



Dr. Oliver Mielenz
and S. Staud, HEKO,
discuss how reliable and
maintenance-friendly chains
and chain accessories are
manufactured.

MAKING CHAINS EASY TO MAINTAIN

The foundation of reliable and maintenance friendly chains and chain accessories is laid in their construction, considering the required high mechanical load capacity, fatigue strength and wear resistance.

In addition to the standardised HEKO portfolio of approved bushed conveyor chains and related assemblies, the company's engineers and technicians are developing reliable technical solutions and products in close co-operation with customers. This customised engineering is not limited to spare parts like chains and related assemblies but is also available for the retrofit or upgrade of existing machines.

Chain manufacturing

The chain manufacturing of HEKO's bushed conveyor chains, chain wheels and related assemblies is performed using state-of-the-art manufacturing technologies. Most of the components are manufactured in the company's production plants. All chains and components are made from high quality steel grades of European origin.

Machining

Pins, bushes, toothed and toothless chain wheels or segments, hubs and shafts are manufactured in state-of-the-art CNC based machining facilities. These facilities are also used to machine the round bores in the link plates to provide a continuous high press fit between bushing/pins and chain link plates and, additionally, to guarantee a straight and non-twisted chain.

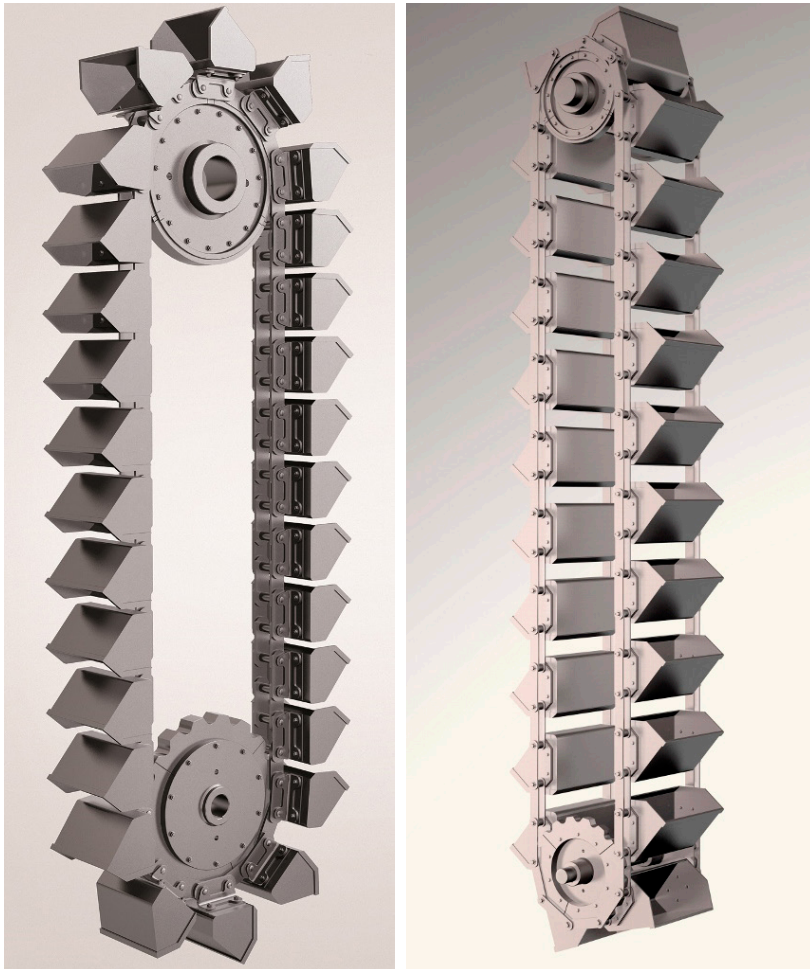
HEKO's manufacturing facilities enable adaptation of different standard chains corresponding to customers' specific requirements.

Laser cutting

The flat link plates are produced in a modern computer-based laser cutting centre allowing for high precision and cost-efficient production.



Bucket elevators, pan conveyors and stockpile reclaimers.



Central chain bucket elevator (left) and double strand bucket elevator (right).

Heat treatment technology

Generally, the service life of bushed conveyor chains depends on the wear of the chain link joint, i.e. the contact area of pin and bushing. Accordingly, a hardening technique is the key technology in the manufacture of high quality and wear resistant conveyor chains, and this has been given high priority by HEKO for decades. The selection and definition of the appropriate heat treatment procedure is performed in order to maintain long service life and fatigue strength of the respected component. The company runs its own heat treatment facilities for case hardening, tempering and quenching, and induction hardening.

The latest step in case hardening has been the introduction of vacuum technology. The products are carburised in vacuum chambers

and finally quenched in a helium atmosphere. High wear resistance and hardening depths are achieved, whilst maintaining a tough core. Typical case-hardened parts are pins, bushes and rollers.

Case hardened bush

HEKO also performs quenching and tempering under inert conditions. This gives the product a fine-grained structure with high strength evenly throughout the whole cross section. High breaking loads of the product results. Typical quenched and tempered parts are forged links, pins and rollers.

Like case hardening, induction hardening also results in a hard, wear-resistant surface layer. A limited area is heated via induction and subsequently cooled, followed by tempering to increase the surface hardened part. Thereby, only the surfaces which are subjected to abrasive wear are hardened and the remaining part retains its toughness. HEKO applies induction hardening to pins, rollers, chain wheels and block link chains.

Chain assembly

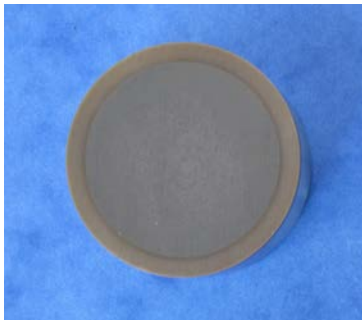
The chain assembly of all bushed conveyor chains is performed with a modern, powerful press and individual assembly tools to maintain the best chain straightness and reliable chain run under operation conditions.

Quality control

The certified HEKO Ketten GmbH Management system covers the quality management system as per DIN EN ISO 9001:2015, the environmental management system as per ISO 14001:2015 and the occupational health and safety assessment series as per DIN ISO 45001:2018. Furthermore, the company is AEOF certified.



Vacuum carburising plant.



Induction hardened pin (left) and induction hardened tooth (right).



Central bucket elevator chains with separate angular brackets (left) and with bent outer links (right) as bucket attachment.

The entire production process is accompanied and controlled by extensive sample testing in the laboratory. This assures high-quality and provides control over production and the final products. An investigation and testing of samples provided by the customer will provide a detailed specification of non-standard parts and ensures that the quality of the HEKO part meets the customer's expectations.

Moreover, the factual results of sample testing can be used by the company's specialists to develop and recommend improved solutions.

Bushed conveyor chains

HEKO provides a wide range of bushed conveyor chains for bucket elevators, pan conveyors and portal or bridge reclaimers. Load and wear-orientated construction and dimensioning as well as a selection of appropriate materials and heat treatment parameters are the keys for long term service life and reliability of bushed conveyor chains.

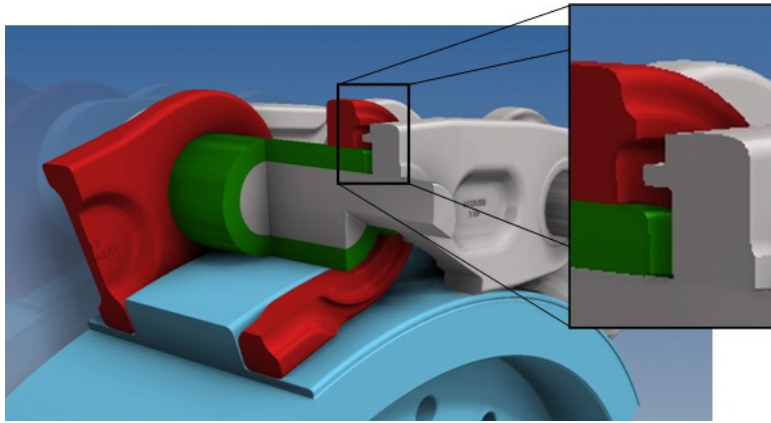
In addition to providing customised bushed conveyor chains individually optimised to clients' specifications, the company also offers a wide range of its own developed and improved standard bushed conveyor chains, which can be easily installed in existing OEM machines.

Bucket elevator chains

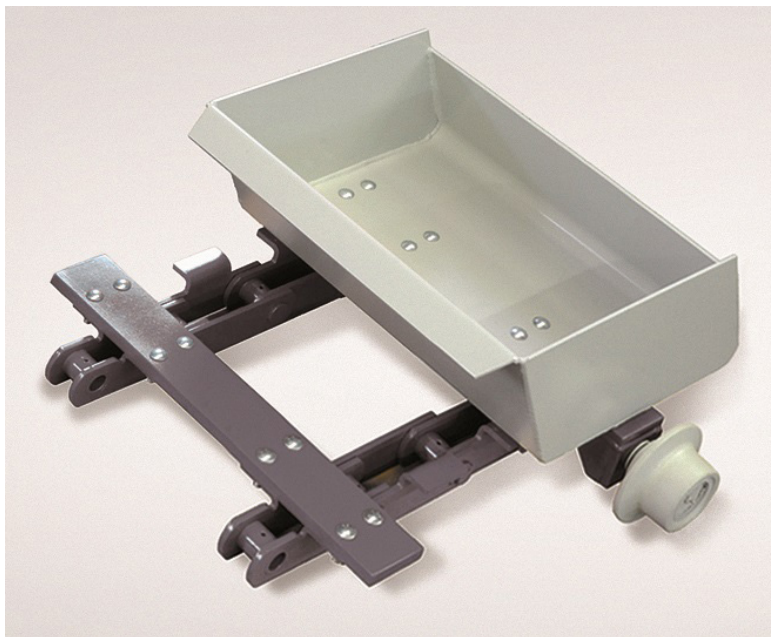
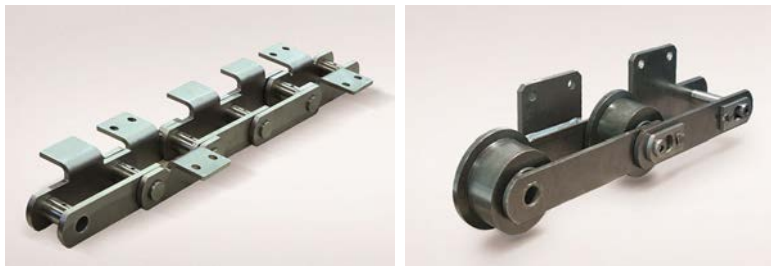
HEKO's chains for central chain and double strand bucket elevators are manufactured in a wide range of dimensions and assemblies.

For high power central chain bucket elevators, the chains have separate angular brackets for bucket fixation fitted to elongated chain pins by means of loose fit in order to absorb vibrations and, hence, to increase fatigue resistance of the buckets.

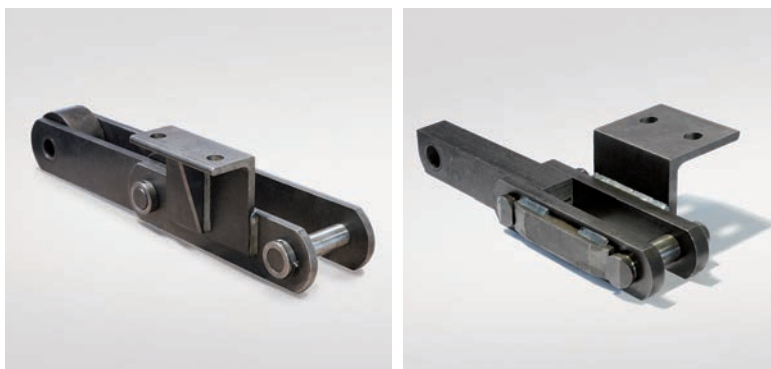
Bucket elevator chains are subjected to high dynamic loads and the emphasis is to achieve high fatigue strength whilst maintaining good wear resistance and, hence, optimum service life. Therefore, pins are tempered, quenched and subjected to induction hardening. High wear resistance is achieved by well-levelled hardening depths of case-hardened bushes and finally inductive hardened tempered and quenched pins. The flat link plates are made of high quality heat-treated



Central bucket elevator chain with forged links and labyrinth sealing.



Examples of different HEKO bushed conveyor chains.



Examples of different HEKO stockpile reclaimer chains.

fine-grained steel. For higher loads, central bucket elevator chains with forged links made from boron-alloyed, quenched, and tempered steel can be provided. HEKO provides forged link bucket elevator chains with labyrinth sealing for reduced wear under highly abrasive operating conditions.

Considerable attention is given to surface quality of bores, pins and bushes, accurate tolerances and assembly. HEKO's bucket elevator chains can be classified as high precision special chains which can resist tough operating conditions with fluctuating load conditions throughout their service life. This is completed by a range of buckets, toothed and toothless chain wheels with replaceable segmented rim, shafts and tensioning stations.

Bushed conveyor chains and components for pan conveyors

HEKO furnish bushed chains to DIN 8165 and DIN 8175 as well as bespoke bushed chains. Mainly twin strand chains are employed for these applications. The company offers their full technical support to customers, including visits on site to find and implement customised solutions.

The wide range of available components enables the company to offer solutions specific to customer applications. Generally, the chains have a pitch of 160, 200, 250 or 315 mm with pin and bush sizes either to DIN or to customer requirements. The chains can be supplied with or without stiffening.

The company provides a variety of roller types, e.g. with plug in or threaded shaft, life-time lubrication and sealing and different kinds of bearings. Compatible chain wheels, with or without replaceable toothed rims or with wear-reducing pitch, are part of HEKO's portfolio as well as attachment flats, apron segments and deep buckets.

Bushed chains and block chains for stockpile reclaimers

Stockpile reclaimers are generally fitted either with double stranded

bushed or block chain; occasionally forged fork link chains are fitted. These chains are not only subjected to tension but also to side loads due to the linear and circular movement of the reclaimer.

Consequently, the sides of the chain links need to be protected against wear. The company provides a wide range of reclaimer chains in all required dimensions, commonly with a pitch of 200, 250 and 400 mm.

These chains often incorporate plain rollers fitted with bushed or roller bearings in the inside or outside chain strand. The angular attachments for connecting the scrapers are either welded to the links or bent as an angular part of the links. The external links are protected against side load by wear strips. The HEKO portfolio of reclaimer chains is completed by matching customised chain wheels.

Installation

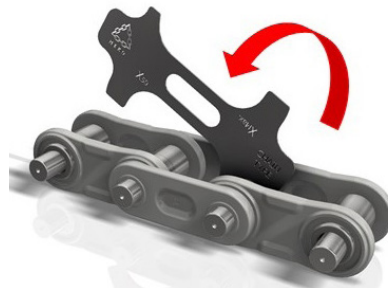
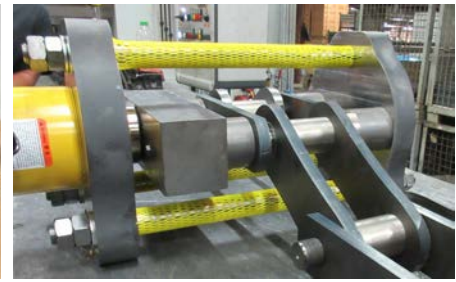
The best chain design and manufacturing quality is worthless without accurate chain installation on site. Much of the damage caused to chains during operation is a result of inaccurate installation. Examples of inaccurate installations and their consequences are as follows:

- Twisting of the chain strands during the installation induces bending stresses and deformations leading to reduced fatigue strength and pure chain running.
- Poor alignment of buckets, pans, scrapers etc. in double strand systems may lead to pure chain running, fatigue stresses and premature wear.
- Connection of chain strands with insufficient tools may destroy the high press fits between pins and chain links, required to guarantee the reliable connection of chain strands, or may lead to increased tensile stresses within the link plates, resulting in reduced fatigue strength.

HEKO's experienced engineers and technicians provide support on site helping customers to prevent these problems during installation



HEKO ChainMaster pressing devices.



HEKO chain wear indicator in operation (left), HEKO chain wear indicator (right).



Detection of zero/low wear (left), 50% wear (middle) and maximum allowable wear (right).

and commissioning. Moreover, this support is supplemented by providing pressing tools for connection of chain strands and finally closing of the chain loop on site.

These pressing devices are merged into the HEKO ChainMaster family. Each type of ChainMaster is optimised and adapted to the respective type of bushed conveyor chain and allows the chain link connection and closing of chain loop on site.

Special attention is paid to avoid the over-pressing of chain link joints. No separate spacers must be introduced, instead over-pressing is avoided by integrated mechanical end stops.

Different HEKO ChainMaster pressing devices are available for the different types and sizes of standard bushed conveyor chains. Moreover, their modular design can be easily adapted to further non-standard chains.

Maintenance

State-of-the-art manufacturing technologies and a selection of best materials can minimise the wear of the chain link joints of bushed conveyor chains. However, each bushed conveyor chain is subjected to a certain wear of its chain link joints, i.e. the wear of the contact areas of bushes and pins. This wear of the chain link joints leads to

an elongation of the chain strands and, hence, to a deterioration of the chain run as well as the necessity to adjust the tensioning station and/or to shorten the chain. Moreover, the wear of the chain pins limits the maximum sustainable chain load.

Consequently, the wear of the chain link joints must be kept under the control of the plant operators. The common method of gathering information on the actual chain wear condition is to measure the distance between the bushes of the chain by means of a caliper gauge and to compare the measured distance with the respected distance of the new chain. This measurement is error-prone and accomplished by limited accessibility of the chain.

Based on long-term experiences in manufacturing and servicing state-of-the-art bushed conveyor chains, HEKO has developed an easy-to-use measuring tool for detection of the actual wear of bushed conveyor chains. The wear indicator has one side for detection of the 50% chain wear (X50) and another side for detection of the maximum allowable chain wear (Xmax).

The measurement is performed over a double link and has to be carried out on different positions of the chain strands. For detection of the actual chain wear, the recess of the HEKO chain wear indicator

is placed on a bush and the measurement finger is swivelled down upon the chain.

The greater the wear, the deeper the finger sinks in. If the X50 finger sinks fully in and the wear indicator completely rests on the three bushes, the chain is at least 50% worn. From then on, the wear measurement should be carried out regularly in shorter periods of time. If the Xmax measurement finger sinks fully in, the chain wear has reached its maximum allowable value and the chain should be renewed within the next scheduled conveyor shut down.

The new chain wear indicator gives plant operators and maintenance people the opportunity to detect the actual wear of HEKO conveyor chains easily during scheduled predictive maintenance and helps to schedule necessary chain replacements in order to avoid unexpected chain failures. Due to its simple design, the chain wear indicator can easily be adapted to all kind of bushed conveyor chains. ■

About the authors

Dr. Oliver Mielenz (head of R&D) and Stefan Staud (R&D Engineer) are responsible for the R&D activities of the HEKO Group.