PLASTICIZING SYSTEMS
The key to successful injection molding
WITTMANN BATTENFELD PLASTICIZING SYSTEMS
For top performance and efficiency

WITTMANN BATTENFELD
Plasticizing systems

- In-house development
  Since 1948, WITTMANN BATTENFELD has been developing and manufacturing plasticizing systems to process a great variety of materials. These range from various types of standard materials to engineering plastics, including high-performance engineering polymers, which are transformed from their solid state into polymer melt to suit the specific application.

- A wide range of different sizes
  The portfolio includes micro plasticizing aggregates with 14 mm screws and a stroke volume from 1.2 to 4 cm³ all the way up to aggregates for large machines with 180 mm screws and 22266 cm³ stroke volume.

- An extensive choice of models
  In addition to the standard range of 3-zone screws, there are many variants tailored to special applications. These include solutions for PMMA, PVC and LIM processing as well as special designs for elastomer, thermoset and foam injection molding.

- Perfect matches for every material
  Many variants of screws, barrels, check valves and nozzles are available to provide a perfect match for every application. These can be delivered nitrided or through-hardened, with hard chromium plating, or armored with a hard metal coating.
screw
barrel
material feeding
cooling
heating
PLASTICIZING KNOW-HOW
Experience combined with innovation

Our expertise for your success
Plasticizing systems for injection molding machines must meet many different requirements. These range from processing easy-flowing, semi-crystalline thermoplastics to molding highly reinforced, slug-gishly flowing plastics with processing temperatures of up to 450 °C. Just as diversified is the interac-tion between the plastic materials processed and the plasticizing components coming into contact with them. In-depth expert knowledge is required to choose the right components in each case – and to manufacture them.

Experience
WITTMANN BATTENFELD can draw on many years of experience in manufacturing plastics processing machinery. Process technology performance and engineering expertise in screw-and-barrel systems have always been a major concern in its product development.

Knowledge
Knowledge accumulated over many years about the flow dynamics of plastics in plasticizing systems and its effect on various system components (abrasion, adhesion, corrosion) provides the basis for the high level of efficiency of WITTMANN BATTENFELD injection molding machines.

Innovation
Continuous verification of contact and wear effects produced by new plastics and compounds is a perma-nent driver of innovation in the design and choice of materials for plasticizing systems.

Expert advice
The choice of material combinations and geometries for screw-and-barrel systems depends on the processing attributes and wear intensity of the plastic materials to be processed.

Assistance
The WITTMANN BATTENFELD service portfolio does not end with assistance in making a selection for the basic project, but offers information and assistance with all questions concerning plastics processing as required.
WEAR MECHANISMS
Identification and understanding

The plasticizing unit is the central aggregate of an injection molding machine whose components come into contact with the melting plastic material in all of its physical states.

Depending on the momentary physical state of the plastic being processed, several processes of wear generally occur simultaneously (abrasion, corrosion and adhesion), according to the actual contact situation (tribological partners).

The extent and effect of the types and mechanisms of continuous wear are heavily influenced by the plastic material being processed (including all of its fillers and functional additives) as well as the process parameters (temperature, metering time, metering speed, pressure). To achieve a long service life, preventive measures to counteract the predominant types of wear are taken by choosing appropriate materials and a suitable protective surface coating.

For processing engineering thermoplastics in particular, a special focus is placed on protection against abrasion and corrosion, or a combination of both.

### Types and mechanisms of wear in the plasticizing unit

<table>
<thead>
<tr>
<th>Metering zone</th>
<th>Compression zone</th>
<th>Feed zone</th>
</tr>
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<tbody>
<tr>
<td>Feed zone</td>
<td>Compression zone</td>
<td>Feed zone</td>
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<table>
<thead>
<tr>
<th>Wear combination</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
<td></td>
<td>metal (liquid) plastic</td>
<td>(liquid) plastic with mineral</td>
<td>(solid) plastic with mineral</td>
<td>(solid) plastic with mineral</td>
<td>metal</td>
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<td>metal</td>
<td>metal</td>
<td>metal</td>
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<td>metal</td>
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<tr>
<td>Type</td>
<td>wet abrasion</td>
<td>erosion (corrosion)</td>
<td>grain abrasion with restricted mobility</td>
<td>grain abrasion with additional rolling and circulation</td>
<td>sliding wear</td>
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<td>Mechanisms</td>
<td>adhesion + abrasion</td>
<td>abrasion (corrosion)</td>
<td>abrasion</td>
<td>abrasion</td>
<td>adhesion + abrasion</td>
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<tr>
<td>Symptoms</td>
<td>seizure score marks</td>
<td>ripples depressions (perforations)</td>
<td>score marks embedding rolling marks</td>
<td>score marks chippings embedding smoothing</td>
<td>seizure score marks</td>
</tr>
</tbody>
</table>
PLASTICS AND ADDITIVES
How polymers challenge metals

Thermoplastics are organic polymers with either amorphous or semi-crystalline structures in their solid state. Amorphous plastics (e.g. PS, PVC, PC) are long-chain molecules with a random structure, which, due to their structure, are transparent and have no fixed melting point. They melt gradually over a broad temperature range.

The microstructure of semi-crystalline materials consists of amorphous areas combined with crystalline structures (e.g. HDPE, POM, PA). The latter are characterized by dense, regular arrangement of the molecule chains. As a consequence, their attributes are greater hardness, narrower melting temperature ranges (definite melting points) and poor transparency. Here, the degree of crystallinity plays a vital part.

Accordingly, there are considerable variations in melting behavior, viscosity development and stress along the length of a plasticizing screw. Additional factors with an effect on the screw, barrel and check valve are additives (flame retardants, colorants, fibrous reinforcement materials, etc.), by which the original attributes of the virgin plastic material are modified. The most prevalent causes of system stress are friction effects, primarily in combination with a characteristic pressure development as plasticizing progresses, but also corrosion effects through chemical interaction. Such stress factors require appropriate countermeasures. These include various thermal treatment processes (surface hardening or through-hardening), hard coating and/or anti-corrosion coating, which are applied to various components of the plasticizing unit.

The chart below presents a comparison of hardness degrees between commonly available additives in plastics and the metal components used in plasticizing systems. Apart from the form of the fillers used (fibers, platelets, balls, etc.), their hardness is one of the most important indicators for sufficient protection against abrasive wear.
The components most strongly exposed to wear in a plasticizing unit are the screw and especially the check valve.

In addition to frequently high torque loads, the screw is required to withstand potential wear from the plastic material processed. Its surface must also be treated to prevent the adhesion of plastics residues to it effectively. This reduces the frequency of cleaning cycles and makes for high process stability.

The screw flights are among the most intensely worn areas, since they bear extra loads due to coming into contact with the barrel and to the high shearing speed of the reinforced plastic material in the narrow gaps between the barrel wall and the screw flights.

To meet these challenges in the best possible way, it is necessary to select the right base material for the screw and to combine it with the suitable surface treatment for each specific application.

### Overview of attributes of selected base material and surface modifications

<table>
<thead>
<tr>
<th>Designation of material / layer</th>
<th>PM steel</th>
<th>Plasma nitrided</th>
<th>PVD layer (CrN)</th>
<th>Hard chromium-plated</th>
<th>Hard coated</th>
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</thead>
<tbody>
<tr>
<td>Layer thickness [mm]</td>
<td>through-hardened</td>
<td>0.1 – 0.3</td>
<td>0.002 – 0.005</td>
<td>0.02 – 0.05</td>
<td>0.1 – 0.3</td>
</tr>
<tr>
<td>Wear resistance</td>
<td>+++</td>
<td>++++</td>
<td>++</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>Corrosion resistance</td>
<td>+++</td>
<td>+</td>
<td>++++</td>
<td>++</td>
<td>++++</td>
</tr>
<tr>
<td>Used, for example, with</td>
<td>SM04</td>
<td>SM09*</td>
<td>SM08</td>
<td>SM10*</td>
<td>SM13*</td>
</tr>
</tbody>
</table>

* combined with flight armoring
Plasticizing concept according to Maddock

The transition from plastic granulate to liquid plastic melt within the screw channel starts with the formation of a melt film on the heated barrel wall. The rotation of the screw generates a current flowing crosswise to the direction of the screw channel. In this way, the material which has already melted is transported to the active flank of the screw flight, where a melt vortex develops in the course of further infeed. This vortex increases in width as it approaches the tip of the screw, because the additional material melting on the barrel wall gathers in this place. Towards the end of the melting process, the remaining core of solid material breaks up into solid islands surrounded by plastic melt. Finally, these are melted too by the continuing heat input, until a homogeneous polymer melt has been produced.

Stroke volume, melt density (output factor) and shot weight

The heat input leads to a difference in density between the solid material and the melt. The melt density $\varsigma$ (g/cm$^3$) (output factor) enables the calculation of a shot weight estimate, depending on the stroke volume. The shot weight (g) can be calculated by multiplying the stroke volume (cm$^3$) with the specific output factor.

The metering stroke should not be allowed to exceed a maximum length of 3 to 4 screw diameters, because it shortens the effective length of the screw. With increasing length of the metering stroke and retraction of the screw, the length of the channel from the feed hole to the tip of the screw is increasingly shortened. If this is not taken into account, the consequences may be unstable metering processes, air intake or material inhomogeneity.

The metering stroke should not fall below one screw diameter either, since this would significantly increase the dwell time with the consequence of possible damage to the material. Moreover, production can be effected more economically on a smaller-sized machine than on a large one.

Recommended stroke utilization

<table>
<thead>
<tr>
<th>Material</th>
<th>$\varsigma$ (g/cm$^3$)</th>
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<tr>
<td>ABS</td>
<td>0.88</td>
</tr>
<tr>
<td>CA</td>
<td>1.02</td>
</tr>
<tr>
<td>CAB</td>
<td>0.97</td>
</tr>
<tr>
<td>PA</td>
<td>0.91</td>
</tr>
<tr>
<td>PC</td>
<td>0.97</td>
</tr>
<tr>
<td>PE</td>
<td>0.71</td>
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<td>PMMA</td>
<td>0.94</td>
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<td>POM</td>
<td>1.15</td>
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<td>PP</td>
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<tr>
<td>PP + 20% Talc</td>
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<td>PP + 40% Talc</td>
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</tr>
<tr>
<td>PP + 20% GF</td>
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</tr>
<tr>
<td>PS</td>
<td>0.91</td>
</tr>
<tr>
<td>PVC rigid</td>
<td>1.12</td>
</tr>
<tr>
<td>PVC soft</td>
<td>1.02</td>
</tr>
<tr>
<td>SAN</td>
<td>0.88</td>
</tr>
<tr>
<td>SB</td>
<td>0.88</td>
</tr>
<tr>
<td>PE</td>
<td>1.5</td>
</tr>
<tr>
<td>UP</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Dark gray fields = thermosets
Standard 3-zone screw (UNIMELT)

The standard 3-zone geometry is the most commonly used screw geometry. It is characterized by a screw flight with a constant pitch divided into three zones with different flight depths (feed zone, compression zone, metering zone). In the compression zone, the flight depth is reduced by a steady increase in the core diameter. In the feed and metering zones, the flight depth remains constant.

The plasticizing process follows the Maddock concept. The effects of back pressure and the rotation of the screw generate complex, three-dimensional currents, which are responsible for the good mixing effect of a 3-zone screw.

Barrier screw (MeltPro™)*

A barrier screw distinguishes itself from a standard 3-zone screw by an additional screw flight in the compression zone (barrier flight). It serves to separate the solid material in the material current from the melt. This is achieved by making the molten material flow from the solid material channel across the barrier flight into the melt channel. As a consequence, the "lubrication and insulation material" is extracted from the solid part with the result of increased heat input into the solid material, which speeds up the melting process.

In this way, a barrier screw enables an increase of up to 20 to 30 percent in throughput for PE and PP compared to a standard 3-zone screw. Another advantage is the "filter effect" of the barrier flight. It holds back residues of solid material, drops of colorant and air bubbles which may have entered, so that the solid particles cannot pass the barrier flight until after they have melted, and the air can easily escape via the solid material channel through the feed throat.

* MeltPro™ barrier screw geometry is a trademark of Nordson Xaloy Incorporated.
THE PLASTICIZING SCREW
For maximum efficiency

WITTMANN BATTENFELD offers a wide range of plasticizing screws.

- Standard 3-zone screws (UNIMELT) – universal applications
- Mixing screws (COLOURMELT) – excellent material homogenization, especially when colorants have been added
- Barrier screws (MeltPro™) – higher throughput with the same screw diameter
- Customized screws – e.g. PVC, thermoset or elastomer screws, or CELLMELT for N₂-assisted foam injection molding

**UNIMELT (SG01)**
Universal 3-zone screw for processing thermoplastics without fillers. The constant L/D ratio of 22:1 delivers excellent melt quality even with larger metering strokes.

**COLOURMELT (SG02)**
When processing color additives in the form of liquid colorants or Masterbatch, use of the COLOURMELT compounding screw leads to substantially improved homogeneity and blending in of the colorant. Mixing elements promote both radial and tangential distribution of the color pigments.

**Barrier screw MeltPro™**
Barrier screw laid out for low shear stress and maximum material homogeneity, simultaneously with a significant increase in plasticizing performance. Available with or without a mixing section.

**Special geometries**
WITTMANN BATTENFELD offers a great variety of specialized screws. It includes equipment for processing thermosets, powder injection molding (PIM) feedstocks, hard PVC and elastomers (rubber or liquid silicone). Screws designed for special process technologies are also available, such as the DOUBLEMELT and the CELLMELT for CELLMOULD® foam injection molding.
THE CHECK VALVE
Vital for good quality

The check valve is a valve placed at the front end of the plasticizing screw. In the open position, it allows the plastic melt to flow through into the screw antechamber. In the closed position, it prevents the melt from flowing back into the screw, and the screw thus becomes a piston to inject the melt. Opening and closing is triggered without a separate mechanism, solely by the screw’s direction of movement and the current of the plastic melt. Various types of barrier design are available to fit the many different operating conditions. The decisive criteria for selecting a design are its closing and wear attributes.

Ring check valve (CG01)

- Universal model
- Locking mechanism: closing with longitudinal stroke in combination with the screw tip
- Large flow cross-section

Advantages:
- Fast closing reaction
- Minimal material stress
- Good wear resistance

Ball check valve (CG02)

- Better closing behavior, small quantity of plastic inside the locking channel
- Locking mechanism: ball valve
- Small flow cross-section

Advantages:
- Well suited for large screw diameters
- Optimized closing behavior when processing e.g., PP and PE

PVC tip (CG04)

- Screw tip
- Without check valve

Advantages:
- Closeness to gating
- Low shear stress for the material
- Favorable flow geometry
- Deep plunge into the nozzle and complete material discharge

Special solutions

Customized solutions such as the cross bolt check valve are suitable for processing plastic materials extremely sensitive to shearing, and come with the relatively largest flow cross section.

- Specialized model for minimal shear stress
- Locking mechanism: locking ring with longitudinal stroke, combined with a cylindrical screw tip with cross bolt
## The Plasticizing System
Diversity in detail

<table>
<thead>
<tr>
<th>L/D=22</th>
<th>3-Zone Screw</th>
<th>Mixing Section Geometry</th>
<th>Barrier Geometries</th>
<th>Check valve geometry</th>
</tr>
</thead>
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<tr>
<td></td>
<td>UNMELT (SG01)</td>
<td>COLOURMELT (SG02)</td>
<td>MeltPro™ (application-specific)</td>
<td></td>
</tr>
<tr>
<td>STD</td>
<td>AK+</td>
<td>AK+</td>
<td>AK+</td>
<td></td>
</tr>
<tr>
<td>AKC</td>
<td>AKC</td>
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<td>K+C</td>
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<tr>
<td>Screw D≤65 mm</td>
<td>SM01</td>
<td>SM04</td>
<td>SM13</td>
<td>SM08</td>
</tr>
<tr>
<td>Screw D≥75 mm</td>
<td>SM09</td>
<td>SM09</td>
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<td>SM12</td>
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<tr>
<td>Check valve</td>
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<td>CM09</td>
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<td>CM06</td>
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<td>PP</td>
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<td>HDPE</td>
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<tr>
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<tr>
<td>PEI</td>
<td>+</td>
<td>++</td>
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</table>

### Materials
- **Standard thermoplastics**
  - PP
  - HDPE
  - LDPE
  - COC
  - HiPS
- **Engineering thermoplastics**
  - ABS
  - ASA
  - SAN
  - SAN (optical)
  - EVA
  - PA
  - PC
  - PC (optical)
  - PMMA
  - PMMA (optical)
  - PET
  - PBT
  - POM Homo
  - POM Copo
  - TPE
  - TPU
  - PPE + PS
  - PPE + PA
  - PC + ABS
  - PC + ASA
- **Polymer blends**
  - PPA
  - PPS
  - PSU
  - PESU
  - PPSU
  - PVDF
  - PTFE
  - PFA/ETFE
  - LCP
  - PEEK
  - PEI

### High-performance plastics
- **PPA**
- **PPS**
- **PSU**
- **PESU**
- **PPSU**
- **PVDF**
- **PTFE**
- **PFA/ETFE**
- **LCP**
- **PEEK**
- **PEI**
### Special Geometries

<table>
<thead>
<tr>
<th>L/D=22</th>
<th>Rigid PVC (SG09)</th>
<th>High-compression screw (SG03)</th>
<th>MIM (SG12)</th>
<th>CIM (SG12)</th>
<th>Thermoset (SG10)</th>
<th>LIM (SG11)</th>
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<td>AK+</td>
<td>AKCN</td>
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<td>Screw D=75 mm</td>
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<tr>
<td>Check valve</td>
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<td>CM06</td>
<td>CM09</td>
<td>CM08</td>
<td>–</td>
<td>CM02</td>
</tr>
<tr>
<td>Barrel</td>
<td>BM02</td>
<td>BM02</td>
<td>BM02</td>
<td>BM02</td>
<td>BM05</td>
<td>BM02</td>
<td>BM04</td>
</tr>
</tbody>
</table>

### Screw Materials

- **SM01**: Nitriding steel, nitrided
- **SM03**: Cold-work steel, hardened and tempered, nitrided
- **SM04**: Powder metallurgical steel, hardened and tempered
- **SM06**: Nickel-based alloy
- **SM08**: Plastic mold steel, CrN-coated
- **SM09**: Q + T (quenched and tempered) steel, with flight armoring, nitrided
- **SM10**: Q + T (quenched and tempered) steel, with flight armoring and hard chrome coating
- **SM12**: Q + T (quenched and tempered) steel, with flight armoring and CrN coating
- **SM13**: Full tungsten carbide armoring
- **SM14**: Hard metal

### Check Valve Materials

- **CM02**: Cold-work steel, nitrided
- **CM03**: Powder metallurgical steel, hardened and tempered
- **CM06**: High-chrome plastic mold steel, casement-armed, CrN-coated
- **CM08**: Plastic mold steel with hard metal
- **CM09**: High-chrome plastic mold steel, casement-armed

### Materials

- **Screw D≤65 mm**: SM04, SM04, SM08, SM04, SM14, SM03, SM13, SM04
- **Screw D≥75 mm**: SM10, SM10

### Special Applications

- **PVC-U**: CG04
- **PA**: CG01
- **POM Homo**: CG01
- **POM Copo**: CG01
- **PF**: +++, –
- **EP**: +++, –
- **MF**: +++, –
- **LSR**: CG06, CG05
- **MIM**: ++
- **CIM**: ++
- **PSU**: CG01
- **PESU**: CG01
- **PPSU**: CG01
- **PAI**: CG04

**Legend**

**Color Codes and Symbols**

- **Limited Suitability**
- **Suitable**
- **Excellent Suitability**

- **Symbols**
  - **Without filler**
  - **≤ 20 % filler**
  - **< 35 % filler**
  - **≥ 35 % filler**
  - **Customized layout**

- **Barrel Materials**
  - **BM02**: Bimetallic barrel with Fe-based alloy (10 % chrome)
  - **BM03**: Bimetallic barrel with Ni-Co-based alloy
  - **BM04**: Bimetallic barrel with Ni-alloy, with premium-quality tungsten carbide
  - **BM05**: Bimetallic barrel with hard metal insert

**Abbreviations for Materials and Geometries**

- **SM**: Screw materials
- **CM**: Check valve materials
- **BM**: Barrel materials
EQUIPMENT PACKAGES
Where protection against wear is a priority

Standard Package
Low-cost anti-wear protection for standard applications

Applications: plastics without reinforcement (filler content < 20%), without flame retardants and/or colorants
Examples: PP, PE, PS

<table>
<thead>
<tr>
<th>Component</th>
<th>Composition/attributes</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw</td>
<td>Nitriding steel, nitrided, from Ø 75 mm Q + T steel with flight armoring, nitrided</td>
<td>≤ ø 65 mm SM01 from ø 75 mm SM09</td>
</tr>
<tr>
<td>Check valve</td>
<td>High-chrome plastic mold steel, casement-armored</td>
<td>CM09</td>
</tr>
<tr>
<td>Barrel</td>
<td>Bimetallic barrel with martensitic Fe-based alloy</td>
<td>BM02</td>
</tr>
</tbody>
</table>

AK+ Package
Optimal balance between abrasion- and corrosion-resistance

Applications: reinforced plastics with up to 35% filler content
Example: PA6 GF30

<table>
<thead>
<tr>
<th>Component</th>
<th>Composition/attributes</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw</td>
<td>Powder metallurgical steel, hardened and tempered, from Ø 75 mm Q + T steel, with flight armoring and nitrided or with hard chrome coating</td>
<td>≤ ø 65 mm SM04 from ø 75 mm SM09 or SM10</td>
</tr>
<tr>
<td>Check valve</td>
<td>High-chrome plastic mold steel, casement-armored</td>
<td>CM09</td>
</tr>
<tr>
<td>Barrel</td>
<td>Bimetallic barrel with martensitic Fe-based alloy</td>
<td>BM02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Structure of powder-metallurgical screw (SM04)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight armoring of a screw (SM09, SM10)</td>
</tr>
<tr>
<td>Composition of bimetallic barrel (BM02) with armor coating structure</td>
</tr>
</tbody>
</table>
**AK++ Package**

Maximum resistance against abrasive and corrosive wear

*Applications*: reinforced plastics with more than 35% filler content  
*Examples*: PA6 GF 35 VO, PA66 GK 50

<table>
<thead>
<tr>
<th>Component</th>
<th>Composition/attributes</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw</td>
<td>Fully armored with a 0.2 to 0.3 mm layer consisting of a nickel-based tungsten carbide alloy</td>
<td>SM13</td>
</tr>
<tr>
<td>Check valve</td>
<td>Protected by hard metal inserts and a solid hard metal ring</td>
<td>CM08</td>
</tr>
<tr>
<td>Barrel</td>
<td>Bimetallic barrel with extremely corrosion-resistant Ni-matrix alloy with thermally stable, premium-quality tungsten carbide</td>
<td>BM04</td>
</tr>
</tbody>
</table>

**K++ Package**

For extremely corrosive applications

*Applications*: plastics with a strongly corrosive reaction  
*Examples*: fluoride polymers and materials with a high flame retardant content

<table>
<thead>
<tr>
<th>Component</th>
<th>Composition/attributes</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw</td>
<td>Nickel-based alloy</td>
<td>SM06</td>
</tr>
<tr>
<td>Check valve</td>
<td>High-chrome plastic mold steel, casement- armored</td>
<td>CM09</td>
</tr>
<tr>
<td>Barrel</td>
<td>Bimetallic barrel with Ni-Co based alloy</td>
<td>BM03</td>
</tr>
</tbody>
</table>

Composition of bimetallic barrel (BM03) with armor coating structure

 Fully encapsulated screw (SM 13)

Check valve (CG01, CM08)
SPECIALIZED EQUIPMENT PACKAGES
Solutions for specific tasks

AKCN PACKAGE
Transparent parts
For transparent thermoplastic parts with stringent optical requirements, especially PC and PMMA, which are prone to form deposits on the screw surface.
Advantages: crystal-clear parts, excellent protection against adhesion of the melt

Package highlights:
» bimetallic barrel
» PVD-coated screw
» PVD-coated check valve
» corrosion-resistant nozzle head and nozzle

PVC PACKAGE
Stable PVC processing
The material’s requirements for high corrosion resistance, a geometry designed for minimal shear stress and high drive torques are the essential equipment factors in a PVC plasticizing system.

Package highlights:
» bimetallic barrel
» screw consisting of corrosion-resistant steel
» corrosion-resistant nozzle head and nozzle

LIM PACKAGE
Liquid Silicone
Liquid Injection Molding (LIM) utilizes the injection molding process for producing elastic parts from 2-component liquid silicone rubber (LSR). In the LIM process, the two-component raw material is pumped into the barrel via a multi-component metering and compounding system, then injected into the heated mold.

Package highlights:
» liquid-cooled barrel and pneumatic needle shut-off nozzle to exclude cross-linking reactions
» plasticizing screw with LSR-optimized geometry
» check valve for repeatable shot volumes
» screw sealing to prevent material leakage
THERMOSET PACKAGE
Thermoset for maximum component strength

Processing thermoset materials places the most stringent requirements on the surface hardness and wear resistance of the plasticizing unit. Due to compounds with extremely high filler content and considerable injection pressures, the load-bearing capacity of the surface is a vital prerequisite for the durability of the processing unit.

Package highlights:
» bimetallic barrel
» screw made of abrasion-resistant steel alloy with tip

MIM PACKAGE
Metal Injection Molding

Metal injection molding (MIM) is a process for making metal parts, in which an injection molding compound consisting of a metal powder, polymer binder and various additives is used. This compound is first formed by an injection molding process and then sintered. The sintering process removes the binder and gives the component its final strength. Due to the use of metal powder, the plasticizing system is subjected to extreme abrasive and adhesive wear.

Package highlights:
» bimetallic barrel
» screw made of abrasion-resistant steel alloy
» specialized check valve geometry for processing powder injection molding compounds

CIM PACKAGE
Ceramic Injection Molding

Similar to metal injection molding (MIM), a compound consisting of a binder and some additives is used, but this time combined with ceramic powder. The greatest impact MIM compounds have on plasticizing units is abrasion, due to the hard ceramic particles in the compound.

Package highlights:
» bimetallic barrel
» screw made of a special, extremely abrasion-resistant material
» specialized check valve geometry for ceramic powder compounds
In addition to the development and optimization of drive and application technologies, the continuous improvement of plasticizing systems is a top priority at WITTMANN BATTENFELD.

In-house production at WITTMANN BATTENFELD, using optimized manufacturing processes, is geared to satisfying the most stringent quality requirements. High-tech manufacturing centers and a fully equipped technical lab, which are continuously further extended, are at our disposal for comprehensive quality management and constant further development.

» Production and quality
WITTMANN BATTENFELD insists on a high level of vertical production in the interest of optimal response to our customers’ wishes using our broad and diverse in-depth knowledge. To promote the further advancement of know-how, we regularly invest in new manufacturing technologies. Our production equipment includes a stock of machinery consisting of manufacturing centers and heat treatment furnaces as well as automatic grinding and polishing systems. All system-relevant components undergo 100 % quality inspection in our measuring room, which is equipped with 3D measuring machines.

- Production of high-precision components such as screws, check valves and barrels
- In-house nitrating plant
- In-house rough and fine polishing stations for high-gloss surface finish
- Multi-axis manufacturing centers
- 3D measuring machines

» Application technology assistance
WITTMANN BATTENFELD ranks among the pioneers in injection molding technology and has made substantial contributions to the development of standard and specialized processes, in particular the processes listed below.

- AIRMOULD® – a complete solution for gas injection technology
- COMBIMOULD – customized multi-component technology solutions
- CELLMould® – a physical foaming process developed in-house
- WPC (Wood Plastic Compounds)
- Co-injection (sandwich) molding
- BFMOULD® – variothermal mold tempering
- VARIOMOULD® – variothermal process with hot water temperature controllers
RESEARCH AND DEVELOPMENT
Efficiency through innovation

To meet the ever more stringent market demands and continuously increase the efficiency of our products, we engage in fundamental research and development.

To advance the fundamental research for plasticizing systems, we have established cooperation partnerships with the Plastics Technology Department at the University of Leoben, the Institute for Material Sciences and Technologies of the Vienna University of Technology, and the Austrian Center of Competence for Tribology (AC2T research GmbH).

» Technical lab for development and application technology
In our corporate R&D department, the plasticizing components are subjected to systematic, continuous further development and improvement. The performance of all new developments is verified by practical tests.

In our technical lab, machines and peripherals of various sizes from many different series are available to our customers for feasibility studies and test runs. In this way, it is possible to validate customized solutions in practice.

– Machines from a great variety of series and various peripheral systems including complete production cells
– Screw operation simulatores with comprehensive measurement data acquisition
– Equipment for screw measurement and inspection of plasticizing components

» Material testing and development
Laboratory and testing equipment is available at WITTMANN BATTENFELD and cooperating partners. Our customers and business partners can use these resources to answer their individual questions.

The findings gained from our regular research and development projects are continuously utilized in systematic further development of our serial production technology.

Various types of special tools and equipment are available internally or externally (via our cooperation partners), such as

– Stereoscopic microscope
– Endoscope
– Hardness testing equipment
– Metallographic equipment
– Material testing equipment
– Tribometer