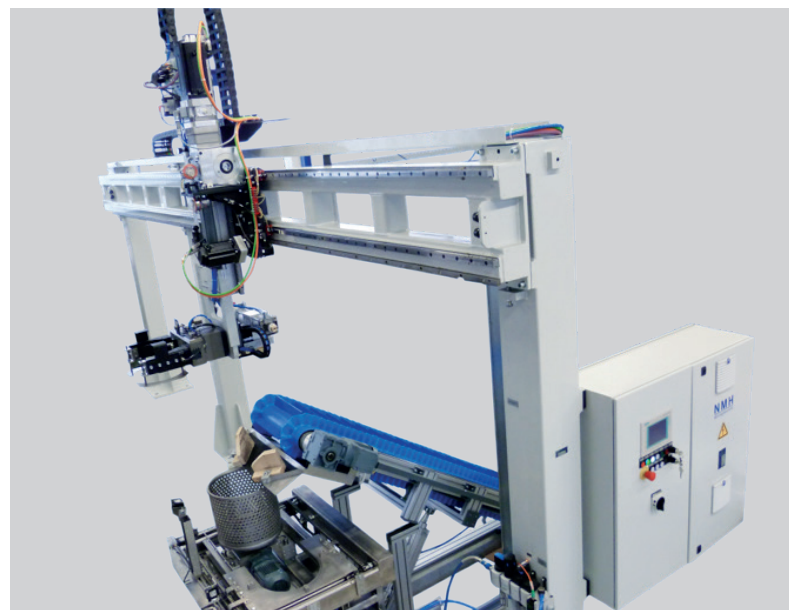


ASSEMBLY TECHNOLOGY

We develop complete solutions for measuring, testing and assembly systems from the design to the final production, assembly and commissioning.

**See the difference for yourself. NMMH –
Innovation is our world**



Assembly system

CAMSHAFT BUSHINGS

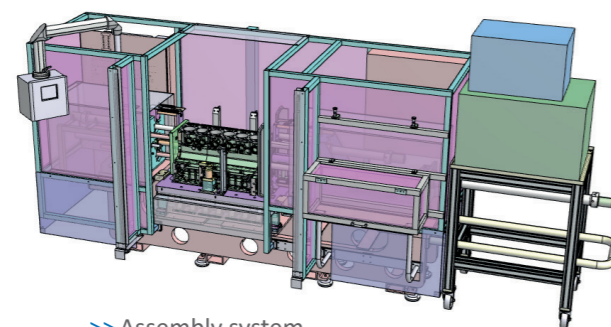
- >> Assembly system for joining of camshafts and control rod bushings for commercial vehicles
- >> The bearing bushings are positioned with the help of individually adjustable bushing holders
- >> The bushings are aligned in the correct position with cushioned pressure pieces to ensure lubrication during later operation
- >> The joining process takes place hydraulically with force / path monitoring
- >> 4 and 6 cylinders can be processed without manual equipping
- >> The bushing positions are checked by means of an air blast before each joining process



>> Assembly system rear side



>> Assembly system front side



>> Assembly system

Special

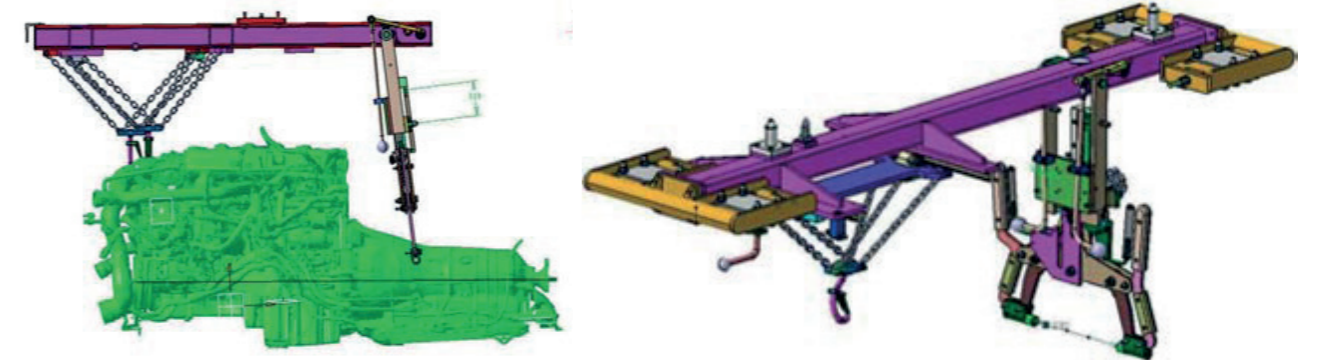
LOAD-HANDLING DEVICES

Advantages

- >> Easy integration into a superordinate overall control unit, high flexibility with modification and simple expandability with use of a standard Siemens control unit
- >> Free accessibility to assemblies or products on the load-handling device. Variable load handling is possible from all sides. Suitable for various product types and variants with simple adjustment
- >> Navigation of production devices, transport paths and other obstacles ($\Delta h = 120 \text{ cm}$) is possible with a height-adjustable suspension
- >> Overall system integration and delivery from a single provider by NMH

Special load-handling devices

- >> Suspension for complete drive unit
 - > Easy equipping for 49 engine / transmission combinations
 - > Stable suspension without swinging motion for assembly work directly on the suspension with holders / stabilisers
- >> Painted or coated surfaces
- >> Testing and certification (CE documentation according to EC Directives with calculation, Declaration of Conformity, risk analysis and operating manual)



>> Special load-handling devices

TRANSMISSION ASSEMBLY AND MEASUREMENT

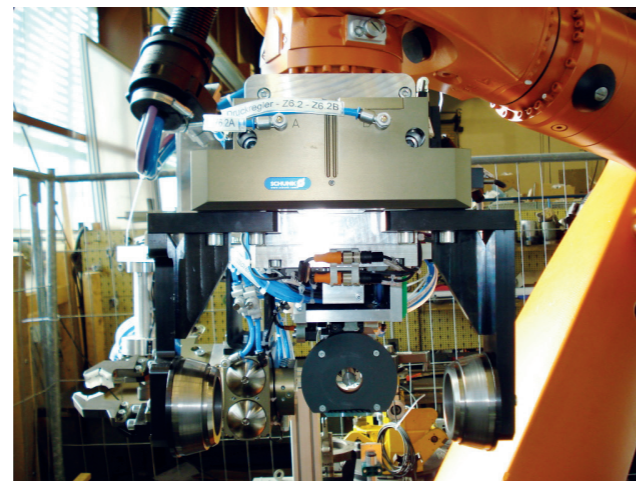
Fully-automatic system for assembly and measurement of front and rear axle transmissions. The transmission is indexed with a workpiece carrier and is fed via a belt system.

Drive bevel gear and drive flange assembly system

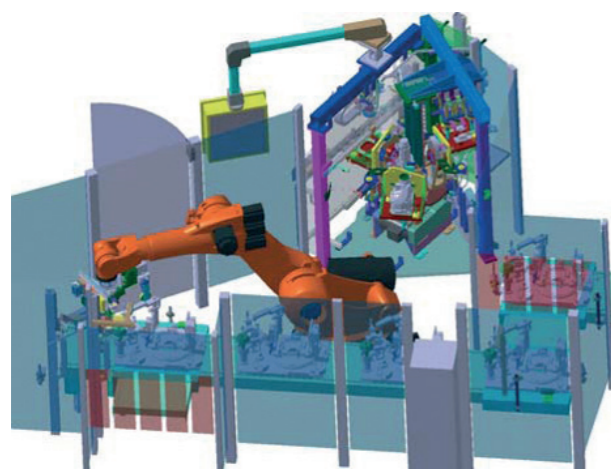
Gear box housing, drive bevel gear and inner bearing rings for the drive bevel gear are taken from the workpiece carrier by a robot grabber and placed in the system. The system comprises 3 stations, clocked by a rotary table:

- >> Inner bearing ring for the drive bevel gear and press-in of the bearing
- >> Drive flange mounting and collared nut fastening (by worker)
- >> Transfer station to robot grabber

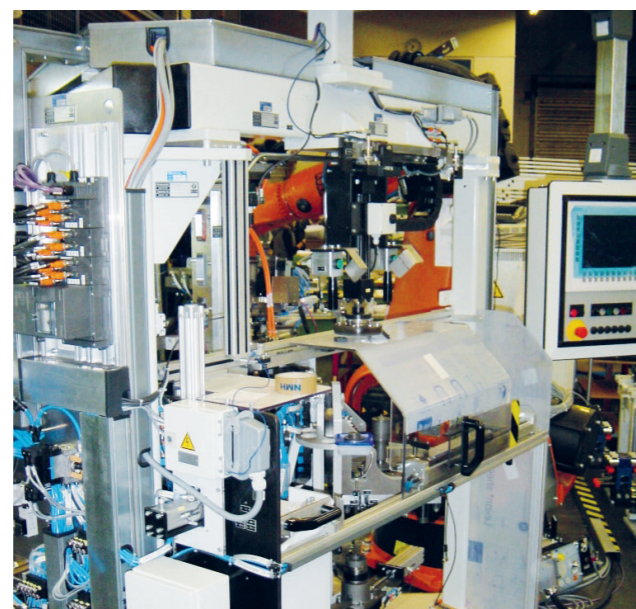
The work station is monitored by access hatches (manual closing, automatic opening) with a safety switch.



>> Robot grabber



>> Drive bevel gear and drive flange assembly system



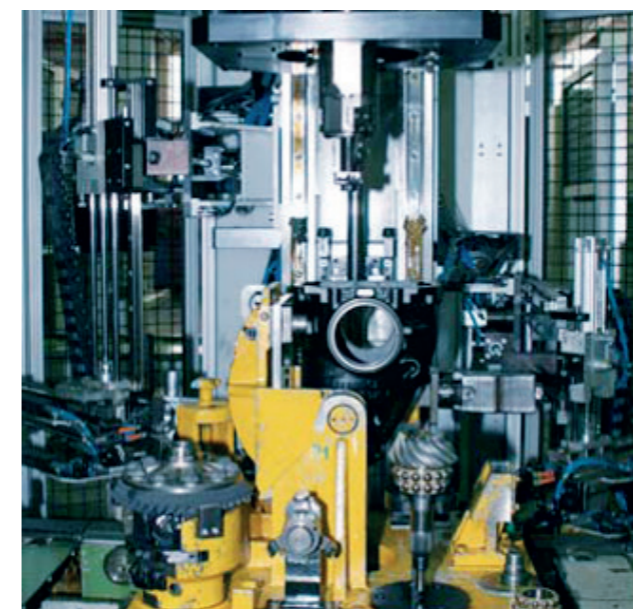
>> Loading side

Press-in of the drive bevel gear outer bearing ring in the housing

- >> Automatic removal and preparation of the outer bearing ring by the workpiece carrier
- >> Press-in of both outer bearing rings (flange and head bearing) by an NMH electric press-in spindle in a single step
- >> Monitoring of press-in force and representation in force / path diagram

Details / innovations

- >> Simultaneous press-in and pulling of both drive bevel gear outer bearing rings with force / path monitoring on one machine in a single step
- >> Total cycle time of 25 seconds (including workpiece carrier change and bearing feed)



>> Press-in of the drive bevel gear outer bearing ring in the housing

Drive bevel gear measuring station

Measurement of the diameter of the head bearing outer ring, pinion installation height and axial run-out under load in order to determine the thickness of the fitted washer for the specified block dimension (pinion head – output shaft axis distance).

Measuring station housing

- >> Measurement and check of characteristics and quality factors, such as bore diameter, installation depth and angularity of bore axes
- >> Automatically changeable measuring heads for various housing sizes
- >> Automatic calibration takes place with a calibration master



>> Measuring station housing

Block dimension measuring station

- >> Check of the block dimension (pinion head – output shaft axis distance) after drive bevel pinion assembly and fastening in order to determine the choice of the correct fitted washer
- >> Axial run-out measurement in order to identify any fastening or bearing errors
- >> Check of bearing friction moment of the drive bevel gear bearing

Backlash measuring station

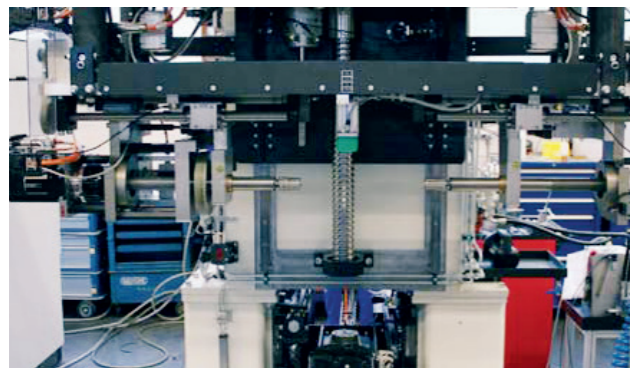
- >> Measurement of the backlash between crown ring and drive bevel gear and determination of disc thickness on the crown ring (S2) and frame side (S3)
- >> Housing expansion dimension measurement

Single flank rolling test stations

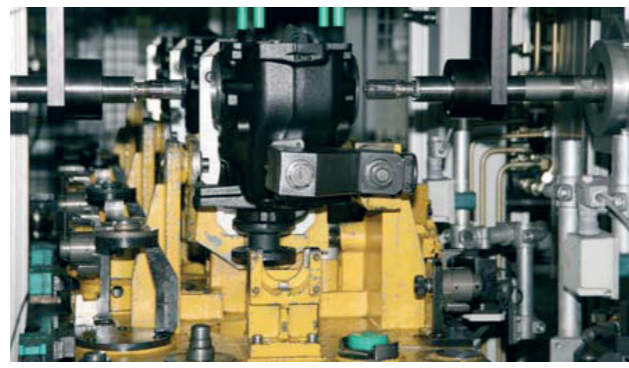
Single flank rolling testing in accordance with DIN 3960 is used to determine the operating behaviour and noise development of transmissions. The single flank rolling test is an alternative to noise testing.

It is conducted at a relatively low speed and low torque, so the transmission does not have to be filled with oil. Therefore, 100 % testing of the transmission on a production line is possible:

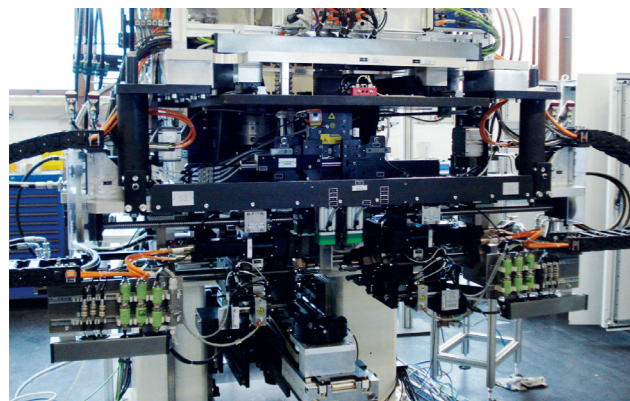
- >> Testing of the transmission for push and pull operation
- >> Drive and measuring units are combined into a single unit, but the drive and measuring shafts are uncoupled from each other and thus permit a drive moment of 18 Nm



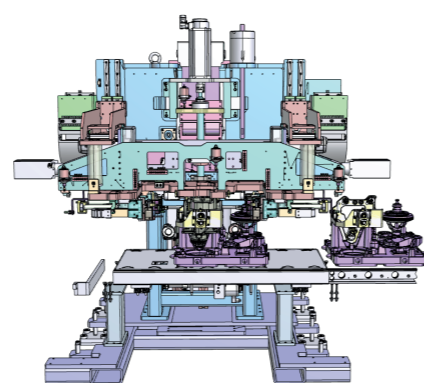
>> Backlash and single flank rolling testing



>> Backlash and single flank rolling testing



>> S2 / S3 disc determination on the front axle transmission



>> Semi-automatic S2 / S3 disc assembly

Joining, fastening and measurement

LANCHESTER TRANSMISSION

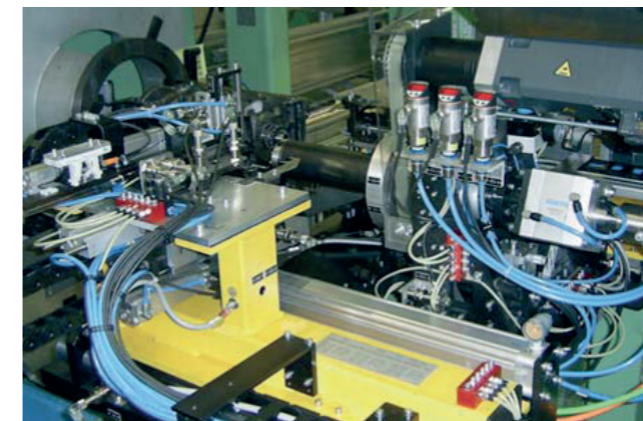
The base plate with floating suspension of the Lanchester grabber enables precise joining of the Lanchester in the index bores of the crankshaft housing. After the joining, the Lanchester is fastened on the crankcase housing automatically (torque and angle of rotation are monitored). The measuring and drive unit are combined as a single unit on the crankshaft.

Very high torques can be realised by disconnecting the measuring shaft from the drive. After joining and fastening, the radial clearance between the Lanchester and crankshaft toothing over a crankshaft rotation are measured. The individual measurements are represented on the measuring computer (MEC) as a numerical value (minimum, maximum and mean value) or graphically.

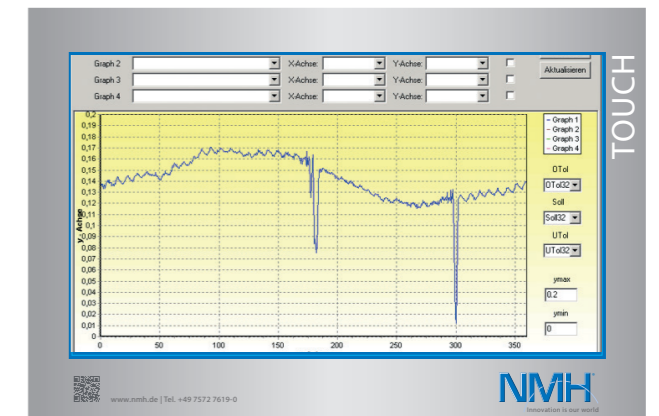
With an NOK measurement, the Lanchester is automatically disassembled, the discs are removed, sorted and discarded and new discs are inserted, then the Lanchester is re-joined and fastened before the radial clearance is measured again.

The radial clearance measuring units are checked by an automatically adjusted calibration master integrated in the system once per shift.

The cycle time for an OK process is less than 50 seconds; if a spacer must be changed due to a radial clearance outside of tolerances, the process time is 70 seconds. Depending on the component characteristics, a mean cycle time of 56 seconds can be achieved. The measured and adjusted tolerance range is 95 µm.



>> Crankshaft measuring and drive unit detail view



>> Radial clearance measurement graphic

Pre-assembly

SUSPENSION STRUT ASSEMBLY

Universal tools and holders enable construction of left and right suspension struts for both front and rear axles.

Your advantages with tried and tested NMH technology

>> Universal

1 assembly station for left and right and front and rear axle suspension struts in pair operation

>> Maintenance-friendly

Open design for ideal accessibility

>> Rapid-fitting

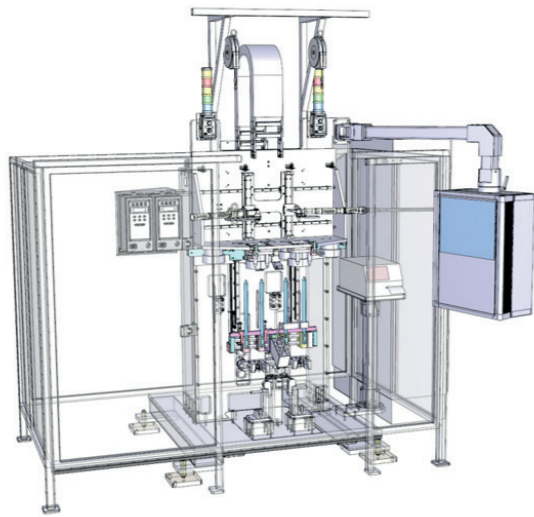
Type change within 20 seconds

>> Resource-saving

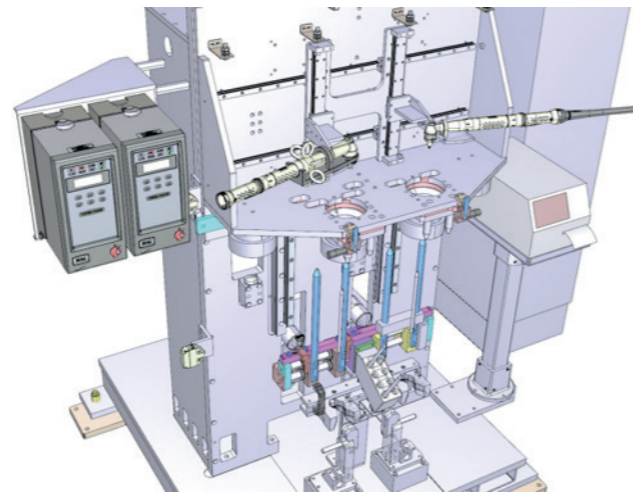
Recording of consumption of power and air and data storage

>> Process safety

- > Graphic worker guidance
- > Use of a handheld scanner
- > Camera station for prevention of incorrect assembly
- > Poka-yoke measures against component mix-ups
- > Monitored screwdrivers
- > Bar code printer for adhesive labels
- > Interface for customer control system for component traceability
- > Workpiece release for manual removal after process sequence OK



>> Overall suspension strut assembly layout



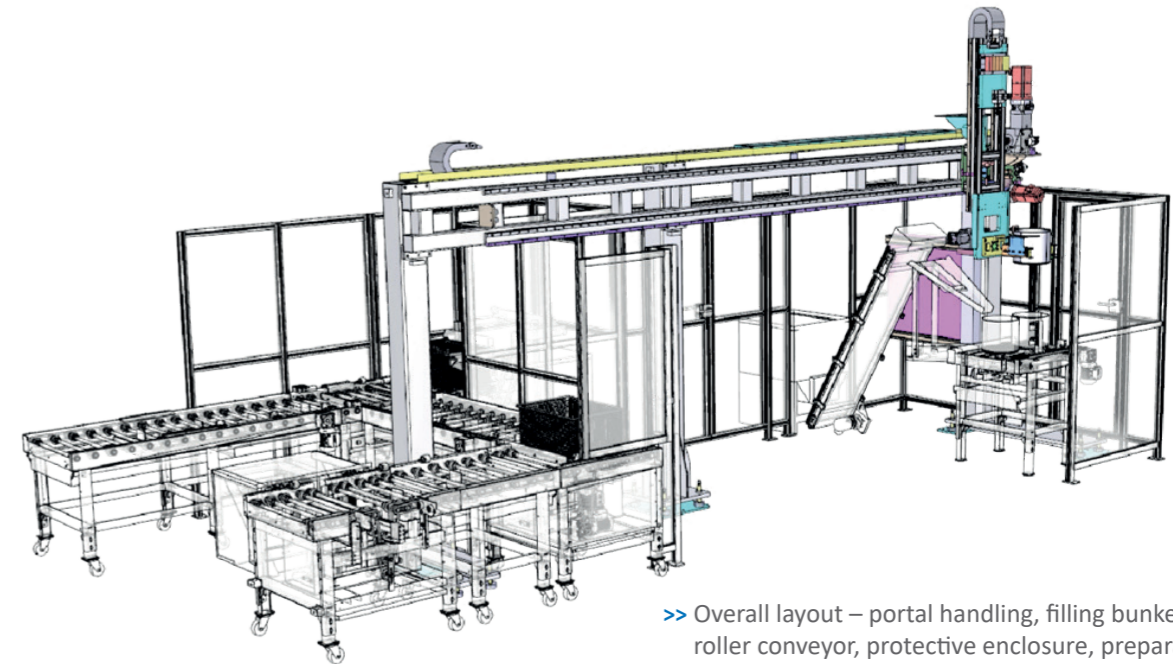
>> Suspension strut assembly detail

NMH

HANDLING TECHNOLOGY

Whether for transport from round containers, handling of cubic components or pick and place tasks, NMH portal handling offers you flexibility in terms of transport weight, transport paths and approach positions.

Universally adaptable grabber solutions enable a diverse range of applications.



>> Overall layout – portal handling, filling bunker, roller conveyor, protective enclosure, preparation table

Your advantages with tried and tested NMH technology

>> Universal

X-Z portal handling with 2 energy-efficient servo axle drives in combination with flexibly designed positioning and operating program

>> Powerful

Lifting loads of up to 100 kg or more

>> Maintenance-friendly

Automatic lubricating system

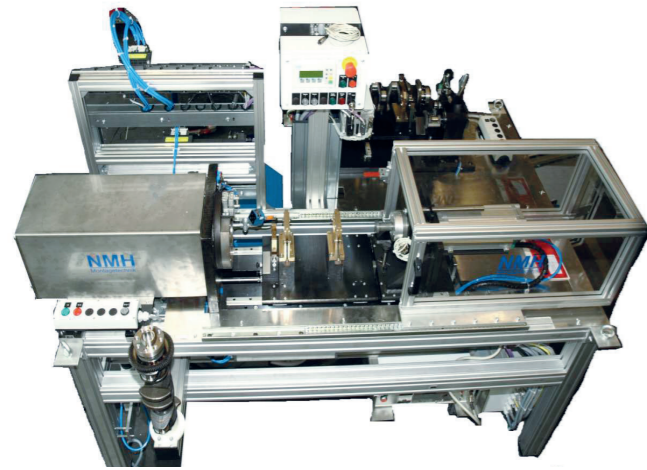
>> Safety "Plus"

Workpiece and tool safeguarding with collision monitoring



Assembly, including testing and measuring device

CRANKSHAFT



>> Station 1 (front side): semi-automatic mounting of gearwheels on crankshafts



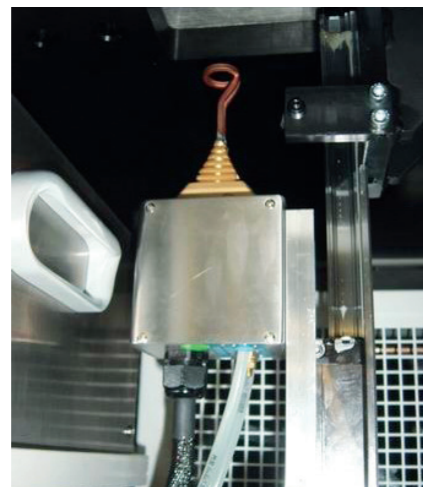
>> Station 2 (rear side): torque testing – gearwheel seat strength on crankshaft

Example: Gear wheel fitting on crankshafts

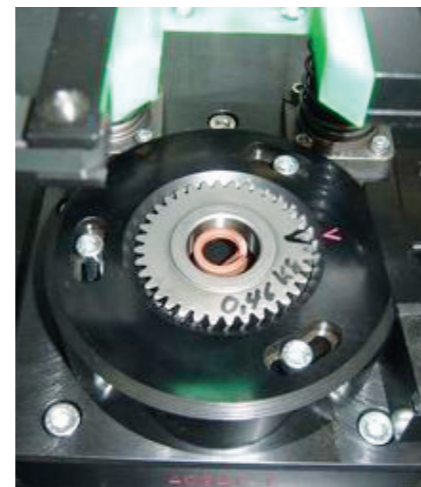
NMH EP 50-300 for pressing of gear wheels on shafts for crankshafts and motor assembly. This press has a retractable probe under the table plate that extends into the gear wheel for induction heating of the fit prior to the joining of the gear wheel on the crankshaft. The loading / unloading of the system take place manually.



>> EP 50-300: Semi-automatic mounting of gearwheels on crankshafts



>> Inductive sensor (view from below)



>> Inductive sensor (view from above)

NMH

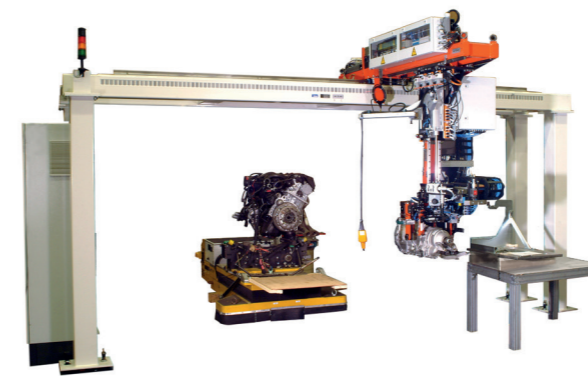
TRANSMISSION JOINING FIXTURE

Description

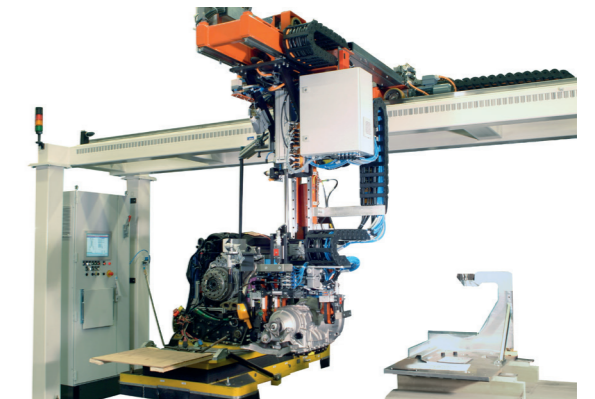
The transmission is grabbed at the pick-up position with the transmission joining fixture. The suspension of the fixture compensates the weight of the transmission with a pneumatic weight balance. The worker can now move the transmission up to the engine with the kinematics of the fixture. The engine and transmission data are stored in the control program with a few parameters. The passively and actively compensating design assures a gentle joining process with parallel alignment between the engine and transmission. The worker aligns the transmission gear wheels and starts the monitored joining process with the push of a button.

Advantages

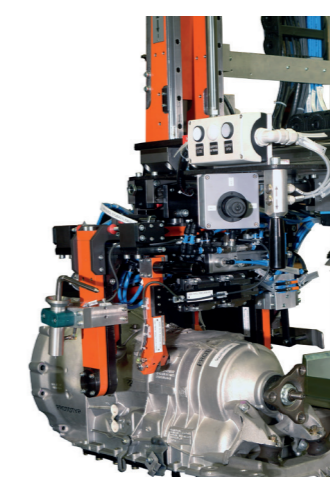
- >> Fast and safe joining of engine and transmission
- >> Effortless, ergonomic work thanks to the suspension with pneumatic weight compensation
- >> No canting of joining components due to mechanical guided parallel joining
- >> Separate joining cylinder for defined, monitored joining at the push of a button
- >> Quick adjustment to changing variants and products with parameterised control program



>> Transmission joining fixture, general view



>> Grabber travel axis detail view



>> Grabber detail view

Technical data

- >> Handling weight: transmissions weighing up to 250 kg
- >> Joining force: monitored, 280 N
- >> Cycle time: 40 seconds

**MORE THAN 3,400 CUSTOMERS
WORLDWIDE – INNOVATION IS
OUR WORLD**



About NMH

NMH is one of the “hidden champions” for complex measuring, testing and assembly systems. The company employs around 100 employees at the Hohentengen location. NMH offers complete solutions – from the design to the final production, assembly and commissioning. Nearly all German premium automotive manufacturers and their suppliers are NMH customers.

**Excerpt of
references**



Company film



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