



# **BRIDGE** CONSTRUCTION & MAINTENANCE

**ENERPAC** 

# Bridge Construction & Maintenance



POWERFUL SOLUTIONS. GLOBAL FORCE.

## Equipment for Bridge Construction and Maintenance

Enerpac offers highly specialized tools and equipment to enhance operator safety during bridge construction, maintenance and repair. Enerpac tools and systems deliver solutions for reducing operational downtime and improving overall productivity. Enerpac products comply with international safety standards and make construction tasks safer, easier to perform and improve overall productivity.

We have been involved in numerous projects, delivering innovative solutions, on-site technical assistance and products for the most complex bridge construction applications.

With more than 50 years of experience, Enerpac has gained unique expertise in delivering hydraulic solutions for the controlled movement and positioning of heavy loads.

This expertise has been acknowledged by the world's leading industrial professionals and has contributed to the successful movement of a number of the most recognizable structures on earth.

# Bridge Construction & Maintenance

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# Bridge Construction & Maintenance - Products

## Hydraulic Pumps for Synchronised Lifting



### Split-Flow Pumps

#### SFP-Series

Split-Flow pumps distribute an equal amount of hydraulic oil to a maximum of 6 outlets. Smart valve technology allows both controlled lifting and lowering of heavy loads.



### Synchronized Lifting Pumps

#### EVO-B Series

PLC-controlled lifting systems using stroke sensors signals for synchronized lifting and lowering of multiple lifting points.

Depending on the model, the PLC operated pump unit can control 4 up to 8 lifting points.



#### EVO-Series

PLC-controlled lifting systems up to 12 lifting points. Modular network capability between units to synchronize up to 48 points. Smart pump technology in combination with stroke and load monitoring per lifting point, provides high accuracy for lifting and lowering applications.

Optional: Weighing and center of gravity determination.

## High Tonnage and Ultra-Flat Cylinders for every Lifting Challenge



### Ultra-Flat Cylinders

#### CUSP-Series Ultra-Flat Cylinders

- 10 - 1000 ton lifting capacity
- 7 - 17 mm lifting stroke
- Single-acting, gravity return
- Extremely low collapsed height
- Integrated tilting function up to 4 degrees.
- Side load capability of 4% at full stroke



### Lock-Nut Cylinders

#### LPL-Series - low height, lock-nut

- 60 - 500 ton lifting capacity
- 45 - 50 mm lifting stroke
- Integrated tilt saddle
- Single-Acting, Gravity return
- Lock nut for mechanical load holding
- 5-10% side-load of maximum capacity.

#### HCL-Series - lock-nut

- 50 - 1000 ton lifting capacity
- 50 - 300 mm lifting stroke
- Single-Acting, Gravity return
- Lock nut for mechanical load holding
- 10% side-load up to 90% of max. stroke.



### Single/Double-Acting Cylinders

#### HCG, HCR -Series Cylinders

- 50 - 1000 ton lifting capacity
- 50 - 300 mm lifting stroke

#### HCG-Series - single-acting

- Gravity return
- Stop ring to prevent plunger blow-out
- Up to 10% side-load of max. capacity.

#### HCR-Series - double-acting

- Hydraulic advance and retract for controlled movement
- Up to 10% side-load of max. capacity.



## Heavy Lifting Technology



### Strand Jacks

#### HSL-Series,

#### Heavy Lifting Strand Jacks

Compact high capacity system for controlled lifting and lowering. Strand jack systems that provide fully controlled precise lifting.

- 15 - 1250 ton lifting capacity
- 250 - 600 mm lifting stroke
- 350 bar operating pressure



### Jack-Up Systems

#### JS-Series,

#### Jack-Up Systems

The Jack-Up system is a custom developed multipoint incremental lifting system - synchronously lift and mechanically hold. A typical system setup includes four Jack-Up units positioned under each corner of the load.

- 125 - 750 ton lifting capacity per tower
- up to 6 - 20 meters lifting height



### Gantries

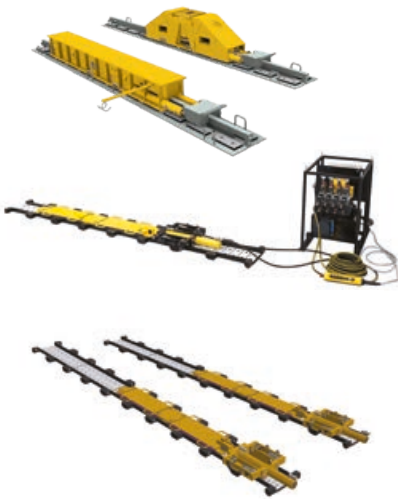
#### SL, SBL, MBL-Series,

#### Telescopic Hydraulic Gantries

Heavy lifting systems that offer control and stability, even in confined spaces. For your most demanding lifting and rigging operations.

- 61 - 1069 ton lifting capacity with 4 towers
- 3,49 - 14,55 meters lifting height

## Heavy Lifting Technology



### Skidding Systems

#### HSK- and LHS-Series

- 90 - 250 ton capacity
- 600 mm Push/Pull stroke
- 175 mm lifting stroke



### SyncHoist Systems

Enerpac SyncHoist systems are hydraulically actuated auxiliary attachments for high precision load positioning for cranes.

The automatic version (SHS) with PLC-controlled hydraulic pump monitors and guides the powerful double-acting push-pull cylinders. The autonomous system (SHAS) with integrated PLC-controlled hydraulics, monitors and guides the powerful double-acting push-pull cylinders.

Complete system meets the European lifting directive and safety requirements.



### SPMT-Series

#### Self-Propelled Modular Transporter

- A low-profile, slim design, ideal for in-plant operation
- Highest rating Tier-4 diesel hydraulic power unit for reduced emissions
- Intelli-Drive wireless control system, intuitive and easy to use
- Two trailers and a power pack can be shipped inside one 20-ft. container.
- 60 ton (600kN) capacity
- 3 - 1,5 km/h transport speed
- 55 kW motor size

# Bridge Construction & Maintenance

## Lowering a Bridge Span for the Demolition of the Kosciuszko Bridge

**Customer:** Bigge Crane and Rigging and Kiewit/Skanska Joint Venture

**Location:** New York, USA

**Challenge:** The Kosciuszko Bridge is actually two bridges that span Newtown Creek between the New York City boroughs of Brooklyn and Queens. Opened in 1939, the 1800 meter truss bridge is known locally as the Brooklyn-Queens Expressway. The bridge also is known as a notorious - and perhaps the worst - bridge for bottlenecks in New York City.

To increase traffic capacity, the aging truss bridge had to be replaced. The new, majestic cable-stayed bridge began accommodating two-way traffic in early 2017, and demolition of the old spans began in the summer of 2017.

**Solution:** Bigge Crane and Rigging was selected to supply the equipment to remove the largest span, which is 38 meter high, and over 90 meter in length. To safely meet the tight demolition schedule, the customer used 8 Enerpac 500 ton strand jacks to lower the span. The strand jacks feature a sophisticated, proven software program that enhances safety by synchronizing the motion of the strand jacks and adjusting the motion to the loads per lifting point.

**Products:** HSL-Series, Strand Jacks





## Lifting 5 major bridges at the NATO Military Training Center



**Customer:** SBN Schachtbau Nordhausen

**Location:** Sachsen Anhalt, Germany

**Challenge:** At the new NATO Military Training Center in Sachsen Anhalt (North Germany) 5 bridges needed to be constructed. These bridges are designed especially for training in the military environment. The bridge decks had to be lifted and lowered, plus they had to be able to slide the bridge deck back and forth; simulating a destroyed bridge during battle. As part of their training troops will build a temporary bridge as part of their training.

**Solution:** Enerpac provided the perfect suitable solution to permanently install the five bridges by using 10 Lock Nut Cylinders of 50 ton, that were operated by a single computer controlled EVO-Series Synchronous Lifting System.

The hydraulic solution Enerpac offered enabled both horizontal and vertical movement to simulate a destroyed bridge.

**Products:** EVO-Series, Synchronous Lifting System  
High Tonnage Lock Nut Cylinders



# Bridge Construction & Maintenance

## Pre-Loading Bridge Cables with a Battery Powered Hydraulic Pump

**Customer:** ALE Heavy Lift

**Location:** Erlangen, Germany

**Challenge:** ALE Heavy Lift was tasked with skidding an 800 ton railway bridge over a highway using skidding equipment and steel strands. The steel strands were used as diagonals within the skidding towers and as a connection in a longitudinal direction between the skidding supports. Before the bridge could be skidded onto the towers, more than 20 cable strands had to be pre-loaded to the same tension.

**Solution:** A hollow plunger hydraulic cylinder, and a battery powered XC-Series hydraulic pump was used to pre-load the cables. Due to the quantity and access restrictions of the cables, the battery powered pump provided an ideal solution; portable, fast and safe.

**Products:** XC-Series, Battery Pump  
Hollow Plunger Cylinder



## Bridge Lift for Bearing Replacement



**Customers:** RMS

**Location:** Sydney, Australia

**Challenge:** Lifting a bridge to replace the old bearings under all 8 pillars.

**Solution:** A Synchronous Lifting System with ZE-Series pump was used to operate 6 Low Height Lock Nut cylinders in a safe and controlled manner. The relatively small set-up allowed the operators to install and move the system easily and quickly. Each of the 8 lifts was executed in only 15 minutes, resulting in a short road closure and reduced traffic delay.

**Products:** Synchronous Lifting System  
with ZE-Series Pump  
Low Height Lock Nut Cylinders



# Bridge Construction & Maintenance

## Bridge Lift for Bearing Replacement

**Customer:** John Holland, Engineers of Aurecon, RTA

**Location:** Sydney, Australia

**Challenge:** Lifting and lowering a 200 ton bridge 560 mm to replace the worn bearings, with a special requirement for high lifting accuracy.

**Solution:** Installed 8 High Tonnage cylinders that were continuously controlled by an EVO-Series, Synchronous Lifting System. After lifting the bridge, the old bearings were taken out and replaced with new bearings. After the bearing placement, the bridge was lowered again on its new bearings. The accuracy during lifting was 1 mm across all cylinders.

Enerpac hand pumps were used together with hydraulic wedges to loosen the old bearings.

**Products:** EVO-Series, Synchronous Lifting System  
High Tonnage Cylinders  
P-Series, Steel Hand Pumps  
Hydraulic Wedges





## Removing the Spans and Truss Section of the old Bay Bridge in Record Time



**Customer:** Burkhalter Rigging, Inc.

**Location:** San Francisco, California, USA

**Challenge:** The San Francisco–Oakland Bay Bridge has one of the longest spans in the United States. Demolition of the old eastern part of the bridge included the removal of 19 truss sections, weighing 800 Tons, stretching over 1,2 kilometers. At its highest point, the bridge is 36m above water level, with a progressive downward slope to the shore to 12 meters above the water. This meant that each span was at a decreasing angle as the segments reached the shoreline. Moreover, lifting would need to take account of tidal changes and wind/weather conditions.

**Solution:** Burkhalter used the Enerpac hydraulic Jack-Up System to lift each 85 meter bridge truss section. Given the length of each truss section, the four jack-up towers were deployed on a twin barge assembly to form a single floating platform, with two jack-up towers on each barge. The barge was floated in position under the segment and the jack-up towers raised. The west and east facing towers were each connected by a beam on which the truss would rest when lifted. Because of the angle of the segment, the west side towers were approximately 1m higher than the east side towers.

**Products:** JS-Series, Jack-Up System





# Bridge Construction & Maintenance

## Replacing Rail Bridge Decks with a Telescopic Hydraulic Gantry

**Customer:** Osprey Heavy Lift Ltd

**Location:** United Kingdom

**Challenge:** Timing is critical for rail construction projects to avoid unscheduled disruption to train and passenger services. However, the best project planning can be undermined by adverse weather conditions. High wind speed may prevent bridge deck lifting by using a crane, leading to project delays.

**Solution:** An Enerpac hydraulic gantry which comprises of 4 or more telescopic legs and an overhead beam, allowing vertical lifting of heavy loads. If movement of the load is required the complete gantry system and load can be traversed along a track. A wireless control system provides the operator an unobstructed view on the lift job and information about stroke and load per lifting leg. Moreover, the gantry lift is less affected by wind speeds than crane lifts.

The Enerpac gantry allows the new deck to be completely constructed on site at ground level, avoiding the need to work at height.

**Products:** SBL-Series, Hydraulic Gantry



## Controlled Hydraulics helps to position a railway bridge



**Customers:** Victor Buyck Steel Construction

**Location:** Brussels, Belgium

**Challenge:** A new railway bridge in Brussels Schaerbeke was constructed on an adjacent site before being moved to its final position. The steel railway bridge with a length of 140 meters and a weight of over 1600 tons had to be slid across a number of existing tracks. Time was the challenge here; the railway bridge installation job had to be finished within 48 hours in order to limit rail traffic disruptions.

**Solution:** Enerpac supplied a custom made 'Synchronous Lifting System', which monitors and corrects the movement and forces during positioning. This system consisted of a total of 28 hydraulic cylinders all equipped with stroke sensors. These are connected to a PLC control panel, which displays real time data of the lifting job.

**Products:** EVO-Series, Synchronous Lifting System  
High Tonnage Lock Nut Cylinders



# Bridge Construction & Maintenance

## Pushing the 4000 ton Millau Viaduct Bridge Deck out into Position

**Customer:** Eiffage

**Location:** Tarn valley, France

**Challenge:** Building a 245 metres high and 2460 metres long bridge over the Tarn river to reduce traffic through Millau city center, and relieve traffic on Autoroute du Soleil A6/A7.

**Solution:** Enerpac's technically advanced hydraulic launching system was designed to push the 27,35 m wide deck from both sides onto the bridge's seven concrete piers. During the launching process, the deck was supported by seven temporary metal piers.

The enormous, yet at the same time, "light" deck is pushed by means of hydraulic launching devices on each pier, which first lifts and then pushes the deck. An adjustable nose structure at the end of the deck, allows the deck to land on each pier as it approaches it.

Each launching system consists of a lifting cylinder, with a capacity of 250 ton, lifting the deck off the supporting structure of the pier, and two or four skates, each equipped with two 60 tons cylinders, which retract to launch the deck a maximum of 600 mm. All of this rests on a system of single-acting lock nut cylinders supporting both the launching device and the deck.

**Products:** High Tonnage Cylinders  
PLC-Controlled Hydraulic System





## Replacing Bridge Bearings without Interrupting Traffic



**Customer:** Cagil Construction

**Location:** Istanbul, Turkey

**Challenge:** The Sadabad Viaduct is a connecting motorway to the Second Bosphorus Bridge. Approximately 400 bearings needed to be replaced on the Sadabad Viaduct while the road remained continuously open to traffic.

**Solution:** Our customer utilized an 8 point Synchronous Lifting System and 20 pancake locknut cylinders to jack the deck sections and replace the 400 bearings. The cylinder's locknut mechanically supported the load while the bearings were replaced. The hydraulic system was equipped with a central control unit to synchronously lift and lower each deck section with a 2mm stroke tolerance. Both mechanical load holding and precise control during operations, allowed the highway to safely remain open to traffic throughout maintenance activities.

**Products:** EVO-Series, Synchronous Lifting System  
Low Profile Lock Nut Cylinders



## Jack and Roll System Pulls the Fort Lyon Bridge into Position

**Customer:** Kiewit

**Location:** Colorado, U.S.A

**Challenge:** Minimizing the amount of time state highway 266 was shut off to traffic was a primary objective during the reconstruction of the Fort Lyon bridge structure. The customer built the replacement bridge adjacent to the existing bridge. The new bridge was initially used as a detour while the old bridge was demolished. The new bridge now needed to be moved into position of the original bridge.

**Solution:** Enerpac provided a hydraulic solution capable of pushing the new 13,5 meter bridge structure into position using a lateral slide method. Two double acting hydraulic cylinders, each with their own ZU-Series Hydraulic Pump and integrated pendant control, allowed the operator to maintain individual control and prevent misalignment and wedging of the bridge structure between the abutments. With this solution the customer completed the slide in 52 minutes, a full two hours ahead of schedule.

**Products:** RR-Series, Double-Acting Long Stroke Cylinders  
RRH-Series, Hollow Plunger Cylinders  
ZU4-Series, Portable Electric Pumps





## Lifting and Installing the Deck Sections of the Golden Horn Metro Bridge



**Customer:** Gülermak

**Location:** Istanbul, Turkey

**Challenge:** The Golden Horn Metro Bridge is a 936 m long cable-stayed bridge, across the Golden Horn waterway in Istanbul. Portions of the bridge deck will rotate in order to permit large shipping vessels through the waterway. During construction, the rotating bridge deck segments were fabricated off-site and floated in on a barge. The 300 ton deck sections needed to be lifted off the barge nearly 17 meters and installed into position.

**Solution:** To lift the segments, 4 hydraulic strand jacks, each with a 200 ton lifting capacity, were installed on two temporary gantries. Custom made brackets were attached to lift the segments and, operating in unison, the strand jacks lifted the deck sections.

**Products:** HSL-Series, Strand Jacks  
SLPP-Series, Hydraulic Power Packs



# Bridge Construction & Maintenance

## Jack-Up System Lifts 1500-ton Span on Fore River Bridge

**Customer:** Burkhalter

**Location:** Massachusetts, U.S.A

**Challenge:** For the construction of a steel vertical lift bridge, the off-site constructed 1500 ton lift span needed to be lifted 20 meters into place from barges under the bridge.

**Solution:** Enerpac provided a Jack-Up system, an incremental lifting system that typically includes four jack-up towers positioned under each corner of a load. The four-tower setup has a lifting capacity of 2,000 metric tons (500 metric tons per tower). The load is lifted in increments as steel boxes are inserted via an automated system, lifted, and stacked, forming the lifting towers.

**Products:** JS-Series, Jack-Up System



## Safely Erecting a Bridge Over Water with a Hydraulic Driven Launching Nose



**Customer:** Downer and Jonel Hydraulics

**Location:** Ongarue River, New Zealand

**Challenge:** Construction of a new bridge as part of the KiwiRail project, to improve the country's main trunk rail network and allow more freight to be carried over the strengthened refurbished structure.

**Solution:** Custom-engineered steel bridge launching nose recovery system, constructed with Enerpac bolting equipment and driven by Enerpac hydraulic cylinders and pumps.

**Products:** Hollow Plunger Cylinders  
General Purpose Cylinders  
Hydraulic Electric Pumps  
ZU4T-Series, Electric Torque Wrench Pumps  
S-Series, Hydraulic Torque Wrenches



## Lifting the Songdo Cable-Stayed Bridge Pylons

**Customer:** DH

**Location:** Incheon, South Korea

**Challenge:** Lifting and positioning two 2000 ton cable-stayed bridge pylons into place. To prevent counterbalance issues, it was critical to erect both pylon sections simultaneously and within a very tight tolerance. Any counterbalance issues would have created a lopsided load and put undue stress on the center pillar.

The lack of a good footprint and the approximately 100 m lifting height made the lift almost impossible for two cranes. The need to lift from the central point of the structure required a high capacity lifting solution that could raise both sections simultaneously from a central point.

**Solution:** Four HSL8500 strand jacks were installed on top of a temporary bent tower and simultaneously lifted both pylons up to their permanent position at 75 degrees. The operator monitored and controlled the lift using a computer controlled strand jack system supplied by Enerpac. The whole process was completed in 2 days.

**Products:** HSL-Series, Heavy Lifting Strand Jacks  
SLPP-Series, Hydraulic Power Packs





## Bridge Construction by Crane with SyncHoist Segment Hoisting and Positioning



**Customer:** Ghidoni

**Location:** Bellinzona, Switzerland

**Challenge:** The steel bridge segment needed to be lifted over the river with a crane. Accurate leveling and positioning was required to bolt the segments together.

**Solution:** Using an Enerpac SyncHoist system, loads can be positioned with high accuracy using one crane. The PLC-controlled hydraulic system is mounted below-the-hook. With the 4-point SyncHoist System the steel segments were picked-up, moved and positioned.

**Products:** SHS-Series, SyncHoist System





## Placing Bridge Girders with a SyncHoist System

**Customer:** Universal Cranes, Smithbridge

**Location:** New South Wales, Australia

**Challenge:** The Pacific Highway expansion project included hundreds of kilometers of new highway between Sydney and Brisbane. Part of this project was the construction of a new bridge over the Nambucca River.

The Nambucca River Bridge is 850 meters long and includes 21 bridge spans comprised of four precast concrete girders. Weighing up to 158 tons and 41 meters in length, each of the girders needed to be placed on bearings with precise control.

**Solution:** To save time and simplify the placement of the girders, the customer utilized a Synchronous Hoist System. Positioned below the lattice spreader, the SyncHoist System enabled adjustment of the beams during placement on the bearings.

The system also helped save up to half a day in downtime. The team only needed to adjust the slings, rather than changing the rigging gear.

**Products:** SHS-Series, SyncHoist System



## Box Girder Launching System on the John Greenleaf Whittier Bridge



**Customer:** Walsh Construction

**Location:** Massachusetts, USA

**Challenge:** Constructed in 1951, the John Greenleaf Whittier Bridge needed to be replaced by a new bridge compliant with current safety standards. Walsh Construction employed a rail mounted crane system to simplify the placement of the steel bridge girders and precast deck. Two 182,8 cm tall, 292,6 m long temporary support steel box girders were launched across temporary piers to create a rail system for the crane to operate on during the approach span construction.

**Solution:** Enerpac worked with the customer to design a box girder launching system that would first clamp, then advance or retract the two separate box girders synchronously. The box girder launching system was mounted at various temporary pier locations as the gantry crane moves to each stage of approach span construction.

**Products:** Double-Acting Long Stroke Cylinders  
Electric Split Flow pumps



# Bridge Construction & Maintenance

## Arch span raise the profile of 'The Crossing' bridge with precision lifting and positioning

**Customer:** Bouwcombinatie Stadsbrug Nijmegen  
Koninklijke BAM Groep and Max Bögl.

**Location:** Nijmegen, The Netherlands

**Challenge:** Raising the bridge structure arch span required precision lifting and positioning.

**Solution:** Enerpac provided a Strand Jack solution to lift and position the main span onto the structure of the bridge.

**Products:** HSL-Series, Strand Jacks



## Installing Pylon Sections of a Cable-Stayed Bridge with a SyncHoist



**Customer:** FIRMA "Gotowski" Budownictwo Komunikacyjne I Przemysłowe Sp. z o.o.

**Location:** Bydgoszcz, Poland

**Challenge:** The 200 meter long cablestayed "University Bridge" connects two parts of Bydgoszcz separated by the Brda River. The bridge's design requires the erection of two 68 meter tall pylons (towers) to support the bridge deck. Constructed in sections, the pylons weighed 90 to 130 tons and needed to be positioned with precise accuracy.

**Solution:** An Enerpac SyncHoist system was attached below the hook of a 350 ton crane. Comprising four specialized double acting push pull cylinders, the SyncHoist enabled a single operator to precisely mount each pylon section. Enhancing the capability of a single crane with a computer controlled hydraulic positioning system provided a safer and more precise solution than utilizing multiple cranes to install the pylon sections.

**Products:** SHS-Series, SyncHoist System









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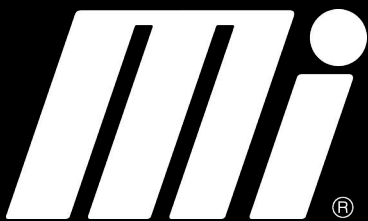
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