Konstruktionsbüro Hein GmbH

Your product developer

Product Development
Parts Optimisation
Injection Moulding Simulation
Simulation of Warpage
Shrinkage Data
FEM Analysis
Mould Design
Temperature Regulation
Visualisation
IsoForm® / HeiNo®
Regarding road traffic we have gotten used to many construction sites, accidents, dilapidated bridges and other obstacles, and we have accepted them as a sort of necessary evil. The same applies to many avoidable problems in production which often result from previous "economy" measures or accepted customs ("We have always done things this way."). Every subdiscipline (injection moulding machines, temperature control units, software etc.) presents innovations within its field, but overall concepts with proofs of energy efficiency and sustainability are missing.

More than 80% of the industry acknowledges a scarcity of skilled workers and more than 70% think that the biggest challenges are cost and time pressure. Currently, increased demands regarding quality and process reliability of tools and moulds frequently cannot be met. At the same time, projects with and from plastics need to be conducted in narrow timeframes.

This leads us to a solution called "automation". It has formerly been rated to make jobs redundant but today has to be considered a means to the economy's survival. Due to an increasing scarcity of skilled workers we need to worry if automation has not started, yet.

In schools, it is already an issue but at workplaces "sustainability" is not being sufficiently considered. However, this is of utmost importance if we don't want to repeat past mistakes regarding environmental pollutants and damage to the climate.

With everything we know today, it does no longer make sense to burn the precious fossil resource oil through the chimney or the exhaust or produce environmentally unfriendly products on its base. We rather need to use it for manufacturing light-weight, sustainable and energy-efficient parts.

Beside a few shining examples for innovation, future-oriented developments with sustainable products and sustainable production do not yet prevail.

Imagine that the first benchmark for company targets was sustainability and maximum profit came only in second. This could mean that developments may be planned in the long run again and the "return on investment" is no longer limited to a less than a year - at such short notice an economically efficient rerouting simply isn't possible. In addition, a new line of thinking could mean that people and companies living and promoting verifiable sustainability will be the ones to win recognition and to inspire the industry.

Europe has the chance to lead the way in this context!
Contents

- **Measure instead of rolling the dice**
  - Product shrinkage and warpage
  - Page 9

- **NEU VORKON**
  - From idea to plastic part / Influences on part quality
  - Page 4f.

- **Product development / Prototyping**
  - FEM analysis
  - Page 6f.

- **FEM analysis**
  - Temperature regulation, feed gate, ventilation
  - Page 8

- **Injection moulding simulation / Parts optimisation**
  - Temperature regulation, feed gate, ventilation
  - Page 10f.

- **Avoiding part defects and optimising processes**
  - Co-operations Training courses
  - Page 22f.

- **Mould design / IsoForm tools**
  - Special technologies Gas injection / water injection
  - Page 17ff.

- **Special technologies Gas injection / water injection**
  - Images and animations based on 3D data
  - Page 20

- **Images and animations based on 3D data**
  - Technology Workshop
  - Page 21

Further information at Kb-Hein.de
A maximum influence on the part quality is possible during product development. It is then the decisions for setting the right course are taken: You might invest slightly more money at the beginning, e.g. for simulation and optimisation, but you will benefit many times over in the course of the project.

**YOUR GOALS = OUR GOALS**

- high part quality
- high process reliability
- high rentability
- high customer satisfaction
- high sustainability
- high degree of innovation
- high degree of automation

headlight (WWS GmbH)
At an early stage of product development and/or for a first calculation, VORKON provides important details and pre-concepts within a few days. This results in a competitive advantage for quotations thanks to increased information and many benefits for the course of the project.

VORKON may form the basis for a subsequent elaborate simulation incl. parts optimisation and the costs of a max. of 1000 € may partially be considered.

Requirements:
- 3D data of the part
- exact material name
- details on prerequisites or considerations
- sample parts, no. of cavities, tool draft, technology to be used, if applicable

**OUR OFFER**

- **details** regarding filling behaviour, fibre orientation, reasonable wall thicknesses, weld lines, air traps, hot spots, undercuts, potential for optimisation
- **first simplified concepts** for injection, filling, ejection, separation

**YOUR BENEFIT**

- detect **potential for optimisation** early on
- avoid **part defects** early on
- **calculate** quotations and projects more accurately
- make **processes** more efficient

Further information at Kb-Hein.de
In product development, we will assist you with our entire range of services, consulting and training with regard to innovative ideas, choice of materials (incl. metal substitution), procedures and technologies up to the implementation of a production ensuring process reliability.

The properties of the workpiece will be designed optimally according to your specifications using FEM analysis and injection moulding simulation. Product development for plastic parts is done plastics-oriented with mean tolerances, draft angles and optimum wall thicknesses. An FMEA may be used to critically analyse and verify developments.

**YOUR BENEFIT**
- reduced costs for tool making
- reduced cycle times
- improved part quality
- reduced project time
- reduce possible defects
- experiences from medical engineering, electronics, automotive, aerospace, sports, agriculture etc.

**OUR OFFER**
- design
- product development
- parts optimisation
- injection moulding simulation
- FEM analysis
- FMEA
- prototyping
- material selection (e.g. metal substit.)
Tasks that today are frequently done during tool design or production planning will need to be transferred to product development in the future in order to be able to avoid additional costs during tool construction and to identify and prevent possible difficulties for injection moulding early on.

These tasks include, for example, parts optimisation and the first draft tool concepts.

The product developer thus becomes the decisive co-ordinator for sustainable planning and definitely needs to enhance his or her knowledge at short notice.

The aforementioned course of action also forms the optimum basis for automation.

**OUR OFFER**

- sustainable product development
- early pre-concepts
- material consultancy
- parts optimisation
- tool concept
- geometry reconstruction from scanned data

**PROTOTYPING**

- prototype construction or test series at nearby pilot plant
- sophisticated prototypes for testing the functionalities and for further fine-tuning
- list of properties and parameters for strength (e-modulus) for each material on demand

Further information at Kb-Hein.de
Simulation instead of trial-and-error using fem (finite elements method) analysis

**OUR OFFER**

- for almost any material (e.g. metal, glass, plastics)
- analysing sealing behaviour, acoustics, thermal insulation, dynamic deformation, strength, unwinding behaviour

**YOUR BENEFIT**

- **parts characteristics** can already be analysed before part is actually being manufactured
- **collision observations** are ensured using work movement
- verification using **computer tomography** possible

In this example, an increase (> 50 %) of load capacity of an oscillatory element after part optimisation was verified with FEM.

membrane seal for printed circuit board: functionality of sealing verified with fem
Determine product shrinkage

"Is your production rolling or are you still rolling the dice?"
SHRINKAGE EXPERT METHOD

The effects of fibre orientation will also be determined by measurement in the injected test geometries. The results may be used as a reference for shrinkage determination or for simulation purposes.

volume contraction of non-reinforced polypropylene (PP) can be up to 20%

YOUR BENEFIT
- determine shrinkage at a high precision
- determine shrinkage allowance for your tool
- establish company-specific databases for shrinkage and warpage

OUR OFFER
- methodical measurement of shrinkage
- references for more accurate shrinkage and warpage forecasts
- data for your simulation system
- support with setting up your specific database for shrinkage and warpage

Further information at Kb-Hein.de
An injection moulding simulation shows filling and cooling (thermoplastics) or cross-linking (silicone / rubber) while including the influence of the tool (e.g. temperature regulation and feed situation) – before the tool has actually been designed.

Qualified simulation and expert interpretation of results allow for recognising possible defects of the moulded part and/or of the mould tool at an early stage thus providing the basis for parts optimisation.

Our additional report analyses individual results in more detail.
Simulation - potential for optimisation

WE ANALYSE

- warpage
- cycle time
- clamping force
- part defects such as weld lines and trapped air
- injection pressure on core(s)
- identifiable potential for optimisation
- planning and calculation

Further information at Kb-Hein.de

Our additional report analyses individual results in more detail.
On the basis of the results from the injection moulding simulation of the ACTUAL state, the part can now be optimised.

Using sectional views and illustrations we devise suggestions for parts optimisation, feed gate design and temperature regulation. Those will then be implemented in different ways and verified using further simulations or FEM analysis.

Qualified optimisation will result in quality products!

- reduced cycle time
- better part quality
- faster project cycle
- larger process window
- reduced warpage, improved compensation of shrinkage and wall thickness relations
- fewer part defects
The results from parts optimisation will be verified using further simulations or FEM analysis.

There may also be a calculated negative correction or a determined allowance for components reinforced with glass fibres. Using the Shrinkage Expert Method an early negative correction becomes possible.

Thus, the best possible result for the part's geometry may be obtained.

At this point, all parameters regarding feeding, temperature regulation, heating times (e.g. for rubber) and separations are available and tool design can be done very quickly and on a solid basis.

After optimisation, the following results could be obtained in co-operation with the customer:

- warpage reduced by 71%
- weight reduced by 15%
- cycle time reduced by 70%

Project "housing": warpage considerably reduced after optimisation

Optimised 3D part

Pictures by Festo GmbH & Co. KG

YOUR BENEFIT:

- high process reliability
- improved part quality
- avoiding revisions
- optimum preparation of tool design
- when implementing results into IsoForm® tool design good parts frequently at first sample run
Tool temperature regulation

OUR OFFER

- simulation of regulation
- design of temperature regulation
- close-to-the-contour, cycle-dependent and/or variothermic temperature regulation
- different media: air, water (up to 220°C), oil, coolant (CO₂) etc.
- HeiNo® redirection elements

For obtaining a good part quality, any plastic material needs its own determined mould wall surface temperature that should be attained homogeneously or individually and cycle-dependent.

In an injection moulding simulation, the temperature regulation is already being dimensioned before the tool itself has been designed. The simulation informs about the heat exchange on the tool's surfaces and about its influences on the product during injection moulding.

The temperature regulation system is designed close to the contour or cycle-dependently using either drilling, laser melting, vacuum brazing or special materials. Holes for temperature regulation should always be round and connected for forced circulation.

YOUR BENEFIT

- reduced cycle time
- high surface quality
- less wear at the tool
- process-reliable production
- high quality of moulded part

HeiNo® redirection element ensures round section of holes for temperature regulation.

Simulation of regulation

holes + connecting nipples + coupling + tube: homogeneous round sections are important!

HeiNo® redirection element ensures round section of holes for temperature regulation.

animation with media flow

temperature regulated close to the contour with exchangeable IsoForm® tool
Depending on the material, feeding needs to be designed for low pressure and shear, with controlled shear, dead runner, balancing etc. in order to ensure a process-reliable production without part defects. Frequently, the formation of streaks, vacuoles or air traps and an inadequate surface structure of the part are pre-determined at this point.

For the past couple of years, new additives in plastic materials have called for comprehensive ventilation in injection moulding tools. HeiNo® geometries for ventilation feature a comprehensive ventilation of the mould inside of as well as around the cavity. This improves the quality of weld lines and allows for a controlled ventilation of both the part and the feed area.

**OUR OFFER**

- feed area design
- temperature regulation of gate
- low or controlled shear, dead runner, flow speed reduction etc. on demand
- comprehensive and controlled ventilation inside of as well as around the cavity

**YOUR BENEFIT**

- high part quality
- reduced cycle time
- maximum packing effect
- less part defects
- lower energy demand
- process-reliable production
- customised
Focus: Avoiding weld lines

**OUR OFFER**

- mould flow simulation for identifying weld lines
- definition of overflow area (for re-orientation of glass fibres, if applicable)
- specification for optimum installation of HeiNo® overflow ventilation insert

The protected HeiNo® overflow ventilation insert improves the quality of weld lines and allows for a controlled ventilation of the part area thanks to special ventilated HeiNo® ejectors.

The intense ventilation takes effect up to the end of filling and also guarantees the discharge of substrates preceding the flow front. The overflow area will ideally be defined using an injection moulding simulation in order to obtain a good weld line quality and resilience by re-orienting the glass fibre in the weld line. The weld line should close by definition before the overflow cavity of the overflow ventilation insert is filled. The filled overflow cavity will then be separated and removed like a tunnel gate.

**YOUR BENEFIT**

- controlled ventilation of part and feed gate areas
- high weld line quality
- increased resilience
- comprehensive ventilation

**HeiNo® tunnel gate with overflow ventilation insert**

parts optimisation thanks to overflow ventilation

**animation of HeiNo® overflow ventilation**
Mould design

**OUR OFFER**
- **injection moulding tools** for thermoplastics
- **hot press tools** for thermosets
- **pressure moulding tools** for zinc and aluminium
- **elastomer moulds** for rubber and silicones
- **special tools** for hybrid applications

**YOUR BENEFIT**
- state of the art
- long tool life
- process reliability
- optimum ventilation (e.g. using vacuum forming)
- high precision

*We also offer tool design for the following special technologies:*
- multi-component
- sandwich
- foaming
- tandem solutions
- collapsible cores
- unscrewing solutions
- transfer moulding
- gas: injection, cooling, counter-pressure, external gas moulding
- film back injection moulding

---

**IsoForm®**

*IsoForm® tool* for rubber processing

*pictures by Rohde und Grahl / MBS UG*

*IsoForm® exchangeable tool*

---

*Historic project: tool "contact socket" - no burrs on the inside despite filigree separations*

Further information at Kb-Hein.de
Developed using the TRIZ method, the isolated tool concept IsoForm®, together with HeiNo® standard elements for gates, ventilation and temperature ventilation, forms the basis for a holistic approach to tool design with the subsequent advantages for process reliability and efficiency with regard to quality, costs, time and energy requirements.

IsoForm® and HeiNo® standard elements are distributed by Nonnenmann GmbH.

Please order our “IsoForm®” and “HeiNo®” brochures or get current information from Kb-Hein.de

---

**OUR OFFER**

- thermal separation
- consistent hub-centring
- innovative ejection frame
- can be combined with almost any application and system
- tool change systems

---

**YOUR BENEFIT**

- high process reliability and energy efficiency
- for any kind of temperature regulation
- high precision due to hub-centring
- reduced deflexion
- reduced follow-up costs
- perfect for automation, change of inserts and tools

---

Further information on IsoForm® in our IsoForm® brochure.
What is an IsoForm® tool?

**FEATURES**

- consistent isolation of the contour-forming area
- consistent hub-centring of all inserts, mould plates and mould halves with regards to one another
- maximum support thanks to ejection frame

**IsoForm® tool (section)**

**IsoForm® BASIC**

- cost-optimised standard
- includes basic isolation and centering
- may be upgraded with ceramic centring elements at any time
- costs comparable to conventional mould units

**IsoForm® PREMIUM**

- optimum solution for all advantages
- highest degree of isolation
- consistent hub-centring
- ceramic centring elements

Further information at Kb-Hein.de
Gas injection GIT - WIT water injection

Gas injection - GIT

- controlled packing pressure
- tension-free and low-distortion part
- for different wall thicknesses within the part
- better cooling effect
- low closing pressure
- reliable process at high quality

With the aid of cross-sections the gas is guided to the relevant areas where it compensates volume contraction. Thus, the gas assumes the role of the packing pressure at a constant level for the entire workpiece.

Polarisation films on the overhead projector (see upper picture at the centre left) expose the lower potential for tensions in the workpiece with GIT.

Partner project GRIFF (companies Stieler und Hein): In this special WIT process, the part is partially filled with water which is then pressed, at high pressure, into the blind hole that has been formed. The water is then extracted well-controlled from the part in order that the part leaves the tool almost dry.

Water injection - WIT

- short cycle times for appropriate geometries (only round geometries, such as pipes for the passage of media, can be manufactured with relatively constant wall thickness)
- With mass clusters, a shrinkage of the volume cannot be compensated as easily as when gas injection is used.

For water injection, the excellent thermal conductivity of water is used to achieve a favourable cycle. Different procedures such as partial filling or auxiliary cavities can be applied.

The picture on the right depicts the small inlet and outlet orifice for water injection with a blind hole.

The picture at the centre-right of this page shows the homogeneous wall thicknesses that are produced.
You would like to present your ideas, design visions or concepts to your supervisors, customers or colleagues at an early stage - using photo-realistic images of the product, the production process or the mould tool?

Using rendering we turn your 3D data into realistic images and animation which visualise parts, tools and prototypes.

According to your specifications the functionality of your product or the injection moulding process may be shown as film clips - before the part has been produced or the tool has been manufactured.

**OUR OFFER**

- **realistic product and/or tool visualisation** using **rendered images**
- **part demonstration** before start of series production
- **animations** of product functionalities and/or production processes

**YOUR BENEFIT**

- photo-realistic demonstrations for **presentations** (up to 4K)
- vivid **documentation** of the progress of a project
- early animations of **functionalities** or **processes** to help decision making

Further information at Kb-Hein.de
Co-operation projects

- IsoForm® projects "espresso cup", "HeiNo® redirection element" and "cover"

- project "Shrinkage Expert Method": co-operation project for methodically measured shrinkage with Simcon kunststofftechnische Software und KB Hein (see p. 9)

“The thanks to our long and close co-operation with Konstruktionsbüro Hein we are always able to identify difficult areas on the most different parts quickly and flexibly and to then come up with suggestions for optimisation together. This means that we can always offer competent solutions to our end-customer that will result in an improved final product.”

(Benedikt Ostermann, Josef Mawick Kunststoff- Spritzgusswerk GmbH & Co. KG)

Partners "espresso cup": Konstruktionsbüro Hein, Nonnenmann, BARLOG plastics, Günther Heisskanaltechnik, Simcon, Werkzeugbau Wollenburg and Wittmann Battenfeld

Partners "redirection element": Konstruktionsbüro Hein, Nonnenmann, Sigma Engineering and Wittmann Battenfeld

technology partners

- prototype construction or test series at nearby pilot plant

- tool testing, e. g. with Wittmann Battenfeld

- co-operation with research institutes and universities
Our courses and training programmes are always adapted specifically to the participants’ requirements (company course).

According to our motto "From idea to series production" in plastics technology we are able to establish a training concept that meets your needs.

Frequently, trainings are held at our customers' premises in order to integrate current projects and difficulties easily into the training process.

In co-operation with the German expert associations WIP Kunststoffe e.V. and SKZ (Peine) we also offer trainings and workshops in the fields of product development, injection moulding, tool design, parts optimisation etc.

### OUR OFFER

- project training
- injection moulding for its users (basics, product development, tool design and construction)
- special processes
- training "part failure"
- expert lectures

### YOUR BENEFIT

- close to practice (examples from over 30 years of KB Hein)
- project-oriented / inhouse
- with regard to the participants (e.g. for product developers, design engineers, toolmakers, injection moulders, heads of production, business people)
- co-operation with partners
Your task ... our solutions

OUR OFFER

- interpretation of defects
- implementation of parts optimisation
- drafting of constructive solutions
- verification of solutions using simulations
- trouble shooting
- CT for reducing sample runs

We interpret defects and work out constructive solutions in order to eliminate them.

Our injection moulding simulations ensure that problems with ventilation won't arise or we devise new solutions for ventilation together with our customer.

When the part fails we optimise the part using fem analysis and injection moulding simulation. By subsequently developing constructive modifications of the part and optimisations of the tool (e.g. for the gate) we find ways to ensure that the part meets the requirements in the future.

Make use of our experience for problem solving!

Part defects that can be avoided

- weld line
- ventilation
- streaks
- rib relation
- sink marks
- warpage

YOUR BENEFIT

- suggestions for optimisation verified by simulation and fem analysis
- elimination of part defects
- fewer sample runs
- avoiding potential sources of defects in the future

part failure
If potential for optimisation detected at an early stage is used, e. g. to improve wall thickness relations, weld lines, air traps and temperature regulation, the process capability will be increased while cycle time and maintenance effort will be reduced. Together with you and your team we will devise sustainable measures for optimisation.

**OUR OFFER**

- competence - expert on site
- process check on site
- evaluation and suggestions
- optimisation on site
- project training

**YOUR BENEFIT**

- reduced project time and lower costs if optimisation has started early
- increased process reliability
- improved effect of temperature regulation
- increased part quality
Press review
We are a team of specialists with professional backgrounds in practice. As a family-owned company, we have been striving for innovations, challenges and fair co-operation since 1986.

Homepage: Kb-Hein.de
E-mail: info@KB-Hein.de
tt@KB-Hein.de

Data exchange: ftp server (access data via e-mail)

How to reach us: Kb-Hein.de/english/contact/

Address: Konstruktionsbüro Hein GmbH
Marschstraße 25
D - 31535 Neustadt
(near Hannover)

Phone: + 49 (0) 50 32 / 63 15 1
Fax: + 49 (0) 50 32 / 63 11 6
The 20th edition of the renowned event for professionals in the plastics and tool and mould-making industry, the Hein Technology day, did not disappoint. The event attracted 550 visitors on 19 February. The various presentations on a diverse range of topics including hot runners, materials, injection moulding, design, additive manufacturing and many more completed the program.

ETMM 2016-03-02