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# From Melt to Yarn, Fibers and Nonwovens Solutions for polymer processing





## From Melt to ...

Homogenous melt is the very basis for high-quality yarn and all other plastic materials. Producing this is the job of our efficient and high-end continuous polycondensation systems and extrusions lines for fiber-grade and bottle-grade polyester (and other polymers) melt and granulate.

The engineering services for the complex systems – built in collaboration with well-known partners – are provided by highly-qualified specialists from all divisions of the global Oerlikon Manmade Fibers segment network. This allows you to secure all process steps – from the unloading of the purified terephthalic acid, polycondensation and spinning plant all the way through to texturing – all from one hand. This means optimum tuning of the individual production steps and system components, hence guaranteeing the very best product quality and a high degree of production efficiency from the melt through to the final product itself.

The benefits of an in-house polycondensation system are clear to see: in addition to independence from external granulate manufacturers, short-term price fluctuations within the raw materials market and direct influence on polymer quality, it is – above all – the additional value added that promises further profits.

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# The only thing that counts is the quality of your product

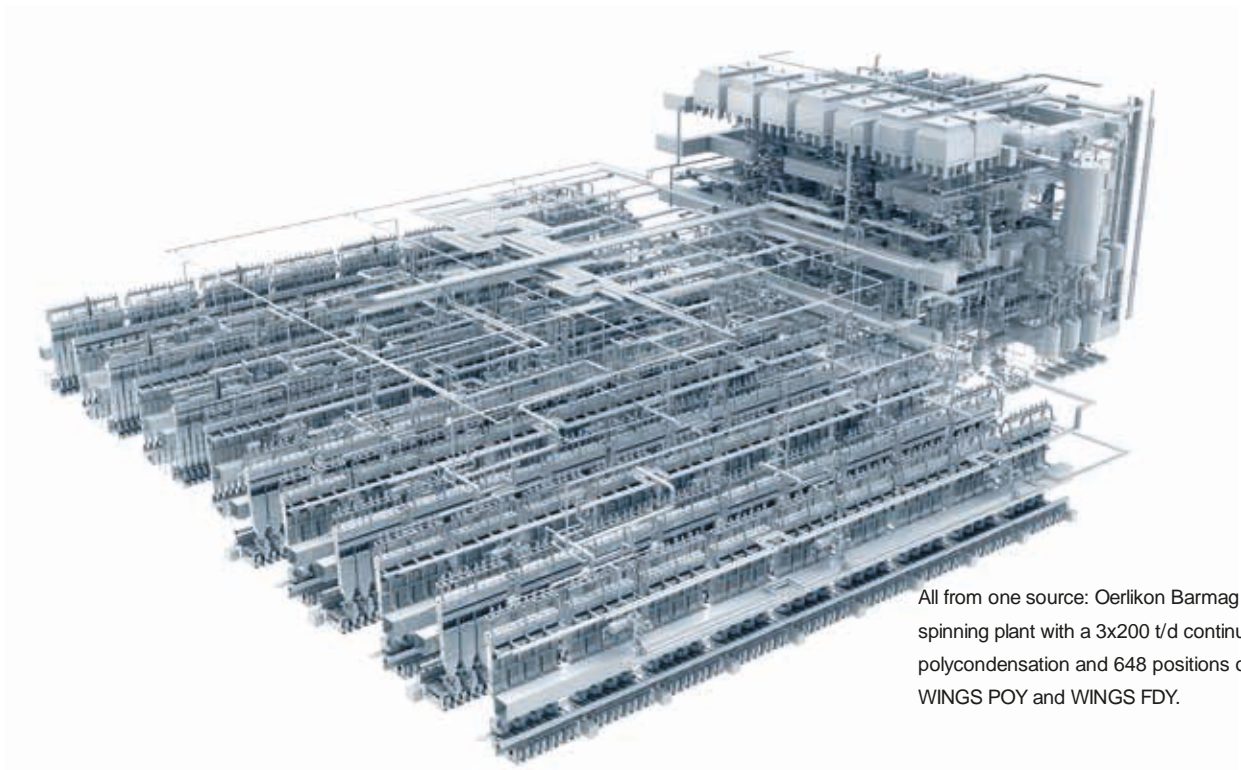
The focus of all our work is on the quality of your final product. This comes from perfectly coordinated technologies and processes based on faultless raw materials.

## Along the entire value chain

You know you have a strong partner at your side with Oerlikon Manmade Fibers. We take responsibility for the quality of your products, manufactured in a closed production chain tailored to your requirements that we have designed, installed and maintain in house. We will be happy to support you along your entire value creation chain with our comprehensive Customer Services – true to our slogan: Partnering for Performance.

## World market leader

Oerlikon Manmade Fibers segment with its product brands Oerlikon Barmag and Oerlikon Neumag is therefore not without reason the world market leader for filament spinning systems used for manufacturing manmade fibers, texturing machines, BCF systems, staple fiber spinning and nonwovens solutions and – as an engineering services provider – offers solutions along the entire textile value added chain. As a future oriented company, our research and development is driven by energy-efficiency and sustainable technologies. Our product range includes continuous polycondensation systems, extrusion lines and their key components. We cater to the entire production process – from the monomer all the way through to the textured yarn.



All from one source: Oerlikon Barmag spinning plant with a 3x200 t/d continuous polycondensation and 648 positions of WINGS POY and WINGS FDY.







## ... Yarn for textile and apparel as well as industrial applications

The principle behind manufacturing a thread is always the same: our precise gear metering spinning pumps press the plastic melt from our continuous polycondensation system and extrusion lines through micro-fine spinnerets under extremely high pressure. The filaments created are then bundled into threads, drawn over godets and wound using a winder.

Reliably mastering this principle requires high-precision and simultaneously extremely sturdy technology. These machines are in operation day and night, year in, year out. Oerlikon Barmag systems master the processes required for manufacturing textile (POY/DTY and FDY) with WINGS (Winding INtegrated Godet Solution) and industrial yarns (IDY). We spin the standard polymers polyester, polyamide 6 and 6.6 and polypropylene. Furthermore, we have also taken on the challenge of processing complex materials such as PTT, aramid, carbon fibers, glass fibers and similar.

With a production window of between 12 and 12,000 den per yarn end, Oerlikon Barmag covers an extremely-wide titer range. Depending on the application and the required yarn characteristics, our systems produce high quality yarns for all applications.

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## ...Bulked Continuous Yarn (BCF) for an efficient carpet production

Oerlikon Neumag BCF carpet yarn plants set the benchmark in the industry with regard to performance, quality and reliability. The latest development S+ is a 3-end BCF machine which combines the advantages of the former S5 and the single-end solution Sytec One. Some of the components of the S+ machine, such as godets, texturing system, cooling drum and winder, are well known from the S5. The straight yarn spinning, the spin-finish application via F-Jet (Finish Jet) and certain winder improvements were transferred from the Sytec One technology.

What characterises the S+ in the first place, is the high process speed and at the same time, a very stable and robust spinning performance. As known from the Sytec One, the optimised spinning and the straight yarn path realises the increased process speed. Further the design of the S+ is simplified and ensures a trouble-free handling of the take-up section. The rear side of the machine is better accessible and makes the maintenance much easier. The winder has been redesigned resulting in an improved doffing performance.

With the S+ an efficiency of 99% and a significant speed increase has been realized. Including the new rotating tangle unit RoTac<sup>3</sup> means an additional energy-efficient, very uniform tangling also at high speeds. The compressed air consumption in the RoTac<sup>3</sup> can, according to the type of yarn, be reduced by up to 50 %.

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## ...Synthetic Staple Fibers for textile applications

More than 4 million tons installed production capacity worldwide speak for themselves. Oerlikon Neumag staple fiber plants stand for highest product quality and absolute reliability.

Oerlikon Neumag's compact 1-step short spinning lines have an excellent flexibility with regard to the processable raw materials (PET, R-PET, PP, PA6) and titer range. These plants enable a highly economical production of fibers for a wide range of downstream processes e.g. carpets or geotextiles.

Oerlikon Neumag's 2-step staple fiber plants are designed to meet highest quality requirements at minimum operation cost. The largest plants with production capacities of up to 300 t/d guarantee high production yields under absolutely stable conditions for the production of high quality PET cotton type fibers. Beyond this, Oerlikon Neumag offers 2-step lines for the production of staple fibers with most different properties out of PET, PP, PA or bicomponent for a wide variety of applications like hygiene or medical products, geotextiles or concrete reinforcements.

The latest development is the Staple FORCE S 1000. The compact plant is specially laid out for the economical production of staple fibers in small lots up to 15 tons per day, as necessary for the production of carded nonwovens. The Staple FORCE not only impresses with its low initial investment and compact construction, but also the energy costs are significantly reduced by replacing steam and water baths through a dry drawing process.

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## ...Nonwovens for technical applications

As an engineering company for a wide range of nonwoven technologies, Oerlikon Neumag provides stand-alone machines and turnkey production lines for almost every type of nonwoven product. Oerlikon Neumag offers flexible, high-performance technologies for spunbond, meltblown and airlaid.

The Market for technical nonwovens is growing rapidly with over 9% per year. Increasing demand for these materials in emerging countries is generating tremendous opportunities for all manufacturers. Advanced spunbonds meet the need for thinner, lighter and more efficient materials in such applications. Thinking of manufacturing bitumen roofing substrates, roofing underlayment, or geotextiles? Drawing on many years of know-how, Oerlikon Neumag can supply you with a one step process from a single source – from the spinning plant all the way through to the spunbond roll-goods. The result is technology that is unsurpassed in terms of efficiency and productivity.

Oerlikon Neumag's meltblown systems are utilized in two distinctly different production lines: 1. Stand-alone mono and bicomponent meltblown equipment for a variety of filtration, insulation and sorbents applications. 2. "Plug & Produce" inserts in existing and new outside vendor SXS plants for a variety of medical and hygiene applications. This "Plug & Produce" solution enables a cost-efficient upgrading of new or existing spunbond systems hence offering the nonwoven producers the benefit of access to markets with particularly high quality standards.

Oerlikon Neumag airlaid technology ensures maximum flexibility and constant product quality. The core of this technology is the patented fiber forming system that enables the production of wide width webs based either on 100% pulp fibers or homogeneous mixtures of different fibers and powders.

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## ...the energy efficient production of PET bottle grade granulates

With the drastic increase in world population, drinking water is a scarce resource. Optimum conservation and an efficient transport are all the more important for these precious resources. Bottles made of synthetic polyethylene terephthalate (PET) are not only practical and unbreakable: because of their low weight, transporting them, also consumes less energy. A further advantage is that the material can be easily recycled.

Investment in production facilities for the synthetic granulate out of which the bottles are made, is particularly high in the emerging nations. With its high level of technological expertise in the production and handling of synthetic materials such as manmade fibers, Oerlikon Barmag also enables you in the growing market for bottle grade granulates by constructing plants from the planning to the commissioning. All the components, such as reactors, filters, heating elements, vacuum systems, piping, valves, sensors and control units, are procured from partners in various countries.

The proven Oerlikon Barmag technology led to significant energy savings and a sustainable reduction in operating costs. With the special technology developed by Oerlikon Barmag, the hot steam, generated during the manufacturing process, can be used to produce cold water. This so-called vapor absorption distiller, significantly reduces the plant's energy consumption. On top of this, Oerlikon Barmag's technology has a high conversion rate and creates relatively little waste. Operators thus attain a substantially higher margin and are more competitive. In addition, the plant technology enables manufacturers to use a certain amount of recycled synthetic material in the production process, resulting in a reduced need for raw materials.

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# Partnering for Performance

Our Customer Services department of Oerlikon Manmade Fibers segment has one allembicing mission: we want to make your production increasingly efficient and productive, and your business increasingly competitive and profitable. To do this, we offer you a close working relationship – Partnering for Performance.

Textile technologies are becoming ever more efficient and flexible, opening up great opportunities to enhance your competitiveness. At the same time, this progress accelerates the race in the market. To be able to keep up and react swiftly to a changing market situation, it is important to maintain and expand your technical capabilities and to utilise them properly. To achieve these, we place emphasis on a close, trusting service partnership with you to ensure reliable production and gain a technological edge, to secure your investment and to guarantee success in the future.

Through our partnership we want to increase your operational efficiency to best effect. With this in mind, we focus on optimising your operating and manufacturing processes, your system and logistics management and the acquisition of further skills by your staff. Your success grows with the interplay of all the factors involved. For this we offer you the performance of a technology leader with a unique global service network, along with highly qualified service and engineering experts. We will advise and support you in all phases of your business along the entire value creation chain of fiber production.

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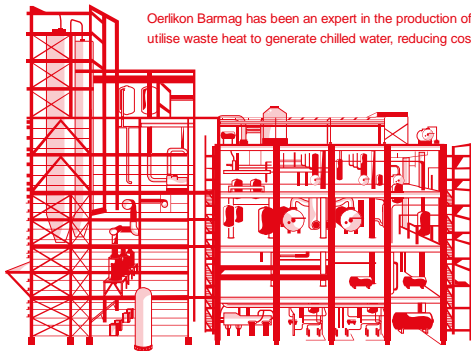






# Oerlikon Barmag Polycondensation Plant

How to save 630,000 USD per year and produce the best polyester.



Oerlikon Barmag has been an expert in the production of efficient and high-end continuous polycondensation systems for polyester melt and granulate since 2008. Our plants are energy efficient and utilise waste heat to generate chilled water, reducing cost overall. Find out the details and benefits of our polycondensation plants and how they can improve your operation and product quality.

Polycondensation plants are modular designed for the production of Polyethylene terephthalate:

up to **750** tonnes per day (TPD) in single stream

up to **1500** tonnes per day (TPD) in two streams

The plants are made for textile applications, apparel and industrial textiles as well as for packaging (PET bottles and films).



1 icon = 100 TPD

OR



## Main Features



Four reactor technology



Cage type finisher



Low temperature process



Medium residence time process



Integrated process vapour waste heat recovery



Vacuum generation through EG vapour driven ejector

## Process Features

### In-Line EG-Recirculation & Recovery



- No additional storage tanks
- No colour control problem
- Less raw material and energy consumption
- No EG recovery plant requirement

### Esterification System

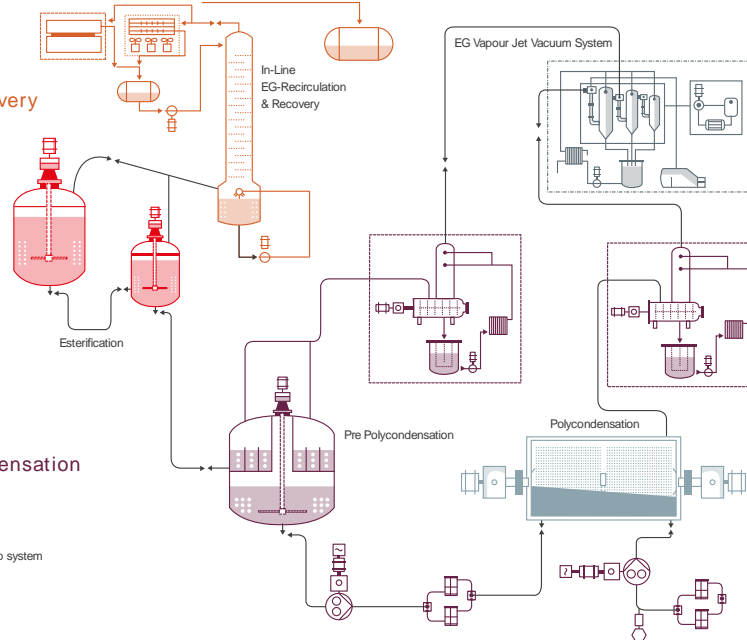


- Moderate retention time
- Compact design
- Waste heat recovery for generating chilled water

### Pre-Polycondensation / Polycondensation



- No dead corners, inherent cleaning
- High capacity utilisation range
- Short retention time at low temperatures
- Compact and modular design
- EG vapour jet vacuum system with close EG loop system



### EG Vapour Jet Vacuum System



- No steam required
- No waste water
- Close EG loop system

### Cage Finisher System



- No dead corners
- High capacity utilisation range
- Short retention time at low temperatures

### Own Technology

- No license fees
- No market restrictions

### Environmentally Friendly Process

- Off-gases burned
- No relevant emissions
- Process column's liquid effluents pre-cleaned
- No relevant disposals

### Summary of Advantages

**Four reactor technology**  
for a short residence time

**PTA-paste preparation concept**  
concept for a consistent slurry transfer to the esterification process

**Cage type finisher**  
for a short residence time

- Avoids "dead corners" of residing polymer inside the reactor
- Agitator design ensures low thermal stress for a minimum thermal degradation of the polymer

Low Carboxyl group **OR** IV-variations

Excellent colour

**High uniformity in PET polymer properties**

**No emissions water effluent**  
due to vapour condensations by EG

### Organisational Value Additions

Complete plant with end product guarantee

Ease in communication due to dealing with local team

Experienced polycondensation engineers

Local services and help in plant optimisation

### Waste Heat Recovery and Its Economics

**Process vapour**  
is used to drive a Vapour Absorption Chiller and produce chilled water

**Generates ~45 Refrigeration Tonnes (RT) of chilled water per tonne**

Approximate cost of 1 RT of chilled water is **cents USD** **\$\$\$\$\$**

**For a 600 TPD plant the annual saving of operation cost amounts to:**

**\$630.000**





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