Gear pump in an extrusion line: The technical and economic solution for increasing the performance of extrusion lines

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The use of a gear pump turns conventional single-screw and twin-screw extruders into extrusion systems with optimized metering accuracy, a wider operation window and increased cost-effectiveness. The pump reduces the load on the extruder and takes responsibility for the pressure build-up and metering stages of the process. The extruder’s primary tasks such as melting, homogenization, compounding and degassing can therefore be carried out separated from these stages of the process.

The resulting advantages, such as
- productivity increase by up to 25%,
- reduction in material and operating costs by up to 30%,
- reduction in waste material production by up to 50%
lead to a short payback period for the gear pump. This applies to single-screw extruders but also and in particular to twin-screw extruders.

Extrusion equipment is almost always operated at its upper performance limit and is generally very sensitive to fluctuations in pressure or throughput capacities. Waste material and/or plant downtime are often the result if the production tolerances are pushed beyond the narrow limits as a result of fluctuations in other parameters such as granulate size, granulate or viscosity fluctuations.

Although the combination of the extruder with the appropriate gear pump for the extrusion process cannot cancel out the problems caused by the process, the gear pump can, however, eliminate or reduce their effects.

The high volumetric efficiency of Barmag’s precision gear pumps ensures a reduction of pressure fluctuations to as little as 1/10 of the original pressure fluctuations upstream of the gear pump. A pressure/speed control guarantees constant filling of the gear pump and compensates for product-dependent throughput fluctuations in the extruder by automatically adjusting the screw speed.

As a result of the incorporation or retrofitting of a gear pump in an extrusion plant
a) the extrusion throughput can be substantially increased without any risk being incurred because of fluctuations in the operational parameters.
=> increase in productivity by up to 25%

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**Example: Tape Stretching Line**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target extrusion line throughput</td>
<td>400 kg/h</td>
</tr>
<tr>
<td>Throughput fluctuations without gear pump (required throughput to ensure target extrusion line throughput)</td>
<td>420 kg/h</td>
</tr>
<tr>
<td>Throughput fluctuations with gear pump (required throughput to ensure target extrusion line throughput)</td>
<td>404 kg/h</td>
</tr>
<tr>
<td>Material savings over 7200 operating hours (300 days @ 24 h)</td>
<td>115,200 kg</td>
</tr>
<tr>
<td>At a kilo price of EUR 1.00 for the granulate</td>
<td>savings of EUR 115,200.00</td>
</tr>
</tbody>
</table>

The payback period can be calculated from this based on the capital value of the gear pump, drive, adaptors etc.

This is just one example for calculating the payback period. There are further aspects related to increased productivity, reduced material costs, enhanced product quality etc. which also interact and therefore reduce the payback period further.
b) a high proportion of recycled material can be processed which would otherwise result in reduced product quality because of viscosity fluctuations and inaccurate throughput in the extruder.
=> reduction in material costs by up to 30%
c) the start-up time until stable production is achieved or the changeover time to a different batch can be reduced. This time saving results from fast, reproducible settings and from the constant throughput with the gear pump.
=> waste reduced by to 50% and higher utilization of plant capacity
d) polymer shear in the extruder can be reduced, and the extruder is subjected to far lower mechanical stresses than without a gear pump.
=> low-shear production and therefore enhanced quality in the finished product

An increase in performance of 10-50% is frequently achieved by using a gear pump. Furthermore, the raw material costs (granulate) can be reduced by increasing the proportion of recycled material used which can be processed without problems when a gear pump is used.

Depending on the application, payback periods of 6-12 months can be calculated for Barmag gear pumps based on the above variables.

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