Maximum product quality and production reliability
Sheet extrusion lines
Processes

Extrusion

- Single-screw extruders
- Co-rotating twin-screw extruders (ZE series)
- Counter-rotating, parallel twin-screw extruders (KMD series)

Lamination/calibration

- Vertically
- Horizontally
- J type
- PlanetCalander with flexible roll arrangement

Finishing

- Winding
- Cutting and stacking
- Measuring and checking
- Printing and coating
One partner – many solutions

From the sealing sheet for the roofs of buildings to the floor of your deck, from lightweight panels for advertising media through to sheets for the vehicle interior: we encounter plastic sheets everywhere. Without state-of-the-art extrusion and polishing stack technology, all this would not be possible. Manufacturing sheets in large quantities, in high quality, using different materials, with the desired properties – and not only quickly but also cost-efficiently. All this calls for sophisticated technology – and a partner supplying state-of-the-art production solutions.

Development and construction of sheet extrusion systems are rooted in the perfect connection of building precision machines and expertise in processes and presuppose longtime experience and the fulfillment of the highest demands for quality. KraussMaffei Berstorff provides specially customized solutions for the entire value chain of the manufacture of sheets including matching maintenance and consulting services. You will receive everything from a single source: handling of raw material – metering the individual components extrusion and compounding – calibration and cooling the using the most varied polishing stacks – post-processing and packaging.

Taking the product to be manufactured as the starting point, KraussMaffei Berstorff, as general contractor, provides all components for a high-performance extrusion system. Concept, logistics, design of basics and details, coordination of interfaces with the building partner, concept of the testing lab and the workshop, installation of the system, training the machine operators and start-up. With complete solutions, alongside the economical advantages, we offer you, above all, the guarantee of the best possible technical matching of all individual components. In this way, even in the project planning phase, you can be sure that there will be no problems later.

Use our extensive knowledge and our longtime experience for your customized system solution – for standard procedures as well as for special processes.
# Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed and cost-efficiency for the best results</td>
<td>3</td>
</tr>
<tr>
<td>Processes</td>
<td>3</td>
</tr>
<tr>
<td>One partner – many solutions</td>
<td>3</td>
</tr>
<tr>
<td>All for more competitiveness</td>
<td>4</td>
</tr>
<tr>
<td>Integrative use</td>
<td>6</td>
</tr>
<tr>
<td>Sheets of polyolefins and elastomer compounds</td>
<td>8</td>
</tr>
<tr>
<td>Sheets of flexible PVC or modified polyolefins</td>
<td>10</td>
</tr>
<tr>
<td>Sheets of PVC</td>
<td>12</td>
</tr>
<tr>
<td>Sheets of C-PVC</td>
<td>13</td>
</tr>
<tr>
<td>Engineering polymers</td>
<td>14</td>
</tr>
<tr>
<td>High-performance polymers</td>
<td>16</td>
</tr>
<tr>
<td>Physical foaming</td>
<td>17</td>
</tr>
<tr>
<td>System technology redefined</td>
<td>18</td>
</tr>
<tr>
<td>Extruders and downstream units customized</td>
<td>20</td>
</tr>
<tr>
<td>Perfect polishing stacks and downstream units</td>
<td>22</td>
</tr>
<tr>
<td>TechCenter</td>
<td>23</td>
</tr>
<tr>
<td>High-performance extrusion systems</td>
<td>24</td>
</tr>
<tr>
<td>OEE Plus</td>
<td>26</td>
</tr>
<tr>
<td>KraussMaffei Berstorff</td>
<td>27</td>
</tr>
</tbody>
</table>
Speed and cost-efficiency for the best results
Challenges for sheet extrusion systems

Manufacturing sheets in large quantities, in high quality, using various materials, with the desired properties – and not only quickly but also cost-efficiently: all this calls for state-of-the-art production solutions. Welcome to KraussMaffei Berstorff.

Now even easier – one contact for everything, from the raw material through to finished product.

Now even more cost-effective – prepare and mold plastic formulations in a single pass, achieving higher throughput and increasing efficiency.

Now even higher quality – continuously attain the highest quality using reliable twin-screw extruders as well as innovative system concepts.
Higher quality, more production reliability, increased cost-efficiency
All for more competitiveness

Integrated process solutions from a single source are the focus of the planning and design engineering of KraussMaffei Berstorff sheet systems.
Secure your competitive edge. Using customized production technology by KraussMaffei Berstorff you produce premium quality plastic sheets – more easily and with more cost-efficiency than ever.

Besides systems with single-screw extruders, KraussMaffei Berstorff also provides extrusion systems with twin-screw extruders for in-line production, specifically for processing formulations with larger quantities of additives. Here, the compounding process is integrated into the production of sheets. For premium quality PVC sheets, excellent melt homogeneity is the foremost requirement. The homogeneity is achieved in the counter-rotating 32D twin-screw extruder of the sheet series by various measures. In the machine design, all critical process parameters are controlled, monitored and documented centrally. The processor thus continuously has an overview of the systems, an indispensable factor for production with quality assurance.

Optimal system concepts for your product – your advantages
- More flexibility and the option of producing on shorter notice, particularly with non-standard formulations
- High throughput
- Lower operating costs thanks to lower consumption of energy and operating fluids and less need for maintenance, especially for in-line compounding
- Use of more cost-effective raw materials instead of finished compounds
- Larger selection of potential suppliers of raw materials
- Lower capital lock-up for materials
- Lower raw material costs thanks to complete reincorporation of startup material, edge strips and scrap webs
- Lower production costs

In-depth process understanding
Our focus is on the processes in which our machines form the core of the system and for which we are able to provide expertise from the raw material through to the finished product in an end-to-end solution. Consequently, we are ideally equipped for projects of any scope, from an individual machine though to a turnkey system. We ensure high reliability of our systems by:
- Innovative technical solutions for the respective tasks
- Extensive engineering resources
- Experienced project management
- State-of-the-art project control tools
- Qualified suppliers and partners

We are your system partner
From advice on the optimization of the procedure and the production process through to the installation and system startup, commissioning and detailed adjustment – KraussMaffei Berstorff is your system partner in all project phases:
- Plant planning
- Plant logistics
- Basic design of the building and infrastructure
- Interface coordination with third parties
- Project transactions
- Training, production support and servicing

Highest precision is required
As designer and manufacturer of all core components, KraussMaffei Berstorff is your highly skilled contact. Our engineers see to it that your sheet extrusion systems are functioning with high precision and reliability. Our systems thus satisfy the stringent requirements regarding stability and accuracy throughout the entire production process.
Insulation board
Material: XPS
Technology: foam extrusion systems

Sheet for vehicle interiors
Material: TPO
Technology: in-line extrusion systems

Impact sound insulation
Material: polyethylene
Technology: foam extrusion systems

Fiber composite sheets and fiber-filled sheets
Material: formulations and compounds based on a fiber-reinforced hybrid material.
Technology: 32D twin-screw extruder with premium-quality wear resistance

Our solutions are implemented in an integrative way.
Furniture, interiors
Material: PVC, polypropylene
Technology: 32D twin-screw extruder

Advertising billboards, wall panels (furniture)
Material: PVC sheets, compact, foamed or coextruded
Technology: 32D twin-screw extruder

Floor coverings
Material: PVC, highly filled core layers
Technology: in-line extrusion systems

Optical plate and safety glass
Material: polycarbonate, PMMA, EVA

Roofing membranes
Material: TPO or PVC
Technology: extrusion coating systems

Sheet for swimming pools or ponds
Material: PVC, polypropylene
Technology: coating systems
We are your system provider for integrated solutions
Here is how you profit from sheets of polyolefins and elastomer compounds

Reducing the use of raw materials and integrating multiple working steps means saving money. Make use of all your resources in manufacturing sheets of polyolefins.

Chemically foamed sheets
The 36D single-screw extruders are optimally suited for extrusion of foaming PO sheets. The surface of the sheets is closed-cell, whereas the inner core cross-section has a uniform cell-shaped structure. The foaming process is triggered by chemical blowing agents under application of temperature and pressure. The interaction of formulations, melting processes, and the special geometry of the contours of the lips of the flat sheet die make it possible to produce sheets with significantly reduced density and, consequently, reduced use of raw materials. Ideal prerequisites for the construction of containers for water and acids, for example.

In the in-line process for manufacturing chemically foamed sheets, the two separate working steps, compounding and extrusion, are combined into an integrated solution. In-line compounding enhances cost-efficiency and quality. The twin-screw extruder makes it possible to mix the polymer with the blowing agent and other additives and to extrude a compact sheet in a single pass. The process prepares the material more gently and with greater cost-efficiency.

Sample products by KraussMaffei Berstorff

Chemically foamed sheets

<table>
<thead>
<tr>
<th>Material</th>
<th>HDPE, polypropylene, with addition of specific blowing agents, coordinated with customer requirement</th>
</tr>
</thead>
</table>
| Technology | Extrusion using 36D single-screw extruder  
- With melt pump depending on requirement  
- Specially designed flat sheet die  
- 3-roll polishing stack |
| Benefits for customers | Reduction of materials costs due to low density  
- Gentle melt processing using 36D single-screw technology  
- Optimal melt homogeneity and foam structure  
- Closed surfaces  
- High output |
### Sample products by KraussMaffei Berstorff

<table>
<thead>
<tr>
<th>TPO roofing membranes</th>
<th>Automotive decorated sheets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td><strong>Material</strong></td>
</tr>
<tr>
<td>- TPO, HDPE, with and without fabric reinforcement</td>
<td>- TPO, PET, ABS, PMMA, PVC</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td><strong>Technology</strong></td>
</tr>
<tr>
<td>- Single-layer and multilayer extrusion</td>
<td>- Multilayer extrusion</td>
</tr>
<tr>
<td>- Coating system with in-line compounding</td>
<td>- Compression molding</td>
</tr>
<tr>
<td><strong>Benefits for customers</strong></td>
<td><strong>Benefits for customers</strong></td>
</tr>
<tr>
<td>- Use of cost-effective raw materials</td>
<td>- Lower costs of raw material and energy</td>
</tr>
<tr>
<td>- Reincorporation of edge strips and scrap webs</td>
<td>- High filler content</td>
</tr>
<tr>
<td>- High filler content</td>
<td>- Sheet widths up to 3,600 mm</td>
</tr>
<tr>
<td>- Sheet widths up to 8,000 mm</td>
<td>- System design optimized for processing and energy use</td>
</tr>
</tbody>
</table>

---

### Customizing almost without limits

Sheets are an essential component in the design of interiors. This applies to vehicles (door inner panels, instrument panels, seats) and to the residential area (furniture, paneling of walls and objects). Depending on configuration and requirement, sheets of one or multiple layers can be manufactured in the extrusion process and linearly enhanced by embossing or laminating (e.g. with a foam back).

### Cost-effective systems for the manufacturing of sealing sheets

Extrusion systems for coating by KraussMaffei Berstorff are proving their quality every day in the production of landfill linings and geomembranes. The systems can be designed for sheets of one or multiple layers, with and without fabric reinforcement, and thus always provide the optimal cost-effective solution for your sheet manufacturing. In particular, using the modularly designed twin-screw extruders, sheets can be produced reliably and with the highest quality immediately from recyclates with and without filler. In this, a filler content up to 80% and in-line blending of polymers are possible. In combination with the KraussMaffei Berstorff single-screw extruders, colored outer layers or weldable and sealable layers can be manufactured. Systems for sheets with thicknesses from 0.2 to 3 mm and widths from 2 to 8 m at a throughput of up to 5 t/h have been completed.
Perfectly combined process steps
Compounding and reproduction of sheets of flexible PVC or modified polyolefins

Your production department can look forward to significant cost advantages – our systems make it possible to manufacture sheets of premium quality for the most diverse tasks. In addition, the otherwise separate process steps of compounding and sheet extrusion are consolidated in one continuous process.

Highest flexibility and cost-efficiency
In manufacturing roof tracks, highest flexibility is required: variable organization of the layer thicknesses on the upper and lower side of the sheet, various reinforcements, back fleeces, different color shades, fillers and flame retardants, small rolls for retail, large rolls for finishers. For all these requirements, KraussMaffei Berstorff provides customized concepts. Whether it is a system for smaller throughput with one polishing stack or a highly automated solution with two polishing stacks, the focus is always on cost-efficiency and quality. Using KraussMaffei Berstorff twin-screw extruders, quick conversion of a system from PVC processing to TPO processing is also possible.

Compounding and engineering
For manufacturing floor coverings, KraussMaffei Berstorff provides an economical system concept combining compounding and sheet manufacturing at one heat. Designed specifically for filling the thermally sensitive material PVC with 60 to 70% mineral filler, these systems provide you with unbeatable productivity. On request, our engineering team will integrate the extrusion system into an existing production system for floor coverings. Leave the coordination of interfaces to our experts and concentrate on the design of your product.

Specialized in processing natural fiber-reinforced materials
KraussMaffei Berstorff covers the entire value chain for composite materials with its portfolio in co-rotation and counter-rotating extrusion technology.

Sample products by KraussMaffei Berstorff

<table>
<thead>
<tr>
<th>Roofing membranes</th>
<th>Floors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td>PVC, filled with 60 to 70% mineral additives</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Counter-rotating and co-rotating twin-screw extruders for processing and extruding the compound</td>
</tr>
<tr>
<td><strong>Benefits for customers</strong></td>
<td>Lower costs of raw material and energy, High filler content, Sheet widths up to 3.6 m, System design optimized for processing and energy use</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>In-line laminating station for decorated sheet and surface protection</td>
</tr>
<tr>
<td><strong>Benefits for customers</strong></td>
<td>Lower costs of raw material and energy, High filler content, Sheet widths up to 3.6 m, System design optimized for processing and energy use</td>
</tr>
</tbody>
</table>

Your production department can look forward to significant cost advantages – our systems make it possible to manufacture sheets of premium quality for the most diverse tasks. In addition, the otherwise separate process steps of compounding and sheet extrusion are consolidated in one continuous process.

Highest flexibility and cost-efficiency
In manufacturing roof tracks, highest flexibility is required: variable organization of the layer thicknesses on the upper and lower side of the sheet, various reinforcements, back fleeces, different color shades, fillers and flame retardants, small rolls for retail, large rolls for finishers. For all these requirements, KraussMaffei Berstorff provides customized concepts. Whether it is a system for smaller throughput with one polishing stack or a highly automated solution with two polishing stacks, the focus is always on cost-efficiency and quality. Using KraussMaffei Berstorff twin-screw extruders, quick conversion of a system from PVC processing to TPO processing is also possible.

Compounding and engineering
For manufacturing floor coverings, KraussMaffei Berstorff provides an economical system concept combining compounding and sheet manufacturing at one heat. Designed specifically for filling the thermally sensitive material PVC with 60 to 70% mineral filler, these systems provide you with unbeatable productivity. On request, our engineering team will integrate the extrusion system into an existing production system for floor coverings. Leave the coordination of interfaces to our experts and concentrate on the design of your product.

Specialized in processing natural fiber-reinforced materials
KraussMaffei Berstorff covers the entire value chain for composite materials with its portfolio in co-rotation and counter-rotating extrusion technology.
Beginning with the selection of the suitable raw material by way of the formulation, material processing and pelletizing through to extrusion and manufacturing complete application systems, we fulfill the individualized wishes of our customers as their system partner.

Processing natural fiber-reinforced and filled plastics requires special machine technology, a high measure of expertise in process technology, and active wear resistance for the process unit. KraussMaffei Berstorff has aligned its machine design with these demands consistently. For instance, a specific metering unit ensures consistent material feed.

The adapted and special degassing zone of our 32D twin-screw extruders ensures that residual moisture can escape. A high installed screw torque paired with an internal screw heat-balancing unit and a screw geometry modified specifically for natural fiber compounds guarantees a uniform melt and consequently provides a finished product of premium quality. In addition, at KraussMaffei Berstorff, the screws are armored with highly wear-resistant coating beyond the standard measure, and the barrels are equally coated with premium-quality material. This combination provides the process unit with optimal protection against wear by corrosion and adhesion.

### Sample products by KraussMaffei Berstorff

<table>
<thead>
<tr>
<th><strong>Truck tarps / advertising banners</strong></th>
<th><strong>Sheets of natural fiber material</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td><strong>Material</strong></td>
</tr>
<tr>
<td>- PVC</td>
<td>- WPC (wood plastics composites), composite material of renewable resources and polymers (HDPE, polypropylene or PVC)</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td><strong>Technology</strong></td>
</tr>
<tr>
<td>- Counter-rotating twin-screw extruders for processing and extruding the compound</td>
<td>- Co-rotating twin-screw extruders for cost-effective processing of a compound</td>
</tr>
<tr>
<td>- In-line laminating station for surface protection</td>
<td>- Counter-rotating twin-screw extruders of the 32D series for processing and extruding the compound</td>
</tr>
<tr>
<td><strong>Benefits for customers</strong></td>
<td><strong>Benefits for customers</strong></td>
</tr>
<tr>
<td>- Without solvent</td>
<td>Energy-efficient production thanks to innovative machine technology</td>
</tr>
<tr>
<td>- System design optimized for processing and energy use</td>
<td>- Active wear resistance through bimetal process unit</td>
</tr>
<tr>
<td>- Sheet widths up to 3.6 m</td>
<td>- High flexibility in processing various formulations</td>
</tr>
</tbody>
</table>

### Truck tarps and advertising banners

For manufacturing truck tarps and advertising banners using flexible PVC, the sheet extrusion systems by KraussMaffei Berstorff are the ideal machines. Thanks to their reliable extrusion and polishing stack technology, they provide production and investment security and high sheet quality.

Outstanding energy efficiency and higher flexibility make the sheet systems a cost-effective solution. Perfectly coordinated peripheral devices upstream and downstream are specifically tuned to the requirement and function with high efficiency.
Large portfolio for individualized applications
Cost-effective production of PVC sheets

PVC sheets – compact, foamed or coextruded – are a contemporary alternative to wood, fiberboards, and other compact materials. They can be further processed or refined in many ways, and they are applied in many areas of the construction and advertising industries.

KraussMaffei Berstorff, as a highly skilled system provider, for years has offered proven, integrated total system concepts for a variety of PVC sheet products. For this, the 32D twin-screw extruder series has been used. The product portfolio includes the models of the KMD 90-32/PL through to the KMD 184-32/PL – both for the production of foam sheets and of thermoformable, premium-quality compact sheets.

Advanced process technology expertise for perfect product quality
By means of its optimized screw geometry, the 32D process unit grants, in addition to high output and a wide processing window, optimal melt homogeneity. The screws are armored with molybdenum by default, chrome-plated and externally heat-balanced.

Complete system concepts for the cost-effective production of PVC sheets
To be capable of producing premium-quality sheets, both experience in extrusion technology and expertise beyond it are necessary. Thus, our concept provides a list of eminent advantages, for example for integral foam extrusion: high output, delivery of the entire system from a single source. All engineering work is carried out by an experienced team of experts.

Sample products by KraussMaffei Berstorff

<table>
<thead>
<tr>
<th>Separating walls, facade construction, advertising billboards</th>
<th>PVC corrugated sheets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td><strong>Material</strong></td>
</tr>
<tr>
<td>– PVC</td>
<td>– PVC</td>
</tr>
<tr>
<td></td>
<td>– With molded-in color or transparent</td>
</tr>
<tr>
<td></td>
<td>– Coextruded, with outer layer that can be colored</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td><strong>Technology</strong></td>
</tr>
<tr>
<td>– 32D twin-screw extruder</td>
<td>– Extrusion using 32D twin screw</td>
</tr>
<tr>
<td>– Complete sheet lines coordinated with the raw material</td>
<td>– Mono compact line for classic sine-wave sheet or customer-specific sine design</td>
</tr>
<tr>
<td></td>
<td>– Coex line for classic sine-wave sheet or customer-specific sine design</td>
</tr>
<tr>
<td></td>
<td>– Mono or Coex combined line for regular sheet extrusion, can be reconfigured for sine-wave sheet production</td>
</tr>
<tr>
<td></td>
<td>– Mono or Coex line for Imperial design</td>
</tr>
<tr>
<td><strong>Benefits for customers</strong></td>
<td><strong>Benefits for customers</strong></td>
</tr>
<tr>
<td>– Optimum melt homogeneity</td>
<td>– Cost-optimized solution by reduction of the polishing stack designs and the cooling section</td>
</tr>
<tr>
<td>– High output</td>
<td>– High output at the same time</td>
</tr>
<tr>
<td>– Wide processing window</td>
<td>– In combination systems, flexible market entry for the customer</td>
</tr>
<tr>
<td>– Longest possible service life</td>
<td></td>
</tr>
<tr>
<td>– Excellent price-performance ratio</td>
<td></td>
</tr>
</tbody>
</table>

Systems for corrugated sheets
Manufacturing corrugated sheets is a special application of PVC sheet extrusion. For various corrugated sheets, KraussMaffei Berstorff provides cost-optimized individual solutions, such as transparent or coextruded versions.
System solution from a single source
Systems for manufacturing C-PVC sheets

KraussMaffei Berstorff provides systems for processing C-PVC, a material especially in demand in apparatus and system engineering and in the chemical and semiconductor industries due to its higher chemical resistance to acids and bases.

**Premium quality wear resistance for C-PVC processing**
Besides the optimal design from a process technology standpoint, in C-PVC processing, special attention must be paid to perfect wear resistance. That’s why all KraussMaffei Berstorff machines are equipped with fully chrome-plated screws and adapters. In addition, we use hardened, glossy chrome-plated rolls in the polishing stack. The screws are molybdenum-welded in standard models, and they operate in a deep-nitrided barrel of high hardness and high hardening depth. To ensure even greater wear resistance, we can optionally provide tungsten-carbide-armored screws and bi-metal barrels for the parallel twin-screw extruders. The service life of these processing units increases by multiple times compared to standard equipment.

**Varied applications (C-PVC)**
C-PVC sheets are mostly used in areas in which increased requirements for mechanical strength simultaneously coexist with higher thermal stress, for example in sheets for industrial applications, in galvanizing, in container construction, in tanks for acids and bases, and in pharmaceutical production installations.

**Sample products by KraussMaffei Berstorff**

**C-PVC sheets for industrial applications and container construction**

<table>
<thead>
<tr>
<th>Material</th>
<th>– C-PVC</th>
</tr>
</thead>
</table>
| Technology| – 32D twin-screw extruder  
– Complete sheet lines coordinated to the raw material |

| Benefits for customers | – Optimal process concept for processing C-PVC  
– Special screw geometries adapted to the melting and enthalpy demands of the material settings  
– Perfect wear resistance, with molybdenum-welded screws and deep-nitrided barrels  
– Steady, uniform processing over very long production time  
– Maximum output with homogeneous melt  
– Excellent price-performance ratio |
Perfect interplay for highest transparency
Engineering polymers

More flexibility for your manufacturing by fast adaptation to the thickness of the material, problem-free conversion and easy operability. All this means higher availability.

Sheet extrusion systems with clear results
In manufacturing crystal-clear plastic sheets, the PlanetCalander by KraussMaffei Berstorff provides one-of-a-kind flexibility and performance for highest quality and productivity. Its two adjustable rolls permit fast adaptation of the system to the thickness of the respective sheet and thus high machine availability. The central roll can also be replaced conveniently, making a quick conversion from smooth to structured product surfaces possible. From extrusion of the plastic through to stacking the finished sheets, the systems fulfill all requirements of perfect operability. KraussMaffei Berstorff meets the individualized requirements and process technology conditions thanks to absolute customer-specific flexibility in planning and designing systems. Well-founded knowledge about the complete production process makes KraussMaffei Berstorff a reliable partner for manufacturing transparent sheets.

EVA sheets
High transmission, low shrinking tendency, good homogeneity and, as necessary, double-sided embossing. Thus the performance specifications for the quality of a sheet of ethylene-vinyl acetate (EVA) is defined, as it is used for manufacturing photovoltaic modules or laminated safety glass panels. A new technology by KraussMaffei Berstorff fulfills these requirements, and in addition, it also has enormous advantages for the sheet manufacturer. The flat sheet extrusion system optimally configured

Sample products by KraussMaffei Berstorff

<table>
<thead>
<tr>
<th>EVA and PVB sheets</th>
<th>Transparent sheets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td><strong>Material</strong></td>
</tr>
<tr>
<td>- Sheets of ethylene-vinyl acetate (EVA) for encapsulating photovoltaic modules</td>
<td>- PC, PMMA, PETG, APET</td>
</tr>
<tr>
<td>- Sheets of polyvinyl butyral (PVB) for laminated glass panels</td>
<td></td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td><strong>Technology</strong></td>
</tr>
<tr>
<td>- Flat sheet extrusion systems with in-line compounding</td>
<td>- Sheet extrusion system with twin-screw extruder and PlanetCalander</td>
</tr>
<tr>
<td>- Special cooling equipment</td>
<td></td>
</tr>
<tr>
<td><strong>Benefits for customers</strong></td>
<td><strong>Benefits for customers</strong></td>
</tr>
<tr>
<td>- Sheet widths over 3 m at uniform sheet thicknesses</td>
<td>- Manufacturing sheets with perfect visual properties</td>
</tr>
<tr>
<td>- Throughput greater than 1,200 kg/h</td>
<td>- Sheet thickness up to 10 mm</td>
</tr>
<tr>
<td>- Recycling of the edge trimming</td>
<td></td>
</tr>
<tr>
<td>- Twin-screw extruder for the uniform preparation of the plastic</td>
<td></td>
</tr>
<tr>
<td>- No premature cross-linking of the material</td>
<td></td>
</tr>
<tr>
<td>- Low shrinking tendency of the sheet</td>
<td></td>
</tr>
<tr>
<td>- Can be embossed on both sides</td>
<td></td>
</tr>
</tbody>
</table>
for this application is able to produce, at high velocities, sheets more than 3 m net wide, which corresponds to tripling the widths common so far. The system’s efficiency is further increased by the option of recycling the edge trimming directly to production without loss of quality. With the new, patented technology of a specific flat-sheet extrusion line, an exciting solution from an ecological and economical perspective for manufacturing EVA sheets is available now.

**Direct extrusion of PET sheets**
While the PlanetCalander can be flexibly and easily configured for the optimal cooling of a sheet depending on material and thickness, the twin-screw extruder from the ZE UT, ZE UTxi or ZE BluePower series takes care of the perfect and improved melt quality of the polymer. Whether it is new A-PET and G-PET material or regrind from bottles and edge strips, the material does not have to be crystallized or pre-dried. Simultaneously, powdered additives for improving the product properties can be embedded. Even using high proportions of regrind, premium quality, clear sheets can be manufactured. The flexible concept permits the integration of single-screw extruders as coextruders for manufacturing multi-layered sheets with functional layers. The combination of twin-screw extruder and PlanetCalander work with particular cost efficiency – thanks to the use of cost-effective raw materials instead of finished compounds, the addition of regrind and production waste and the omission of energy-intensive pre-drying.
Specialists for special tasks
High-performance polymers

The KraussMaffei Group offers you cross-procedural technology concepts along the entire value chain for manufacturing fiber-reinforced components.

High-performance plastic materials are particularly suited to medical applications for which biocompatibility of the material is a prerequisite. However, many of the plastics used here are very corrosive as melt and require high processing temperatures. Take advantage of the longtime experience that KraussMaffei Berstorff has accumulated in selecting and processing special steels resistant to temperature and corrosion.

System solutions for fiber-reinforced sheets
Saving weight – an important objective in developing automobiles because lightweight vehicles consume less energy and therefore allow drivers to cover longer ranges at the same cost. To lower the costs for components of fiber-reinforced plastic and, simultaneously, to make recycling these materials possible, optimization is indispensable.

The KraussMaffei Group offers you cross-procedural technology concepts along the entire value chain for manufacturing fiber-reinforced components. The extrusion of sheets with endless fiber reinforcement, so-called UD sheets, is only one example. For unwinding the rovings, spreading the fibers and embedding them in the polymer matrix, the engineers of KraussMaffei Berstorff provide various system solutions, in combination with a single-screw or twin-screw extruder for preparing the plastic. For efficient further processing of the sheets into a finished component, the companies of the KraussMaffei Group are able to offer you a wide range of robotics and injection molding machines.

Sandwich pane design engineering
Outer layers of fiber-reinforced plastics in combination with lightweight foamed plastics as core material are sandwich pane designs of the lightweight construction for the automotive and shipbuilding industries as well as for the construction industry. Using our individually configured extrusion systems, you reliably produce sandwich pane elements.

Sample products by KraussMaffei Berstorff

<table>
<thead>
<tr>
<th>High-performance plastics</th>
<th>Fiberglass-reinforced lightweight construction panels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td><strong>Material</strong></td>
</tr>
<tr>
<td>- PEEK, FEP, PVF, PVDF, polyamide-imide, ETFE, PEI</td>
<td>- polypropylene, PC, PA, PMMA, PEEK, with carbon fiber, natural fiber or fiberglass reinforcement</td>
</tr>
<tr>
<td>- Sheets for components in medical technology, electrical engineering and mechanical engineering</td>
<td></td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td><strong>Technology</strong></td>
</tr>
<tr>
<td>- Co-rotating twin-screw extruder with materials highly resistant to high temperature corrosion</td>
<td>- Single-screw extruder or co-rotating twin-screw extruder for plasticizing and dispersing the raw material</td>
</tr>
<tr>
<td></td>
<td>- Gentle embedding of the fibers by means of special dies, rolls or presses</td>
</tr>
<tr>
<td><strong>Benefits for customers</strong></td>
<td><strong>Benefits for customers</strong></td>
</tr>
<tr>
<td>- Excellent mechanical properties</td>
<td>- Excellent mechanical properties</td>
</tr>
<tr>
<td>- Significant savings in material costs</td>
<td>- Sheet widths up to 1,200 mm</td>
</tr>
<tr>
<td>- Sheet widths up to 1,200 mm</td>
<td>- Lab equipment for developing new products and applications</td>
</tr>
<tr>
<td>- Lab equipment for the development of new products and applications</td>
<td>- Fiber-friendly processing and high flexibility</td>
</tr>
</tbody>
</table>

Partially reinforced frontend carrier (source: Fraunhofer IMWS, “Von der Endlosfaser zum konsolidierten Halbzeug” [From continuous fiber to consolidated semifinished product])
A guarantee for the conservation of resources

Physical foaming

In the construction industry and in the automotive industry, foamed plastic products are produced for the most different applications with individual properties in a cost-effective way.

The range of products is extremely diverse: impact sound insulation and rigid foam sheets for heat insulation for the construction industry. Sandwich-assembly / sandwich-platen and compact sheet or foam sheet as decorated sheet in the vehicle interior.

Thanks to process expertise acquired over decades and innovative extrusion technology, sheets for different applications can be manufactured. The systems provide excellent product quality especially for sheets of polystyrene, polyethylene-light foam XPS or polyethylene/polypropylene-high-density foam XPS.

Finely incremented temperature control

Depending on the original material and process, the sheets can have totally different properties. Here in particular, the finely incremented temperature control in our extruders guarantees a high quality standard.

All systems are configured for processing environmentally friendly blowing agents.

Sample products by KraussMaffei Berstorff

Physically foamed sheets

Material
- PS, polyethylene, polypropylene, PET, PEI, PES, physically foamed using environmentally friendly blowing agents

Technology
- Foam tandex ZE/KE twin-screw extruder ZE combined with single-screw extruder KE for throughput up to 2,800 kg/h
- Foam ex single-screw extruder KE for throughput up to 320 kg/h

Benefits for customers
- Processing environmentally friendly blowing agents
- Recycling startup material, edge strips and scrap webs
- Central system control with touchscreen for consistently intuitive and ergonomic operation
- Perfectly coordinated system components
- Optimally equipped company-owned TechCenter for product development and process optimization
High product quality can only be guaranteed if processes and technology harmonize perfectly. KraussMaffei Berstorff contributes excellent expertise, high standards and longtime experience to make extruders and downstream units harmonize with one another optimally. For the maximum cost-efficiency of your production.
Twin-screw extruders with flat sheet die

Polishing stack technology used in processing polyolefine materials into sheets

Sheets of polyolefins and technical thermoplastics
Extruders and downstream units customized

Whether it is an extruder, a polishing stack or a cooling roller track: all components of the production system are consistently coordinated with each other to guarantee a process flow without a hitch.

The single-screw extruders by KraussMaffei Berstorff are not only suited to extruding common polyolefins such as HDPE and polypropylene but are also perfect – for processing PMMA, PA, ABS, PP, (HI)PS, PET and many other polymers. For processing corrosive, filled, reinforced and foamed polymers, the process units of the extruders are designed with different materials and with special wear resistance. The results of our experience and expertise in designing multi-zone screws, degassing screws or barrier screws are the high quality of your finished products and the cost-efficiency of your production.

Twin-screw extruder – compounding instead of extruding
Design your sheet system with regard to the extruder exactly in the way that is optimal for the product to be manufactured and for the production process. KraussMaffei Berstorff has the right extruder to boost your system: with a single or twin-screw design, as a mono extrusion system or co-extrusion system.

For quickly changing the screws, you can also obtain the KraussMaffei Berstorff twin-screw extruder in the Ultra-Glide version. Using a mechanical positioning unit, you can move the complete extruder.
drive laterally, and the screws can be pulled out backwards without disassembling the die or other units.

The counter-rotating 32D twin-screw series is perfectly suited to extruding compact and foamed PVC sheets as well as to processing C-PVC and natural fiber-reinforced materials.

**Polishing stack technology**

KraussMaffei Berstorff polishing stacks in various models always provide an optimum, cost-effective solution for your sheet production.

The technology, which has been tried-and-tested and developed continually for decades, ensures the best sheet quality with the highest throughputs and minimal maintenance costs.

---

### Your advantages

- Highest tolerance of concentricity and uniform cooling
- Tested for pressure resistance in accordance with the strict European directives
- Mechanical or self-optimizing hydraulic gap settings
Pioneering design engineering
Perfect polishing stacks and downstream units

The KraussMaffei Berstorff polishing stacks set new standards by means of their design features, such as:
- Rigid frame and roll constructions
- Individually designed temperature control systems
- Highly accurate single drives for each roll
- Horizontal, tilted or vertical roll arrangements
- Optimum product quality thanks to perfectly coordinated downstream units

Depending on the kind and strength of material, the extruded sheet or webs, having been calibrated in the polishing stack, are cooled more, laminated, trimmed, and wrapped or stacked. For windable sheets there is a wide variety of winder versions available, from the simple large-roll winder to the fully automatic turret winder.

Reliability and flexibility combined perfectly
The patented PlanetCalander is the perfect mold for manufacturing clear sheets made of the materials PMMA, PC, PETG, APET, PS, SAN, or ABS with highest visual quality. With its variable positioning of rolls 1 and 3, this polishing stack combines all advantages of the standard constructions – horizontal, tilted, or vertical – from a process technology standpoint.

In addition to the option of optimizing the melt infeed angle by rotating the entire frame, the dwell time of the melt can be controlled on the central roll 2. To do so, the position of roll 3 can be adjusted relative to central roll 2. Consequently, it is possible to optimize the cooling conditions for a wide variety of material types and strengths.

The dwell time of the melt on roll 2 can be adapted to the material and the various sheet strengths. By adjusting the first roll, the melt infeed angle can also be controlled, nearly at will, depending on the weight and elongation of the melt.

Another great advantage in processing compression-molded webs is the change of the central roll in only 30 minutes. This reduces downtimes and creates significant potential savings.

Optimum product quality by means of perfectly coordinated downstream units
At KraussMaffei Berstorff, all other components of the downstream equipment for the sheet systems have been designed with the future in mind. They are equipped with state-of-the-art technology, and yet are robust, reliable, and able to handle the highest throughputs.

The polishing stack is followed by an adapted cooling roller track, which automatically follows the movement of the last polishing roll in the PlanetCalander.

Depending on the task, a wide variety of auxiliary units can be integrated into the corresponding sheet system.

Your advantages
- Reduced downtime
- Perfectly coordinated downstream units
- Highest throughput
Here we are building the future for you
TechCenter

Do you want to try out new process problems in advance and refine individual parameters as necessary in order to achieve the best results from the beginning? Welcome to the nearest KraussMaffei Berstorff TechCenter! Talk to our experts.

Testing and optimizing processes
The KraussMaffei Berstorff TechCenters in Hanover and Munich are available as facilities for your trials. Here sheets and coatings in widths up to approx. 1,100 mm can be produced.

The ideal place for optimizing your process even before you begin design engineering a new system with the support of KraussMaffei Berstorff. Determine in your trials the perfect configuration and design of all system components.

Together with a skilled team, here you can test and optimize every process step, every screw geometry and every barrel configuration of the extruder and almost every type of further processing regarding sheets under realistic operating conditions and using your own material.
Sheet manufacturing in perfection
High-performance extrusion systems up to any challenge
OEE Plus
Boosting cost-efficiency for you

High overall equipment efficiency (OEE) is a fundamental prerequisite for your company’s success. KraussMaffei Berstorff’s product portfolio comprises tailored machines and lines along with perfectly matched services that increase the economic efficiency and the sustainability of your production. Benefit from our proven know-how of extrusion technology in any application.

For more information about OEE Plus, visit:
www.kraussmaffei-berstorff.com/oeeplus
KraussMaffei Berstorff
A strong brand in a unique global group

Value-proven Extrusion Technology solutions
Around the world, KraussMaffei Berstorff stands for reliable and value-proven solutions in Extrusion Technology. These range from using individual extruders for degassing in polymerization, compounding, pipe, profile, film and sheet extrusion, physical foaming and the manufacture of technical rubber articles and intermediates for tire production up to complete extrusion lines. All machines and systems from KraussMaffei Berstorff are custom-configured, for example for the chemical, automotive, construction, packaging or pharmaceutical industry.

There for you around the world
KraussMaffei Berstorff is your partner – from the first planning meeting through development of the best possible technical and business solution up through commissioning, servicing and production of your system. We guarantee high-quality advice, solution expertise, reliable spare parts logistics and fast-reacting service during each phase. Our goal is increasing your success.

Individualized service
Benefit from KraussMaffei Berstorff’s reliable service. Our customer service team and experienced fitters, technicians and engineers are there for you as quickly as possible and even help on location to optimize your systems and processes and to minimize downtime as much as possible. Rely on our highly skilled repair and spare parts service.

You can find additional information about KraussMaffei Berstorff at: www.kraussmaffeiberstorff.com

KraussMaffei Group
Comprehensive expertise

Unique selling proposition Technology³
The KraussMaffei Group is the only provider in the world to possess the essential machine technologies for plastics and rubber processing with its KraussMaffei, KraussMaffei Berstorff and Netstal brands: Injection Molding Machinery, Automation, Reaction Process Machinery and Extrusion Technology.

The group is represented internationally with more than 30 subsidiaries and over ten production plants as well as about 570 commercial and service partners. This is what makes us your highly skilled and integrated partner. Use our comprehensive and unique expertise in the industry.

You can find additional information at: www.kraussmaffeigroup.com

The KraussMaffei Group has a global presence. Countries with subsidiaries are marked in light blue. In the white-colored regions, the Group is represented by over 570 sales and service partners.
Maximum product quality and production reliability

Market requirements for sheet extrusion systems

The requirements for the manufacturers of plastic plastic sheets are increasing continuously. The growing demand for premium quality sheets requires a corresponding technological solution, with which you will be able not only to match these challenges but even to exceed expectations. The extrusion solutions by KraussMaffei Berstorff provide you with much more than that.

Our systems integrate all process steps, from the supply of raw materials through to the extrusion of the various formulations for front and rear side, the coating procedures, embossing, and cooling to the edge stripe processing and development on large or short web rolls in a single process. Thanks to the direct compounding into the continuous production process you will not only save material and time but also achieve higher efficiency.

www.kraussmaffeiberstorff.com