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**Press release**

**60 years of ZSK twin screw extruders**

**Anniversary of Coperion's high-performance ZSK extruder series**

*Stuttgart, September 2017* – The ZSK twin screw extruder, the “forefather” of all twin screw extruders, celebrates its 60th anniversary this year. Werner & Pfleiderer, known nowadays as Coperion GmbH, delivered the first co-rotating, closely intermeshing ZSK twin screw extruder in 1957 – exactly 60 years ago. Since then, the ZSK extruders have undergone a transformation that was inconceivable 60 years ago – from what would now be considered relatively simplistic co-kneaders with a throughput rate of 170 kg/h to sophisticated, high-performance processing machines for a variety of applications in the plastic, chemical, food and pharmaceutical industries. They are manufactured with screw diameter sizes ranging from 18 to 420 mm and achieve throughput rates from 200 g to 125 t/h for polyolefins.

**Four years from the first prototype to serial production**

In 1953, Werner & Pfleiderer acquired an exclusive license from Bayer in Leverkusen, Germany. The work was started by Rudolf Erdmenger and Walter Meskat at the IG plant in Wolfen in 1943. In 1945 Rudolf Erdmenger continued the work as part of the “High-Viscosity Technology” group and developed the fully self-wiping profile for co-rotating intermeshing screws. This was the inception of the ZSK twin screw extruder, which remains functional over a wide range of viscosities or frictional properties of the processed material. The prototype of this machine invented by Erdmenger was still equipped with vertically arranged screws, unlike the ZSK twin screw extruder of today. Werner & Pfleiderer undertook an additional four years of development work in order to make the first machines fit for production.

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## Throughput increased by a factor of 35

Today, the ZSK twin screw extruder is distinguished by a performance level considered revolutionary at the time of its market launch and for a long time afterwards. For a machine of the same shaft center distance, the throughput rate today is 35 times higher than it was 60 years ago. At the same time, today's compounding machines handle a considerably higher number of processing tasks. The length of the process section is a main factor enabling this. Today, the process section can be extended up to 80 D (D = screw diameter) from an original figure of 6 D. While the first ZSKs featured a specific torque  $Md/a^3$  of  $3.7 \text{ Nm/cm}^3$ , today's ZSK high-performance extruders boast torques of  $18 \text{ Nm/cm}^3$  on the ZSK Mc<sup>18</sup> and  $11.3 \text{ Nm/cm}^3$  on the ZSK Mv PLUS. Together with a significant increase in speed from  $150 \text{ min}^{-1}$  to  $1,200 \text{ min}^{-1}$  or  $1,800 \text{ min}^{-1}$  – which some experts initially viewed with skepticism – the current ZSK range can achieve incredibly high throughput rates.

## Continuous development of the technology

The levels of performance and flexibility currently achieved by the ZSK twin screw extruder are the result of intensive, continuous development work by the engineers at Werner & Pfleiderer – as it was back then – and Coperion today. These developments include the following examples:

- The transition to a process section with modular barrel sections and screw elements facilitates the versatility needed to fulfill a wide range of processing tasks while remaining cost-effective.
- The type of connection between the screw shaft and the screw elements is vital in determining the maximum transferable torque. Over the years, development has progressed from the simple taper and keyway to the spline shaft, and then to an involute toothing optimized with the aid of the FEM and produced in a special cold hammering process for increased robustness. This type of connection is capable of transmitting extremely high torque.
- Improved materials and production methods have made it possible to gradually increase the screws' ratio of outer diameter  $D_o$  to inside diameter  $D_i$  from an original value of 1.22 to a current value of 1.55 (on the ZSK Mc<sup>18</sup> and the ZSK MEGAcoumpounder) and 1.80 (on the ZSK Mv PLUS), which has led to a significant increase in the free volume in the process section.

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- Numerous developments with the aim of pushing back the boundaries of process feasibility enabled the torque available today to be used to the fullest. These include the new Feed Enhancement Technology (FET) for considerably improved feeding of fillers with a low bulk density and the ZS-EG side devolatilization unit for more efficient and reliable devolatilization.
- Today, various materials and coatings are available for areas of the screws and barrels which come into contact with products to ensure both a prolonged service life and a high purity of product.

### **A bright future**

There is no end in sight for the ZSK success story. The developers at Coperion already have their sights set on the machines of tomorrow – with an even wider spectrum of applications for new tasks in a vast range of industrial sectors. Energy efficiency, the conservation of resources and the integration of ZSK high-performance extruders into companies' digital environments are the current hot topics that are shaping the future of the ZSK. Frank Lechner, Head of Process Technology at Coperion, states: "Current examples of our innovative strength are the changeover from batch processes to continuous processes, which are increasingly in demand by customers in the chemical and pharmaceutical industries in particular. We have already been able to achieve impressive results with our ZSK extruders when producing products such as sealants or cleaning agents. In many processes, we are also able to increase the throughput rates and the product quality many times over with our latest development, the recently introduced involute screw elements, thus contributing to more efficient use of the systems and resources. We are also equipped for the future requirements of the 'Circular Economy' as far as both extruder technology and our decades of processing know-how are concerned."

Coperion ([www.coperion.com](http://www.coperion.com)) is the international market and technology leader in compounding and extrusion systems, feeding and weighing technology, bulk materials handling systems and services. Coperion designs, develops, manufactures and maintains systems, machines and components for the plastics, chemicals, pharmaceutical, food and minerals industries. Within its four divisions – Compounding & Extrusion, Equipment & Systems, Materials Handling and Service – Coperion has 2,500 employees and nearly 30 sales and service companies worldwide. For more information visit [www.coperion.com](http://www.coperion.com) or email [info@coperion.com](mailto:info@coperion.com).

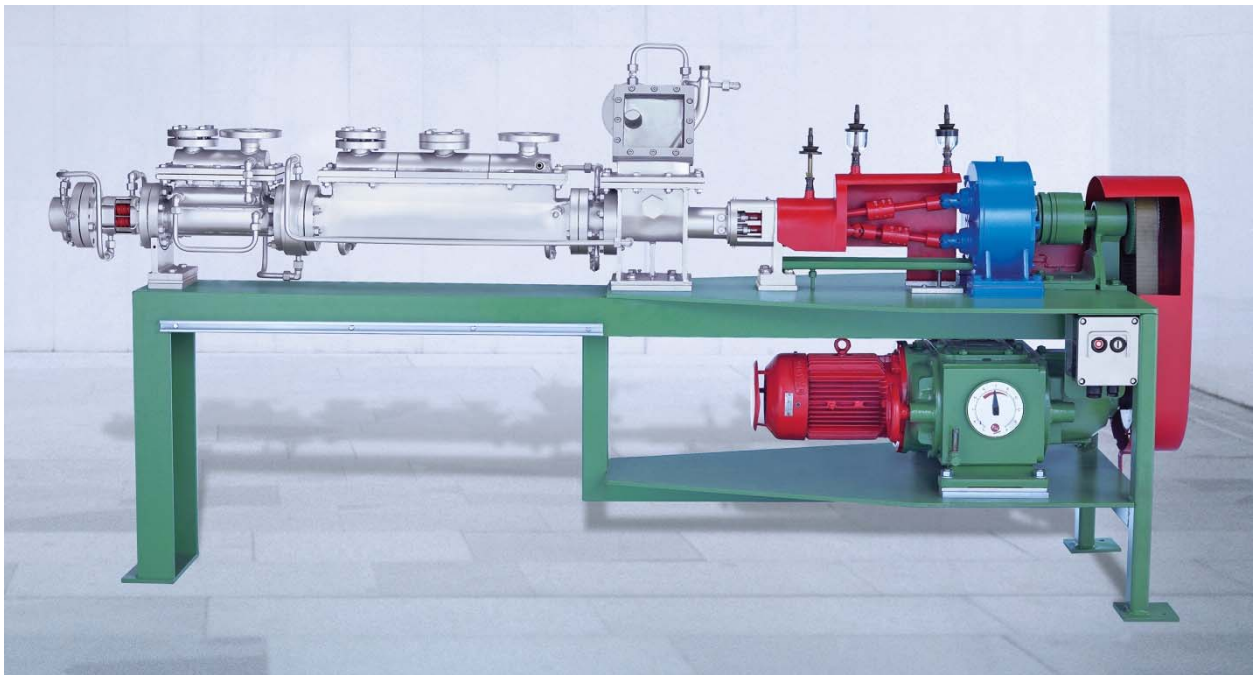


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*The prototype built by Erdmenger – the “forefather” of all ZSK twin screw extruders – was equipped with a cardan-shaft drive system and numerous vent caps*

*Image: Coperion, Stuttgart*

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*A modern, high-performance extruder from the ZSK Mc<sup>18</sup> series with a specific torque of 18 Nm/cm<sup>3</sup> and a  $D_o/D_i$  ratio of 1.55 for preparing products with high torque requirements, such as engineering plastics*

*Image: Coperion, Stuttgart*

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*ZSK Mv PLUS twin screw extruder with a screw diameter of 54 mm, in hygienic design, designed especially for the strict requirements of food production applications*

*Image: Coperion, Stuttgart*