MacroPower Combimould

400 – 2000 t

The flexible large-molding machine

world of innovation

MacroPower Combimould
Extra functionality and more freedom for design

Based on the MacroPower model with 2-platen technology, the MacroPower Combimould series comes with a wide range of options and an extensive choice of different combinations, thus offering the right package for every multi-component technology. In this way the machine, mold and automation technologies can be optimally adapted to each individual product.

Combimould stands for WITTMANN BATTENFELD's multi-component injection molding technology. In this process, a basic part is produced in the first injection molding station, then plastic components in different colors or made of different materials are added in one or several more injection molding stations, all in one cyclical sequence. In this way, various material attributes are combined with each other to create a composite part of better quality in terms of visual attractiveness and functionality. This material combination technology can be used to produce individual parts as well as integrated components joined together by assembly injection molding. Depending on the parts geometry in each case, this requires different process variants.

The WITTMANN BATTENFELD know-how covers all process variants, such as multi-color, 2-component, assembly, multi-component and sandwich injection molding.

For technical details of standard MacroPower machines see the MacroPower brochure.

Photo: Haidlmair GmbH

MacroPower Combimould
Applications

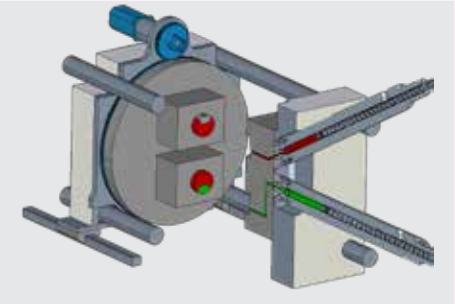
» **Hard-soft combinations and overmolded sealing components**
The use of thermoplastic elastomers allows direct overmolding of sealing components. Moreover, the surface touch can be improved by adding a soft component. The bonding strength can be increased by mechanical anchoring. Multi-component technology is also frequently used in LIM processes (liquid silicon processing).

» **Multi-color injection molding**
Several parts made of the same material but in different colors are combined into one component. Classic examples are multi-colored bottle cases with soft-handles and the frames for flat screens (LED TV sets, computers, laptops etc.) with piano finish effect. Multi-color injection molding improves the appearance of parts with guaranteed colorfastness.

» **In-Mold Assembling**
Parts consisting of two halves can be joined together directly in the mold. For example, to make this two-component oil closure, its two halves are injected in separate stations with the help of cube molds, then, following rotation, brought together in the 3rd station by closing the mold. But jointed connections can also be injected in one production step. Non-adhesive materials are chosen for this purpose. Ball joints and hings can easily be formed in this way.

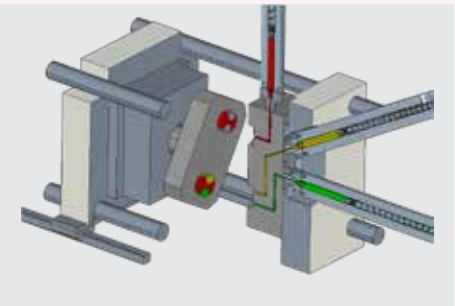
» **Sandwich injection molding – co-injection technology**
This process serves to produce parts with a three-layer structure, consisting of two continuous outer surface layers and a core layer. This is achieved by consecutive injection of two materials through the same nozzle into a conventional mold. A foamed or reinforced core component improves the part's mechanical attributes. Costs can be reduced by using regrind and Cellmould foam technology. The surface layers consisting of high-grade materials provide the desired high-quality surface attributes. In the packaging industry, barrier layers can be incorporated in the parts. Reproducible, attractive marbling effects can be achieved by switching several times between two materials of different colors. Depending on the area of application and the requirements to be met by the production equipment, a sandwich adapter plate, a sandwich and interval nozzle or a "monosandwich" process is used.

Combimould PROCESS TECHNOLOGY
Optimally coordinated solution



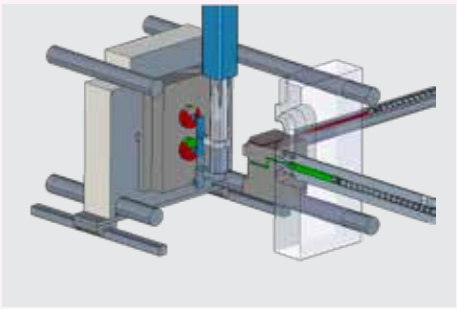
» **Rotary unit process**
The standard process

Rotary unit technology is the most frequently used Combimould variant. It is used both for overmolding and back molding. Here, the ejector half of an X + X-cavity mold is mounted on a rotary unit. The rotary unit can be designed for alternating rotation movements of +/- 180 degrees (2 stations), 120 degrees (3 stations) or 90 degrees (4 stations).
Following the injection molding process in station 1, the base part produced there is transferred to the overmolding station by opening and rotating the mold half on the ejector side. Parallel to molding the additional components in the subsequent stations, the next base part is produced in station 1. The finished part is removed from the last station.



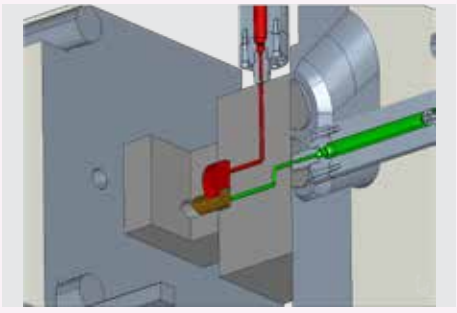
» **Index plate process**
For complex part design

In index plate technology, the rotation and transfer mechanism is an integral part of the mold. This process must be applied if the second component is to be added on both sides of the part. To this end, the preform must be transferred to a station to receive a modified shape on both sides. This is carried out with the help of an intermediate plate inside the mold, also known as index plate, by which the parts are lifted out of station 1, turned and then re-inserted into station 2. The drive system for the index plate is either integrated in the mold or may be connected to the machine with a servo-electric drive. Rotations of +/- 180 degrees (2 stations), 120 degrees (3 stations) or 90 degrees (4 stations) are possible. The index plate system offers the maximum possible flexibility for molded parts engineering.



» **Transfer process**
For special cases and small series projects

This process is used as an alternative to the index plate process where the molded part No. 1, due to its geometry, has an insufficient contact area on the index plate for being transported by the index plate between the injection molding stations. Other types of applications are combinations of bulky inserts (such as screwdrivers or knife blades) with plastic components, or a low-cost production alternative for small series.



» **Valve gate retraction process**
To add flat components without parts transfer

In valve gate technology, the second component is added without prior mold opening and rotation. The different geometry required inside the cavity is produced by a hydraulic valve gate which, when retracted, provides the space for adding the second component.

In spite of a longer cycle time due to serial production steps, the valve gate process may be of interest economically in mold technology for small numbers of units because of the lower cost of mold technology. In some cases, the compact mold design even allows the use of smaller machines. However, a possible use strongly depends on the design of the molded part and on flat geometries of the additions.

CLAMPING UNIT
High functionality with ample mold space

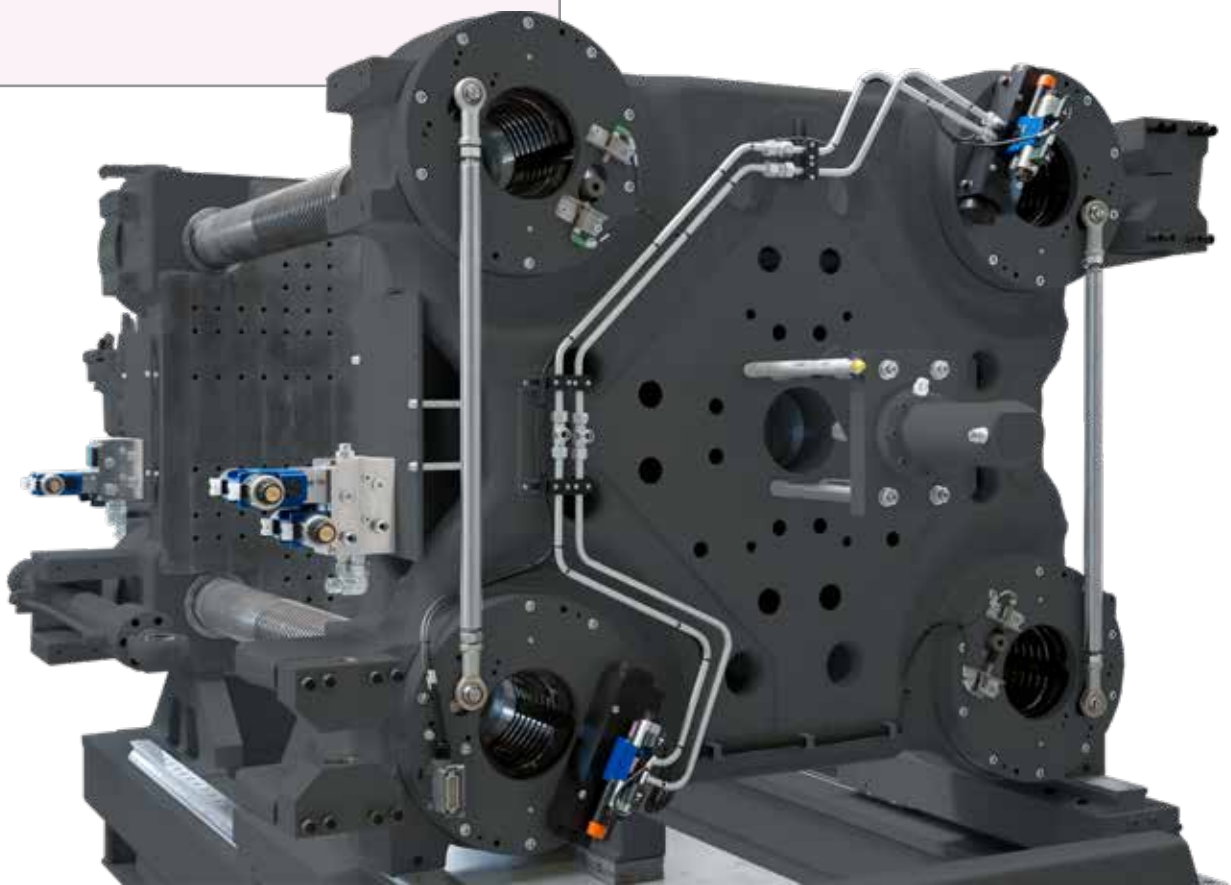
» **Large and flexible**
The extensive MacroPower system construction kit offers a wide range of combination options from numerous clamping force variants with matching distances between tie-bars, in both standard and XL versions.

» **Sensitive and precise**
In the MacroPower clamping system, the tie-bars are only used for the force transmission between the mold platens. The moving platen is mounted on a carriage, which travels on high-precision linear bearings along the machine frame. The minimal rolling friction in the linear bearings is the prerequisite for highly sensitive mold protection and high cleanless.

» **Fast and synchronized**
The Quicklock locking system between the tie-bars and the moving platen consists of four synchronized tooth segment nuts, which are integrated in the moving platen to minimize the machine's footprint.

» **Compact design for minimal footprint**
The integrated tie-bar nuts and short tie-bars offer two advantages: short footprint and simultaneously free space for lateral mold insertion.

» **Symmetrical and powerful**
The moving platen is driven by two diagonally positioned traveling cylinders designed for high speed. The traveling drive in combination with a hydraulic differential gear system provides the basic conditions for high speed, precision in movements and power.



CLAMPING UNIT
Fast rotation units

The optional, adaptive rotary table comes with a servo-electric drive and is laid out for a rotation angle of 360° or +/-180°.
In addition, it is characterized by extremely low installation height, high dynamics, flexibility, safety and gentle treatment of the mold.

» **Highly dynamic servo motor**
- Minimal rotation times
- Parallel movements
- Shorter cycle times

» **Short changeover times**
- Very low installation height
- Easy and flexible installation and removal
- Unit can be deactivated via control-system

» **Safety and mold protection**
- Dampened end position control
- Indexing device

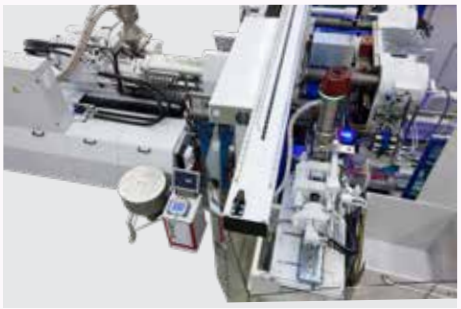
» **Extension of the standard version by various options**
- 3-station (120°) or 4-station (90°) processes
- Additional media circuits
- Individual ejector positions
- Magnetic clamping plate

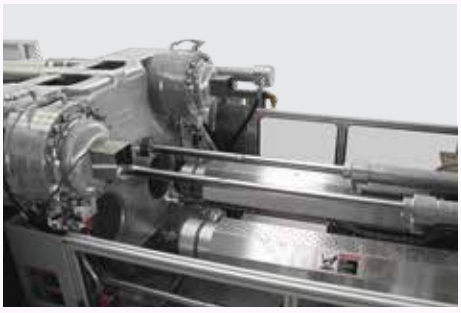
Best access
for rotation devices

Rotation devices for the required media, for temperature control, hydraulics and pneumatics can be supplied with up to 12 circuits.

The 2-platen technology design of the MacroPower machines ensures optimal access to its media supply connections.

INJECTION UNIT
Configurations





Injection unit
Configuration

The *MacroPower* Combimould offers a choice of V, S and L configurations as standard. Special configurations, such as the Y, B or H-H configuration, are available upon request.

» **V configuration**
Injection from above, also into the mold parting line
- Generous adjustment range
- Sliding unit with linear guides
- Easy horizontal adjustment
- Complete V aggregate can be moved back to provide an absolutely free mold space

» **S configuration**
Slanted above horizontal injection unit
- Compact machine design
- Small footprint
- S and H aggregates can be moved independently
- Independent, adjustable, torque-free nozzle contact pressure
- Excellent access to the nozzle

» **L configuration**
Injection from the non-operator side, also into the mold parting line
- Sliding unit freely mounted on the back of the fixed platen
- Injection unit supported by linear guides
- Long adjustment path
- Access to the nozzle and to the mold from the rear via large operator safety gate
- Fixed platen kept free for standard linear robot

» **B configuration**
Injection unit on the moving platen
- For cube technology
- Injection into the moving mold half

» **H-H configuration**
2 parallel horizontal aggregates
- Both aggregates can be moved independently
- For sandwich technology
- Excellent thermal insulation of each aggregate

DRIVE TECHNOLOGY
Energy efficient and modular

Fast-responding, precise, thrifty
"Drive-on-Demand" is the innovative combination of a fast-responding, speed-controlled, air-cooled servo motor with a fixed displacement pump. This drive unit is only activated when required by movements and pressure build-up. During cooling times or cycle pauses for parts handling, the servo drive remains switched off and thus consumes no energy. In operation, "Drive-on-Demand" is the basis for highly dynamic, controlled machine movements and short cycle times. Monitored shut-off valves are installed in the suction pipes to ensure operational safety.

The "Drive-on-Demand" system is standard in the MacroPower machine series.

Hydraulic system extension levels for parallel functions
- S1: twin pump system for parallel movements of ejector and core pull
- S2: twin pump system with increased drive performance (optional) for parallel movements of ejector and core pull plus faster injection
- S4: twin pump system with increased drive performance (optional) for parallel movements of ejector and core pull and high-speed injection with an accumulator for short cycle times

A brake on operating costs
- The "Drive-on-Demand" system is standard equipment.
- "Drive-on-Demand" lowers energy consumption by up to 40 per cent compared to modern variable displacement pump systems.
- Additional energy cost cuts through reduction of idle power
- Lower total expense for cooling, since oil cooling is normally not required
- Lower maintenance expense through longer preservation of the oil quality due to less thermal load
- Lower sound emission levels, consequently less investment in sound protection required
- Second servo drive package is standard, third servo drive package for parallel movements for the mold shut-off nozzle system as an option

COMBINATION OPTIONS
MacroPower Combimould

MacroPower Combimould 400 / 450					
Injection unit H	**130**	**210**	**350**	**525**	**750**
1330	V – L	V – L – S	V – L – S	V – L – S	V – L – S
2250	V – L	V – L – S	V – L – S	V – L – S	V – L – S
3400	V – L	V – L – S	V – L – S	V – L – S	V – L – S

MacroPower Combimould XL 450 / 500 / 550					
Injection unit H	**130**	**210**	**350**	**525**	**750**
1330	V – L	V – L – S	V – L – S	V – L – S	V – L – S
2250	V – L	V – L – S	V – L – S	V – L – S	V – L – S
3400	V – L	V – L – S	V – L – S	V – L – S	V – L – S

MacroPower Combimould XL 550 / 650 / 700				
Injection unit H	**210**	**350**	**525**	**750**
2250	V – L – S	V – L – S	V – L – S	V – L – S
3400	V – L – S	V – L – S	V – L – S	V – L – S
5100	V – L – S	V – L – S	V – L – S	V – L – S

Further combinations and B or H-H configuration available upon request.

H	horizontal
V	vertical

S	slanted from above
L	horizontal from rear

B	horizontal on clamping unit
HH	horizontal parallel

MacroPower Combimould XL 700 / 850 / 900				
Injection unit H	350	525	750	1000
2250	V – L – S	V – L – S	V – L – S	L
3400	V – L – S	V – L – S	V – L – S	L
5100	V – L – S	V – L – S	V – L – S	L

MacroPower Combimould XL 900 / 1000 / 1100					
Injection unit H	350	525	750	1000	1330
3400	L – S	L – S	L – S	L	L
5100	L – S	L – S	L – S	L	L
8800	L – S	L – S	L – S	L	L

MacroPower Combimould XL 1100 / 1300 / 1500 / 1600						
Injection unit H	350	525	750	1000	1330	2250
5100	L – S	L – S	L – S	L	L	L
8800	L – S	L – S	L – S	L	L	L
12800	L – S	L – S	L – S	L	L	L

MacroPower Combimould XL 1600 / 1800 / 2000						
Injection unit H	350	525	750	1000	1330	2250
12800	L – S	L – S	L – S	L	L	L
16800	L – S	L – S	L – S	L	L	L
19000	L – S	L – S	L – S	L	L	L

Further combinations and B or H-H configuration available upon request.

DATA MacroPower Combimould 400 – 2000

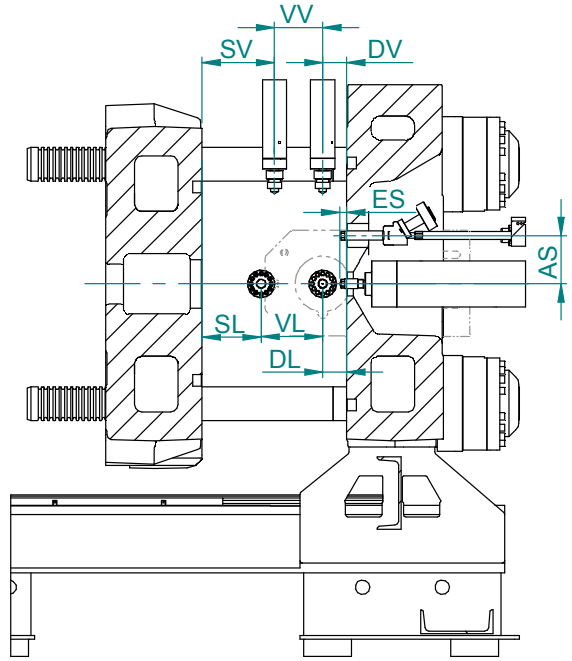
		MacroPower Combimould 400 / 450			MacroPower Combimould XL 450 / 500 / 550			MacroPower Combimould XL 550 / 650 / 700		
Injection unit H		**1330**	**2250**	**3400**	**1330**	**2250**	**3400**	**2250**	**3400**	**5100**
Weight[1]	t	23	23	23	25	26	26	31	31	32
L	m	6.80	6.80	7.10	7.10	7.10	7.40	7.40	7.70	8.20
W	m		2.50			2.60			2.80	
H	m		2.50			2.50			2.80	

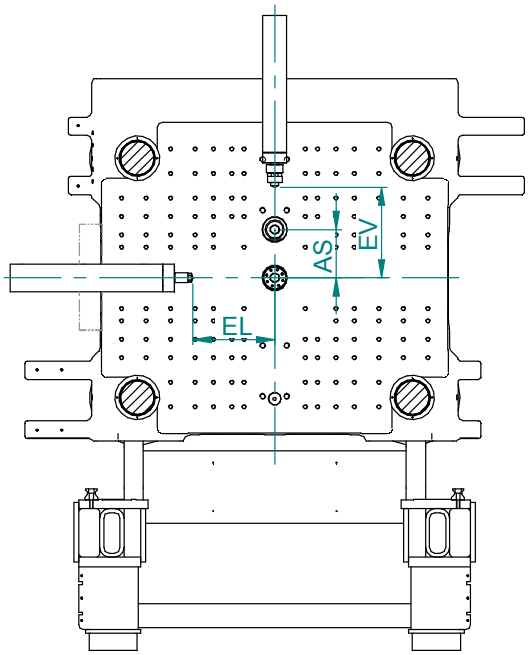
Injection unit V		**130[2]**	**210**	**350**	**525**	**750**	**130[2]**	**210**	**350**	**525**	**750**	**210**	**350**	**525**	**750**
HV	m	3.90	4.20	4.40	4.55	4.95	3.95	4.25	4.45	4.60	5.00	4.35	4.55	4.70	5.10
EV	mm			325					375				425		
DV	mm			100					100				100		
VV	mm			200					200				200		
SV	mm			100					100				100		

Injection unit L		**130[2]**	**210**	**350**	**525**	**750**	**130[2]**	**210**	**350**	**525**	**750**	**210**	**350**	**525**	**750**
BL	m	1.40	1.70	1.80	1.90	2.20	1.40	1.70	1.80	1.90	2.20	1.70	1.80	1.90	2.20
EL	mm			350					400				450		
DL	mm			100					100				100		
VL	mm			200					200				200		
SL	mm			100					100				100		

Injection unit S			**210**	**350**	**525**	**750**		**210**	**350**	**525**	**750**	**210**	**350**	**525**	**750**
HS	m	–	3.00	3.05	3.10	3.15	–	3.00	3.05	3.10	3.15	3.10	3.15	3.20	3.25
ES	mm	–		30			–		30				30		
AS	mm	–		200			–		200				300		

1) with additional injection unit of maximum size
2) only available with Ø 25 and 30 mm diameter screw



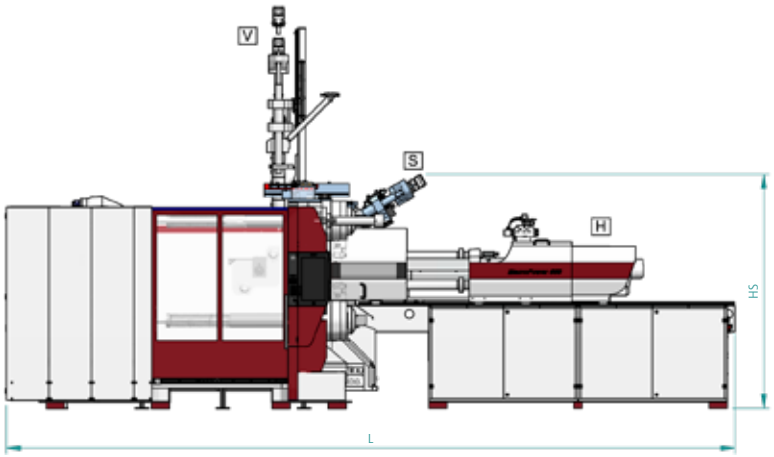


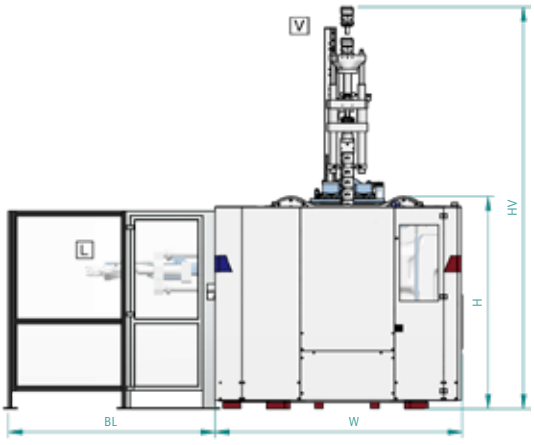
MacroPower Combimould XL 700 / 850 / 900			MacroPower Combimould XL 900 / 1000 / 1100			MacroPower Combimould XL 1100 / 1300 / 1500 / 1600			MacroPower Combimould XL 1600 / 1800 / 2000		
2250	**3400**	**5100**	**3400**	**5100**	**8800**	**5100**	**8800**	**12800**	**12800**	**16800**	**19000**
39	39	40	50	51	53	72	74	78	111	114	115
8.70	8.70	8.70	9.20	9.20	10.10	10.30	11.10	11.60	12.80	13.90	14.10
	3.00			3.40			3.70			4.40	
	2.70			2.70			3.00			3.30	

350	**525**	**750**																			
4.60	4.80	5.20	–			–			–				–					–			
	450		–			–			–				–					–			
	100		–			–			–				–					–			
	200		–			–			–				–					–			
	100		–			–			–				–					–			

350	**525**	**750**	**1000**	**350**	**525**	**750**	**1000**	**1330**	**350**	**525**	**750**	**1000**	**1330**	**2250**	**350**	**525**	750	1000	1330	2250
1.80	1.90	2.20	2.30	1.80	1.90	2.20	2.30	2.40	1.80	1.90	2.20	2.30	2.40	3.40	1.80	1.90	2.20	2.30	2.40	3.40
	500				625					700						825				
	100				100					100				150		100				150
	350				350					350				300		350				300
	100				100					100				150		100				150

350	**525**	**750**		**350**	**525**	**750**			**350**	**525**	**750**				**350**	**525**	750			
3.25	3.25	3.25	–	3.35	3.35	3.35	–	–	3.45	3.45	3.45	–	–	–	3.55	3.55	3.55	–	–	–
	30		–		30		–	–		30		–	–	–		30		–	–	–
	300		–		300		–	–		300		–	–	–		300		–	–	–





Injection units[1)]

		130		210			350			525		
Screw diameter	mm	25	30	25	30	35	30	35	40	35	40	45
Screw stroke	mm	125		125	150	150	150	175	175	175	200	200
Screw L/D ratio		22		22			22			22		
Theoretical shot volume	cm^3	61.4	88.4	61.4	106	144	106	169	220	169	251	318
Specific injection pressure	bar	2218	1540	2940	2042	1500	2835	2083	1595	2500	2100	1659
Max. screw speed	min^{-1}	318		310			298			318		
Max. plasticizing rate (PS)[2)]	g/s	8.5	12.3	8.2	12.0	18.6	11.6	17.9	28.5	19.1	30.4	39.7
Screw torque	Nm	340	357	340	490	490	600	621	621	770		
Nozzle stroke/contact press	mm/kN	400/47		450/86			450/86			450/86		
Injection rate into air	cm^3/s	63.1	90.9	59.5	85.7	117.0	74.1	101.0	132.0	102.0	133.0	169.0
Barrel heating power	kW	6.5	7.8	6.5	7.8	10.5	7.8	10.5	12.2	10.5	12.2	13.9
Number of heating zones		4		4			4			4		

		750			1000			1330			2250		
Screw diameter	mm	40	45	50	45	50	55	50	55	65	55	65	75
Screw stroke	mm	200	225	225	225	250	250	250	275	275	275	325	325
Screw L/D ratio		22			22			22			22		
Theoretical shot volume	cm^3	251	358	442	358	491	594	491	653	913	653	1078	1436
Specific injection pressure	bar	2500	2116	1714	2490	2016	1666	2470	2041	1461	2500	2070	1555
Max. screw speed	min^{-1}	291			260			278			255		
Max. plasticizing rate (PS)[2)]	g/s	27.9	36.3	43.9	32.4	39.2	48.5	41.9	51.9	62.0	48.0	71.0	108.0
Screw torque	Nm	998			1540			1940			2625		
Nozzle stroke/contact press	mm/kN	650/86			650/100			650/100			650/129		
Injection rate into air	cm^3/s	124	157	194	183	226	273	248	300	419	242	338	450
Barrel heating power	kW	12.2	13.9	17.5	13.9	17.5	18.4	17.5	18.4	21.0	22.7	26.4	32.7
Number of heating zones		4	4	5	4	5	5	5			6		

1) technical data for standard and additional injection units dependent on combinations
2) according to WITTMANN BATTENFELD standard

Rotary table on the moving platen

		400 / 450	XL 450 / 500 / 550	XL 550 / 650 / 700	XL 700 / 850 / 900	XL 900 / 1000 / 1100	XL 1100 / 1300 / 1500 / 1600
Diameter rotation unit	mm	1150	1300	1400	1500	1750	2050
Height	mm	180	180	180	208	208	260
Weight	kg	1500	2000	2100	3200	3500	7500
Rotation time 180°	s	1.6	2.0	2.2	2.9	3.2	3.5
Number of cooling and/or hydraulic circuits		4 x G 3/8"	4 x G 3/8"	4 x G 3/8"	8 x G 3/8"	8 x G 3/8"	8 x G 3/8"
Min. mold diameter/ Max. mold diameter	mm	700/1200	800/1350	900/1500	1050/1600	1200/1900	1400/2100
Max. total mold weight	kg	5000	6000	8000	10000	15000	22500
Max. mold weight on rotation unit	kg	2000	3000	4000	5000	7000	10000
Max. mold torque on rotation unit	kgm	600	900	1300	1700	2500	5000
Ejector cross according to SPI/ EUROMAP	inch	16" x 4"	16" x 4"	16" x 4"	–	–	–
		28" x 6"	28" x 6"	28" x 6"	28" x 6"	28" x 6"	28" x 6"
		–	–	–	40" x 10"	40" x 10"	40" x 10"
		–	–	–	–	–	52" x 16"

Bonding of hard-soft material combinations

	TPE based on polyamide	TPE-polyester-elastomers	TPE based on polyolefin	TPE based on styrene	TPE thermoplastic plyurethane	TPE types with modified adhesive properties
ABS	■	□	■	■	▲	△
ASA		▲			▲	
CA						▲
PA 6	△		■	■	▲	△
PA 6.6	△			■	▲	△
PA-Blend	△		□	□		△
PBTP	■	□		▲	■	△
PC	■	□	■	□	▲	△
PC/ABS	■	□	■	□	▲	△
PC/PBT	■	□	■	□	▲	△
PC/PET	■	□	■	□	▲	△
PE	■		□	□		▲
PETP	■					▲
PMMA				□	□	▲
POM	■				▲	▲
PP	■	■		▲		△
PPO	■					▲
PS	■	■	■			△
PAN	■				▲	△

Due to the great variety of TPE types, the bonding strength must be checked in each individual case.

The bonding strength also depends on the part geometry, process conditions and processes involved.

Bonding of thermoplastic materials in multi-component injection molding

	ABS	ASA	CA	PA 6	PA 6.6	PA-Blend	PBTP	PC	PC/ABS	PC/PBT	PC/PET	PE	PETP	PMMA	POM	PP	PPO	PS	SAN	TPE/TPU
ABS	△	▲	▲	▲	▲		▲	▲	▲	▲	▲	□	▲	▲	■		■		□	□
ASA	▲	△	▲		▲		▲	▲	▲	▲	▲	■	▲	▲	■	■	■	■	▲	□
CA	▲	▲	△				▲					■			■	■	■			
PA 6	▲			△	△	▲	▲	□	▲	▲	▲	□			■	□	■	■		□
PA 6.6	▲	▲		△	△	▲	□		▲	▲	▲	□			■	□	■	■		□
PA-Blend				▲	▲	△									□	□	■			□
PBTP	▲	▲	▲	▲	□		△	▲	▲	▲	▲	□	▲	□	□	□		□	▲	□
PC	▲	▲			▲		▲	△	▲	▲	▲	■	▲		□	■		■	▲	□
PC/ABS	▲	▲		▲	▲		▲	▲	△	▲		■			□	■		■		□
PC/PBT	▲	▲		▲	▲		▲	▲	▲	△	▲	■	▲	▲	□	■		■		□
PC/PET	▲	▲		▲	▲		▲	▲	▲	▲	△	■	▲	▲	□	■		■		□
PE	□	■	■	□	□		□					△				▲			□	▲
PETP	▲	▲					▲	▲		▲	▲	■	△							□
PMMA	▲	▲					□			▲	▲	■		△		■	■	■	▲	□
POM	□	■	■	■	■	□	□	□	□	□	□	■			△					□
PP		■	■	□	□	□	□	■	■	■	■			■		△	□			
PPO	■	■	■	■	■	■								■		□	△			□
PS	■	■		■	■		□	■	■	■	■			■			▲	△		□
SAN	□	▲	▲				▲	▲	□	□	□	□		▲			■	□	△	▲
TPE/TPU	□	□		□	□	□	□	□	□	□	□	▲	□	□	□	△	□	□	▲	△

In some cases, particularly where modified materials are involved, tests must be carried out to check the bonding strength.

□ limited bonding
■ no bonding
▲ good bonding
△ excellent bonding

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