

# Chain evolution

A key element in bucket elevators are conveyor chains, which often have to withstand high rates of wear and stress as materials with different types of abrasiveness are elevated to increasing heights. A sustainable improved chain design, high-precision manufacturing processes and reliable material sources are important in ensuring a long service life.

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A wide range of bushed conveyor chains for bucket elevators, pan conveyors and portal or bridge reclaimers are available on the market. To ensure a long service life and reliable performance, load- and wear-orientated construction and dimensioning are important, as is the selection of appropriate materials and heat treatment parameters. Specialist chain manufacturers can help with this process.

## Bucket elevator chains

To meet the individual demands of the customer, chains for central-chain and double-strand bucket elevators are manufactured by Germany-based chain supplier Heko in a wide range of dimensions and assemblies.

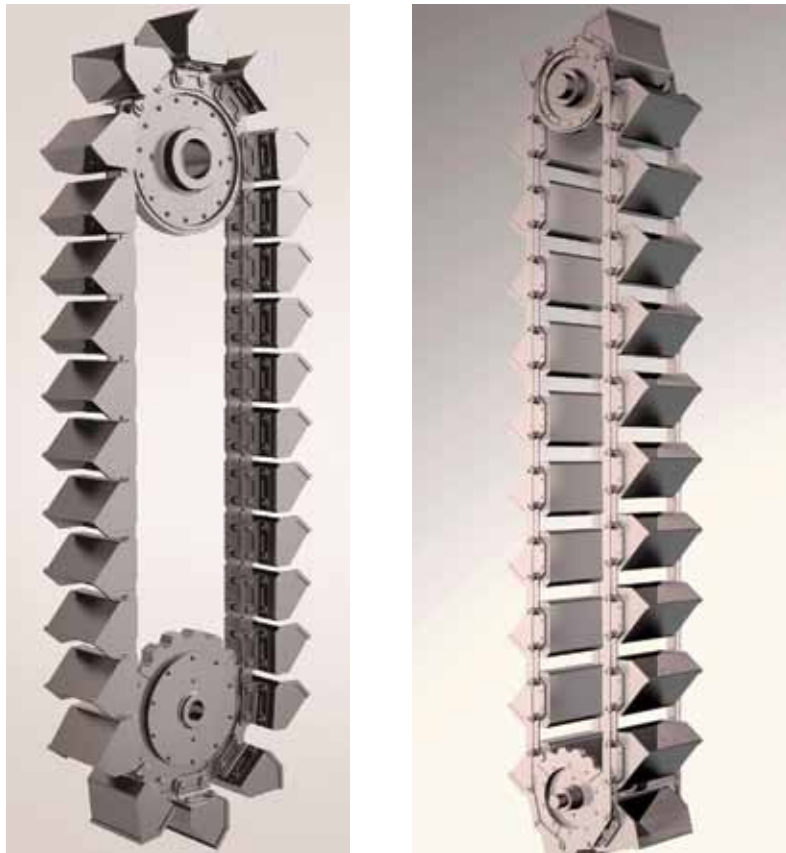
For high-power central chain bucket elevators Heko chains have separate angular brackets for bucket fixation, fitted loosely to elongated chain bolts to absorb vibrations and, as a result, increase fatigue resistance of the buckets.

Bucket elevator chains are subjected to high dynamic loads and Heko's emphasis is to achieve high fatigue strength while maintaining excellent wear resistance and optimum service life. Bolts are tempered, quenched and finally inductive hardened. High wear resistance is achieved by sufficiently-deep hardening depths of case-hardened bushes as well as inductive-hardened tempered and quenched bolts. The flat link plates are made of high-quality, heat-treated fine-grained steel.

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

Considerable attention is given to the surface quality of bores, bolts and bushes, accurate tolerances and assembly. Heko's bucket elevator chains can be classified

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



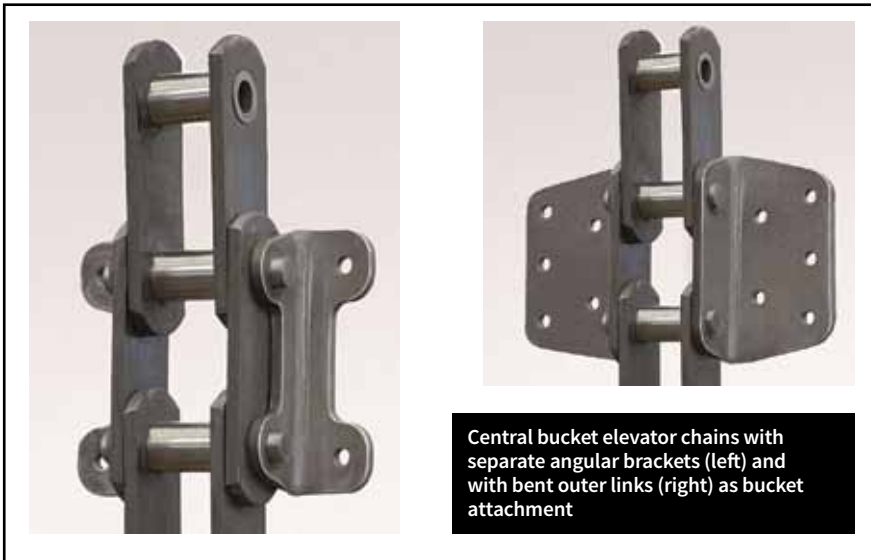
as high-precision special chains, which can resist tough operating conditions with fluctuating load conditions throughout their service life. This is completed by a range of buckets, toothed and toothless chain wheels with replaceable segmented rims, shafts, tensioning stations as well as bucket elevator boots and heads.

## Bushed conveyor chains and components for pan conveyors

Heko furnishes bushed chains to DIN 8165 and DIN 8175 standards, as well as bespoke bushed chains. For these applications mainly twin-strand chains are employed.

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

Heko provides a variety of roller types, eg with plug-in or threaded shaft, lifetime 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 the company's portfolio, as well as attachment flats, apron segments and deep buckets.



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



Central bucket elevator chain with forged links and labyrinth sealing



Double-strand block chain with welded angular attachment bracket and wear strip welded to the outside link (left) and double-strand bushed chain with welded angular attachment bracket and plain roller (right)

**Bushed chains and block chains for stockpile reclaimers**

Stockpile reclaimers are generally fitted either with double stranded, bushed or block chain, although 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. Heko provides a wide range of reclaimer chains in all required dimensions, commonly with a pitch of 200, 250 or 400mm.

These chains often incorporate plain rollers fitted with bushed or roller bearings within 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 company's portfolio of reclaimer chains is completed by matching customised chain wheels.

**Engineering**

Beside the standardised Heko portfolio of bushed conveyor chains and related assemblies, the chain supplier's engineers and technicians are developing reliable technical solutions and products in close co-operation with its customers. This customised engineering is not limited to spare parts such as chains and related assemblies, but is also available for the retrofit or upgrade of existing machines, as well as the construction of new bucket elevators and pan conveyors. Thereby, Heko applies modern 3-D CAD tools for detailed engineering as well as for plant optimisation.

**Research and development**

Beside developing customised solutions, Heko is continuously optimising its standardised bushed conveyor chains and associated components to meet future demands in terms of conveying capacities, conveying materials and customer requests for further enhanced service life. Permanent technical exchange with universities, research institutes and clients guarantees a target-orientated product evolution under consideration of state-of-the-art developing and manufacturing tools. Amongst other developing tools modern computer-based tools, such as

**Exchange of bucket elevator chain**

In 2014 Heko-KoWey, a sister company to Heko-Ketten, delivered and exchanged spare parts – ie chain, chain wheels and buckets – for a cement mill central chain bucket elevator in a cement plant in Vietnam.

This bucket elevator (bucket width 1000mm and bucket protrusion 320mm) has a capacity of 1060tph and a centre distance of 38m.



## Retrofit of central chain bucket elevator

In 2014 Heko-KoWey retrofitted a raw meal central chain bucket elevator in a cement plant in Iran.

This central chain bucket elevator for kiln feeding has a capacity of 300tph and a centre distance of 25.5m.



finite element analysis (FE-analysis), are applied for detailed optimisation and verification of progress. These theoretical methods are complemented by laboratory testing and final operational trials.

### Chain production

The entire chain production of HEKO's bushed conveyor chains is performed by applying state-of-the-art manufacturing technologies, with most components produced in the company's production plants. The chains are made from high-quality European steel grades.

### Machining

Bolts, bushes, toothed and toothless chain wheels or segments, hubs and shafts are manufactured in latest-generation computer numeric control (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/bolts and chain link plates and, additionally, to guarantee a straight and non-twisted chain.

### Laser cutting

The flat link plates are produced in a

modern computer-based laser cutting centre, allowing for highest precision and cost efficient production.

### Heat treatment technology

The service life of bushed conveyor chains often depends on the wear of the chain link joint, ie the contact area of bolt and bushing. Therefore, the hardening technique is the key technology in the manufacture of high-quality and wear-resistant conveyor chains. The selection and definition of an appropriate heat treatment procedure is performed to maintain long time service life of the respected component. Heko 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 helium atmosphere. High wear resistance and hardening depths are achieved, while maintaining a tough core. Typical case-hardened parts are bolts, bushes and rollers.

Heko also performs quenching and tempering under inert conditions. The product receives a fine-grained structure

## New deep drawn pan conveyor for clinker transport

Heko-KoWey delivered and installed a new deep drawn pan conveyor for clinker transport in Iran in 2011.

The pan conveyor of type KCT10/800-300 has a capacity of 300tph and a centre distance of 155m.



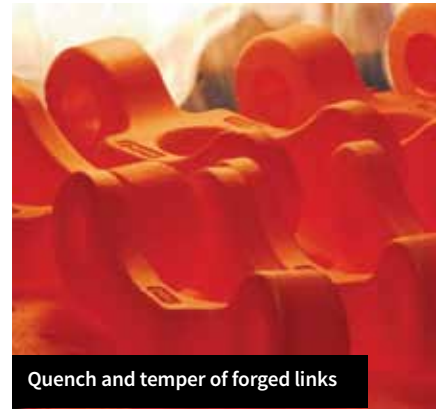
Machining of toothed wheel rim



Laser cutting of central bucket elevator links



Vacuum carburising plant (main pic) and case hardened bush (inset)



Quench and temper of forged links



Preassembly of bucket elevator central chain inner link

with high strength evenly throughout the whole cross-section, leading to high breaking loads of the product. Typical quenched and tempered parts are forged links, bolts and rollers.

Similar to 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 area. Thereby, only those surfaces are hardened which are subjected to abrasive wear and the remaining parts retain their toughness. Heko applies induction hardening to bolts, rollers, chain wheels and block link chains.

#### Chain assembly

The chain assembly of Heko bushed conveyor chains is performed with a modern powerful press and assembly tools of the highest accuracy to maintain best chain straightness and reliable chain run under operating conditions.

#### Heko quality control

The entire production process is accompanied and controlled by extensive sample testing in the Heko laboratory. This assures the high-quality demands and provides control over production and the final products. An investigation and testing of samples provided by the customer will supply a detailed specification of non-standard parts and ensures that the quality of the Heko part is identical to the customer's demand. Moreover, the factual results of sample testing can be used by Heko's specialists to develop and recommend improved solutions.

Cement production, with its challenging

manufacturing environment, ensures chain producers are continuing their efforts to design and produce reliable and high wear-resistant chains.

To successfully bring such chains to the market, advanced R&D skills and stringent quality control are key to satisfied customers and repeat business. ■

## Spare parts delivery for pan conveyor



In 2010 Heko-KoWey delivered and installed deep drawn pan conveyor sections (chain with pans) as spare parts for a deep drawn pan conveyor that transported clinker in a Saudi Arabian cement plant.

The key parameters in the pan conveyor's technical specification were:

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|----------------------------|------|
| • centre distance (m)      | 174  |
| • inclination height (m)   | 32.6 |
| • conveying capacity (tph) | 300  |