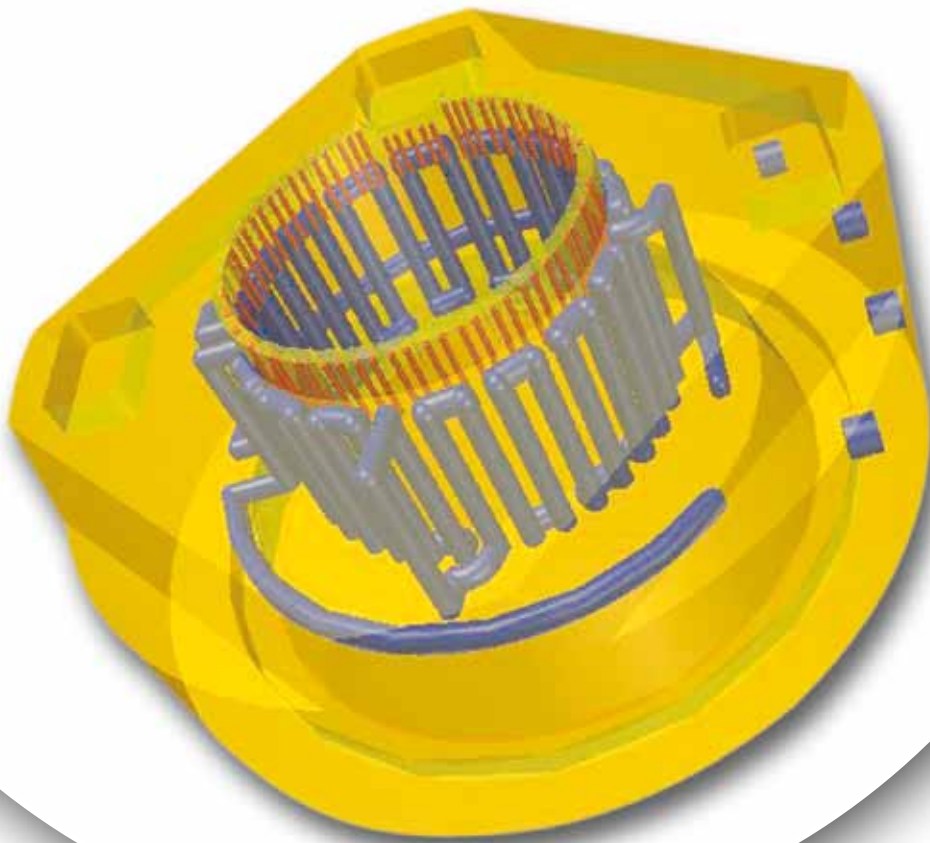




## **integrat 4D**

**Close-to-cavity mould temperature control**



Successful in global  
competition with high-  
performance injection moulds

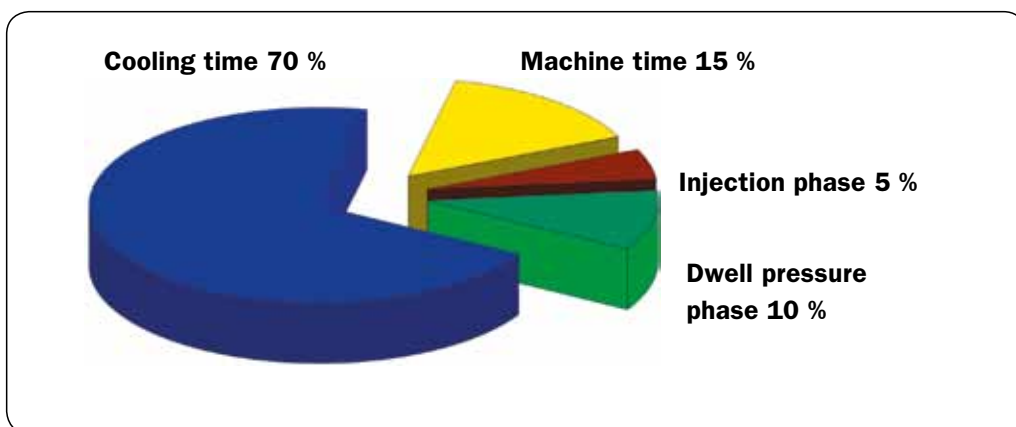
**gwkk**

## integrat 4D

The most important part in the process chain of producing plastic products is the injection mould. Nowadays, ordinary drilled cooling systems are hardly able to meet the requirements in terms of cycle time and quality.

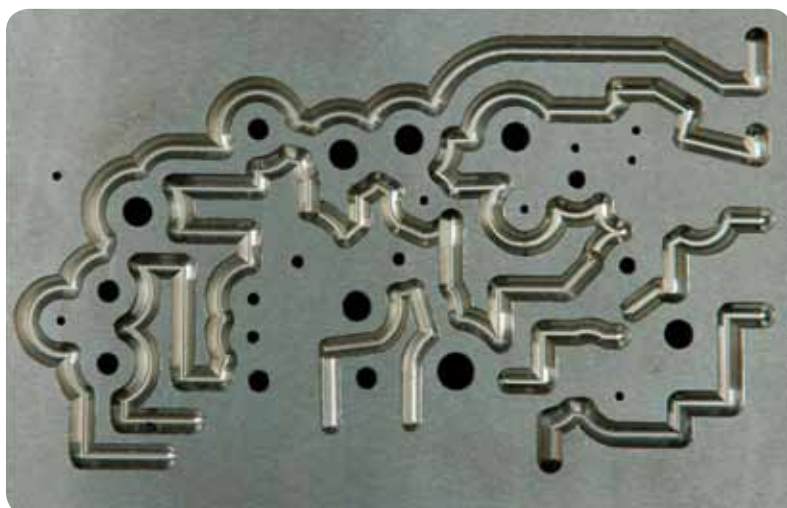
The **gwk integrat 4D system** is the rational answer to the economic cooling process.





For technical parts, the cooling time is 2/3 of the overall cycle time, thus the largest cost-factor; therefore the greatest potential for rationalization lies in a correctly dimensioned cooling process.



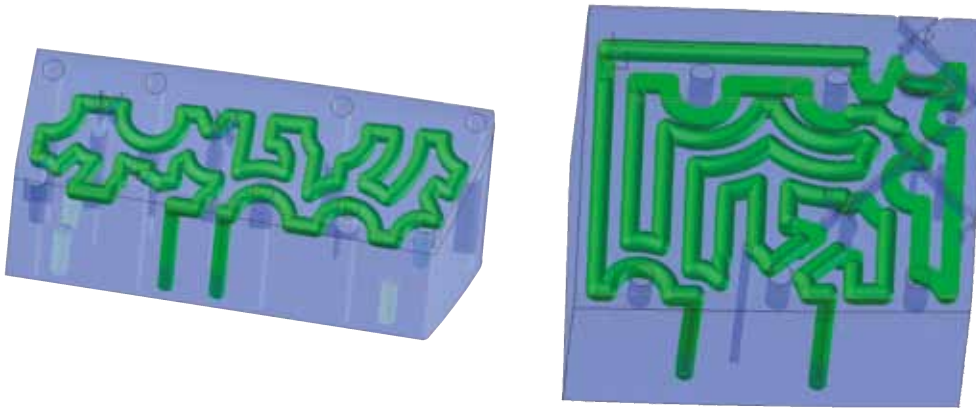
Through close-to-cavity and segmented allocation of the cooling surfaces and the water quantities and temperatures necessary to do so it is possible to reach

- the shortest cooling time
- the best possible mould quality
- a considerably reduced reject rate
- a stable production process



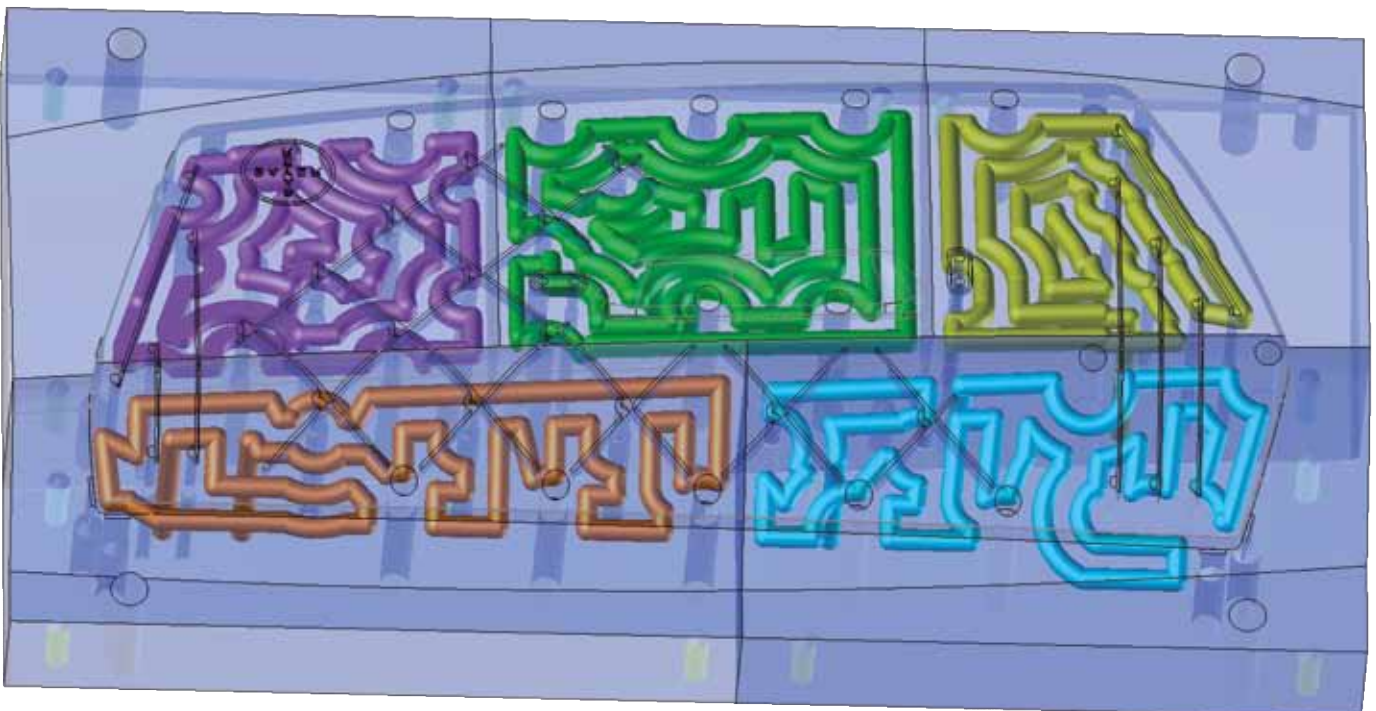
-  **Reduce cycle time**
-  **Improve parts quality**
-  **Minimize reject rates**
-  **Increase productivity**

# Increase of productivity through close-to-cavity mould temperature control



The closer the cooling channels are placed to the cavity and the more even the water distribution is realized, the more homogeneously heat can be transferred, which allows a faster cooling process. For technical parts, the gwk-system may decrease **cooling time** by ca. **30 - 50 %**. As a result, the **overall cycle time** is reduced by between **20 - 30 %**.

The largest benefits associated with this option of reducing cycle times while preserving or improving the moulded part quality are most likely the cost savings for injection moulding companies looking to lower their production costs.



# gwk project schedule

## 1 Analysis phase

- Determination of ACTUAL situation and task alignment
- Preparation of a project-specific mould and temperature control concept
- Dimensioning and position of temperature control channels
- Determination of components for the temperature control concept
- Analysis of costs and benefits
- Description of project schedule
- Determination of budget

### Objectives:

- Exploitation of potential for thermal energy management in the mould
- Determination of suitable standards for mould temperature control
- Optimum part quality at short cycle time
- Increase in productivity due to reduced cooling time
- Minimisation of number of rejects and rework

## 2 Commercial coordination

- Preparation of a detailed quotation
- Coordination with customer
- Award of contract by customer

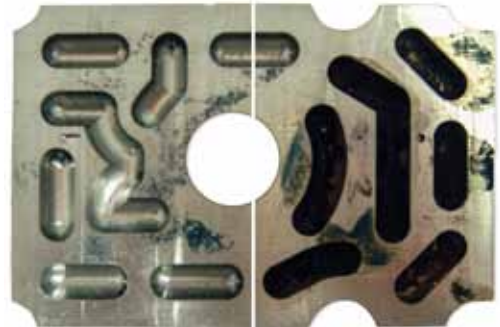
## 3 Customer approval

- Arrangement of cooling channels according to project study and structural design calculations
- Preparation of design drawings (cooling channel arrangements, dimensions of blank) and approval by customer

## 4 Manufacture

- **Machining:**  
Insertion of multidimensional cooling channels in the parting levels of the mould insert plates via CNC controlled processing centres (milling, turning, drilling, spark machining)
- **Materials:**  
Blanks for the inserts are made of high-strength steel grades: 1.2343ESU (H11), 1.2344ESU (H13), M333 (Böhler), M340 (Böhler), W360 (Böhler), W400 (Böhler) and possibly SPM. The use of other steel grades is possible and needs to be tested for technical feasibility.
- **Roughing of mould insert:**  
Pre-machining of contour in a non-hardened mould insert via 2D machining (stages) or via 3D processing as needed. Blank dimensions are determined in consultation with the customer.
- **Hybrid technology from gwk via heat transfer elements:**  
Increase in heat transfer capacity by 15 to 20 times when compared to tool steels
- **Brazing technology:**  
Following a special pre-machining process, the separate mould insert plates will be brazed by diffusion at their parting surfaces via a high-temperature vacuum process at the hardening temperature of the corresponding steel material in a structure-preserving manner. The strength, tenacity, and resistance to wear correspond to those of a mould insert manufactured using conventional processes.
- **Hardening / Tempering:**  
Heat treatment of the mould inserts according to the steel specification for reaching the required hardness.
- **Protection against corrosion of the cooling ducts:**  
Optional special coating to prevent adverse effects due to corrosion regarding the thermal conductivity of the cooling channel surfaces.

# Road map for saving energy and boosting productivity



protected against corrosion by gwk

unprotected

## 5 Quality tests

- Following the brazing process, each mould insert is tested for tightness (pressure test up to 20 bar) and flow (l/min) using a special test bench with results being documented.
- The brazed areas of each mould insert are checked for full surface bonding using an ultrasonic process with the results being documented.
- For checking the surface hardness of every insert, the Rockwell hardness test is used with the results being documented.



The complete manufacturing process is carried out at the headquarters in Meinerzhagen

# Cost-benefit-analysis

When projecting / optimizing moulds of an overall considered moulded part we conduct a cost-benefits analysis on the basis of our cooling time calculation and with regards to experience values.

In our analysis, the **gwk integrat 4D system** (close-to-cavity cooling channels) and the **segmented mould temperature control** of conventional technology are compared. The customer is shown the considerable potential for economization due to reduction of cooling

time / quality improvement brought about by the **gwk integrat 4D system**.

The cost-benefits-analysis may also be conducted for individual critical areas to be optimized with close-to-cavity cooling channels. To do so, the remaining area processed with conventional drilled technology (according to our recommendation), must have sufficient temperature homogeneity (an even mould cavity temperature).

## In practice:

**Increased productivity through close-to-cavity mould temperature control – practical examples:** Typical task for optimizing projects: • Lowering of warpage • Lowering of cooling time • Improvement of the surface quality • Reduction of rejects

### Example 1: PA6 GF30 gearbox casing



#### Heat exchange surface in the fixed half:

With conventional temperature control: 6.847 mm<sup>2</sup>  
 With integrat 4D-temperature control: 19.016 mm<sup>2</sup>



#### Heat exchange surface in the moving half:

With conventional temperature control: 6.253 mm<sup>2</sup>  
 With integrat 4D-temperature control: 18.972 mm<sup>2</sup>

Productivity Cost-benefit calculation	
Piece number/year	150000
Cavitation	2
Cooling time gwK	16 sec
Cycle time gwK	26 sec
Cooling time conventional	28 sec
Cycle time conventional	38 sec
Machine hour rate	38 Euro/h
Total costs close-to-cavity use	9400 Euro
Machine costs saved	9500 Euro
Costs amortisation	1620 Euro
Savings after 1 year	7880 Euro
Shots/year	75000
Number machine hours gwK	842 h
Number machine hours conventional	792 h
Machine hours saved	250 h
Cycle time saved	32 %
Amortisation time	2.05 months
Savings in each following year	9500 Euro

#### Cost-benefit-analysis:

Additional costs: € 1.620  
**Savings: € 9.500 p.a.**  
**Pay back: 2 months**

### Example 2: Transport trays for car keys made of ABS and TPE material



#### Result:

Savings due to reduced cycle time: approx. 25%



#### Analysis of costs and benefits:

Additional costs € 52.000  
**Savings: € 59.000 p.a.**  
**Amortisation period: 10 months**

# Increase of productivity through close-to-cavity mould temperature control

 **Reduce cycle time**

 **Minimize reject rates**

 **Improve parts quality**

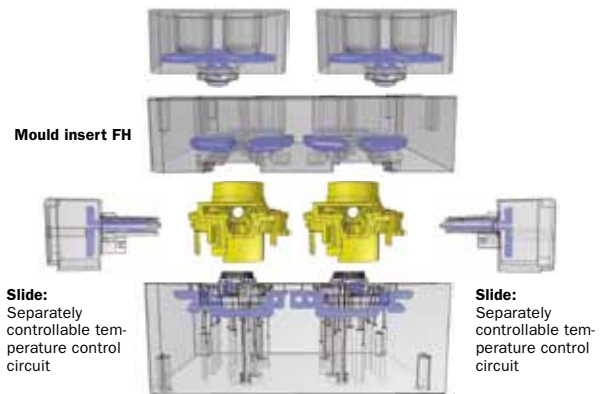
 **Increase productivity**

**Example 3:**  
**PA6.6 GF35 carbon brush guide,**  
 produced with **integrat 4D**



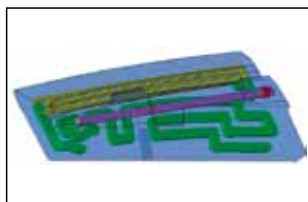
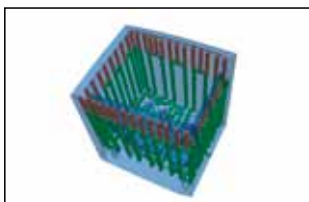
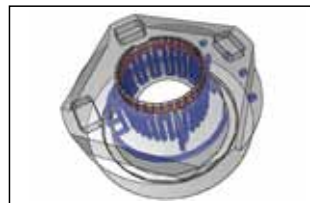
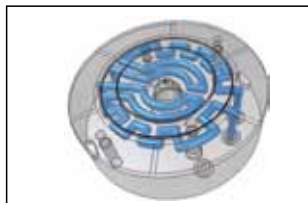
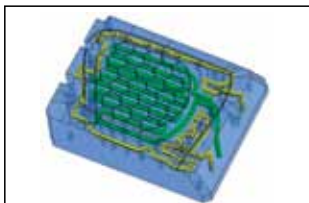
**Result: saving of cycle time: approx. 26 %**  
**Exactly reproducible, warp-free part quality**

**Gate bush with temperature control:**  
 Separate temperature control circuit for the hot runner nozzles to control the gate area (frictional heat).

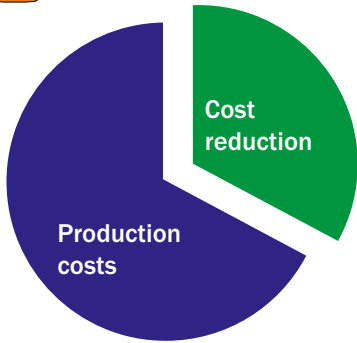


**Mould insert MH/FH:**  
 Two separate temperature control circuits per mould insert  
 = Close-to-cavity control of the mould wall temperature.  
 Installation of the largest possible heat exchange surface.

## Individual design possibilities



# gwk Perfect Cooling and Temperature Control



## Increased productivity

In many areas of the industry, cooling and temperature control provides a great potential for increasing productivity and thus for lowering costs.

## Many factors serve to improve productivity:

- Reduction of cooling time, therefore savings in required machine hours
- Increasing availability of production plants
- Improvement of product quality
- Decreasing running cost
- Reduction of maintenance cost



### integrat 40/80/direct

Increase of productivity by means of specific and segmented mould temperature control.



### Modular temperature control units

Effective temperature control applications with high material throughput. Also ideally suited for the preheating of large injection moulds.



### integrat vario

For complex injection moulding processes, teco vario wh offers a cyclic water-water mould wall temperature control system with water temperatures up to 200 °C.



### gwk moldclean

Increased productivity through effective, automatically controlled cleaning of heat exchange surfaces in cooling and temperature controlled circuits.



### integrat evolution

Dynamic mould cavity temperature control system using ceramic high-performance heaters



### gwk weco

Controllable production in variable climatic conditions and high flexibility with compact, energy-saving water chillers using environmentally friendly refrigerant.



### gwk teco c

The compact series with excellent price-performance ratio for the demanding plastics processor.



### gwk hermeticool hybrid

Innovative cooling system to decrease the running and maintenance cost in comparison to conventional cooling systems.



### gwk protemp

High-performance temperature controller with increased flow rate and reduced energy consumption due to high quality stainless steel centrifugal pump.



### gwk service

Decreasing the maintenance cost and protection of company owned resources through professional execution of installation and maintenance works incl. cooling water treatment.



Member of the technotrans group

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