

# ***APC PLUS***

*STABILITY, PRECISION AND  
COST-EFFICIENCY IN PRODUCTION*



***KraussMaffei***

*Pioneering Plastics*

# EXTERNAL FACTORS IMPAIR PART QUALITY APC PLUS CANCELS OUT ENVIRONMENTAL INFLUENCES

Numerous external factors can negatively affect component quality. Environmental influences such as temperature and air humidity, fluctuating material quality, flow resistance and interventions by the operator all affect the production process.

## Possible external factors

### Changing environmental conditions

- Seasons
- Day and night
- Fluctuations in temperature and humidity

### Fluctuating flow resistance

- Hot runner mold
- Mold cooling and heat-balancing of hot runner
- Shut-off nozzle of non-return valve

### Operator

- Availability
- Qualifications
- Start-up after standstill
- Intervention in event of process deviations

### Fluctuating material quality

- Batch fluctuations
- Additives (recyclate amount, masterbatch)
- Contamination

### Safety reserves for settings

- Back pressure
- Barrel temperature
- Mold temperature
- Cycle time



# CRUISE CONTROL FOR YOUR INJECTION MOLDING PROCESSES APC PLUS KEEPS PROCESSES STABLE

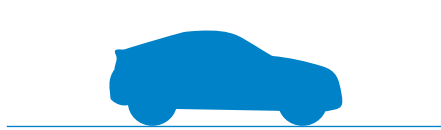
APC plus is comparable with the principle of an automobile cruise control system. Cruise control automatically regulates the fuel supply to the engine to prevent the speed exceeding or dropping below the speed specified by the driver on any gradient. The speed of the vehicle remains constant at all times, even if outside conditions change.

Similarly, APC plus keeps the production process constant, even if parameters change due to external influences. On the basis of the material properties, APC plus precisely regulates the charging of the molding volume. The entire process becomes more robust and the cavity is always completely charged.

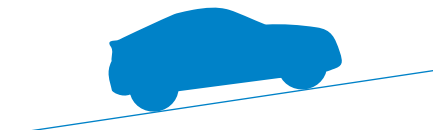
## Dynamic control

The mold setter configures the ideal process. APC plus detects deviations and continuously adjusts the actual status back to this target status. Faults are canceled out and you retain consistently high part quality.

## Consistent speed = robust process

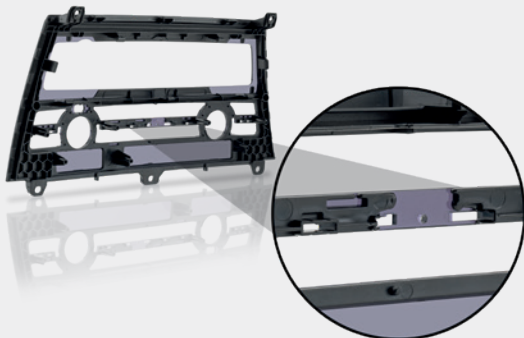


*Consistent speed on a horizontal segment*

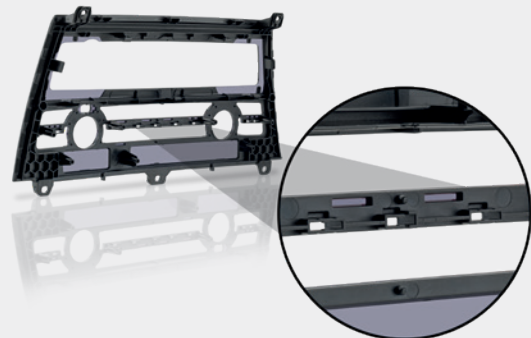


*Consistent speed on a slope*

## APC plus – your path to zero-defect production



**Rejects:** Defect on a panel.



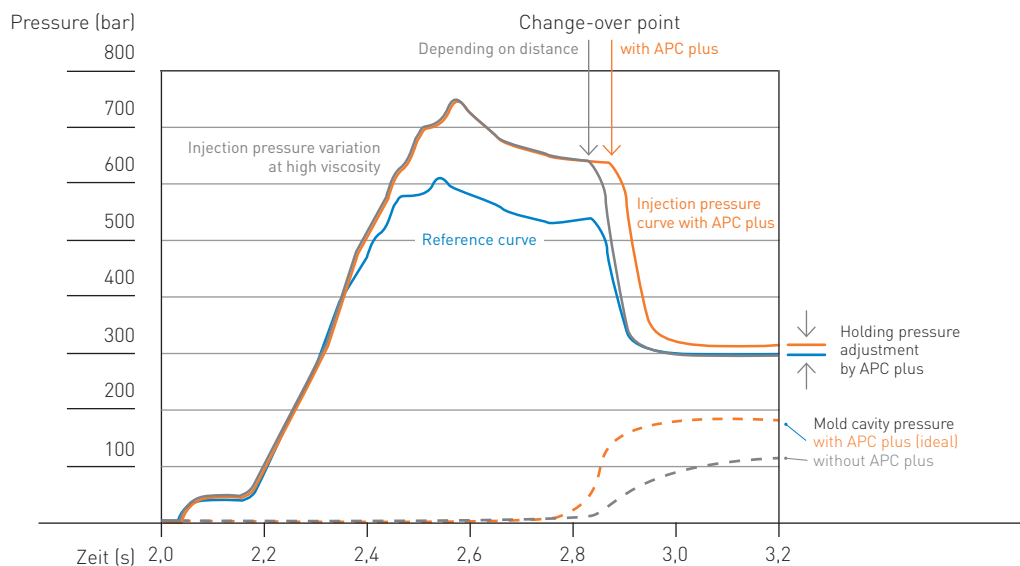
**With APC plus:** Perfectly charged mold with every shot.

# APC PLUS FOR CONSISTENTLY HIGH COMPONENT QUALITY

## INTELLIGENT AND AUTOMATIC CONTROL

After intensive research and with many years of experience, KraussMaffei has succeeded in reaching the next level in perfectly consistent component quality. The patented APC plus technology\* analyzes and dynamically regulates the injection molding process, and can be used for all thermoplastic series.

### Dynamic control for maximum process stability



### Good standard

According to the standard, the mold setter defines the change-over point and holding pressure profile as a target state. However, these fixed values are only optimal if there is no interference from external influences. Every fluctuation in viscosity directly and immediately affects the mold charging. This could result in defects in the product; defective parts must be sorted out.

### Better with APC plus

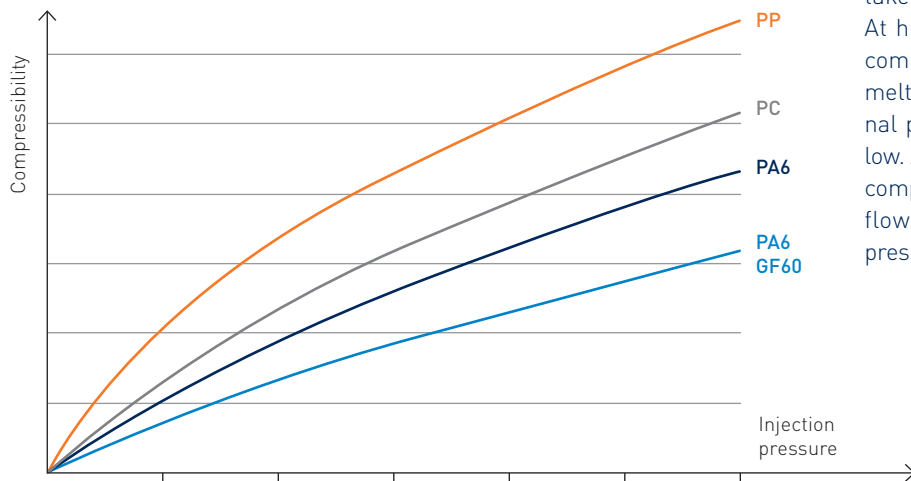
Adaptive Process Control (APC) plus analyzes the current process state and continually compares this with the configured target curve (reference curve). The change-over point and the holding pressure profile are automatically adjusted according to the melt pressure. APC plus directly and automatically executes the necessary corrections for every single shot. All interference parameters are canceled out in real time. This means the mold is completely charged for every shot. The rejects rate tends toward zero.

\* patent DE 10 2015 117 237 B3

## YOUR BENEFITS:

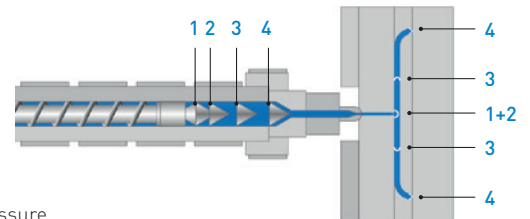
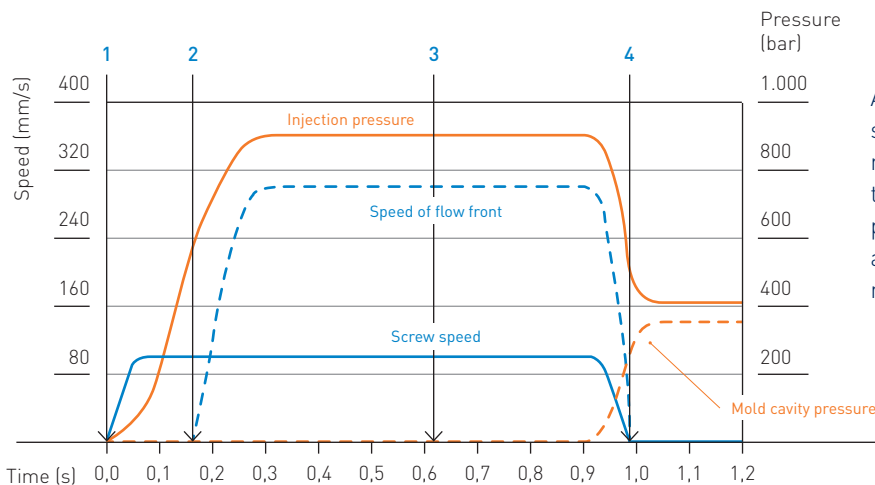
- Balances out fluctuations in viscosity in real time
- Constant mold charging
- Optimum component quality

### Consideration of the melt compressibility



Plastic materials have different melt compressions, and this has to be taken into account in the process. At high melt pressure, the melt is compressed more strongly and less melt flows into the cavity. The internal pressure within the mold is too low. At low melt pressure, the melt is compressed less and too much melt flows into the cavity. The internal pressure within the mold is too high.

### Compressibility delays the mold charging – Pressures and speeds in the injection process

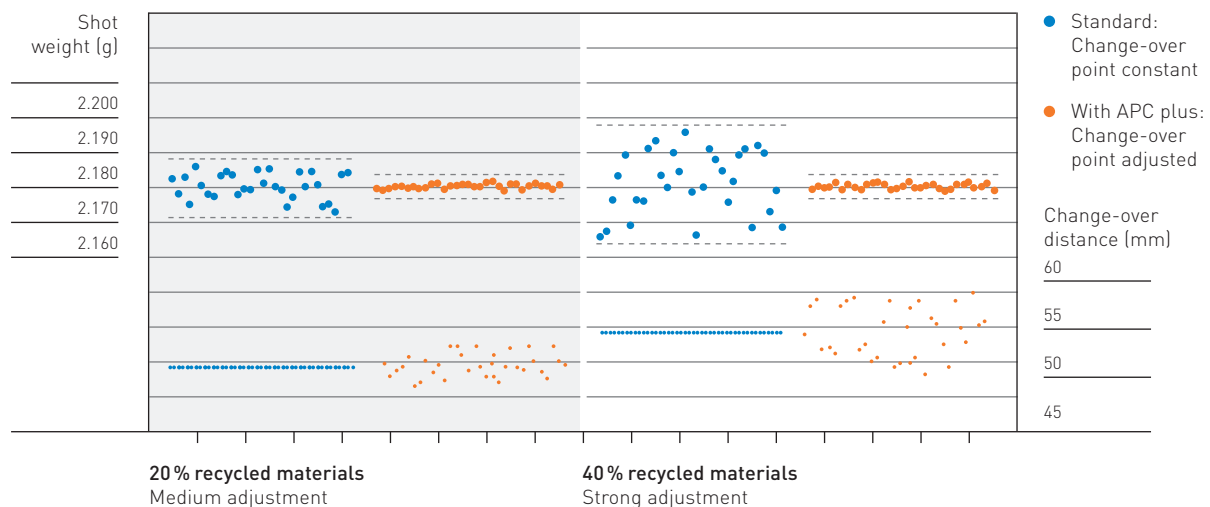


APC plus takes into account the specific compression of the material being processed. On this basis, the system adjusts the change-over point and the holding pressure to achieve a constant volume in the mold at all times.

# QUICK START-UP AND STABLE PROCESSES APC PLUS GUARANTEES SHOT WEIGHT CONSISTENCY

APC plus ensures consistent shot weight and component quality under all conditions. In the start-up sequence, during cascade injection molding or working with varying mixtures of recycled materials – even when the door to the hall is open and there is a draft.

Shot weight consistency: use of recycled materials of 20% and 40% – each with and without APC plus



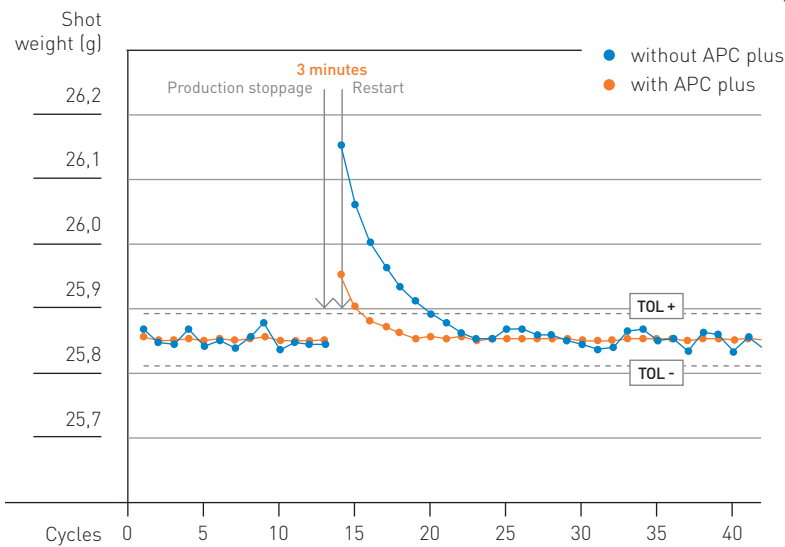
Regardless of the proportion and the properties of the recycled material, APC plus reacts to fluctuations and reliably stabilizes the component weight.

With APC plus you will master sophisticated processes even when using high proportions of recycled materials.

## YOUR BENEFITS:

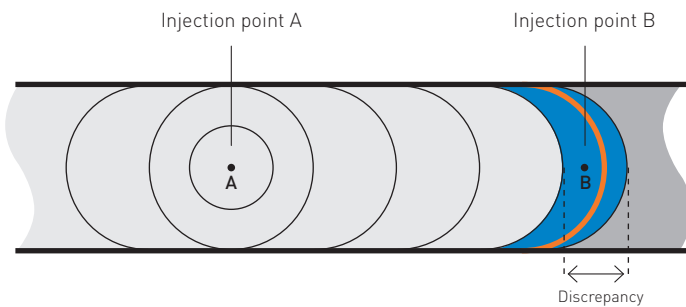
- Shot weight consistency with high proportion of recycled material
- Quick restart
- Consistently high quality for cascade injection molding
- Environmental influences canceled out

### Quick restart after production stoppage



The viscosity of the material in the cylinder changes during a production stoppage. After the restart, the required shot weight consistency is only attained after a certain number of cycles. APC plus reduces this startup time to a minimum because it immediately reacts to changes in viscosity.

### Perfect cascades



- **Without APC plus:**  
The flow front varies from one shot to the next, cascades open, depending on the screw distance without knowledge of the actual melt front
- **With APC plus:**  
Cascades open at the right moment, behind the flow front

### APC plus ensures perfect component quality, even with cascade injection molding

Depending on the melt pressure, APC plus calculates the progression of the melt front for every shot on the basis of melt compression. This allows the cascade opening points to open at exactly the right time.

# REVOLUTIONIZE YOUR MANUFACTURING PROCESS

## ADVANTAGES THAT SPEAK FOR THEMSELVES



*Consistently high quality is a vital factor in maintaining good customer relations. With APC plus, you can protect this important commitment.*

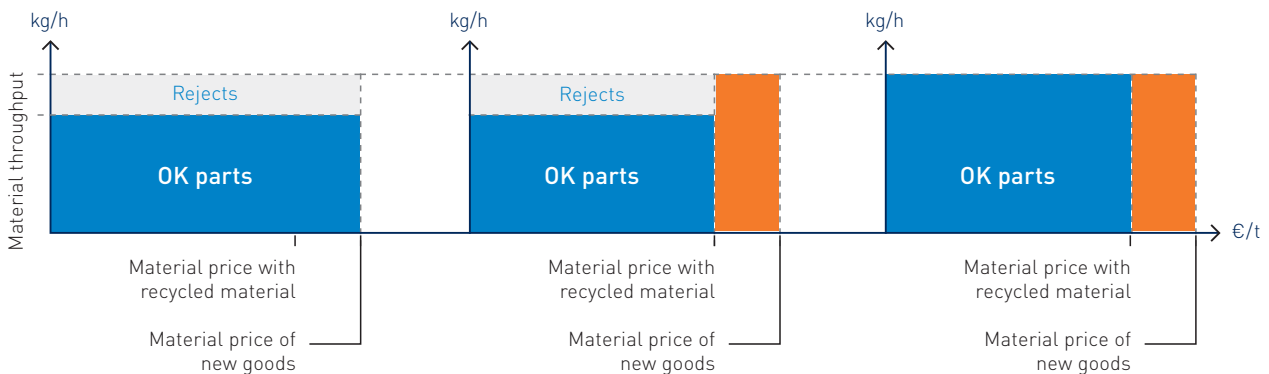
### Zero-defect production

Efficiency and stability of the process are of decisive importance for a high margin and large quantities. APC plus prevents component defects such as overmolding or sunk spots. Based on exact knowledge of the pressure-dependent melt behavior and taking into account external influences, APC plus automatically adjusts the change-over point and holding pressure level for every shot. This means you always achieve the required volume in the mold.

### YOUR BENEFITS:

- Substantially lower scrap rates
- Consistently high component quality
- Lower quality assurance costs
- Enormous cost reduction possible
- Proportion of recycled material can easily be substantially increased

### Reduce costs with APC plus



#### Cost situation without APC plus

Rejects and material costs define the unit price of the good parts. Cost reductions and increases in margins represent major challenges for every organization.

#### Cutting material costs

APC plus allows a higher proportion of recycled materials to be used, reducing material costs drastically.

#### Reducing rejects

APC plus improves process stability and thus reduces scrap rates. More good parts are produced for a given material consumption. The costs are also reduced by less material loss.



### Easy handling

The demands placed on modern manufacturing are constantly increasing: it must be flexible and as cost-effective as possible. Therefore, downtimes, lengthy start-ups and fluctuations in production must be reduced to a minimum. APC plus uses Intelligent process adaptation to automatically balance out process discrepancies and disruptions. Even after a restart, the machine immediately produces components with the usual high quality from the very first shot.

### OTHER BENEFITS:

- Learn with various change-over procedures
- Choice of several learning cycles as reference
- Automatic holding pressure correction
- Drop-down menu with choice of 20 plastics and eight fillers
- Input of up to five user-specified materials and fillers possible
- Extended range of use (cascade injection molding and thin-wall applications)



*The MC6 control system boasts optimal user-friendliness.*



# OUR WORLDWIDE EXPERTISE IS YOUR ADVANTAGE **DIGITAL & SERVICE SOLUTIONS**

With your KraussMaffei machine, you have chosen a product that delivers the highest levels of productivity and reliability. In addition to our range of machinery, KraussMaffei focuses on comprehensive and future-oriented solutions, innovative business models and an innovative portfolio of digital products.

## **Customer service at the touch of a button**

The process of digital transformation is becoming faster and easier than ever for the customer. Our Digital & Service Solutions unit makes your production chain even more flexible and efficient with future-oriented solutions. KraussMaffei thus globally provides an all-inclusive customer service package and networks machines and processes with each other. Our global support offers a sound basis for your local long-term success.

## **Individual challenges in mechanical engineering call for intelligent solutions**

With our services portfolio, we support you throughout your machine's lifecycle with a strong focus on your specific needs. In order to satisfy your wishes, we offer you a wide range of solutions in order to ensure maximum availability and optimum productivity of your machines.

## **Technology<sup>3</sup> as a unique selling proposition**

KraussMaffei is the only supplier in the world with a product range comprising the most important machine technologies for plastic and rubber processing: injection molding machinery, automation, reaction process machinery and extrusion technology. KraussMaffei is represented worldwide with more than 30 subsidiaries and over 10 production plants as well as about 570 commercial and service partners. Working together with our customers and partners, we are thus in a position to offer vast and unique expertise in the industry.

**You can find further information at:**  
[www.kraussmaffei.com](http://www.kraussmaffei.com)

# KRAUSSMAFFEI – PIONEERING PLASTICS



## Extensive expertise from a single supplier

KraussMaffei is one of the world's leading manufacturers of machinery and systems for producing and processing plastics and rubber. Our brand has been synonymous with cutting-edge technology for over 180 years. Our product range includes all technologies in injection molding, extrusion and reaction process machinery. KraussMaffei has a unique selling proposition in the industry as a result. By drawing on our proven innovative capacity, we can guarantee our customers sustained additional value over their entire value-adding chain through our standardized and individual product, process, digital and service solutions. The range of our products and services allows us to serve customers in

many sectors including the automotive, packaging, medical and construction industries. We also supply manufacturers of electrical and electronic products and household appliances.

## At your service all over the world

KraussMaffei is represented all over the world. Subsidiaries provide you with support in the countries shown in light blue. Our sales and service partners take care of you in the regions shown in white.

You can find all contact information at  
[www.kraussmaffei.com](http://www.kraussmaffei.com)

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