MicroPower 15 t

The best for micro injection molding

world of innovation

PRECISE – EFFICIENT – ECONOMICAL
The optimum for all types of micro parts

The advantages

» Reliable injection molding technology for shot weights from 0.05 to 4 g

» 2-step injection unit with screw plasticizing and plunger injection

» Energy-efficient, all-electric "Drive-on-Demand" motor system

» Innovative 5-point toggle lever clamping unit

» User-friendly through Unilog B8 control unit with integrated assistance systems

» Compact machine cell to accomodate a rotary table, robot, quality assurance system and conveyor belt inside the machine

» Matching integrated auxiliaries available (material dryer, material loader and temperature controller)

» Easy conversion into a clean room cell by adding a laminar flow unit

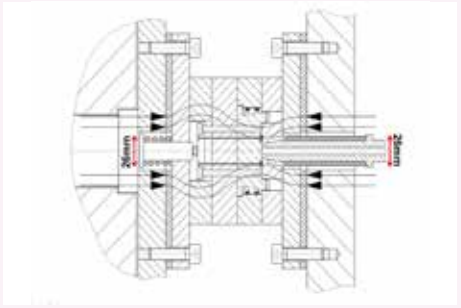
» Also as 2-component machine with second injection module and an adjusted rotary table available

The machine series

MicroPower standard: 1 clamping force size – 15 t

MicroPower Medical: for clean room applications – 15 t

MicroPower Combimould: for multi-component injection molding – 15 t



MicroPower

The system highlights

» **Clamping unit – all-electric – with optimal access**
The MicroPower clamping unit is a 2-platen system, in which the clamping force between the nozzle and the toggle lever side is transmitted by a U frame element. The moving platen is driven by an integrated, high-precision 5-point toggle lever. It moves the mold platen guided with high precision on linear bearings smoothly and with high dynamism.

» **Plasticizing unit: best control of micro quantities**
Three injection unit sizes are available for MicroPower machines, with shot volumes ranging from 1.2 to 4 cm^3. In all three of these aggregates, plasticizing is effected by a 14 mm 3-zone screw with a 20:1 L/D ratio. Injection takes place via a plunger either 5 or 8 mm in diameter, with injection pressure of up to 3000 bar and with an injection speed of up to 750 mm/s.

» **Small platen drillings – optimal force transmission**
The small through holes of only 26 mm in both mold platens enable optimal clamping force transmission into the mold, thus providing ideal conditions for high precision and long service life of the molds.

» **All-in-one production cell available on request**
The MicroPower system is totally modular. Therefore it can be extended into a complete production cell inside the standard machine frame by adding a WITTMANN SCARA robot, a rotary table, an optical parts inspection system and a conveyor belt or glass container for finished parts.

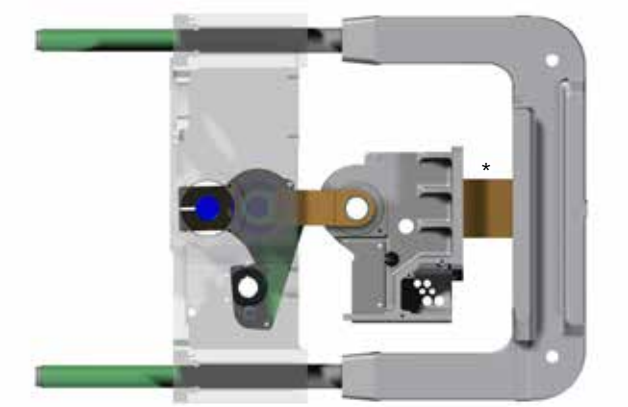
» **Clean room-compatible standard concept**
The standard machine frame is designed for easy cleaning. Without any structural alterations, it can be combined with a laminar flow unit, which supplies class 7 clean air according to ISO 14644-1 standard. Hygienic depositing of the finished parts is possible within the clean room cell strictly according to cavities in an 8-compartment depositing unit with glass containers.

CLAMPING UNIT
Free mold space

» **High precision**
The MicroPower clamping unit meets the most stringent requirements for precision in movements and automation options. Its high standard of precision is achieved by guidance of the system platen on the clamping side and the mold carrier plate on the same linear bearings. The central positioning of the toggle lever inside the U frame clamping unit ensures symmetrical clamping force transmission into the mold.

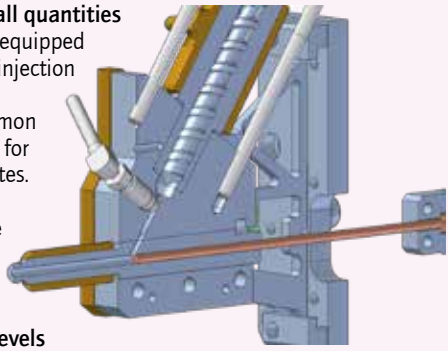
» **One machine size as standard**
- The clamping unit is available with 15 t clamping force.
- The mold platens on the ejector side come in one uniform size of 240 x 248 mm as standard.
- The width of the fixed platen is 240 mm.
- The maximum daylight between platens is 400 mm.

» **Free access and flexible automation**
- Thanks to the U frame, the mold space remains free of tie-bars.
- Ample space is provided on both sides of the U frame for the installation of a rotary table (rotation diameter 443 or 466 mm), a parts handling robot and other auxiliaries for quality inspection and parts depositing.



INJECTION UNIT
Specially designed for micro parts

» **Injection unit for extremely small quantities**
The MicroPower injection unit is equipped with a two-step plasticizing and injection unit. It is available in three sizes. What all three sizes have in common is their 14 mm plasticizing screw for processing standard-size granulates. The injection plunger comes in different sizes. They are available for shot volumes ranging from 1.2 to 4 cm^3.



» **One system for 3 shot volume levels**
The MicroPower plasticizing and injection aggregate is a 2-step unit. Step one is plasticizing with controlled back pressure. Step two is a separate plunger injection unit. The plunger of this aggregate functions simultaneously as a shut-off device to separate the melt channel of the plasticizing unit from the injection unit. Behind the injection plunger, an injection pressure sensor is located, which actively regulates the injection process and thus controls the precision and consistency of the molded parts.

The advantages of the MicroPower injection unit

» Low-stress metering at low pressure
» System without check valve, therefore no damage to materials through shear stress
» FI-FO injection process (first in – first out)
» Minimal pressure loss during injection
» Extremely small melt cushion, consequently high temperature stability of the shot volume
» Shot weights below 50 mg possible
» All standard granulates can be processed.

Anti-wear options
In addition to the high-quality standard finish, an extensive range of optional versions with extra anti-wear and/or anti-corrosion protection is available. Pre-defined option packages and a selection matrix facilitate the choice of the right version.

CLAMPING UNIT – COMBIMOULD SOLUTION
Fast rotary unit

The all-electric rotary unit is laid out for running in the +/- 180° mode. The rotary table features high dynamism, flexibility, operational safety and mold protection packed into a minimum of space. The robust basic structure provides optimal clamping force transmission. In combination with the backlash-free toggle lever, it thus enables extremely energy-efficient operation of the machine. The direct drive situated behind the rotary table combines ultimate precision with high rotary speed.

» **Highly dynamic electric servo drive**
- Short rotary times
- Parallel movements possible
- Short cycle times

» **Short changeover times**
- Optimal accessibility
- Easy mold insertion and removal
- Direct plug-in media connections for pneumatic systems/water
- Media supply via covered energy chain

» **Great flexibility**
- Location of ejector in both injection stations
- Servo-electric ejector control for ultimate precision
- Use as a 2x1-component machine also possible

» **Sensitive and accurate**
The rotary plate moves virtually without friction on its linear bearings. The mold protection system is very finely adjustable and thus ensures optimal mold protection.

» **Clean room-compatibility as standard**
- Smooth surface for fast cleaning
- Encapsulated structure
- Stainless steel cover

INJECTION UNIT – COMBIMOULD SOLUTION
Designed for molding micro parts

2-component injection molding
A 2-component machine also is available by combining two injection aggregates placed next to each other and using a rotary table inside the clamping unit.

» **Parallel operation of the injection units possible**
In the MicroPower Combimould machine, both plasticizing and injection units can be operated parallel to each other. This equally applies to the ejectors, core pulls and air valves, which can be operated parallel to the clamping movement.

» **H-H configuration**
Two parallel horizontal aggregates
- Both aggregates moveable individually
- Effective thermal separation of the aggregates

» **Flexible – modular – compact**
- Fast changeover between the injection units (PIM, LIM, thermoplastics)
- All standard granulates can be processed.
- Part weights below 50 mg possible
- Easy barrel change

» **Ultimate prescision**
- 2-step screw-and-plunger system
- Minimal injection times
- Optimal injection pressure control combined with highly dynamic changeover to holding pressure

MicroPower
Production cell “ex works”

The production cell concept is an “ex works” solution for MicroPower injection molding machines.

The advantages of the MicroPower production cell

» Machine frame closed on all sides as standard. Thus molding of the micro parts takes place in an isolated environment.

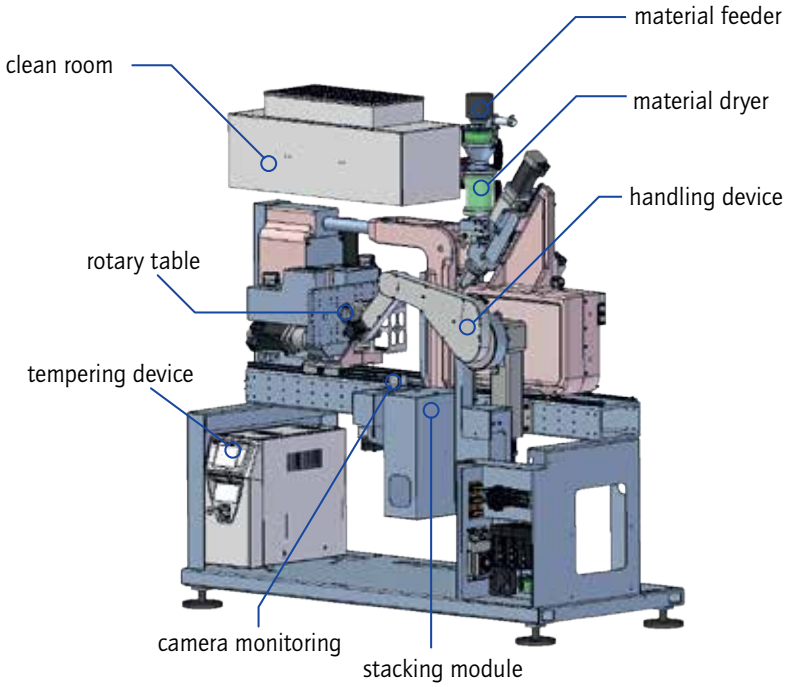
» The enclosed machine cell is designed to provide space for additional equipment modules inside the standard cell.

» The enclosed cell can be fitted with a clean room module. It consists of a suction filter and a ventilation unit for laminar air flow through the machine.

» Cost benefits, since all danger areas are covered and certified ex works.

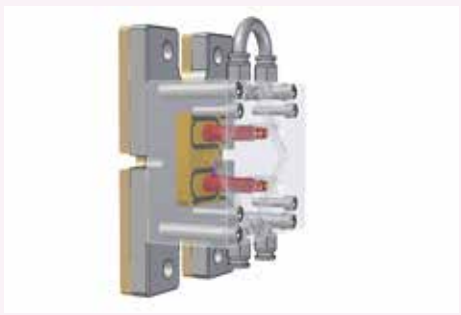
» MicroPower clean room production cells are suitable for producing micro parts for medical technology, as well as the electronics, watch making and optical industries.

» CE mark included for every machine with an insider solution. No separate costs for individual examinations.



CE-certified by type examination CE

OPTIONS
Flexible – proven – powerful



MicroPower
The option highlights

» **Rotary table**
The rotary table enables use of 2 bottom mold halves to achieve shorter cycle times on the one hand, and on the other hand to implement insertion and removal processes. In the multi-component version, the rotary table serves to accommodate the two different mold halves.

» **Silicone processing in micro dimensions**
For liquid silicone processing, for example in the production of medical components, a micro two-component material loader is available, including a blending and metering system. With this equipment, the machine can be quickly converted from thermoplastics to LIM injection molding.

» **High-precision coining (Expert-pvT-Coining)**
For the production of optical or micro-structured parts, a high-precision coining system is available as an optional equipment package. In this process, the coining pressure is controlled with high dynamism via the clamping stroke, depending on mold temperature or cavity pressure.

» **HiQ control for hot runners**
With decreasing part size, the proportion of sprue in the shot volume increases, due to the nature of the system. Minimizing the proportion of sprue is given a high priority in WITTMANN BATTENFELD product development.

» **WITTMANN auxiliaries in micro dimensions**
The optional Wittmann 4.0 auxiliaries integration package is the basis for "Plug & Produce" technology of WITTMANN BATTENFELD injection molding machines with auxiliaries from WITTMANN.

WITTMANN auxiliaries specially developed for the MicroPower:
- Tempro plus D Micro 100/140/160
- Drymax Micro F2-15 compact + material loader
- W8VS2 Vertical SCARA
- W8VS4 Vertical SCARA

UNILOG B8
Complex matters simplified

The Unilog B8 machine control system is the WITTMANN BATTENFELD solution to facilitate the operation of complex processes for human operators. For this purpose, the integrated industrial PC has been equipped with an enlarged intuitive touch screen operator terminal. The visualization screen is the interface to the Windows® 10 IoT operating system, which offers extensive process control functions. Next to the pivotable monitor screen, a connected panel/handset is mounted on the machine's central console.

Unilog B8
Highlights

» **Operating logic**
with a high degree of self-explanation, similar to modern communication devices

» **2 major operating principles**
- Operating/movement functions via tactile keys
- Process functions on touch screen (access via RFID, key card or key ring)

» **Process visualization**
via 21.5" touch screen display (full HD), pivoting laterally

» **New screen functions**
- Uniform layout for all WITTMANN auxiliaries
- Recognition of gestures (wiping and zooming by finger movements)
- Container function – split screen for sub-functions and programs

» **Status visualization**
Uniform signaling system across the entire WITTMANN Group. Headline on the screen with colored status bars and pop-up menus

» **Operator assistance**
Extensive help library integrated

WITTMANN 4.0
Barrier-free communication

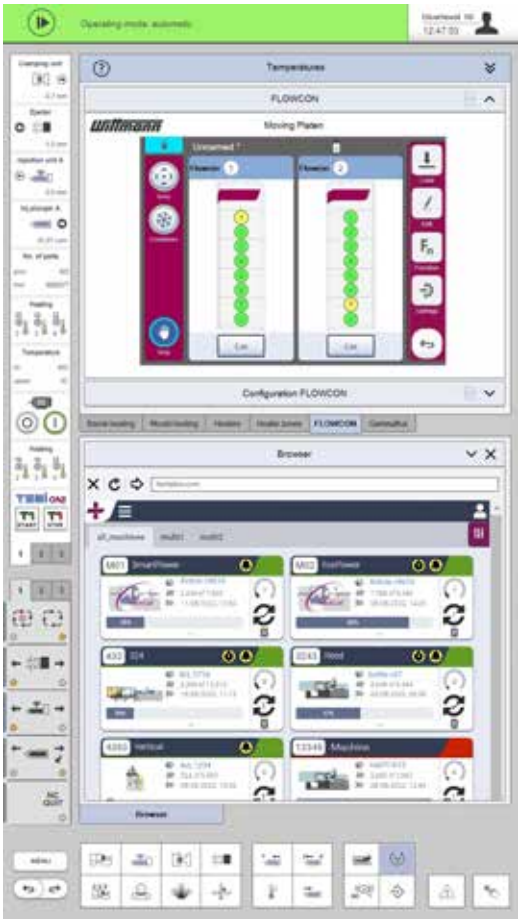
With its communication standard Wittmann 4.0, the WITTMANN group offers a uniform data transfer platform between injection molding machines and auxiliaries from WITTMANN. In case of a unit change, the corresponding visualizations and settings are loaded automatically via an update function, following the principle of "Plug & Produce".

Connection of auxiliaries via Wittmann 4.0

» **WITTMANN robots with R9 control system**
- Operation of robots via the machine's monitor screen
- High-speed communication between machine and robot to synchronize movements
- Important machine movements can be set via the R9 robot control system.

» **WITTMANN Tempro plus D temperature controllers**
- Setting and control of temperatures via the machine's control system possible
- All functions can be operated either on the unit or via the machine's control system.

Integration in MES system
The integration of machines and complete production cells in an MES system is a prerequisite for an efficient and transparent production facility according to the Industry 4.0 concept.
Depending on customers' requirements, small and medium-sized companies as well as global players are offered a compact MES solution based on TEMI+. With the Windows® 10 IoT operating system it is also possible to have selected status information from all connected machines on the production floor shown under SmartMonitoring on the display screen of every machine.



Wittmann 4.0 system
With Wittmann 4.0, a machine and its robots and auxiliaries are transformed into a uniform technical organism, which communicates externally via a specific IP address. Such a "Single point entry" with an integrated internal firewall substantially increases cyber security.

"Single point entry"
via router into the Industry 4.0 world

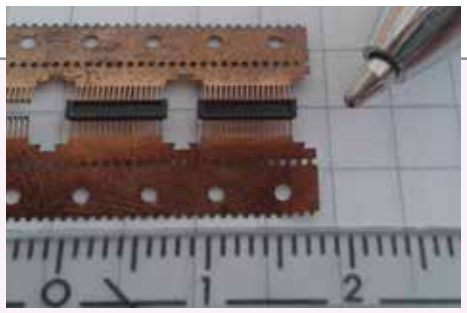
APPLICATION TECHNOLOGY
Outstanding competence

Photo: Micro Systems (UK) Ltd.

» **Clean room injection molding**
When medical components or electronic parts need to be manufactured in a particle-free environment, the MicroPower concept offers excellent conditions with its easy-to-clean mold environment and an optional clean air supply system.

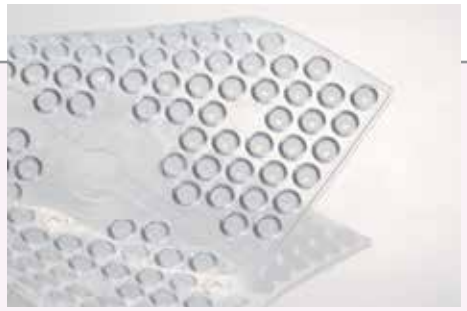
Photo: mikrotechnik Freudenreich GmbH & Co. KG

» **Combimould**
Two or more plastic materials in different colors or with different attributes can be combined into one part by upgrading the standard MicroPower with a second micro aggregate or by combining several machines into one production unit.



» **Reel-to-reel molding**
To produce electronic parts, punched structures are fed through the clamping unit and insert-molded. The ample mold mounting space of the MicroPower offers optimal conditions for this process.

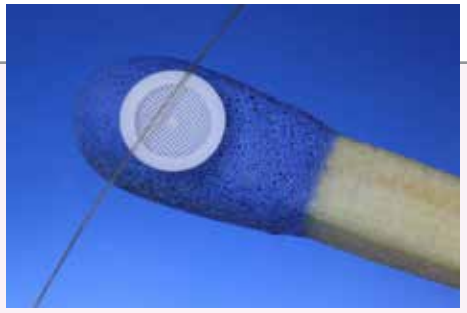
» **Insert molding**
When individual parts such as plug contacts need to be insert-molded, an insert station on a rotary table outside the mold is available for this purpose. A high-precision SCARA handling robot and a metal parts feeding station can be integrated into the machine as additional modules.



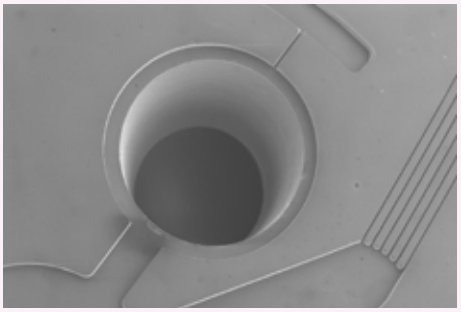
» **LIM – Liquid Injection Molding**
LIM designates the injection molding process for making elastic parts from 2-component liquid silicone rubber (LSR). LIM micro parts are used for optical and medical applications.

Photo: Frauenhofer IFAM

» **PIM (CIM/MIM) – Powder Injection Molding**
Powder injection molding (PIM) is a manufacturing process for series production of parts made of metallic or ceramic materials. PIM is the ideal process to make complex, functional components with stringent material requirements in large quantities.



» **High-precision micro parts**
In addition to standard plastics processing, the MicroPower injection unit is an ideal choice for manufacturing high-precision parts from engineering plastics such as POM, PEEK or PSU.



» **Microstructures**
The quality of the plastic melt generated gently and at a constant temperature inside the MicroPower injection unit is particularly suited for high-precision reproduction of micro structures inside the mold, from sensor structures to Fresnel lenses or copy protection holograms.

TECHNICAL DATA MicroPower 15

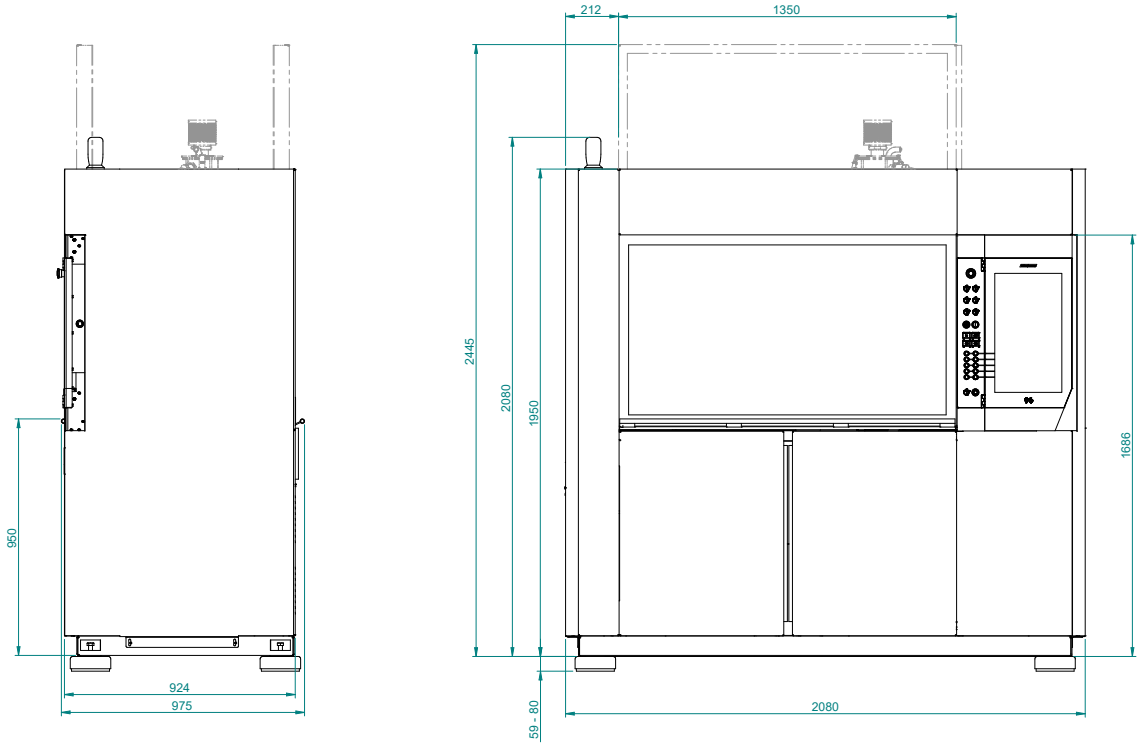
Clamping unit		**MicroPower 15**
Clamping force	kN	150
Platen size (h x v)	mm x mm	240 x 400 (248)
Mold height (min.)	mm	100
Mold height (max.)	mm	300
Opening stroke/Opening force	mm/kN	100/15
Maximum daylight	mm	400
Ejector stroke/ejector force	mm/kN	40/3.5
Dry cycle time[1)]	s – mm	1.2 – 100

Injection unit		**3**	**7.5**	**10**
Dosing screw diameter	mm		14	
Dosing screw stroke	mm	8	20	26
Screw L/D ratio			20	
Injection plunger diameter	mm	5	8	8
Theoretical shot volume	cm^3	1.2	3	4
Specific injection pressure	bar	3000	2500	2500
Max. screw speed	min^{-1}		200	
Max. plasticizing rate (PS)[2)]	g/s		1.7	
Max. screw torque	Nm		90	
Nozzle stroke/contact force[3)]	mm/kN		230/40	
Injection speed	mm/s		750	
Injection rate into air	cm^3/s	15	38	38
Barrel heating power, nozzle incl.	kW		2.45	
Number of heating zones			5	

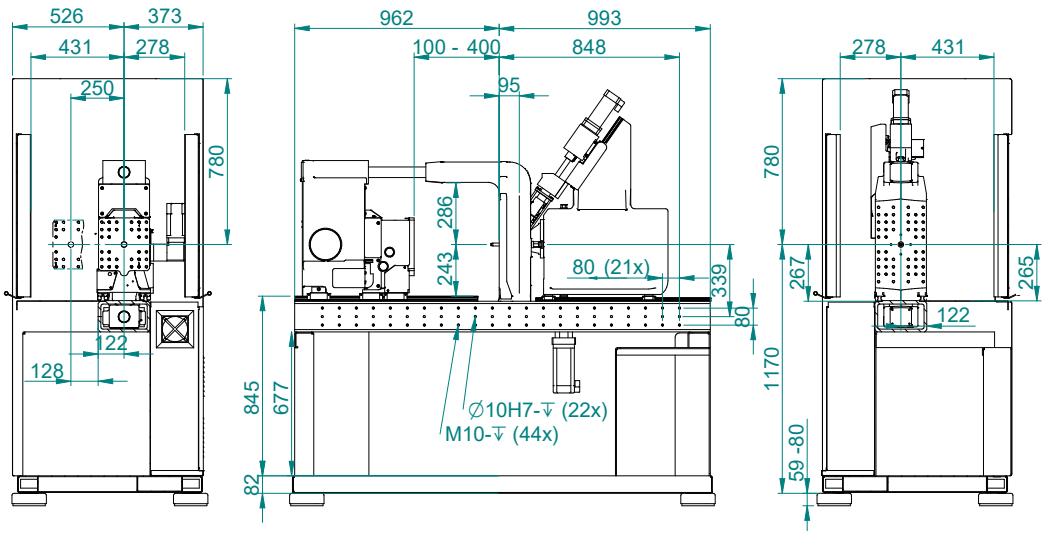
Drive		
Electrical power supply	kVA	9
Emission sound pressure level[4)]	dB(A)	65

Weights, dimensions		
Net weight	kg	1420
Length x width x height	m	2.1 x 0.98 x 2.1
Max. mold weight/ Min. mold diameter	kg/mm	60/120
Max. mold weight on rotary table[5]	kg	35

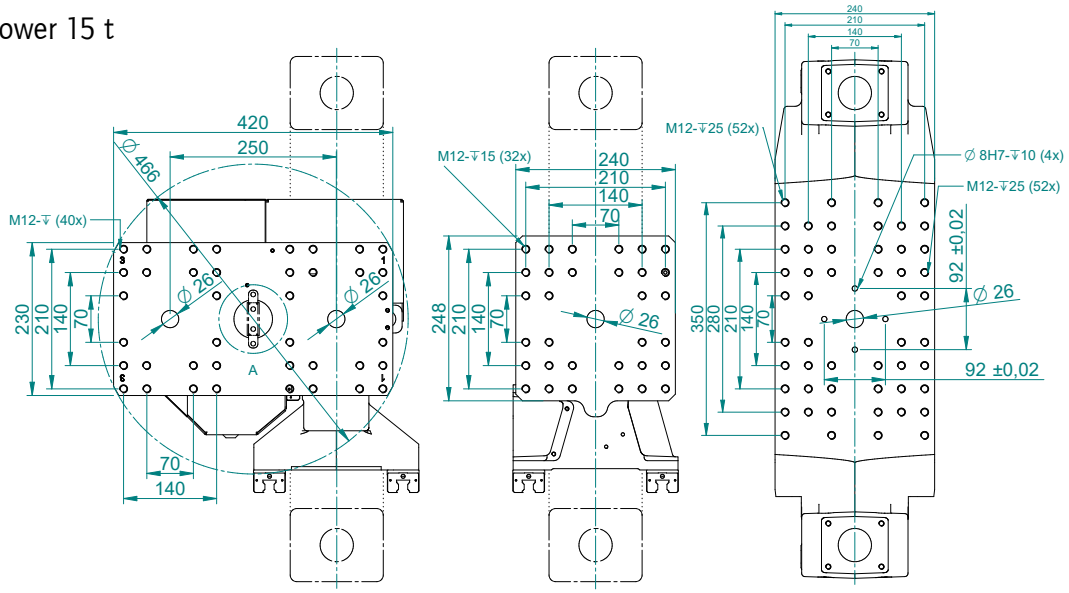
1) theoretical according to EUROMAP 6 2) according to WITTMANN BATTENFELD norm 3) manual
4) according to ÖNORM EN 201:2010 annex K 5) no asymmetrical load/or unbalance at RT permissible



General machine view



MicroPower 15 t



TECHNICAL DATA MicroPower 15 Combimould

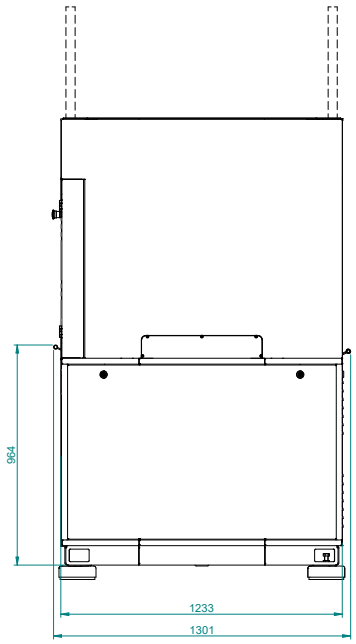
Clamping unit		**MicroPower 15**
Clamping force	kN	150
Platen size (h x v)	mm x mm	485 x 400 (248)
Mold height (min.)	mm	100
Mold height (max.)	mm	300
Opening stroke/Opening force	mm/kN	100/15
Maximum daylight	mm	400
Ejector stroke/ejector force	mm/kN	40/3.5
Dry cycle time[1)]	s – mm	1.2 – 100

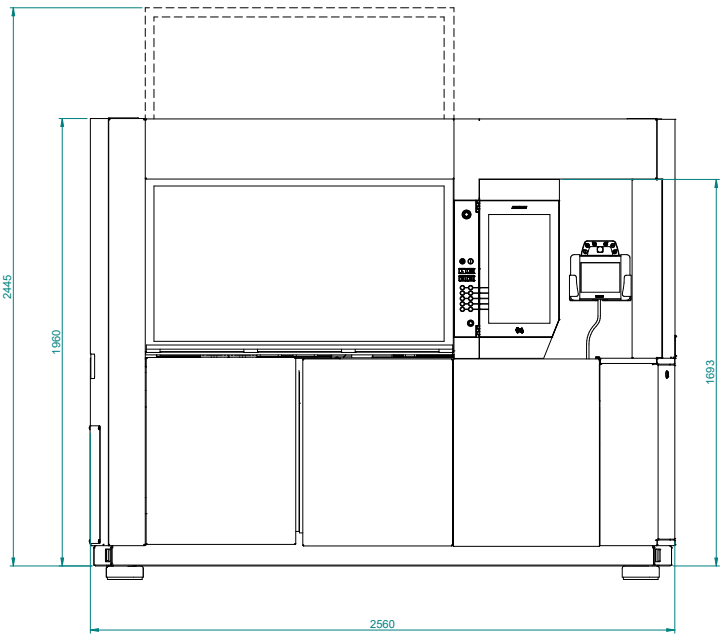
Injection unit		**3**	**7.5**	**10**
Dosing screw diameter	mm		14	
Dosing screw stroke	mm	8	20	26
Screw L/D ratio			20	
Injection plunger diameter	mm	5	8	8
Theoretical shot volume	cm^3	1.2	3	4
Specific injection pressure	bar	3000	2500	2500
Max. screw speed	min^{-1}		200	
Max. plasticizing rate (PS)[2)]	g/s		1.2	
Max. screw torque	Nm		90	
Nozzle stroke/contact force[3)]	mm/kN		230/40	
Injection speed	mm/s		750	
Injection rate into air	cm^3/s	15	38	38
Barrel heating power, nozzle incl.	kW		2.45	
Number of heating zones			5	

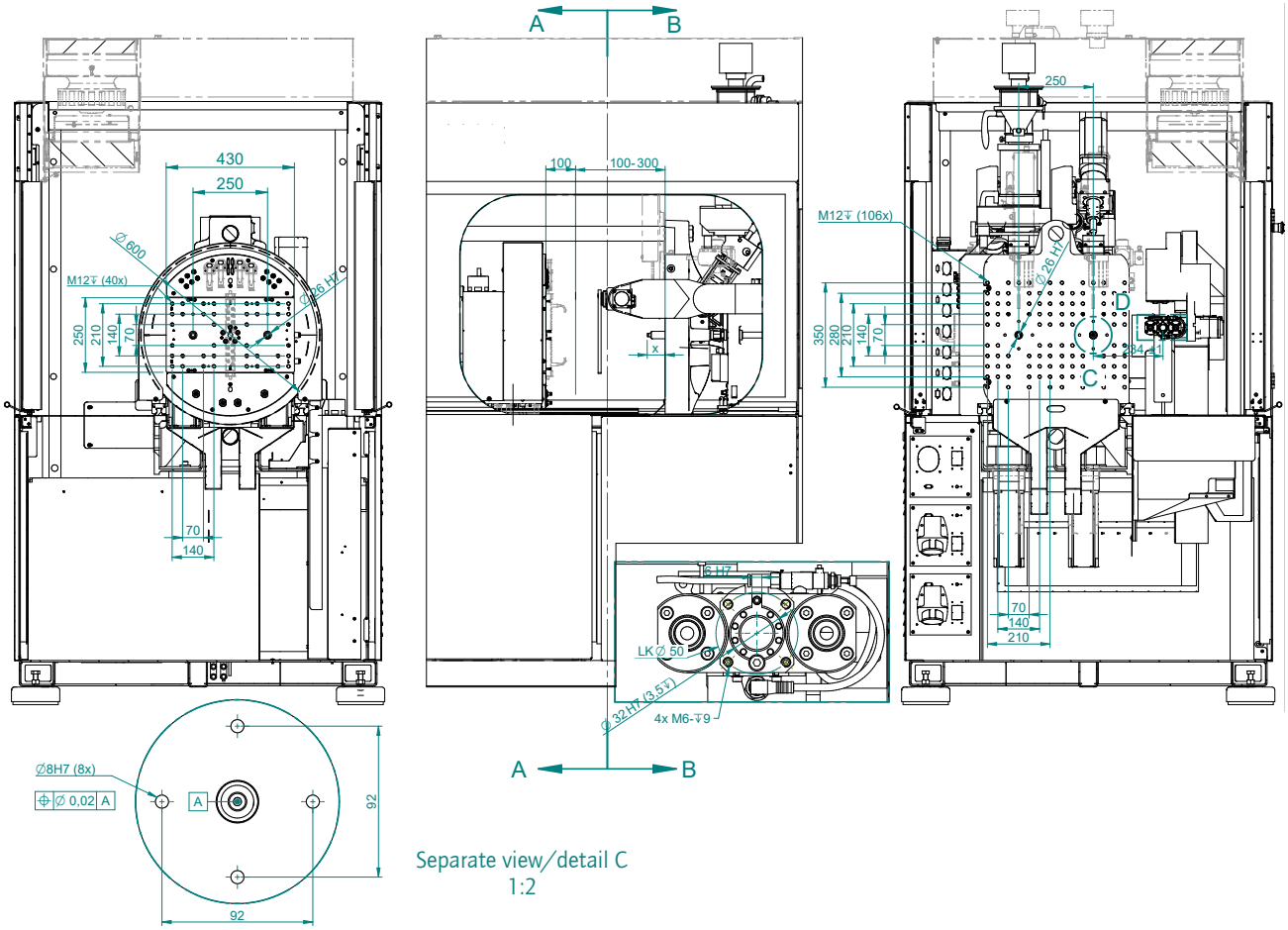
Drive		
Electrical power supply	kVA	9
Emission sound pressure level[4)]	dB(A)	65

Weights, dimensions		
Net weight	kg	2400
Length x width x height	m	2.6 x 1.3 x 2.2 (2.52)
Max. mold weight/ Min. mold diameter	kg/mm	80/120
Max. mold weight on rotary table[5]	kg	50

1) theoretical according to EUROMAP 6 2) according to WITTMANN BATTENFELD norm 3) manual
4) according to ÖNORM EN 201:2010 annex K 5) no asymmetrical load/or unbalance at RT permissible







Separate view/detail C
1:2

STANDARD

Base machine
Paint RAL 7047 tele grey 4
Rectangular main beam on one-piece base frame
Built-in control cabinet
Part transp. on operator side, or parallel to machine axis
Drillings for auxiliaries – like robot, camera, etc. – operator sided on rectangular main beam

Clamping unit
Clamping system: 5-point toggle with servo-electric direct drive
Servo-electric mold height adjustment
Clamping and opening forces for mold safety system adjustable
Mold safety program with envelope curves monitoring for optimal mold cover
Precise platen parallelism with low-maintenance moving platen support
Platen drillings metrical as per EUROMAP
Clamping force displayed on screen
Clamping force monitoring incl. display via screen
Servo-electric ejector
Mechanical ejector couple
Cooling hole in the mold mounting platen

Injection unit
Servo-closed loop control
Increased injection performance
Screw drive by 3-phase servo motor, screw speed continuously adjustable via screen
Barrel, screw, distributor block and injection nozzle in hot-work tool steel, injection piston TIN coated
Thermocouple failure monitor
Plug-in ceramic heater bands
Open nozzle
Quick removal for injection nozzle and cylinder
Hopper of V2A stainless steel can be shut and emptied
Linear bearings for the injection unit
Selectable barrel stand-by temperature
Decompression before and/or after metering
Physical units – bar, ccm, mm/s etc.
Screw protection
Auxiliary screw speed indication
Linear interpolation of holding pressure set values
Bar chart for barrel temperature with set value and actual value display
Selectable injection pressure limitation
Changeover from injection to holding pressure depending on stroke, time and pressure

Safety gate
Maintenance-free safety gate locked by electromagnet
Safety gate with electric monitoring according to CE standard
Safety gate on the rear side

Cooling and conditioning
Watercooling with open cooling system
Feeding zone with controlled cooling system

Additional equipment
Operating instructions
User manual

Electrics
Operating voltage 230/400 V-3PH, 50 Hz
Common voltage supply for drive and heat
Separate voltage supply for drive and heat USA/CDN
USB – 1 x operating unit
1 Ethernet interface (switch cabinet)
Printer via USB connection or network
Signal lamp at the machine

Control system
Control system Unilog B8 – 21,5" multi-touch screen (full HD)
Software for operating hours counter
Closing/opening – 5 profile steps
Ejection forward/back – 3 profile steps
Injection/holding pressure – 10 profile steps
Injection parallel to clamp force build-up
Screw speed/back pressure – 6 profile steps
Parts counter with good/bad part evaluation
Purging program
Stroke zero offset settings
Start-up program
Adjustable injection pressure limitation
Switchover to holding press. MASTER/SLAVE by injection time, screw stroke/injection volume and injection pressure
Self-teaching temperature controller
Display of temperature inside electrical cabinet
Seven-day timer
Access authorization via USB interface, password system and RFID authorization system
Freely configurable status bar
Physical, process-related units
Energy consumption monitoring for motors and heating
Automatic dimming
Logbook with filter function
User programming system (APS)
Cycle time analysis
Energy measurement displayed
Freely configurable screen pages „user page"
Notepad function
Hardcopy function
Internal data storage via USB connection or network
Online language selection
Online selection of imperial or metric units
Operator manual incl. hydr., mech. and el. schedules online
Time monitoring
Basic Quality Monitoring (1 freely configurable network connection, quality table with 1000 storage depth, events protocol (logbook) for 1000 events, actual value graphics with 5 curves, 1 envelope curves monitoring)
Injection integral supervision
Metering integral supervision
Alarm message via Email
SmartEdit – sequence editor

OPTIONS

Clamping unit
Servo electric rotary table
Mechanical mold safety mechanism
SPI bolt pattern
Ejector platen safety device as per EUROMAP 13
Parts chute for separation of good/bad parts
Nickel plated platen in lieu of standard
Air valve, action initiated (ON) and timer (OFF)
Non-standard layout of fastening bores in clamping/nozzle platen
Turning-out device with servo motor, installed on ejector plate

Injection unit
Grooves in the feeding zone of barrel for improved feeding
High temperature heaterbands up to 450 °C
Barrel insulation
Enter block with additional connection for nitrogen supply in lieu of standard
Wear and corrosion resistant injection unit AK+
Equipment package for liquid silicone
Equipment package for PIM (MIM/CIM)
Equipment package for technical plastics (PC, PMMA, ABS)
Equipment package for bioresorbable materials
Screw in special geometry
Conversion kit injection unit reduction to size 3 in AK+
Vacuum package: vacuum pump incl. interface, vacuum valve, vacuum sensor
Material hopper in DURAN glas design, 0.6 litres in volume
Connecting flange for customer-supplied hopper drier or drying unit
Equipment packages available in lieu of standard and/or in addition

Safety gate
Pneumatic safety gate at the operator side
Initiation of the next cycle by closing safety gate in semi-auto operation
Front side safety system for manual part removal

Pneumatic
Pneumatic maintenance unit incl. pressure regulation
Pneumatic core pullers incl. pressure regulator
Additional compressed-air controller

Cooling and conditioning
Watercooling with closed cooling system
Hosting of cooling circuits on the fixed platen of the moving platen
Integrated WITTMANN temperating units and dryer
Cooling circuits 2x additionally without shut-off valve

Granulat/dryer/feeder
Integrated WITTMANN dryer/dew point sensor
Integrated WITTMANN feeder

Robot/handling unit
W8VS2 WITTMANN Vertical SCARA robot with 3 servo axis
W8VS4 WITTMANN Vertical SCARA robot with 4 servo axis
Teachbox R8.2/R9
Additional valve
Additional vacuum circuit (Venturi)
Additional vacuum circuit (Venturi with blow-off function)
I/O expansion control cabinet (8I/8O)
Interface for COGNEX camera
Adapter for gripper plate (EOAT) with crash sensor
Conveyor belt

Electrics
Temperature control zone for hot runner
Special voltage
Control cabinet cooler
Interface for handling equipment
Temperature control interface digital, serial 20 mA TTY protocol
CAN-Bus-interface for mold conditioner as per EUROMAP 66-2
Interface for WITTMANN dryer integrated
Interface for WITTMANN temperating units integrated
Interface for robots as per EUROMAP 67
Interface for robots as per EUROMAP 67 with add. signals for rotary table
Interface for conveyor belt and dosing unit
Interface for full integration of robot incl. Ethernet switch
Host computer interface/PDA (EUROMAP 63)
Relays contact parallel to plasticizing
Kistler module for cavity pressure dependent switchover
BNC connectors for injection process analysis
Machine fault (potential-free contact)
Part inlay monitoring via vacuum
Signal tower with acustic element
CEE socket 16 A
Protection of the socket circuits via residual-current-operating circuit breaker with 30 mA conventional tripping current
Additional emergency-stop button, mounted on the rear of the machine
Interface evacuation with software (incl. vacuum valves for rotary table)
Interface for freely configurable mold monitoring

Control system
Energy consumption analysis
Switch over to holding pressure by cavity or melt pressure
Switch over to holding pressure by external signal
Injection compression and venting sequences
Second injection data setting for automatic start up
HiQ Cushion – melt cushion control
HiQ Flow – injection integral control
HiQ Melt – monitoring of material quality
Injection compression program/Extended injection compression program
Gate start special program
Special program according to customer specification
User specific limiting input value system
Program in US dimensions
RJG eDart interface
Expert Quality Monitoring (4 freely configurable network connections, quality table with 10000 storage depth, events protocol (logbook) for 10000 events, actual value graphic with 16 curves, 4 envelope curves monitoring, SPC charts, trend diagrams)
Add. screen text not according to EU (max. 2 languages in add. to German)
Second injection parameter record for lower mold allocation or injection parameter change-over during start-up phase
Variotherm processing package

Additional equipment
Special paint and/or touch-up paint
Tool kit
Levelling pads
Lighting in mold space
Distance blocks 100 mm for leveling mounts
Spare parts package
Sprue-cut-off-appliance with air nozzle
Clean room box
Visual quality inspection
Ionization
8-fold parts depositing

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