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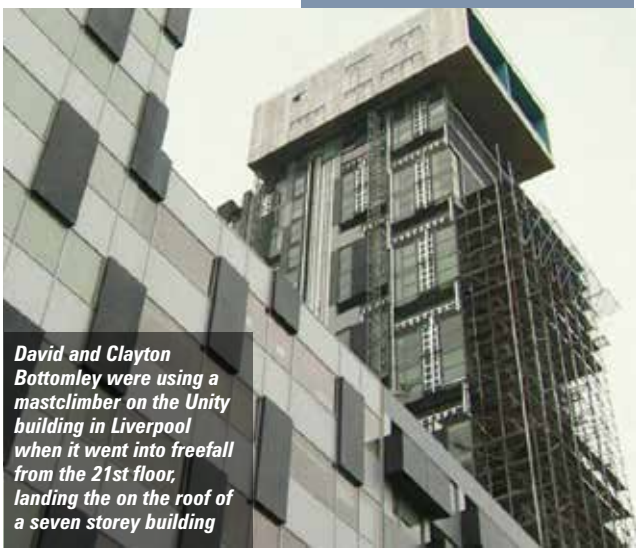

David and Clayton Bottomley were using a mastclimber on the Unity building in Liverpool when it went into freefall from the 21st floor, landing the on the roof of a seven storey building

ARE WE LEARNING ANYTHING FROM FAILURES?

Over the past year or so, mastclimbers and hoists have been in the news for all the wrong reasons. Seven people have died in just two incidents - five in Sweden and two in the UK - yet the difference in the way the safety authorities have dealt with them could not be more different. C&A takes a look at both.

The UK incident occurred on 19th May 2021 when father and son David and Clayton Bottomley were using a mastclimber to carry out cladding work on the Unity building in Liverpool when it went into freefall from the 21st floor, landing on the roof of a seven storey building. David died at the scene while Clayton died in hospital four days later. The full details and information on the tragic incident only started to come to light when the inquest began last September, three years and four months after the event occurred.

David and Clayton Bottomley

At the pre-inquest hearing in July 2023, coroner Johanna Thompson announced the investigation would be held with a jury, as UK law states this must occur 'when a death was caused by an accident, poisoning or disease reported to a government department or inspector'.

Solicitors representing the Bottomley family, site contractor Laing O'Rourke, building facade specialist AAI Selby, mastclimber supplier Adastra Access - which appointed an insolvency administrator the month before - and gearbox specialist Nord Gear all appeared in court for the pre-inquest hearing along with representatives from the Health & Safety Executive and Merseyside Police.

For reasons known only to themselves, the HSE said it would likely take a further two to three months - September or October - for the leading inspector to prepare a full report into what happened - at this point 40 months after the incident! The coroner said: "At the moment, we are unable to make any more substantial progress until we have the report from the Health & Safety Executive, so I am going to therefore arrange a future pre-inquest review hearing. That is not likely to be for at least another two or three months. It's very difficult because this is a case with complexities, and it is important we get it right by making all the evidence come at the right time so we will progress."

At a pre-inquest review which took place on October 20th 2023, the court was told that the cause of the sudden failure of the mastclimber was due to a 'mechanical fault'. The solicitor representing the Bottomley family asked that evidence regarding the maintenance of the platform from contractors Laing O'Rourke, the mastclimber supplier Adastra Access, and the machine's rack & pinion gearbox supplier Nord Gear be requested.

Almost a year later in September 2024 the inquest actually got underway. HSE inspector Andrew Crouch confirmed the investigation had found that a small pinion shaft in the gearbox - which sits between the drive motor and brake and the main drive pinion - had fractured and failed on both drive motor assemblies leaving the platform without any drive or brakes leading to the freefall.

Crouch added that the shafts must have failed at different times, indicating that the unit continued to be used after one of the drive motors and brakes had broken. He added that it was impossible to say when the first shaft had failed, and therefore how long the platform had been operated with a single drive motor and brake. As to the cause of the failure he said that an HSE metallurgist had simply determined that it was due to 'metal fatigue'.

Floral tributes left at the site of the incident in Liverpool

The findings highlighted the fact that rules regarding regular drive and brake tests had not been adequately followed. The manufacturer's manual recommends carrying out a brake test once a day at a bare minimum, and ideally before every ascent. Crouch also confirmed that such a test would have revealed that one of the motor/brakes had failed, adding that the platform did not have a system installed that monitored how much power each motor was using, which could have alerted users to a potential issue, well in advance of the second failure. "If this system had been in place, this accident would simply not have happened."

The coroner did however say that a daily and weekly check had been completed as per the provided checklist, which included 'visual and functional' checks of switches. These had apparently been completed on the day of the incident and somehow did not identify a problem.

The evidence however indicated a woeful lack of service and maintenance, while the failure itself may also have highlighted a poor design or the use of substandard materials. The jury was also told that the mastclimber was made in China and branded TDT and that it was supplied and installed by Adastra. Both deaths were recorded as an accident.

SWEDISH HOIST INCIDENT

Compare that investigation into the fatal Swedish hoist incident in Sundbyberg on the north side of Stockholm in December last year. It occurred on the construction site of a new residential apartment building complex, the highest element being 14 storeys high.

The Alimak Scando 650 hoist was attached to the building being built by local contractor and developer Andersson Company. It initially appeared that the mast had given way or became detached, causing the mast and hoist car to crash to the ground from a height of around 20 metres killing all five occupants.

The day after the incident three senior experts from hoist manufacturer Alimak visited the site together with investigators from the Swedish Accident Investigation Authority and the police. The following day Alimak issued details of its initial investigation and based on observations, concluded that two of the mast sections holding the hoist in place had not been bolted together, which may have been the reason why the hoist fell to the ground.

Sweden's Statens haverikommission (SHK) - National Accident Commission - published its full and detailed report less than eight months later. It confirmed that the hoist was originally installed on the 24th of August and inspected by an accredited inspector from the independent control body Lyftbesiktningar i Sverige. The hoist was approved for use and went into operation. As part of the inspection and signing off process Lyftbesiktningar approved the plans for adding additional mast sections as the building work moved upwards, only requiring an inspection by the supplier - ABC Bygghissar - which also agreed to inspect and service the hoist once a month. The monthly inspections were supposed to include a full mast check including the bolts between sections.

Five occupants in this hoist car died when it crashed to ground from a height of around 20 metres

Two days after the incident manufacturer Alimak issued details of its initial investigation and based on observations, concluded that two of the mast sections holding the hoist in place had not been bolted together

Between August 24th and December 11th four extensions to the mast were carried out - on 21st of September, 18th of October, November 1st and finally on December 5th when the mast was extended to the ninth storey. The investigation found that five of the bolts and nuts that connect the mast sections together were missing, with all four corner bolts missing between two of the sections. The unbolted joints were simply not strong enough to support the forces applied when the hoist car moved above these sections.

The investigation report said: "The accident occurred when the load on the mast where the four bolts and nut assemblies were missing became greater than the structure could hold, leading to the mast sections separating and the hoist car falling to the ground. It is likely that the bolts were already missing from the three-section mast extension when it was added at the start of November. However, this was not spotted when installed, nor in the subsequent inspections and service measures taken after the assembly. The accident was caused by failure to perform relevant safety inspections on the mast and thus not picking up the missing bolts."

THE HOIST

The Scando 650 - serial number 816849 and manufactured in 2016 - has 1.5 metre long mast sections each weighing 115kg. The sections are connected with short spigots on each of the four corner tubes, with four large bolts - one near each corner - and lock nuts to hold the sections firmly together. They are installed from below, with the nuts on top, so that they cannot be left off as the bolts would simply drop out. Also, if by chance a nut vibrates loose, or the bolt should shear they drop out.

The hoist has a free standing height of 15 metres and needs to be braced to the building when extended above that. In this case the first tie was placed at 16 metres. Two assembly procedures are permitted: Assembling section by section from the hoist car, or pre-assembling three or four sections on the ground, and then lifting them into place with a crane, guiding them into position and bolting the length to the existing mast from the hoist car roof. In total 21 sections had been added to the mast by the time the incident occurred.

With critical bolts missing, the mast sections were only held in place by the friction between the short spigots and the sockets of the section below

The installation guide/manual with drawings clearly warns of the risks of leaving any bolts out. And yet it is clear that five bolts were missing at the time of the accident - one between sections 19 and 20 and all four bolts between sections 18 and 19, meaning that the sections above that were only held in place by the friction between the short spigots and the sockets of the section below.

The offending sections were installed on the 1st of November with the joint in question being the one between the middle and lower section in a run of three that were preassembled and installed by crane. It has not been determined if the bolts were missing when the 4.5 metre length was delivered to site some weeks earlier, or if the bolts had been removed on site for some reason. Regardless, the subsequent inspections failed to spot that they were missing.

CAUSES

The incident was caused by the control measures intended to catch assembly errors being carried out without the due diligence required, completely ignoring the fact that the critical bolts were missing, allowing the top section of the mast to rely purely on friction and gravity to remain in position.

SAFETY RECOMMENDATIONS

A number of measures have already been instigated by those who wish to use the lessons learnt from this incident, to improve hoist safety and reduce the risk of similar incidents. The SHK has not made any specific recommendations on possible changes to overall safety regulations and inspections, as its remit is to simply identify the shortcomings.

The report recommended that an investigation be launched into how safety measures applied in the hoist assembly process can be improved, while also looking at how risks involving construction hoists are managed. It has recommended that the main contractor, Andersson Byggnads, and hoist supplier ABC Bygghissar och Byggmaskiner, integrate risks relating to hoist assembly into their systematic work environment safety management, and improve inspection routines to reduce the risk for assembly errors occurring.

CONCLUSION

As stated above the root cause was that the mast bolts were missing and were not spotted during the erection and subsequent inspections or maintenance of the hoist.

Due to the design of the mast section joints once they have been properly bolted together it can require a load of around 2,500kg to break the joint connection if the bolts are removed. This was proven by a series of tests carried out with the manufacturer and the inspectors at Alimak's facilities in Skelleftea, Sweden. Unfortunately, this factor ultimately caused the failure when the car was fully loaded.

Each country is different when it comes to inspection requirements. Some insist that the inspections are carried out any time there is a change to the build - as in Sweden - but that the inspection is done by a competent person that has NOT been involved with the installation - ideally a qualified third party.

The design of a product must allow for predictable human error factors, but this can only be done to a certain degree. Any product that has a modular and variable construction, such as mastclimbers, hoists or tower cranes, will always carry an extra element of risk, especially when other variables are added to the mix. As with aviation, safety of such products depends on those carrying out the installation, dismantling or inspections, being fully familiar with the correct process and understanding the reasons for it being that way, along with the potential risks if elements of the procedure are missed, ignored or short circuited.

Follow the instructions and the warnings religiously and all should go well every time. But equally important is that subsequent inspections are carried out by a diligent and even overzealous inspector. For instance, by paying them a bonus for each error they manage to discover!

Since the accident Alimak has looked at ways of improving/making it easier to check the bolts. This it has done by painting bolts red so that it is easier to carry out a visual check even from a distance.

SWEDEN V UK?

This is not the first time that incidents in the UK have taken years to get to court - often without reaching a satisfactory conclusion. Not only is it totally unacceptable that important information on how and why these incidents occur are kept hidden by the HSE/police, but the whole focus appears to be one of blame and prosecution rather than as in the incident in Sweden, learning from the mistakes that caused the deaths in the first place and spreading that information in an open, detailed, comprehensive and easy to digest report.

In the case of the Swedish incident, the reasons behind the collapse were known within two days and the full report published eight months later. When years go by before a meaningful outcome in the UK, is it any wonder that the end results are somewhat meaningless?

An Alimak Scando 650 hoist

ELECTROELSA 'BOLT PRESENCE'

One company that already has a system that detects missing, or even loose mast bolts is Italian hoist and mastclimber manufacturer Electroelsa. Introduced and patented in 2021 it is now installed as standard on all of its models.

During the mast assembly the installer places the 'Bolt Presence' system on top of the mastclimber or hoist and around one side of the mast. The system then applies pressure on the mast section it is in contact with and monitors any unexpected movements, such as when the mast sections are not correctly bolted together or adequately torqued. If it does, the power is automatically cut and the brake applied stopping the platform from climbing any further. The operator must then manually override the brake to restore the power to lower the platform and insert or tighten the bolt. Once the mast section is correctly bolted together, the hoist or mastclimber can continue its movement up the mast.

The system is more easily seen on a mastclimber

The bolt presence system in use on a hoist

SUSTAINABLE
100% renewable energy used in manufacturing, low CO_2 impact

TOUGH
Robust and durable design, made for tough working conditions

CONNECTED
Digitally connected and accessible via the My Alimak portal

COMPATIBLE
Compatible with Alimak's 650 mast, tie and landing gate systems

EXTRA LARGE
Support efficient vertical transportation of wide and bulky loads

COMBINABLE
Enhanced productivity and safety in combination with Alimak construction hoists

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Visit our website for further information.

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ALIMAK

RISING TO THE CHALLENGE

One of the biggest challenges facing high rise construction or maintenance works in urban areas is the limited ground space available to work from. Because of this there has been a notable shift in mentality amongst forward-thinking developers and contactors, with, in many cases, solutions to work with these limitations taking priority over value engineering and budgets.

Therefore, early involvement with a project in relation to access and lifting is essential. Specialist suppliers such as the UK international Brogan Group, along with hoist, mastclimber and common tower manufacturers understand this and are collaborating to provide innovative solutions to meet the demands of increasing heights and complexities of the latest high rise buildings.

HOISTS

The hoist market is now big business, said to be worth more than £2 billion globally in 2023 and is predicted to grow rapidly to around £3 billion by 2030, if not sooner. This is driven by the surge in construction projects around the world - in particular high rise and infrastructure projects - together with advancements in technology and an underlying focus on safety and manual handling. Vertical transport for personnel, materials and equipment is no longer seen as a luxury, but more of a necessity, particularly on projects of five storeys or more.

Size matters and demand for larger passenger cars or lift platforms, coupled with high lift capacities has never been greater. The need for speed is also an increasingly important factor - time is money with faster machines meaning more productivity onsite. The ability to load large bulky items such as bathroom pods and the freeing up of invaluable crane time is also helping improve efficiency.

MASTCLIMBERS

The use of mastclimbers is also on a growth curve as contractors seek more efficient and safer work at height solutions. Taller buildings, the rise of prefabricated modular buildings and recladding projects are playing a major contributing role in this, along with the ability to reach multiple elevations, and adjust the platform height to the ideal point, along with fast easy erection and dismantling are just some of the advantages mastclimbers offer over conventional scaffolding.

COMMON TOWERS

The common tower solution has quickly become an attractive proposition for developers looking to build taller buildings more efficiently. The standard five by five metre four-sided tower is erected next to the building façade with the inside face connected to the building at each required floor by a three metre opening. The tower can support up to six large construction hoists on the remaining three free sides - two hoists per side - all of which feed into the tower and the single entry into the building.

Reducing the number of building openings has a massive effect on the cladding installation and completion speed. For example, six individual large construction hoists may take up to 18 metres wide ground space and building façade. The common tower only requires a façade width of three metres.

Floors of the tower can support 4,000kg per square metre, and heights in excess of 250

Brogan mastclimbers on College Road, Croydon development

Wood Wharf development in Canary Wharf, London


Canada Water, London

metres are possible. The minimal interference with the building façade means that only one very small cladding panel needs to be left off to accommodate the tower ties which speeds up the cladding installation and allows floors to be completed and occupied as work continues around. Optional staircases can also be included.

The common tower maximises capacity for the transport of materials and personnel while minimising interference to the building. Its modular structure is easily adaptable to building heights and shapes. The Brogan Group recently acquired common tower specialist Construction Access Systems (CAS), leading to work on projects across Europe, the Middle East and the USA, and not just on high rise projects.

INCREASED DEMAND

Over the last 12 months, Brogan has seen a huge uplift in demand and has invested substantial amounts in the latest, largest and fastest machines. Its fleet now includes more than 400 hoists, from standard two tonne goods/passenger hoists up to the five tonne Colossus hoist with a 40 metres per minute lift speed. Its largest goods hoist cage measures 6.5 x 3.2 metres.

The group can fabricate mastclimbers to meet unusual building profiles such as saw tooth, inclined and curved facades. Sliding decks are available to accommodate balconies and protrusions and double stacked machines enabling access to multiple levels simultaneously.

The CAS fleet added heavy duty loading platforms, larger cage sizes, bigger payloads, extra long ties and angled mast configurations as well as expertise to the engineering and design of temporary works structures to construction programmes.

CANOPY ACQUIRES ALBA-MACREL

US based access solutions company Canopy Brands has acquired rack and pinion and suspended platform divisions of Alba-Macrel. Founded in 1957 Alba is based in Spain's Basque region and manufactures products including material and personnel hoists, transport platforms, mastclimbers, construction elevators and modular suspended platforms with sales in 77 countries.

Canopy is made up of numerous companies including Safewaze, HySafe, Xtirpa, SST, Bee Access, Galaxy Lifts and American Muscle Docks. It has more than 6,000 products covering fall protection, suspended and permanent access, powered lifts, marine access and confined space equipment plus a growing range of services from design, engineering and installation to training.

Bee Access will continue to distribute Alba products in the USA, while Alba will retain the Alba brand, related intellectual property and continue to operate from its plant in Miranda de Ebro, Spain.

NEW ALIMAK MODELS

Swedish international hoist, mastclimber and façade access group Alimak has launched two new products - the Medius 350 construction hoist and the Vectio 650 transport platform.

The Medius 350 is aimed at small to medium sized projects with restricted space. It offers a maximum capacity of 1,000kg or 11 passengers, has a car size of 1.4 by 1.5 metres with an internal height of 2.2 metres, while being lighter than the Alimak Scando with the same capacity. Maximum lift height is 100 metres with a speed of 24 metres a minute. It features a new 1.3 by 2.0 metre vertical sliding door with a folding threshold ramp and low power consumption.

The ride is said to be more comfortable with Alimak's newly developed AliSoft soft start technology. It is compatible with Scando landing equipment and Alimak TPL transport platform as well as being digitally connected and accessible via My Alimak portal.

The Vectio 650 offers platform widths of either 1.5 metres or 3.0 metres while lengths vary from 3.1 metres up to 4.9 metres. Maximum capacities range from 2,500kg to 3,700kg depending on whether it is a single or twin mast set up.

The large platform size makes it ideal for transporting wide, heavy and bulky goods. Speed is 12/24 metres a minute with a power requirement of 400-480V/50-60HZ. Maximum lift height is 100 metres.

Compatible with Alimak's 650 mast, tie and landing systems its open design and low 400mm step in height makes loading and unloading easier. The unit is digitally connected and accessible via My Alimak.


Vectio 650


Medius 350

HANGAR ONE PROJECT

Moffett Field's Hangar One in the San Francisco Bay Area of California is one of the world's largest freestanding structures covering 32,000 square metres. Dating back to 1933 the massive hangar is an iconic landmark, originally designed for the USS Macon dirigible airship and now part of the NASA Ames Research Centre. At 345 metres long, by 94 metres wide and 60 metres high, it can accommodate six American football fields and its interior is so large that fog sometimes forms near the ceiling.

Hangar one in the 1930s

The structure is currently undergoing a massive restoration project headed by Google and NASA that includes removing and renovating parts of the steel structure and installing new cladding. It is hoped that this will preserve its historical value but also re-establish it as a hub for innovation.

To carry out the external cladding work a custom twin deck, triple mast P45 mastclimber from SAEclimber was chosen featuring two independent drive units on one mast, while a material hoist at one end is also being used.

The mastclimber is 65 metres high and inclined at angles of 25 and 30 degrees. In order to keep the platform level, special drive units with levelling mechanisms are employed. A crucial aspect of the P45 was the anchor forces on the inclined façade and the metal structure's function, form and construction which required special attention including a tie solution specifically for the job and a new method of cladding placement.

NEW GEDA COMFORT

German hoist manufacturer Geda has launched the 200 Z Comfort - a compact, lightweight hoist for use with all types of scaffolding, especially modular and frame scaffolding. Maximum capacity is 200kg while the maximum height is 35 metres.

The hoist is quickly assembled using the quick lock system for the ladder sections and the base unit can be easily aligned with the optional scaffolding spindle holders - ideal when working on slopes or non-asphalted surfaces - reducing substructure or alignment work. The 1.2 metre wide platform opening makes it easy to unload large materials without the need for landing level safety gates. New anchors provide the exact distance to the scaffolding without the need for time consuming measuring, which saves time and therefore money. The 200 Z Comfort is compatible with Geda accessories including remote controllers.