

GOLIATH

300/450/600/900/
1200/1500/2000

SHIPYARD GANTRY CRANE



KOCKS





↑
An engineering classic optimised for ship yards of the future: the Goliath

THE GOLIATH.

THE PRECISION SHIPYARD GANTRY CRANE.

THE SHIPYARD SOLUTION FOR
CHALLENGING PROJECTS.

The rapid pace of globalisation is transforming the shipbuilding business, ships are becoming larger with greater capacity. Cranes play a key role within the shipbuilding sector. Increased load-bearing capacities and higher spans combined with the simultaneously increasing requirements of positioning accuracy, hoisting heights and flexibility are all demands placed on this pivotal equipment.

Gantry cranes are in demand to span widths of more than 200 meters and are operated within block storage yards as well as docks. Today's docks often have lengths of 300 – 700 meters and in general one single big crane is in operation covering this area. The cranes reliability is crucial for the productive efficiency of a yard.

A shipyard gantry crane should be able to handle reliably all tasks which cannot be coped with by any other hoisting device. Throughout the vessel construction process ship sections will be turned at regular intervals; these panels with a weight of up to 2,000 tonnes must be transported and maneuvered in the dry dock with millimeter precision and then held in position whilst the production stage is completed.

→ INFO

→ What exactly characterizes the best shipyard gantry crane?
What are the important factors?

→ The essential factors are:

- reliability and availability
- positioning accuracy
- flexibility

→ Precisely:

- efficient and safe handling of heavy loads
- transporting and positioning accuracy
- energy efficiency, e.g. active feedback into the existing power network
- low maintenance and operational costs
- long service life

The Goliath with its two-trolley system of upper trolley and lower trolley is the guarantor of peak performance in the shipbuilding industry.

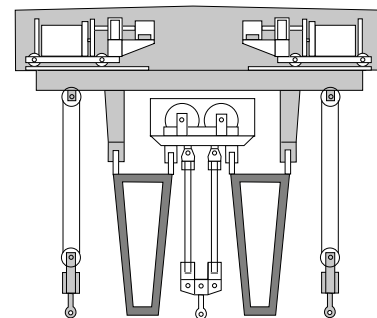


AN ENGINEERING CLASSIC OPTIMISED FOR YARDS OF THE FUTURE: THE **GOLIATH** WITH TWIN GIRDER AND TWO-TROLLEY SYSTEM.

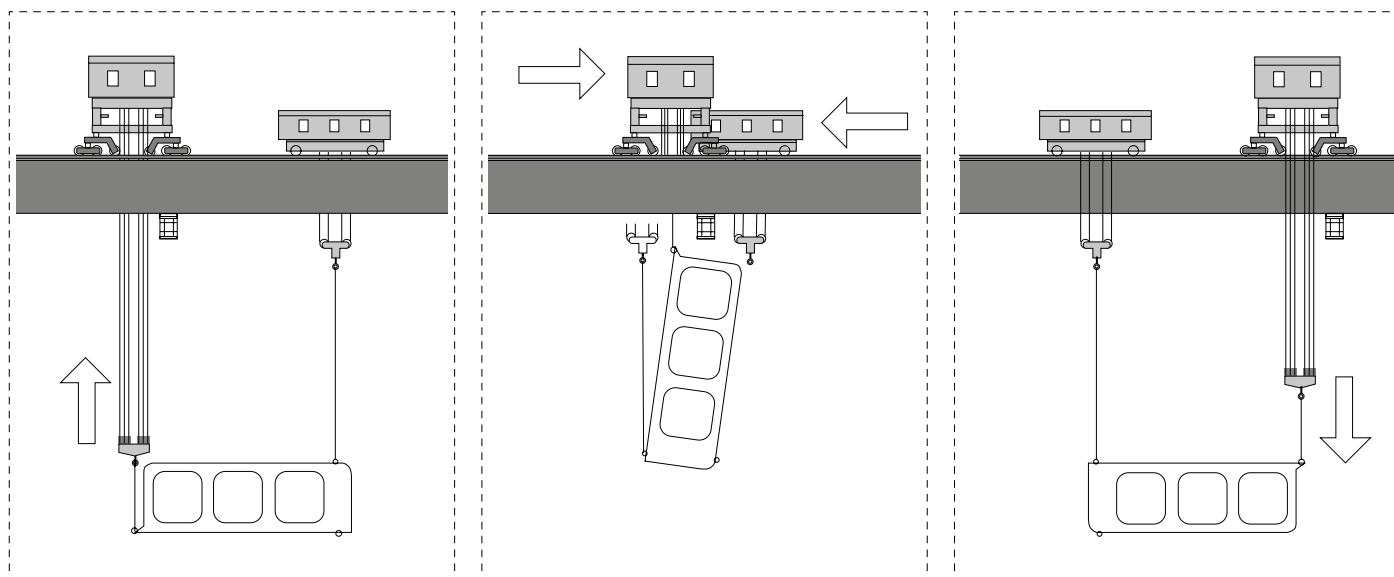
Kocks have been building Goliath cranes since 1958 for the shipbuilding industry for installation in yards with different crane systems including variations of girder cross-sections, leg types, trolleys and drive mechanisms. We have always implemented rigorous product development through constant design and performance review right through to the present generation of the Goliath.

Our engineers always have one thing in mind when developing this crane: maximising performance while minimising operational costs. They have achieved this, for example, with the twin girder trapezoid cross-section, considered the best girder cross-section of all applications in the field of big block building or offshore equipment. This bench-mark two girder design provides most of the advantages to the Kocks Goliath. The trolley wheel loads are transferred directly into the main webs of the girders – without insertion of rail supports. The result: The chords of the main girders are not loaded in addition by the bending moment of the rail supports. In alternative types of cross-sections, wheel loads of the lower trolley are transferred indirectly via the longitudinal girders of the runway and the transverse frame. The bending loads on the runway of the girders caused from the wheel loads also inevitably wears the main girders, this clearly reduces the service life.

One further advantage of the Goliath is the complete utilisation of the hoisting height. The eye hooks of all hoisting mechanisms can be drawn up over the girder edge. Thus the hoisting height of all Goliath hoisting mechanisms can be used optimally taking into account a specified clearance.



↑ Lower trolley with hooks between the girders, upper trolley with hooks on the right and left side outside the girders



↑ Turning manoeuvre with interaction of upper trolley and lower trolley

All components subject to maintenance are arranged on the girders and are easily accessible for example: the upper trolley and lower trolley, both travelling on rails on the upper chords of the girders, as well as the power supply via cable chains. The exact crane dimensions and crane capacities always depend on the corresponding task, but the basic principle is always the same, it applies to all Goliath cranes: These cranes consist of one fixed leg, one hinged leg and the bridge girder in twin trapezoid cross-section plus one upper trolley and one lower trolley both travelling on the bridge girder. If required, the crane can also be equipped with two lower trolleys and/or two upper trolleys.

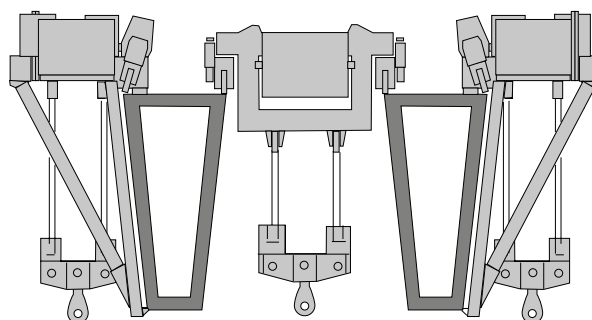
In terms of figures, the sum of the load-bearing capacities of upper trolley and lower trolley can be higher than the permissible total capacity of the crane. This provides a higher flexibility, for example: transport tasks, the upper trolley, the lower trolley or both can be used optionally. Segments, however, are only turned with upper trolley and lower trolley interaction. The sum of the load-bearing capacities of both hoisting mechanisms of the upper

trolleys determines the maximum possible load of the turning procedures.

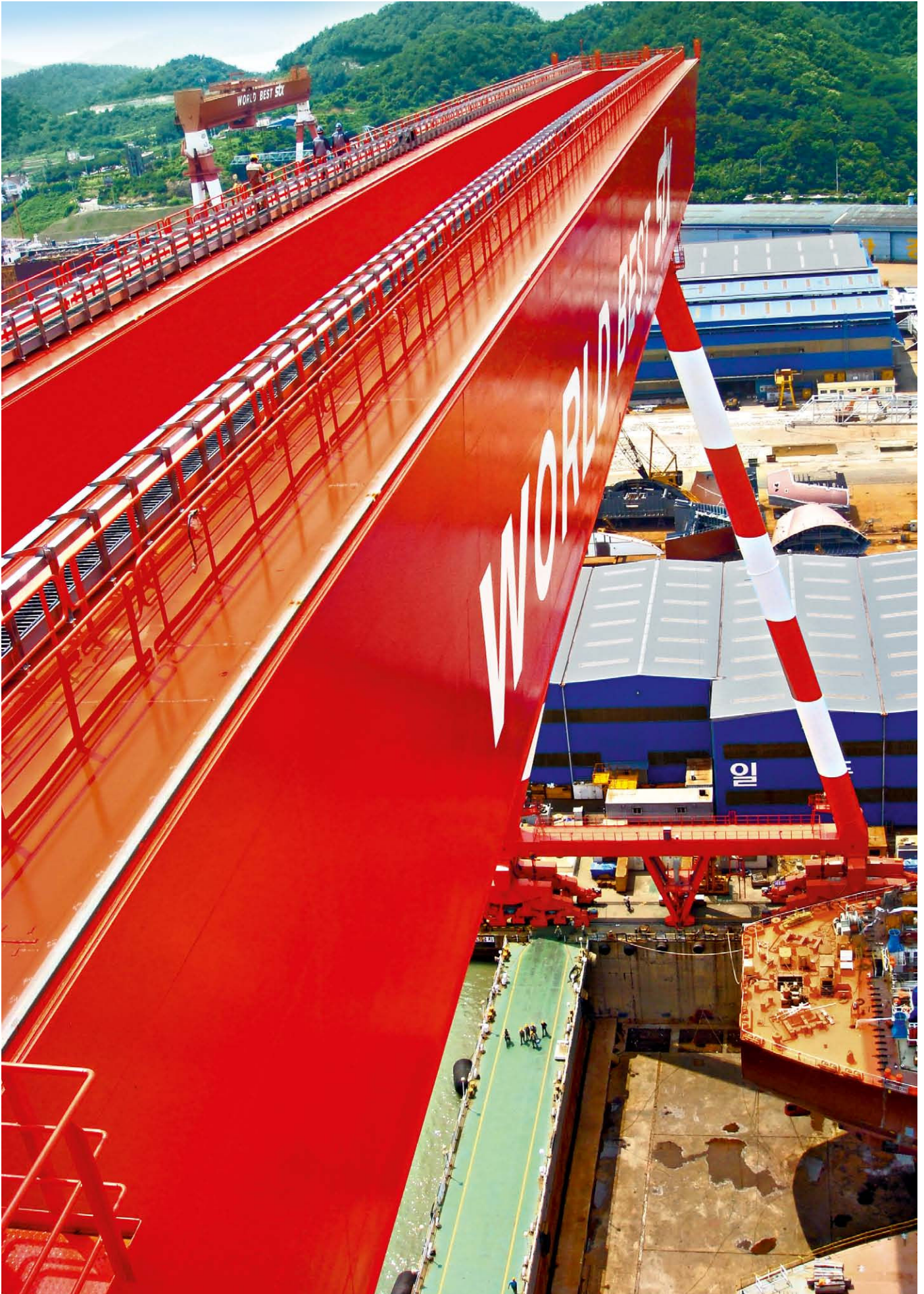
The Goliath crane can, of course, also be erected indoors. Important: In order to reach the optimum hoisting height taking into account the specified height of the hall, the constructional height of girder and trolleys must be reduced to a minimum. The classic upper trolley is not possible, a different solution must be found: The upper trolley is replaced by two side trolleys at the same height as the lower trolley, girders and trolleys

are thus height-optimised. One further decisive advantage of the twin trapezoid cross-section compared with other constructions: The trapezoid girder permits standard diagonal pulls of the hoisting mechanisms of 3°, higher diagonal pulls are also possible in accordance with the customer's requirements.

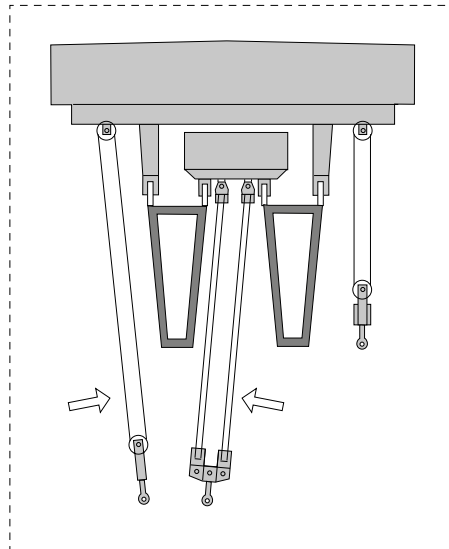
The trapezoid form avoids chafing and damage to the ropes at the edges of the girders thus extending the service life of the crane. Typically the bridge girder of a Goliath is constructed with a



↑ Side Trolleys Goliath Indoor Version

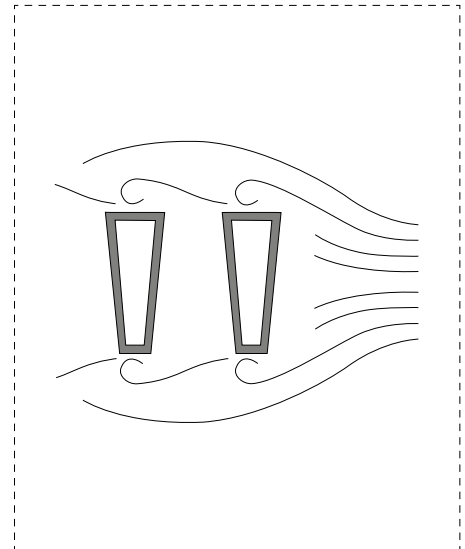


↑ Minimal bow avoiding negativ bending



Standard:

Our double girders are designed to permit a diagonal pull of up to 3°. Upon request higher diagonal pull angles are possible



Advantage:

Lower wind reaction forces due to twin girder design. Results of aero dynamic studies: Wind vibration disturbance is minimised and no operational time is lost for Goliath cranes with a span of more than 200m with twin trapezoidal girders

minimal bow. This 'in-built' bow is structurally calculated and means that, even under full load conditions taking into account the dead weight and the trolley weight, the girder will not bend any further. The deformation of the bridge girder is almost zero even in the heaviest load case. There will always be a minimum bow remaining.

In spite of its immense size, the control system of the Goliath crane is extremely precise. There are four different modes of operation for different applications. The upper trolleys are provided as standard with two shifting trolleys. These trolleys permit moving of the winches mounted on either in synchronisation, symmetrically or independent of one another. The hook distance can thus be coordinated exactly with the block. For 'spotting', it is possible to shift a block or a ship segment via shifting mechanisms (e.g. adaption to a certain structure) without moving the crane. Alternatively, the shifting trolleys can be moved into one direction, permitting slight turning of the handled section enabling precise positioning. A further adaption is achieved together with a three-point suspension at the upper trolley and

lower trolley. By adapting the hoisting mechanisms precise hoisting is possible or trolley travelling under 'creep speed' conditions with very slow movement is also possible.

→ **INFO**

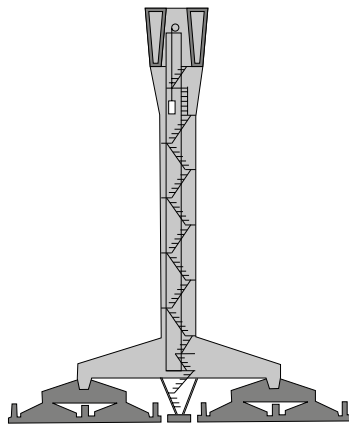
Typically Goliath

- Precisly: four modes of operation for different applications, the hook distance can be coordinated exactly with the block
- Low-maintenance: easily accessible via large hatches in the trolley roofs, stationary maintenance crane, high quality components
- Safe: dynamic deformations under extreme conditions are calculated and minimised
- Clear static conditions: twin girder execution, trolley wheel loads transferred directly into the main webs of the girders

THERE ARE MANY REASONS FOR CHOOSING THE **GOLIATH**. THE MOST COMPELLING ARE:

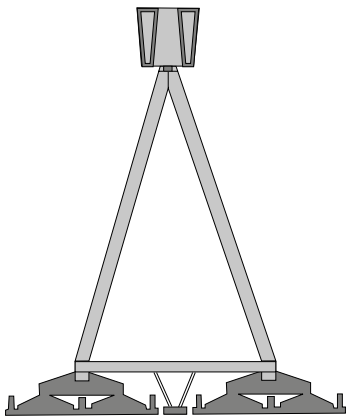
01 THE BRIDGE GIRDER

The bridge girder is constructed in our bench-mark twin girder design, this classic design provides most of the advantages of a Goliath crane, it provides full utilization and full utilisation of the hoisting height, as the eye hooks of all hoisting mechanisms can be drawn up over the lower girder edges. The bridge girder is always built with a minimal bow, thus avoiding bending under full load conditions including the dead weight and the trolley weight. Its deformation is +/- zero even in the worst load case.



02 THE FIXED LEG

The fixed leg is characterised by a single-box section housing comfortably a weather-proof staircase, an elevator and the electrical compartments in the upper section. Extremely high cranes or for sites with special erection requirements, it is also possible to fabricate the fixed leg as an A-frame design.



03 THE HINGED LEG

The hinged leg consists of one A-shaped frame with tubular posts. The advantage: low wind resistance and low maintenance costs due to the smooth surface. The girder is arranged on the head of this tube structure via a Neopot bearing. Neopot bearings are standard components within the bridge building industry. As these bearings consist of a two-part bearing case fixed at the lower side of the girder and on the head of the support, extremely high forces can be transferred to it. A plastic neoprene layer is arranged between both bearing halves providing a floating support and assuring the required angle rotations around all axles. Neopot bearings are completely maintenance-free.

04 ACCESS TO THE CRANE

The integrated concept of the Goliath allows the complete structure to be reached easily and safely. Therefore ladders, stairs and platforms complement one another to form an intelligent system of access. Elevator and stairs are arranged in the fixed leg and ladders in



↑ Fixed Leg with Stairs and Elevator



↑ Hinged Leg

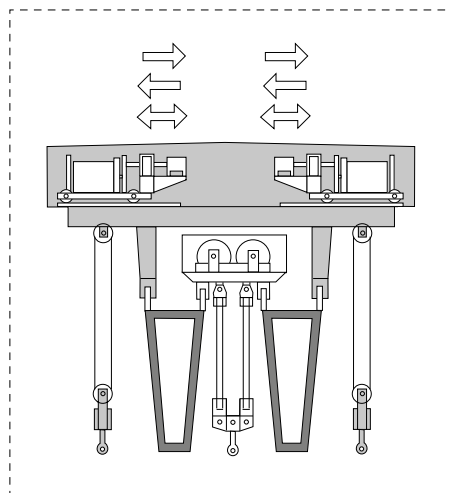
the hinged leg. All accesses, also in the driver's cabin, are equipped with safety platforms, backrests and handrails. This includes also the primary access to the trolleys as an important measure in order to reach all parts on the bridge girder easily and safely, e.g. the power supply system or the cable chains.

05 THE UPPER TROLLEY

The upper trolley with shifting trolleys is the performance-dominating crane component of the Goliath it is sophisticated technical engineering. The hoisting mechanisms with eye hooks or double hooks are arranged on it. These are placed on movable frames and can be moved horizontally by the shifting mechanism either mirror-inverted or in the same direction. Advantage: Hook adjustment at the upper trolley or slewing movements of the load around the vertical axis can be carried out very easily for precise adjustment of ship sections. Each shifting mechanism is actuated electrically by a spindle drive. The movements are indicated in the operator's cabin and self-monitored.

Clever technical solution: The rope drums of the hoisting mechanisms wind in two layers. This means both layers are wound up/off simultaneously with offset. Rope crossings that reduce the service life of ropes are thus excluded. A rope press-on device and electrical sensors supervise correct winding of the ropes even in case of diagonal pulling. Advantage: The rope drums can be smaller. This saves space and permits small hook distances and approaches.

The trolley mechanism has two (or more) wheels per corner, they are always driven in pairs. The required friction is guaranteed for the wheels of the trolley drive even at low load conditions. This remains the same with an unintentional high diagonal pull. The trolleys are equipped with a weather-proof housing protecting the machinery and the electronic components against climatic conditions thus increasing their



service life. Hatches for maintenance purposes are arranged in the roof of the trolley house from which all components can be reached easily.

06 THE LOWER TROLLEY

The hoisting mechanisms of the lower trolley are also equipped with eye hooks or double hooks. Winding of the ropes is affected in two layers in the same way as the upper trolley, thus increasing the service life of the ropes significantly. The trolley travel mechanism is equipped with guide rollers and with at least one or more wheels per corner. Hatches are provided in the roof for maintenance purposes, all components are comfortably accessible by the maintenance crane. Both trolleys run on the upper chord of the girder and, as such, are accessible for maintenance. All gear parts of the trolley can be reached easily in any position of the trolleys via the upper chords of the girder that are designed as platforms. The cable chains of the power supply system are also arranged at the upper chord of the girder and are easily accessible. This allows convenient access for all inspection and maintenance work.



↑ Upper Trolley and Lower Trolley



↑ Hoisting Mechanism of Lower Trolley



↑ Trolley Travel Mechanism of Upper Trolley

07 THE DRIVER'S CAB

The panoramic cabin provides comfort and a full range of visibility. It is suspended directly at the upper trolley or at the fixed leg. The controls and indication panels – e.g. information display of the trolley positions and hoisting mechanisms or on the working conditions – are designed carefully and ergonomically. In this cabin, the crane driver has everything under control.

08 THE CRANE TRAVEL MECHANISMS

We also set standards when it comes to the crane travel mechanisms. The wheels are arranged in a bogie equalising system and are driven either as single wheels or in pairs. Either as support for the wheels or in the gearboxes: anti-friction bearings from marketleading suppliers are a must. In high-risk areas, we have developed floodable travel

mechanisms. Hydraulic rail clamps are used as security against drifting due to high wind conditions, holding the crane even when out for operation. The clamps are closed automatically as soon as the wind warning device is actuated, the crane is switched off or the power supply fails. If the crane is moved during any of these events, the brake is applied before the clamps are actuated.

09 THE ELECTRICAL COMPARTMENTS

These compartments are arranged in the upper part of the fixed leg. For maintenance purposes, all components can be reached easily and comfortably from above via hatches. In order to assure optimal conditions, the electrical compartments are fully air-conditioned.

10 THE ELECTRICAL EQUIPMENT

The freely programmable electrical control, is state-of-the-art technical engineering. It is based on approved industry components communicating via bus systems with the digital three-phase frequency converters. Speed regulated drives, controlled via frequency converters, offer many design options. The (two or three) hoisting mechanisms can be switched in groups and driven in synchronisation. The same applies to common trolley travelling. The devices communicate via Industrial Ethernet, profibus or CANbus, to a large extent via LWL connections.

11 THE MAINTENANCE CRANE

Maintenance at regular intervals is essential to reach the maximum service life of a crane. Each Goliath crane is provided with a maintenance crane on the fixed leg in order to be able to carry out maintenance as easily and fast as



↑ Driver's Cab at Upper Trolley



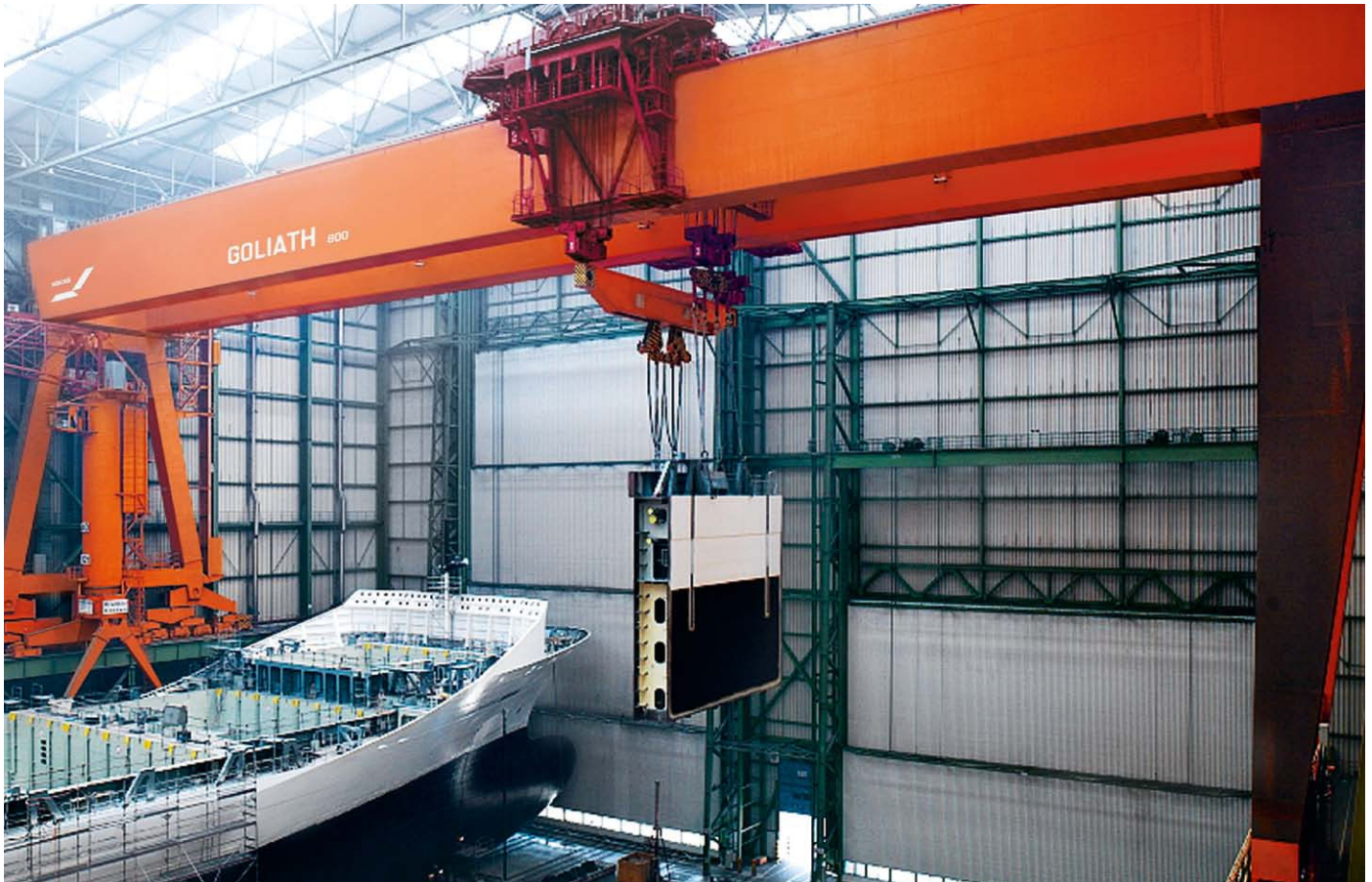
↑ Crane Travel Mechanism available in One Rail or Two Rail Design



↑ Maintenance Crane

possible; with sufficient capacity and outreach to pick up large machinery parts from the trolley, lower them to the ground and to reinstall them. The trolley roofs are constructed with ample access hatches in order to make the components comfortably accessible during the maintenance work.

THE THEORY: MAXIMUM CAPACITY WITH HIGHEST POSITIONING ACCURACY. THE PRACTICE: THE GOLIATH.



↑
Indoor Goliath Manoeuvring a Ship Section

The Goliath is used where large ship sections are to be turned and transported.

In this context, the Goliath proves to be an extremely reliable and at the same time very precise crane: Thanks to bridge lengths of up to 250 meters, the Goliath is capable of spanning large areas, for example wide pre-erection sites, block storage yards and construction docks. This offers efficient transport from the pre-erection site to the construction dock at any time. The sophisticated two-trolley system permits high precision turning with accurate positioning for erection of complete ship sections or blocks with a

weight of up to 2,000 tonnes in different modes of operation. There is usually only one Goliath in the construction dock. If the crane fails, the entire production stalls. Therefore the distinct feature of this crane giant is its absolute reliability.

Kocks have always met the extremely high demands of its customers, for example as long ago as 1978 two Goliath cranes were built with a capacity of 900 tonnes and a gauge of 205 meters. But ships and offshore platforms are becoming increasingly larger, therefore shipyard cranes are in demand today that can set new standards, with particular

emphasis being placed on capacity and hoisting height with absolute positioning accuracy. The Goliath is the answer.

The Goliath is characterised as follows:

- twin girder system
- two-trolley system with upper and lower trolley
- upper trolley with shifting trolleys
- high availability
- low operational costs
- low maintenance investment and low maintenance running costs
- long service life

WHY KOCKS?

BUILDING CRANES SINCE 1872.

→ KNOW-HOW

Kocks is considered a pioneer in the development of container cranes in Europe. We have been building high-performance ship unloaders since 1913 and we are the world leader in Goliath cranes. We set standards for the high performance of cranes.

Our engineers consistently apply the proven rules of German engineering to the ongoing further development and design work on the cranes. Designing and classification for continuous operation is carried out particularly conscientiously.

The goal is always the same: increased efficiency, safety and environmental friendliness of the cranes.

→ QUALITY

To us, quality means: a sophisticated product concept, profound know-how in the fields of design and control as well as the greatest accuracy with regard to fabrication and execution. It goes without saying that our engineers meticulously test and check all mechanical and electrical components.

All this provides decisive advantages:

- maximum efficiency and reliability of the cranes
- low operating costs
- long service life (even under the toughest operating conditions)

→ SERVICE

For us, perfect service and maintenance are part of a good product. We therefore give our customers' personnel intensive training in crane theory and practice. We want to make sure that continuous availability of the cranes is always guaranteed.

If there should be a failure in spite of all this, we are there to help quickly, flexibly and un-bureaucratically. Day and night.

→ PARTNER APPROACH

The Goliath is an extremely durable product. Choosing it signals the beginning of a comprehensive customer/supplier relationship – which is often manifested in repeat and follow orders. We therefore attach great importance to ensuring this relationship is fair and with long-term benefits for both parties.

Just so you know – for us this starts long before the contract is signed. We will be happy to advise you at any time, just give us a call.



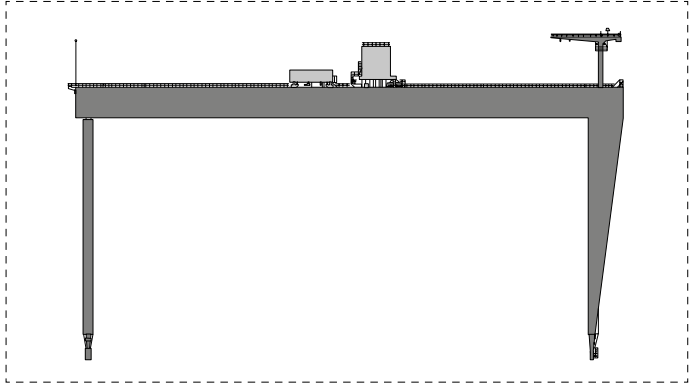
↑
Home of Kocks Crane in Bremen

THE GOLIATH – THE ESSENTIAL TECHNICAL DATA.

INDOOR AND OUTDOOR USE



↑ Indoor Goliath



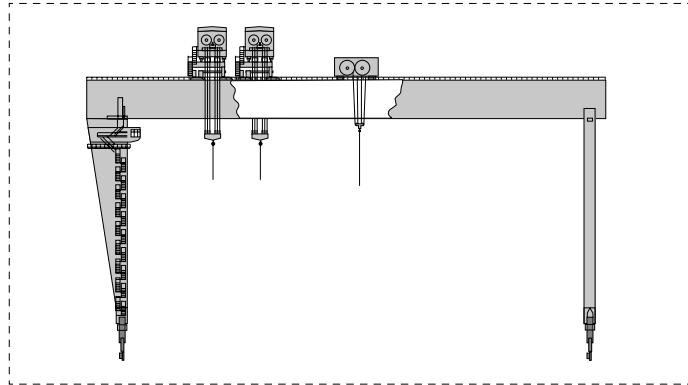
↑ Goliath standard with one upper trolley and one lower trolley

→ The technical data of shipyard Goliath cranes vary essentially according to the erection site and the application. The statements on the following pages therefore represent by way of example the key data of projects already realised with different construction sizes and requirements.

Goliath	300	600	900	1200	1500	2000
Upper Trolley	2 x 150t	2 x 300t	2 x 450t	2 x 600t	2 x 750t	2 x 1000t
Lower Trolley	1 x 150t – 300t	1 x 300t – 600t	1 x 450t – 900t	1 x 600t – 1000t	1 x 750t – 1200t	1 x 1000t – 1300t
Gauges	up to 250m					
Hoisting Heights	uo to 130m					
Lowering Depths	up to 30m					
Hoisting Speeds	nominal load 3-9 m/min* without load 6-18 m/min* *with gear shifting					
Trolley Travelling	20-40 m/min partially with field weakening					
Crane Travelling	30-50 m/min partially with field weakening					

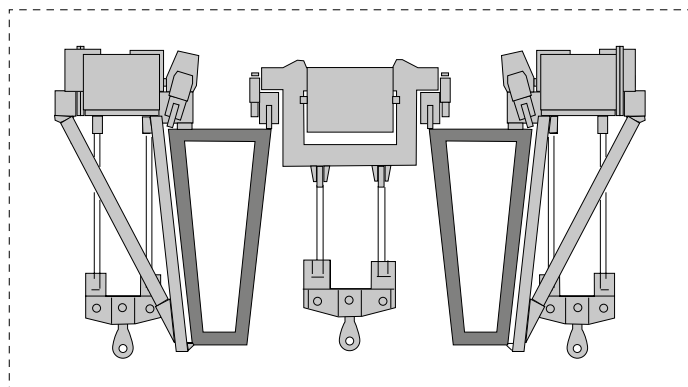
→ As erection sites and conditions of use may vary extensively we design and construct to the particular requirements of our customers.

SPECIAL SOLUTIONS



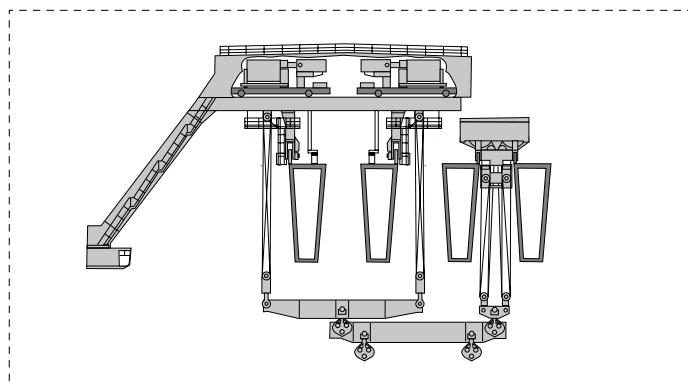
↑ Goliath with two upper trolleys

- GOLIATH WITH 2 UPPER TROLLEYS
5 hoisting mechanisms / 4 hook operation with load compensation



↑ Goliath with side trolleys

- INDOOR CRANES
with side trolleys / flat constructional height



↑ Tandem Operation

- TANDEM OPERATION
Coupling of two Goliath for common hoisting work.
The tandem operation permits hoisting of loads of approx. 80% of the summarised load of both cranes.

KRANUNION. WORLD MARKET LEADERS UNITED.

Kranunion is an association of three manufacturers who have specialised in lifting and transporting heavy loads:

- KIROW is the world market leader for railway cranes and slag pot carriers.
- ARDELT is the world market leader for double jib level luffing cranes.
- KOCKS is the world market leader for Goliath cranes and a pioneer in the development of container cranes.

Central to all Kranunion products are the technical design concepts created by our experts. Of course, we continue to optimise these fundamental concepts even further in the interests of our customers. Kranunion products are therefore based on practical requirements and are a symbiosis of tradition and innovation combining the tried and tested with the new.

Customers who choose Kranunion choose great German engineering skill: for environmentally-friendly and safe, modern technology, for low operating costs, for high performance and reliability.