Cooling pipes using GIT / WIT

- Air-cleaning-technique into overflow cavity

- Air-cleaning-technique into screw channel
  Branches into additional overflow cavities

GIT-Cooling pipe out of Durethan

Actual technique:

- Bending of pipes
- Solder on of ramification and functional elements
- Painting

Advantages of GIT-processed Durethan cooling pipes:

- reduction of costs
- reduction of weight
- no corrosion
- high grade of automatisation

Kühlwasserrohre aus Durethan

GIT-Cooling pipe out of Durethan

Target:

Substitution of sheet metal in cooling pipes with Durethan

Activities:

Material development:

- smooth interior surface
- good hydrolysis stability

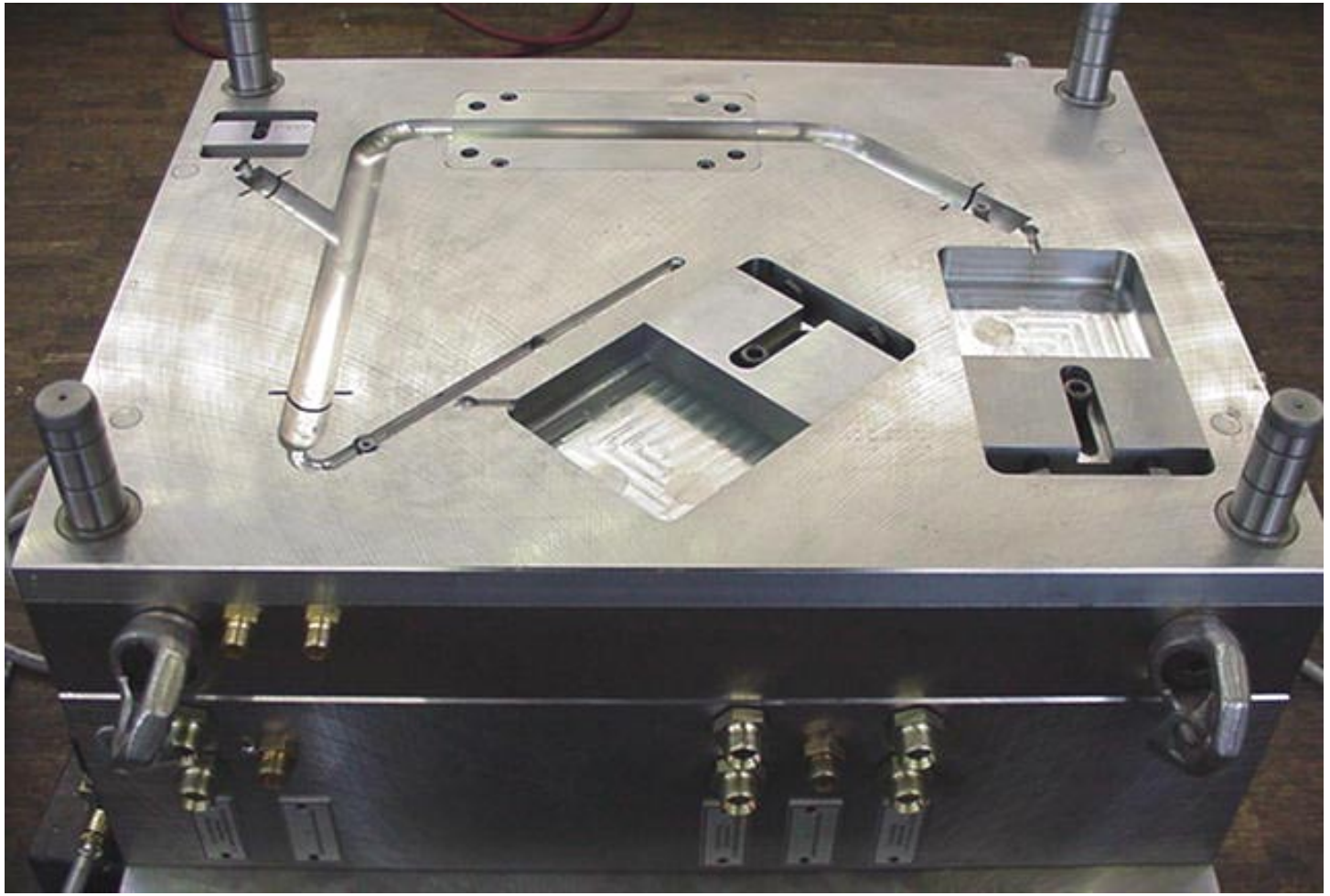
Processing technique:

- greater wall-thickness
- uniform wall-thickness distribution

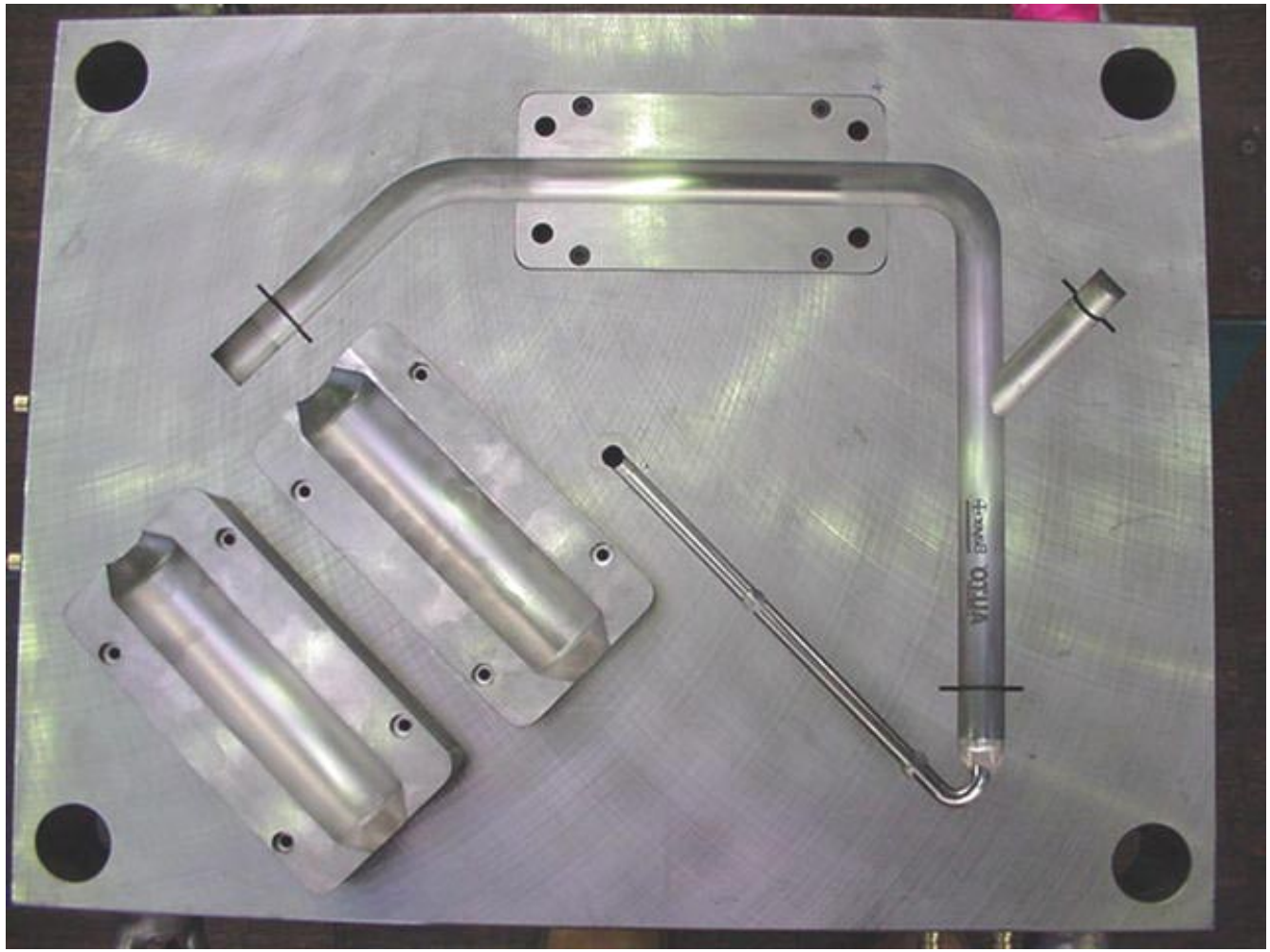
Cooling pipes out of Durethan

GIT/WIT - Trial pipe

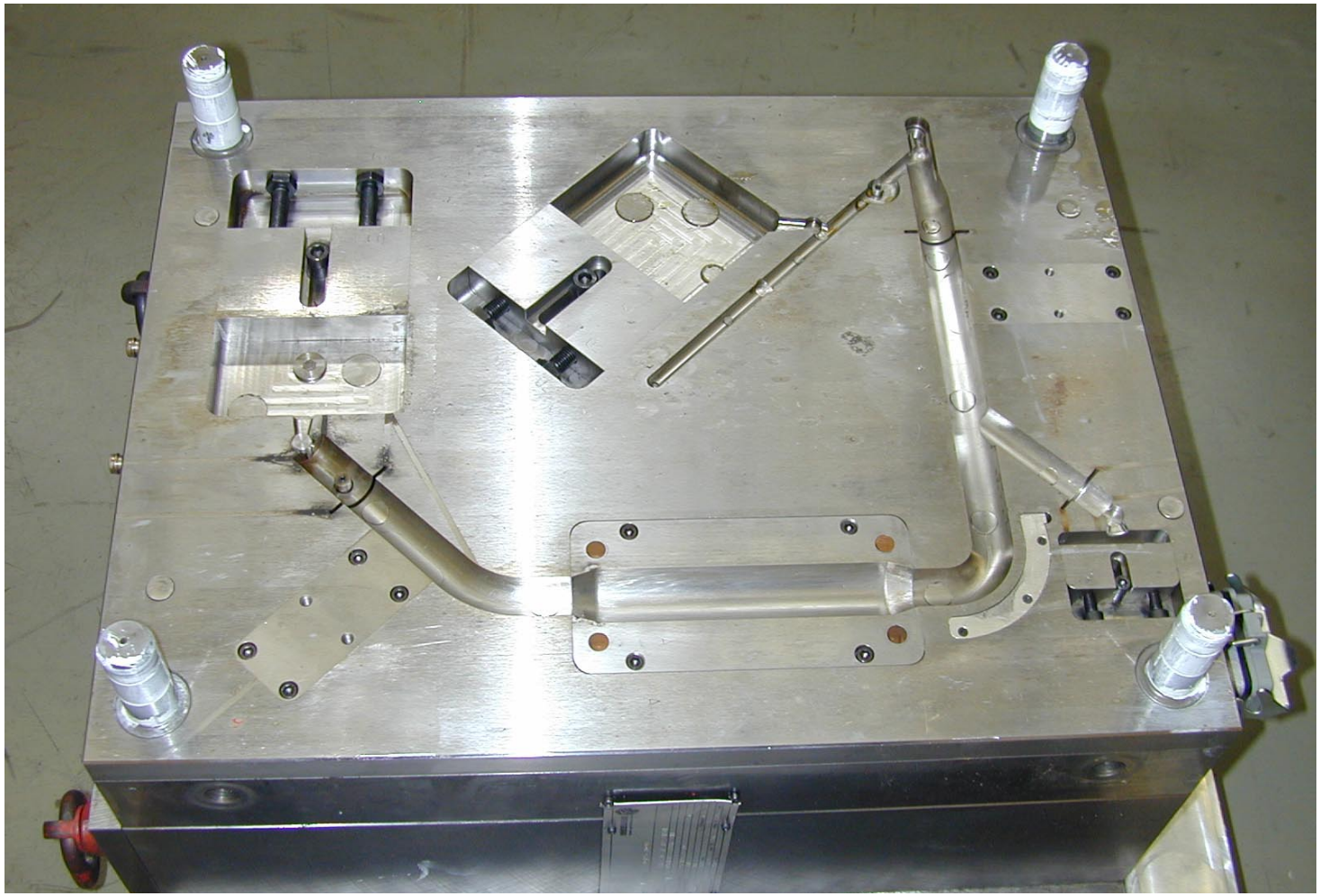
GIT / WIT tool (status of first delivery)



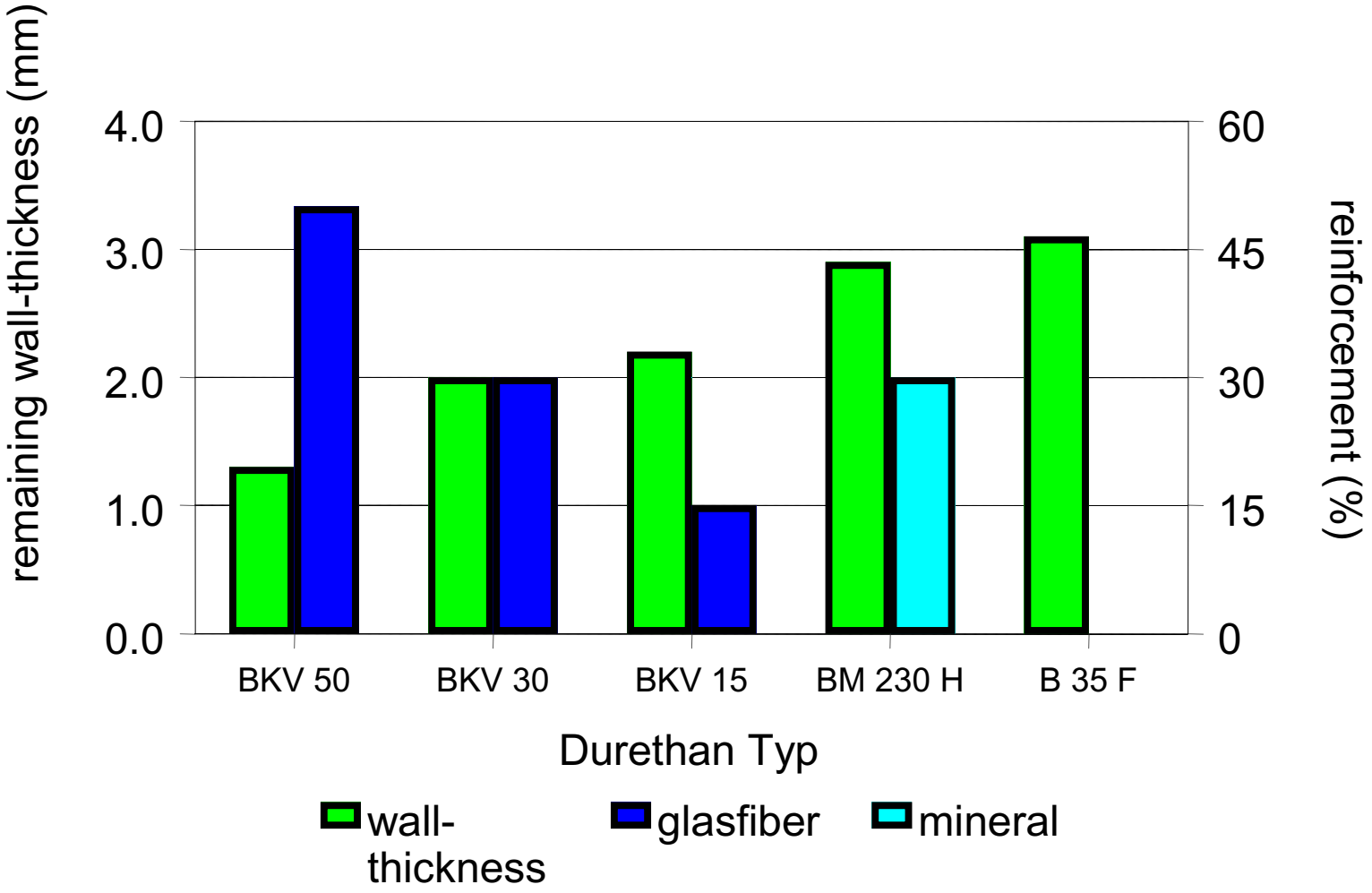
GIT / WIT tool (status of first delivery)



GIT / WIT tool (optimized)



Influence of reinforcement



Cooling pipes in different materials

PA 6.6 GF 30

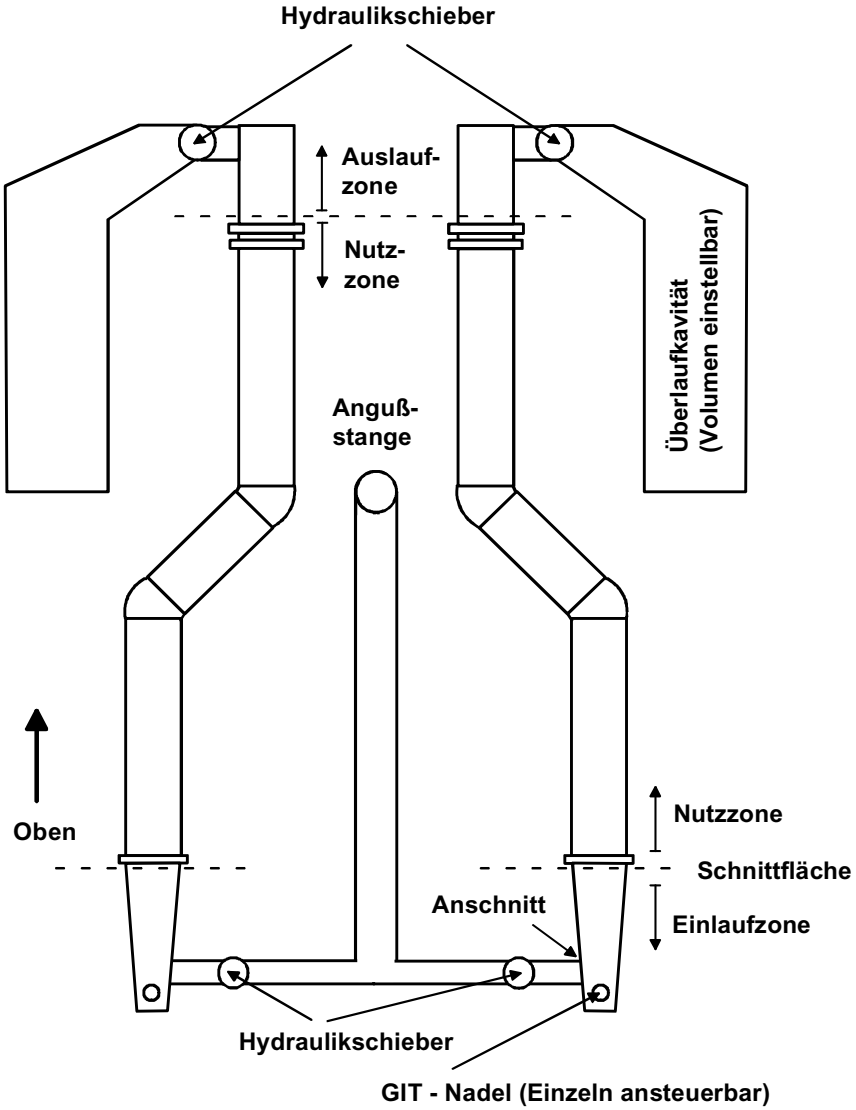
Durethan KU2-2224/30H2.0

Cooling pipe out of standard PA 6.6 GF 30

Cooling pipe out of standard PA 6.6 GF 30

Cooling pipe out of standard PA 6.6 GF 30

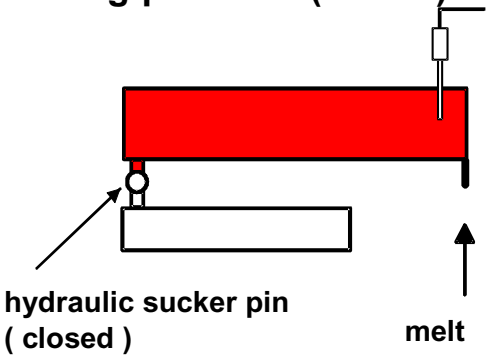
Cooling pipe out of standard PA 6.6 GF 30



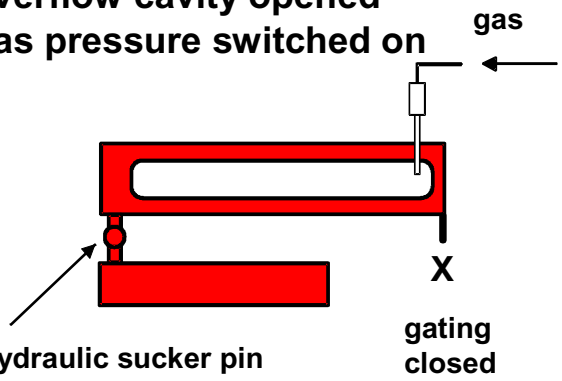
GIT - pipes (double, tool draft)

Air- cleaning technique

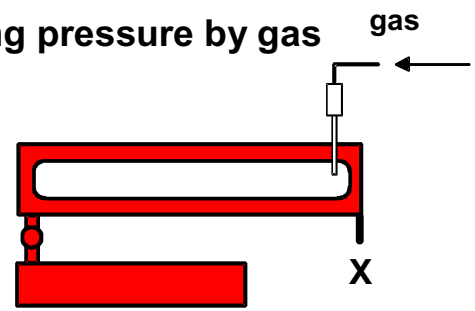
A stage of injection with holding-pressure (short)



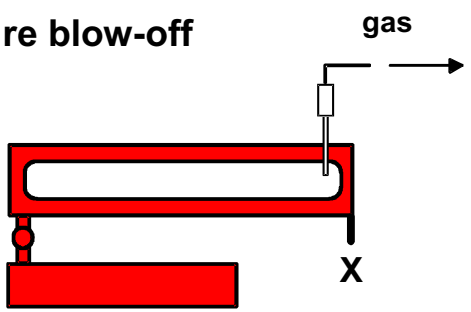
B overflow cavity opened gas pressure switched on



C holding pressure by gas

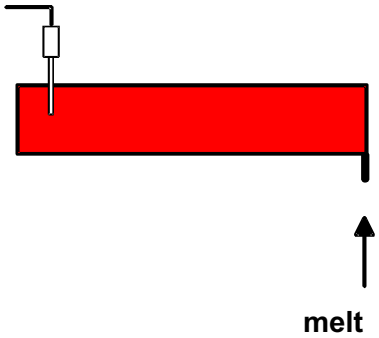


D pressure blow-off

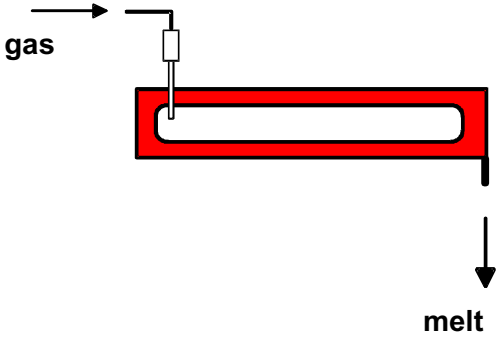


Air-cleaning-technique into screw channel

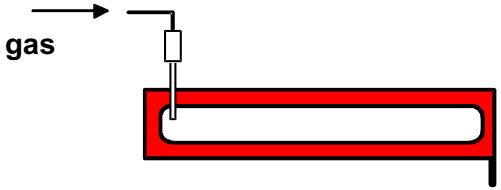
A stage of injection with holding-pressure (short)



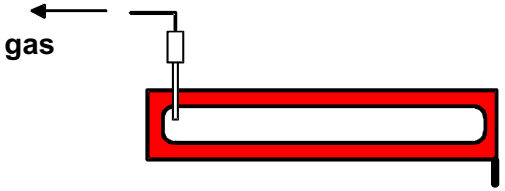
B gas pressure switched on melt into screw channel



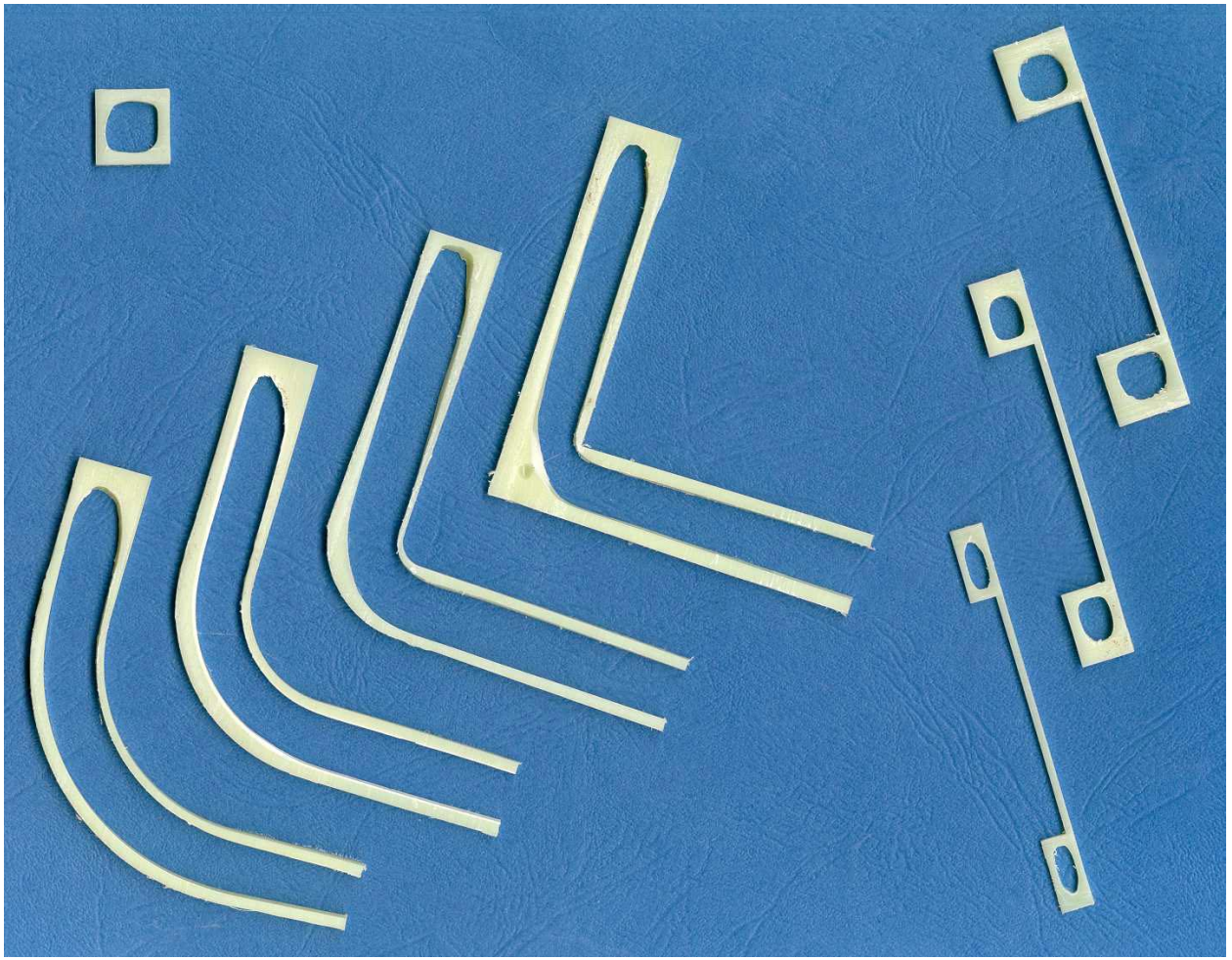
C holding pressure by gas



D pressure blow-off



Influence of geometry on gas bubble



WIT - Water Injection Technique

Analogous to GIT following techniques can be used :

⇒ **Blow-up technique (standard)**

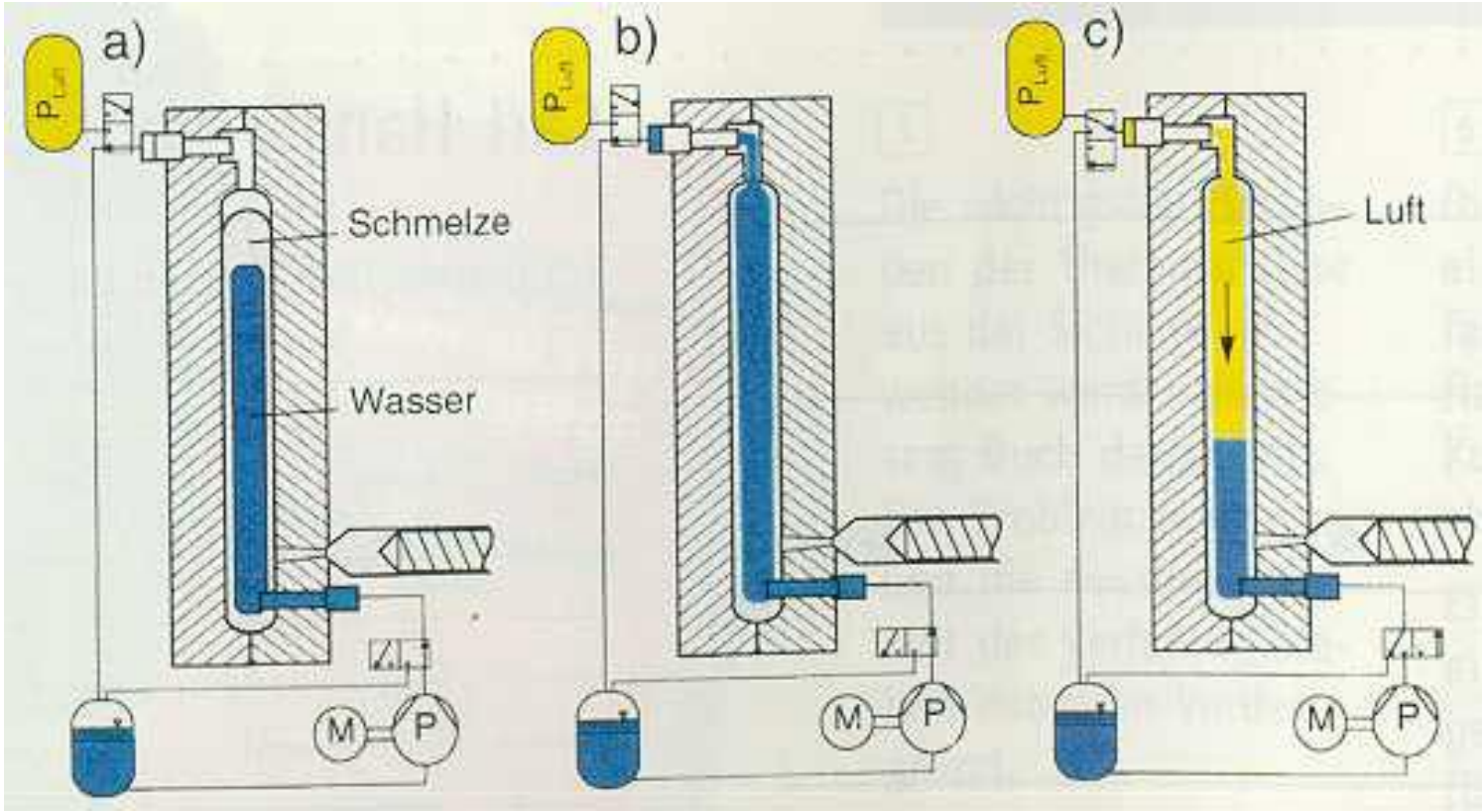
⇒ **Blow-out technique**

- **into auxiliary cavity**
- **into screw**

⇒ **Core puller technique**

Quelle: IKV, Aachen

Processing flow sheet (one possibility)



Quelle: IKV, Aachen

Processing

After melt has been injected into cavity part is formed by injected fluid
Subsequently the water must be removed by :

- ⇒ **Blowing Out with air pressure through second injector gate**
- ⇒ **Alternated airpressure injection through water injector gate**
- ⇒ **Outflow by gravity**
- ⇒ **Evaporation**
- ⇒ **Coinjection of a liquid blowing agent**
- ⇒ **Removement exterior the tool**

Additional possibility: Water remains in the part

- ⇒ **Using as incompressible core**
- ⇒ **Raising of part weight (higher valence --> door handle) Erhöhung**
- ⇒ **Optical effect (tooth brush with glimmer)**

Quelle: IKV, Aachen

Application fields

GIT well used for:

⇒ thick-walled rodformed parts
⇒ ribbed parts with great surface
⇒ combination of thin- and thick-walled regions
⇒ Avoidance of sink marks at mass accumulation (dome,ribs,etc.)

Due to better cooling effect WIT is suitable for greater rodformed parts (no effect of foam up)

Quelle: IKV, Aachen

Dis- and Advantages in comparison to GIT

Advantages:

- ⇒ **shortened cooling time up to 75%**
- ⇒ **no effect of foam up; therefore greater part diameter realizable**
- ⇒ **cheap medium**
- ⇒ **low costs for equipment**
- ⇒ **stage of injection possible to check because medium is incompressible**

Disadvantages:

- ⇒ **risk of water leckage in case of mistakes**
- ⇒ **risk of holes in case of too low water pressure**
- ⇒ **process of water removement is necessary**
- ⇒ **partially greater injector gates necessary**
- ⇒ **use of corrosion inhibitate tool metal advisable**
- ⇒ **not possible to use in combination with all materials (e.g. amorphous grades as PS, PC , PA, PP, PE has been tested with positive results)**

Quelle: IKV, Aachen

Effect of foam up / building of holes

Bild 8. Ursachen für Schaum- oder Lunkerbildung bei GIT und WIT

Quelle: IKV, Aachen

Comparison of remaining wall-thickness

⇒ in case of WIT remaining wall thickness can be influenced by rheological properties of materials and additionally by process parameters (e.g. time of retardation)

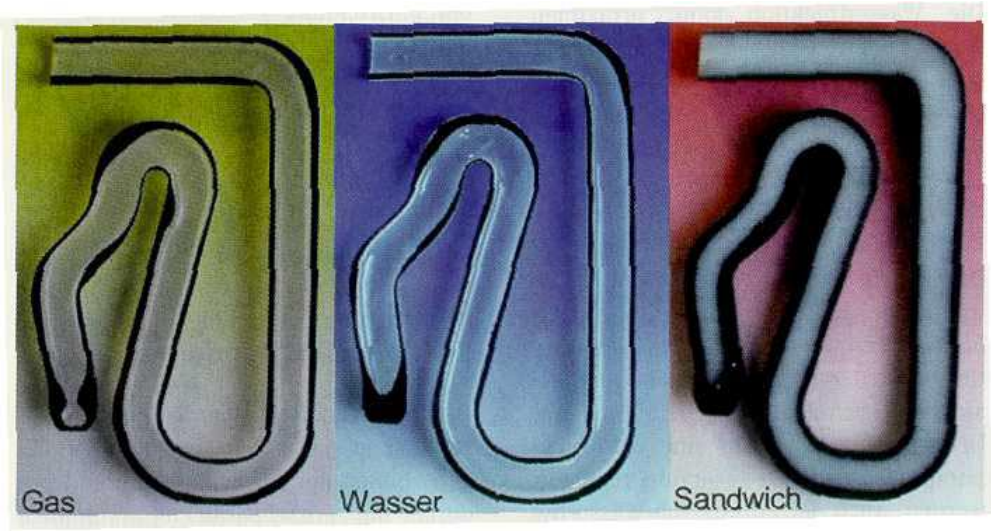
⇒ in comparison to GIT less remaining wall thickness in tendency

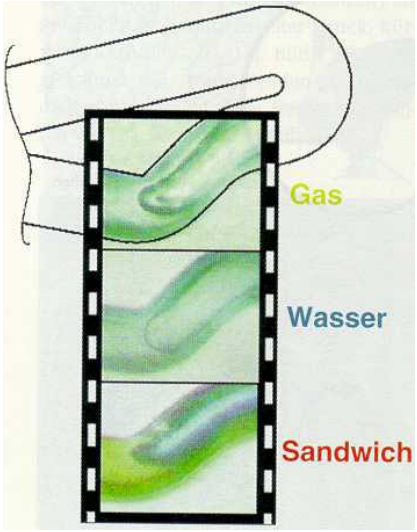
⇒ improved uniform remaining wall thickness (interior & exterior) at curves

- in comparison to GIT improved centering by higher inertia effect of water column)
- therefore improved wall thickness ratio all over the part length

Quelle: IKV, Aachen

Remaining wall thickness at curves





Quelle: IKV, Aachen

Cooling Pipes
Comparison Of Different Processes

Characteristic	GIT	2-Shell	Blow Moulding
Wall thickness distribution	little influenceable hangs off of material and procedures	very precisely, influenceable by tool modification	well influenceable by (partial) wall thickness control
Wall thickness changeable through	practically not influenceable	complex tool modification	at the machine adjustable
Integration of Fastening parts	(very) high	very high	high
Hard soft combination	yes; sandwich and composite injection moulding	yes; composite injection moulding	ja Coex; Seco
max. part size	no limitation	no limitation	no limitation
max. diameter	ca 30-40 mm	nearly no limitation	120 mm

Cooling Pipes
Comparison Of Different Processes

Characteristic	GIT	2-Shell	Blow Moulding
possibility of geometrical design	very high	limited	very high
interior surface quality	depending on used material	excellent	depending on used material
exterior surface quality	(very) high-quality	very high-quality	high-quality
fashioning	evtl. separation of gate and overflow	evtl. gate separation, welding	separation of pinch-off and lost heads
branchings	possible	possible	possible by over crimpings not possible in 3D-process
material	no special request	weldability	weldability (for conventional Blow Moulding) high melt stiffness