.66</td>
<td>12.5</td>
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<tr>
<td>35</td>
<td>35.1</td>
<td>1.66</td>
<td>15.0</td>
</tr>
<tr>
<td>40</td>
<td>41.4</td>
<td>1.66</td>
<td>15.0</td>
</tr>
<tr>
<td>50</td>
<td>51.0</td>
<td>1.66</td>
<td>15.0</td>
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<tr>
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<td>61.6</td>
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<tr>
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</tr>
<tr>
<td>260</td>
<td>258.0</td>
<td>1.66</td>
<td>15.0</td>
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</table>

The ZSE MAXX series is the most elaborate twin screw extruder series with a consistent OD/ID and high torque, which facilitates a scale-up from smaller machines to larger production plants.
EXTRUSION TECHNOLOGY

Available for you all over the world

USA
Leistritz Advanced Technologies Corp., Somerville, NJ

GERMANY
Headquarters
Leistritz Extrusionstechnik GmbH, Nuremberg

CHINA
Leistritz Machinery (Taicang) Co., Ltd., Taicang

ITALY
Leistritz Italia Estrusione, Castellanza

FRANCE
Leistritz France Extrusion, Ceyzeriat

SINGAPORE
Leistritz SEA Pte Ltd., Singapore

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