

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.

SIGNIFICANTLY MORE THROUGHPUT THANKS TO:

- **maXXvolume**
high, free volume in the screw
(OD/ID = 1.66)
- **maXXshaft**
very high total torque due to patented splined shaft connection
- **maXXcooling**
increased cooling capacity by means of optimized flow of the liquid coolant through the barrel
- **maXXtorque**
very high available specific torque
(up to 15.0 Nm/cm³)

high OD/ID (1.66) and high specific torque
(15 Nm/cm³)

drive unit: extremely reliable and powerful
co-rotating extruder gearbox

water-cooled AC drive

cooling: barrel cooling concept with
maintenance-free high-end valves

machine concept: platform design allows
a wide range of modules

Example of a
ZSE MAXX extruder

oil system for gearbox lubrication

control concept: individual integration of all
conventional upstream and downstream
equipment in one visualization and operating
panel

» 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 re-search 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

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

high-torque gearbox

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

maXXshaft

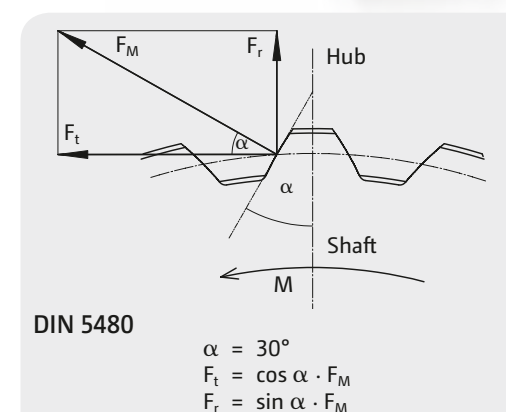
More splines for a better torque transmission

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

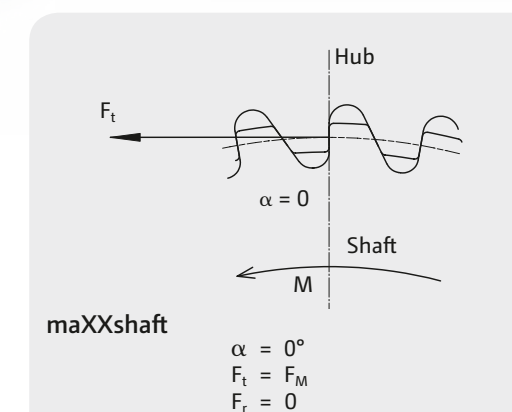
in order to further develop co-rotating twin screw extruders. The result - maXXshaft - is both amazing and simple: Since the power only has to be transmitted in one direction with a co-rotating twin screw, the spline profile is changed to an asymmetric shape.

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.



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.



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.

maXXcooling

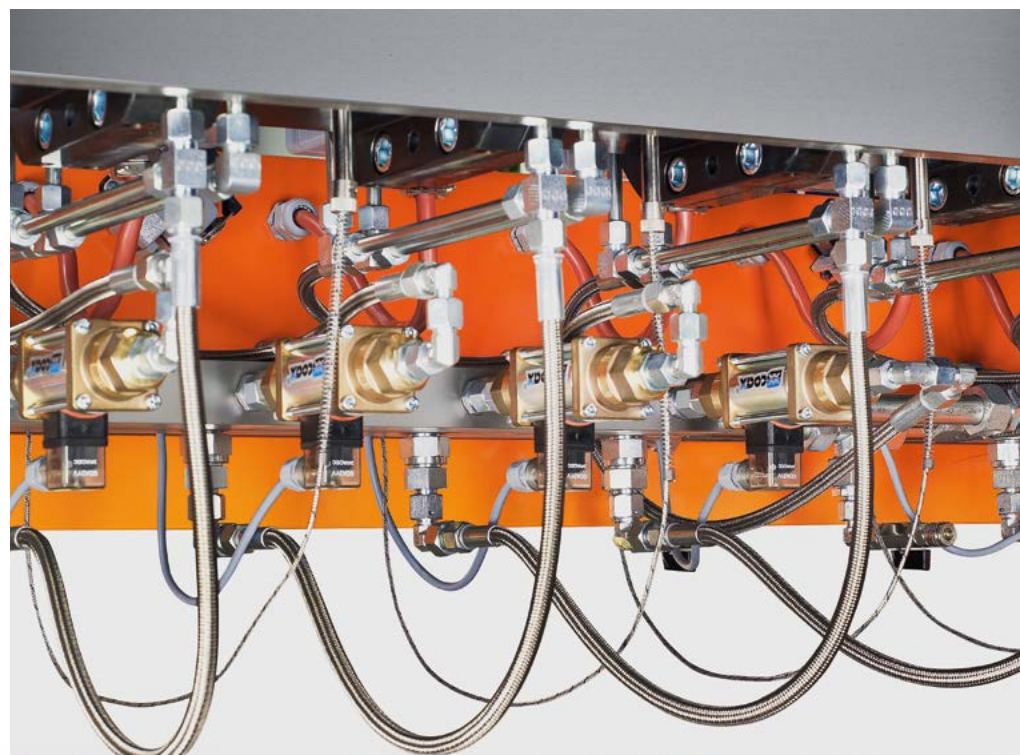
More cooling capacity for a larger process window

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.

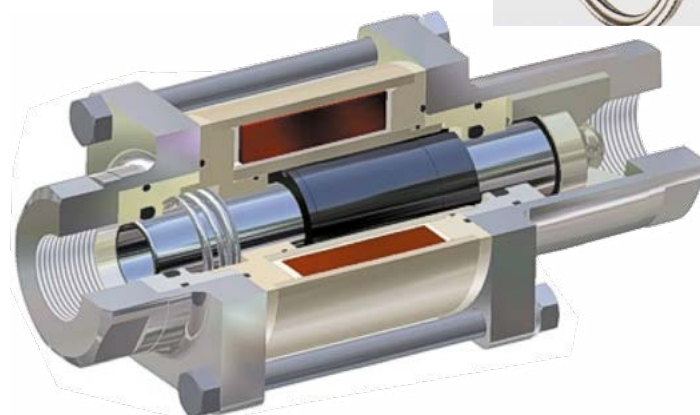
The cooling capacity is fully utilized on account of the short distance between the cooling bores and processing chamber as well as the counterflow principle. The processing unit is held by a functional carrier system with integrated cooling pipe installation. The high-quality coax valves are assembled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



Please also note the explanations on page 13 to cylinder heating / cylinder cooling



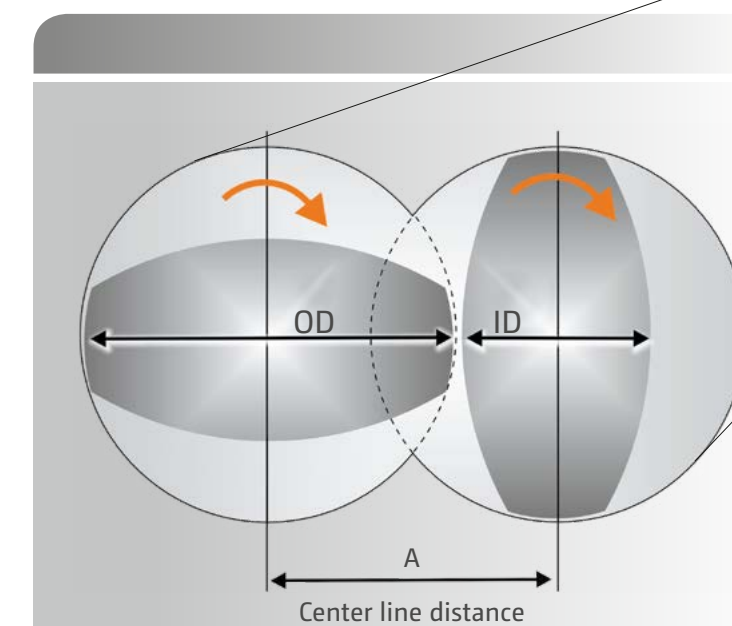
maXXvolume

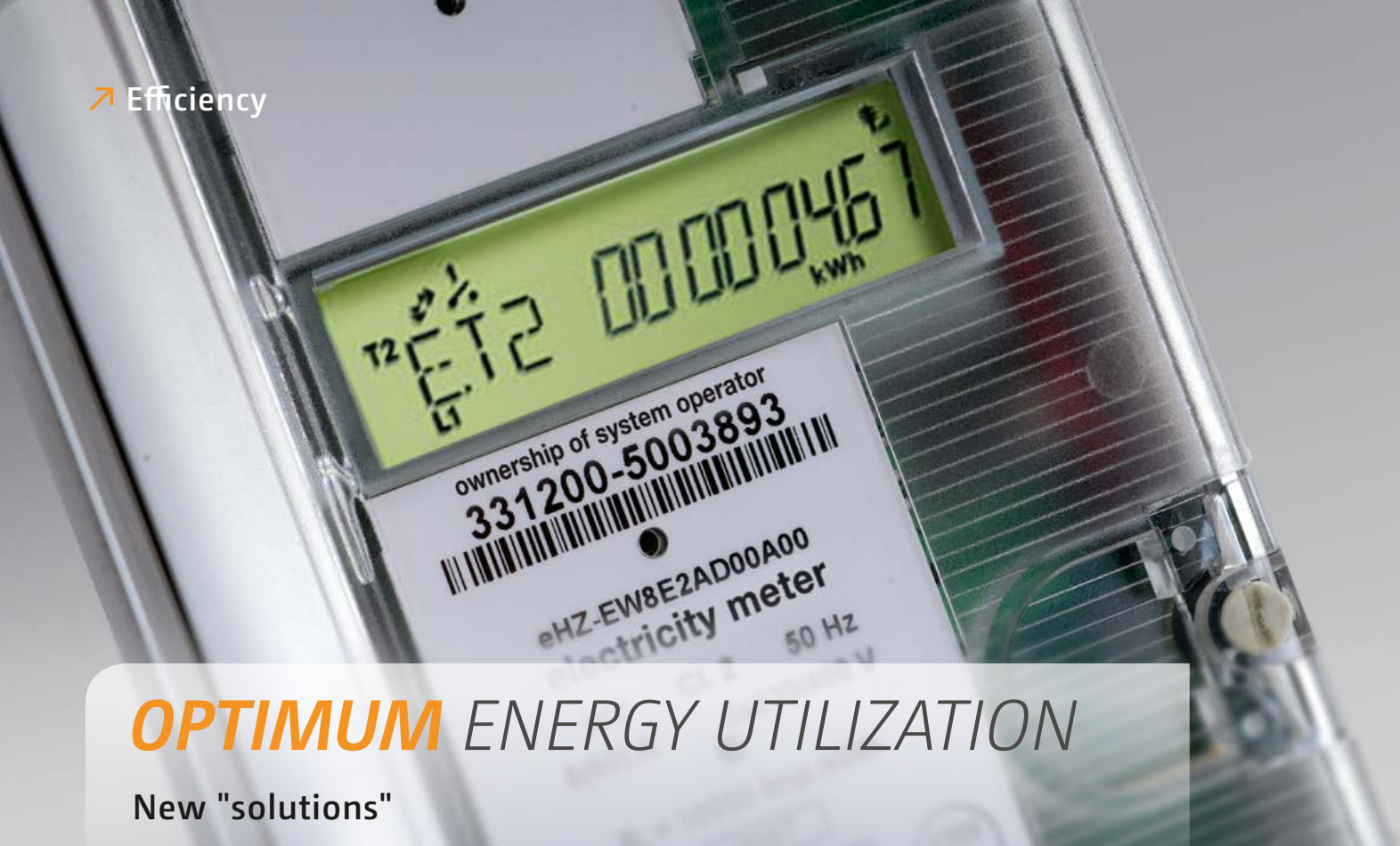
More throughput by means of increased volume

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.





OPTIMUM ENERGY UTILIZATION

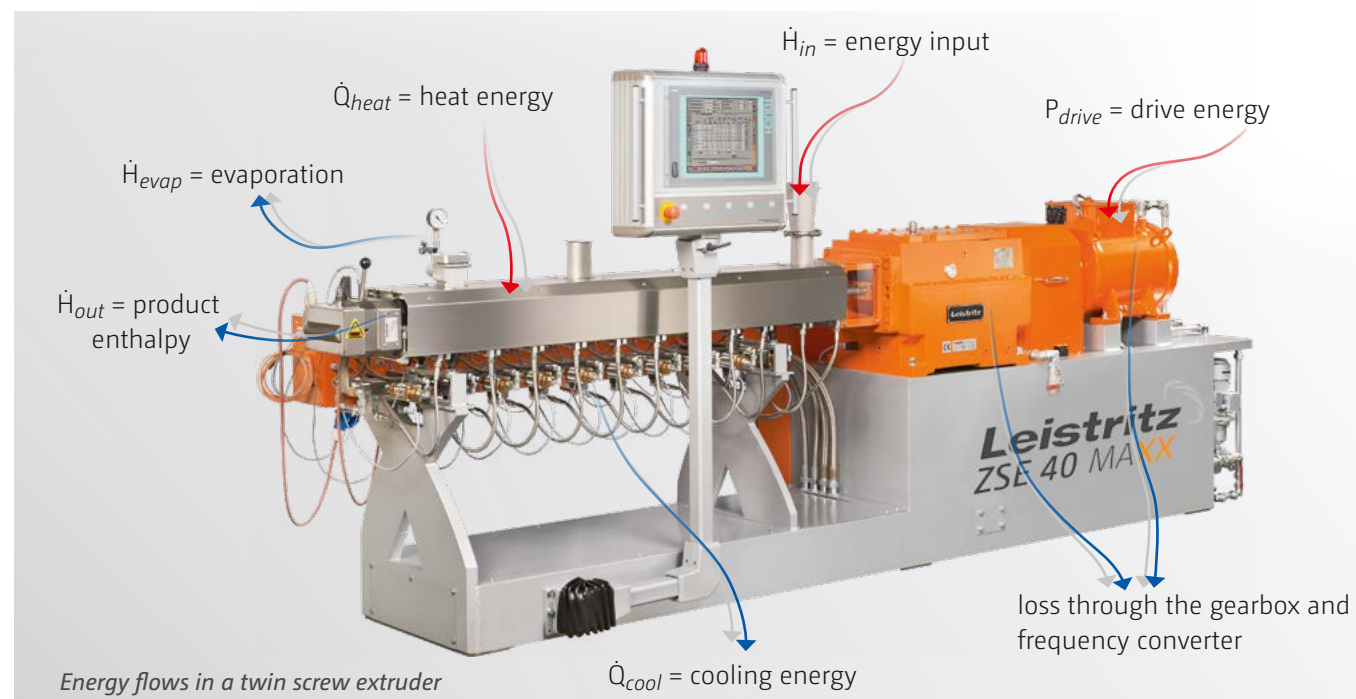
New "solutions"

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.



Insulating the processing unit

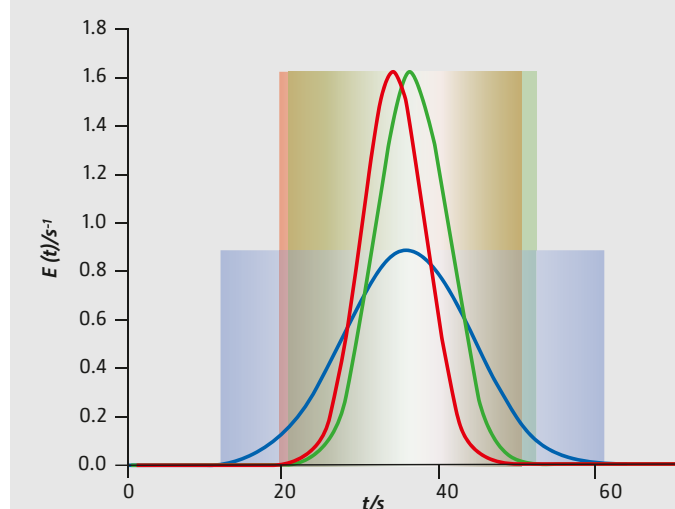
However, it is not only drive energy that is required to provide the energy needed for melting at low speeds. Energy also enters the process through the barrel heating. Leistritz offers insulations for processing units to reduce the heat-up times and to use the barrel heating even more efficiently.



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.

RESIDENCE TIME DISTRIBUTION FUNCTIONS $E(t)$



OD/ID	SEI [kWh/kg]
1.5	0.276
1.66 = 1.5	0.253
1.66 (mod*)	0.275

*modified screw geometry through the use of additional kneading blocks

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



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



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



Example of a screw shaft

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

OVERVIEW OF MATERIALS FOR SCREW ELEMENTS:

Material code	Material	Thickness (mm)	Hardness (HRC)	Protection against			Remarks
				Abrasion	Corrosion		
VSA100	Nitrided steel	0.4	>750HV	very high	none	very high	on request
VSA200	Hot work steel	through hardened	59±1				standard
VSA300	Stainless steel	through hardened	57-2				on request
VSA401	CrV-HIP material	through hardened	64±1				on request
VSA402	CrNbV-HIP material	through hardened	61±1				standard
VSA503	Hastelloy/Stellite	3	45+5				on request
VSA504	WC material	through hardened	1,450HV				on request

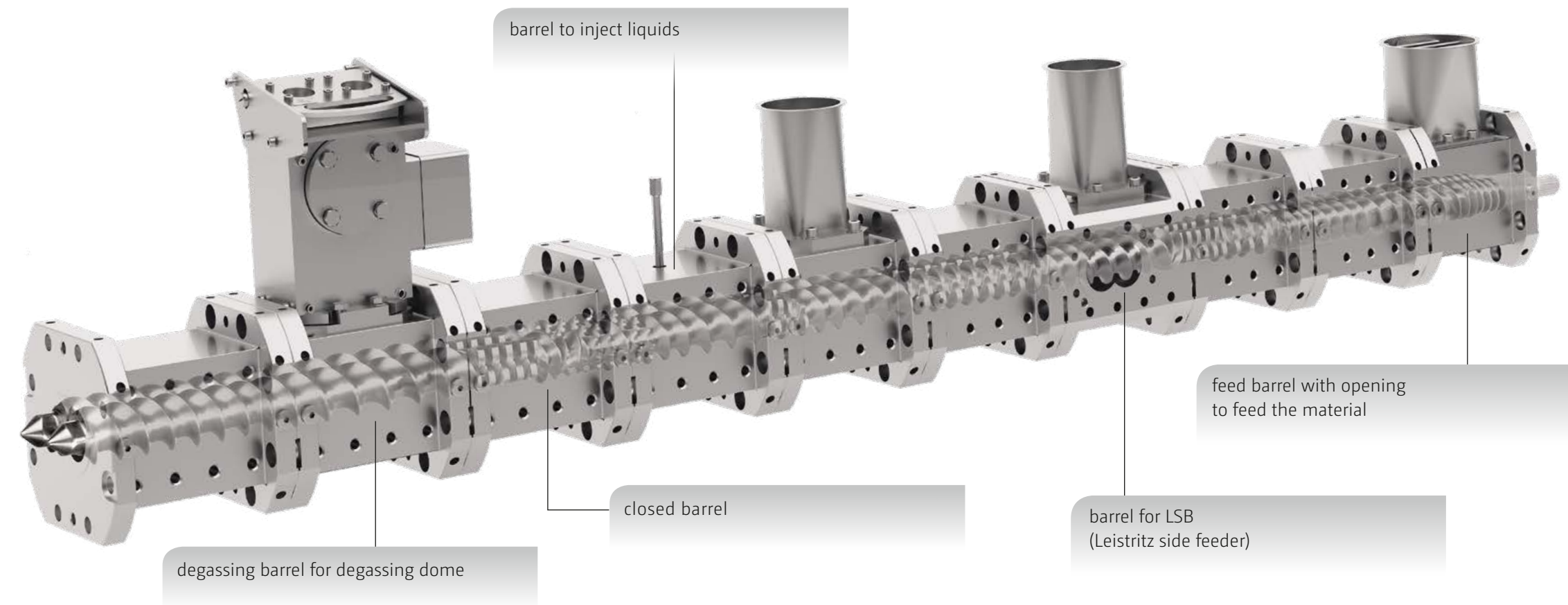
MODULAR BARREL SYSTEM

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 in-serts 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.

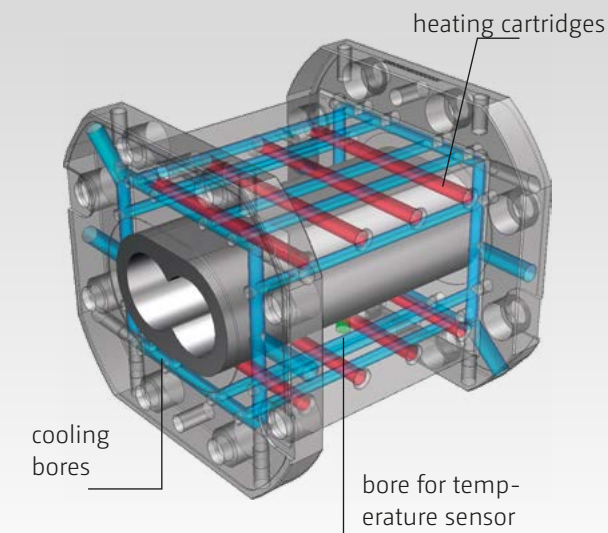
The optimum combination of cooling and heating is one of an extruder's essential quality characteristics. It plays a very important role so that every process can be adequately run. Each barrel hereby has a separate heating/cooling zone that can be heated or cooled as required.



BARREL HEATING/COOLING

Heating cartridges are used to heat up 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 (see figure below)
- more efficient spare part administration → same type of heating cartridges for all barrel types



OVERVIEW OF MATERIALS FOR BARREL ELEMENTS:

Material code	Material	Thickness (mm)	Hardness (HRC)	Protection against			Comment
				Abrasion	Corrosion		
VSA100	Nitrided steel	0.4	>750HV	very high	none	very high	on request
VSA200	Hot work steel liner	through hardened	58±2				standard
VSA300	Stainless steel liner	through hardened	57-2				on request
VSA402	CrNbV-HIP liner	through hardened	60±2				standard
VSA403	NiCrB-HIP liner	3	60±2				on request
VSA404	WCNiCrB-HIP liner	3	63±2				on request
VSA501	NiCrB cast liner	through hardened	60±2				on request
VSA502	Conforma Clad	3	63±2				on request
VSA504	WC liner	through hardened	1450HV				on request



Example:
barrel with liner

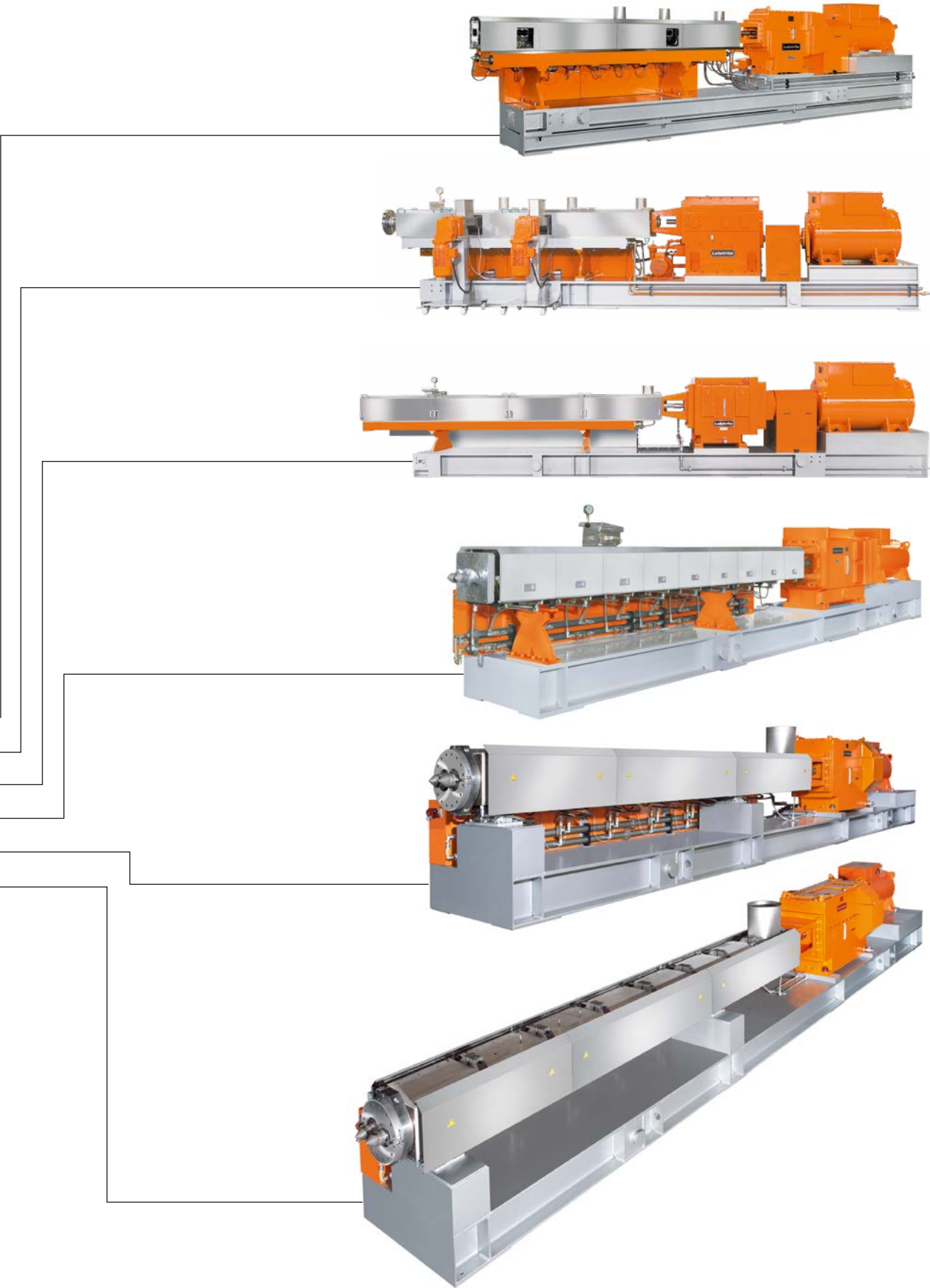
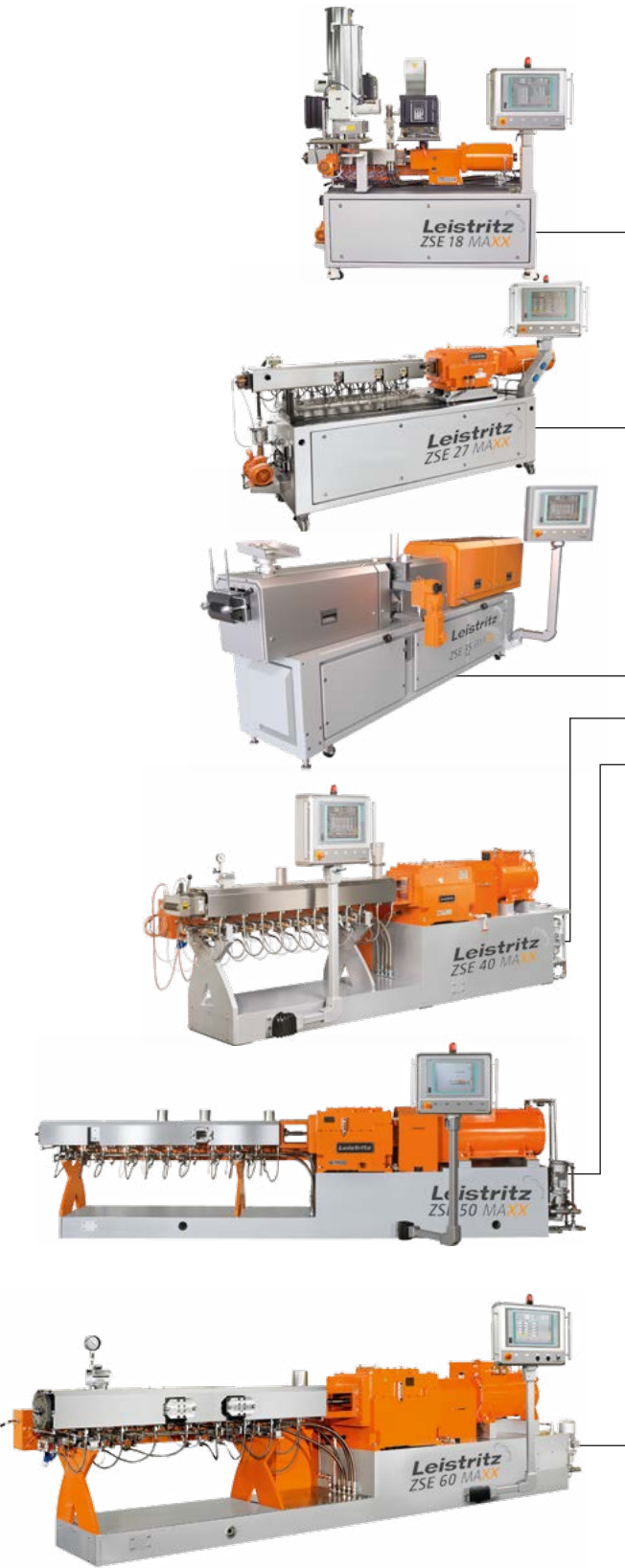
ZSE MAXX SERIES

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.

Type	Screw diameter OD (mm)	OD/ID	Spec. torque density (Nm/cm³) up to max.
18	18.5	1.66	11.0
27	28.3	1.66	12.5
35	35.1	1.66	15.0
40	41.4	1.66	15.0
50	51.0	1.66	15.0
60	61.6	1.66	15.0
75	77.0	1.66	15.0
87	89.4	1.66	15.0
110	113.1	1.66	15.0
135	138.7	1.66	15.0
160	159.9	1.66	15.0
180	178.8	1.66	15.0
260	258.0	1.66	15.0

» 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



➤ Leistritz Extrusionstechnik GmbH | Markgrafenstraße 36-39 | 90459 Nuremberg | Germany
T +49 911 4306-0 | extruder@leistritz.com