Heat Shrink Assembly Technology

EMAG

Heat Shrink Assembly from EMAG is primarily used in the manufacture of high-precision powertrain components. It also works well with workpieces that are subject to high torque rates and very dynamic loads. Throughout the continuing development of its systems EMAG is focusing on the individual solution. Heat Shrink technology leads to a significant reduction in component weight and a high degree of functional density.

HEAT SHRINK ASSEMBLY TECHNOLOGY

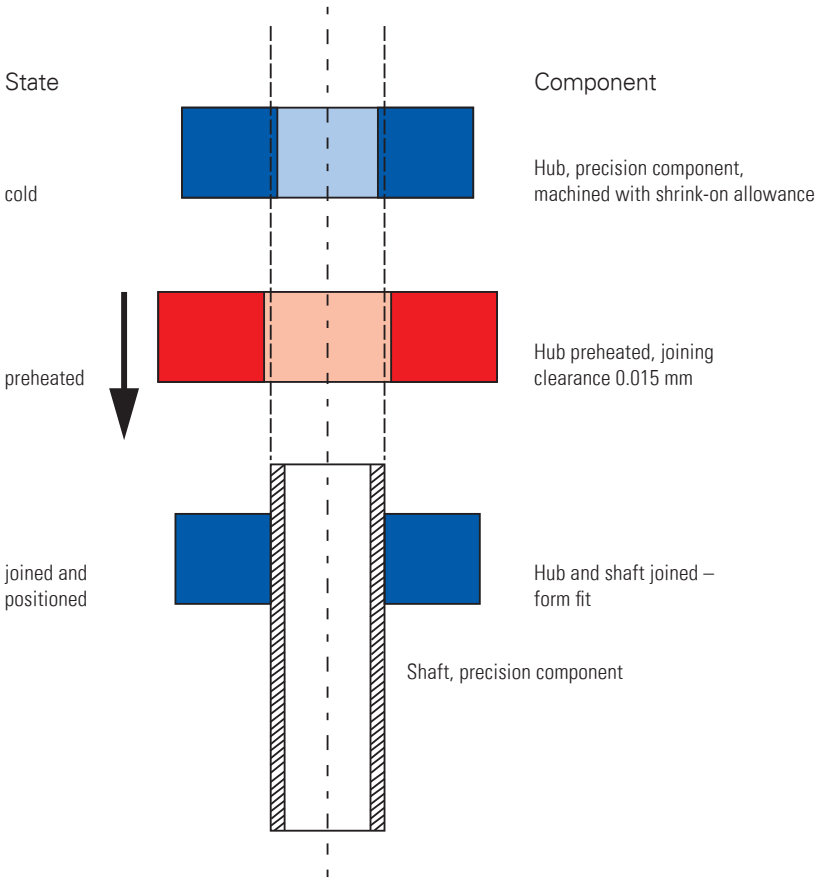
Heat Shrink Assembly Technology.

This technology is a production technique that does not need more processing. Whether control cams or gears have to be matched with shafts or shafts need to be fi tted into housings, the heat shrink technique is a safe and continuous process. The advantage of EMAG's technology lies in the preheating unit, which is geometrically matched to the workpiece and features an essential temperature control. EMAG's patented system is used to join complex precision components. This technology can be applied, especially in the manufacture of shafts.

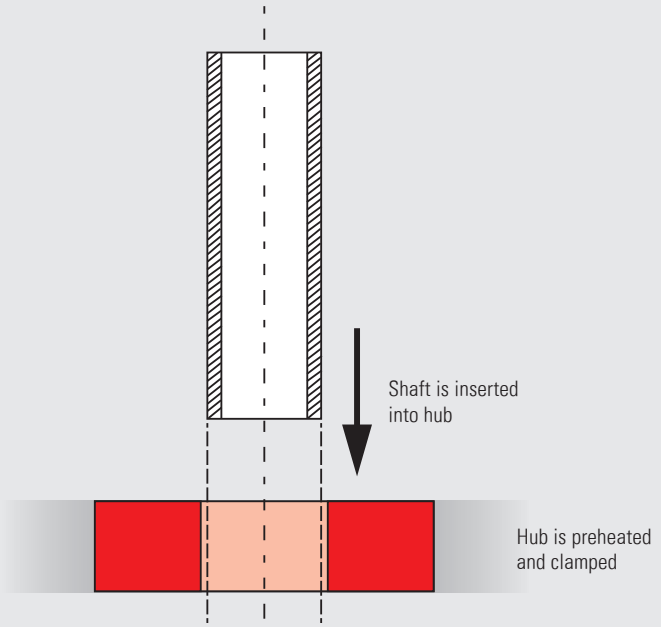
The advantages of Heat Shrink Assembly:

- A high degree of precision that requires no post-processing operation
- Component weight reductions which leads to savings in material
- No component deformation after joining
- It is possible to join diverse materials
- Freely selectable component sequences
- Freely selectable angular and axial positions
- In case of product changes, resetting is quick

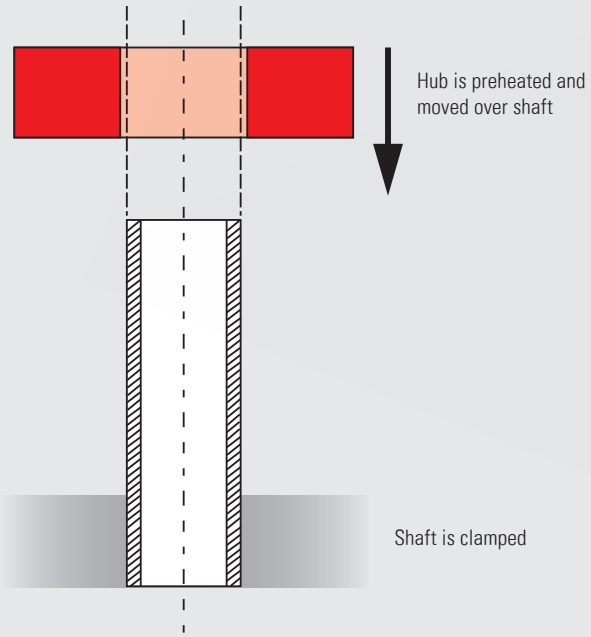
The process.

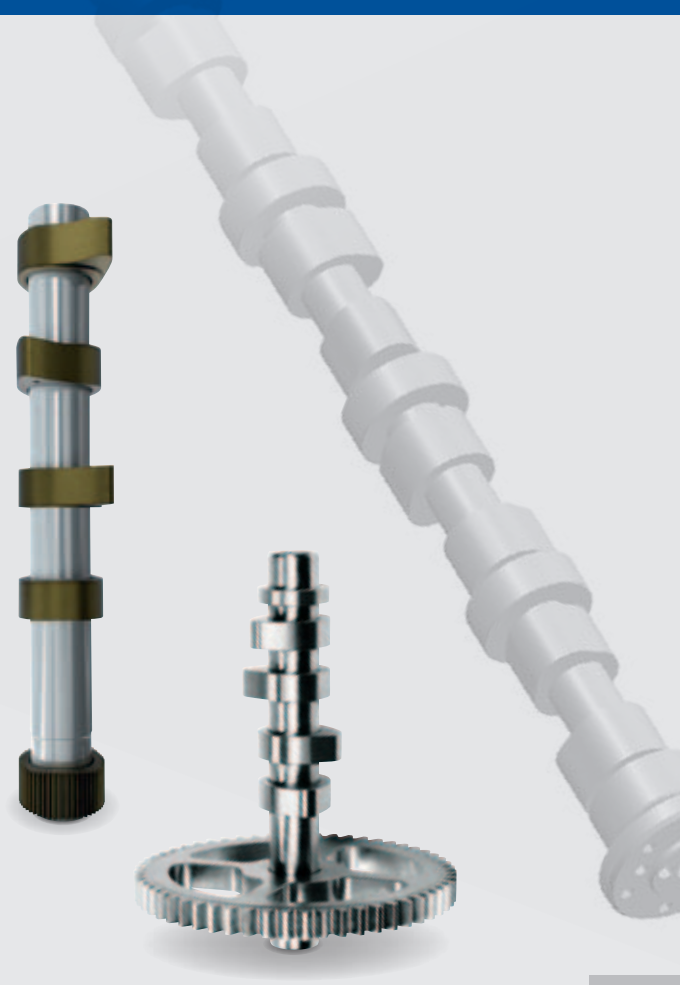


Method 1 – Shaft fitted into hub.



Method 2 – Hub fitted onto shaft.





The joining process for composite camshafts.

EMAG's Heat Shrink Assembly is characterized by a stress-free joining process. The best combination of a robot and specially designed gripper system make it possible to work with a joining clearance of < 15 µm. The flexibility of this concept allows for greater freedom in the design of camshafts and has its advantage in medium batch production with frequent resetting to accommodate different shafts. The Heat Shrink Assembly process combines flexibility and productivity, as the user benefits from constructional, production-specific freedom and from short cycle times. While one cam is fitted, the next one is already being preheated. By equipping the joining machine with a number of preheating units the process can be scaled to suit specific requirements.

J O I N I N G

The advantages composite camshafts provide:

- A reduction in costs
- A reduction in component weight
- The cams can be of different materials
- Greater flexibility in production
- New cam geometries, such as negative radii, can easily be accommodated

Camshafts for passenger cars

Reducing the number of downstream operations:
The high precision of the composite camshaft allows for the cam contour grinding operation to be drastically reduced, or – where precision cams are employed – eliminated altogether.
Another advantage in using this method is the possibility to combine different materials in the manufacture of the shaft. For instance, forged cams (e.g. in 100Cr6) can be used alongside sintered cams that do not call for a subsequent grinding operation.

Ancillary components, such as plugs or endpieces, can – just like the shaft itself – be made of more advantageous materials. This allows for the camshaft to be designed to suit the requirements of the particular engine and to be optimized concerning loading capacity and manufacturing costs.

Camshafts for commercial vehicles

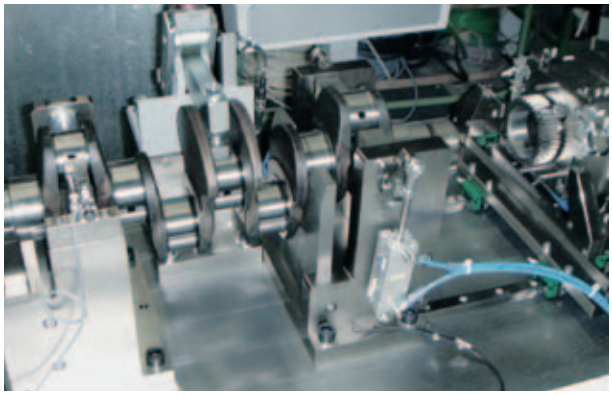
Camshafts for small-power and passenger car engines

The manufacturing process for composite drive shafts.

Heat Shrink Assembly of gear shafts ensure that they are compact and have a high degree of functional density, as the gears can be brought right up close to the shoulders. This ensures that shaft variations are easy to manufacture. And the use of hollow shafts meets the demands for weight reduction. Rotating mass is reduced significantly, without any negative effect on the shaft's resilience.

Thermal joining technology offers design engineers new opportunities to ensure that gear shafts are compact, lightweight and of the right functional density. The results are individual solutions for every requirement.

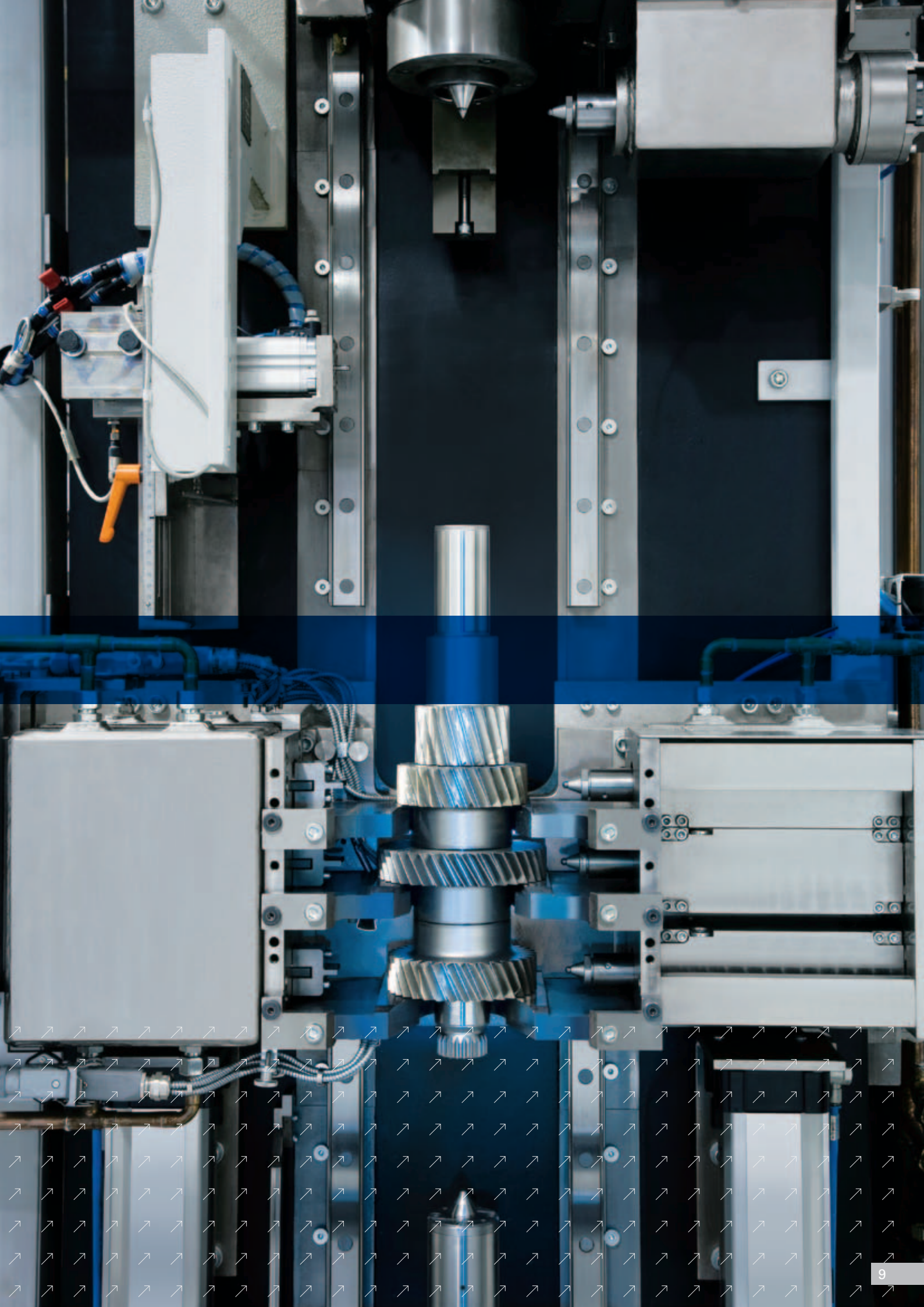
JOINING



Assembly line for crankshafts

Assembly line for drive shafts

Assembly line for gears fitted on camshafts



Preheating systems AWG.

The advantages:

- Component-matching system geometries for optimal heat transfer
- The joining temperature remains constant throughout the process
- Individually controlled preheating units
- State-of-the-art measuring and control technology guarantees minimal energy consumption and accurate temperature control
- Simple to operate; with maximum process integrity assured

Sturdy, compact metal housing with solid worktop in aluminium and integrated prewarming units

Technical data:

- Power supply: CEE-plug (5-pole, 16 A) / shockproof plug
- Protection class: mechanics IP40, electrics IP54
- Application-dependent parameters: cycle time, heat output and preheating time per component
- Choice of housings: W x D x H (standard)
  a) 500 x 500 x 400 mm
  b) 700 x 500 x 400 mm
  c) 900 x 500 x 400 mm
  (dependent on workpiece size)
- Preheating unit:
  a) up to 40 mm internal diameter
  b) > 40 mm to 70 mm internal diameter
  c) > 70 mm to 120 mm internal diameter

Engineering and advisory service.

The way to the best machining solution begins with great preparation, i.e. the definition and selection of the proper technology. We offer a competent advisory service in all questions concerning our Heat Shrink Assembly process and will create a customized comprehensive concept that covers everything from workpiece and technology to machining sequence optimization and assembly parameters / sequence.

- Checking the possibility to join specific workpieces and assemblies
- Checking tolerances and establishing the way to join the workpieces
- Identifying geometric details and surface finish
- Calculating transmissible torque and axial forces
- Design changes between existing components and composite version
- Support in product development, with a view to the joining capabilities of the EMAG process
- Identification of the appropriate preheating technology

Prototyping / laboratory.

From prototyping to the testing of new developments – the EMAG heat shrink laboratory analyzes component geometries with the focus on defining the optimal cost-benefit ratio.

- Construction of prototypes for initial sample inspection
- Production of a pilot series
- Establishing transmissible moments
- Cycle time studies
- Establishing an achievable machine capability

At home in the world.

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