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DOCUMENT NO.

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REPLACEMENT FOR DOCUMENT NO

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1 Scope

This company standard applies to the ETO GRUPPE.

This equipment specification is a guideline for the design of injection molding tools. This equipment specification shall be complied with for all ETO orders. The technical execution shall be reviewed with a checklist as part of the acceptance procedure of equipment.

Deviations from this specification need a written confirmation and only apply to the specific order. Verbal agreements are not valid.

If deviations from the supplier specification, which would have been possible to comply with, are detected in the acceptance procedure, then conversion at the expense of the supplier can be demanded.

The injection molding tool must be planned and designed according to the state of technology.

2 Change history

Issue	Change description
January 2021	English version of German issue from January 2021

3 Project organization and project processing

When procuring injection molds, ETO's process development department must be involved in the technical evaluation.

All drawings and planning documents shall be submitted to ETO for review and approval as part of the design discussion. Approval only applies to the execution principle. However, this does not release the supplier from its obligation to manufacture a functional tool that satisfies the technical specification, as well as the requirements stipulated in relevant standards and laws.

Project planning documents are:

- Tool concept
  - Mechanical (including separation model, ejector concept)
  - Electrical
  - Thermal (tempering, cooling, insulation)
  - If applicable safety concept
- Measuring process concept coordinated with ETO for PPF/PPAP-sampling

Technical changes during manufacturing and project planning shall be reported by the supplier and coordinated with ETO. In case of duplications, the changes of the initial design shall be summarized in a list.

The supplier shall act as the general contractor. Likewise, the supplier is responsible for all interfaces and processes.

The supplier shall inform itself of the local conditions. This will be done with ETO’s assistance and refers to the possibility of installation and power supply, as well as the setup of the injection molding machine.

The acceptance of the injection molding tool is based on the specification. The supplier has to work through the checklist for acceptance – injection molding tool and document the result. Random samples are taken by ETO.

The following process steps are performed for the acceptance of the injection mold:

- Presentation of the injection mold design by the manufacturer.
- Preliminary acceptance at the supplier: Inspection for functional fulfilment and implementation of the requirements according to the specification.
- Commissioning/operational acceptance: The mold proving is done at ETO (if necessary in presence of the mold manufacturer). The requirements will be checked according to the specification during sampling. A short-term capability of the features required in the specification will be carried out.
- Final acceptance: The final acceptance is carried out as soon as all requirements from the specification and a positive result from the initial sampling are available (PPF/PPAP-approval).

The PPF/PPAP-approval is carried out in writing with a test report by the ETO-quality assurance.

If deviations of the injection molded sample parts from the product design are detected, the supplier must rework or correct the tool immediately and at its own expense after consultation with the ETO-process planning department. The supplier shall perform measurements on injection molded products and on the tools up until the initial sampling, even if the mold proving is already being done at ETO.

In advance, the supplier agrees with ETO on all connecting dimensions, e.g. for individual parts to be overmolded: bobbin mandrels, inner contour of the connector inserts, jaw geometry. Within the scope of the preliminary acceptance, the supplier informs ETO about the actual connection dimensions of the mold at room temperature.

4 Machine and work safety

All relevant standards and regulations from the EU-law and from the national law of the intended operating country must be researched and complied with by the supplier. This usually includes the German product safety act with its appended regulations, which include the current version of the machinery guideline and other EU guidelines. If safety relevant regulations are not followed, the supplier must make the corresponding changes and additions free of charge.

Before placing the injection molding tool on the market (making it available on the market, delivery) the supplier must carry out all necessary, safety-relevant tests, if applicable by experts, and if required issue the EU declaration of conformity and affix the CE marking to the system.

The safety-relevant tests include, among other things:

- Electrical tests according to EN 60204-1
- Checking the safe design of the hydraulic system and the suitability of the load handling devices

Corresponding protocols and evidence must be submitted to ETO.

The tool shall be designed inherently safe so that there are as few residual risks as possible when removing parts and loading the tool. The tool must be integrated correctly and in accordance with its intended use into the safety concept of the defined basic machine(s). This includes the arrangement of the tool relative to the post-run relevant protective devices. The supplier is responsible for, among other things, the design of a sufficient safety distance between the tool's danger points and the safety light curtain or the two-hand buttons of the basic machine(s).

As part of the risk assessment of the workplace, ETO ensures that a run-on measurement is carried out before the mold is put into operation for the first time on the basic machine (test report for post-run measurements IS-003).

The manufacturer of the injection molding tool must give reasons for deciding whether the mold falls under the term „interchangeable equipment" within the meaning of the EU Machinery Directive, or whether it generally falls under the German Product Safety Act.

In the first case, the EU conformity process must be run through, EU declaration of conformity and CE marking etc. are required accordingly.

Irrespective of this, the manufacturer complies with the following minimum requirements:

- Ensure that the tool can be operated within the scope of the intended use of the defined basic machine(s).
- The tool must be designed safely according to the state of art, for this purpose a risk assessment shall be carried out in order to comply with the basic health protection requirements (for Germany the Product Safety Act must be complied with).
- Safety instructions must be provided where necessary
- Supply operating instructions in accordance with the language version(s) defined in the specification, which includes at least:
  - With which basic machine(s) is the tool compatible and can be used safely and in accordance with its intended purpose. The required technical features of the basic machine or specific machine types can be specified for this.
  - Indication of the danger points relevant to post-run
  - Instructions for safe assembly and disassembly, set-up, use, maintenance
  - Description of reasonably foreseeable misuse, cause of malfunction, incorrect installation, connection, etc.
  - The required qualification of the operating personnel
  - The required maintenance intervals
  - Spare parts and wear parts lists and, if applicable, parts drawings

5 Technical design of the tool

5.1 Size, shape and weight of the tool

The injection molding tool is usually intended for a specific machine. When dimensioning the mold, the machine data must be taken into account (holm distance; min./max. installation height; max. opening stroke; ejector stroke; diameter of the rotary table; hole pattern; etc.).

In case of tools for rigid table machines, the operator must provide a minimum opening distance of 300mm for the accessibility.

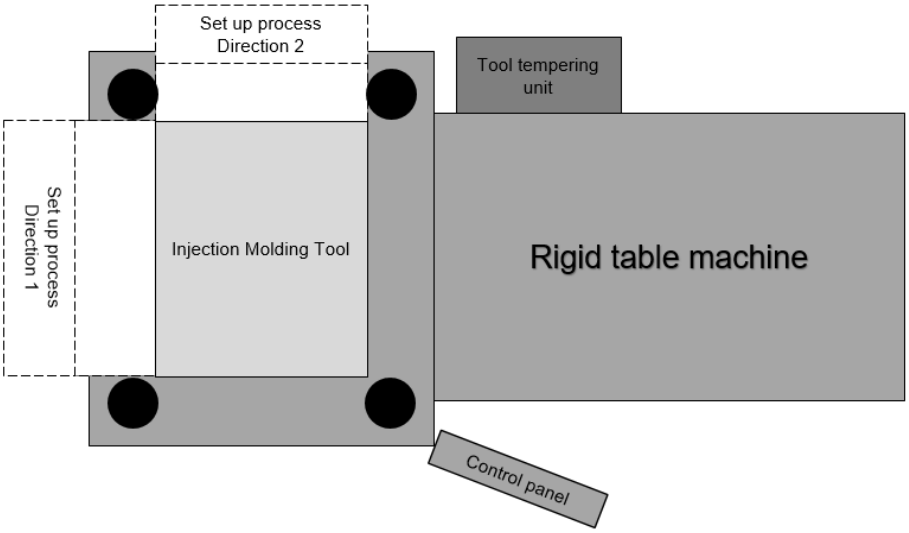
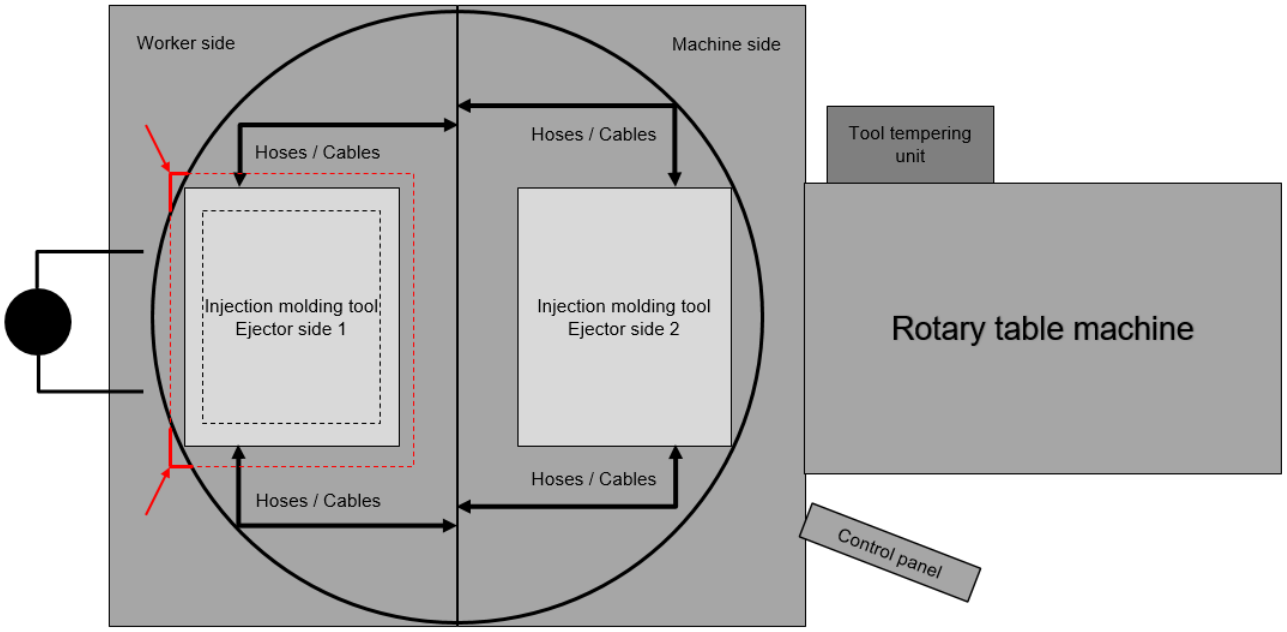


Figure 1: Schematic figure with notes on the set up process on the rigid table machine

The maximum permissible tool weight must be taken into account for the machine side and also for the set-up process. This must always be coordinated with ETO in each individual case.

Particularly in case of rotary table injection molding machines, no tool elements (temperature control hoses, connections, plugs, etc.) may protrude beyond the rotary table. This applies for both the ejector and the nozzle side. Hoses on the ejector side must be attached in such a way that they cannot protrude beyond the rotary table or protrude due to movement (see Figure 2).



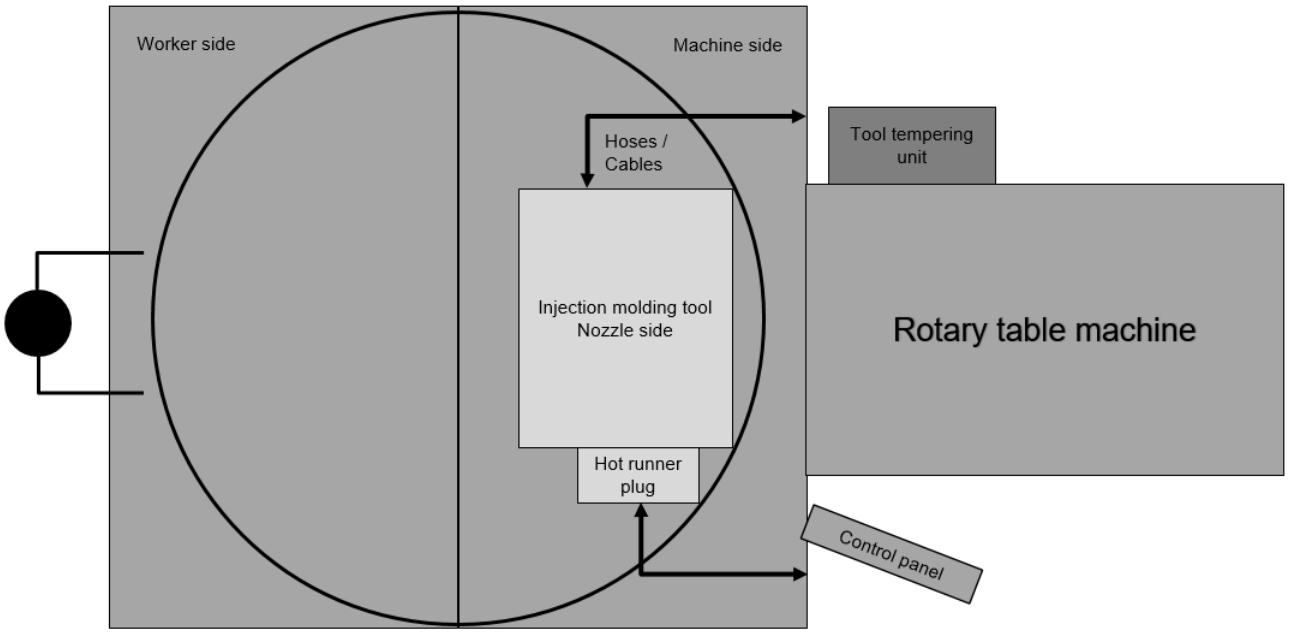
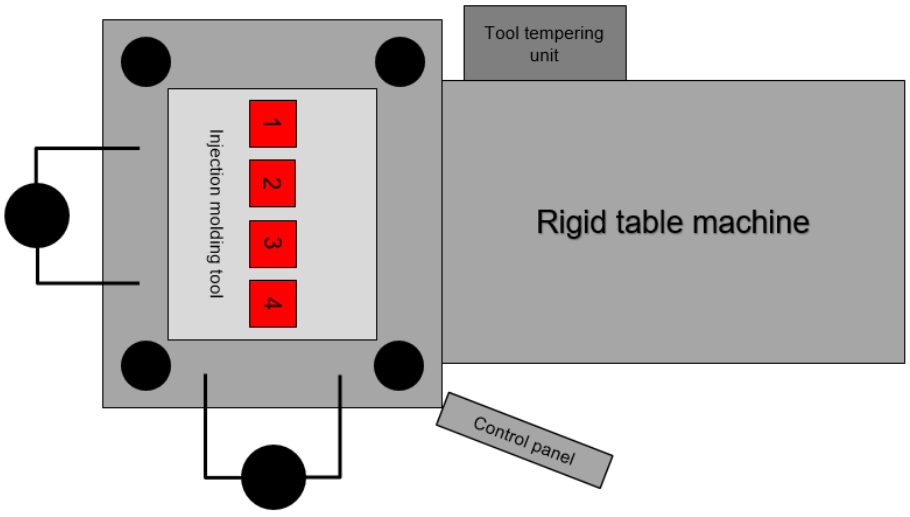


Figure 2: Schematic figures with notes on the hose and cable arrangement on the rotary table machine (2 figures)

5.2 Arrangement and numbering of the cavities

The cavities can be arranged in the tool in a row, for example, or in a rectangular shape with 4 or more cavities. When arranging the cavities, it must be taken care to ensure that all cavities are easily accessible to the worker and are therefore ergonomic.

The cavities are numbered in ascending order from left to right or from back to front (Numbering for tool setup and operator view, see Figure 3). On the rotary table machine, it must be ensured that consecutive numbering is applied to both ejector sides.



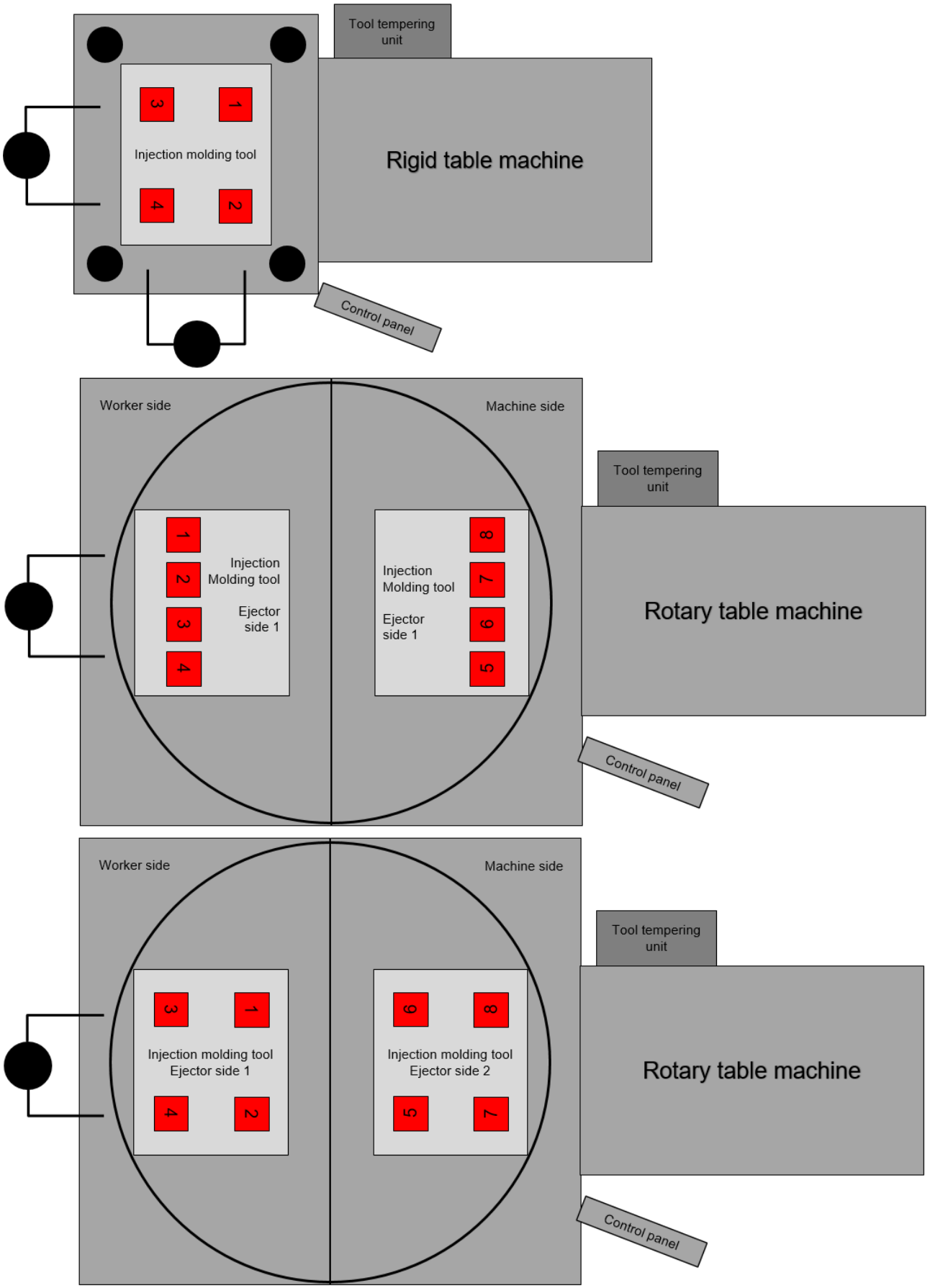
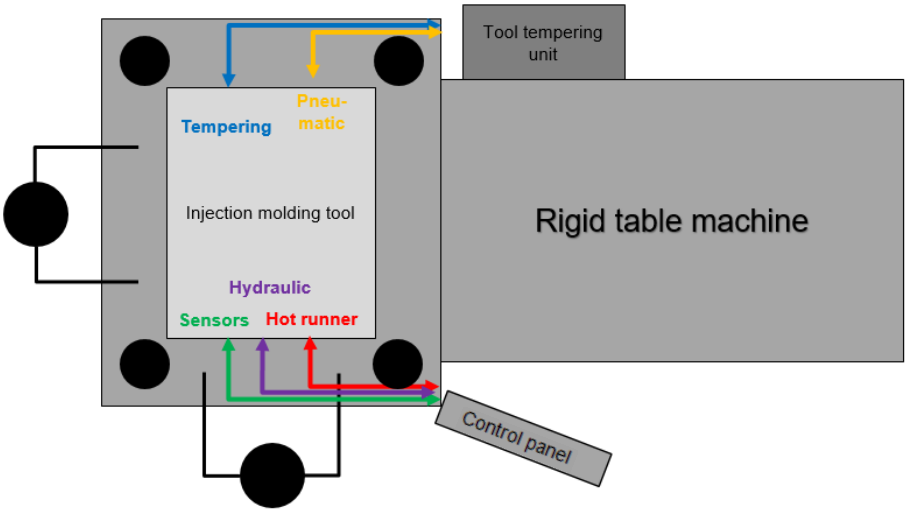


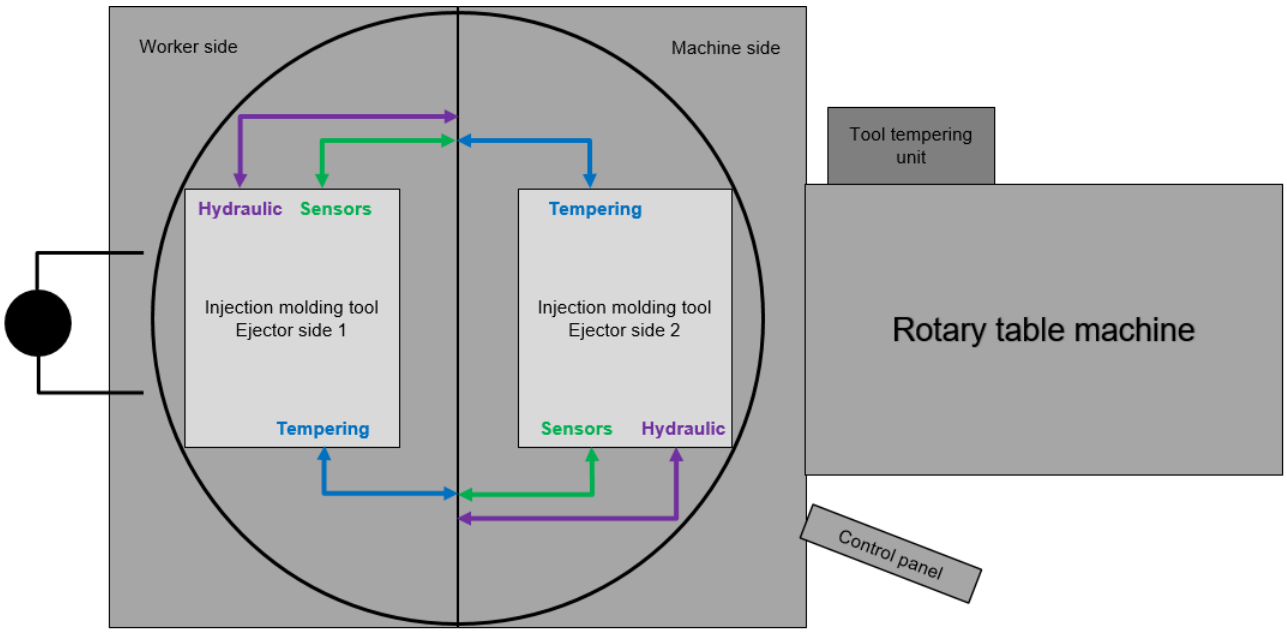
Figure 3: Schematic figures with notes on the numbering of the cavities on the rigid table machine and the rotary table machine (4 figures)

5.3 Arrangement of the connections

Depending on type and age of the injection molding machine, the machine-side connections can be arranged differently. The following figures show the standard connections at ETO (see Figure 4).

In general, it must be ensured that all connections are not obstructive and easily accessible during set-up.





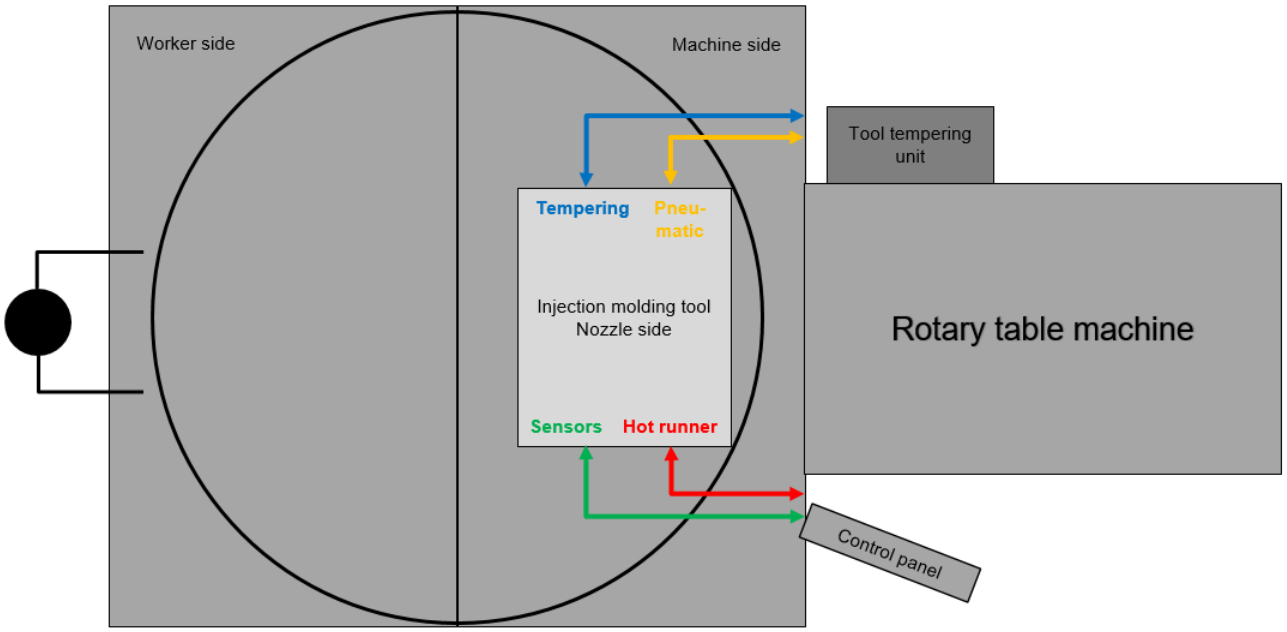


Figure 4: Schematic figures showing the preferred arrangement of the connections on the rigid table machine and the rotary table machine (3 figures)

5.4 Screw connection on the injections molding machine

The injection molding tool is screwed directly (without additional clamping devices) onto the clamping plates of the injection machine. In doings so, the hole pattern of the respective machine must be observed.

The bore diameter shall be 13.5mm.

A screw connection on the narrow sides is preferred (see Figure 6).

If the clamping plate does protrude far enough beyond the other intermediate plates (Figure 5 left picture) cut-outs must be made over the screw holes (Figure 5 picture in the middle and on the right side). These must be big enough so that the screws can be tightened and loosened easily by using standard tools (Allen wrench or ratchet with Allen socket wrench). The height of the clearance should be at least 100mm.

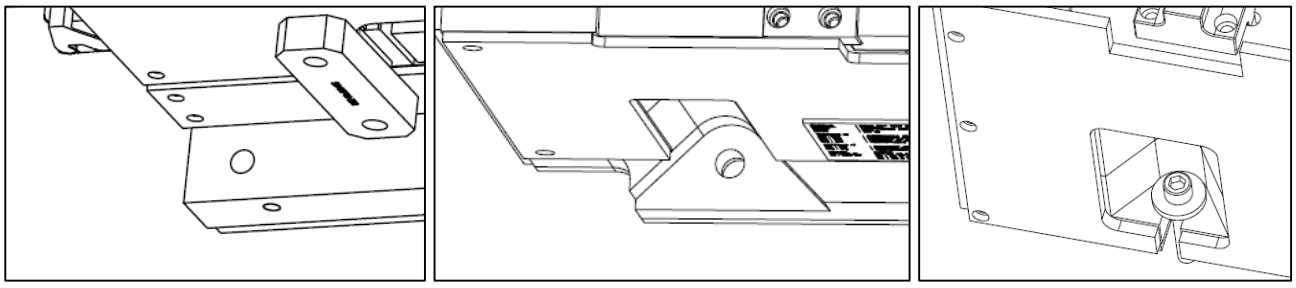


Figure 5: Schematic figure of the screw connection on the injection molding machine (3 figures, description see text)

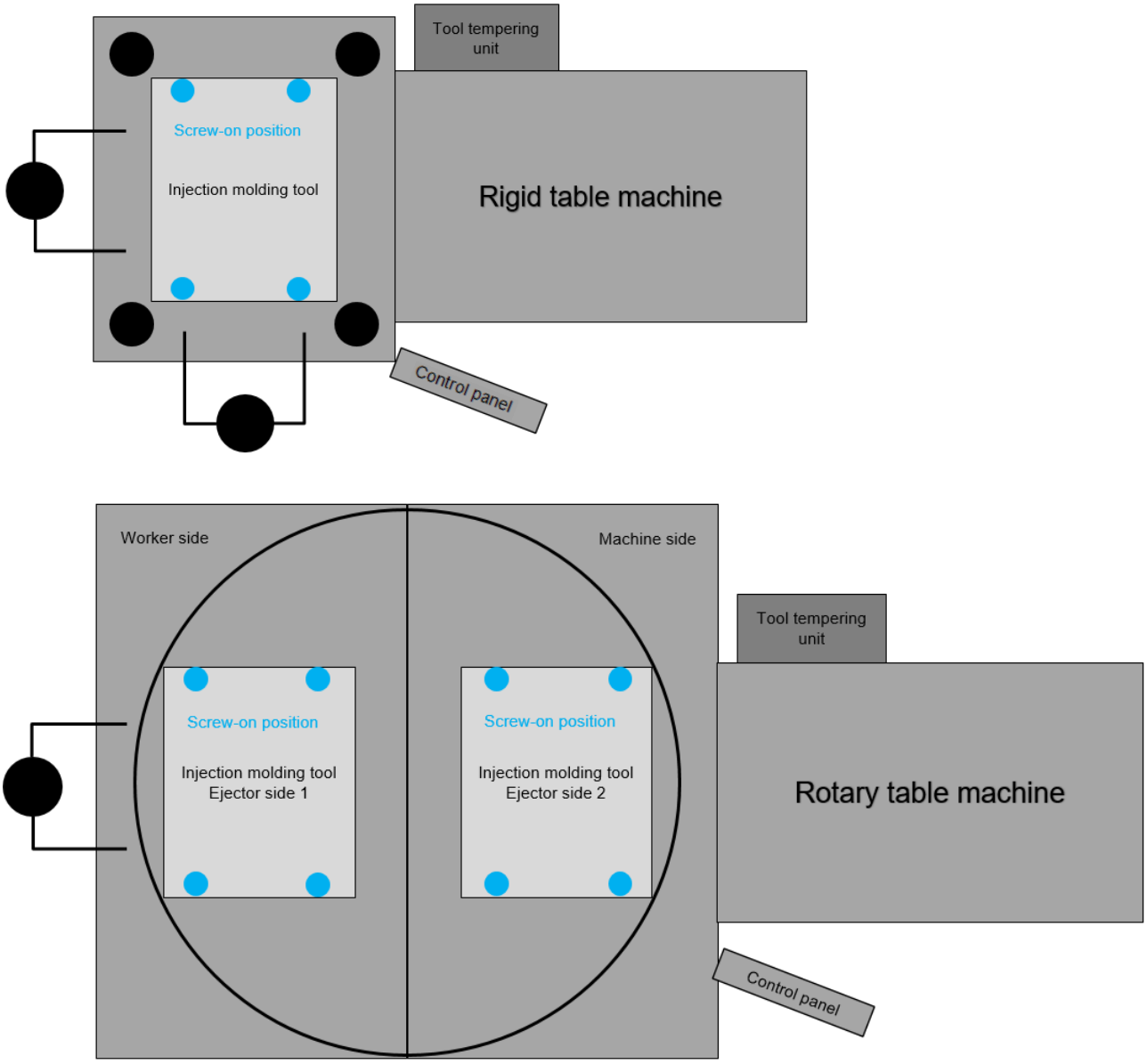


Figure 6: Schematic figure with notes on the screw-on situation on the rigid table machine and the rotary table machine (2 figures)

5.5 Centering

The centering is done by means of centering flanges with a centering diameter $\emptyset 125\ ^{-0,1}_{-0,2}$ mm and insertion chamfer on ejector and nozzle side.

5.6 Tool handling / setting-up

Lifting devices are required for tool handling.

The lifting device shall be able to be fixed on the nozzle side above the centering flange with M16 screws for handling the entire tool. The boreholes shall be drilled in the longitudinal axis of the tool as well as crosswise to it (see Figure 7).

A rotatable ring bolt with an inner diameter of min. 35mm and M16 thread should be mounted on the lifting device (see preferred components list).

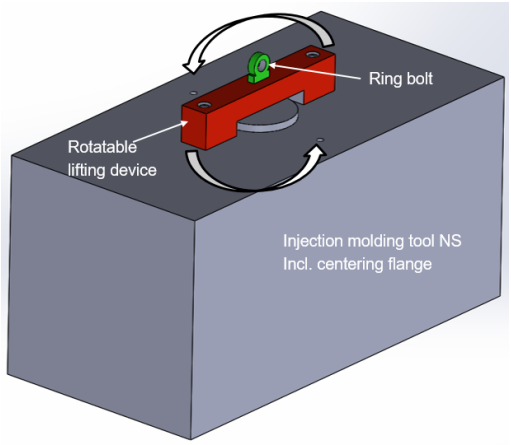


Figure 7: Schematic figure of a lifting device for the mold nozzle side

In order to be able to lift the ejector side separately, a lifting device shall also be constructed for this purpose. Alternatively, a common device for the ejector side and the entire mold can be created.

The hole patterns for the lifting devices shall be designed in such a way that the mold is horizontally balanced when it is lifted.

If a single ejector side is supplied (without nozzle side, e.g. for a rotary table machine), a protective cover against contamination and damage must be included in the delivery. The protective cover can be made of sheet metal or sturdy plastic and should be able to be fixed together with the lifting device (see Figure 8).

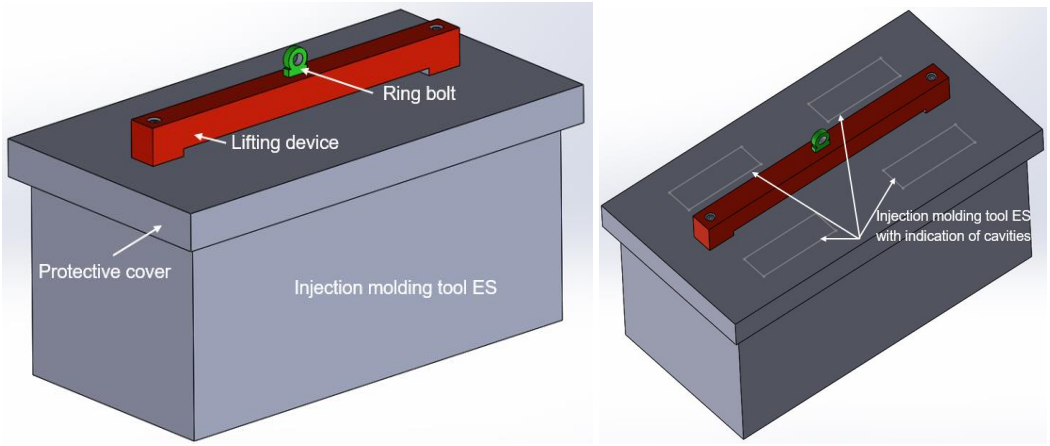


Figure 8: Schematic figures of a protective cover incl. lifting device for the individual ejector mold half

The upper and lower parts of the tool are secured for transport by two tool transport locking devices. The positioning must be designed in such a way that the tool securing device is easily accessible. M16 screws with strength class 12.9 must be provided for the transport lock.

The tool transport locking devices and the lifting device are to be marked red and labelled with the tool number.

The individual mold plates (clamping plate, baffle plate, cavity plate, nozzle clamping plate, etc.) must each be provided with one M12 threaded hole on all 4 outer surfaces to facilitate maintenance work. The hole pattern must be designed in such a way that the mold is horizontally balanced when it is lifted.

5.7 Screw quality

Steel screws with property class 12.9 and hexagon socket head cap as well as metric thread for the tool body are preferred (according to ISO 4762). Plugs, Plug covers, labels and insulations can be mounted with simpler screw quality.

5.8 Design sprue bush

A flat design must be used as sprue bush. The diameter of the sprue bush must be coordinated with ETO. The shot volume is decisive. The diameter of the sprue bush should be designed rather large to reduce the shear in plastic.

5.9 Demolding, ejector

The demolding of the injection parts is carried out by the ejector. The injection molding parts are not permitted to be damaged during demolding. Therefore, the injection molded part must be lifted out completely, if applicable, which is also true for non-overmolded but guided cables with connectors etc.

Spring-loaded ejectors/ pins must be realized in such way that the springs do not fall out in an uncontrolled manner during disassembly.

Mold ejectors must be secured against rotation during installation.

A suitable ejector bolt must be produced.

5.10 Parting planes and inserts

The parting plane must be designed according to the parts drawings.

Parting planes in the area of the mold inserts must be raised. The molding box can be lowered by 0.5mm to the mold insert.

Complicated and sensitive geometries in the mold cavity must be formed by using separate inserts and these must be provided as spare parts, after consultation with ETO.

In case of connector gating, the slides in the contact plane must be designed as several parts to facilitate cleaning of the inserts.

Mold and interchangeable inserts must be secured against rotation during installation.

Molding inserts shall be installable and de-installable from the parting plane in set up condition, if possible. To facilitate installation/de-installation, there must be insertion chamfers for the ejectors on the inserts. To facilitate inserting the ejectors even more, the entire ejector package shall be guided well. If there are tempering channels in the mold insert, the sealing must be ensured also after several assembly and disassembly cycles.

5.11 Mold temperature control

Temperature control is intended to ensure the most uniform possible cavity wall temperature in the running process. Hot spots should be avoided by suitable arrangement, e.g. separately cooled/ tempered cores, thermally conductive alloys or cooling close to the contour. The selected arrangements must be coordinated with ETO.

Temperature control circuits shall preferably have a diameter of 8mm. Smaller diameters are also permissible in more filigree mold inserts.

Water up to 140 °C is the preferred temperature control medium. The connections, hoses, seals, plugs, etc. must be designed for this.

Cooling circuits for specially cooled mold parts (e.g. cable clamping jaws) must be laid separately and the contact surfaces between „hot“ and „cold“ mold parts must be minimized. Cooling lines that lead through hot mold parts must be insulated via air gap or ceramic.

All tempering and cooling channels must be checked for leakage and flow rate at operating temperature before delivery.

When bridging several tempering channels, a series connection is preferable.

Connections of the tempering system must always be equipped with safety quick-release fasteners (see preferred components list).

Wherever possible and reasonable, tempering bridges must be attached firmly to the mold as rigid pipes. However, these may not be a hindrance during set-up procedures (note the external dimensions of the mold).

5.12 Deaeration vents

Deaeration vents should preferably be self-cleaning, e.g. via ejectors. Deaeration on blind hole-like recesses must be made possible by additional separating edges. Especially at the end of the flow path, adequate deaeration shall be provided.

Non self-cleaning venting ducts /e.g. in the parting line or on sliders) should be easily accessible for cleaning.

If special deaeration inserts are used, they must be entered in the design of drawing and bill of material.

When dimensioning the deaeration, the recommendations of the resin manufacturers must be observed.

5.13 Surface quality

The surface of the mold cavities must be designed so that the surface on the component after injection molding corresponds to the specifications on the drawings.

If there are no specifications on the drawing, it must be individually agreed with ETO whether a milled surface is suitable for the component or the surface is to be eroded, polished or ground.

The surface of the main parting line shall be designed in such way that it can be easily cleaned and no dirt can be deposited in grooves.

The component drawing may include information on the separation flash or on separation in general. These must be complied with.

5.14 Steel inserts

In principle, the use of steel inserts should be avoided. However, in case of special part geometry it may be necessary or helpful to design certain slider elements as separate inserts. These are then demolded in a separate process. For this purpose, it may be necessary that the steel inserts are demolded with a device. The necessary fixture geometry must be agreed with ETO.

For the steel inserts, attention must be paid to ergonomic design (especially shape and weight). It must be ensured constructively by the supplier that it is not possible to insert them upside down or twistedly in the injection mold (Poka Yoke). Before closing the injection tool, make sure that the steel inserts are positioned at the stop (x,y,z). The insert must be designed in such a way that it is subject to as little wear and tear as possible due to handling and use, e.g. choice of insertion chamfers.

When designing the inserts and tool pockets, care must be taken to ensure that they are easy to clean.

The number of steel inserts required for an uninterrupted process as well as additional spare parts must be coordinated separately with ETO.

5.15 Sliders

Mechanically and hydraulically actuated sliders must be incorporated into the mold with adjusted fixed stops and secured against loss. Sliders and inserts must reach a defined end position in the open and closed mold, if applicable a monitoring system must be used. The end positions must be clearly indicated by markings on the slider and guide.

Ball latches for securing the position of the sliders must be integrated into the slider in such a way that the ball latch can be readjusted from the slider. The tungsten carbide guides must be exposed in in such a way to ensure that the movement is smooth.

To simplify disassembly, the insulating plate can be exposed. The sliders must be designed in such a way that they can be cleaned easily.

For special part geometry it may be necessary to close the sliders manually (e.g. when threading contact pins). However, locking in the end position and demolding must be performed by the mold movements. Manually operated sliders must be secured against crashes. This means that the mold closing movement must be possible in any slider position.

5.16 Core pullers

If possible, core pullers should be avoided by means of additional sliders, inclined ejectors, etc. The use of core pullers must be coordinated with ETO. It should be checked whether the machine to be used includes a core puller control.

The end positions of the core pullers must be monitored via suitable limit switches. These must be installed in such a way that they are easily accessible, adjustable and protected against temperature.

The piping of the core pullers must be safe and functional. The core puller cylinders must be installed in such way that they are protected against high temperatures. Components must be used which can permanently withstand the temperature load.

When attaching the core pullers and cylinders, the space conditions must be taken into account both on the machine and during set-up process.

In order to identify the function of the core pullers and the position of the limit switches, they must be clearly marked. Furthermore, a type plate for the function/ assignment of the limit switches must be attached.

5.17 Position fixing of the insert assembly

Insert components or assemblies are often overmolded.

The insert assemblies must be fixed in the mold by means of suitable geometries (mandrels, pins, hold-down devices, etc.) in all spatial directions and in rotation axes.

Component tolerances on the fixture surfaces must be compensated for by spring-loaded inserts or hydraulically locked core pullers.

The insert assemblies must not be damaged during the insertion process or by the fixtures themselves (inclusion of demolding chamfers).

The type and position of the fixing of insert assemblies must be coordinated with ETO.

During construction, it is important to ensure ease of maintenance and assembly.

The positioning in the tool must be designed to be as wear resistant as possible, e.g. by hardening, polishing, coating.

5.18 Cut-outs for marking on the inserts

Inserts can be marked with data matrix coding for traceability on non-extruded areas. The corresponding areas must be formed with cut-outs so that the markings remain legible for optical systems. The exact positioning of the DMC can be found in the parts drawing.

5.19 Thermal insulation

The mold must be equipped with an insulating plate on the clamping surface on the nozzle and ejector side. These plates must have the necessary compressive strength and flatness.

Furthermore, the nozzle and ejector side must be completely insulated laterally. Insulating plates with lower requirements can be used for this.

All connections must be sufficiently exposed to ensure good accessibility. In order to increase the ease of maintenance, additional clearance can be provided in the area of the sliders. Very large slider surfaces should be insulated separately from the outside.

The cut and drilled edges on the insulation plates must be chamfered.

The insulation plates must be fixed with countersunk screws at a sufficient number of points.

5.20 Internal pressure and temperature sensor

For each sensor a type plate with reference to the mold cavity must be visibly attached to the insulation of the mold. The positioning must be coordinated with ETO.

The tendency is to prefer a position close to the gate on the nozzle side for the internal pressure sensors. For the temperature sensors, a position away from the gate on the nozzle side is preferable.

5.21 Hot runner

A type plate must be visibly attached to the insulation of the mold on the nozzle side for the hot runner.

Nozzles, manifold and sprue bush must be heated with 230V.

The hot runner manifold and the hot runner nozzles must be thermally separated or insulated from the mold frame according to the hot runner manufacturer's specifications. The use of titanium bushings or similar for thermal separation of the nozzle tips must be provided.

For lifetime and service reasons, the plugs of the hot runner nozzles may not be located in the immediate vicinity of the hot runner manifold.

When using valve gate nozzles, the actuation must be implemented pneumatically by means of a lifting plate for all needles. Readjustment of the needles must be made possible from the rear through the mounted clamping plate.

The sprue bush of the hot runner must be flat.

The diameter of the runner and the nozzles must be adapted to the shot volume and coordinated with ETO.

The hot runner system must be designed for the plastic material to be processed with regard to dimensioning, wear and temperatures.

The needle drive (pneumatic cylinder) must be thermally separated from the mold block according to the hot runner manufacturer's specification, e.g. by using insulating plates to the hot mold block. Furthermore, the outer insulating plates in the area of the lifting cylinder can be exposed to allow cooling by ambient air.

The tubing of the pneumatic cylinders for the needle drive must be equipped with temperature-resistant connections and hoses (PTFE; FEP or PFA). Alternatively, metal tubes can be used.

5.22 Connection of the hot runner heating and the temperature sensors

16-pin connections shall be used on the injection mold for both the hot runner heater and the temperature sensor (see preferred components list).

Heating connection			**Temperature sensor**		
1 - 8 = ground (green 230 V)			1 - 8 positive (white); 9 - 16 negative (red) (24V)		
	green	red		white	red
Nozzle 1	4	12	**Nozzle 1**	3	11
Nozzle 2	5	13	**Nozzle 2**	4	12
Nozzle 3	3	11	**Nozzle 3**	2	10
Nozzle 4	2	10	**Nozzle 4**	1	9
Manifold 1	1	9	**Manifold 1**	5	13
Sprue bush	6	14	**Sprue bush**	6	14
Manifold 2	7	15	**Manifold 2**	7	15
Coding	16		**Coding**	16	

Table 1: Tabular representation of the circuit diagram for the heating and temperature sensor connection on the injection mold

The hot runner nozzles can be clearly assigned to the cavities: Cavity 1 – Nozzle 1; Cavity 2 – Nozzle 2; etc.

The connections for the temperature sensor and the heater on the injection mold must be mounted vertically. Locking is done from the outside to the inside on the narrow sides (i.e. there should be only one lug on the connections). During mounting, it is also important to ensure that the coding point away from each other and that the connection of the temperature sensor is always on the left and the connection of the heater is always on the right (see Figure 9).

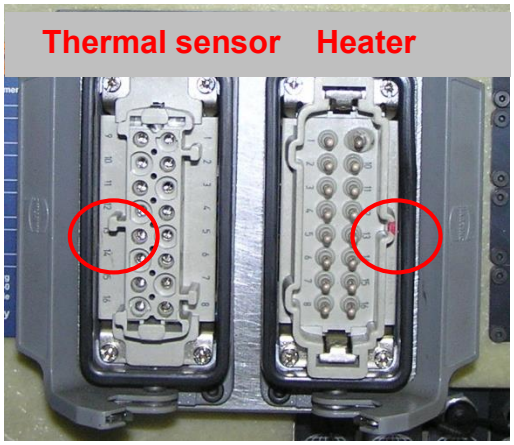


Figure 9: Arrangement of the „thermal sensor and heater“ connections on the injection molding tool

5.23 Monitoring sensors

When using switches, sensors and also when laying cables, the temperature resistance must observed.

All sensor systems must function faultlessly in the heated state. The expansion of the tool must be observed.

The cables must be adapted with device plugs according to the preferred components list.

The signal lines are connected to a common connector on the tool side.

The pin assignment of the connector must be coordinated individually with ETO.

5.24 Wiring of the electrical components

The cable ducts must be arranged in the mold in such a way that they are easily accessible, have no sharp edges and cannot be squeezed during mounting/ dismounting. The cables must be additionally fixed within the ducts.

All cables, connection plugs, connecting elements or fasteners must be designed to be heat-resistant.

Adequate electrical insulation of all cables and sensors must be ensured.

5.25 Shot counter / cycle counter

A mechanical shot counter (see list of preferred components) must be installed recessed in the mold on the narrow side of the nozzle side on the „electrical side“, easily readable when the mold is set up.

The counter may not be resettable and must withstand the mold temperature.

5.26 Marking on the tool

When aligning the type plates and markings, the vertical arrangement of the tool must be taken into account. All markings must be applied to the outside of the insulating plates in a clearly visible and legible manner. The legibility should be maintained in the assembled state.

The language of the marking is defined in the specification.

Further space must be provided for the customer's type plate, which is attached after final inspection.

5.26.1 General type plate

The injection molding tool must be provided with a type plate on the nozzle side. This plate must contain the following information (minimum information according to EU machinery guideline):

- Company name and full address of the manufacturer and, if applicable, his authorized representative
- Series or type description
- (if applicable) Serial number
- Year of construction (time of operational acceptance)
- Weights (nozzle side and ejector side)

5.26.2 Type plates of the components

The other type plates must be firmly attached to the tool:

- Hot runner system and nozzle arrangement
- Cavity pressure sensors
- Temperature sensors
- Monitoring and end position sensors (e.g. of core pullers)

Mold cavity related sensors must be clearly marked.

If possible, the positioning should be on the insulating plates on the electrical side of the nozzle side. If there is insufficient space, the same side of the ejector side can be used.

5.26.3 Marking of the tool elements

The equipment number of the injection mold shall be attached to the clamping plates of the ejector side, clearly legible by the operator in the injection position.

In order to avoid mixing up tool elements (mold inserts, sliders, jaws, ejectors, etc.) between the cavities, all tool elements shall be marked with the corresponding cavity number or a unique position number. The same numbering shall be applied to the mold plate or ejector plate next to it.

Moreover, all tool plates must be provided with a consecutive position number.

5.26.4 Marking of the media connections

The marking and counting starts on the nozzle side and continues on the ejector side. If 2 ejector sides are produced, the same numbering is used as for ejector side 1.

The 3-digit abbreviations shown in the Table 2 must be used for the inscription of the media inlets and outlets.

First digit		Second digit		Third digit	
Temperature control circuit (water or oil)	**T**	Media inlet (In)	**I**	Serial No.	**1,2,3 …**
Cooling circuit (water)	**C**				
Pneumatic connection (e.g. drive for needle valve)	**P**	Media outlet (Out)	**O**		
Hydraulic connection (e.g. core puller)	**H**				

Table 2: Tabular representation of the marking of the media connections on the injection mold

Examples:

TI1 --> Temperature control circuit inlet 1; CO5 --> Cooling circuit outlet 5

5.27 Operation and maintenance requirements

Only semiskilled workers will work on the injection molding tool. Training in the operation and maintenance of the injection mold tool is included in the scope of delivery.

For maintenance and repair of the injection tool, specially trained workers are deployed.

In order to achieve high availability, all wear parts and the activities necessary for the replacement shall be listed. In principle, all arrangements for the replacement of parts or module components must be made easy and quick to perform. All setting and adjustment activities must be designed to be done easily and quickly. Wear parts and sensitive tool elements must be designed to be easily replaceable and easily accessible.

The cleaning of the injection tool must be easy, i.e. no grooves, no lateral recesses, no inaccessible but visible spaces and avoidance of unsealed hollows. It must be easy to remove particles that arise during handling of inserts.

5.28 Spare parts

Sensitive inserts and steel inserts shall be provided as spare parts. The spare parts included in the scope of supply must be coordinated with ETO.

Furthermore, a set of all seals installed must be supplied.

All spare parts must be included at the latest when the tool is finally delivered.

6 Documentation

The documents must be created in the language required in the specification.

When the injection molding tool is delivered to ETO, at least the following documents must be handed over:

- Drawings (single components and assembly)
- Bill of material (with reference to wear parts)
- Tempering diagram (course and connecting diagram of the tempering system)
- 3D-data
- Sampling documentation (process parameters; equipment used; images from the filling study; etc.)
- Documentation/ drawings of hot runner, sensors, end position switches, light barriers, hydraulic cylinders, etc.
- If necessary, mounting instruction for subassemblies or special mold assemblies

After approval by the customer, all data must be updated to the latest status (after corrections) and delivered in a timely manner.

Furthermore, we would like to point out that in case of possible later tool change orders, the drawing documentation must be consulted and a modified set of drawings must be supplied by the tool manufacturer.

7 Dispatch / scope of delivery

Unless otherwise agreed, the toolmaker is responsible for the safe and timely transport to the respective ETO location.

The following points must be observed for the delivery or transport of the tool to the respective ETO GRUPPE location, especially for international deliveries:

- Sufficient corrosion protection for transport
- Suitable packaging
- Compliance with the customs regulations
- Suitable hauler

Damage caused by inadequate packaging or corrosion protection must be repaired by the tool supplier.

The scope of delivery includes the following components:

- Complete tool kit
- If applicable, additional steel inserts
- Accessories/ auxiliary equipment (e.g. ejector bolt for injection molding machine, tool safety device, lifting device, (if applicable) special tools for maintenance, etc.)
- Final design data (CAD data, set of drawings, bill of material)
- Data sheets of the components used
- Operating instruction for subassemblies or special tool assemblies
- Mounting instruction for subassemblies or special tool assemblies
- Spare parts package
- Seal kit