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The growth of the mega lifters



In this our third heavy lift feature of the year, we chart the development of the new generation of heavy lift cranes which has just seen the launch of the new Sarens 250,000 tonne/metre SGC-250 (see page 22). We also take a look at a several applications using the larger capacity crawler and All Terrain cranes as well as a few alternative methods to lift and move large items.

The new Sarens SGC-250 is the latest of the heavy lift 'machines' which appear to have taken over from large crawler and ringer cranes for the increasingly heavy module lifts. These 'mega lifters' have grown in popularity and capacity since ALE's launched its AL.SK crane series 10 years ago, joining the small club of companies making their own heavy lift machines, such as Lampson and Deep South in the USA and Mammoet in Europe.

Work on the first AL.SK crane - the AL.SK90 - began in 2006 at ALE's R&D division in Breda, the Netherlands, the result of needing a larger capacity crane and faced with total lack of interest by the major manufacturers in building such a machine. When launched

in 2008, it took heavy lifting to a new level, offering capacities up to 4,300 tonnes and coinciding with an increasing demand to lift and place larger and heavier capacity components.

It also created a major split in the market. Mainline manufacturers such as Terex, Manitowoc and Liebherr had gradually introduced higher capacity crawler cranes but appear to have called a halt at the 3,200 tonne level with the Terex Demag CC8800-1 Twin and 3,000 tonne Liebherr LR13000. There are some Chinese designed and built alternatives such as Sany's 3,600 tonne SCC86000TM launched in 2011 and XCMG's 4,000 tonne XGC88000 which carried out a 4,500 tonne test lift at a radius of 17.5 metres with a 60 metre boom

in 2013. The problem for mainstream manufacturers is that the sheer volume of engineering hours required to develop and document these massive cranes, and the cost of building them bears no resemblance to the price that they can be sold at, while unit volume is limited.

Terex/Demag has done the best with the CC8800, having got in early with the launch in 2001 as a 1,250 tonner, later upgraded to 1,600

tonnes and then 2,500 tonnes in 2006. The 3200 tonne twin boom version was delivered to Al Jaber in late 2007. Since then around half a dozen units have been sold of the CC8800 Twins, while the regular

single boom unit has been far more successful and can always be upgraded. Liebherr meanwhile has delivered three or maybe four of its LR13000.



XCMG's 4,000 tonne XGC88000



ALE AL.SK350

However while the big 'home made' heavy lifters were at the top end, two major incidents in North America changed the market when two 'bespoke' large capacity cranes - a 2,500 tonne VersaCrane TC36000 owned by Deep South Crane and Rigging of Baton Rouge, Louisiana and a 1,100 tonne Lampson Translift working at the Black Thunder Mine in Wyoming - collapsed. This handed the initiative in the large capacity alternative crane sector to the Europeans with Mammoet having pioneered its PTC cranes in the late 1990s, and ALE raised the stakes with the new AL.SK90 kicking off a new impetus in heavy crane development which also now includes Sarens, following its acquisition of Rigging International in 2009.

Like most of the new mega lifters, the AL.SK90 - which is capable of lifting loads of up to 4,300 tonnes - was designed specifically for a contract. In this instance, the Jubail petrochemical contract in Saudi Arabia. The crane completed its first of several major lifts in 2009, including a 69 metre long depropaniser column weighing 755 tonnes. Working at 84 metres radius it allowed engineers to complete the foundations and pipe racks in advance of the column installation. With a little modification - basically widening the base - the crane's capacity could be increased to 5,000 tonnes - a version called the AL.SK120. The crane was also equipped with a standard hoist system for lifts up to 600 tonnes and strand jacks for the heavier loads. On a 130 metre main boom the crane could lift 3,000 tonnes at 31.5 metre radius, 1,500 tonnes at 69 metres and 540 tonnes at 114

metres radius.

ALE went through a major company rebrand in 2010 which included renaming its heavy lift AL.SK cranes to reflect the load moment measurement around the point of rotation and also reducing the confusion when comparing performance. Renamed the AL.SK 190 and the AL.SK350, the cranes had 190,000 tonne metre and 354,000 tonne metre load moments respectively. The AL.SK350 launched in 2013 had a maximum capacity of 5,000 tonnes, which it claimed made it the world's highest capacity land based crane.

In 2016 it completed its inaugural lifts in Brazil, installing 40 modules up to 3,000 tonnes on the P-74 Floating Production, Storage and Offloading (FPSO) vessel in the south of the country - the largest commercial lift by a land based crane. The same year ALE fabricated a new heavy duty jib for the cranes and announced plans for the AL.SK700 which is says can lift loads up to 8,000 tonnes.

Cees Segeren, ALE technical adviser said: "The AL.SK fleet has revolutionised the way the industry perceives crane lifting and has had many notable achievements in the last 10 years. One of their great advantages is that they can operate in a small space and this was showcased while removing beams at Earls Court in London, UK. The 4,300 tonne AL.SK190 lifted and removed 61 portal beams - weighing up to 1,500 tonnes - from over the London Underground lines below the former exhibition centre. This allowed other demolition works to continue, saving the clients both time and money."

Liebherr's LR13000 at a polypropylene plant in La Porte, Texas.



Mammoet

Mammoet was the next manufacturer to launch a 'next generation' mega crane. Since 1997 the company had been developing big lifting machines in partnership with offshore crane specialist Huisman. In 2009 it unveiled plans for its new mega lift cranes, a 100,000 tonne/metre plus version of its Platform ringer Twin boom Containerised (PTC) crane - the PTC120DS. The crane could take 3,000 tonnes to a radius of 48 metres, 2,000 tonnes to 53 metres and 1,000 tonnes to almost 100

metres. Using a 45 metre diameter ring it had a 130 metre main boom plus a jib of up to 43 metres.

The PTC is designed to mobile crane standards with hoists and 360 degree slew in normal configuration, unlike the ALE AL.SK machines and Mammoet's own MSG cranes which use strand jacks and are considerably slower. The hoist speeds on the PTC 120 are two metres a minute for the largest winch which can cope with up to 3,200 tonnes and five metres a minute on the smaller 'runner' hoist which can lift up to 250 tonnes.



The ALE AL.SK350 completed its inaugural lifts in Brazil in 2016



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Sarens launched its SGC-140 a year ago and has just unveiled the SGC-250

Slewing is via normal crane type rollers with a full rotation taking 30 minutes which was fast for this size of lifting machine. The crane can also be rigged to run on straight tracks.

Soon after Mammoet unveiled plans for a larger 160,000 tonne/metre version, the PTC160DS. The two cranes have the same boom and jib configuration, the same counterweight and winches. However, the main difference is the footprint - the PTC160DS has a 54.5 metre diameter ring, almost 10 metres larger than the 120.

In 2011 Mammoet rejigged the PTC machines to offer capacities of between 140 and 200 thousand tonne/metres, each with three rigging options - main boom, main boom plus fixed jib and fixed main boom plus luffing jib.

The PTC140 was tested with a load of 3,520 tonnes at 33 metres radius rigged with an 83 metre main boom and 36 metre jib. Mammoet at the time said 'the maximum design load on the jib is 2,900 tonnes which sets a world record among jib and sheerleg cranes'.

The larger PTC200 has a maximum radius of 205 metres and can lift 1,000 tonnes at 100 metres. However the need for more capacity has meant that Mammoet has



Two major accidents in N. America changed the large capacity market.

upgraded the PTC 200DS to the 210,000 tonne metre PTC210 DS to enable it to safely lift a 2,000 tonne module at the world's largest refinery in Jamnagar, India.

Given that this will be a partial shutdown project with time and disruption needing to be kept to an absolute minimum, Mammoet wanted to ensure that the crane could lift the fully assembled vessel in one go, from a single location with a healthy margin of safety. The PTC200 DS can handle a 2,000 tonne load at a radius of up to 78 metres with 3,500 tonnes of ballast and 117 metre of main boom or 58 metres radius on a 140 metre boom.

Sarens SGC

Belgian international lifting specialist Sarens entered the heavy sector in 2010 unveiling details of its SGC-120 heavy lift crane which had a maximum capacity of a 3,250 tonnes 120,000 tonne/metre and capable of handling 600 tonnes at 100 metres radius. The concept had been in development for some time with Californian-based Rigging International, which as mentioned above Sarens acquired in 2009.

The SGC-120 is a classic ringer design, slewing on a double ring track system which sits on a load bearing mat. The resulting ground bearing pressures are less than 20 tonnes a square metre, virtually eliminating any special ground preparation requirements. The outer ring has a 38.5 metre diameter or just over 44 metres to the edge of the load bearing mats that the two rings sit on.

The twin boom design has a maximum length of 130 metres with twin back masts. A 90 metre luffing jib can be added with a 68 metre jib pendant to ensure good fully luffed



The 210,000 tonne metre PTC210 DS

capacities. The crane ships in 135 standard 40ft containers and when in position has up to 3,600 tonnes of counterweight which is made up of specially reinforced 40ft containers filled with locally sourced materials.

The SGC120 uses up to six high power winches rather than strand jacks, with 61 tonnes of line pull and line speeds of up to 20 metres a minute, making it more akin to a heavy lift crane than some other heavy lift machines of this size. For applications requiring frequent movement, the crane can be mounted on a dual track rail system laid out to suit the job site.

At the end of last year the company launched its largest to date - the

SGC-140 - which can handle 2,820 tonnes at 50 metres radius. After undergoing tests at the Port of Ghent, it was shipped to Kazakhstan and used on the Tengizcheroil (TCO) project on the north eastern shores of the Caspian Sea lifting modules weighing up to 2,500 tonnes at 50 metre radius.

At the time Sarens said additional models would include a smaller 90,000 tonne/metre SGC-90 to be launched this year and the 250,000 tonne metre SGC-250 due next year. However the early introduction of the SGC-250 - the flagship of the Sarens fleet - is because of a four year contract at Hinkley Point power station in Somerset, UK.



The SGC-140 can lift 2,000 tonnes at 50 metre radius



The SGC-140 is a classic ringer design

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World's largest land-based crane?

Earlier this month, Belgian heavy lift and transport company Sarens launched its largest crane to date, the 250,000 tonne/metre SGC-250 at its construction yard in Ghent. The company claims that this third generation SGC is the largest land-based crane in the world, capable of lifting 5,000 tonnes at a 40 metre radius and 2,000 tonnes at 100 metres on its main boom. As soon as the testing is completed the crane will be dismantled and transported to the UK for a four year contract at the Hinkley Point nuclear power station project in Somerset.

Everything about the SGC-250 is big and impressive. To make it easier to visualise, 5,000 tonnes is the equivalent of around 1,400 elephants, 650 farm tractors or 20 Airbus A380 aircraft.

It has two main boom options - 118 and 160.5 metres - together with

five heavy duty jibs - 40.5, 52.3, 64.1, 87.7 or 99.5 metres. The maximum lift height of 250 metres is achieved with the 160 metre main boom topped by the 99.5 metre jib, in this configuration it has a maximum radius of 275 metres. The Hinkley Point crane is equipped with the 118 metre main boom and 52.3 metre jib, allowing it to lift 4,250 tonnes at 40 metres, 1,781 tonnes at 65 metres or 775 tonnes at 165 metres radius.

While the SGC-250 is essentially a larger version of earlier SGC heavy lift cranes - the 90, 120 and 140 - it is unusual in that it can reposition itself on site while fully rigged, moving from one lifting position to another. This is a first for Sarens and the company says it 'constitutes a



Carl Sarens - director of global operations and technical solutions



The SGC-250 dominates the Ghent skyline



The SGC-250 can lift 5,000t at 40m radius



Sarens' president Ludo Sarens



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The crane continues the naming tradition which started with the Big Benny after Benny Sarens, the father of this generation of cranes. Benny's son Carl has been responsible for driving this project

breakthrough for the crane industry as a whole'. The slewing tracks/rings rest on a circle of 80 spreader mats with an overall diameter of 52.8 metres. This is topped by two very large ring beams, each of which carries a two rail track.

Unlike the previous models, the SCG-250 has two sets of travel wheels - one with 16 bogies in four assemblies with a total of 128 wheels for slewing 360 degrees around the ring tracks, and another set of 12 retractable bogies - six at the front and six in the rear - with 96 wheels for travelling on straight track for repositioning.

To switch from slewing to travelling

the crane lowers the 12 in-line travel bogies which lift the crane free of the slewing track and drive the crane forward thanks to 24 hydraulic motors. The Hinckley Point contract will have three slewing tracks/rings positions with travelling track in between them. This allows the crane to complete a lift and then travel to another lift area and be ready to lift again in just 10 hours/overnight - as it travels at a faster speed than a large tracked excavator.

The additional equipment that enables it to relocate fully rigged means that its overall weight has increased slightly more



After testing the crane will be transported to Hinkley Point power station in the UK



The 3,200 tonne main hook block

than expected to 9,000 tonnes, however ground pressure is just 25 tonnes per square metre. Major components include the 500 tonne crane deck, the 160 metre main boom weighing 910 tonnes and the 52 counterweight containers with 100 tonnes in each for a grand total of 5,200 tonnes.

Introducing the new crane to the 400 guests at the launch event, company president Ludo Sarens paid tribute to those involved in its design and development, saying: "The SCG-250 was designed and

engineered in-house based on the design of Rigging International that we acquired in 2009 although many improvements have since been added. Unfortunately the father of this generation of cranes - Benny Sarens - passed away last year however it is one of his products that we can admire today. His lifetime achievement was his leading involvement in pushing the development of the SGC cranes - Big Benny (the SGC 120) and Big Benny XL (the SGC 140)."

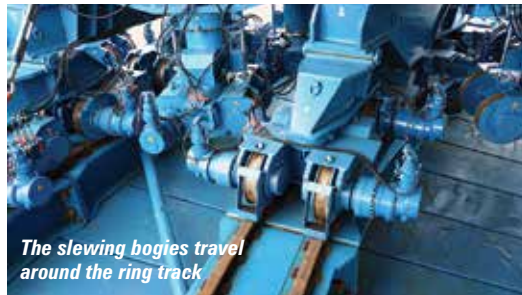
The project is now being driven



A Liebherr support crane



Cab monitors and controls



The slewing bogies travel around the ring track



Using two sets of travel wheels, the crane can reposition fully rigged

forward by his son Carl Sarens - director of global operations and technical solutions - with the latest crane continuing the naming tradition by being called 'Big Carl'.

"At the moment we have four cranes - the SGC-90 which has undergone a few upgrades and is currently available, the SGC-120 is working in the UK on offshore wind projects, the SGC-140, launched last year which is working in Kazakhstan

and the new SGC-250 heading to Hinkley Point in the UK," he said.

The crane took slightly less than 14 months to build and hand over for testing, with the manufacturing process starting last August with parts being sourced from the UK, Belgium, Germany, Italy, Poland, Romania and the Netherlands. Erection at Hinkley Point will take between eight and 10 weeks.

The SCG-250 in numbers

The crane has:

Six Power Packs Units (PPU) each with two CAT 421hp/310Kw Tier 4 compliant engines

10 winches with the six Zollern main hoist winches holding 3,600 metres of 50mm diameter wire rope - (4 x 1,600m and 2 x 2,000m).

9,000 litres of diesel fuel

18,000 litres of hydraulic oil

82 hydraulic filters

2,000 metres of hydraulic hose

112 hydraulic slew motors

28 hydraulic secondary units

932 hydraulic quick connections

24 motion control PLCs

1 master PLC

6,000 hours of software and control system development

1,000 metres special hybrid cable

2,000 metres of power cable

Some examples weights include:

The 80 metre back mast weighs 350 tonnes

Two 65 metre back mast struts weigh 200 tonnes

The 3,200 tonne main hook block weighs 105 tonnes

The 1,600 tonne auxiliary hook block that runs from the jib, weighs 58 tonnes

Two interesting presentations FYI

<https://www.youtube.com/watch?v=z53HJCEKA3M&t=25s>

http://www.sarens.com/media/1558122/sgc-250_technical_presentation.pdf

http://www.sarens.com/media/1558122/sgc-250_technical_presentation.pdf



The SGC-250 cab



With its 118m main boom and 52.3m jib it can lift 4,250t at 40m radius

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Dock gates lift

Hanover-based crane rental company Nolte was called on to remove six large steel harbour gates in Büsum, Schleswig-Holstein on Germany's North Sea coast for refurbishment. The greatest challenge was finding space for a crane large enough to carry out the lift. Each gate is 12 metres wide by 16 metres high and weighs 90 tonnes.

The company selected an eight axle 750 tonne Liebherr LG 1750 truck crane for the lifts, however the lack of space and suitable ground was problematic. The solution was to build a temporary concrete slab base on a grassed area close to the harbour entrance. The LG 1750 was rigged with 49 metres of main boom, plus 56 metre luffing jib and derrick boom with 570 tonnes of ballast in order to lift the gates from their hinges, slew them over the harbour building and place them in a frame on the bottom of a drained dock chamber for the refurbishment work to be carried out. The toughest lift involved a 101 tonne load at a radius of 67 metres.

The LG 1750 was supported by a 200 tonne five axle LTM 1200-5.1 All Terrain crane, and an MK88 mobile self-erecting tower crane for the minor hoisting work and helping with building the steel girder and pipe emergency barrier to seal the dry dock chamber from the sea.

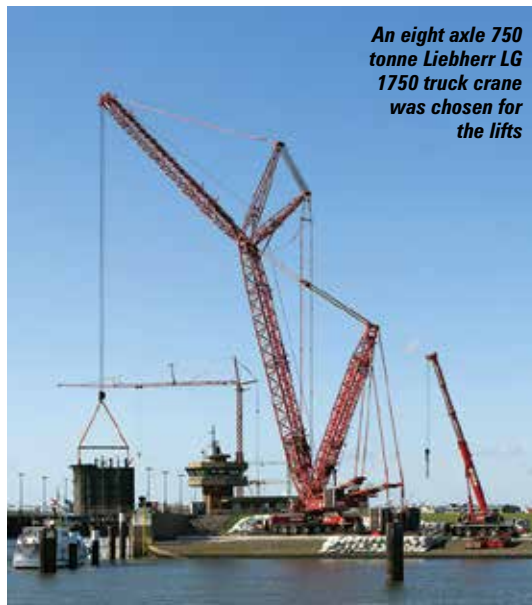
Site manager Jürgen Peters said: "The Liebherr LG 1750 was the ideal crane for this job because the slewing range for the derrick platform was very limited. Work on the €2.5 million barrage was completed after six weeks with the lock gates fully refurbished and reinstalled."



A temporary concrete slab base on a grassed area close to the harbour entrance was specifically built for the crane



Each of the six steel harbour gates measured 12 metres wide and 16 metres high and weigh 90 tonnes



An eight axle 750 tonne Liebherr LG 1750 truck crane was chosen for the lifts

One big crane

When Mammoet was asked to provide a solution to a number of heavy lifts at Braskem's new \$675 million Gulf Coast polypropylene plant at its Delta facility in La Porte, Texas, it concluded that the most efficient approach would be to use one crane capable of performing all of the lifts from a single location.

With loads of up to 750 tonnes and 160 metres of reach required over the full contract, it chose the 3,000 tonne Liebherr LR13000. Germany's Linde - the lead Engineering, Procurement, and Construction services contractor for the project liked the plan with the first and heaviest lifts - placing two South Korean built reactors onto their foundations - carried out this summer. The heavier of the two weighed 725 tonnes with an overall length of 49 metres.

The crane was rigged with 96 metres of main Power boom, 400 tonnes of superstructure counterweight, derrick mast and 1,500 tonnes of suspended counterweight. In this configuration it can handle up to 1,859 tonnes at 16 metres radius. The LR13000 raised each reactor from horizontal with one of Mammoet's Demag CC2800 crawler cranes 'tailing in'. Once the reactor was vertical the LR13000 slewed it through 180 degrees and travelled a short distance with the load, placing it precisely on its base. In this configuration the crane could have taken the 750 tonne total load out to a radius of just over 60 metres.

The crane was then re-rigged adding a 72 metre luffing jib to the 96 metre 'P' boom in preparation for a further 16 lifts that range from 38.5 to 482 tonnes, all of which should be completed by next July. The new plant is scheduled to be commissioned during the first quarter 2020 and will add a further 450,000 tonnes capacity a year to the existing Delta facility creating North America's largest polypropylene plant.

Kleber Sousa, Braskem's lead process engineer on the project said: "Watching the first reactor being lifted to its final position was a special moment, not only for the astonishing engineering involved in moving such a big piece of equipment, but also because I have been close to the reactors since the beginning, from engineering in Dresden, Germany, to final inspection in South Korea."



Mammoet used just one heavy lift crane - a 3,200 tonne Liebherr LR13000 - at Braskem's new \$675 million Gulf Coast polypropylene plant at its Delta facility in La Porte, Texas.

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ALE TLG1000 gantry makes debut

UK-based heavy lift contractor ALE is currently installing 538 bridge deck beams weighing up to 230 tonnes each on the new five kilometre San Martin mass transit train/tram viaduct connecting the Palermo and La Paternal neighbourhoods in Buenos Aires, Argentina - part of which runs over the top of the San Martin railway tracks.

The company is erecting most of the beams with a girder type launching crane, however, the space between two of the piles was too large for the launching crane to reach, so four beams were installed with the company's new TLG1000 gantry system which lifted the beams off to the side of the viaduct and travelled them into place on rails.

A large crawler crane would have been the easier option to install these sections, however an underground gas pipeline located beneath the viaduct meant that its higher ground bearing pressures risked damaging the pipe. The gantry was able to spread the load over a wider area and use its monitoring systems to provide live data on ground pressures and settlements, helping reassure the client.

Juan Manuel Hinojosa, project manager, said: "It is fantastic to see the TLG1000 in operation for the first time and deployed to overcome the challenges of the underground pipeline."



ALE's new 1,000 tonne capacity TLG1000 gantry system installed four beams avoiding damage to an underground gas pipeline

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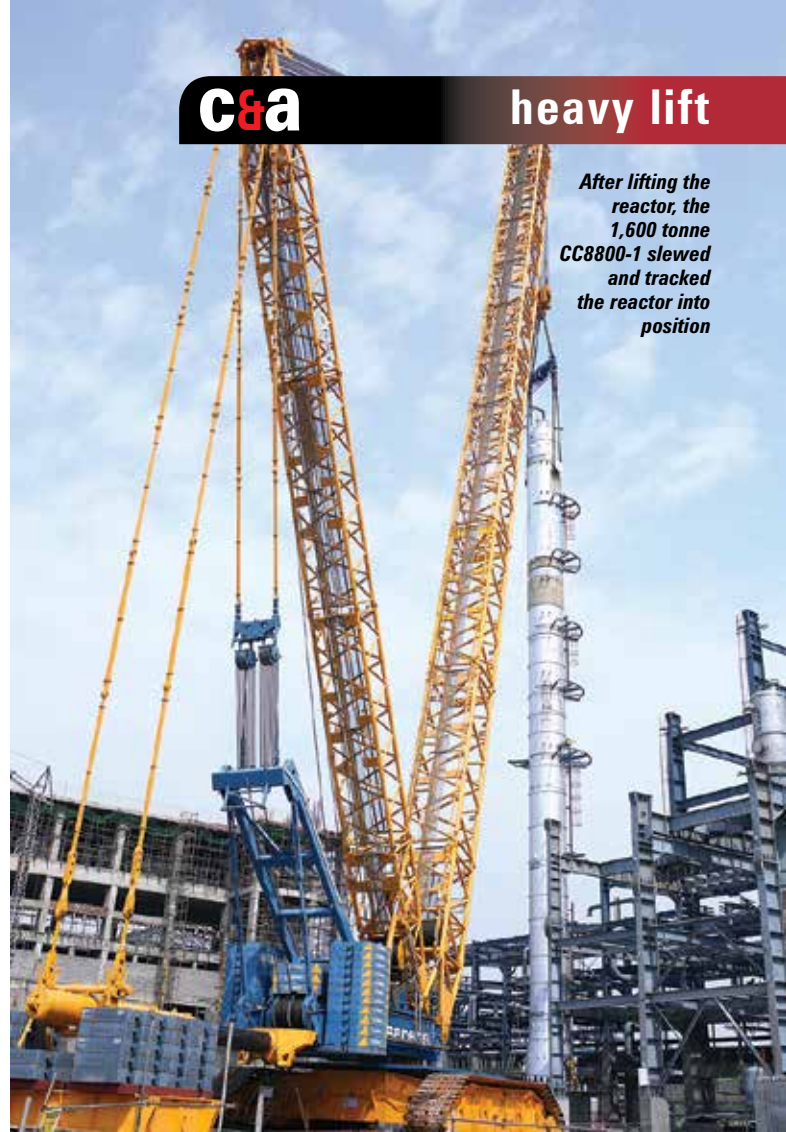
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CC8800-1 at Indian fertiliser plant

Sarens has carried out a series of challenging lifts at the \$750 million Ramagundam fertiliser plant in India, using a 1,600 tonne Demag CC 8800-1 crawler crane from Greece. The project involves constructing new ammonia and urea plants.

The first and most challenging lift involved raising a 425 tonne, 53 metre long and 3.8 metre diameter urea reactor from horizontal to vertical, and then travelling and placing it on its base. To perform the lift, the CC8800-1 was in SSL 84/72 configuration, working at a radius of 24 metres with a CC2800-1 to 'tail in'. After lifting the reactor, the CC8800-1 slewed and tracked the load into position. The Demag CC 8800-1 then had a further 40 days to carry out five more key component lifts weighing up to 640 tonnes.



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