



# LEISTRITZ TWIN SCREW REPORT

2024



## The Leistriz Twin Screw Report

**A technical review of the latest processing technologies via twin screw extrusion**

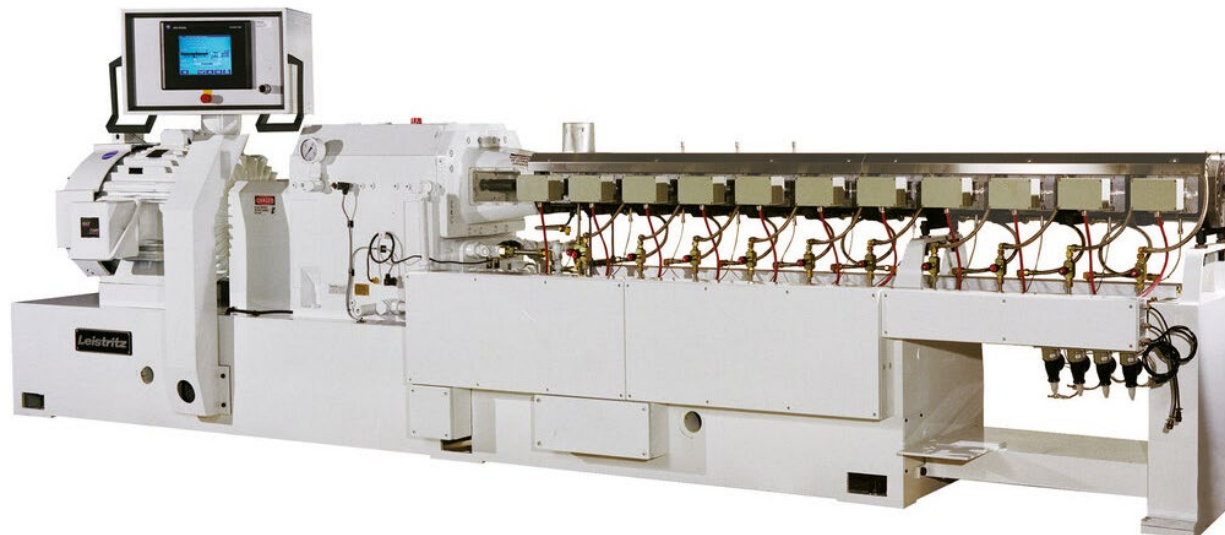
**The following is included in this e-tech newsletter:**

- 1 Tips to inject sCO<sub>2</sub> into the twin screw extruder process section....and why?
- 2 When and how to use gear pumps with TSE processes (and a helpful quick and easy formula)

- 3 Free on-demand webinar: Compounding of bioplastics and natural fiber composites on TSEs**
  - 4 See you @ NPE 2024 - The Race to Success**
  - 5 Get the Free Leistriz Extrusion Extrusion Calendar**
  - 6 Technical article download: Get Better at Swapping Out Your Twin Screw Elements**
  - 7 Leistriz Extrusion Technology overview brochure**
- Download this newsletter as pdf**

## **1 Tips to inject sCO<sub>2</sub> into the twin screw extruder process section... and why?**

**Supercritical carbon dioxide (sCO<sub>2</sub>) can be injected into the twin screw extruder (TSE) process section to facilitate foaming, as well as a process aid for other processes. Regardless of the final product, the design of the injection and cooling mechanisms are identical.**



**ZSE-60 MAXX configured for sCO<sub>2</sub> injection/foaming (no vent)**

**Atypical TSE barrel and screw designs are required to accommodate the high injection pressures inherent with the injection of sCO<sub>2</sub>. (and other supercritical fluids too)**

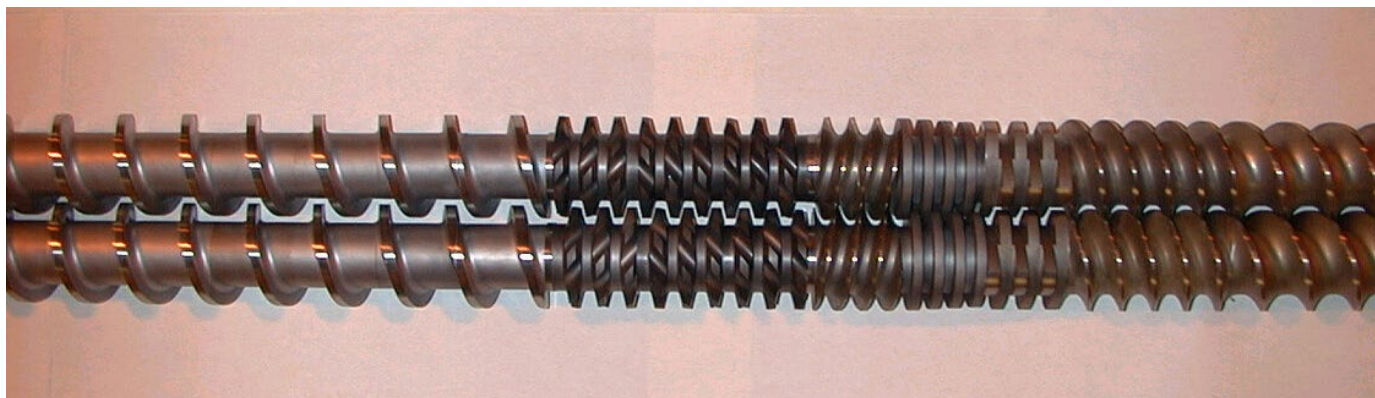


**TSE screw schematic denoting unit operations for injection of physical blowing agents**

**Co-rotating screws that are self-wiping are modular and assembled on high torque shafts and rotating screws with mixing elements transmit energy into the process from the motor. In the initial stages of the screw design:**

- **Polymer/additives are metered into the feed throat and solids conveying, melting and mixing occurs**
- **Then a dynamic seal is integrated into the design to facilitate high-**

**pressure injection of the sCO<sub>2</sub> into distributive mixing elements without blow-back. Barrel flange designs are also modified to accommodate the high-pressure environment.**



**Close-up: injection mixers and dynamic seal**



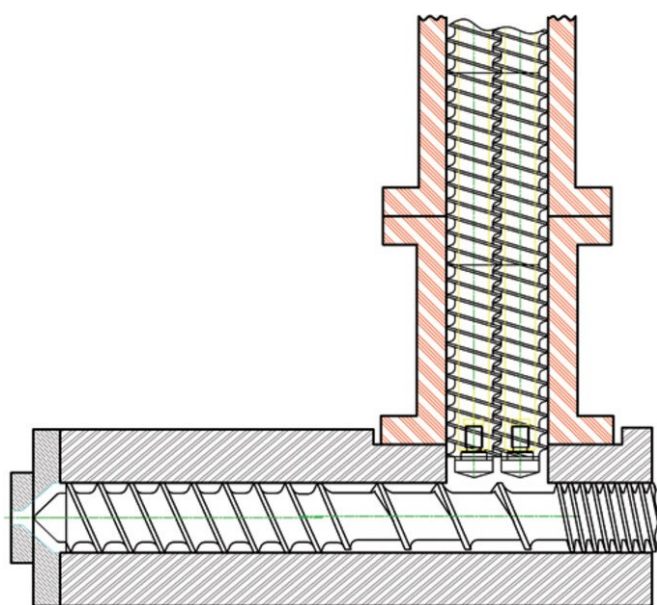
**Foamed synthetic wine corks**

## **Foaming**

**Screws run filled (pressurized) and pump the melt in a supercritical state and distributive mixing elements perform thermal homogenization. Barrel sections with high intensity internal cooling**

**bores are specified for increased heat transfer.**

**Common foamed products include foamed sheet, profiles and a variety of packaging products. Life Science applications also use foamed products for fast acting, fast dissolving dosage forms.**



**Example co-rotating intermeshing TSE attached to tandem SSE cooling extruder**

**Note: The heat transfer limitations inherent with TSEs allow successful process up to approx. 200 kgs/hr. To achieve higher rates a single screw “cooling” extruder/pump (or static mixer/cooler attachment) is mated to the TSE front-end for additional cooling. (1000+ kgs/hr)**

**In addition to foaming, there are other applications that also benefit from sCO<sub>2</sub> injection.**

## **sCO<sub>2</sub> as a stripping agent**

**To reduce volatile contaminant levels, sCO<sub>2</sub> is introduced into the melt and mixed to create bubbles in rolling pools under vents that burst and create additional surface area that facilitates ultra-fine devolatilization, when assisted by vacuum venting.**



**Foamed beads of a pharmaceutical formulation**

## **sCO<sub>2</sub> as a plasticizer**

**sCO<sub>2</sub> is also used as a plasticizer, which is particularly useful for processing pharmaceutical polymers to reduce viscosities/ torque to enable heat and**

**shear sensitive active drug ingredients to be processed. Benefits include the enhanced bioavailability of the active ingredient and increased milling efficiencies of the foamed beads. (that improves the mechanical properties of the final tablet)**

## **Devulcanization of tire rubber**

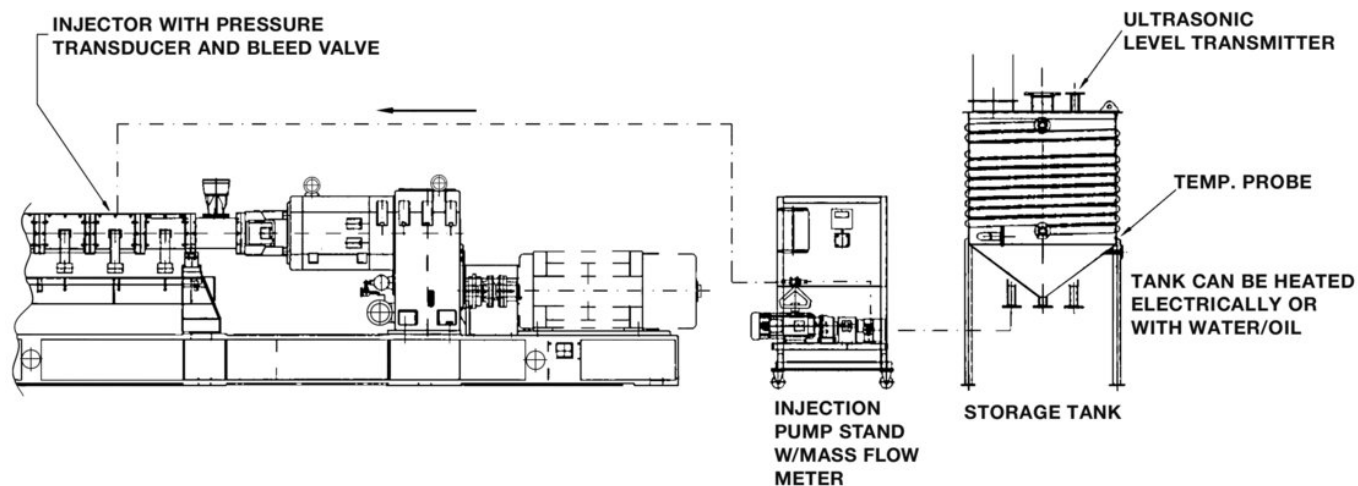
**The injection of sCO<sub>2</sub> assists in the conversion of recycled/vulcanized ground tire rubber into devulcanized rubber (and patented by Tyromer Inc.) Tire rubber particles are metered into a TSE and a combination of the plasticizing effects of sCO<sub>2</sub> with intensive kneading from the rotating screws results in a devulcanized rubber which can then be successfully reprocessed.**

**Note: sCO<sub>2</sub> injection capabilities is available in the Leistriz Extrusion USA Process Laboratory**

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## **2 When and how to use gear pump with TSE processes (and a helpful quick and easy formula)**

**A gear pump is a positive displacement device that enables precision pumping of a liquid or melt. Gear pumps are used to inject liquids into the TSE process section, and also integrated into the TSE front-end melt delivery equipment to build and stabilize pressure to the downstream filtration and die system.**



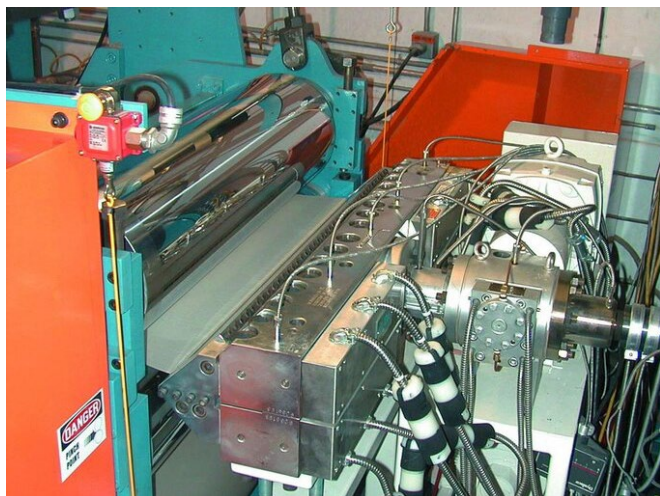
**To deliver fluids to the TSE process section following componentry is integrated:**

- Gear pump (cc/rev TBD) with AC motor/drive (other type injection pump types are available)
- Stainless steel reservoir with lid
- Flexible/braided stainless steel interconnection hose
- Injector assembly with pressure gauge
- Stainless steel stand with drip pan
- Optional load cell for LIW operation or mass-flow meter, heated tank/pump/transfer lines





**Injection system to meter liquids into a TSE  
Reactive Extrusion System**



**Gear pump and sheet die attached to a ZSE-  
50 MAXX**

**Gear pumps are used to make a better,  
tighter tolerance product, i.e. film,**

sheet, profile+++.

**Front-end systems may require elevated pressures to optimize the process, whether it is for ultra-fine filtration or a high pressure die. The inlet/outlet pressure differential (approx. 1000 to 4000 psi) inherent with a gear pump makes it possible for the TSE to operate with comparatively lower discharge pressures (400-800 psi) while isolating the high-pressure pumping task. In addition to melt flow and pressure stability, the ability to set a lower TSE discharge pressure will markedly decrease the melt temperature, resulting in less discharge screws wear and a decrease of thrust on the TSE gearbox.**

**When a gear pump is used, closed loop process control is integrated into the PLC/HMI logic. The feed system, twin screw extruder rpms and gear pump rpms must all be integrated into the algorithm, which is not always an easy task.**

## **Quick and easy gear pump formula**

**Whether injecting into or building pressure out, it is important to know a precise rate that's being metered by the gear pump. The following formula can be used to calculate the GP throughput rate and/or the Specific Gravity of the liquid being injected or the process melt stream.**

**If the SG is known, plugging in the orange #'s will approximate the**

achievable rate. If the rate is known but not the SG that parameter can be determined by inputting that # until the formula works.

[Download the gearpump calculator](#)

Quick and easy gear pump calculator							
SG	Rate (kg/hour)	Rate (gms/hour)	Rate (gms/min.)	Rate (cc/min.)	GP cc/rev	GP Efficiency (%)	Pump RPM
Calculation if SG is known							
1.00	46.56	46560.00	776.00	776.00	10.00	0.97	80.00
1- Input		gm/min x 60	SG * cc/min	RPM x cc/rev x %	1-Input	1-Input	1-Input
SG calculation if rate is known							
1.29	60.00	60000.00	1000.00	776.00	10.00	0.97	80.00
(gms/min)/(cc/min)	1-Input	Rate/1000	(gms/hr)/60	RPM x cc/rev x %			

3 Free on-demand webinar:

## Compounding of Bioplastics and Natural Fiber Composites on TSEs



Twin screw extruders are the preferred device to mix polymers, natural fibers, and bioplastics. The final product can be pellets, film,

sheet, pipe/profile, filaments and/or fibers. Relevant theory, tips and test results will be presented. The following topics will be addressed:

- Continuous mixing of heat- and shear-sensitive bioplastic formulations via twin screw extruders
  - Matching twin screw barrel geometries to unit operations
  - Comparison of co-rotating and counter-rotating twin screw extruder designs
  - Devolatilization theory, techniques, and practices
  - Upstream material handling and downstream system considerations
- Access this free online webinar: [Leistritz Bioplastics Webinar - \(Link to YouTube\)](#)

**NPE2024**  
The Plastics Show

4 See you @ NPE 2024

**The Race to Success -  
There's no substitute  
for face-to-face**

# **communications!**

**Leistritz Extrusion will be participating in numerous industry events and Leistritz sponsored workshops for the Plastics and Life Science industries, which are denoted on the Leistritz Extrusion 2024 Calendar.**

**The highlight of 2024 will be the National Plastics Exposition, May 6-10, 2024 in Orlando, FL. The theme of the Leistritz Extrusion exhibit (booth # W6343) will be The Race to Success that will feature state-of-the-art twin screw extrusion hardware and controls technologies. Please visit us to discuss your project...or just say hi.**

# 2024

## Twin Screw Extruders & Systems

### 2024 Events

Plastics West/WM, Anaheim, CA  
February 2-6

SPE International Polymers Conference, Galveston, TX  
February 18-21

SPE ANTEC 2024, St. Louis, MO  
March 6-7

NPE 2024: The Plastics Show, Orlando, FL  
April 8-12

PPS International Conference of the Polymer Processing Society, Cartagena, Colombia  
May 15-22

SPE Screw Design Conference - Napoli, Lowell, MA  
June 19-20

SPE Color and Appearance Conference (C&A) RETEC, Tempe, AZ  
September 23-25

AKPS Pharm Sci 2024, Salt Lake City, UT  
October 20-22

See you at NPE 2024!

ZSE-140 MAXX

ZSE-90 MAXX

ZSE-32

January	February	March	April	May	June
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Leistritz

EXTRUSION TECHNOLOGY

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Business Unit of Leistritz Advanced Technologies Corp.

Compounding
Devolatilization
Reactive Processing
Direct Extrusion
Foaming

# 5 Leistritz Extrusion 2024 Extrusion Calendar

To receive a free copy of the Leistritz Extrusion 2024 Calendar and/ or a pass to the NPE 2024 Exposition contact [sales@leistritz-extrusion.com](mailto:sales@leistritz-extrusion.com)

## 6 Technical article

# Get Better at Swapping Out Your Twin Screw Elements

Toll compounders process a range of products on the same TSE that may require different screw designs. As compounders move from one job to the next, time is money. Twin screw extruders are designed with segmented screw elements assembled on splined shafts to optimize a given process. When the run ends and it's time to change the design. Sometimes a complete 2<sup>nd</sup> screw set is warranted, or maybe changing the elements is viable. How quickly and efficiently either task is carried out has a direct impact on operation efficiencies, and the bottom line.



Example of a screw shaft



**Examples of screw elements**

**Here are some of the best practices that are described to help expedite this process:**

**Cleaning and inspection: How to perform an initial cleaning and check for nicks, gouges and tolerances**

**Rebuilding the screws: Proper positioning of the components and application of anti-seize compound**

**Reinstalling the screw set: Ensure that the gearbox output shafts and couplings are in the correct position**

**Must-have tools and parts: A well-equipped facility requires a variety of tools and parts to ensure success**



# Test, don't guess.....develop your path forward in the Leistritz Extrusion Process Laboratory

The Leistritz Extrusion USA process laboratory is unique in that both pellets and/or film sheet samples are possible. The Leistritz process development laboratory includes:

- 6 twin screw extruders: ZSE 12 MAXX to ZSE 50 MAXX
- Strand, underwater and hot face pelletizing (air quench and water quench)
- 40+ feeders: pellets, powders, fibers, liquids, reclaim+++
- Downstream: film/sheet, tube/profile
- Film/sheet samples from 50 mm to 1 meter in width
- Up to 5-layer coex structures
- Lamination of substrates
- 3D filament extrusion
- Supercritical injection: foaming and stripping
- Devolatilization: 60/1 L/D, multi-stage, atmospheric and vacuum venting
- Multi-stage TSE system setups- string together 2 or 3 extruders in 1 system

**Contact us today to discuss your process development project.**



7 Outlook

# New Leistriz Extrusion Overview Brochure

A 16-page brochure describes the range of twin screw technologies and services available from Leistriz.

Curious? Please get in touch for additional information. Or anything contained in this newsletter. We look forward to serving you.

Team @ Leistriz Extrusion

## Leistriz Extrusion

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We look forward to working together to  
advance twin screw technologies!



## Kontakt



## Company

Overview

Sites

History

Our strengths

Quality / Certification

News room

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Overview

ZSE MAXX series

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