

Enerpac and W.O. Grubb apply lifting engineering skills to a star-studded stage. **ACT** reports

The “Claw”



W.O. Grubb used four mobile cranes to assist in the erection of the U2 360° World Tour stage.

The band U2 has been rocking fans around the nation with its 360° world tour. In October four cranes from the fleet of W. O. Grubb were used to erect the elaborate stage at Scott Stadium on the University of Virginia campus in Charlottesville, VA. The stage, designed in Belgium, features a 360° platform surrounded by a four-legged steel structure known as “the Claw.” It stands 165 feet tall and more than 300 feet wide. The stage – claimed to be the largest musical stage structure in the world – requires more than 120 truckloads to transport, and eclipses the previous record held by a Rolling Stones concert stage used a few years ago.

To erect the stage W. O. Grubb used two Liebherr LTM-1060/2s, a Grove TMS-900E and a Grove TMS-800E. The cranes lifted the steel structure into place and also constructed the surrounding light towers, sound booth, speakers and hardware.

Grubb spokesperson David S. Wheeler says the cranes chosen were selected because



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they could travel through the narrow tunnel leading into the stadium. After the concert crew and cranes were dispatched back to the stadium to disassemble “the Claw” and pack it up for transport in preparation for the next venue.

The U2 360° tour has provided a lot of



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work for crane and rigging companies around the world. Belgian company Stageco constructed three identical stages for the

tour. What makes the design distinct is the high-pressure hydraulics used to assemble and dismantle the 230-ton stage system. Stageco developed the system based on Enerpac's Synchronous Lift System which allows the modular construction to rise to its 165-foot height quickly and safely.

But besides being functional, stages for these types of concerts must be spectacular, featuring glitz and special effects that audiences love. Stageco has worked with U2 before, designing the stage for the band's PopMart Tour in 1997. Over the years, the company has built stages for the Rolling Stones, Bon Jovi, Tina Turner, Elton John and Johnny Hallyday. Stageco provides technical design and manufacturing services, including logistics.

Leap frogging

Since there is a short time between U2 performances, and seven to eight days are needed to assemble and dismantle the stage construction, three whole stages were constructed and are used following the "leap frogging" principle: one is used for the show, while the second is already being built at the next location and the third is being dismantled at the previous location.

One of the construction requirements was that the stage could be built and taken down again easily. The challenge for Stageco was how to assemble and dismantle the massive stage at each venue. A solution also had to be found for the installation of the light and sound technics, and the special 60-ton video screen that has to be raised and lowered for



Belgium-based Stageco designed the current two-year world tour for the rock band U2. The company has designed stages for the Rolling Stones and other bands. This is the first stage designed using Enerpac's Synchronous Lift System



For this world tour, set designer Willy Williams and stage architect Mark Fisher came up with "the claw," a 165-foot-high stage construction on four legs, giving spectators all around the stage an unobstructed view of the band

each concert. Chain hoists and winches are normally used for stages, with the support of light mobile cranes where required.

However, the load in this project was so great that a different solution was required.

One of the alternatives considered was the use of extremely heavy mobile cranes with a lifting capacity of at least 400 to 500 tons. However, there was doubt as to whether such cranes would fit inside the stadiums where the concerts were to be held and whether they could be stabilized sufficiently. Plus, using such heavy lift cranes would be expensive and time consuming.

Another alternative considered was the use of hydraulic strand jacks. But Stageco eventually joined up with Enerpac to design a custom solution that was "plug-and-play." Enerpac's Synchronous Lift System using high-pressure hydraulics was the answer.

Gradual lifting

The steel stage construction consists of a central "block" which rests on four legs, each made up of six sections. The central block is gradually lifted off the ground in 38 steps and a section is added to each of the four legs after every six or seven steps. A temporary truss (lifting portal) containing a supporting frame at the top has been fabricated for each leg.

Each hydraulic unit, consisting of a pumps

unit, four lifting cylinders and four locking cylinders, moves along the guide rails. Within each truss, a hydraulic pump unit, four high-pressure lifting cylinders, each with an applied pulling force of 20 tons, and four 0.5 ton low-pressure locking cylinders, are all attached to a supporting frame, which moves along the guide rails.

The complete hoisting system for each stage consists of 16 lifting cylinders, 16 locking cylinders and four fully hydraulic units. The lifting cylinders are fitted with a pressure transducer, a built-in stroke sensor and two proximity switches. The hydraulic pump unit includes individual pumps – one for the lifting cylinders and one for the locking cylinders. The pump units are controlled according to the master/slave principle from a central operating computer on the ground, which has a touch screen with images showing the position of the various hydraulic cylinders and their position within the lifting portals. The force of each lifting cylinder and each lifting portal is also displayed, along with the total force. What is more, a local PLC has been installed on each platform so that the lifting platform can be operated locally if necessary.

Up and down

When the frame is lifted, the top beams are first raised one step hydraulically, and then locked mechanically using locking pins and hydraulic locking cylinders. The bottom locking pins are then cleared hydraulically and the cylinders raise the load to the same



Stageco, based in Tildonk, Belgium, was established 25 years ago and has branches in France, the US, the Netherlands, Germany and Austria. Stageco is a market leader in stage design and it primarily sets itself apart through customization.

Founded in 1910, Enerpac (US) is a manufacturer in high-pressure hydraulics, with 28 offices in 22 different countries and more than 1,000 employees. Enerpac produces thousands of high-pressure hydraulic products that are distributed worldwide. Enerpac focuses on the design of products, from the smallest cylinder to complete computer-operated systems, which provide maximum capacity and therefore increase productivity and make operations easier, faster and safer.



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height. In this way, the four hydraulic units lift themselves in the lifting portals with the load, as it were, at a net speed of around 32 feet per hour. Lift synchronism is vital.

The operating computer's display shows that the load in the four portals remains in perfect balance, and also shows which steps in the lifting process have been completed. The operator gives the system a command for each step. After the claw has been assembled, the pump units are lifted out of

the portals using a mobile crane. The system works according to the same principle but in the opposite direction when the whole construction is lowered and dismantled.

Stageco made no concessions in terms of safety. Every step in the lifting process is controlled, and the next step can only be performed when all the required conditions have been fulfilled. The system also gives information on the position the load is in

and how the tension is distributed during lifting. The Enerpac system measures the forces continuously and in real time.

Although the operational speed is significant, Stageco considers safety to be one of the greatest advantages of this technology. Since the three stages are travelling around the world over the next two years, there was also strong emphasis is also on reliability and durability. **act**

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