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Hollow block mould assembly: from welded to bolted versions – a constructional journey through time

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In 2009, Kobra Formen GmbH introduced the bolted version of hollow block moulds that until then had always been welded. They tested the constructional assembly with pilot customers on different continents. The Kobra designers incorporated ideas, suggestions and criticism and the mould was continuously developed. To this day, the bolted assembly is a unique Kobra selling proposition in mould manufacturing. It raises the question of why Kobra implemented a modular concept based on plug-in and bolted joints and what benefits resulted that justified alignment of all mould production with this concept.

The beginning of the bolt

In concrete block production, dimensional stability of the tool is decisive in being able to produce qualitatively uniform and, above all, high-quality products. This also includes the material properties of the concrete block mould, which guarantee high resistance to wear and thus a long service life.

Theoretically, the nominal size and surface hardness grade of bolted and welded versions hardly differ at the beginning of a mould's life. The verifiable difference appears in the course of production.

Some concrete block plants, in the Middle East, for example, have a daily production capacity of more than 100,000 hollow blocks. With such mass production, the mould tool is subjected to extreme stress. Before 2009, the completely welded Kobra moulds of the period were hardly repairable. At that time, special steel alloys were used for the heated, welded construction method to achieve greater resistance to wear in the moulds. Nevertheless, in the event of damage, a repair was associated with long downtime, since complicated alignment of mould parts was also necessary for the welding work. Some cases even required complete mould replacement.

For the concrete goods manufacturer, cost-effective production with this system was only possible within narrow limits. Today, the bolted construction method is cheaper for both parties – user and manufacturer – in the event of a warranty claim and damage.
The engineering of new construction methods is therefore primarily aligned with market requirements, which demand, above all, wear resistant and easily repaired tools for the production of hollow blocks. This necessitated new hardening techniques for the steel employed as well as innovative mould construction methods. Kobra's task consisted of combining diverse requirements while complying with applicable industrial standards and tolerance ranges.

With the adoption of the bolted mould construction, which was already in use in the paving stone mould product group, Kobra initially faced some skepticism in the market. Specific customers from different sales regions that have tested the bolted hollow block mould were therefore selected. The system successfully mastered every test procedure. Today it is a standard Kobra design for tall products under the Boltline1 brand.

Boltline1 is used for hollow and solid concrete block, standard and rounded curb moulds. The insert is assembled from individual walls that are plugged into each other and bolted and can be combined with Moduline1 and Dynamic frame versions, so that a four-part, bolted frame, which can be reused repeatedly, is always used. Consequently, this construction method follows a reduced-CO_2 material consumption model. The cover plates are also bolted and thus easily replaceable.

With hollow block moulds, the module concept is fully implemented all the way to the core assembly, which consists of individual elements that are bolted together. If a core is defective, it can be replaced without great expense by simply loosening individual bolts and replacing the defective component with a functional one.

With the introduction of segmented, carbo-quality cover plates, Kobra has once again improved the modular design

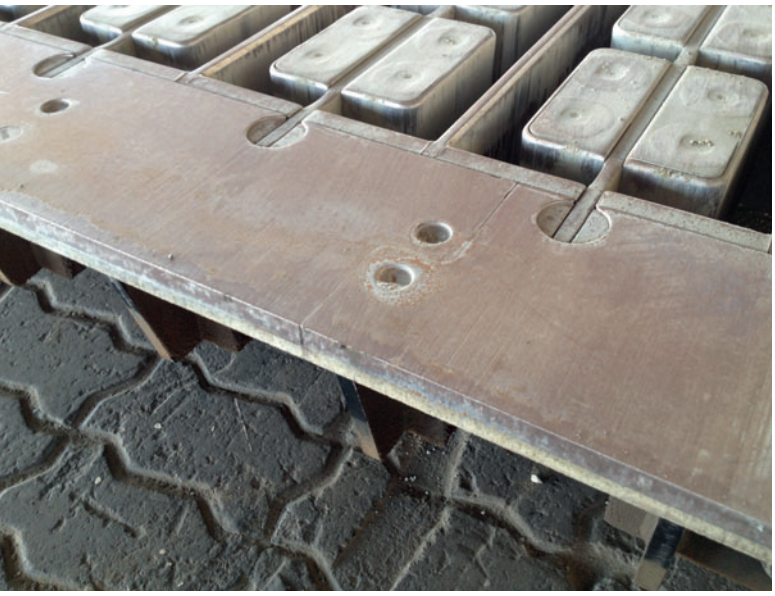

Figure 1: Segmented cover plates for simplified exchange of wearing parts.

of the hollow block mould, because maintenance will be even easier.

Overall, Kobra enables targeted, needs-based planning of wear part replacement by their customers. There is an opportunity to order the component needed for the specific concrete block mould and significantly extend the tool's service life. Kobra also offers an organizational basis for planned wear part replacement. With completion of a premium partnership for the particular Boltline mould, wearing parts can be requested online and delivered directly to the plant within a very short time.

Comparison of typical wear patterns in bolted and welded hollow block moulds

Vertical versus horizontal fastening of core bar and core assembly

Earlier Kobra design versions contained a core bar fastening with bolt and pin. The core bars were fixed by means of a transverse screw connection. Since the force action on the bolt takes place longitudinally during the production process, a horizontal screw connection proved to be a disadvantage. Cracks could form around the screw hole and lead, in the worst case, to the core bar breaking off.

One of the constantly successful variants in practice is therefore the combination of a vertically installed long screw with threaded bolts that exhibit high stability during the production process.

Even the single cores in the core assembly are bolted and thus reparable and replaceable.

Kobra has adapted the hollow block mould construction to the forces arising during the manufacturing process, minimiz-

Figure 2: Vertically installed long screw with bolt (Kobra)

Figure 3: Horizontal bolting

ing mould wear. Furthermore, the bolted, modular system guarantees simple, uncomplicated mould reparability, in contrast to the welded models.

Cracks in the lamella and broken core bars are typical repairs with welded hollow block moulds. In these cases, the entire core assembly must be burned out, completely re-welded and aligned - an expense that can be avoided with the use of bolted joints.

Carbonizing versus nitrating

Kobra hollow block moulds bear the "Optimill carbo™" label. Optimill stands for the use of innovative milling technology that results in very high dimensional accuracy. Carbo identifies the hardening process used, in which the boundary layer of the mould is enriched with a carbon emitting medium in a thermochemical process and then quenched and thus hardened. After hardening, the workpiece is tempered in order to reduce internal stress and to generate the required usage strength. Using this principle, Kobra hollow block moulds achieve a homogeneous surface hardness of 64 HRC and exhibit significantly improved resistance to wear than is the case with nitrated hollow block moulds.

Effect of the hardening process on the formation of typical wear patterns

The property of homogeneity in combination with the depth of hardening of 1.2 mm plays an important role in the surface hardness, because it has direct effects on the wear behaviour of the hollow block mould.

An especially positive effect of the carbon-hardened concrete block mould is not only the slow, very limited, but most especially uniform wear of individual components and assemblies, which enables long-term production of concrete products in consistent quality. Fig. 4 shows a hollow block mould which exhibits only insignificant corner wear after more than 100,000 cycles.

The current construction method is also distinguished by low wear at the lower edge of the mould. This, too, is a benefit of carbonizing compared to nitrated moulds and enables qualitatively consistent production of concrete products.

In some markets, heavily abrasive aggregates are used in the production of hollow blocks, which can increase tool wear. In some cases, Kobra service engineers have even found foreign objects (steel parts, tools, etc.) in the mix, which could cause significant damage to the mould.

Thus, the concrete block mould must basically be distinguished by especially robust construction and a high level of hardness. Fig. 5 shows wear extending all the way to complete material loss on a nitrated, welded core.

For the concrete goods manufacturer, consistent conversion from welded to bolted hollow block mould construction method combines the benefits of precisely crafted, milled components that are individually replaceable, quickly and

Figure 4: Minimal corner wear in a carbo-hardened Kobra hollow block mould.

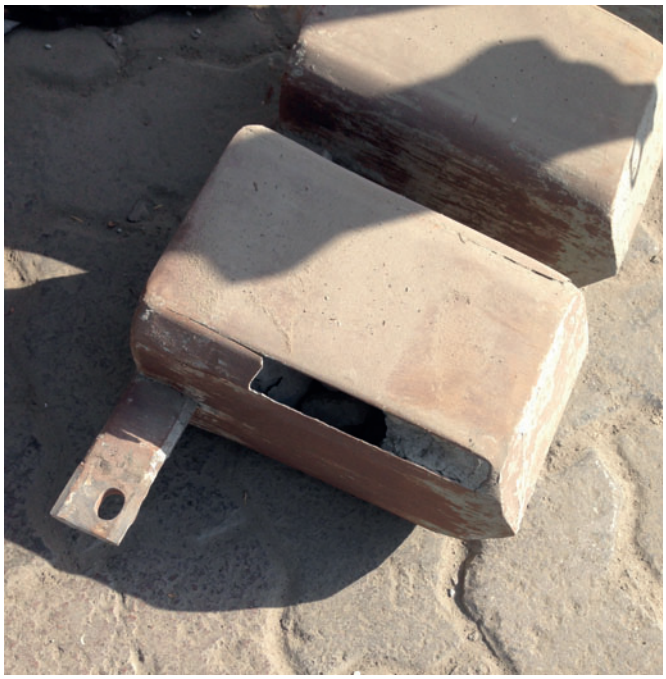

Figure 5: Nitrated core, totally worn out

easily, because of their bolted joints. They can also be integrated into the mould maintenance intervals beforehand using the software-supported planning tool from a premium partnership. Furthermore, the Kobra hardness standard can protect the hollow block mould from excessive and irregular wear.

This means the concrete block plant has the option of on-site wear part replacement by Kobra service engineers or even taking care of this in-house. Kobra offers training on the subject of mould maintenance and care that can also take place at the concrete block plant.

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