EcoPower Combimould

55 – 300 t

All-electric multi-component technology

world of innovation

EcoPower COMBIMOULD
Highly versatile multi-component injection molding

EcoPower stands for the WITTMANN BATTENFELD injection molding machines with small to medium clamping force sizes (55 to 550 t), featuring a highly efficient servo-electric drive system combined with a compact servo-electric clamping unit and lean injection units in the international standard sizes of 70 to 5000.

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 (for details see page 4).

EcoPower Combimould from 55 to 300 t stands for the combination of EcoPower machines with one or several additional plasticizing/injection aggregates in various configurations.

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

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EcoPower Combimould
Applications

» **Back molding**
Simple back molding of two or three plastic layers on a base part or certain areas thereof is the most frequent application. Examples are decorations or anti-wear protection layers.

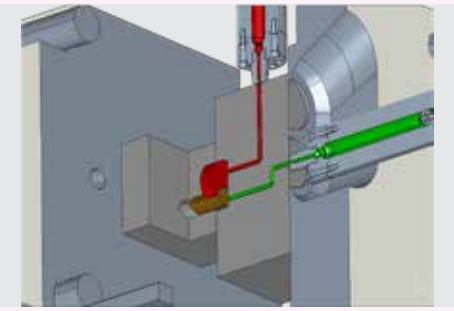
» **Assembly injection molding**
By targeted use of the differences in attributes of the plastic materials combined with each other, assemblies can be produced with individual movable or detachable parts. Examples are flexible toy figures, chain links, switch rockers or spout closures with resealing caps.

» **Hard-soft composites**
An important field of application for assembly injection molding is seal installation. In this process, sealing lips made of silicone or thermoplastic elastomers can be molded directly onto housing bodies or technical parts in a second injection molding step.

» **Overmolding**
"Overmolding" is a special form of hard-soft combination, where soft, skid-resistant surfaces are created on housing parts or appliance handles with elastomer layers.

» **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. In terms of process technology, 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 or a sandwich and interval nozzle is used.

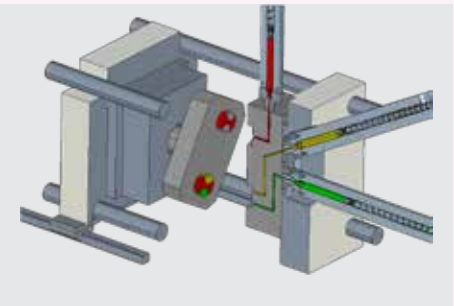
COMBIMOULD PROCESS TECHNOLOGY
Optimally coordinated solution



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

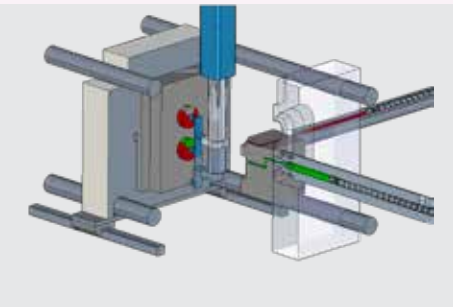
In valve gate technology, the second component is added without prior mold opening and rotation. The different geometry required inside the cavity is produced by a hydraulic valve gate which, when retracted, provides the space for adding the second component.

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.



» **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.

CLAMPING UNIT
Servo-electric speed and dynamism

» **Ample space for complex molds**
- Generously dimensioned mold platens [1] and a clean toggle lever clamping system offer the optimal environment for all molds including all media connections.
- The ejector area and the environment of the platens offer easy access for machine setup and adjustment work. [2]

» **Sensitive and precise**
In the EcoPower clamping system, the tie-bars are exclusively used for force transmission between the outer platens. The moving platen travels virtually free of friction across the linear bearings without coming into contact with the tie-bars. [3]

» **Servo-electric dynamism**
- The moving platen is moved quickly and with high precision by a self-locking 5-point toggle lever. [4]
- The toggle lever is driven by a highly dynamic servo motor via a rack-and-pinion drive system. [5]
- The synchronized mold height adjustment via 4 bronze bar nuts and a sun gear system is driven by a servo motor. In this way, an extremely accurate clamping force regulation can be achieved. [6]

» **Servo-hydraulic ancillary strokes**
To drive the ancillary strokes (ejector, nozzle strokes and core pulls), a hydraulic aggregate powered by a servo-electric motor is mounted on the inside of the machine frame. Being specially designed for high efficiency, it requires no cooling water connection. The maintenance-friendly access is from the rear, behind the clamping unit. Servo-mechanical drives for the ancillary strokes are available as options.

INJECTION UNIT
Precision from beginning to end

» **Everything to ensure series consistency**
- All screws > 25 mm come with a 22:1 L/D ratio.
- All injection units offer a wide injection pressure range.
- Plasticizing parallel to clamping unit movements and start of the injection process during clamping force build-up are possible as standard.
- EcoPower injection units with a higher injection performance can be supplied as an option.
- Moment-free nozzle contact thanks to axial configuration of traveling cylinders [7]
- Plasticizing units can be mounted to different injection aggregates with identical screw diameters.
- In combination with WITTMANN BATTENFELD HiQ software packages sensitive adjustment facilities are available in the form of (optional) software modules to compensate environmental factors such as temperature and moisture, regrind or masterbatch content.

» **Optimal operational excellence**
- The complete range of all-electric injection units is designed for quick barrel exchange from above.
- Easy access for changeover work thanks to compact design and sliding guard [8]

» **More productivity and efficiency**
- High-resolution absolute value encoder for precise control [9]
- Low-noise injection spindle with modern ball screw drive and "spacer" technology and low grease consumption [10]

Anti-wear options
In addition to the premium-quality standard equipment, an extensive range of options is available to provide extra anti-wear and/or anti-corrosion protection. Predefined option packages and a selection matrix facilitate the selection of the right plasticizing unit.

INJECTION UNIT
The right combination for every application

In addition to the (horizontal) aggregate included in series production, EcoPower Combimould machines can be fitted in V (vertical) and L (horizontal at the rear of the machine) configurations. Simultaneous, parallel operation of all servo-electric injection units is possible as standard. All process variants can be set individually.

» **V configuration**
Injection from above, also into the mold parting line

- Generously dimensioned adjustment range
- Slide device with linear guides
- Simple horizontal adjustment
- V aggregate completely retractable to the rear to provide an absolutely free mold space
- Nozzle position stroke measurement incl. display in the control system

» **L configuration**
Injection from the non-operator side, even into the mold parting line

- Slide device free on the rear of the fixed platen
- Injection unit supported on linear guides
- Large adjustment range
- Access to the nozzles and to the mold from the rear via large operator safety gate
- Fixed platen free for standard linear robot
- Nozzle position stroke measurement incl. display in control system

DRIVE TECHNOLOGY
Efficient through servo motors

Fast-responding, precise, cost-efficient
The use of servo-electric drive technology for all main movements affecting the cycle offers a large number of advantages compared to conventional hydraulic injection molding machines:

» Energy efficiency through direct drive without energy conversion into hydro energy
» Energy efficiency through the servo drives' high efficiency rates
» Digital control for maximum repeatability
» Use of recovered braking energy via KERS system for powering of heater bands
» Cycle flexibility thanks to possibilities with parallel movements
» Low sound emission (< 65 dBA)

The combination of servo motors and drive units (rack-and-pinion drive for the toggle lever and spindle drive for the injection stroke) can be supplied at different performance levels for different speeds.

Basically, the EcoPower drive concept offers the advantage of modularity for demand-oriented adjustment of drive performance to the intended use in each case.

Servo-hydraulic drive for ancillary strokes
» Integrated in the machine frame without additional space requirements
» Drive unit for hydraulic core pulls
» Energy-efficient, maintenance-free nozzle contact with high pressure
» No cooling required for standard applications

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 new 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 appliances
- 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
- ambiLED display on machine

» **Operator assistance**
- QuickSetup: process parameter setting assistant using an integrated material database and a simple query system to retrieve molded part data with machine settings pre-selection
- Extensive help library integrated

For more information see the Unilog B8 brochure.

COMBINATION OPTIONS
EcoPower Combimould

EcoPower Combimould 55			
Injection unit	**70H**	**130H**	**350H**
70	V – L	V – L	V – L
130	V – L	V – L	V – L

EcoPower Combimould 90 / 110			
Injection unit	**130H**	**350H**	**750H**
70	V – L	V – L	V – L
130	V – L	V – L	V – L
350	V – L	V – L	V – L

EcoPower Combimould 160 / 180			
Injection unit	**350H**	**750H**	**1330H**
70	V – L	V – L	V – L
130	V – L	V – L	V – L
350	V – L	V – L	V – L

EcoPower Combimould 240			
Injection unit	**350H**	**750H**	**1330H**
70	V – L	V – L	V – L
130	V – L	V – L	V – L
350	V – L	V – L	V – L

EcoPower Combimould 300			
Injection unit	**750H**	**1330H**	**2100H**
70	V – L	V – L	V – L
130	V – L	V – L	V – L
350	V – L	V – L	V – L

V	vertical	**L**	horizontal from rear	**H**	horizontal

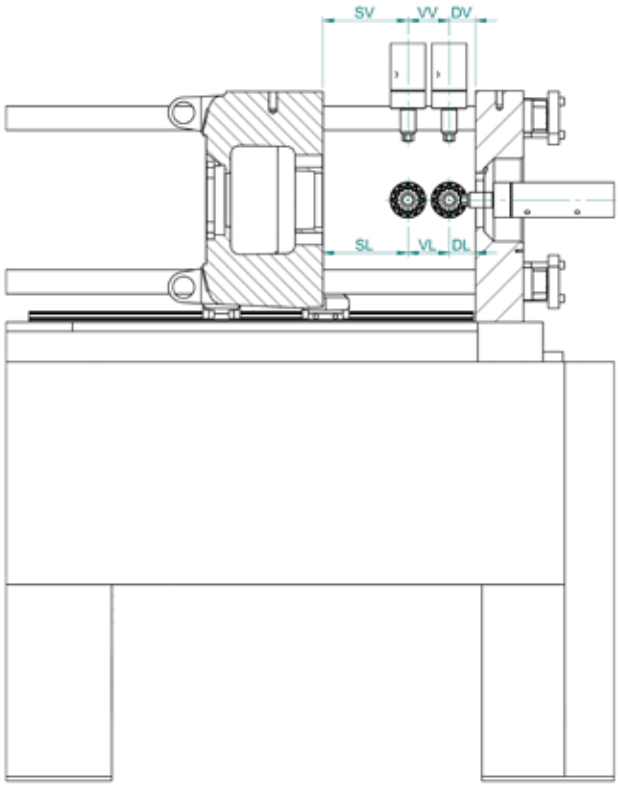
DATA EcoPower Combimould 55 – 300

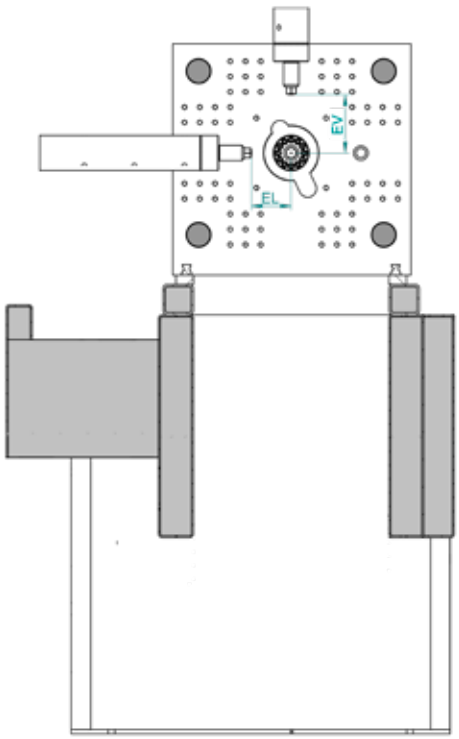
		EcoPower Combimould 55			EcoPower Combimould 90 / 110			EcoPower Combimould 160 / 180		
Injection unit H		**70**	**130**	**350**	**130**	**350**	**750**	**350**	**750**	**1330**
Weight[1)]	kg	5000	5000	5200	6400	6600	7000	8600	9000	10600
L	mm	4000	4100	4400	4400	4700	5400	5600	5900	6600
W	mm		1400			1500			1600	
H	mm		2000			2100			2200	

Injection unit V		**70**	**130**	**70**	**130**	**350**	**70**	**130**	**350**
HV	mm	3500	3700	3600	3800	4100	3800	4000	4300
EV	mm	170			170			220	
DV	mm	60			60			60	
VV	mm	90			90			115	
SV	mm	75			100			125	

Injection unit L		**70**	**130**	**70**	**130**	**350**	**70**	**130**	**350**
BL	mm	2300	2300	2300	2300	2500	2300	2300	2500
EL	mm	195			195			245	
DL	mm	60			60			60	
VL	mm	90			90			115	
SL	mm	75			100			125	

1) with additional injection unit of maximum size

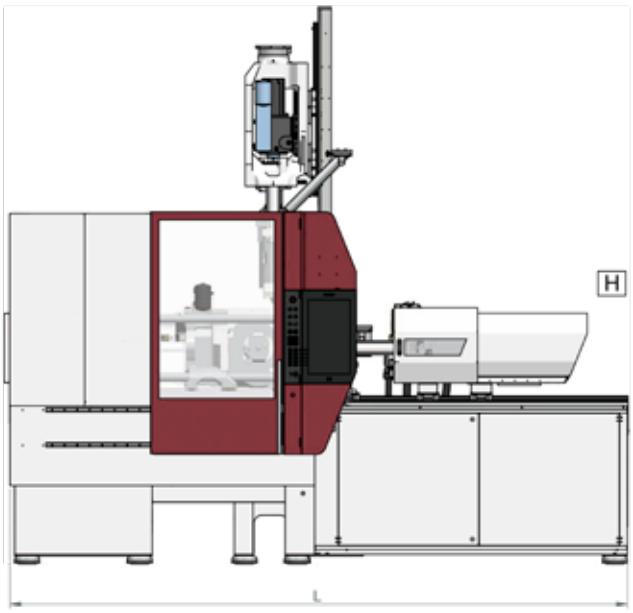


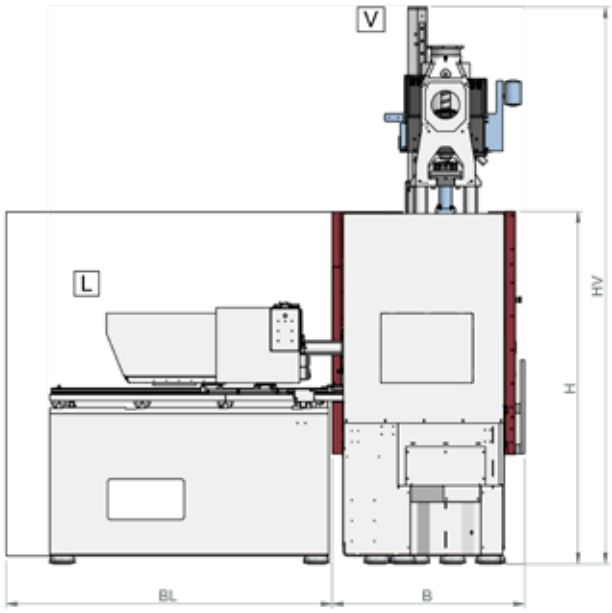


EcoPower Combimould 240			EcoPower Combimould 300				
350	**750**	**1330**	**750**	**1330**	**2100**	**Injection unit H**	
10900	11300	12900	14100	15700	17900	kg	Weight[1)]
6400	6400	7100	7000	7700	8300	mm	L
	1800			1900		mm	W
	2400			2400		mm	H

70	**130**	**350**	**70**	**130**	**350**	**Injection unit V**	
3900	4100	4400	4100	4300	4600	mm	HV
	245			295		mm	EV
	75			75		mm	DV
	150			150		mm	VV
	125			125		mm	SV

70	**130**	**350**	**70**	**130**	**350**	**Injection unit L**	
2300	2300	2500	2300	2300	2500	mm	BL
	270			325		mm	EL
	75			75		mm	DL
	150			150		mm	VL
	125			125		mm	SL





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Additional Injection units V - L[1)]

		70		
Screw diameter	mm	14	18	22
Screw stroke	mm	70	90	90
Screw L/D ratio	mm		20	
Theoretical shot volume	cm^3	10.8	22.9	34.2
Specific injection pressure	bar	3000	2593	1736
Max. screw speed	min^{-1}		600	
Max. plasticizing rate (PS)[2)]	g/s	2.0	6.0	8.6
Screw torque	Nm	65	120	150
Nozzle stroke/contact press	mm/kN		250/40	
Injection rate into air	cm^3/s	61.6	102.0	152.0
Barrel heating power	kW	2.9	5.5	6.3
Number of heating zones			4	

		130			
Screw diameter	mm	18	22	25	30
Screw stroke	mm	90	110	125	125
Screw L/D ratio	mm	20	20	22	22
Theoretical shot volume	cm^3	22.9	41.8	61.4	88.4
Specific injection pressure	bar	3000	2864	2218	1540
Max. screw speed	min^{-1}	500	500	400	400
Max. plasticizing rate (PS)[2)]	g/s	5.0	7.2	10.5	15.4
Screw torque	Nm	120	150	250	250
Nozzle stroke/contact press	mm/kN		250/40		
Injection rate into air	cm^3/s	50.9	76.0	98.2	141.0
Barrel heating power	kW	5.5	6.3	9.0	10.4
Number of heating zones			4		

		350		
Screw diameter	mm	30	35	40
Screw stroke	mm	150	175	175
Screw L/D ratio	mm		22	
Theoretical shot volume	cm^3	106	169	220
Specific injection pressure	bar	2835	2083	1595
Max. screw speed	min^{-1}		350	
Max. plasticizing rate (PS)[2)]	g/s	13.5	21.0	33.5
Screw torque	Nm		500	
Nozzle stroke/contact press	mm/kN		250/40	
Injection rate into air	cm^3/s	141	192	251
Barrel heating power	kW	10.4	10.4	12.9
Number of heating zones			4	

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

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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