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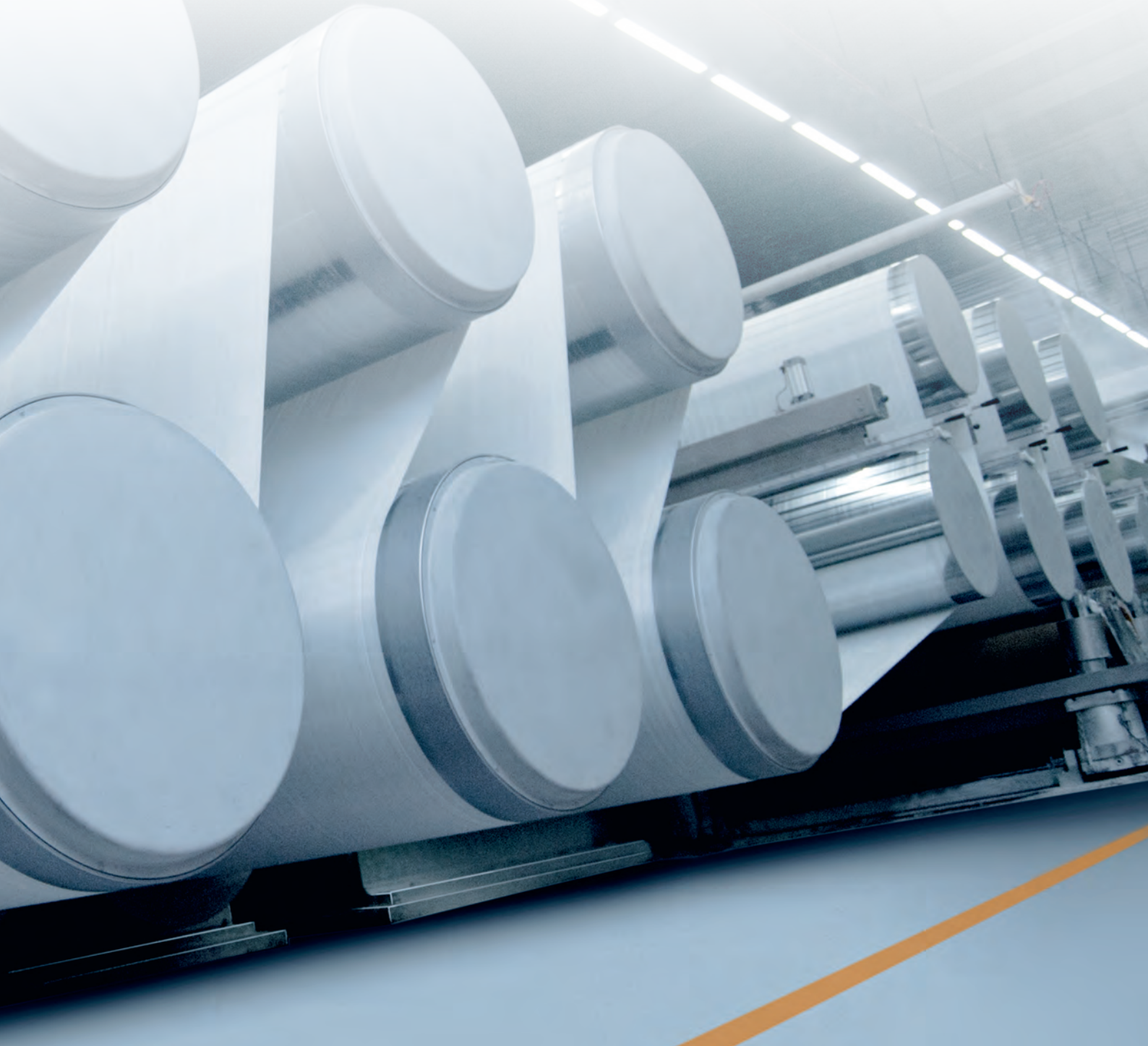
Synthetic staple fiber production

The right solution for every need



Synthetic staple fiber production with Oerlikon Neumag technology

Oerlikon Neumag staple fiber plants stand for highest product quality and absolute reliability.

The idea

Synthetic staple fibers are produced by the main conversion steps: extrusion, melt spinning, drawing, crimping, cutting and baling. The design of the key components as well as the composition of components in highly reliable production lines and the process know-how determine the fiber quality, efficiency of the production and ultimately the overall success.

The benefit

We have developed the processes and engineered dedicated from melt to fiber production lines:

- From 15 – 225 tons per day
- One-step or two-step technology
- Polyester, recycled polyester, polypropylene, polyamide and more
- Commodity or special applications

e-save
comprehensive efficiency

e-save provides you with a competitive edge

With e-save, Oerlikon Manmade Fibers introduced a label for particularly energy-efficient systems, machines and components back in 2004. Over the past years, e-save has established itself as the trademark of a comprehensive efficiency program. This underlines the preeminent role of Oerlikon Manmade Fibers when it comes to commercial success and sustainability.

Compared to other concepts available on the market, our staple fiber solutions convince in terms of

- Energy: with up to 20 % lower energy consumption in spinning and fiber line area
- Economics: with up to 50 % fewer operating staff due to a capacity increase up to 225 tons per day
- Environment: with up to 10 % lower steam consumption due to lower free area on calender drier godets

Commodity, bicomponent or special fibers with two-step plants

Our two-step staple fiber plants are designed to meet the highest quality requirements at the lowest operating costs.

The largest plants with production capacities of up to 225 tons per day guarantee high production yields under absolutely stable conditions for the production of high quality PET cotton-type fibers. Beyond this, we offer two-step lines for the production of staple fibers with the most diverse properties made using PET, PP, PA or bicomponent for a wide variety of applications such as hygiene and medical products, geotextiles and concrete reinforcements.

PET cotton-type fibers

A major competitive advantage of the 225-ton-per-day staple fiber plant for commodity fibers is the considerably higher profitability per ton of fiber compared to smaller plants, which is essentially based on the energy efficiency of the large-scale plant.

Our technology offers a further advantage with the possibility of dyeing fibers directly in the spinning process. Because the large plants are always connected to a polycondensation plant, fibers cannot be dyed until processing. With side stream extrusion, however, the master batch can be mixed directly into the spinning process. This means, for example, that black or optical bright fibers can be produced directly. Later dyeing is no longer necessary.

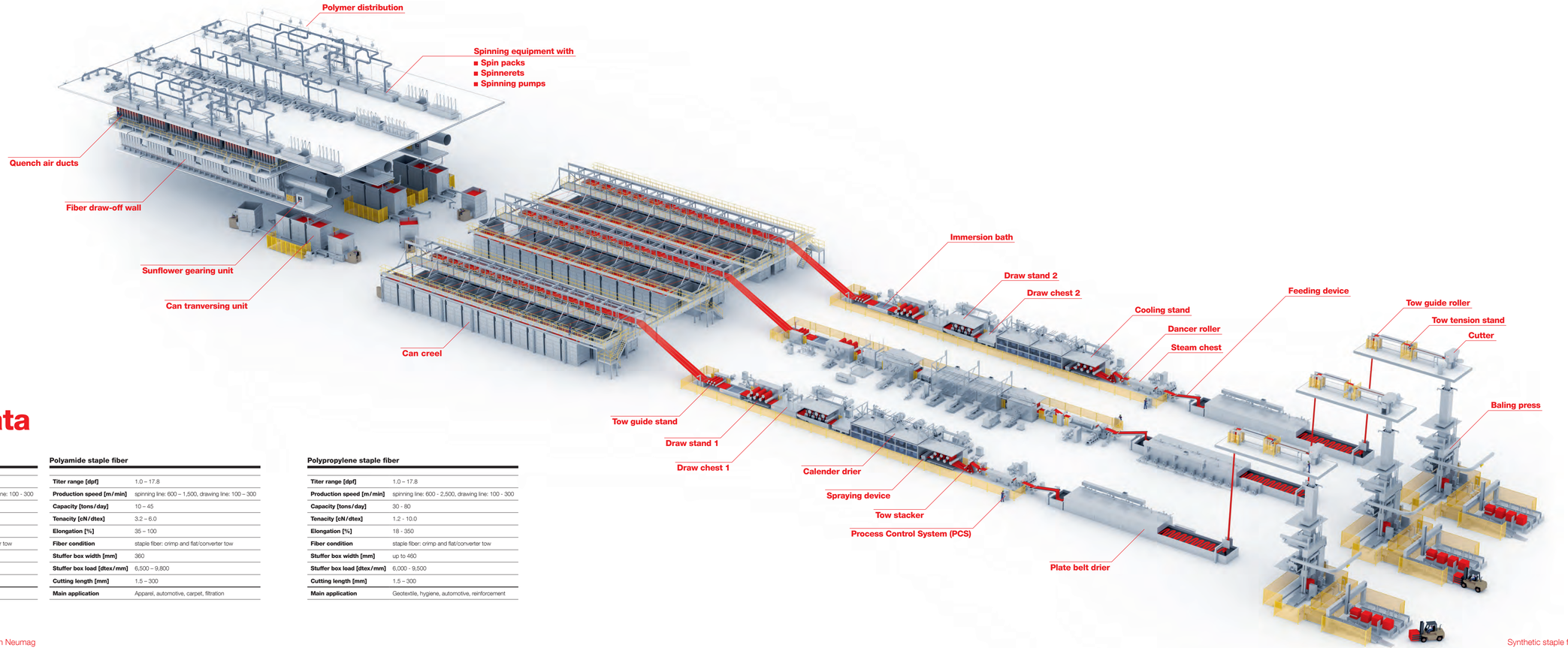
Your benefits:

- Higher profitability per ton of fiber
- Capacities up to 225 tons per day
- Side stream extrusion

Specialties

And in addition to cotton-type and bicomponent fibers other special fibers can be optimally produced in the two-step process:

- PP fibers for hygiene nonwovens
- PP short cut fibers for concrete reinforcements
- PET hollow fibers for insulation and filling
- PET fibers for geotextiles and other needled felts
- PLA fibers for apparel



Technical data

Polyester staple fiber

Titer range [dpf]	1.0 – 17.8
Production speed [m/min]	spinning line: 600 - 2,000, drawing line: 100 - 300
Capacity [tons/day]	30 - 225
Tenacity [cN/dtex]	3.6 - 6.0
Elongation [%]	18 - 55
Fiber condition	staple fiber: crimp and flat /converter tow
Stuffer box width [mm]	max. 800
Stuffer box load [dtex/mm]	6,000 - 12,500
Cutting length [mm]	1.5 – 125
Main application	Apparel, carpet, fiberfill, hygiene

Polyamide staple fiber

Titer range [dpf]	1.0 – 17.8
Production speed [m/min]	spinning line: 600 – 1,500, drawing line: 100 – 300
Capacity [tons/day]	10 – 45
Tenacity [cN/dtex]	3.2 – 6.0
Elongation [%]	35 – 100
Fiber condition	staple fiber: crimp and flat/converter tow
Stuffer box width [mm]	360
Stuffer box load [dtex/mm]	6,500 – 9,800
Cutting length [mm]	1.5 – 300
Main application	Apparel, automotive, carpet, filtration

Polypropylene staple fiber

Titer range [dpf]	1.0 – 17.8
Production speed [m/min]	spinning line: 600 - 2,500, drawing line: 100 - 300
Capacity [tons/day]	30 - 80
Tenacity [cN/dtex]	1.2 - 10.0
Elongation [%]	18 - 350
Fiber condition	staple fiber: crimp and flat/converter tow
Stuffer box width [mm]	up to 460
Stuffer box load [dtex/mm]	6,000 - 9,500
Cutting length [mm]	1.5 – 300
Main application	Geotextile, hygiene, automotive, reinforcement

Bicomponent fibers offer diverse application possibilities

Not only commodity fibers, but also bicomponent fibers are produced in the two-step process. Here, we offer solutions for self-crimping fibers, bonding fibers, super microfibers and hollow fibers, for example.

Bicomponent fibers offer a huge range of possible cross-sections. In general, these fibers comprise of two different polymers, which give them specific properties. Bicomponent fibers with the corresponding cross-sections are manufactured depending on the desired application, for example:

- Fulfilling various requirements only in one fiber
- Achieving thermobonding properties
- Producing spunbond fleece with extreme properties
- Achieving “Super Micro Fibers” by
  - Splitting the two components through mechanical stress
  - Dissolving one of the two components
- Achieving a 3-dimensional self-crimping fiber

Core-sheath and side-by-side cross-sections are typical and often used in staple fibers. While core-sheath bicomponent yarns are frequently processed as bonding fibers for nonwovens, the focus when manufacturing side-by-side bicomponent yarns is on the desired self-crimping effect.

Our competence is based on many years of experience – we commisioned the first staple fiber plant for bicomponent fibers in 1995. Through the composition of two or more polymers in one fiber, the door to an unlimited horizon of fiber applications is opened.

Diverse cross-sections ensure diverse yarn properties

Bicomponent overview

	1	2	3	3a	4	5
Type	core-sheath	core-sheath eccentric	side-by-side full	side-by-side full	side-by-side hollow	side-by-side hollow eccentric
						
Materials	R-PET/PET PET/CoPET PET/PE PP/PP	R-PET/PET PP/PE PP/PP PET/CoPET	PET/PET PP/PE PP/PP PET/CoPET R-PET/R-PET PET/PE	PET/PET PP/PE PP/PP PET/CoPET R-PET/R-PET PET/PE	PET/PET PP/PE PP/PP PET/PE	PET/PET PP/PE PP/PP PE/PE
Final titer [dtex]	1.7 - 20	1.7 - 20	2 - 20	2 - 20	2 - 20	2 - 20
Ratio [%/%]	30/70 70/30 90/10	30/70 70/30	50/50	50/50	50/50 70/30	30/70 70/30

6	7	8	9	10	11	12
orange-type with centre 16 segments	orange-type w/o centre 16 segments	striped fibers	conductive fibers	island-in-the-sea	profile bico	mixed fibers
						
PET/PA6 PET/PA6.6 PET/CoPET	PET/PA6 PET/PA6.6 PET/CoPET	PET/PA6	PA6/MB	PA6/CoPET PET/CoPET	PP/PA6 PA6/PA6 PET/R-PET PTT/PET	PET/PET PP/PP PA6/PA6 PA 6.6/PA 6.6 PET/CoPET
0.1 - 0.2	0.1 - 0.2	0.1 - 0.2	25 - 30 undrawn	< 0.05	15 - 20	
50/50 65/35	50/50 65/35 80/20	50/50 70/30	50/50 70/30	80/20 50/50 70/30	50/50 30/70	

Inline systems with 1-step process for special applications

Our compact 1-step staple fiber spinning lines have an excellent flexibility with regard to the processable raw materials and titer range. These plants enable highly economical production of fibers for a wide range of downstream processes.

Cost-efficient plant configuration

The one-step technology includes the spinning operation and the subsequent drawing in one process step. This compact construction permits the production of staple fiber capacities of up to 80 tons per day.

Your benefits:

- Single-storey operation, compact design -> Less staff requirements
- Spinning and drawing in one line -> no buffer between spinning section and drawing line
- Long spin pack running time

High flexibility

The applications are as diverse as they are specific: from fibers for geotextiles, filtration applications and hygiene applications to reinforcement fibers through to fibers for automotive applications.

Because of the extruder spinning, the inline process is ideally suited to processing recycled polyester. Whether as regranulated chips or directly as R-PET flakes (bottle flakes), even recycled polyester that does not 100% satisfy the qualities of virgin polyester can be processed.

Your benefits:

- Highest flexibility in raw material input: PET, R-PET, PP, PA6
- Titer range: 1.7 – 90 dtex
- Quick colour change due to side extrusion


DRAW STAND - III
DANGER
Do Not Go Inside
While Machine
Is Running
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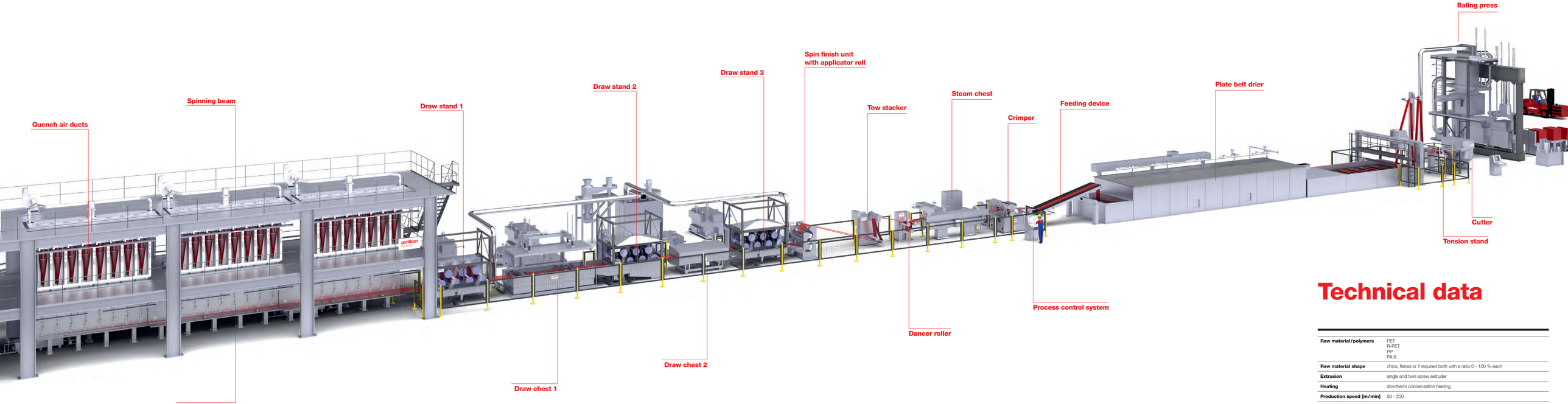

Technical data

Raw material/polymers	PET R-PET PP PA 6
Raw material shape	chips, flakes or if required both with a ratio 0 - 100 % each
Extrusion	single and twin screw extruder
Heating	dowtherm condensation heating
Production speed [m/min]	50 - 200
Capacity [tons/day]	4 - 70
Titer range [dtex]	PET: 1.7 - 35 PP: 1.0 - 90 PA 6: 1.7 - 44
Tenacity [cN/dtex]	2.5 - 6.5
Elongation [%]	25 - 300
Crimp	2-dimensional, flat
Fiber cross-section	i.e. round, trilobal
Cutting length [mm]	2 - 125
Main application	Geotextile, filtration, hygiene, medical

Crimper and cutter – key components in staple fiber production

Crimping is one of the most important and challenging process steps in the manufacture of staple fibers. It provides the tow with a textile structure, which ensures the required adherence in yarn and textile manufacturing and enables the desired surface and volume properties in the end products.

An even and stable crimp is decisive for optimum further processing results. Oerlikon Neumag crimp technology guarantees optimum crimping as a result of:

- Guided tow package through inlet guide/chute
- Adjustable crimper roll temperature
- Constant stuffer box pressure due to pneumatic cylinders
- Constant pressure on thrust pads due to the use of worldwide patented hydraulic pressure device
- Worldwide patented decoupled two-rocker-arm design crimper
- Constant tow tension by the means of a dancer roll and alternatively by means of a tension measuring roll
- Uniform tow package and tow laying
- Uniform tow temperature and humidity
- Stuffer box made of high-end steel and non-ferrous metals with extremely-low wear-and-tear

But a stable crimp is not the only factor decisive for further processing, so too are precise lengths and clean cutting edges in the case of fibers. Oerlikon Neumag offers two different cutting types: horizontal cutting and vertical cutting.

While the blades are positioned parallel to the direction of cutting during horizontal cutting, they are positioned perpendicular to the direction of cutting in the case of vertical cutting.

Your benefits:

- High quality cut with
  - Clean cut edges
  - No fused fibers
  - No long fibers
  - No double cuts
- High staple accuracy
- No bending stress on the blades; therefore, lower blade breakage risk
- Flexible cutting head design – all staple fiber lengths achievable with the same cutting head
- Very good fiber opening during carding due to low compacting of the fibers
- Parallel distance of the blades enables shortest staple lengths down to 1.5 mm
- Discharge of fibers by means of gravity
- No production stop required during head change


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