



# Hot gas welding of polyamides





## KVT Bielefeld GmbH – It's the connection that counts!

### A brief portrait

KVT Bielefeld was founded in 1982 and can today draw on experience gained from more than 25 years of experience in the area of plastic welding technology.

The company is a manufacturer of welding machines for joining all thermoplastics and for creating joins between thermoplastics and metals.

The customers include companies from all areas of the plastic processing industry. In particular here, from the automotive industry and the household appliances area, the so-called "white goods".

The long established customer base also includes the manufacturers and suppliers of telecommunication and electrical engineering equipment such as the producers of medical technology.

The annual sales are approx. 5.5 million Euros.

Exports account for approx. 65% of the total sales.  
Exports are made world wide.

KVT Bielefeld has 30 employees in the areas of Sales, Engineering and Service who have all been with the company for a long time.

The company's motto is:

"The customer does not need any machines; he needs a solution to problems".

Innovative, highly productive welding machines, matched to the customers' needs result from this motto.



**KVT Bielefeld GmbH – It's the connection that counts!**

### **The process**

- ERW - Electromagnetic resistance welding
- HEW - Heat element welding
- HGW - Hot gas welding
- IRW - Infrared welding
- LLW - Laser light welding
- RFW - Rotation friction welding
- TF - Single-phase and two-phase thermoforming
- USW - Ultrasonic welding



## Hot gas welding of polyamides

### The process

The hot gas welding process is a further development of the heat element welding process as a result of the consequential use of the many years of technical application experience in the area of welding thermoplastic components.

This mature process is basically suitable for all thermoplastic moulded parts. Outstanding results are achieved for the thermal welding of polyamide and other high-tech materials. Thus, all other difficult to weld plastics such as PBT, POM, PPO and PPS can also be successfully welded.

This innovative process is mainly used when high-strength welded joints have to be realised without microparticles being produced during the welding process which is the case for mechanical welding processes.

This also applies to welded joints whose thermal decomposition or the damage to the material is not acceptable for the welded joint.

Thus, the hot gas welding process is the only option for many high quality thermoplastics to realise a high-strength, homogenous and particle-free thermal weld.



## Hot gas welding of polyamides

### The process

Both the join partners to be welded are each inserted into a product-specific workpiece holder.

The check for the presence of the workpieces is made with the start signal. The parts are aligned and clamped by moving the two feeder units together, and the dimensional accuracy is checked using an end distance check.

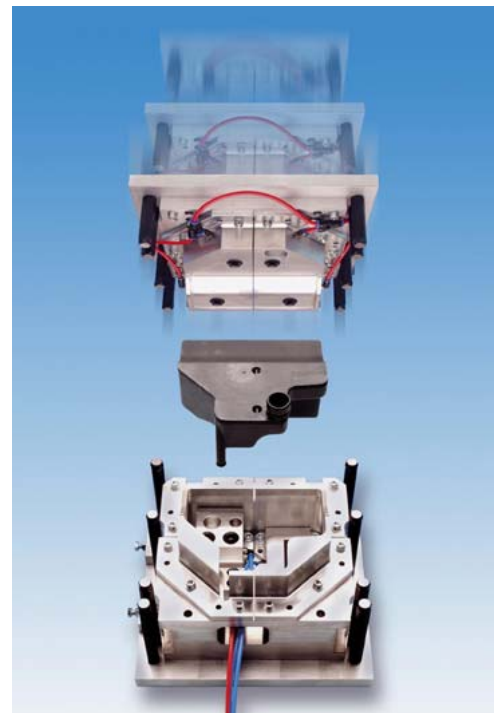
If the end distance is correct, the feeder units open and the actual welding process is initiated by extending the heating element into the heating position. The diathermal (heating through) phase now takes place during which the join zone is plastified using radiated heat. The heat transfer from the heating element to the weld seam of the weld is forced by a hot protective gas flow.

After applying the necessary fusion heat to the plastic part, the feeders move as far apart from each other so that the heating element can move from the working position to the park position.

The actual joining process now takes place by closing the feeder units so that the plastified weld defined geometries can be fused with each other.

The specified joining path is monitored and thus ensures the correct final dimension of the welded parts.

The finished part can be removed after expiry of a short cooling time during which the joint partners continue to be subjected to joining pressure.





## Hot gas welding of polyamides

### The benefits

- No particles caused by the welding process inside the welded product due to adhesion of the weld seam expulsion to the joining zone
- Welding inside fins of the products is possible; in this way the load of the tensile and shear forces on the weld seam is reduced. This mainly increases the strength of pressure vessels.
- Due to the weld seam design, this builds up less than with alternative processes as no inside partition of the weld seam has to be done. This results in an increase in volume.
- No mechanical load of any kind on the workpieces to be processed.
- No mechanical load on electrical components inside the workpieces.
- No markings or damage on the outside of the products caused by the workpiece holders.
- Thermal heating of the joining zone without contacting the heating element.
- Absolute homogeneity of the material in the area of the weld seam.
- Optimum strength values with a weld seam factor up to 1.0 for unfilled materials and in ideal weld seam design.
- Almost all three-dimensional weld seam runs can be realised (up to 45° from the plane is possible without problems).
- No kind of oxidation of the plastified material in the weld seam area due to the use of protective gas, and also no kind of colour changes to natural, white, red, blue, yellow etc material.
- Slight defects of the parts and dips in the area of the welding seam can be bridged.
- High cost effectiveness due to the low investment in relation to the production performance (multiple dies).
- No material loss due to "equalising the joining partners" as is the case with conventional heat element welding.



## Hot gas welding of polyamides

### The sample parts

Inlet manifold with three-dimensional weld seam run

Material: PA6-GF15



Charge air pipe made of PA6-GF





## Hot gas welding of polyamides

### The cross sections

Oil tank  
made of unreinforced PA6



Exhaust gas manifold casing  
made of PPS-GF50







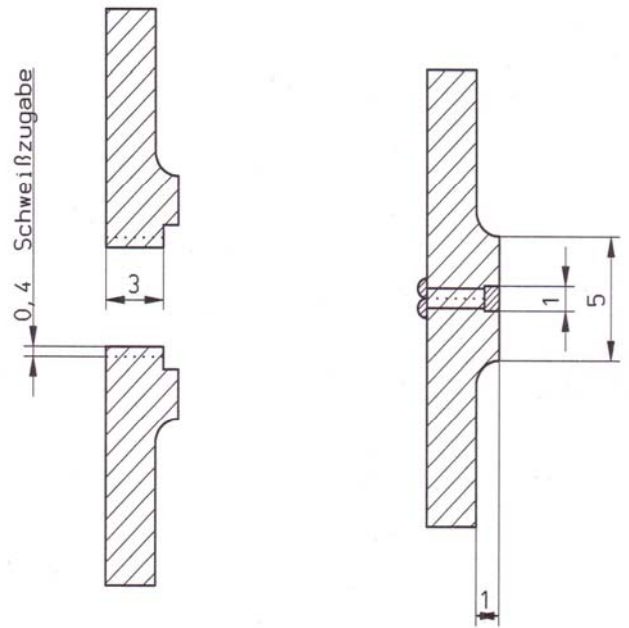
## Hot gas welding of polyamides

### The weld seam design

#### Weld seam without inside and outside cover.

An inside cover is not required as the weld expulsion is firmly bonded to the part.

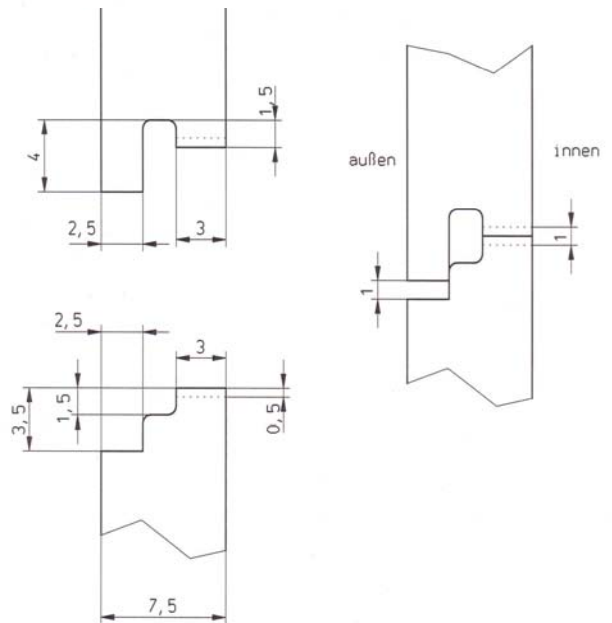
An outside cover is not required if the part is not a visible part.



#### Outside weld seam covered on one side.

This is a visible part; the outside weld expulsion must not be seen.

No cover of the weld expulsion for the inside of the part is made as this is firmly bonded with the part and no particles can loosen.





## Hot gas welding of polyamides

### The machines



#### **Polyamide welding machine KVT VP-C 80-40-200-NC-HGS**

- Stable machine base frame
- Machine safety cover
- 3 NC axis modules for the "top" and "bottom" feeder units and for the horizontal "heat element" feeder unit
- NC machine controller Type S7 from Siemens
- 3 temperature regulation circuits with temperature monitoring
- Gas generator for producing protective gas
- Seam distance and joining force measurement



## Hot gas welding of polyamides

### The machines



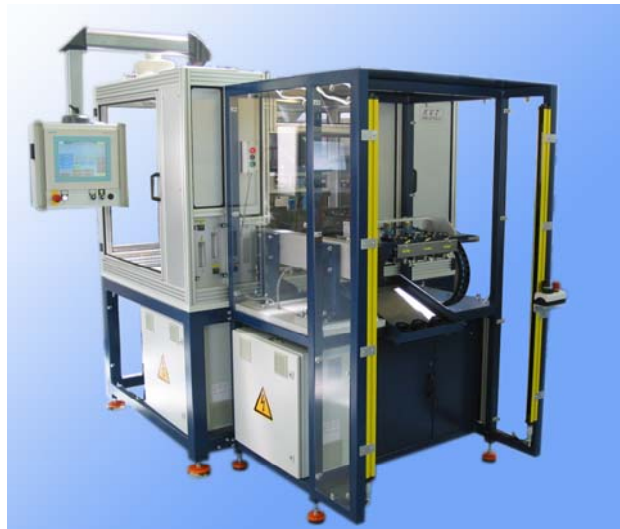
#### **Specially designed HGW machine for welding window guide rails**

- Welding machine with two-position sliding table for alternate loading of the machine
- Four cavities per sliding table
- Fetch cycle of the top case halves through the machine
- NC-controlled traversing movement of the axes
- Including integrated nitrogen generator
- Heat element dimensions 1000 x 600 mm
- Heat element weight 600 kg



## Hot gas welding of polyamides

### The machines



#### **HGW machine for the manufacture of steering fluid reservoirs**

- Welding machine with four NC-controlled feeder units
- Machining of three cavities per cycle
- Integrated transfer handling for single parts and the welded parts
- OK / not OK part separation
- Integrated nitrogen generator



## Hot gas welding of polyamides

### The applications

- Oil sumps
- Brake fluid reservoirs
- Fuel tanks
- Coolant balance reservoirs
- Steering fluid reservoirs
- Thermostat cases
- Pump cases
- Gearbox oil sumps
- Hydraulic oil reservoirs
- Cylinder head covers
- Suction modules
- Air ducts
- Charge air pumps
- Filter elements
- Filter cases
- Oil filler necks
- Piping
- Engine cases
- Pipe connection elements
- Oil mist separators



## Hot gas welding of polyamides

### The result

The hot gas welding process will always be used when joining partners made of polyamide and other partially crystalline materials have to be welded with **high strength** and **without** the production of **particles**.

The particle freedom in the product interior is increasingly important mainly due to the increasing complexity of parts.

You can obtain detailed information about your application case from:

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