KUNSTSTOFF VERBINDUNGS-TECHNIK

E.W.S.

The EWS welding process

offers new prospects for joining and connecting techniques

KVT®
BIELEFELD

An alternative to conventional bonding techniques
The EWS electromagnetic resistance welding method

The fundamentals of the most common methods of welding for the processing of plastic materials employed today rest on the application of heated tools, hot gas, high frequency, ultrasound, vibration and friction. However, dependent on the material, size and geometry of the pre-forms and limited by the design of the bonding zone, the limits of the conventional welding methods are often restricted. That's where electromagnetic resistance welding (below called the EWS method) offers an interesting alternative as a complement to the long-established welding techniques. It enables the fast and high-strength bonding of thermoplastic materials.

All the known welding methods essentially differ from each other in the method of generating the fusion heat that is necessary for the bonding process:

- Heating the bonding zones with contact or radiation heat using a heated tool or hot gas.
- Heating the bonding zones by molecular friction as a result of high-frequency ultrasonic oscillations.
- Dielectric heating of polar plastics in a high-frequency electric field applying a bonding force at the same time e.g. HF high-frequency welding.
- Heating the bonding zones by interface friction caused by vibration or rotation movement.

In the electromagnetic resistance welding procedure, on the other hand, the heating and the plastification of the joining zones takes place as follows: an available metal component is heated by electromagnetic energy without any contact taking place. Thus the electromagnetic resistance welding method, which has proven itself in industrial utilization for well over half a decade now, has turned out to be excellently suitable for welding in threaded inserts and other metal construction elements. Some examples are the threaded bushings of suction manifolds for the engines for passenger cars. In addition, the EWS method caters for those application requirements not met by conventional welding techniques where high-tech plastics and plastic materials with extremely highly fluid melts like polyamide (PA), acetal resins (POM), polypropylene (PP) and similar polymers are to be bonded.
As it is a relatively new alternative, the possibilities EWS offers have most certainly not been exhausted yet, yet already it is becoming obvious that the EWS method proffers an array of convincing advantages:

- It enables fast, safe and high-strength bonds of plastic parts.
- By embedding a metal reinforcement in the joining zone, the welding seam acquires additional strength which has a particularly positive effect on the manufacture of pressure vessels.
- The joining zones of the plastic parts can also be three-dimensional.
- It is possible to achieve welding seam lengths of 3 to 3,000m with standard EWS machines.

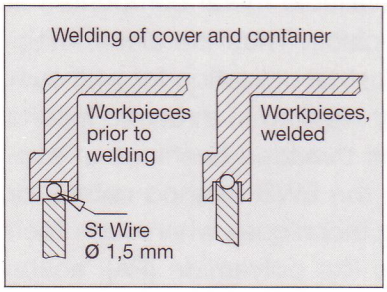
Apart from all this, the method is extremely process-safe and can be virtually perfectly monitored and recorded with a distance/time measuring device.

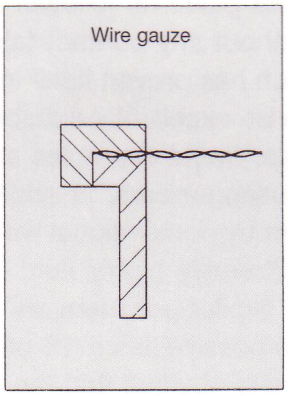
The procedure:
fast, efficient and without heat loss

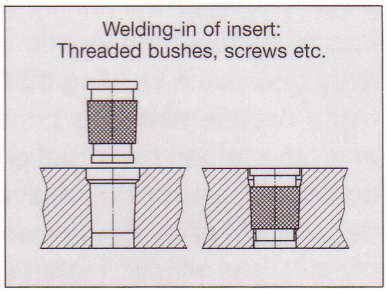
An essential advantage of the electromagnetic resistance welding technique is that the thermal energy reaches the surfaces to be welded quickly, efficiently and without heat loss, using the principle of induction heat. A metal (electroconductive) welding aid e.g. an insert heated tool is inserted into the joining zone of the plastic parts which are to be welded. Then these parts and the welding aid are brought into the welding tool of the electromagnetic resistance welding (EWS) machine. This generates the desired melt heat and the required bonding force.
Electromagnetic transformers which are connected to the generator of the EWS machine are located in the welding tools which are adapted in their contours to the parts to be welded. A strong magnetic field is built up within the welding tools with a medium-frequency alternating current voltage. This means that the insert heating element is heated to the respective required temperature within seconds. As a result of the heat, the melt of the two parts to be welded spreads at the same time and flows together and is pressed into a homogenous compound by the joining force summoned by the machine. When the generator is switched off, the melt and the metal heating element cool down. After a cooling-down phase of a few seconds, the ready welded plastic parts can be removed from the tool.

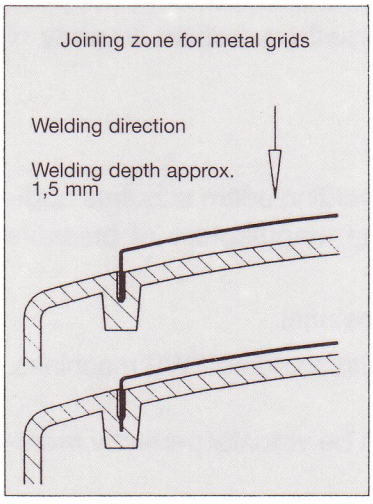
As a result of residual heat in the heating element during the cooling-down process, a kind of "postheating" takes place. This removes nearly all possible remaining tensions in the joining zones. If the joining zones are laid out correspondingly, the fusion of the melts takes place by and large with oxygen cut off in order to achieve an optimal welding factor. By the way, parts which have already been welded can be separated again if necessary using the "reverse" procedure.

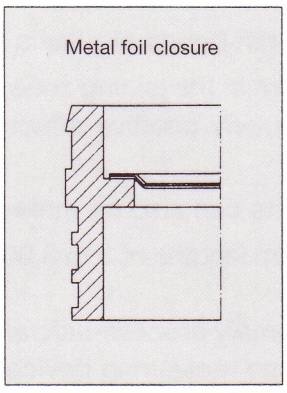
EWS Joining-zone geometry for different applications

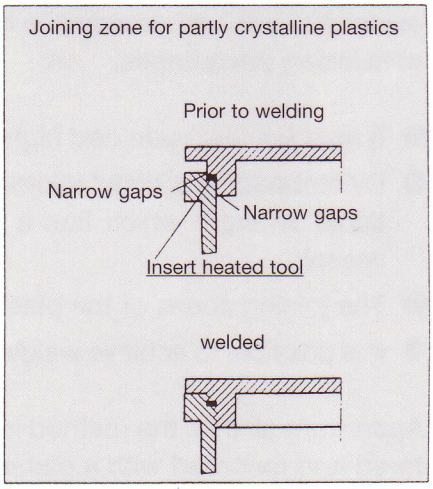












EWS Double welding machine for metallic screens

Standard program EWS welding machine

EWS welding machine Type	GIGANT 1500/3000	GIGANT 1500/3000	GIGANT 2500/1000	GIGANT 2500/3000	GIGANT 4000/1000	GIGANT 4000/3000	GIGANT 6000/1000	GIGANT 6000/3000
Art. No.	3201	3202	3211	3212	3221	3221	3231	3231
Press stroke	80 mm (50 mm)	80 mm (50 mm)	100 mm (80 mm)	100 mm (80 mm)	160 mm (100 mm)	160 mm (100 mm)	200 mm (160 mm)	200 mm (160 mm)
Press power	1,5 kN	1,5 kN	2,5 kN	2,5 kN	4,0 kN	4,0 kN	6,0 kN	6,0 kN
Tool clamping surface	296 x 296 mm	296 x 296 mm	296 x 296 mm	296 x 296 mm	296 x 296 mm	296 x 296 mm	296 x 296 mm	296 x 296 mm
Adjusting height	330 mm	330 mm	430 mm	430 mm	630 mm	630 mm	630 mm	630 mm
Compressed-air connection max.	8 bar	8 bar	8 bar	8 bar	8 bar	8 bar	8 bar	8 bar
Connected loads, max.	230 V 50 Hz 2 kW	230 V 50 Hz 4 kW	230 V 50 Hz 2 kW	230 V 50 Hz 4 kW	230 V 50 Hz 2 kW	230 V 50 Hz 4 kW	230 V 50 Hz 2 kW	230 V 50 Hz 4 kW
Prompting	Cleartext display	Cleartext display	Cleartext display	Cleartext display	Cleartext display	Cleartext display	Cleartext display	Cleartext display
Width	415 mm	415 mm	415 mm	415 mm	405 mm	405 mm	405 mm	405 mm
Depth	635 mm	635 mm	635 mm	635 mm	750 mm	750 mm	750 mm	750 mm
Height	845 mm	845 mm	845 mm	845 mm	1250 mm	1250 mm	1250 mm	1250 mm
Weight (excluding tool)	95 kg	95 kg	95 kg	95 kg	150 kg	150 kg	150 kg	150 kg

The machine:
particularly suitable for welding in inserts

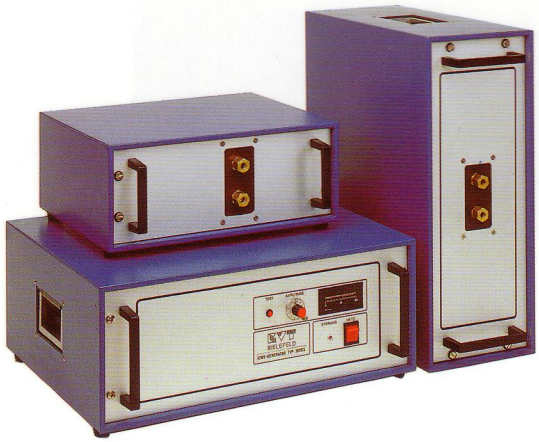
With an EWS machine, basically metal parts of all different kinds and shapes can be heated. For that reason, the machines are also particularly suitable for welding in threaded inserts and other metal construction components into plastic parts. In the area of packing, the EWS method enables the welding of plastic and metal foils or composite materials with metal construction elements. In the consumer electronics sector, EWS machines are used to weld metal grids into a plastic frame as for example the covers for loudspeakers on car radios or TV sets.

Basically, **the EWS welding machine** consists of the following components:

- Welding press
- Machine control
- EWS Generator
- Synchronizing unit
- Welding tools

The EWS generator converts the mains voltage into a medium frequency alternating current in order to create the necessary magnetic field. The generator's automatic power adjustment guarantees an optimum setting.

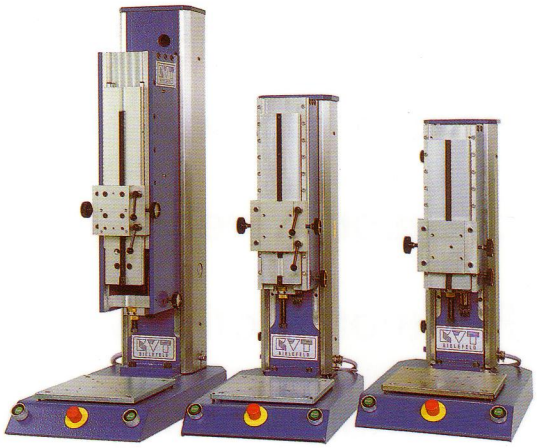
The tuning unit adapts the different tools to the generator.



EWS generator with tuning device for transducer

The electronic machine controller is based on a microprocessor. This contains the entire welding program so that a reproducible process sequence is guaranteed. Devices for quality assurance, printers, or PCs for statistic process control (SPC) can be connected via corresponding interfaces.

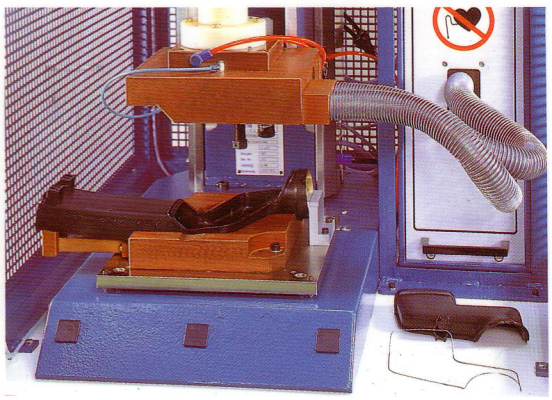
All the standard presses supplied by KVT Bielefeld can be used as welding presses. Selection of the most appropriate model depends on the size of the parts to be welded and the joining forces required. The entire machine construction is largely identical to that of an ultrasonic welding machine. However, in contrast to the ultrasonic welding machines, there are no noises worth mentioning and therefore no noise protection measures are necessary.



Standard welding presses: GIGANT

The holding tools are used for fixing the plastic parts during the welding procedure and they also contain the electromagnetic transducers.

The insert heating element basically consists of an electroconductive metallic material. Depending on the shape and size, it is made very cheaply (for a few pence) by bending, punching or cutting.



EWS Welding of intake pipes

– KVT 19 S –

Type "Monitor" Microprocessor control

EWS:
A formula for high reliability and safe production

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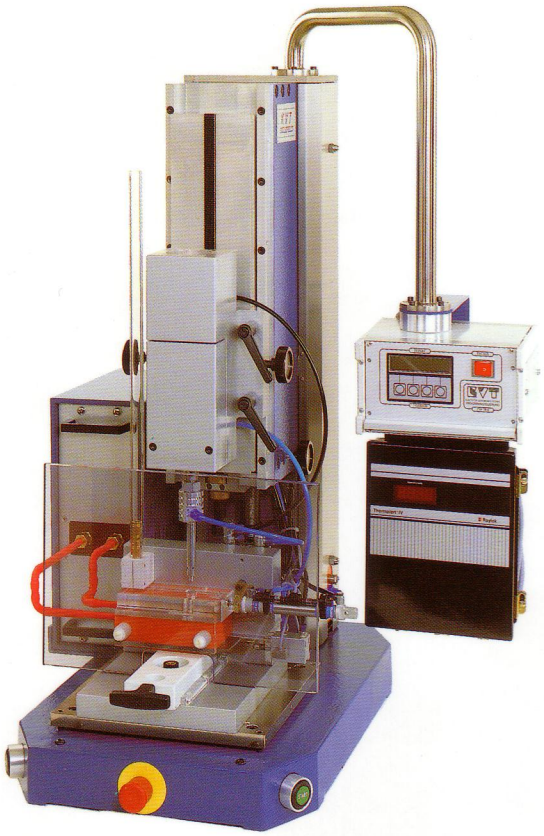
The EWS machines from KVT Bielefeld have been deployed in industry for several years. Their practically contact-free transfer of energy is particularly environmentally friendly and energy saving. At the same time, it is possible to make constructions in plastic with this technology which were previously classed as impossible. Last but not least, the speed and reliability of this method provide an alternative to the established welding methods so that EWS does indeed offer an option for concrete welding problems of the future.



GIGANT 2500/1000 EWS with Infrared temperature measuring instrument

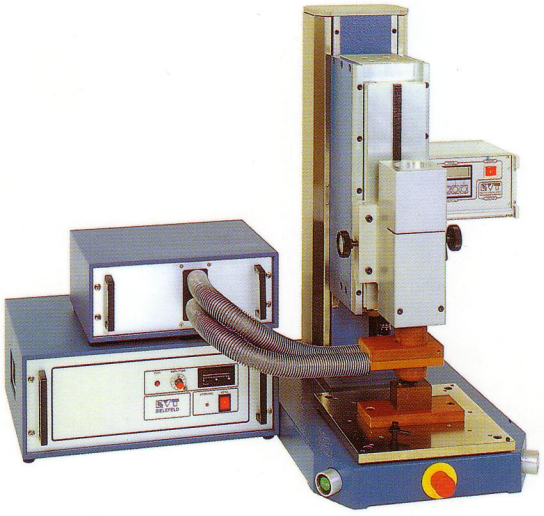
EWS-materials

	ABS	CA, CAB	Ionomere	PA	PBTP	PMMA	Polybuthylen	Polycarbonat	Polyethylen	Polypropylen	Polystyrol	Polysulfon	Polyurethan	POM	PPO	PVC
ABS	○					○		○								
CA, CAB		○														
Ionomere			○													
PA				○												
PBTP					○											
PMMA	○					○		○			○					
Polybuthylen							○									
Polycarbonat	○					○		○			○	○				
Polyethylen									○							
Polypropylen										○						
Polystyrol						○		○			○				○	
Polysulfon								○				○				
Polyurethan													○			
POM														○		
PPO											○				○	
PVC																○

Applications to date

- Compensators
- Fuel valves and containers
- Front masks for TV sets
- Air suction tubes for engines for passenger cars
- Oil mist separators and condensation
- Activated charcoal filters and plate air filters water separators
- Activated charcoal filters and plate air filters
- Housings for loudspeakers and pumps
- Foil packagings and laminated articles
- Household appliances and batteries

ESW Welding machine Type GIGANT 1500/1000



HIGH-TECH FROM BIELEFELD

Electromagnetic resistance welding

Heated tool welding

Ultrasonic welding

Rotation friction welding

Thermoforming machine

10/01

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