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Leistritz

www.leistritz.com

Richard Kretz

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Leistritz

- 1905 established as „Maschinenfabrik Paul Leistritz“
- Privately owned, independent company

Leistritz

- Employees ~ 1,900
- Sales p.a. ~ 265 Mio. EUR
- R & D~ 3.3%
- Export~ 64%
- Investment~ 5%

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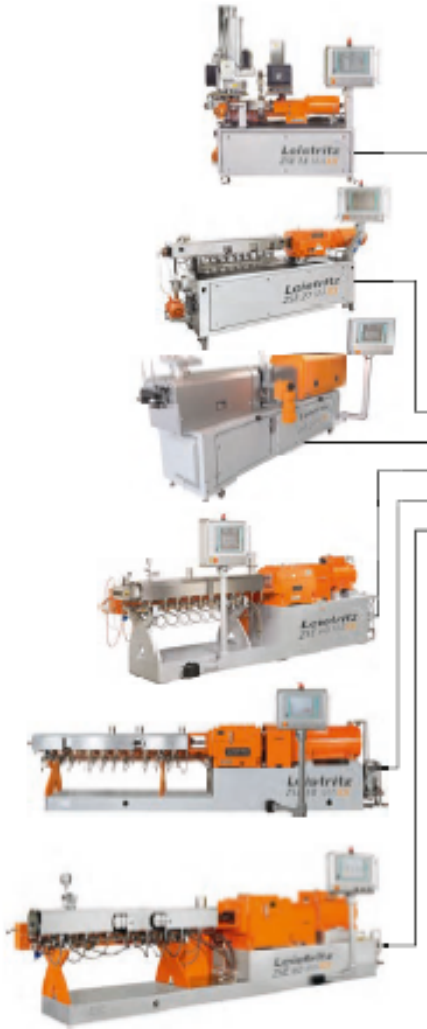
Leistritz

Corotation Twin Screw Extruders (TSE)

ZSE MAXX SERIES

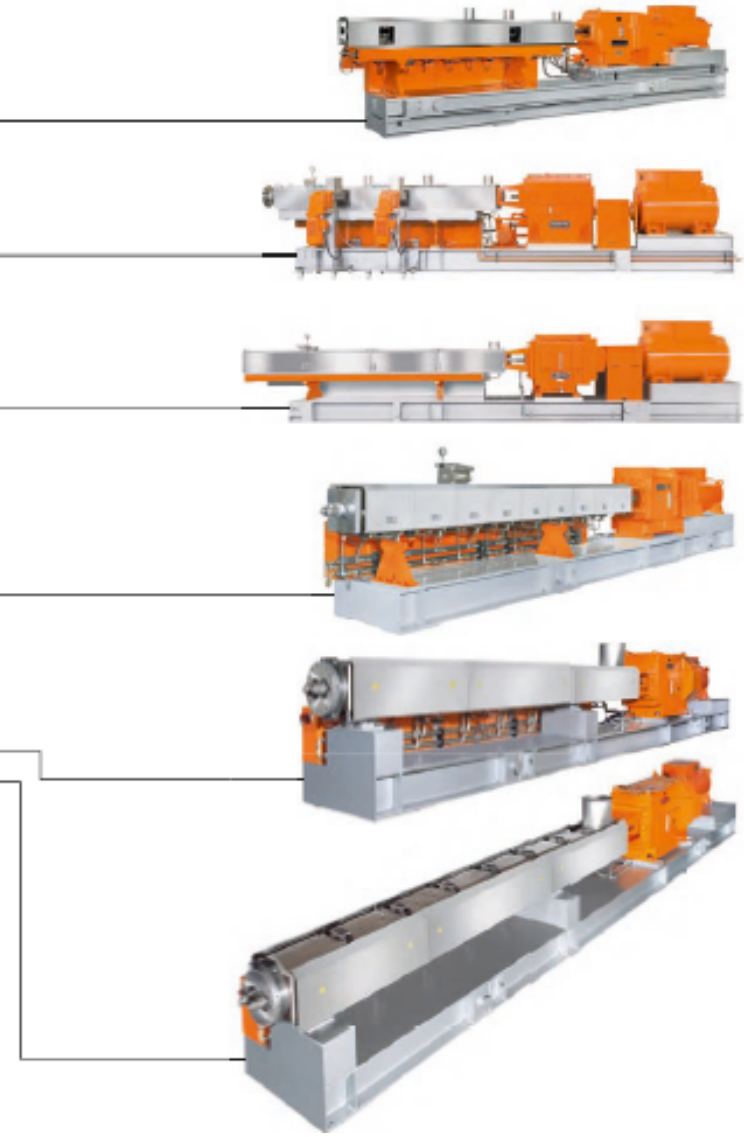
System for maXXimum possibilities



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. «



Today topics

- Industries using Leistritz Twin Screws Extruders
- Main parameters for twin screw extrusion
- A new generation of Leistritz extruders : ZSE35iMAXX
- Leistritz novelties for twin screw extrusion
- Smart Glasses Service

Today topics

- Industries using Leistritz Twin Screws Extruders

Industries using Leistritz Twin Screws Extruders

- Look on a thermoplastic product. In **95%** cases a **twin screw extruder** was used into its conversion cycle.
- Most often an extrusion with a twin screw extruder results to a pellet form named **compound** or **masterbatch**.
- Or sometime the final product is realized directly by compounding without pelletizing step -> **direct extrusion**

Industries using Leistritz Twin Screws Extruders

Industries using Leistritz Twin Screws Extruders

- Polymer
- Compounding
- Masterbatch
- Direct Extrusion
- Recycling
- Pharmaceutical
- Cosmetic
- Food
- R&D

- Adhesives – Hot melt
- Rubber
- Chemical reactions
- Polymerization
- Ceramic
- Metal Injection Molding
- ….

Polymer Industry

© Linde

HDPE
LLDPE
PP

TWIN SCREW EXTRUSION

Polymer Industry

Polymérisation

+

Anti oxydant, UV, Thermal Stabilizers

→

Commercialized Polymers

O_2

Compounding

Polymers

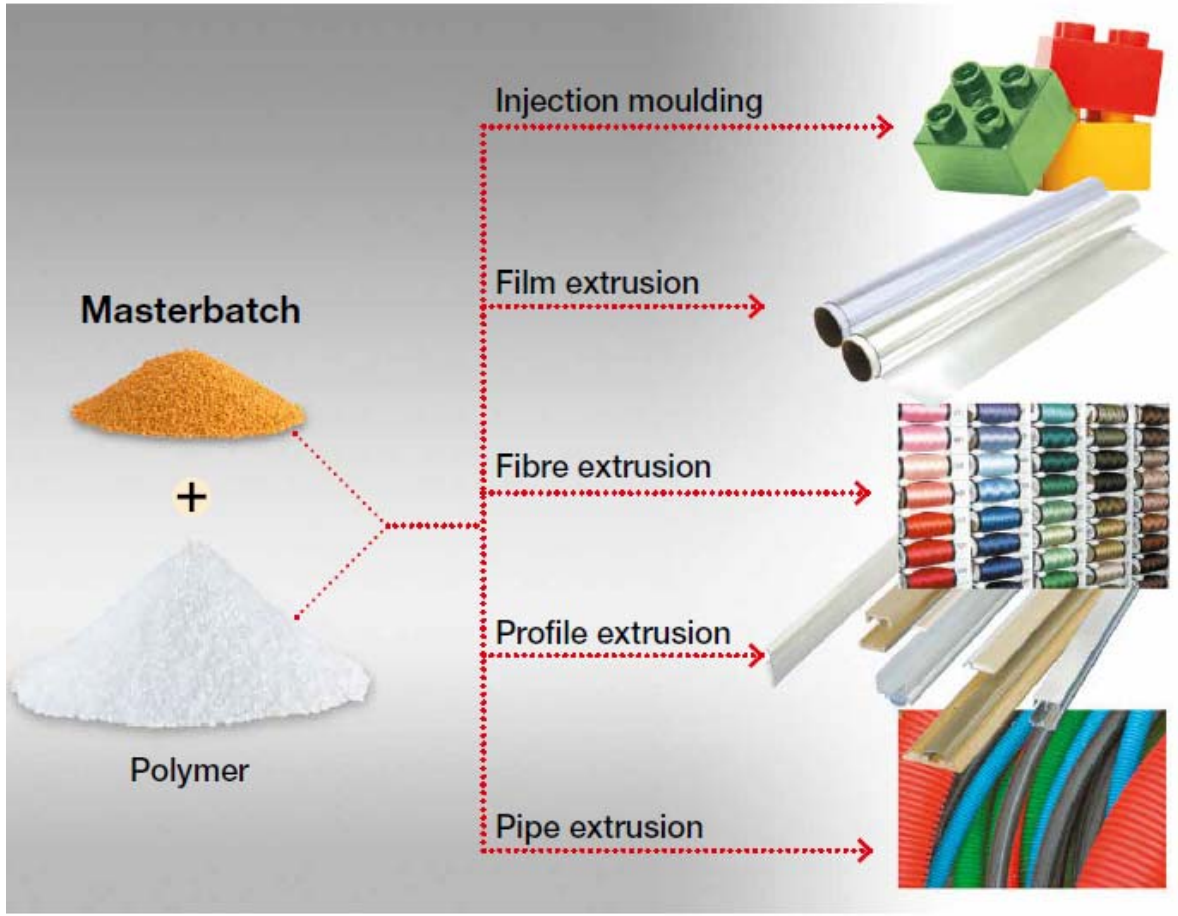
+

Additives, Charges, Reinforced, Masterbatch

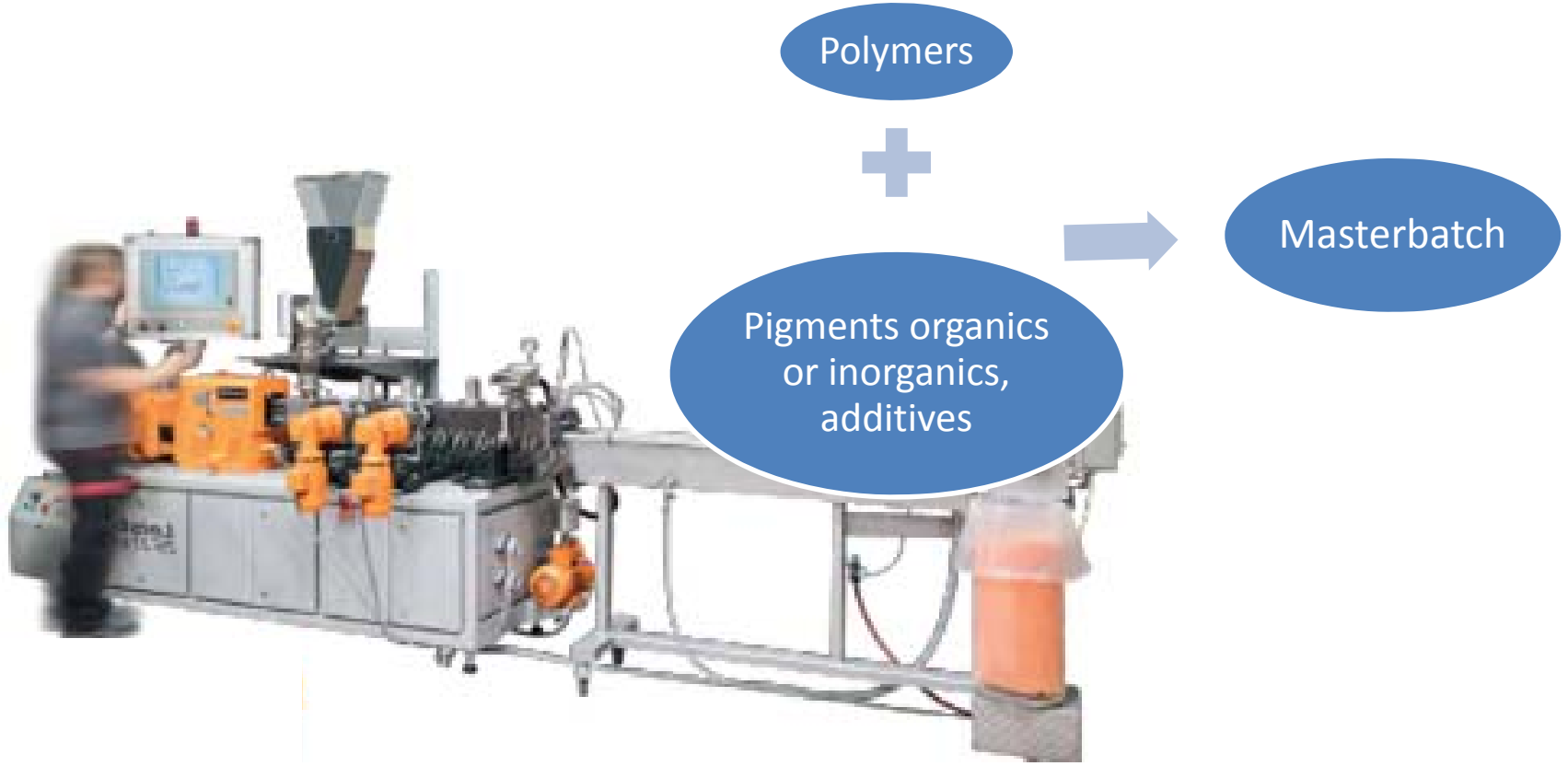
→

Compound

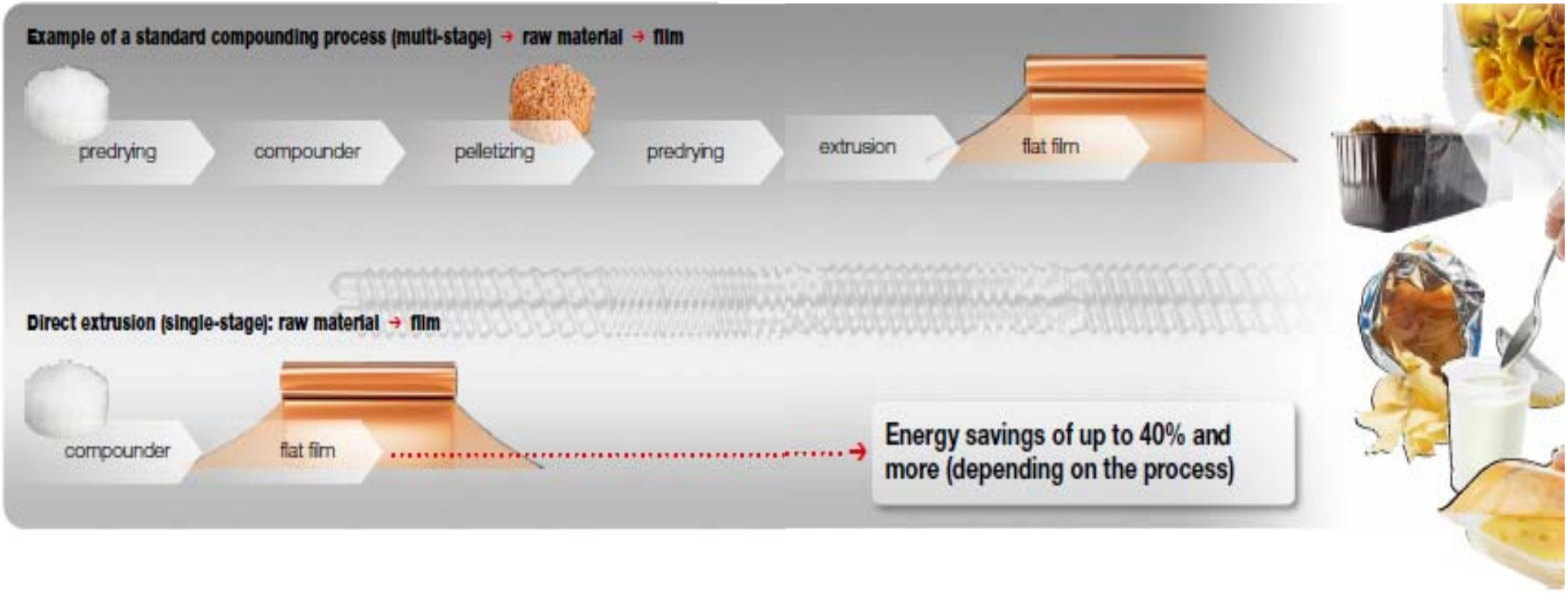
Masterbatch



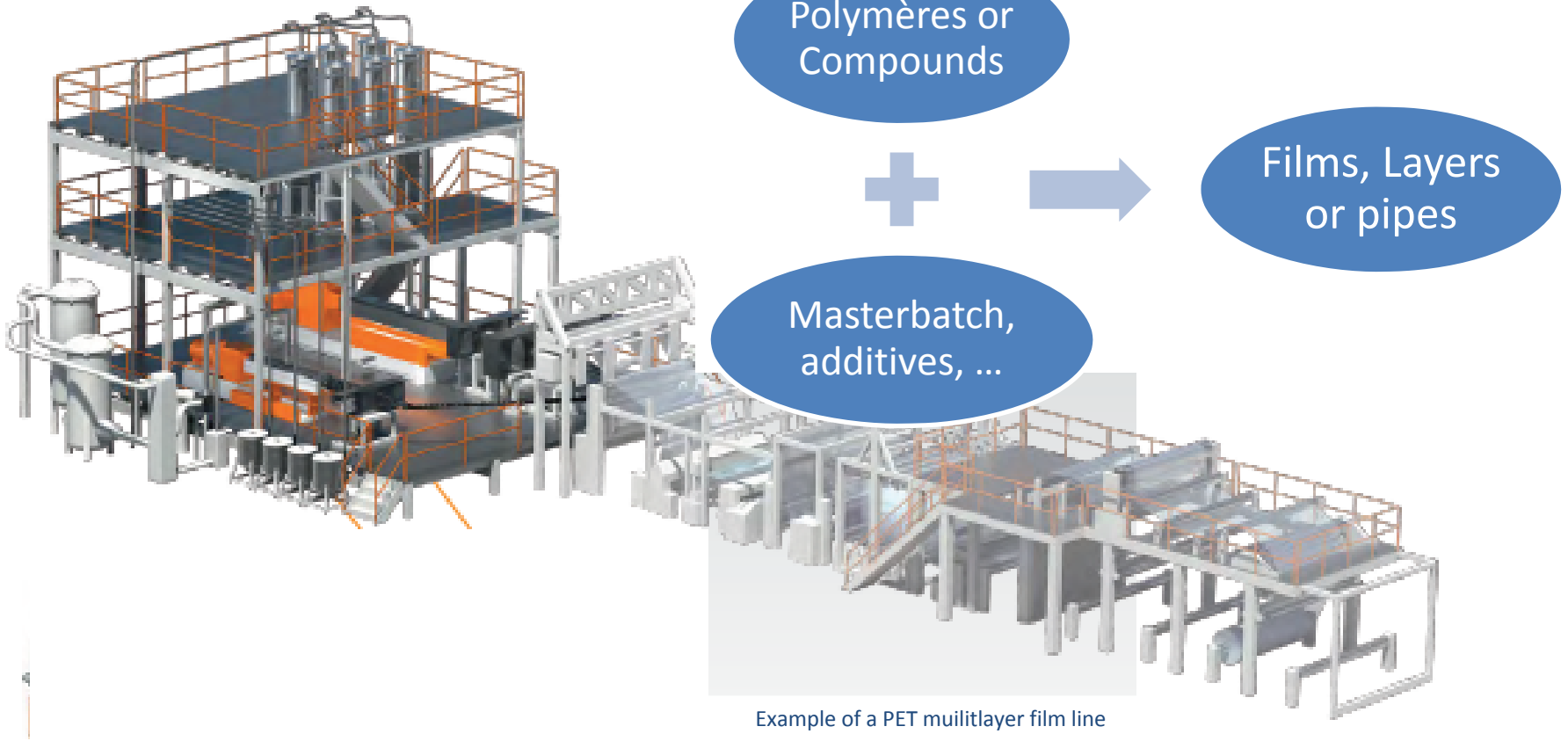
Masterbatch line



Direct extrusion



Direct extrusion



Example of a PET muilitlayer film line

Recycling

End life plastics

+

Additives, Charges, Renforts, Mélanges Maîtres

→

Recycled Compound

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Leistritz

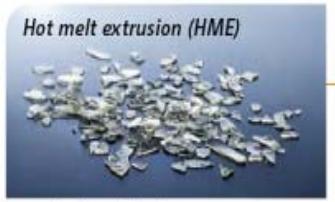
Pharmaceutical, Cosmetics & Food Extrusion

PHARMACEUTICAL
TWIN SCREW EXTRUSION

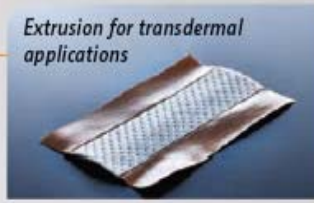
Application fields

Compounding with co-rotating twin-screws has been successfully applied in the plastics industry for decades. Now it is a proven system for hot melt extrusion, granulation, lipid extrusion, transdermals and implants. Leistritz was a pioneer when pharmaceutical extrusion started. Today we are technology leader in this area. We have extensive knowledge in the areas of process technology, GMP design, plant engineering, and qualification.

Example of a ZSE 18 HP-PH



Example after chill Roll process



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Leistritz

Research & Development

Innovation is the key to stay competitive

- Test new formulations
- New raw material validation for your application
- Scale-up

Leistritz Lab extruders type ZSE18Maxx & ZSE27iMaxx are the state of the art :

- High flexibility and easy handling
- Same conception as a production line
- Volume & Torque performance like in production

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Research & Development

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Today topics

- Applications with Leistritz twin screws extruders
- Main parameters for twin screw extrusion

Main parameters for twin screw extrusion for selection

- OD/ID ratio -> 1.4 to 1.8
- Specific Torque -> 8 to 18 Nm/cm3
- L/D length -> 24 to 100
- Screw profile -> multitude

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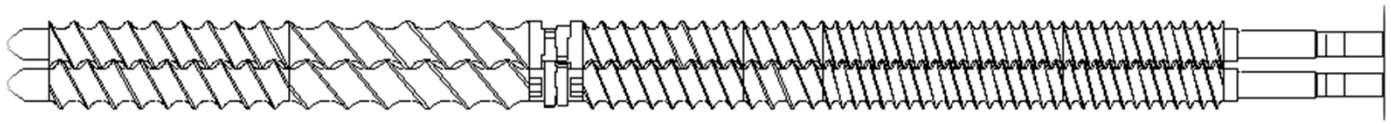
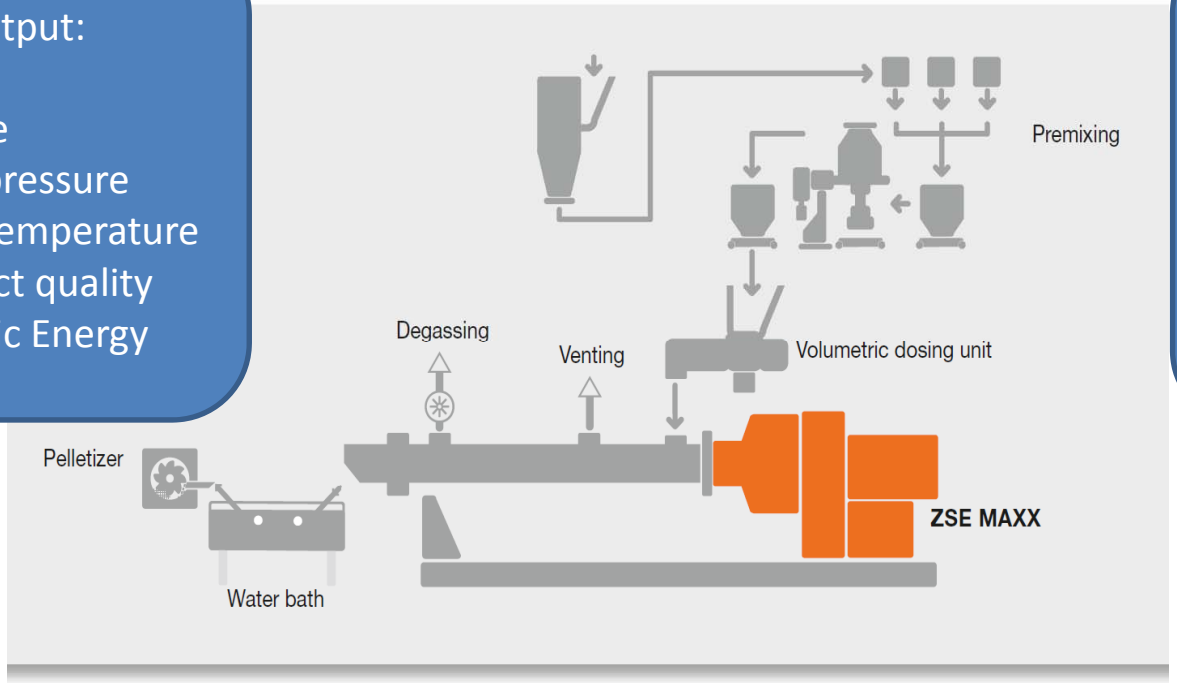
Main parameters for twin screw extrusion for processing



Main parameters for twin screw extrusion for processing

Output:

- Torque
- Melt pressure
- Melt temperature
- Product quality
- Specific Energy



Input:

- Screw profile
- Throughput
- Barrel heating
- Screw speed

- Formula, raw materials quality and shapes are also important success factors.
- Auxiliary equipment will have an impact too (accuracy, régularity, performance)

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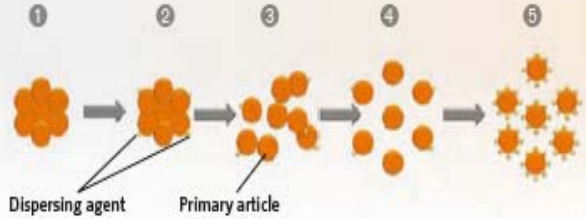
Main parameters for twin screw extrusion

Important: the correct dispersion

The goal when manufacturing masterbatches is the optimum dispersion and distribution of the additives in the polymer matrix. This is carried out after wetting by the mechanical energy introduced by the screws. If this takes place too early in the process, the un-moistened pigments can be compressed back into agglomerates by the force exerted on them (cold agglomeration). Two processes can be used to produce a masterbatch: premix* and split-feed**.

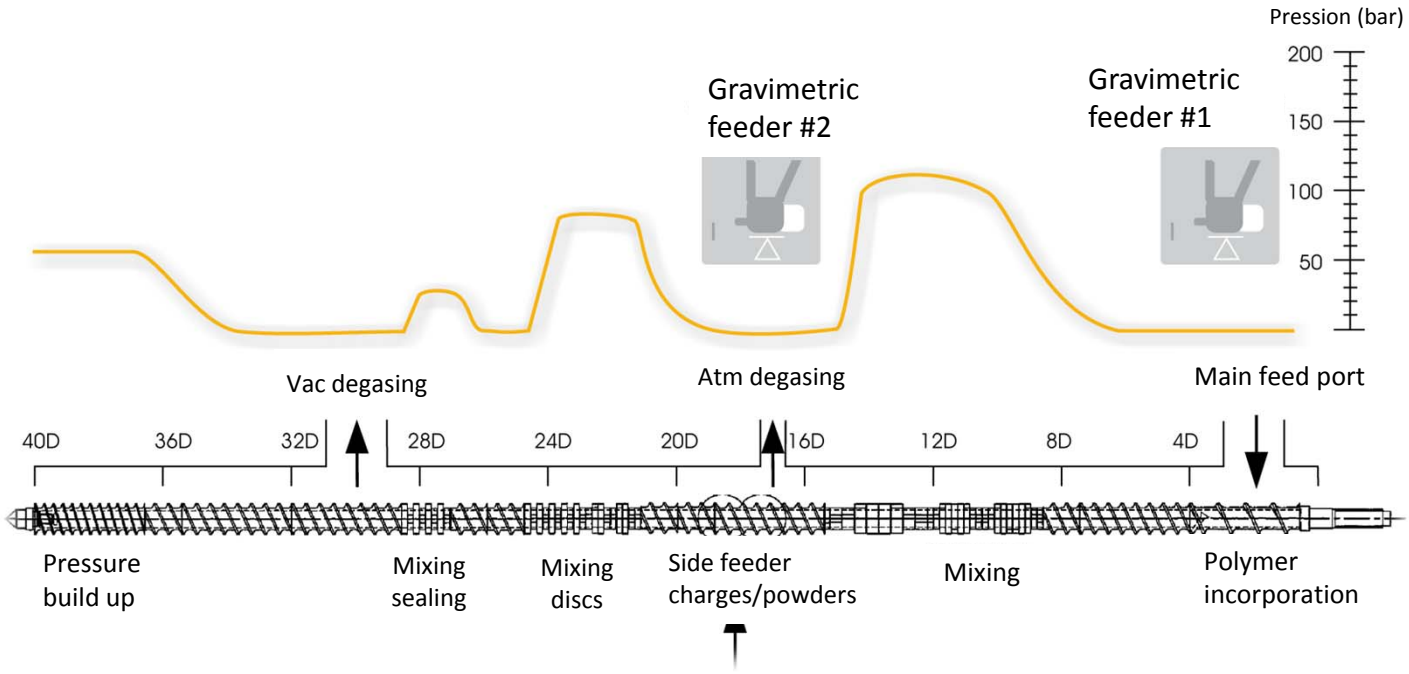
*see P. 8/9 **see P. 10/11



1. **Mixing** (Homogenization of the mixture)
   Dosing (constant addition over time in the continuous extrusion process)
2. **Wetting** (bonding of the pigment particles to the matrix without compacting this)
3. **Dispersion** (dispersion of the agglomerates in a plasticized state, introduction of the dispersion energy)
4. **Distribution**
5. **Stabilization** (prevents re-agglomeration)

Main parameters for twin screw extrusion

Different pressures into the process



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- Main parameters for twin screw extrusion
- A new generation of Leistritz extruders :
  ZSE35iMAXX

» *ZSE 35 iMAXX – the ideal twin screw extruder for frequent product changes!* «

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ZSE35iMAXX

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Example of a ZSE 35 iMAXX

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ZSE35iMAXX

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ZSE35iMAXX

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OD/ID ratio & high Torque

» *With lower cut screw flights and larger external diameters, an increase in volume and thus improved throughputs of up to 30% are possible.* «

maXXtorque

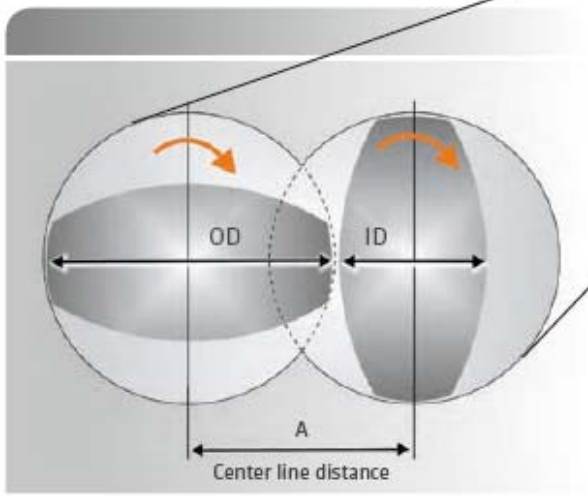
More output for higher operating safety

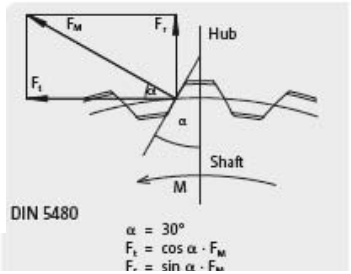
maXXshaft

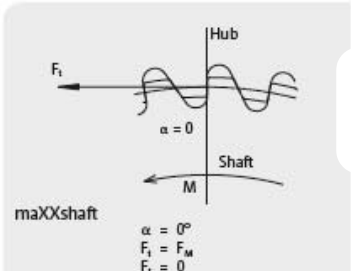
More splines for a better torque transmission

maXXvolume

More throughput by means of increased volume







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Torque Measurement Option

at sleeve coupling to get a value per screw shaft

New Side feeders

- OD/ID ratio : 2
- Easy handling
- Shafts cooled by water (option)
- Different steel quality of screws and barrel according to applications
- Screws could be segmented

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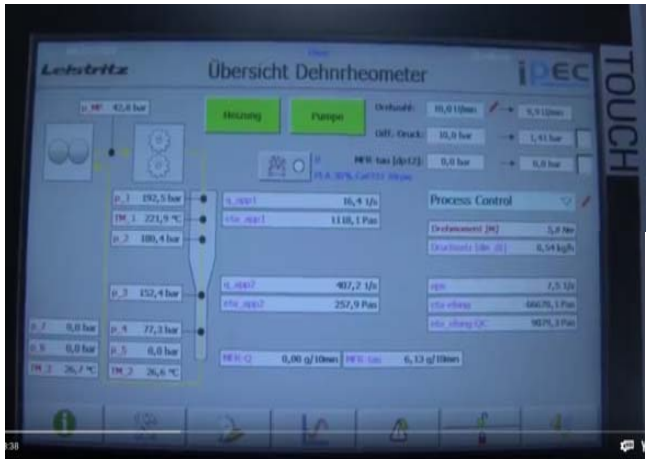
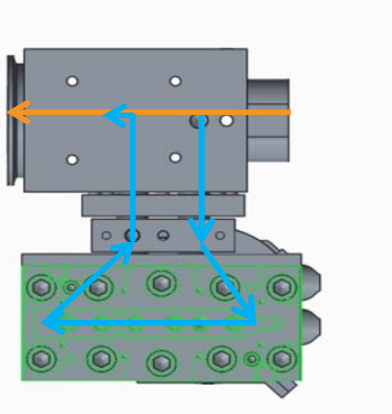
Elongational Rheometer

Inline for system production 4.0



The rheometer facilitates online measuring of the shear viscosity with shear rates in the range of 10 to 10,000 s^{-1} and the elongational viscosity with elongation rates in the range of 5 – 75 s^{-1}. It has a newly developed, patented die geometry with a hyperbolic narrowing that generates a constant elongational flow. This has not been possible with current online measurement devices. During a continuous measuring process, the operator can query two measured values of shear viscosity and one measured value of extensional viscosity in the according, precisely defined shear and expansion ranges at the same time.

Elongational Rheometer



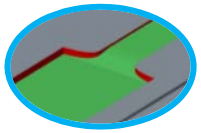
unique elongational die

- Based on Cogswell´s assumptions

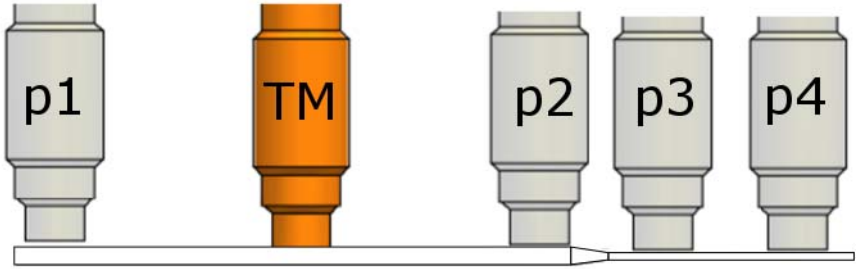
$$\Delta p_{\text{measured}} = \Delta p_{\text{shear}} + \underbrace{\Delta p_{\text{elong.}} + \Delta p_{\text{elast.}}}_{\Delta p_E}$$

$$\frac{\Delta p_{Shear}}{x} = \left(\frac{2^{m+1} \cdot (m+2) \cdot \dot{V}}{W(x) \cdot H(x)^{m+2} \cdot \Phi} \right)^{\frac{1}{m}}$$

$$\eta_{\text{elong.}} = \frac{\sigma}{\dot{\varepsilon}} = \frac{\Delta p_E}{\dot{\varepsilon}} = \frac{\Delta p_{\text{measured}} - \Delta p_{\text{shear}}}{\dot{\varepsilon}}$$



$$\Delta p_E = \Delta p_{\text{elong.}} + \Delta p_{\text{elast.}}$$



- Elongation rate: constant for hyperbolic die: $\dot{\varepsilon} = \frac{\dot{V}}{L} \cdot \left(\frac{1}{H_2 \cdot W_2} - \frac{1}{H_1 \cdot W_1} \right)$

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Elongational Rheometer

Valid tool for online quality control in compounding

Example of application :

- Material degradation
- Blending performance
- Controlling viscosity/MFR during compounding
- Fillers distribution into a polymer

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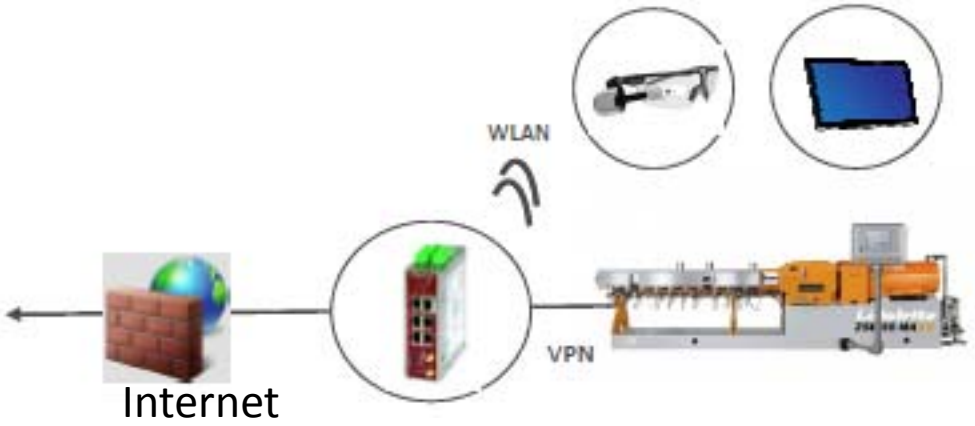
REMOTE SERVICE

INDUSTRY 4.0

Each machine / line is equipped by default with a remote service tool (VPN security router) via an absolutely safe VPN tunnel.

Leistritz remote service central

- ↗ Access to live machine data via VPN
- ↗ Access to live pictures via Smart Glasses
- ↗ Access tablet via Remote Desktop connection



- ↗ Only outbound connection
- ↗ Via company network or mobile network

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Smart glasses

INDUSTRY 4.0

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Conclusion: Leistritz the right partner

- Turnkey installations at high level of engineering
- A lot of know-how & competences in different fields
- Good connections with R&D labs & Universities
- 3 Development Centers worldwide
- Efficient service team
- 7 different trainings offered
- Always improving the future with innovations

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