M-AH: Powerful, dynamic straightening

Our M-AH Series offers you a perfected machine concept of unmatched flexibility in the straightening of shafts and flats. Decades of experience and innovative courage have made MAE the market and technology leader in automatic straightening machines. Following the outstanding success of the M-AH concept, its electromechanical drive became an example to others.

MAE is pleased to present you with the world’s widest and most powerful range of straightening machines:

- for straightening forces of 2–1600 kN
- for workpiece lengths of 30–3000 mm
- for cross sections of 2–300 mm
- for straightening accuracies up to 0.01 mm

Should you require other ranges, MAE can utilise its vast experience in the building of special machines and its wide range of tried and tested products to find the right solution for you. We can then provide the optimally designed installation for your specific needs.
And what can we straighten for you?

MAE automatic straightening machines are used to straighten parts for a large number of industrial sectors. Straightening accuracies of up to 0.01 mm can be achieved with ease. We provide solutions for typical applications ...

... in the automotive industry
Gear, cam, drive, shifter, and crankshafts; steering racks and pinions; rocker arm shafts; formed tubes; chassis and axle components; cylinder heads; etc.

... in the production of standard parts, machine elements, and semi finished products
Ball screws, valve pistons, guide rails, shafts, profiles, tubes, ejector pins, punching dies, precision shafts, etc.

... in the production of electrical equipment
Armature, rotor, and gear shafts

... in the building of textile machines
Axles, spindles, shafts, drawing rollers

... in the production of tools for craft trades and medical engineering
Drills, screwdrivers, spanners
The overall concept behind the world's first straightening machine with electro-mechanical drive still presents a fascinating logic. Compared with the conventional C frame or double column systems borrowed from standard press designs, this patented system offers important advantages:

• Designed for particularly low inertia and dynamic operations, the robust cam disc drive is assembled from fatigue free standard components. The leverage from the pivoting ram plate reduces the drive force, creating the optimal conditions for electromechanical reliability and low energy consumption.

• The maintenance free bearings for the solid ram plate of very high bending and torsional resistance are insensitive to eccentric straightening forces, guaranteeing continuous duty free of disruption – over decades.

• The integrated counterweight makes backlash free operations possible over the long term with a repeat accuracy of less than 0.001 mm, and optimises operator safety in addition.

• Opening over a wide angle, the ram plate allows a linear workpiece flow and integration in your production line for the optimal cycle times.

• The M-AH presents a particularly compact design. This saves space in the layout.

M-AH – an overview of the original:

M-AH for manual loading and unloading. This particularly low cost variant is the perfect solution for small series. The light grid ensures operator safety.
We arranged the straightening tools at the front. The M-AH can be accessed easily for faster changeovers.

The machine table is a stationary unit that does not have to be advanced for loading and unloading. The straightening process can then be initiated immediately after clamping – minimising both cycle times and maintenance costs.

The anvils can be actuated pneumatically. The anvil distances can then be varied, optimising the straightening sequence and hence workpiece stress.

<table>
<thead>
<tr>
<th>Part</th>
<th>Straightening force</th>
<th>Centre distance</th>
<th>Machine type</th>
<th>Straightening positions</th>
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</thead>
<tbody>
<tr>
<td>Car gear shaft</td>
<td>400 kN</td>
<td>750 mm</td>
<td>M-AH 40 – 750</td>
<td>3-5</td>
</tr>
<tr>
<td>Car camshaft</td>
<td>630 kN</td>
<td>1250 mm</td>
<td>M-AH 63 – 1250</td>
<td>4-8</td>
</tr>
<tr>
<td>Rotor shaft</td>
<td>60 kN</td>
<td>400 mm</td>
<td>M-AH 6 – 400</td>
<td>2</td>
</tr>
<tr>
<td>Pinion shaft</td>
<td>1400 kN</td>
<td>500 mm</td>
<td>M-AH 140 – 500</td>
<td>2</td>
</tr>
<tr>
<td>Steering rod tube</td>
<td>60 kN</td>
<td>400 mm</td>
<td>M-AH 6 – 400</td>
<td>1</td>
</tr>
<tr>
<td>Textile machine spindle</td>
<td>60 kN</td>
<td>400 mm</td>
<td>M-AH 6 – 400</td>
<td>3</td>
</tr>
<tr>
<td>Rock drill</td>
<td>160 kN</td>
<td>1250 mm</td>
<td>M-AH 160 – 1250</td>
<td>2-8</td>
</tr>
<tr>
<td>Steering rack</td>
<td>160 kN</td>
<td>1000 mm</td>
<td>M-AH 16 – 1000</td>
<td>3-9</td>
</tr>
</tbody>
</table>
The walking beam conveyor
They have always been fast, but changeovers and ergonomics were their weak points. Forget your experience with walking beam conveyors. The M-AH now has Duorec, its perfect complement for integration in production lines.

- The longitudinal stroke is considerably longer, making intermediate supports superfluous. Instead of four to eight support and transport bars, we now need only two – for guaranteed fast setups. The Duorec is installed on the rear side of the machine with the bars projecting freely to the front. In the initial position, they are completely retracted for unimpeded access to the straightening machine.

- Toolless “fingertip” side adjustment with bars on roller bearings and pneumatic central clamping.

- Especially interesting: Independent of your line tact-time, the Duorec can store workpieces both up- and downstream of the straightening machine.

- This independent unit sorts simple workpieces into receiving chutes, and for sensitive components we can offer the flexible three-axis NORiS sorting handler.

Everything is possible: loading and unloading systems

Just a few years ago, a simple walking beam conveyor was the standard loading and unloading system for by far the most straightening installations. This has changed. Smaller batch sizes and evolving inhouse logistic processes require new solutions. Our current range of automatic loading and unloading systems is built on three powerful basic concepts.
After the transport stroke, the conveying bars retract for completely free access to the front of the machine.
The gantry loader

The gantry loader is the specialist for difficult cases. Some examples are workpieces with complex or top heavy geometries, interconnections with pallet conveyors; and the return of straightened parts to the front of the machine. Benefit from the advantages of our standard portal:

- Double V grippers and the dynamic x axis have been optimised to the M-AH geometry for faster workpiece changes and short overall cycle times.
- Parameterisation and actuation via the RICOS straightening controller simplifies operation and maintenance, resetting work is not required.
- Long lasting components maximise availability and minimise maintenance costs.
- The straightening machine can be accessed freely from the front, simplifying resetting work and also allowing manual loading and unloading.

The robot

You have pallet or basket based production logistics? Now the robot can bring its full strength to bear.

- The sequence of motions is highly flexible, allowing fully automated palletisation.
- Resetting takes place fully automatically.
Straightening machine with gantry loader, sorting station, and additional manual loading facility protected with a light grid.
RICOS: The sum of all experience.

With all mechanical innovations, the controller and the software define the performance of the straightening machine. With this knowledge, we have made software development one of our core fields. At its launch, the RICOS controller was the first industrial PC to be used for straightening. The latest version embodies our experience from over 1000 automatic straightening machines.

- The hardware with separate processors for visualisation and the straightening sequence provides the solid basis for outstanding computing power.

- Optimal ergonomics are ensured by the large TFT touch screen and the Windows user interface.

- The self-teaching stroke depth calculator “remembers” components it has already straightened for reduced cycle times and workpiece stress.

- Remote diagnostics, sequence documentation, extensive fault and help texts, and support from our experts complement each other to perfect effect. Troubleshooting is therefore fast and effective.

- Programming requires no previous CNC experience. You simply define the straightening sequences in the flexible configuration tables. Resetting diagrams provide additional help.

- Interfaces for parts and quality data are provided as standard and can be adapted to your specific requirements.

- RICOS applies a Fourier transform based on the LSC method to filter the runout value needed for straightening out of the measuring curve. Form defects are depicted and evaluated separately. The system precision of 0.001 mm and a max resolution of 1000 measured values per rotation guarantee particularly precise measurements.
• Flexible measuring basis: RICOS straightens towards either the centres or any other basic probes.

• The basic RICOS software allows straightening on round parts and sections, with both the conventional bending-straightening method and pressure straightening for through-hardened parts.

• In addition to the provided workpiece statistics, also individual batches can be analysed specifically. Curvature data are depicted as histograms and tables. You can then monitor the workpiece quality in detail before and after the straightening process.
Precise straightening requires precise measuring.

The precise measurement of running gears and splines is absolutely crucial for straightening on toothed components. MAE can offer you three possibilities, each with its own advantages:

- The patented ball probe has been designed above all for hypoid toothing and small production batches.
- Master gears are the standard for fast measurements on running gears and splines. RICOS evaluates tooth-to-tooth and radial composite errors separately. A patented compensation software reduces the runout effects from master gears.
- The laser measuring system TRILOS provides wear free measurements on virtually all toothing types. Its particular characteristics are the robust design, automatic resetting, and the largely automatic setup for new tooth geometries.
Software innovations for better processes.

Workpiece identification and data transfer
Individual IDs for workpieces and quality data tracking are becoming the standard in a growing number of fields in quantity production. For the detection of ID codes we can offer you camera systems, and with our modified software we can exchange parts and quality data with your master computer.

Measuring device capability
The automatic assessment of instrumentation capability is done by multiple measurements on a component. After evaluating the measurements and their spread, RiCOs documents the capability.

VARIUS: flexible three and four point straightening
The innovative, patented VARIUS system offers many advantages for stretched parts. Two hammers and two anvils can be moved to any position depending on the curving. Long wave curves undergo the four point straightening method, and local curves can be processed with the three point method.

KORIS: internal measurements for tubes and drilled holes
You want to straighten the internal bore of components? We can offer you new possibilities in the form of our contactless measuring system KORIS.
Continuous straightening/VARIUS process screen

VARIUS: three point straightening on short kinks

VARIUS: four point straightening for long wave deformations
Automatic changeover

Systems that automatically reset the straightening system including its loading and unloading installations offer the ideal integration in flexible production.

- The RIVLEX resetting system is responsible for the axial positioning and clamping of workpiece supports, measuring devices, and anvil.
  Components that are not needed are automatically “parked out”, so even large differences in workpiece lengths can be depicted without problems. RIVLEX can also adjust the bars for the Duorec walking beam.

- Three other modules eliminating manual setups: anvil with continuously adjustable heights or pneumatically switched multiple rests; axially traversable straightening hammer and conveyor belts with motor driven width adjustments.

- The NORIS sorting system and the TRILOS laser measuring system are fitted as standard with an automatic setup function.
Detecting and preventing cracks

If the straightening system is to operate as specified, straightening cracks must be detected with the utmost reliability. Strategies for preventing cracks help to reduce reject rates.

• In the form of the Optimizer4D model manufactured by Qass, we have integrated the most powerful version of the crack detection system with piezoelectric quartz sensor and evaluating computer tried and tested a countless number of times. Cracks are detected as they arise, and cracked components are sorted out automatically by the system.

• The best crack is no crack. Our straightening computer RICOS offers many options for reducing cracked rejects. In this case, as many areas as possible on the workpiece’s circumference and length are included in the plastic deformation. Switched anvils enable preliminary and final straightening on a range of anvil distances, and rotation of the component after each stroke (vector straightening) involves additional angle ranges in the process as well. Critical cross sections like transverse drilled holes are then rotated out of the area of greatest stress.
Stay updated: Service and retrofits.

We’ll be pleased to stay in contact with you! Utilise our offer to keep your MAE straightening machine fully operational over the long term and efficient at all times.

Calibration service
We can test and configure the instrumentation on a regular basis.

Maintenance contracts
Staffed for the optimal results, our service department conducts maintenance work on a regular basis anywhere in the world, either following an individual request or according to a maintenance contract at particularly low cost.

Modifications and “retrofits”
MAE straightening machines have a tradition of especially long life. However, so that you can keep pace with the state of the art, we’ll be pleased to fit your system with the latest controllers or replace the drives. Performance and availability are therefore enhanced even on older systems.
Diverse components, diverse requirements: We have your solution.

Having delivered over 1000 straightening machines, we have all the experience in the special straightening requirements for the most diverse components.

For instance, mass optimised, high strength shafts are very susceptible to cracking. This requires a modified straightening sequence that utilises the full potential of plastic deformation in a certain workpiece area.

When straightening thin walled tubes, the anvils must be designed and arranged with particular care if there is to be no damage to the workpieces.

Drills and similar tools require straightening relative to the clamped length. Their subsequent applications therefore generate only low vibration levels.

The straightness measurement of profiles requires special strategies to compensate the influence of gravity and torsion.

The rough surface texture and the large form defects are essential straightening requirements for cast and forged parts.

With MAE ...

... you straighten to particular precision!
... you measure gear teeth to precision!
... you consistently prevent cracks!
... your work processes run reliably, even in harsh environments!
Questions, ideas, wishes?

We’ll be pleased to send you further details on each of our machine ranges. Talk with us! We’re there for you!