

Amendment mould making to GTC for services

In addition to paragraph 9. "Transfer of risk; Acceptance; Inspection of the object of delivery and performance" of the General Terms and Conditions for Services, the following shall apply to brazing orders from the mould making sector:

1. Leak test

- *Listemann* tests all brazed tools and mould inserts for plastic injection moulding and die-casting, hot runner manifolds as well as other components with increased tightness requirements 100% by means of helium leak testing for tightness. The prerequisite is that the above-mentioned components are testable after brazing.
- This helium leak test is very sensitive, but is a vacuum test, which does not replace an overpressure test. Therefore, an additional leak test by pressing with water by the customer is recommended after the processing of the brazed joints.
- Further examinations must be specified in the inquiry and are not included in the standard scope of services. Standard service includes brazing, annealing, hardness testing and helium leak testing.

2. Distortion after brazing

- The combined brazing and hardening takes place in a high-temperature process with rapid cooling in inert gas. A resulting component distortion cannot be excluded.

3. Hardness measurement

- Unless otherwise agreed, the general hardness tolerance is +/- 1 HRC.

4. Pre-machining at the customer's premises

- Mechanical machining with high forces can lead to the build-up of residual stresses in the workpiece. These residual stresses are released during vacuum brazing/vacuum hardening and can lead to distortion and, in unfavourable cases, to leaks in the tool/mould insert.
- Electrical discharge machining (EDM) of the workpieces in the joining area leads to surfaces where the wetting behaviour of the filler metals is negatively impaired. This can lead to defects and, in the worst case, to leaks in the tool/mould insert. Therefore, such surfaces in the area of the joining zone must be removed by grinding.
- Blasting the joining surfaces with glass beads, corundum (aluminium oxide) or other ceramic blasting media can lead to particles being deposited in the workpiece surface. These particles are not wetted by filler metals and can lead to defects and in the worst case to leaks in the tool/mould insert.

5. Further processing by the customer

- Subsequent mechanical and/or ED machining, especially in the area of the brazed joint, can lead to leaks. Therefore, the customer or his subcontractor is obliged to check the above-mentioned brazed components for leaks after further processing and especially before use according to his own standards.
- EDM in the area of the brazed joint can lead to temporary melting of the brazed joint. An impairment of the brazed joint cannot be excluded.
- It is generally recommended to relax the components 20°C below the last annealing temperature after EDM. The recommendations of the steel manufacturers must also be observed here.

6. Tempering of steel 1.2083

- The steel 1.2083 is annealed at 250-300°C under air or at 480-495°C in vacuum. Annealing under air results in discoloration on the component, but this has no influence on the component quality.
- If higher annealing temperatures are required, e.g. due to subsequent coating, *Listemann* must be informed of this before the order is carried out.

7. Bores / threaded bores

- No guarantee can be given for "filler-metal-free" holes of any kind that are exposed to the brazing surface.

8. Coating the cooling channels and/or the mould section

- If cooling channels are to be coated after brazing, this must be stated on the order. In this case, *Listemann* cannot use a stop-off agent.
- If a PVD coating is planned after brazing, the annealing temperature must be above the later coating temperature in order to avoid distortion during coating. This must also be stated on the order.
- The filler metals used by *Listemann* are vacuum resistant and therefore unproblematic for subsequent PVD processes.

9. Sampling and first article fabrications

- Components, which are manufactured for the first time or variants, which show a brazing uncertainty, are processed within the scope of a sampling order. Sample components must be tested by the customer or his subcontractor with regard to strength and tightness of the brazed joint and suitability for the intended use and approved by the customer.
- Repeat or series production will only be carried out after customer approval based on the procedure selected during sampling order.
- In the case of subsequent orders, the reference to the sampling order and tool must be clearly indicated in the order document.