iQ clamp control
Intelligent clamp force optimisation
**ENGEL iQ clamp control**
the next step towards zero-fault production

The tiniest details, such as mould breathing, can substantially influence the quality of your production. Mould breathing occurs when the injection pressure of the melt partially offsets the compression of the mould caused by the clamping force.

If the mould breathing is too high or too low, this can cause rejects due to burrs or burn marks (diesel effect) or flashes. ENGEL iQ clamp control determines the optimum clamping force quickly and objectively, and automatically keeps mould breathing within the ideal range. The intelligent software supports the operator and ensures the quality of your products for every shot.

If mould breathing or the clamping force are not appropriate, quality will fluctuate:

- when breathing is too high, that is, when the clamping force is too low, it leads to overfilled cavities and causes visible burrs
- when the clamping force is too high, the mould and clamping unit are subjected to unnecessary stress
- clamping force that is too high causes burn marks as not enough air can escape
- clamping force that is unnecessarily high means increased energy consumption

**iQ clamp control** automatically regulates the clamping force and ensures component quality:

- automatically determines the optimal clamping force
- provides quality-relevant information about each shot
- prevents rejects due to burns or burn marks
- reduces wear on mould and clamping unit
- increases energy efficiency – with the optimal clamping force

The starting point is closure of both halves of the mould without pressure (Fig. 1).

When the clamping force is built up, the mould is compressed. The volume of the mould cavity is reduced slightly as a result of mould compression (Fig. 2).

Part of the compression is compensated for by the opening pressure exerted by the melt during injection. The increase this causes in the mould cavity size is referred to as mould breathing. The resulting change in the mould height, which is approximately equivalent to the mould breathing, can be determined by iQ clamp control (Fig. 3).
Automatically achieve **optimal clamping force**

**The full clamping force is not always needed**
In practice, optimising the clamping force is a subjective matter: the result is heavily dependent on the experience of the operator. Setting an unnecessarily high clamping force leads to a slight increase in mould wear as well as energy consumption and cycle time. In addition, when the clamping force is too high, the air cannot escape from the cavities fast enough during filling, which can result in burn marks on the surface of the formed part.

**Automatically determine the correct clamping force with ENGEL iQ clamp control**
Achieve top results independent of operator experience: ENGEL iQ control is an efficient tool for optimising clamping force. All that is necessary to determine how much clamping force is actually needed, and the ideal mould breathing value, is to run a few initialising cycles. This ideal value will then be calculated by automatic adaptation of the clamping force even when changes in the process occur.

Produce perfect parts and ensure economical use of resources

**Critical changes to the process can damage the mould**
Changes concerning, for example, the switchover point, holding pressure or adding individual gates, also result in changes in mould breathing. In the worst case, the result could be overfilled cavities. That means the mould is pushed so far apart that the melt flows out of the cavity at the parting line and forms a burr on the moulded part. The burr is pressed between the mould halves – and results in lasting damage to the mould.

**Reduce wear on mould and clamping unit as much as possible with ENGEL iQ clamp control**
In combination with iQ clamp control the existing monitoring packages for the Engel CC300 control unit make it possible to monitor mould breathing with thresholds for alarms and intervention. This helps to significantly reduce the risk of quality issues such as burns, and reliably protect the mould against overfilling.

**Your iQ clamp control benefits**
- automatically adopts the optimal clamping force shot for shot
- keeps the mould breathing within the optimal range
- reduces wear on mould and clamping unit
- provides optimal operator support
- protects the mould against damage due to overfilling
- ensures consistent quality for your products and reduces the reject rate significantly

Transmitted light microscope pictures of the edge of a moulded part. **Left:** burr formation without iQ clamp control **Right:** with iQ clamp control
Process optimisation **without sensors on the mould**

Common process parameters like injection pressure or melt cushion only provide limited information about the processes in the mould. Sensors on the mould deliver important data for process optimisation. However, they cause high additional costs and therefore only a fraction of all injection moulds are equipped with them. With iQ clamp control, we provide a reliable and economic alternative.

**Determine quality-relevant information economically with ENGEL iQ clamp control**

Receive relevant information for process optimisation and monitoring directly from the machine: iQ clamp control without expensive hardware or sensors. The machine control unit determines mould breathing through intelligent use of existing sensors. The mould breathing curve provides quality-relevant information about the formation of the moulded parts from the injection to the cooling phase and thus delivers a “fingerprint” of each individual shot.

Comparison between the mould breathing and the cavity pressure curves. Because mould breathing originates from the opening pressure of the melt, the curves of the two signals show very similar characteristics.

**The extra bonus**

You can immediately utilise the functions of iQ clamp control for all moulds because there is no need to add equipment to the mould.

---

**Thanks to our years of experience in injection moulding machine manufacturing, we understand our customers' concerns, and have continuously developed a fine sense for details. With iQ clamp control, we have now succeeded in taking another large step towards intelligent machine controls. For the first time, the controller can independently determine a process-relevant target value and make automatic adjustments to adopt it – without the risk of damage to the mould, but still maintaining good mould breathing. Our goal is zero-fault production: with iQ clamp control, we have accomplished a crucial task in this direction.”**

Dr Georg Steinbichler | Senior Vice President Research & Development Technologies, ENGEL AUSTRIA