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Electric workhorses

The battery electric scissor lift, including its close cousins that use a Z/Sigma or telescopic mast lift mechanism, is by far and away the most prolific form of powered access equipment in use today and the vast majority of these are compact models designed to pass through single doorways. They are ideal tools for a wide range of applications from internal installation work on construction projects, to refurbishment, cleaning and industrial maintenance.

In spite of its relative simplicity, the electric scissor lift was far from being the first form of self propelled access equipment. That honour goes to the self propelled boom, soon followed by a gasoline powered scissor lift for outdoor use. Once the concept of a self propelled scissor lift was conceived, it took little time for the first battery powered versions to arrive, followed some years later by what was called the 'skinny mini' scissor lift, initially with 20ft platform heights and 8ft/2.4 metre long platforms.

These early machines were not exactly paragons of reliability, with poor battery life and a tendency to leak. In spite of this they were rapidly adopted, particularly in the USA. A number of manufacturers made their name with small electric scissor lifts, including Marklift, Economy, MEC/Mayville, UpRight, and Skyjack.

Interestingly, the three largest self propelled aerial lift manufacturers today made their fortunes with boom lifts and were either latecomers to the small electric scissor lift market or have struggled with the concept, suggesting that boom lifts are the surest route to long-term market leadership.

Small electric scissor lifts began to take off in the mid to late 1970's. Although approaching 35 years as a mainstream product, it is still relatively young in comparison with other types of equipment. During that time there have been a number of notable technological breakthroughs, although on the surface the modern electric scissor is remarkably similar to the original products of the 70's.

Marklift - eventually absorbed into Terex and Economy which became part of Snorkel - did much of the early running with highly popular products that had a strong reputation for reliability and affordability, appealing to the rental industry making the concept affordable to end users.

Bulky scissor guards were the norm in much of Europe until the mid 1990's - they destroyed some of the benefits of compact scissor lifts



Aichi has launched a range of 'Global' scissor lifts in its quest to win a share of the European and US scissor lift market. Its latest are 15 and 19ft elevator models

The North American market took the concept to heart, rapidly appreciating the massive potential for productivity gains, not only by taking skilled tradesmen quickly to their work with all the tools and equipment they needed, but also by having the ability to move to the

next work area without returning to the ground, making it ideal for jobs such as overhead wiring, lighting and sprinkler installation, saving time spent climbing ladders or towers and the passing up tools and equipment.



The JLG ES range of compact electric scissor lifts are arguably the most advanced in terms of specification - although Aichi aims to challenge that



The original Skyjacks in 1985 created the modern compact electric scissor

While units soon arrived in Europe, several factors helped prevent such a rapid adoption on this side of the Atlantic. Firstly the price - in the USA manufacturers sold directly to rental companies and could be collected from the plant where they were made. In Europe, the price escalated with high shipping costs, import duties and the often substantial mark-ups of local distributors, who sold to rental companies. The higher costs were compounded by the misguided notion, originating in the UK, that the scissor mechanism required a two metre high guard, further adding to the cost, making the units bulkier and creating a high cost maintenance item.

Outside of the UK, Scandinavia and Benelux there was a far more significant barrier to the adoption of aerial lifts because of the absence of a non operated equipment rental market with most contractors preferring to own their own equipment. Distributors also tended to treat aerial lifts as a niche product and therefore set their

margins accordingly. The result was the widely held notion at the time that such machines were a 'bit of a luxury'. As a result the concept tended to be sold on the basis of safety rather than efficiency, a notion that has dogged the European industry until quite recently and still persists in some areas.

Another brake on the early development of the European market, which still causes additional rental rate volatility, is the short contract period for access equipment in Europe. The UK and Ireland tends to revolve around weekly rates, while many continental markets focus on daily rates. North America by comparison has always based aerial lift rental rates on a monthly term. The result in the early days was that the cost of delivery was a significant factor in the average contract, compared to small truck mounted or trailer lifts. In spite of this the market for electric scissors steadily gathered momentum, particularly from the mid 1990's on, helped by a number of product developments and falling real prices.

Swing out trays and rental friendly.

A major breakthrough in the market came when Skyjack - a relative latecomer to the market from Canada - developed its first SJ series in 1985, launching in 1986. It took the market by storm by releasing a relatively wide range in terms of widths and heights, with a strong family approach - all sharing the same components - but most importantly of all, the key internal components were all located in swing-out chests, making access for service and maintenance or repair, a breeze, while simplifying production.



They included the first swing-out component trays.

Although Skyjack's new products introduced some completely new ideas, the key to their success was through incorporating the best ideas from competitors into what were considered at the time to be state of the art machines. As an overall package, the products had enormous appeal for rental companies, at a time when some other manufacturers were struggling. The fact that the smaller Skyjack electric scissor lifts have changed little over the years, is a testament to those first products. Skyjack has been able to refine and evolve its small scissor lifts rather than start all over again, as has been the case with some other producers.

Pothole protection

While the overall concept of the small electric scissor lift has not changed a great deal over the years, a more detailed look highlights massive improvements and enhancements.

A major development that is now obligatory on narrow lifts is automatic pothole protection, conceived by Mayville engineering in the mid 1980's, initially to provide some of their lighter scissor lifts with enough stability to meet the ANSI five degree side slop test. The company quickly realised that a version fitted to its heavier scissor



MEC/Mayville began using the pothole protection bars as a marketing tool from the late 1980's.

lift would help prevent one of the most common causes of accidents with small scissor lift, that of inadvertently driving into a pothole or off a kerb. First introduced around 1987, it took almost 10 years until this development became the 'norm' rather than the exception.

Turning on a dime

Another key development, over centre steering, also started in the mid 1980's from California-based UpRight. Already well known for its larger Flying Carpet scissor lift, the company had struggled to turn a profit on its smaller Flying Tiger scissors. In the mid 80's it re-entered the market as a manufacturer of small scissors, while launching the 20ft platform height SL20, which used a sigma linkage rather than a scissor stack. Priced very competitively, the SL20 concept found particular attraction in parts of Europe, where it generally escaped the guarding rules that spoil the appeal of narrow scissor models.



Iteco quickly adopted UpRight's over-centre steering design and more recently followed JLG with direct electric drive.



Mayville patented the lift geometry that most modern compact scissors use today.

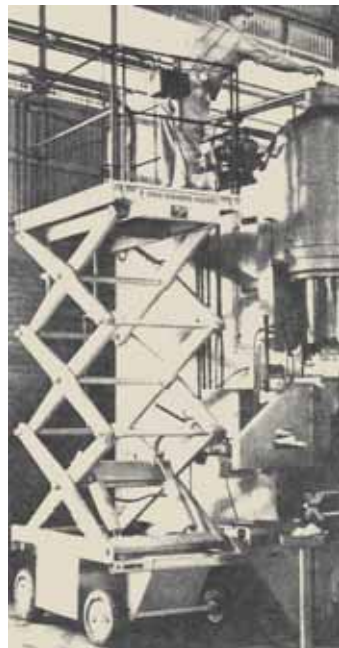
Following its success, the company introduced its US-built XL range of scissor lifts which included a patented over-centre stub-axle steering design with hydraulic front wheel drive. This shift, from regular Ackermann type steering, permitted an almost 90 degree crank angle for the front wheels, allowing its new XL19 and XL24 lifts to turn within their own length. Traditional Ackermann steering reduces the effective overall width of a vehicle as the wheels are turned, especially beyond 45 degrees. This presented competitors with the option of either making their lifts heavier to compensate for the narrower width in sharp turns, or remaining with significantly larger turning circles.

The design was soon copied by Marklift and Iteco and as the company was on the verge of agreeing a licensing deal with Mark, JLG joined the fray. UpRight decided that it was too expensive to fight the infringements - particularly against JLG - with no guarantee of success and the design has become standard on all small and most electric scissor lifts.

Smooth efficient low pressure lifting

Most three or four stack electric scissors now use a single long lift cylinder that runs diagonally from one end of the bottom stack through the centre of the next stack to the other end of the stack above. While this might sound obvious, early small scissor lifts used all manner of configurations, from horizontal screws and cylinders that pushed the lower arms together, to those lift cylinder geometry's that could not get the

lift started and needed helper cylinders or big springs to achieve lift-off from the fully stowed position. Mayville engineering was the first volume producer to push diagonally between two pivot points, a design that it patented and defended over the years. The design provided smoother lift throughout the lift cycle and by avoiding peak hydraulic pressures saved power. Attempts to defend the patent were mixed, as prior-art had existed on a number of niche products, including aerial lifts, however it did cause many manufacturers to modify their designs slightly in order to sidestep the patent.



The first elevator scissor? The Manlift MSM21 was short and weighed under 1,000kg - but it was wide at 42". Launched in 1973 it was probably ahead of its time.

The elevator scissor

In 1994 another development was the 'elevator scissor lift'. The idea for a shorter lift had been around for many years, with Selma Manlift's very short 15ft platform height MSM21 possibly the first in 1973, followed later by the 19ft MSM25B complete with rolling stabilisers. Considerably later Mayville also launched a small product into the sector, although with lower platform heights. UpRight combined a number of new developments into its new ranges and with the USA and UK coming out of the recession of the early 1990's the new products took off.

In the States, the idea of providing each man with his own scissor lift so that no one was left twiddling their thumbs while they waited for a lift, became the norm but has yet to be widely adopted in Europe where



The MEC Dynamite - 1992 - was probably the first modern elevator lift but at 16ft it never really took off.

contractors still mess around off-hiring or changing supplier mid-project in order to benefit from saving a few weeks rental and obtain a slightly better rate. As countless studies have shown, this 'penny wise Pound foolish' attitude is one of the key reasons why European construction costs are consistently higher than in North American.

The original UpRight MX19 was only 1.6 metres long and weighed just under a 1,000kg. Changing regulations over the years has added bulk to these products, to the point where some of them are now nudging 1,500kg while lengths have increased in some cases to almost two metres. For most users however it is the compact and manoeuvrable nature of the machine that is its leading attraction, being less expensive and more compact to transport and store, rather than the specific one tonne elevator test.

The Ream Limiter

Another breakthrough for the small European scissor lift was the adoption of the descent interrupter/cut-out - or Ream Limiter as it was known - rather than scissor guards ensuring that people did not get their hands or other bits inadvertently trapped in the closing scissor pack. It took a number of battles to get the system widely accepted by local Health and Safety inspectors, but rental companies were ready to adopt it, given that the largest single repair cost and cause of downtime was damaged scissor guards. The idea to use such a system was later written into the EN280 standard for

all machines of 1.20 metres or narrower - the standard overall width of a hospital gurney or bed - a typical EU and slightly bizarre, compromise.

Controlling the motor

By now the components used in small scissor lifts had been significantly refined and improved, helping reduce an early problem of poor battery life. The owner of a UK rental company, Peter Hird, helped encourage design improvements in this area by introducing his Hird test - a standard test for comparing the battery life of electric powered lifts.

The introduction of motor controls in the mid 1990's not only quietened scissor lifts down and made them smoother, but significantly extended battery life. By controlling the speed of the electric motor driving the machine's hydraulic pump, the system only uses the exact power required. Motor controls had already become a standard in the forklift industry and had already been used in the access industry by niche German manufacturers. However it was JLG that brought the concept to the volume aerial lift market, with the HA30N, a 30ft non telescopic articulated boom lift. The product itself was not a success but it did bring in motor controls along with direct electric drive for the wheels. Most, if not all small scissor lifts use motor control today, but link them to hydraulic wheel motors.



UpRight X series pioneered the descent cut-out liberating small scissors from expensive and cumbersome guards.



JLG introduced the first direct electric drive on its ES series scissors in 2003.

Direct electric drive AC-DC

Not only did the motor control systems save energy, they also reduced wear on the pump and simplified the hydraulic controls. The next step for the electric scissor lift drive systems was clearly going to be the adoption of direct electric wheel drive motors. While this is now standard on electric booms it is still the exception rather than the rule on small scissors. The easiest way to add direct electric drive is to fit electric wheel motors to the rear, non steering axle. Easy except for the over-centre steering that that is capable of turning the front wheels 90 degrees causes a problem as the rear wheels try and push wheels that are diametrically opposed to the line of force. Even with regular steering the fact that the two rear drive motors are rotating at the same speed causes strain and tyre scrub.

One solution is to sense the position of the front wheels and then operate the speed of each rear wheel independently according to the steering angle selected, almost counter-rotating them in an extreme turn. The problem with this is the cost and the complexity - hard to justify on small low cost machines and just one more thing to go wrong. Electric wheel mounted motors did become available for the steered axle, but initially they were way to costly and too large for a narrow scissor lift. Finally in 2003 JLG 'cracked it' and developed a compact electric wheel motor for its new range of ES mini scissor lifts. The resulting products do have significantly greater battery life, particularly in applications involving a good deal of travelling/driving. A number of rental companies charge a premium for bookings

specifically requesting these models, which range from the 1230ES - with its mast lift mechanism, to the 32ft platform height. 3246ES.

....No rush....

Until recently the only other company to adopt this technology on small lifts has been Iteco, although last year Japanese manufacturer Aichi, unveiled its new 'Global' small scissor range complete not only with direct electric drive, but a direct AC motor drive system rather than the DC system used by JLG.



Aichi has now introduced an AC motor version.

Aichi is not the first mass producer to introduce direct AC drive. Genie has that title, having launched the system on its Z40/23N, 40ft narrow aisle boom lifts in early 2007. The new Aichi scissors have now been out in the market for almost six months and apparently working well.

Interestingly unlike the other 'breakthroughs', the world is not rushing to adopt direct electric drive. Some six years on, JLG is still the only major scissor lift producer to fit it. Why? Firstly there is almost certainly a manufacturing cost penalty. While JLG does try to obtain a premium, only a few buyers are prepared to pay more for its ES range. The key benefit of electric drive is for applications that involve extensive use of the travel/drive function. Unlike boom lifts or larger scissors, mini scissors are rarely driven over large distances. In Europe most are used indoors and are not suited being fitted with solid tyres and a narrow chassis.



Consideration is increasingly being given to attachments to make work easier, such as this clip-on plaster or ply board carrier



The largest electric scissor lifts from Holland Lift are now being equipped with four wheel drive and four wheel steer in order to provide better manoeuvrability.

Higher and narrower

Unlike larger machines it is much faster and easier to lift them with a fork lift if they need to be moved over any distance. Under these circumstances, the battery life of most scissor lifts is more than adequate for most applications. Finally several manufacturers sell on simplicity, familiarity and low-cost, easy repairs and the traditional hydraulic drive system suits this mind-set perfectly. Having said this in 10 years time most small scissors will almost certainly be equipped with direct electric (probably AC) drive but, for now its uptake is very slow indeed.

What brings the future?

Currently, the small electric scissor has been refined and improved to the point where most of the products on offer are first class, reliable workhorses with similar specifications and performance. The problem for most manufacturers is fleet renewal because the products today - as far as the user is concerned - are very similar to those six or more years old. So what can we expect in the years ahead?

The next stages of development might well involve reducing the production costs rather than adding more features. The lower the acquisition and running costs, the lower the rental rate and the more people will use them. Prices have already fallen substantially over the years, both in real terms and even more so after allowing for inflation. Twenty five years ago it was still possible to sell a 20ft scissor lift to a regular rental company buyer for \$12,500. Today you will be lucky to get \$9,000 for a far better machine. The key question is at what level would a lower price trigger significantly more volume?

One significant idea has been to take the narrow aisle concept ever higher. Until relatively recently this was the domain of companies such as Holland Lift which now offers 1.2/1.3 metre wide electric scissor lifts with working heights of up to 28 metres. However if we focus on small scissors, the target has always been how high can you go and still pass through a single doorway, initially this was the domain of the 20ft platform height



Holland Lift's 28 metre 1.3 metre wide top of the range narrow aisle electric scissor lift

scissor lift, but Skyjack quietly broke through this barrier more than 10 years ago with its SJIII3226, a 26ft platform height 32 inch/820mm wide machine. Genie and UpRight followed suit along with Haulotte and JLG. For many, if not all applications, the wider -1.2 metre (46 inch) double door lift is still preferred for its larger deck, better stability and higher lift capacity.

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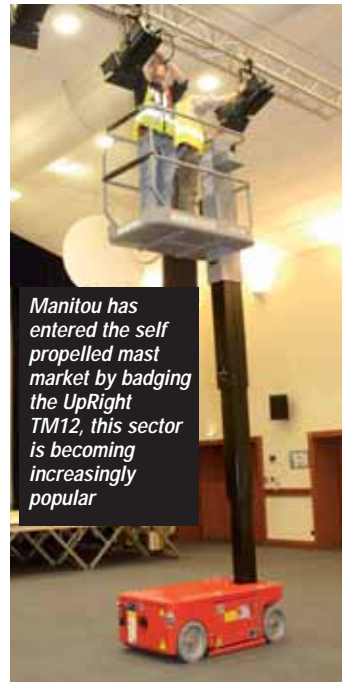
When small electric scissor lifts first came on the scene they replaced other forms of access, such as scaffold towers and large step ladders for work of four metres and more. However these days they are also widely used for even the lowest-level work and it is not unusual to see a small scissor at work with the lift mechanism hardly extended at all. In North America this has come about as it is simply

While the GS3232 concept has yet to spread to other manufacturers, the idea of inboard levelling jacks has taken off among the manufacturers of big electrics such as PB, which now offers them as an option on all of its models.

Hello Jack

Two years ago Genie announced its GS3232, a 32ft platform height, 32 inch wide electric scissor lift. In order to reach the full height though, the machine must level itself, using four built-in jacks, thus avoiding the extra weight required to cope with slopes and driving at full height, while using the same drive components as the smaller models. The result is a machine that is no bigger and not a great deal heavier than the narrow 26ft models. The key question though is how often do you need to pass through an opening of less than a metre and then have working heights of 38ft/11.5m? Rooms of this height tend to have double doors. There is a benefit of more compact transport and storage space, but for many end users a wider more stable platform is more important. So while the 3232 concept has not taken off, the inboard levelling jack concept has, mostly on larger heavier specialist scissor lifts built by Dutch and German manufacturers. The benefit on these behemoths is to meet outdoor stability criteria will also offering the ability to level up on slopes or even small steps or kerbs.

The Genie GS3232 takes the single door concept up to a 12 metre working height.



Manitou has entered the self propelled mast market by badging the UpRight TM12, this sector is becoming increasingly popular

a great deal easier and often cheaper to rent a scissor lift than a tower. In parts of Europe, particularly the UK, it is driven by contractors of developers misunderstanding the Work at Height Regulations or wanting to keep things simple by banning the use of ladders on their projects.

This phenomena is creating a great deal of interest in smaller lifts, partially for cost reasons, but also practicality, as smaller units are lighter and usually more gentle on floor surfaces, while offering a lower entry height. In the UK this has led to the introduction of an increasingly wide range of push-around scissor lifts which are also less costly to buy or rent. In other markets, particularly Scandinavia, the 12ft mast type self propelled lifts, such as the UpRight TM12, Genie Runabout and JLG 1230 ES are increasingly popular and doing work that in other countries is carried out with 19ft scissor lifts. Where they are widely adopted, they are steadily replacing all but the smallest step ladders and towers.



Most mini scissor lifts now have ample gradeability for driving up fairly steep loading ramps.



Skyjack's SJ12/16 concept at Apex

At Apex last year, Skyjack showed a concept machine with took the more popular steel-masted, self propelled lift to a 16ft platform height, complete with a traversing deck. The innovative new lift, retains most, if not all of the sectors key attributes of light weight, short overall length and very low entry height while offering an extra 1.2 metres of working height. Expect deliveries to begin later this year or early next year.

Custom Equipment

Another low level product that has done well in North America, yet slow to be launched in Europe, is the Custom Equipment 10ft platform height Hy-brid 10. Essentially the platform is a lower height, lighter weight scissor lift with very low level entry with dual caster type steering axle that allows it to turn on carpet while stationary without 'rucking'. The company has introduced a CE version of the product and been discussing distribution for what seems an eternity. With the dollar having strengthened and

larger push-arounds coming on the market, Custom may well have 'missed the boat', at least for now.

At the recent Rental show the company unveiled what it described as a concept machine, the five foot platform height self propelled Hy-Brid 5530. The new model uses a traditional, albeit tiny, scissor pack, rather than a mast, but benefits from similarly compact dimensions to the other mast lifts. The company says that the 5530 will weight less than 400kg and is likely to cost around \$5,000/£3,750 complete with a full roll-out deck extension. The company says that it is seriously looking at a higher model, possibly with a 10ft platform height. Custom Equipment owner Steve Kissinger told C&A that during recent renovation work at its head offices contractors staff all preferred the 5530 to the regular scissor lifts, a phenomena also seen when both 12ft steel mast lifts and 19ft scissor lifts are on site with many gravitating towards the 12 foot units possibly due to their better manoeuvrability and lower entry height.



Custom Equipment is launching a 5ft self propelled mast lift later this year

Other new ideas beginning to find their place, include electric powered four wheel drive scissors, firstly on big industrial machines such as the 28 metre Holland Lift, which also boasts four wheel steer and secondly on true Rough Terrain scissor lifts, pioneered so far by MEC, which recently introduced an electric version of the Speed Level. More on this in a future issue.



The mast lift idea is topped out by the Bravi Leonardo with its dual deck extensions and big gradability



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