



BRIGHT MINDS,  
BRIGHT LIGHTS.



**ZKW Mold Standard  
Purchased Parts**  
VERSION 04 - STATUS 03/2020



# BRIGHT MINDS, BRIGHT LIGHTS.

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# BRIGHT MINDS, BRIGHT LIGHTS.

## AIM OF THE MOLD STANDARD

This mold standard provides the mold supplier with comprehensive information about the expectations of ZKW concerning an injection molding mold.

The aim is process-secure molds at the highest standard of quality with the shortest possible cycle times.

The mold supplier manufactures molds in accordance with state-of-the-art technology.

The mold supplier is invited to work with us on continuous improvement of the molds with regard to quality and costs and their execution standards.

Deviations of the following standards and tool specification must be always agreed with ZKW when requesting the molds.

With submittal of quotation means that you accept the content of this ZKW mold standard.

### Scope:

This mold standard applies to all future order detail for series-produced plastic molds for locations ZKW Lichtsysteme GmbH (Wieselburg), ZKW Slovakia s.r.o. (Krusovce), ZKW Lighting Systems (Dalian) Co. Ltd. (Dalian) und ZKW México S.A. de C.V. (Silao).

Headquarter: ZKW Group GmbH, Rottenhauser Straße 8, A-3250 Wieselburg

Index	Date	Changes
Version 1	10/2018	Creation
Version 2	12/2018	Changes in chapters 1, 2.1.3, 2.4, 2.10, 2.11, 2.13, 4.1.1 and 5.3
Version 3	08/2019	Chapter 2.12 change of heading; chapter 2.13 added
Version 4	03/2020	Changes in chapter 2.10 and 2.13
Created : O/GP-C2 Kastenhofer H.		Approved: See SharePoint – IMS Portal

## 1 GENERAL REGULATIONS

- The scope of the necessary simulations is defined in the tool specification. This is part of the delivery contents. During the kick-off meeting the results of the simulation will be reviewed and approved.
- In general, you must use standard parts and the suppliers in accordance with this mold standard.
- On all heavy component parts (> 20kg) you must provide standard screw threads (at least M12) for eye bolts to make removal and installation easier.
- All non-formative components must not have sharp edges.
- Assembly aids for complex mold inserts (grained, high gloss polished cores) must be manufactured and sent along with the first mold delivery.
- Eye bolts for mold transport and assembly and disassembly must be positioned in such a way that the mold or mold components are well-balanced.  
On all molds, 3 screw-in positions for eye bolts must be provided on the top surface (for the center of gravity of the entire mold and the center of gravity of the individual halves of the mold). If an additional bracket becomes necessary, it must be designed in such a way that it does not require disassembly during the manufacture.
- On mounting plates you must provide lateral installation screw threads. On molds that are used on 250 ton machines and larger, you must provide 4 installation screw threads on each main split surface in the molding box. This allows the mold to be tilted over more easily.  
All the eye bolts should be able to be installed and removed without having to carry out any additional dismantling work.

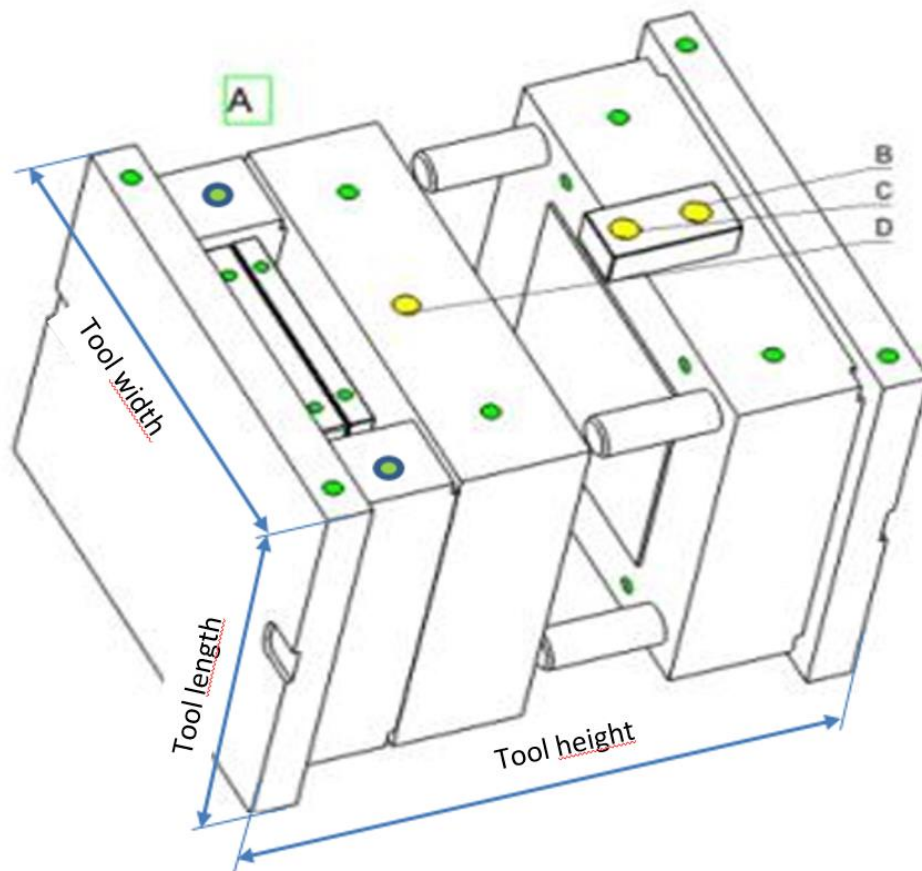


Illustration 1: Mounting thread (A), transport thread for entire mold (C), transport thread for mold halves (B + D)

- The article positioning at 1+1-cavity or 2-cavity molds should be arranged as in the illustration below, it is not allowed to arrange the cavities one above the other. For multi-cavity molds, the article position shall be agreed with ZKW.

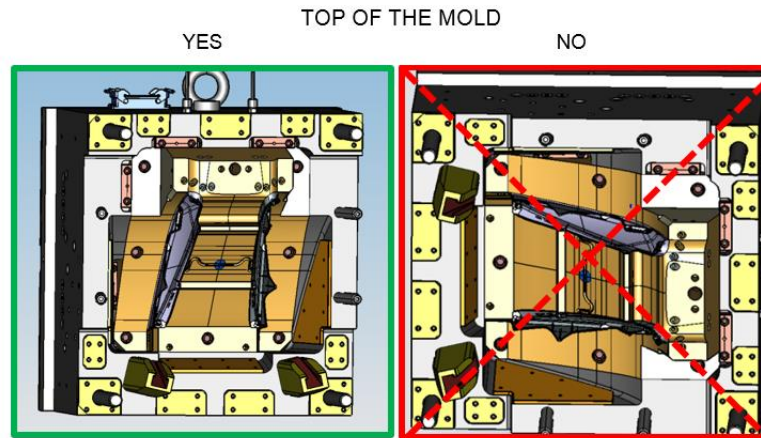


Illustration 2: Example of part array in the mold

- In case of change versions of the article the exchangeable inserts always have to be marked with the version number, e.g.:
  - Base version WZ004614\_1039.**001/002**.0030 Bezel cover frame ECE
  - Change version WZ004614\_1039.**009/010**.0900 Bezel cover frame SAE

## 1.1 Communication

- In general, and after the mold has been ordered, all communication takes place between the relevant ZKW mold manager and the supplier. With all information exchange, these two partners must be informed, at least by sending them a copy of the communication. Agreements concerning costs, deadlines, modification status must always be executed in writing by both partners.

### 1.1.1 Document names – nomenclature

- The following standard must be adopted for improved document location:
  - WZ Nr. [mold-no.] Content\_yymmdd (avoid umlauts and special characters)  
e.g.: WZ005678\_cooling layout\_V2\_140223

## 1.2 Data exchange

- The transmission of the data is to be made with our web portal „ZKW DateExchange“ (<https://dataexchange.zkw.at>).
- After the signing and sending of the non-disclosure agreement the supplier gets his login data.
- Each data set transferred must be sent together with the correctly completed data accompanying sheet to the relevant mold supervisor.
- At the position „format“ you always have to use „Native“. With this setting the data will not be converted automatically by the server (step remains step and CATIA V5 remains CATIA V5).

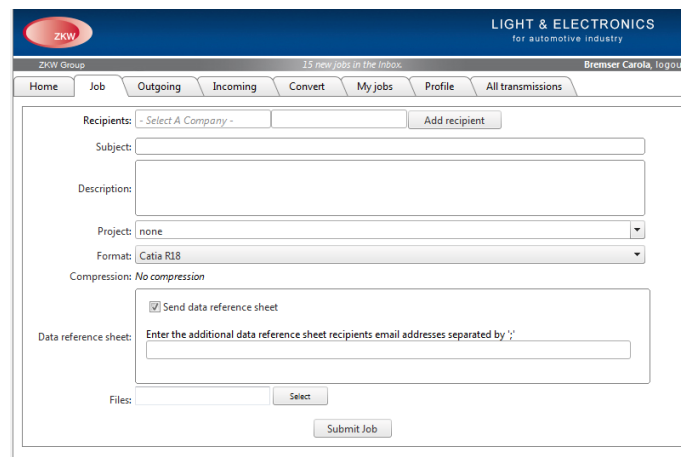


Illustration 3: ZKW DataExchange System

## 1.3 Object of supply, scope of supply

- The object of supply and the scope of supply are defined in the enquiry by the mold specification list, the ZKW mold standard and the table "Process of mold procurement" and the purchase order.
- The scope of supply for a project always consists of the mold by itself, full documentation in the toolbox – incl. the further defined data to be transmitted for unrestricted use, possible distribution and free disposal – and the competent injection molding process. As the occasion arises, any deviations from the aforementioned standard case shall be negotiated between ZKW and the supplier.

## 1.4 Scope of delivery of data

### 1.4.1 3D design of mold

- The mold no. [WZ Nr.] must always be specified in the subject line when transmitting data, so that the data transmission can be assigned correctly. The denomination of the parts and assembly groups must be provided in German and English. (Meaningful markings and/or with the part number from the part list, umlauts and special characters are not allowed)
- A commercial license of a CAD program (e.g. CATIA V5 R19, UG NX 8.0, Pro-E, Solid Edge, Solid Works, etc.) must be used for the mold design. The tool design has to be a 3D-model made of solid parts with structure tree. 2D-, 2,5D-(wire frame models) and 3D-area models are not allowed. 2D-drawings must have a neutral or ZKW title block. Title blocks from the supplier are not allowed.
- Note: The quality and completeness of the data will have influence on the supplier assessment.
- **Admissible data format:**
  - CATIA V5 from R19
  - STEP AP 214
  - Parasolid (\*.x\_t)
- Data from CAM systems (e.g. PowerShape, MasterCAM, etc.) are considered mold documentation, NOT mold design. The responsibility for the use of noncommercial licenses lies with the supplier. In both cases, the invoice release may be rejected.
- **Tolerances:**
  - The following tolerances must be complied (for all parts) with during the mold design:
    - Length tolerance (point consistency): max.  $\pm 0,001$  mm
    - Angle tolerance (tangents consistency): max.  $\pm 0,1$

- **Mold complete**

- The 3D-model of the tool always has to be complete and needs to have the following main assembly groups:
  - Injection side (fixed side)
  - Ejection side (moving side)
  - Ejection unit/ ejection device
- Interchange formats (STEP / Parasolid): When more than 400 MB file size the main assembly groups should be exported in separate files.
- Quick release pins, eyebolts, or other auxiliary devices and parts which are applied on the mold have to be implemented in the 3D data set too.

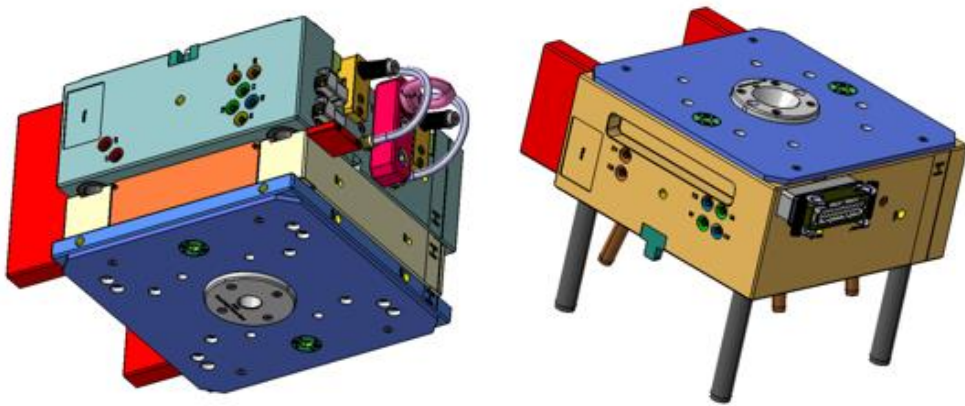


Illustration 4: Ejector side and nozzle side own modules

- **Article + sprue** (including shrinkage in mold position) must be included in the 3D data as well as the hot channel system.

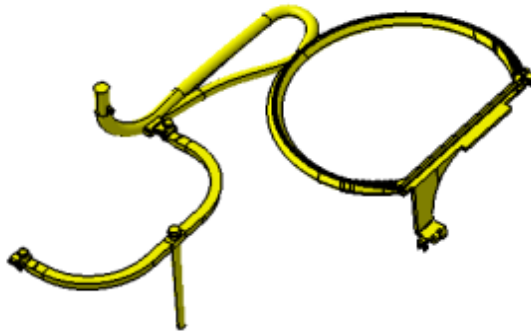


Illustration 5: Article with sprue



- **Sub assemblies**

The structuring in subassembly groups has to be done after functional units. For example, all parts that belong to a slider (inserts, pins, guiding elements, cooling connections etc.) including the slider itself are one assembly group.

General template:

- Article and sprue
- Injection side/ fixed side (FS)
  - FS-plates
  - FS-inserts/cores
  - FS-hot runner system
  - FS-tool tempering (cooling drillings „inverted“ as 3D-solid part)
- Ejection side/ moving side (MS)
  - MS-plates
  - MS-inserts/cores
  - MS-slider
  - MS-tool tempering
- Ejection unit
  - Ejector plates
  - Ejectors

## 1.4.2 Temperature maintenance layout

(Also required with prototype molds)

- The cooling layout is the illustration of the cooling circuits in the tool shown as 3D-view.
- Requirements:
  - The numbering of the cooling circuits with „In and Out“ has to be clearly. (IN1 / OUT1, IN2 / OUT2,...)
  - Numbering per side (Injection and ejection side) starting with number 1
  - The numbers have to be the same in the cooling layout as on the tool itself.
  - The markings of the cooling circuits in the cooling layout have to be linked with arrows or hint lines to the corresponding inlets and outlets in the illustration.
  - For each cooling circuit you have to use an own color, that can be easily distinguished from the others.
  - Allowed data formats: PDF, PowerPoint (\*.ppt / \*.pptx), Word (\*.doc / \*.docx), JPEG (\*.jpg), Bitmap (\*.BMP);  
Not allowed: e.g.: 2D-drawing formats (\*.dxf, \*.dwg, etc.)
- Structure:
  - A depiction of the cooling for the whole ejector side.
  - A depiction of the cooling for the whole nozzle side.
  - Separate depiction for each part or assemblies with an individual cooling circuit.

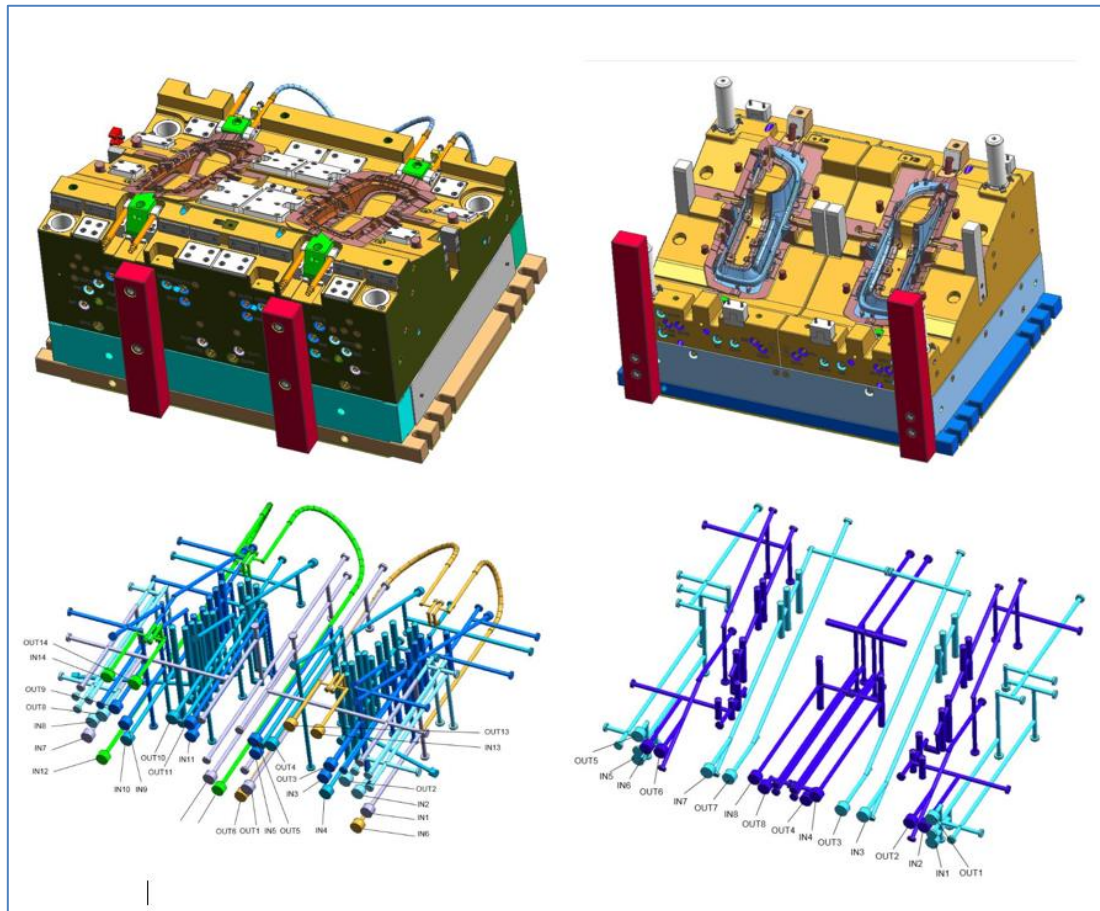


Illustration 6: Example cooling circuit scheme

#### 1.4.3 Hot channel and pressure loss report in data format: .pdf

- If a hot runner system is used in a tool the complete documentation has to be send to ZKW.

#### 1.4.4 Service and maintenance instructions, exchange documentation

(Not required with prototype molds)

- Disassembling manual and maintenance instruction have to be sent to ZKW together with the the tool 3D data.
- The disassembling manual has to show the single disassembling steps sequentially with images.
- Pay attention to the necessary maintenance intervals to operate a steady actionable tool.
- The maintenance intervals should be as long as possible (ideally more than 10,000 shots).
- Maintenance instruction must contain following information:
  - the needed maintenance intervals to operate a steady actionable tool
  - the necessary actions and equipment

#### 1.4.5 Mold certificates, heat treatment evidence

- Mold certificates and heat treatment evidence must be provided for all forming parts.
- The documentation of the coatings must be included in the parts list and in the WZ presentation.

#### 1.4.6 Detailed parts list:

- Each mold must be accompanied by a parts list for all components (mechanical, electrical, bought-out...) in German or English (depending on the industrialization site). These should contain the following information:

- ZKW article number und article designation (e.g.: 686.01.103/153.30 Reflektor FRA)
- ZKW mold number → e.g. WZ003830
- Part number → e.g.. T100; T200;
- Part designation e.g.. Schieber/Slider; Formeinsatz/Mold insert;...
- Material / steel nr. (inclusive advice regarding coatings)
- Quantity
- Supplier/ Manufacturer
- Rough dimensions
- Order number (for bought-out items)
- Heat treatment → e.g. 48-50HRC
- Coating bzw. surface treatment (e.g. CAVEO, DLC, nitrated, grained acc. 3D-data, etc.)
- Standard (ISO, ZKW)
- Ordering designations from hot channel system → + order confirmation with system number
- Recommended spare parts from the supplier including processing time. Only parts with more than 24 hours generation time need to be taken in account.

#### 1.4.7 Measurement reports concerning mold inserts:

- For all molds which produce light-related relevant plastic articles in accordance with the mold specification, you must provide measurement reports of the shaping contour.
- All formative parts, the main split surface, sliders and the frame plates must be measured and if requested you have to send the measurement reports to ZKW.

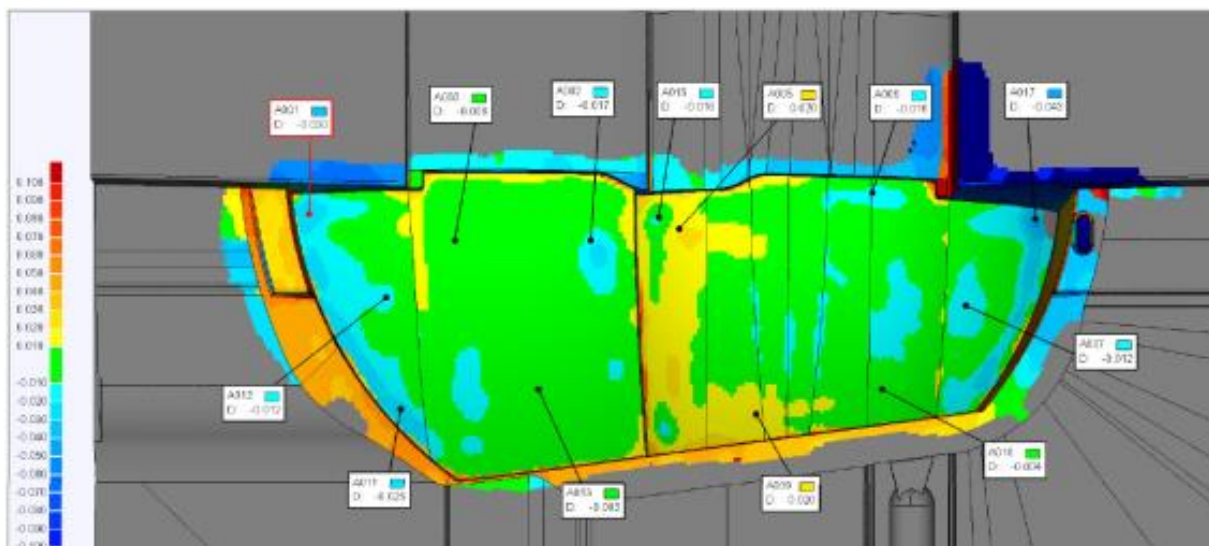


Illustration 7: Measurement of a reflector core - ATOS-Scanner

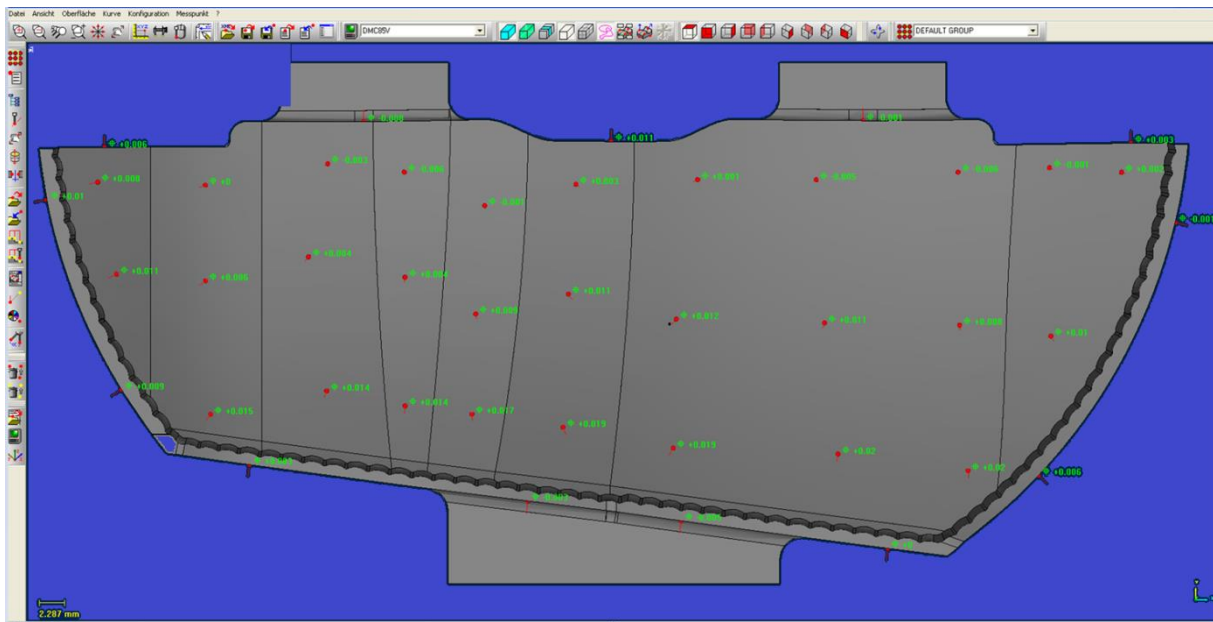


Illustration 8: Measurement of a reflector core - M&H System

### 1.5 Time and scope of delivery of data transfer

- 3D data can be requested at any time by ZKW-Mold manager, and the supplier is obliged to send these with the current state quickly (within 3 working days). Costs that arise because of problems with not updated mold data (such as damages on the mold, time exposure for fixing 3D-data) have to be paid by the supplier.
- PPAP approval:  
All points under the section "1.4 Scope of delivery of data" have to be sent to ZKW within all updated points and modifications.

### 1.6 Mold materials, heat treatment for standard molds

- The steel selection for the parts in the tool have to match the quality and lifetime requirements.
- In areas that are difficult to cool (e.g. cores...) special materials with improved heat conductivity must be used. During the kick-off meeting, the design will be matched with ZKW.
- In the case of steel on parts moving relative to each other you must take care with material pairings of different materials or with different surface hardness values or surfaces. This can prevent fretting corrosion and abrasion points.
- The mold certificate, heat treatment certificate and the hardness test report must accompany the delivery of the mold!

### 1.7 Coatings

- The coatings are pre-defined with regard to the required steel types in the concept approval.
- After the production of 1,000 shots, the ejectors of the surface-relevant components subsequently metalized or coated must be treated with a guide rail coating (preferably DLC).

### 1.8 Layout of the mold – stability and locking pressure

- All the forces (X, Y and Z) and surface pressures that arise must be taken into account in the mold design.

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## 2 DESIGN REGULATIONS

### 2.1. Ejector system

- After opening the mold, the injection molded part must always remain in the ejector side. The injected part must rest flat all around the parting line.
- All standard parts must be compatible with the dimensions and systems of Hasco, Cumsa or Meusburger.
- The ejectors and ejector plates must be permanently marked with the item numbers.
- Avoid ejectors under sliders. If there are ejectors under sliders it is necessary to implement an ejector position safety device and in addition a mechanical safety like a safety ejector (blind ejector) that prevents the ejectors from colliding with the sliders. The safety pins must have at minimum 10 mm diameter.
- If the ejectors are positioned underneath a hydraulically actuated slider, an additional electrical safety device must be included via the core-pull circuit in such a way that the ejectors are not damaged by the core-pull unit when in the front position.
- The basic position of the ejector system must be secured with back-pressure ejectors. These must be released 1 mm.

#### 2.1.1. Ejectors

- All ejectors where the rotational position is important for the function of the mold must be fitted with twist restrictions.  
Incorrect fitting of these ejectors must be prevented. If there is a combination of non-rotationally symmetric cores (B) with sleeve ejectors (A) the correct mounting location of the core must be assured by a suitable support plate (C) in the ejector plate.

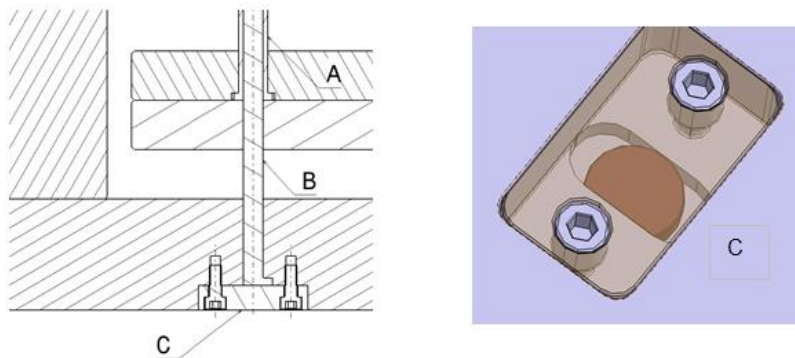


Illustration 9: Example not rotationally symmetric cores with sleeve ejectors

- The ejector forces must be estimated. Correspondingly dimensioned ejectors must prevent damage and abrasion.
- Ejector plates and ejectors must be marked to avoid wrong assembling.
- On the opposing side of the optically relevant surfaces, especially on grained surfaces, there should be no ejectors because these will lead to differences in gloss. If this is not possible, extensive segment / block ejectors must be used.
- The ejector positions are to be agreed with ZKW and must be approved alongside the kick-off meeting.
- Sleeve ejectors must be used in screw bosses and bearing areas.
- Round or flat ejectors with less than 1.5 mm diameter are not permitted.
- Inclined ejector solutions must be avoided, risk of mold removal problems. Generally, mechanical sliders are to be preferred! If inclined ejectors are used, a sufficient clearance of at least 5 mm per side must be provided for reliable removal of the article.
- Ejectors have to be guided at least 20 mm in the main inserts.

## 2.1.2. Ejector safety devices

- The ejector position safety device must be capable of being replaced on the injection molding machine.
- The ejector position safety device must be fitted in such a way that it can easily be accessed from above or from the operating side.
- No adjustable element must be used for actuating the switch.
- With lifting plate systems, you must check whether several ejector safety devices are required.
- For the ejector safety devices standard parts, delivered by suppliers like Meusburger, Strack, etc. or compatible parts (dimensions and electrical connection) have to be used.

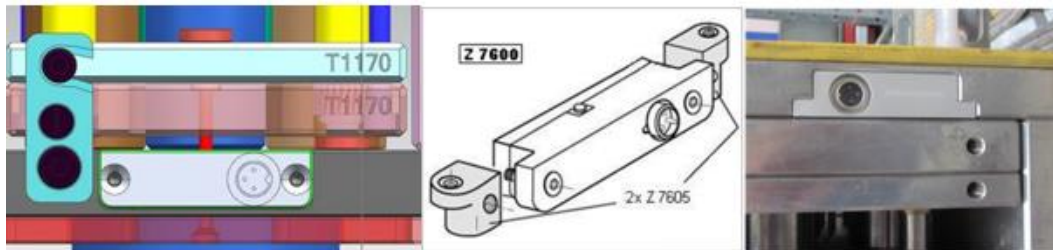


Illustration 70: Example ejector position safety device

- If ejectors are positioned under sliders an additional safeguard must be installed.



Illustration 81: Safeguard of the ejector system (with ejectors under sliders)

## 2.1.3. Cycle counters

- The CVE V3 Monitor has to be used as cycle counter, it has to be implemented on the operator side of the tool. The cycle counter remains active and in use at all times throughout the life of the tool. Improper handling or manipulation is not permitted.



Illustration12: Cycle counter company CVe

## 2.2. Sliders

- Mechanically actuated sliders are preferred.
- The basic position of the sliders (opened state) has to be clearly visible. This has to be realized with a fence.
- When hydraulic sliders are used, which move when the mold is closed, a movement under closing force must be guaranteed.
- Pressure plates need to be brought in all along internal sliders and inclined ejectors to enable a delicate adjustment of the parting line.
- Pressure plates must be brought in at the slider locking to enable a delicate adjustment.
- Pressure plates must be made of steel, material reference 1.6 standard tool materials. Brass, and graphite parts is not allowed to use for pressure plates.
- The slider safety devices should be able to be replaced on the injection molding machine in the mounted condition of the mold.
  - Standard parts must be used for the slider safety devices, but without ball catches.
  - Upwards → slider safety device, stop and tension spring (if possible inside)
  - Downwards → slider safety device and stop
  - Laterally → slider safety device and stop



Illustration 13: Example slider safety device

## 2.3. Mold half guide system

- One of the 4 guide pillars should be of a different diameter or should make it impossible to fit incorrectly by positioning of the pillars.

- When there are second tools or tools that are similar in construction (Halogen, Xenon, LED) the guiding pillars have to be designed so that a wrong assembling (e.g.: injection side of Halogen version and ejection side of Xenon version) is not possible, for example with different diameters or positions.
- The guide bushes must be flush-mounted in the mold box.



Illustration 14: Flush-mounted guide bush

- The guide pillars should preferably be mounted on the core side, or this item needs to be clarified during design discussions.

## 2.4. General sprue systems

- The sprue system will be matching along with the mold design meeting. The location of the injection point must be positioned in accordance with the article drawing or presentation. The sprue system must be designed in accordance with the material to be processed. Wear resistance must be ensured. Injection should preferably be against an impact wall.
- The sprue system must be designed so that the material in the sprue system does not suffer any damage caused by abrupt flow transition points or sharp edges. The sprue distributor system must be executed in a manner producing the optimum flow characteristics, without edges and offsets.
- Molds having multiple cavities must be designed in a balanced manner. The hot channel supplier must be included in the design of the hot channel system. The mold supplier will ensure even part filling.
- The cold plug must be caught by a suitable blind channel.
- The sprue bush must be secured against rotation and falling out.
- For the injection via hot runner system / hot channel nozzle on cold channel distributor, an injection cone / injection mandrel must be used.
- Tunnel gating systems must be able to be used and changed from the front. All other applications must be coordinated with the technical contact at ZKW.
- A film gate must be inserted in both mold halves (B, C).

## 2.5. Inserts

- All areas subject to potential wear should be executed as inserts. The final geometry areas must be clarified with ZKW in the course of kick-off meeting.
- The process capability of the injection molding process must not be affected detrimentally by the inserts. (Cooling)
- The inserts must be safeguarded against incorrect mounting (e.g.: asymmetrical geometry).

## 2.6. Venting

- You must ensure adequate venting of the mold nests because, otherwise, you may experience air inclusions and local burning.
- For the relationship between supports plates in the mold frame and venting see also the Chapter "Stability of the mold".



- Venting should be prepared at the following locations:
  - Material confluence (mass flows coming together lead to air inclusions. These areas in the tool have to be vented with inserts).
  - Domes, ribs (venting via split inserts or ejectors)
- Labyrinth venting to be executed as shown in the example (green areas are inserted).

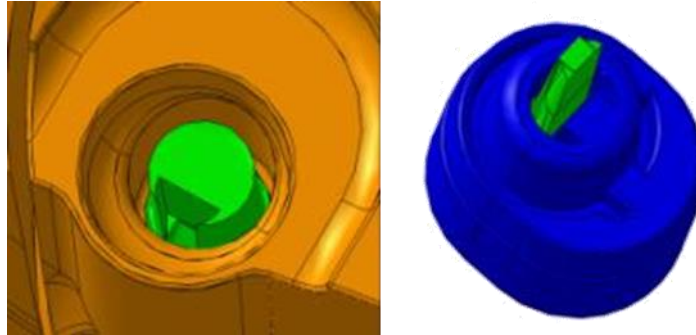


Illustration 15: Labyrinth venting

## 2.7. Cooling / temperature maintenance

- The cooling is to be designed in accordance with the material and the planned cycle time. The cooling must be designed in such a way that the surface of the cavity is maintained at an even temperature with a deviation of max. 5°C to the set value. All cooling elements must be designed for the operating temperature.
- The cooling concept will be presented from the supplier during the kick-off meeting.
- The cooling must be designed in such a way that as even a temperature as possible is achieved on the surface of the mold. The temperature difference between inlet and outlet of the cooling circuit must not exceed 4 degrees Celsius. The distance between the cooling channels and the surface and between the channels is to be arranged in such a way that effective cooling is ensured. In operation, no cracks in the mold must be created by the cooling effect (internal notch effect, flame cracking).
- If possible all inserts and sliders have to have an own cooling circuit.
- The sprue cooling must be arranged separately.
- The cooling connections on the mold should be marked Inlet and Outlet Example: IN1, IN2,... – OUT1, OUT2...
- The cooling connections must be sunk in the mold box (plan with mold outside contour).
- Minimum spacing of cooling nipples:
  - For M14 x 1.5 should be  $\geq 35$  mm.
  - For M 10 x 1 should be  $\geq 30$  mm.
- If the connections are on the bottom of the mold, then standing bars must be applied.

## 2.8. Hydraulics

### 2.8.1. Hydraulic connectors and hydraulic lines

- If the tool temperature is under 60° C hydraulic lines can run through the tool. If the temperature is over 60° C external lines have to be used.
- The connections to the injection molding machine on the distributor block must be mounted in such a way that they point downwards when the mold is in position. The main connections must not be mounted to the top side of the mold.

- The piping of the hydraulic system is depending on the tool temperature. Take care of the temperature reliability of the hoses.
- The connections must be closed for transport in order to prevent contamination with dirt (plastic caps).
- In the set of drawings (CAD data), the hydraulic circuits must be indicated in the plan view, in the 3D view with colors and must be documented in tool book.
- The hydraulic connections on the mold should be marked Inlet and Outlet Example: IN1, IN2,... – OUT1, OUT2...

## 2.9. Electric

- The electrical equipment of an injection molding machine includes:
  - Proximity switches, limit switches (core-pull, position safety devices, ...)
  - Hot channels
- The electrical documentation must include:
  - Test report or signature by a trained expert in the mold check-list which confirms the proper and safe execution.
  - The circuit diagram with clear operational medium marking (addresses) and the circuit diagram used for the hot channel (electronically and on paper).
- The cables used must be selected to suit the ambient conditions (temperature, oil-resistance...). (Standard as Lapp Ölflex cable).
- All electrical lines must be laid in protective sheet metal ducts or in a milled groove with a sheet metal cover. Crushing and kinking points are to be avoided.

### 2.9.1. Hot channel systems

- The design of the hot runner system must be documented using the following data
  - The pressure drop in the hot runner must be quoted (to be requested from the hot channel manufacturer with the details of the planned injection time and the shot speed per nozzle).
  - Type designation
  - Transition from nozzle to sprue system
- Nozzles with a torpedo tip must be provided with a centralization (A) in the mold and the tip must be aligned symmetrically to the distributor runner (see Illustration = WZ top side). Alternative a twisting (min. 30 °) and fixing of the hot runner nozzle can be implemented (see Illustration 179).

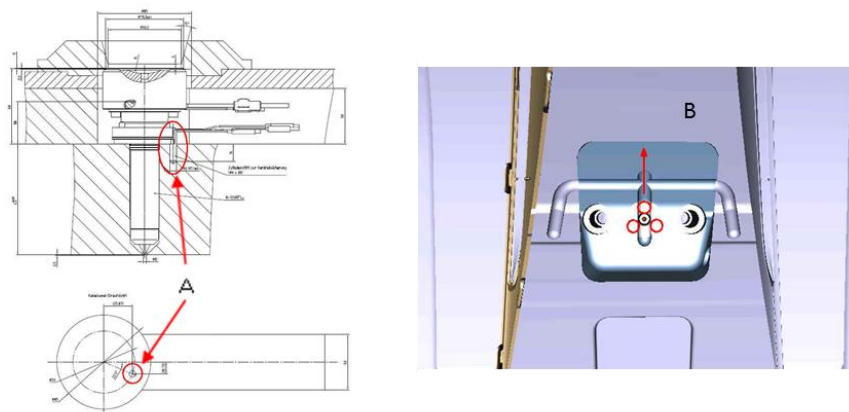


Illustration 16: Example 3-hole-torpedo

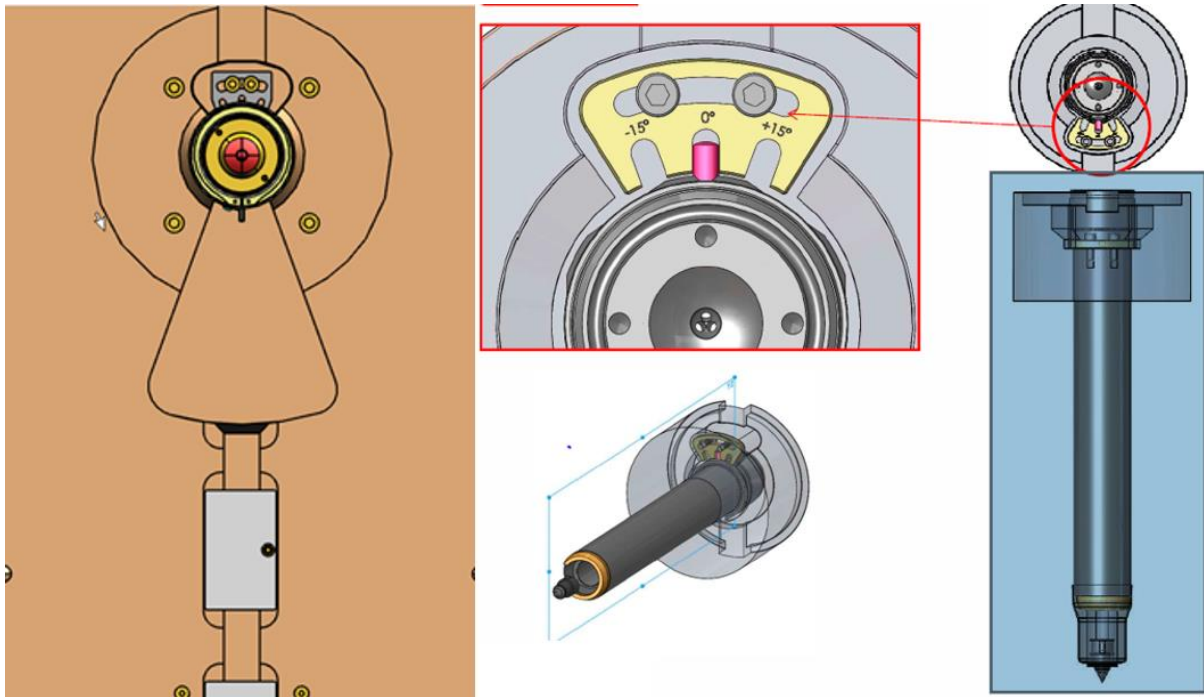


Illustration 179: Nozzle rotation

- All hot runner systems must be ordered and assembled completely finished wired and with a fixed cable-laying (fig. 45). It must be ensured that the cable of the thermocouple for the mould is not connected in the hot runner plug but connected to a separate plug fixed on the mould.

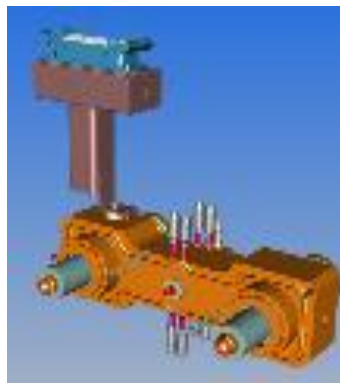


Illustration 18: complete hot runner system

### 2.9.2. Electrical plugs / housings

- When fitting the eye bolts there must be no interference by the plugs.
- All electric connectors have to be mounted in the green marked area A (Illustration19).

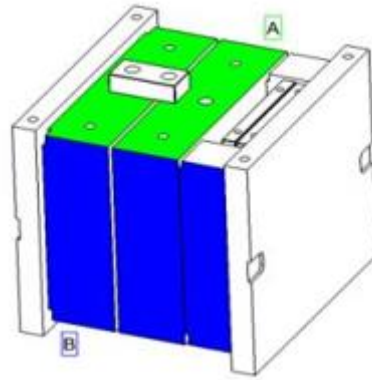


Illustration 19: Area for electric connectors

### 2.10. Date stamp

- The date marking of the parts must be realized with date fields and a punch mark:

- Datumsfeld-Elektrode eckig

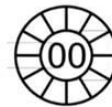
132



- Datumsfeld-Elektrode rund

6 - 20 mm

132



- The position and size of the date field must be stipulated in the article drawing. This should be applied at an easily accessible location. The final release of the position and alignment will be given during the mold concept approval.
- If there is not enough space for the date field described above a date and index stamp has acc. to Quality guideline QV 400 14 can be used.

### 2.11. Transport aids

- The transport safety device is to be fitted on the operator side and must be easily accessible. It must always be mounted to the ejector side. Standard parts must be used.
- When positioning the transport safety device you must take account of the cross beam spacing in the injection molding machine.

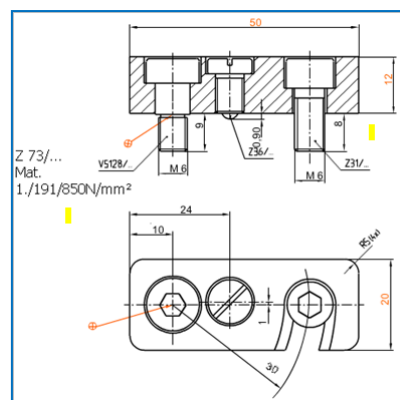


Illustration 2210: Transport safety device

- If a transportation bar is needed it has to be marked with ZKW-article number, ZKW-article name and the tool number (e.g.: 708.01.030 lens 2K WZ001234). If an additional bar is needed it has to be designed so that it does not have to be dismantled during setup. A two-part concept must be used for this.

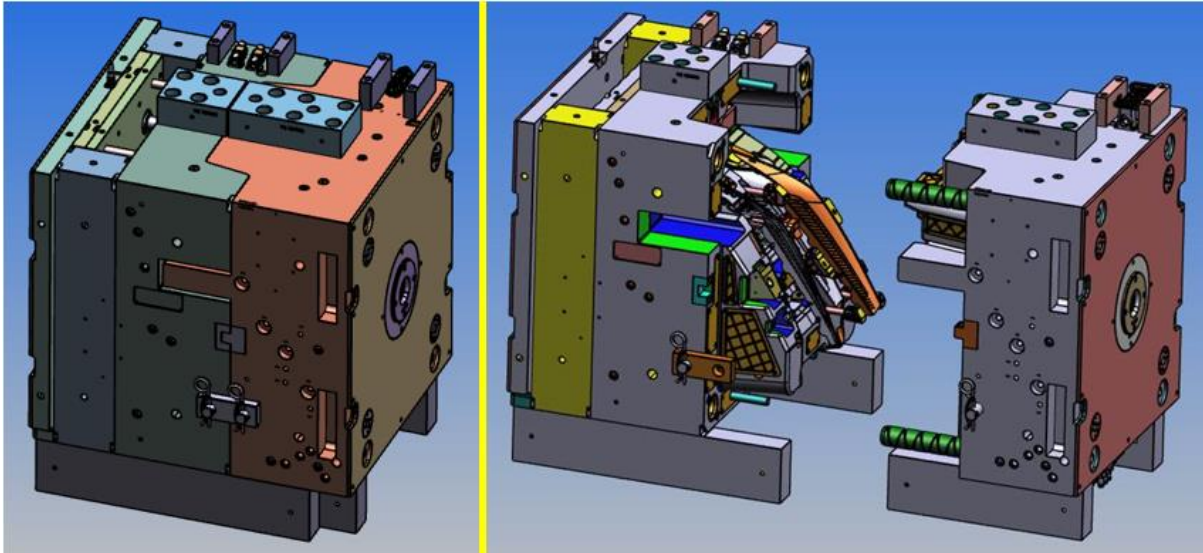


Illustration 23: transport bracket

- Eyebolts for the tool transport and the assembling and disassembling have to be positioned so that the tool or the tool parts are balanced. On all tools 3 screw-in positions for eyebolts must be provided on top of the tool (for center of gravity of the entire tool and center of gravity of the two tool halves). It has to be ensured that all eyebolts can be mounted without any additional disassembling work. When implementing the threads for the eyebolts stick to the values of the last weight table (see Table 1: Last weight table).


Sling type					Dimensions							Price per item				
	Number of sling points	1	1	2	2	3 oder 4	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	h	k	l	Weight	RM ...	RS ...	
Inclination angle	0°	90°	0°-45°	46°-60°	0°-45°	46°-60°	mm	mm	mm	mm	mm	mm	kg	Euro	Euro	
Type	Thread d <sub>1</sub>	Load capacity t					mm	mm	mm	mm	mm	mm	kg	Euro	Euro	
...6	M 6	0,40	0,10	0,20	0,16	0,32	0,24	25	45	25	45	10	13	0,10	11,44	12,10
...8	M 8	0,80	0,20	0,40	0,32	0,64	0,48	25	45	25	45	10	13	0,10	12,74	13,89
...10	M 10	1,00	0,25	0,50	0,40	0,80	0,60	25	45	25	45	10	17	0,12	16,09	16,09
...12	M 12	1,60	0,40	0,80	0,64	1,28	0,96	35	63	35	62	14	22	0,26	19,68	22,64
...14	M 14	3,00	0,75	1,50	1,20	2,40	1,80	35	63	35	62	14	25	0,28	21,23	24,44
...16	M 16	4,00	1,00	2,00	1,60	3,20	2,40	35	63	35	62	14	29	0,30	20,79	24,44
...18	M 18	5,00	1,25	2,50	2,00	4,00	3,00	50	90	50	90	20	29	0,82	32,42	34,74
...20	M 20	6,00	1,50	3,00	2,40	4,80	3,60	50	90	50	90	20	30	0,84	32,42	34,74
...24	M 24	8,00	2,00	4,00	3,20	6,40	4,80	50	90	50	90	20	38	0,88	40,90	46,57
...27	M 27	10,00	2,50	5,00	4,00	8,00	6,00	65	108	60	109	24	42	1,58	69,85	79,75
...30	M 30	12,00	3,00	6,00	4,80	9,60	7,20	65	108	60	109	24	45	1,62	76,29	83,23
...33	M 33	14,00	3,50	7,00	5,60	11,20	8,40	65	144	80	144	30	65	3,72	138,29	148,04
...36	M 36	16,00	4,00	8,00	6,40	12,80	9,60	85	144	80	144	30	65	3,78	138,29	148,06
...42	M 42	24,00	6,00	12,00	9,60	19,20	14,40	85	144	80	144	30	65	3,84	183,31	251,41

Table 1: Last weight table

## 2.12. Mold component marking

- All component parts of the mold must be clearly and permanently marked with the item number in accordance with the corresponding parts list (engraving, punched numbering, labeling...).

- The labeling must be positioned to mold inserts / sliders in such a way that it is legible when mounted.
- Inserts / slider / ejectors must be marked with the corresponding coating.

## 2.13. Marking of cavities

- The cavity marking for left / right articles has to be implemented like below:
  - First mold: L1 / R1
  - For follow up tools – continue at the last number of the first tool: L2 / R2
  - If there are two left and two right parts of the same article implemented in the first tools: L1 / R1 und L2 / R2, follow up tool: L3 / R3 und L4 / R4
- If there are more cavities of exactly the same part in one tool the cavity marking has to be implemented as follows:
  - First tool: e.g.: 1-6
  - Follow up tool: e.g.: 7-12 etc.
- For family tools:
  - If two articles are implemented in the tool and each of them has a left and a right part:
    - L1 / R1 for one article, L1 / R1 for the other article
    - Follow up tools: L2 / R2 for one and L2 / R2 for the other article
- For multi-component-tools:
  - L1/R1 for turning plate no. 1
  - L2/R2 for turning plate no. 2
  - Follow-up tool: L3/R3 and L4/R4

The cavity marking has to be coordinated from the supplier with the responsible GPC. Just if this alignment happens, it is possible to ensure a correct marking of follow up tools.

## 2.14. Mold labels

- The labels must be made of metal.
- The mold labels must be mounted according Table 2 and Illustration 241124.

Types of mold labels	Label position	To fix by
ZKW-Mold label	Operator side	Mold supplier
Property label	Operator side & Postion A	Mold supplier & ZKW
Coating label	Postion B	ZKW
Unconventionall cooling (Contura, Variotherm, Lasercusing, etc.)	Operator side & Postion A	Mold supplier

Table 2: Information to mold lables

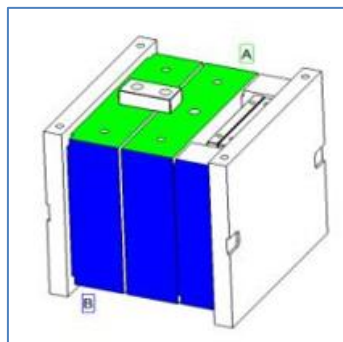


Illustration 2411: Lable positions

## 2.14.1. Mold label

- The ZKW mold label is provided at the kick-off meeting and must be mounted on the operator side.
- The label is to be fixed in position with screws and photographed by the supplier immediately upon completion of the mold box. The photograph must be forwarded to ZKW.
- The actual weight has to be engraved or stamped in the ZKW tool plate by the supplier before the first relocation of the tool.
- 4 x M4 threaded holes are to be provided for fixing the mold label in the positions indicated below (Illustration 2512).
- The tool photo documentation with mounted sign is part of the scope of delivery and therefore relevant for the last partial payment of the tool.

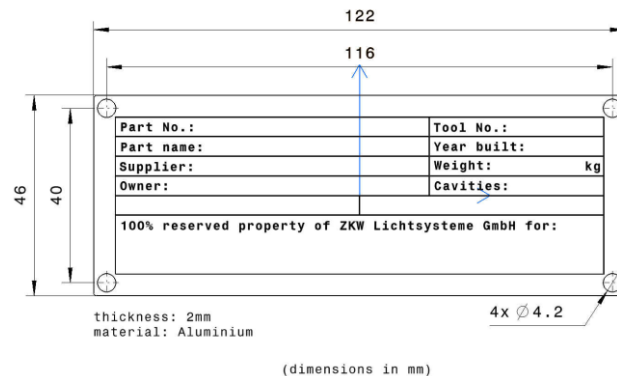


Illustration 2512: Mold label

## 2.15. Insulating plate

- Heat insulation plates must be fitted on both sides above a mold temperature of approx. 60°C.
- For the threads of the eyebolts and screw heads, there must be clearances in the insulating plate. The holes for the dowel pins in the spacers must be 0.3 mm free.
- Place a release on the mounting plate in order to be able to release the mold from the machine mounting plate.

## 3 GENERAL DESIGN REGULATIONS

### 3.1 Mold size, centralization and standing bar

- Centralizing rings must be provided on the nozzle side and on the ejector side and they must project at least 8 mm beyond the insulating plate. The diameter of the machine nozzle can be found in **Fehler! Verweisquelle konnte nicht gefunden werden.**
- A secure and stable mold stand must be guaranteed in a separated and guyed condition. When the standing bars exceed the tool parting the overhanging area has to be cut out 1 mm.
- Mold standing bars must be executed according to Illustration:
  - Bolting is only permitted in the molding boxes (yellow circles)

- There must be a clearance of approx. 1 mm (red line)



Illustration 26: mold standing bar

- If there are any connections on the bottom of the tool, you have to implement standing bars with at least 50 mm height so that no damages can occur during transport and storage.

### 3.2 Mold preservation for the transport

- All tools and parts of the tools that are send by the tool supplier must be packed and preserved properly.
- When the preservation and packaging of the mold is not done properly the tool supplier is in charge of renewing the surface to ensure the needed quality.
- At ZKW the tools are protected from corrosion with the preservation spray „TCE Fluid 435 Einfärbung GRÜN“ (see Illustration 27)



Illustration 28: lubrication grease  
Illustration 27: corrosion protection

- For lubrication of ejectors and sliders for optically visible parts ZKW uses Tungrease SG from Co. TUNAP (see Illustration 8)
- Non-optically visible parts can be lubricated with standard grease (e.g. Hasco Z260/2,.....)





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## 4 DEADLINE MONITORING

### 4.1 New molds:

- In order to provide a continuous overview of the deadline situation, the supplier will send an updated deadline schedule (Tool Time Schedule) every 2 weeks from the date of the order. In single cases, the report must be sent on a weekly basis. This may be defined by the mold manager responsible. On request the template for the Tool Time Schedule will be sent out by the Commodity buyer.

This form will be sent together with the tool-order. Every 2 weeks the supplier has to send this updated report to the tool manager.

TOOL TIME SCHEDULE												
Project: 1101 S01 - Audi HDL Q3											CW 9	
Part name: Spg-WZ-bezel fake reflex full												
Part number: 1101.065/066.0780												
Supplier: XXXXXXXXX												
Call No.:	1-1	Ref. No.:	2017-20384						Tool No.:	W200b44G		
Release date (Date of order)	01.02.2017 (DW1)	Release date (Date of order)	01.02.2017 (DW1)	Release date (Date of order)	01.02.2017 (DW1)	Release date (Date of order)	01.02.2017 (DW1)	Release date (Date of order)	01.02.2017 (DW1)	Release date (Date of order)	01.02.2017 (DW1)	
Status Werkzeugprojekt in % je KW / actual status in % in CW												
Calendar week (KW)	17/1	17/2	17/3	17/4	17/5	17/6	17/7	17/8	17/9	17/10	17/11	17/12
Status des Werkzeugproj. / Current	10%	10%	15%	20%	20%	25%	30%	30%	45%	50%	0%	0%
17 Design concept	25	25	35	40								
18 Concept release												
19 Detailed design												
20 CAD/CAM												
21 Material procurement												
22 Arcus milling/drilling										50		
23 Arcus provided heat treatment												
24 Arcus grinding												
25 Arcus coarse grinding												
26 Arcus fixed grinding												
27 Arcus side material work												
28 Arcus sanding surface treatment												
29 Arcus provided heat treatment												
30 Arcus provided grinding										20		
31 Arcus provided fine grinding												
32 Arcus provided side grinding												
33 Arcus provided side material work												
34 Arcus provided sanding surface treatment												
35 Arcus provided heat treatment												
36 Movable grinding												
37 Movable provided fine grinding												
38 Movable provided side grinding												
39 Movable provided side material work												
40 Movable provided sanding surface treatment												
41 Movable provided heat treatment												
42 Movable provided fine grinding												
43 Movable provided side grinding												
44 Movable provided side material work												
45 Movable provided sanding surface treatment												
46 Moldbase												
47 Tool modification												
48 Try out CO												
49 Try out CO												
50												
51												
52												
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64												
65												
66												
67												
68												

CW in which the report has been created

Total tool status is documented with „traffic light“

Overall tool status in %

Completion status in steps of 5 %: has to be filled up by the supplier every two weeks and by the tool manager for monitoring progress

Scheduling will be filled in by the supplier

For each report 4 photos will be added (take care of file-size)

Example for a scheduling delay

Example for an early progress stage

Illustration 29: Extract of Mold Timing Schedule



## 5 COMMERCIAL CONDITIONS

The standard conditions are the commercial conditions of ZKW Group GmbH, unless agreed otherwise.

### 5.1 Purchasing conditions

The current "ZKW general purchasing conditions" apply. These can be found on the ZKW homepage.

Subcontracting of orders to subcontractors must be disclosed and requires the approval of ZKW. If additional costs should arise for ZKW, the costs will be passed to the supplier commissioned by ZKW. The ZKW nondisclosure agreement must also be signed by subcontractors.

### 5.2 Object of supply, scope of supply

The object of supply and the scope of supply are defined in the enquiry by the mold specification list, the ZKW mold standard and the table "Process of mold procurement" and the purchase order.

The scope of supply for a project always consists of the mold by itself, full documentation – incl. the further defined data to be transmitted for unrestricted use, possible distribution and free disposal – and the competent injection molding process. As the occasion arises, any deviations from the aforementioned standard case shall be negotiated between ZKW and the supplier.

### 5.3 Price

The offer must state a total price for the tool, sample parts (incl. initial sample documentation) and set-up costs as well as any equipment for series production (gauges, handling, etc.). The prices shall be quoted in the "Tool costs detailing" form and sent to ZKW.

ZKW reserves the right to check the level of costs for plausibility and to verify them based on the detailed costs.

### 5.4 Warranty and guarantee

The mold function lies in the responsibility of the mold supplier.

If by the time "End of Production" or within the agreed number of shots an excessive wear, defects, fractures, cracks, etc. of the tool occur which are attributable to weak points of the tool, the supplier will immediately process the complaint free of charge. If this does not guarantee the supply of parts, the supplier must make a voluntary complaint to ZKW.

If defects in the tool cannot generally be remedied by the supplier or cannot be remedied in good time, ZKW may remedy the defect itself or by a third party. Any costs incurred as a result shall be borne by the tool manufacturer.

The supplier is obliged to inform ZKW if the agreed number of shots is exceeded. The notification must be made at a point in time at which the manufacture of a follow-on tool is possible without problems before the number of shots limit is exceeded.

### 5.5 Payment

The following stage payments are taken as the standard for series molds, unless the order states a different agreement:

- 65% for off-mold parts / 30 days net
- 35% at PPAP release / 30 days net

Any modifications after approval of the next produced pre-series production parts 100% (30 days net) payment. The initial off-mold parts and the mold testing after optimization without parts requirements (functional test) are free of charge for ZKW.

### 5.6 Property and marking of the scope of the order

The following regulation applies to all future services of the entire scope of the mold order, including design and parts list items:



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The 100 percent owner of the scope of the order / mold covered by the purchase order is, and remains ZKW (purchaser), or ZKW is the 100 percent (provisional) owner and holds this property for the individual customer of ZKW named in the purchase order. The transfer is replaced by the agreement of a leasing relationship or by the granting of indirect ownership for ZKW, where the supplier becomes / is the owner of the mold until this is revoked by ZKW. If the molds are located with a third party, the transfer is replaced by release from the claim for surrender.

Acceptance of this purchase order signifies re-assignment by the supplier to ZKW, the scope of the order indicated in the purchase order at the specific time of work in progress, where ZKW, at each point in time, is the 100 percent owner or the provisional owner of the molds in the full scope of the purchase order - notwithstanding the specific level of work in progress that the molds are in.

The supplier pledges that the scopes of the purchase order / molds are free from the rights of third parties. In particular, he guarantees that there are no property provision rights, liens or other rights / liabilities of third parties applicable to or extending to cover.

The molds (even when incomplete) must be marked in such a way that the property status of the purchaser is clearly identified and that separate custodianship has been established, as follows (Physical isolation in storage and locked away.)

Application of a label to be provided by the purchaser is indicating the 100 percent ownership or provisional ownership by ZKW.

Notwithstanding this marking, the property or provisional property for ZKW is, in each case, to be regarded as founded by the transfer of this declaration; physical transfer is cancelled and is replaced by the constructive possession described in this document. This applies to all stages of the mold manufacture, independent of the individual stage of production.

At the same time, acceptance of the purchase order, and subsequently, a rental relationship is created, whereby the supplier is entitled until further notice to have custody, to hold or own the objective safety stock. The purchaser can, at any time, demand issue of the molds.

In addition, the molds must be adequately insured by the supplier against destruction or loss. By issuing the invoice or partial invoices, the supplier confirms that the molds are clearly and permanently marked as the property or provisional property of ZKW as described above. If, at any time, ZKW should request it, the supplier is obliged to provide all information required for the purpose of inventory of the molds in his possession - particularly in the event of insolvency or danger of insolvency of the supplier.

If the property of ZKW should be endangered by enforcement measures, especially garnishment, confiscation and insolvency procedures, the supplier must inform ZKW without delay. In such cases, the supplier must inform the enforcement organ of the property rights of ZKW without delay. This applies in particular in the event of a declaration of insolvency of the supplier, so that, if required, the relevant preferential claims or rights to separation are secured for ZKW or the property or provisional property of ZKW is not included in the insolvency assets.

### 5.7 Penalties

If the deadline "CO sample parts initial delivery" is exceeded, a penalty of 1% of the total order value per week started, max. 10% becomes payable. The complete fulfillment of the items "Mold status" and "Parts status" as per table "Process of mold procurement" is required.

For modifications ordered by ZKW, a penalty of 2% of the order value of the modification will become due for exceeding agreed deadlines per commenced calendar day, max. 20%.

If deadlines for data deliveries are exceeded according to point 1.4, a penalty of 1% of the total order value will become due per commenced week, max. 10%.

### 5.8 Modifications

Any subsequent changes to the original order (dates, tool versions, changes of an article, ...) shall be agreed in writing and require the express consent of the purchaser.

If, in the course of tool-manufacturing changes or optimizations are necessary based on supplier intentions, those shall be approved in writing by the purchaser.

Realized as subsequent commissioning (incl. the designation "tool-modification") those changes become a part of the original contract relation. – The defined rights, obligations and procedures shall apply in analogy and expanded



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### 5.9 Transport and insurance

**Valid only for Nafta and China;** the transport to the initial mold delivery shall be included in the mold price and must be organized by the supplier.

**Valid only for Nafta and China;** in the framework of an article optimization or modification, the supplier will organize the transport and cover the costs.

It is at the discretion of the supplier whether to insure this transport. The supplier shall be liable for any transport damages not covered by an insurance policy.

If the transport is organized by ZKW, the transport will be covered by transport insurance.

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