AIRLIFT™

Glass Vacuum Elevators

White Paper

November 2022

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History and evolution of elevators

History

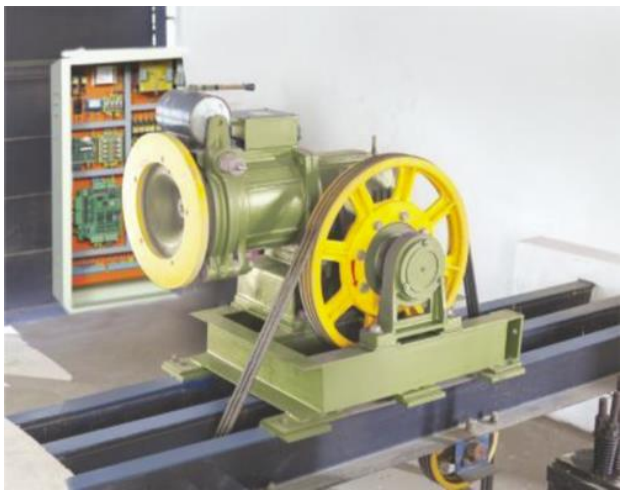
The earliest known reference to an elevator is in the works of the Roman architect Vitruvius, who reported that Archimedes (c. 287 BC – c. 212 BC) built his first elevator probably in 236 BC. Some sources from later historical periods mention elevators as cabs on a hemp rope powered by hand or by animals.

In 1000, the *Book of Secrets* by Ibn Khalaf al-Muradi in Islamic Spain described the use of an elevator-like lifting device, in order to raise a large battering ram to destroy a fortress. In the 17th century the prototypes of elevators were located in the palace buildings of England and France. Louis XV of France had a so-called 'flying chair' built for one of his mistresses at the Chateau de Versailles in 1743.

Ancient and medieval elevators used drive systems based on hoists or windlasses. The invention of a system based on the screw drive was perhaps the most important step in elevator technology since ancient times, leading to the creation of modern passenger elevators. The first screw drive elevator was built by Ivan Kulibin and installed in the Winter Palace in 1793, although there may have been an earlier design by Leonardo da Vinci. Several years later another of Kulibin's elevators was installed in the Arkhangelskoye near Moscow.

The first large scale commercial elevator installation was conducted in the 1st century AD at the Roman Colosseum with 24 to 28 elevators, capable of lifting 600 pound each, lifting spectators and wild animals to Colosseum grandiose gladiator fight shows. At the time of nonexistence of commercial electricity, the spectacular elevator show of the ancient Colosseum was operated by about 260 slaves, with the help of ropes, guides and pulleys [Elevators in Ancient Rome].

Modern elevator designs differ by means of operation, yet they have significant limitations:

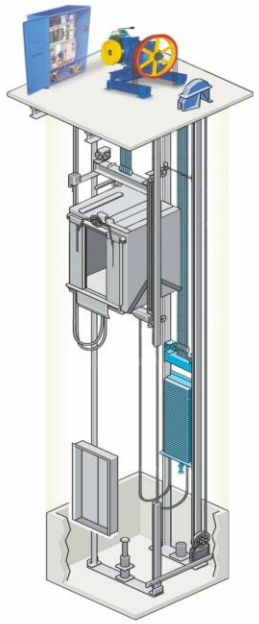


Traction Elevators

Traction elevators are the most common type, where the cabin is raised and lowered by traction steel ropes or belts on a pulley system.

Due to concrete shaft, rails, guides, and counterweights, traction elevators are not space-efficient – traction elevators occupy a large footprint and usually require a separate machine room on top of the elevator shaft. In addition, Traction elevators are expensive to install and maintain and are not suited for low-rise buildings or for use in a private setting inside a dwelling unit or small office due to occupying

large footprint, having high cost of installation and high cost of maintenance, and bearing health risks due to voluminous lubricating oils carrying cancer agents.



Traction elevator designs use a counterweight to offset the weight of the cabin and its occupants. With such design, the motor does not have to move as much weight. Traction elevators may be geared or gearless. In geared elevators, there is a gearbox attached to the motor that drives the wheel and moves the ropes. Geared machines can reach speeds of up to 500 ft./min. These models may have a middle-of-the-road cost in terms of initial investment, maintenance costs and energy consumption. In gearless traction elevators, the sheave is attached directly to the end of the motor. These models can reach speeds of up to 2,000 ft./min. These models have a high initial cost investment and average maintenance costs. Gearless traction elevators are, however, more energy-efficient than geared traction elevators.

Traction elevators are best suited in high rise buildings in a ventilated shaft located outside the living space, where the large footprint overhead and high installation and maintenance cost are tolerable.

Some traction elevators went into the great deal of artistic features at the end of 19th and the first half of 20th century. Examples are the beautiful buildings of Saint Petersburg in Russia, built by famous Swiss-Italian architect Domenico Trezzini in the 18th century, then retrofitted with elevators late 19th and early 20th centuries.

The main principles of traction elevators did not change for 2000 years – ropes (belts) are pulling the elevator up over a pulley, while the cabin is going up and down rolling over rails, old system exhibiting multitude of metal, producing noise and requiring constant lubrication and frequent maintenance.

Hydraulic Elevators

Hydraulic Elevators don't use overhead hoisting machinery. Instead, these systems lift the cabin by using a hydraulic fluid-driven piston mounted inside of a cylinder. The hydraulic fluid has traditionally been synthetic oil-based, creating an environmental impact where installed.

The limitations of hydraulic elevators are low-rise, low speed, high cost of installation and maintenance, high energy cost and high environmental impact, which makes these type elevators unsuitable for installations in private houses. Hydraulic elevators are often found in buildings of up to five stories high, due to low speeds of operation — typically 150 ft./min. or less.

Another reason for the height limitations of hydraulic elevators is the construction of the hydraulic cylinder and the piston that cannot spread to longer heights due to technological limitations. In addition, the power consumption of hydraulic elevators is higher compared to other elevator types.

There are three different types of hydraulic elevators: Holed, Hole-less and Roped. The Holed type of hydraulic elevator has the hydraulic cylinder(s) placed inside of a drilled hole and allows up to 60' of travel. The Hole-less hydraulic elevators do not require a drilled hole, making this type of elevator ideal for existing buildings or in areas where drilling would be too difficult or expensive. Hole-less elevators should not be installed anywhere that requires more than 40 feet of travel. Roped Hydraulic Elevators use a combination of ropes and a piston to move the elevator, and their maximum travel distance is about 60 feet.

Machine-Room-Less Elevators

Machine-Room-Less (MRL) Elevators are traction elevators that do not have a dedicated machine room above the elevator shaft. The machine sits in the override space and is accessed from the top of the elevator cab when maintenance or repairs are required.

MRL elevators are not suited well for usage in private houses or single dwelling units due to environmental impact, relatively high noise level, large footprint, and the mid-to-high prohibitive cost of installation and maintenance.

The control boxes are located in a control room that is adjacent to the elevator shaft. MRL elevators have a maximum travel distance of up to 250 feet and can travel at speeds up to 500 feet-per-minute. MRL elevators are comparable to geared traction elevators in terms of initial and maintenance costs, but MRL elevators have relatively low energy consumption compared to geared elevators. Machine-room-less elevators are becoming the most popular choice for mid-rise buildings where the travel distance is up to 250 feet. MRL elevators are energy efficient, require less space, and their operation and reliability

are on par with gear-less traction elevators. The main reason that MRL elevators have been adopted so slowly in the United States is that the building codes had provisions that did not allow the motor to be situated within the hoistway.

Shaftless Elevators

Shaftless Elevators are small residential elevators designed to fit into 2-story living with minimal disruption during installation. They are a good alternative to a stairlift or shafted elevator.

The limitations of shaftless elevators are many, including safety concerns, which mandate this elevator to travel one floor only, as it represents a fall hazard due to the "open" shaft construction, due to high risk of injury from potential limb cuts. Hence, the shaftless elevators are equipped with multitude of sensors to stop the cabin from motion, should it encounter an obstacle on its way up/down. For safety reasons, this construction is equipped with constant pressure controls, meaning a person to press and hold an elevator call or destination floor buttons to bring and keep the cabin in motion. In addition, this elevator type is noisy, has a negative environmental impact for its bad smell dur to fumes from intense lubrication, and has high maintenance costs.

This type of elevator does not have a shaft and represents an "open" construction, where the rails/guides of the elevator are open and exposed, and the cabin travels up and down the open elevator rails. The motor is installed on top of the cabin and uses ropes/cables to pull the cabin up/down.

Pneumatic Elevators

Pneumatic Elevators use a partial vacuum in the "shaft" on top of the cabin to move the cabin up and down in a hermetically sealed hoistway shaft.

Due to technical limitations, pneumatic elevators have slow speed and small load capacity, they usually can lift a small load (up to 500 lbs for the largest model) and have significant installation limitations due to fully assembled shaft sections to be carried to the installation location. For example, a model of pneumatic elevator that can accommodate a wheelchair, represents a fully assembled tube section of the shaft with a diameter of over 5 feet. Such a construction will not fit into any standard door of an installation site, therefore retrofit installations are prohibitive, while new house installations are non-practical. Another disadvantage of pneumatic elevators is the use of acrylic material for the shaft – it wears out, scratches, and dims over time due to the friction with the cabin's vacuum seal, degrading the look. Also, high noise levels make this unique type of elevators far from being a practical choice for private installations.

In order to keep the cabin at the same elevated level in pneumatic elevators, a valve, situated on top of the "shaft", is shut in conjunction with a diaphragm or a piston used as a "brake". To go down,

pneumatic elevator designs employ a valve so that the air can depressurize the "shaft", allowing the cabin to descent by its own weight.

The ride is not smooth, but rather “bumpy” – e.g., in order for the cabin to go down, first it needs to jerk up to retract brake pistons, then the cabin can go down by reducing the vacuum forces or letting the cabin to descend by its own weight. The same “bumpiness” is also evident during the ascend – when the cabin needs to stop at a certain floor, first it needs to go higher than the floor level, allowing brake pistons to retract, then descend to the floor level and rest on the retracted pistons.

The "shaft" is made of acrylic material and always has a round shape due to technological limitations of pneumatic elevator designs. Acrylic shaft quickly scratches and dims by friction from vacuum seals, rendering a dull look. It also can be easily pierced by a simple screwdriver, breaking the system with no easy recovery from such a damage. On top of all disadvantages, acrylic material melts and burns with lethal fumes, making this device a fire and health hazard.

Shortcomings of incumbent elevators

The shortcomings of existing solutions, that Blissera aim to overcome, is summarized as follows:

Poor design.

Elevators are usually associated with clunky-chunky structures carrying glut of concrete and heavy metal in their construction. While these elements seem necessary at first, the core architecture of elevators has not changed for over 100 years and cries for a change both in the technology and in the aesthetic design. In fact, the technological approaches, that are traditionally used in elevators over many years, impose certain limitations on the size, shape, used materials and the aesthetics of the elevator design, representing a considerable challenge for the look and feel. For that reason, the elevators in private homes are usually concealed in a concrete-like shaft, to cover-up the ugly construction elements like rails, guides, chains, ropes, counterweights, pulleys and gears. As a result, existing elevator systems have become an expensive item in buyer’s budget, where the elevator is considered as a “need-to-have” solution in multi-story living for handicapped, disabled and impaired

Unsafe.

Ropes and cables can break, introducing risk of a free fall, and the system is dependent on emergency brakes that may fire up when cables are broken. The emergency brakes mechanism always requires rails to be present in the construction, as the brakes are being latched on rails. Loss of vacuum in pneumatic elevators creates free fall risk as well. The problem with safety is that any existing elevator design has its safety features dependent often on a single vital mechanism, like brakes latching to rails, which, with any failure, introduces a major safety hazard. Double and triple safety protection for a single feature is often considered a costly overhead. As a consequence, frequent maintenance becomes necessary with regular mandatory replacement of safety parts (e.g. cables, ropes, brakes) to ensure the operability of safety features at all times within the tolerable margins, thus increasing the cost of maintenance. In pneumatic elevators failure in electronics or valve control mechanism may create a free-fall risk as well. Shaftless elevators also possess serious risks of child injury and limb injury due to its open construction

Health Hazard.

Most of the elevators heavily use chemical oils to lubricate moving metal parts like gearboxes, rails, guides. In addition, hydraulic elevators use special synthetic hydraulic oils to push hydraulic piston into motion. All these oils have unwanted fumes carrying cancer agents and bringing unwanted oily smell into people’s living. If placed in a common area with well-ventilated shaft (as modern mainstream installations are implemented), this becomes a tolerable problem to have. But when

installed in a private setting or a confined space – exposes people to hazardous fumes and becomes a health hazard

Bulky

Existing elevators occupy a large footprint. Traction, hydraulic and MRL elevators pretty much require a concrete shaft, a space for rails and guides, a space for sliding doors mechanism within the shaft and a space for counterweights, which extends the shaft footprint way beyond that of the cabin. As a matter of fact, traction, hydraulic and MRL elevators occupy a 3-5 times larger footprint than that of the cabin, making it “very bulky”. Pneumatic elevators are shaped as round tubes and come in pre-assembled bodies, creating an installation challenge. These types of elevators also occupy substantially larger footprint than that of the cabin. For example, the pneumatic elevator model accommodating a wheelchair measures 5+ feet in diameter, which is unlikely to fit into any house door, becoming a retrofit showstopper. Shaftless elevators, on the contrary, occupy the smallest footprint, but are limited to one floor travel and represent a serious safety hazard. Bulky solutions have a major drawback when installing an elevator in existing houses and may be prohibitive when considering a retrofit elevator solution

Noisy.

The noise from a running motor, pulleys, guides, chains and, in case of the pneumatic elevator, a high noise air compressor – represent an additional challenge when considering an elevator installation into private houses and apartments

Slow speed.

All home elevators are extremely slow, traveling at speeds of 5-8 inches per second. Faster solutions are usually associated with bulkier and costlier alternatives

High energy costs.

Due to friction in gearboxes, pulleys, rails and guides of any existing system on the market, an elevator uses a substantial amount of power for overcoming friction, making the overall system energy non-efficient

Expensive.

Due to heavy metal structures like rails and guides, gearboxes, concrete shaft and lengthy installation, modern elevators bear high product and installation costs. In addition, due to frequent maintenance and replacement of wearable parts, the maintenance cost also becomes high, making the high cost of installing and maintaining the elevator – a prohibitive factor.

Why in-unit elevators are becoming important ?

Market Trend – is multi-story

A new trend has emerged in the construction/development industry – "*growing small*", meaning growing vertically and shrinking in footprint. Due to rising costs of land, it is now increasingly expensive to build single-story houses. As a result, multi-story homes are becoming mainstream, and, in the last three years in a row, there were twice as many multi-story houses-built vs single-story houses.

Multi-story is cheaper

For the same square footage, the cost of building two-story house vs one-story is roughly 25% cheaper. Adding the cost of lot, which, in dense urban locations is prohibitively expensive, the two-story estate roughly costs 60-70% of the cost of comparable one-story. For three and four story houses this difference is more profound, resulting in over 50% cost savings.

The cost of a multi-story house for the same square footage is lower not only due to the smaller and cheaper lot, but also because of a smaller foundation and a smaller roof, which are the most expensive parts of a house. Lot prices are growing twice the rate of inflation, so, naturally, building multi-story became a cost-effective alternative to ranch-style housing.

Townhomes: modern trend in residential buildings – single family occupies 4 floors with an underground garage and an upper patio

Struggle with Stairs

The only drawback is that people have to run up and down the stairs inside their living space quite often. This is a compromise that many residents are willing to make in lieu of a lower cost of their estate. For some residents this compromise works, for others – they have to settle with a more expensive single floor living. What if this drawback can be eliminated and household can regain its freedom and an unhindered access to the entire vertical living space?

4 floors and underground garage for a single unit. Don't you need an elevator in each unit? Match that with the glass outfit of the

Vision

Imagine all townhouses and private houses in America, Europe and elsewhere, with rising trend of multi-floor living, imagine all small office and residential buildings, shopping malls, business centers – they all need compact and elegant elevator solution, which is economical, easily installable, has small footprint, is safe and can nicely fit into the interior. Such solution would become a standard, must-have appliance, like a washing machine or a refrigerator that should be an integral part of modern living.

Millions of elderlies, disabled, overweight, families with small children, people struggling with mobility or simply not wanting to run up and down the stairs five times a day – all could enjoy vertical freedom and benefit from living in more affordable multi-floor spaces, by simply having a personal elevator installed in every unit. This target "user base" is the majority of the nation and we envision that a compact, elegant, safe and affordable elevator will become a standard appliance in modern living. Growing number of multi-floor housing units with an option of having a safe, compact, elegant and affordable elevator in each unit - may be a completely overlooked market opportunity with large number of homeowners and renters in need for a viable personal elevator solution. These people in need of vertical lift in their homes became our heroes. With an ever-increasing number of overweight, disabled, elderly or simply challenged with stairs, the size of this market is multi-millions of potential users worldwide.

Blissera's vacuum lifting technology is better suited for low-rise buildings – a segment, that is mostly overlooked by homebuilding industry, with historically low demand. However, that demand is shifting towards higher need for vertical transportation solution in a multi-floor living environment.

AirLift™ – the elegant solution

The future of vertical ride has arrived

Blissera designs and manufactures AirLift™ – a new type of elevator, that is elegant, compact, safe, eco-friendly and affordable. AirLift™ will become a standard must-have in multi-floor houses and offices and can fill a new and almost empty niche in the market of elevators for private use, representing a sizeable business opportunity.

AirLift™ offers a better quality of life in multi-floor living with superior features, like:

- Elegant – tempered glass is the only structural element in the construction of hoistway and cabin
- Space efficient – 70-80% more space efficient compared to existing solutions due to the absence of concrete shaft, rails, guides, cables, chains, counterweights, that take up lot of space in the traditional elevator
- Safe – fallproof, fireproof, childproof, shockproof, shatterproof, scratchproof, trap-proof, bulletproof
- Pathogen repellant – HEPA filters for air purification, UV lamp for air decontamination
- ADA compliant – accommodates full size wheelchair, optional hands-free use with voice control
- Affordable – low-cost installation and low-cost maintenance
- Other – quiet, fast, smooth, wireless, low power, eco-friendly
- Asset – grows estate value, multi-floor living freely accessible

Sleek modern design

When it comes to installing a furniture or an appliance in your home, design should be one of the most important factors to consider. Blissera designed an elegant and ergonomically friendly solution that can fit into almost any interior, creating luxury and comfort for your living.

The hoistway and cabin of our elevators are made of clear tempered glass and can fit nicely into almost any interior, bringing more light and openness into your environment. Design elements like glass walls of the elevator shaft and the cabin, touchless buttons behind the glass, ventilated and illuminated cabin with hidden light fixtures, small footprint of the elevator and many other features – all meant to achieve high standards in luxury and comfort.

Despite the fact, that all components of the construction of both the Hoistway and the Cabin are fastened together with bolts and nuts, yet there are no bolts, screws, nuts or other fasteners visible in the system, whether observing from inside or outside of the elevator – thanks to our signature “boltless” design technique, as part of our sleek look and feel.

Unprecedented safety

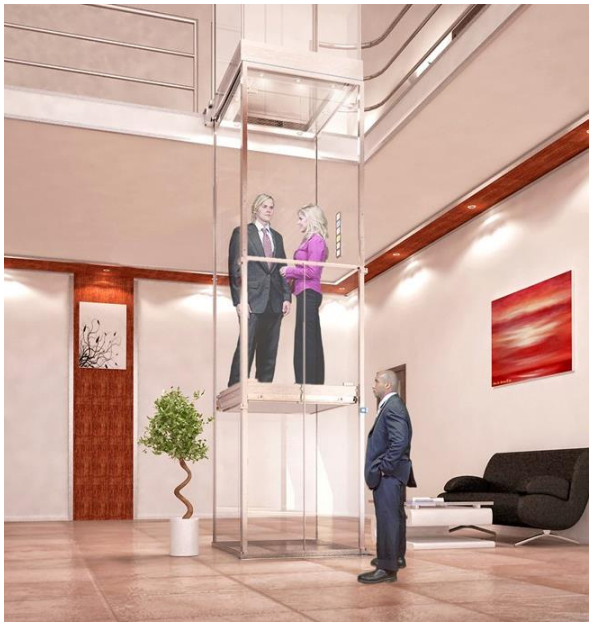
Safety – is the topmost priority. Blissera has eliminated the risks of breaking lifting ropes and cables by eliminating ropes and cables entirely. The elevator car is "hanging" in the vacuum chamber of the hoistway and is suspended by atmospheric pressure and precise machinery.

During power outage the cabin will stay docked to a floor if it was docked before the outage, or will slowly descent to the ground floor, if it was in a motion at the time of outage. Equipped with back-up rechargeable batteries, the doors will automatically operate even in case of a power outage.

The hoistway is made of thick, tempered glass built with multifold margin of safety. Combined with stainless steel foundation and aviation aluminum building blocks, this makes our elevator models very robust and sturdy. Silicon resin seals between glass panels and aluminum frames allow the whole construction to be flexible and resistant to shock waves and moderate earthquakes, while earthquake-resistant pins make AirLift™ elevator able to withstand even strong earthquakes, rendering them practically unbreakable.

In an extreme case of vacuum failure (break of compressor impeller, hypothetical destruction of a portion of the shaft), our elevators are equipped with safety features and emergency brakes that will deploy automatically and suspend the cabin in mid-motion, thus keeping its passengers safe.

Docking mechanism and emergency brakes with double and triple redundancy, extra suspension control and robust mechanical construction – ensures achieving unparalleled safety of AirLift™:



- Fall-proof – implemented with multiple redundancy schema and is 100% fall-proof
  - vacuum seal redundancy – main and secondary vacuum seals of the Cabin
  - emergency brakes redundancy – main and secondary reusable emergency brakes
  - emergency brakes deployment redundancy - electronic and mechanical activation
  - electro-mechanical suspension, smoothly slowing down the Cabin to a full stop
- Shatterproof – reinforced glass, withstands sledgehammer blow, bulletproof
- Shockproof – rests on earthquake-resistant pins, withstanding shakes and shocks
- Fireproof – fireproof materials, thermo-insulated cabin, immediate fire-bunker
- Child-safe – injury-proof, child-proof, tamper-proof
- Accident-proof – door lock mechanism, prevents accidental exposing open shaft
- Trap-proof – power outage friendly, completes ride and opens doors
- ADA compliant – accommodates full-size wheelchair, voice control enabled
- Anti-septic – incorporates HEPA filters for air purification and UV lights for air decontamination
- Eco-friendly – no hazardous chemicals, all recyclable materials
- 24/7 monitoring – automated self-diagnostics and 24/7 connected tech support

Space efficient

The footprint of the elevator is very small – it extends beyond the elevator cabin for about an inch, and the whole construction occupies about 3-5 times (!) smaller footprint vs other solutions that extend beyond the cabin over 1m extra on the sides and back. For example, a 1x1.3m footprint of the AirLift™ elevator hoistway is sufficient to conveniently transporting 4 people or a full-size wheelchair, while other solutions with the same usable cabin space will consume 4-5 sq.m footprint.

Wide openings of the double doors allow easily transporting people on wheelchairs, making AirLift™ elevator a necessary appliance in vertical living for disabled and those with a mobility challenge.

Eco-friendly

Blissera is committed to your safety and health impact of your living. The absence of gears and hydraulics in our elevators eliminates the need for lubrication and hydraulic fluids that contain cancer agents and are harmful to your health. That is why existing commercial solutions always employ a well-ventilated shaft, usually outside of your living area – to keep the harmful lubrication chemicals away from you. Bringing an elevator inside your home – changes the rules of the game. AirLift™ elevator doesn't use rails, guides, or lubricating oils, thus, exhibiting a clean environment inside your home, free of unwanted fumes and harmful chemicals.

Low power

Due to absence of mechanical moving parts, the energy consumption of the AirLift™ elevator is less compared to conventional models. The reason is that conventional models waste significant amount of energy to overcome friction in gears, pulleys and sliding rails, nulling out the benefits of counterweights. AirLift™ elevator car itself is lightweight, the surface of vacuum seal has negligible friction, adding up to the overall efficiency. For example, intensive usage of 30 elevations daily in a 2-floor space uses less energy than a home refrigerator. In addition, AirLift™ elevator generates electricity by using the compressor motor as a generator and using cabin's drag during descent.

Cost-effective

Most elevator products, when quoting the price of an elevator, often exclude few items, that do not directly belong to the elevator, but practically, are part of the elevator solution. For example, elevator concrete shaft is considered to be part of the construction and not the elevator itself. In fact, it is part of the construction and, its price is included in the price of construction works and materials, despite the fact that it belongs to the elevator solution. This artificially decreases the price of the elevator in an attempt to reduce the barrier to buy.

Unlike those traditional price quoting "conventions", when quoting a price of its products, AirLift™ always includes the price of the elevator shaft as part of the elevator price quote and the electrical cabling and foundation works - as part of the elevator installation price quote. Even with all these extra and seemingly expensive items on the pricelist, AirLift™ elevator is still comparable or more affordable versus other conventional solutions on the market.

Competitive Advantages

Feature	AirLift		Pneumatic		Cable Driven, Chain Driven, Gearless, Hydraulic – the rest	
Technology	vacuum based, IoT, wireless, automatic	✓	pneumatic, manual operation	✗	100-years old, boring tech	✗
Design	floor-to-ceiling tempered glass exoskeleton	✓	metal skeleton, acrylic glass, scratchable	✗	poor design – clunky chunky metal	✗
Safety	fallproof, fireproof, shatterproof, trap-proof	✓	fall hazard, fire hazard, breakable	✗	fall hazard, fire hazard, trap hazard	✗
Health impact	ADA-compliant, no fumes, eco-friendly	✓	the largest ADA model very bulky	✗	hazardous fumes from lubricants	✗
Space efficiency	3-5x smaller footprint for same cabin space	✓	bulky, one-door, requires extra clearance	✗	bulky, large footprint, costly to install	✗
Noise level	whisper of the air – 50-55dB (10x quieter)	✓	Harley Davidson in your bedroom – 85dB	✗	average – 65-75dB	✗
Speed	3-10x faster – 12"- 40"/sec	✓	4" – 6"/sec with jerky motion	✗	4"– 8"/sec	✗
Application	both new and retrofit buildings	✓	mostly retrofit installations	✗	mostly new construction	✗
Energy usage	30 lifts/day = less power than a refrigerator	✓	low to average	✓	high – inefficient machinery & friction	✗
Layout options	corner, back-to-wall, shafted, in the open	✓	bulky shaft, need large clearance	✗	confined to a bulky concrete shaft	✗
Install options	opposite side entry for flexible layouts	✓	one-side entry only	✗	optional opposite side entry	✓
Price	low product & maintenance cost + hoistway	✓	high product & maintenance cost	✗	high product & maintenance cost	✗
Market presence	emerging technology		incumbent – 250 distributors worldwide	✓	incumbent – established market	✓

The advantages of a glass vacuum elevator system vs other existing solutions include:

- sleek and elegant look and feel, since transparent large glass panels are a better fit into practically any interior, even if installed in the middle of the room
- exceptionally compact design, occupying several times smaller footprint
- absence of any rails, guides, cables, ropes, belts, pulleys, gears, chains, hydraulics, counterweights, and concrete shaft, therefore, simplifying the installation and maintenance
- better safety features, such as being completely fallproof, fireproof, shockproof, shatterproof, child-safe and power outage friendly
- inherent shipping, logistics and assembly advantages due to less bulky parts
- lower cost of the system due to the use of less costly materials
- lower maintenance costs due to a small number of wearable parts
- eco-friendly, does not require lubricants and fully recyclable.

Aesthetics

The present approaches include a Panoramic Vacuum Elevator system for transporting people, animals and things in a vertically situated elevator shaft, in which large tempered glass panels are used as main structural elements of the elevator hoistway (Hoistway) and the elevator cabin (Cabin).

Contrary to the popular use of glass, that is traditionally used as a filler in a constructive metallic frame-skeleton, the glass panels in the present techniques, are the main structural elements of the elevator system and are the "exoskeleton", carrying the weight of the entire construction.

The glass panels, when used in the Hoistway construction, are stacked atop a "Hoistway Ring" assembly, made of aluminum alloy, and holding glass panels tight and together, forming a sturdy hoistway structure.

The combination of a Hoistway Ring and one-story glass panels assembly forms a one-story elevator shaft assembly with smooth surface inside the elevator shaft assembly. Every one-story elevator

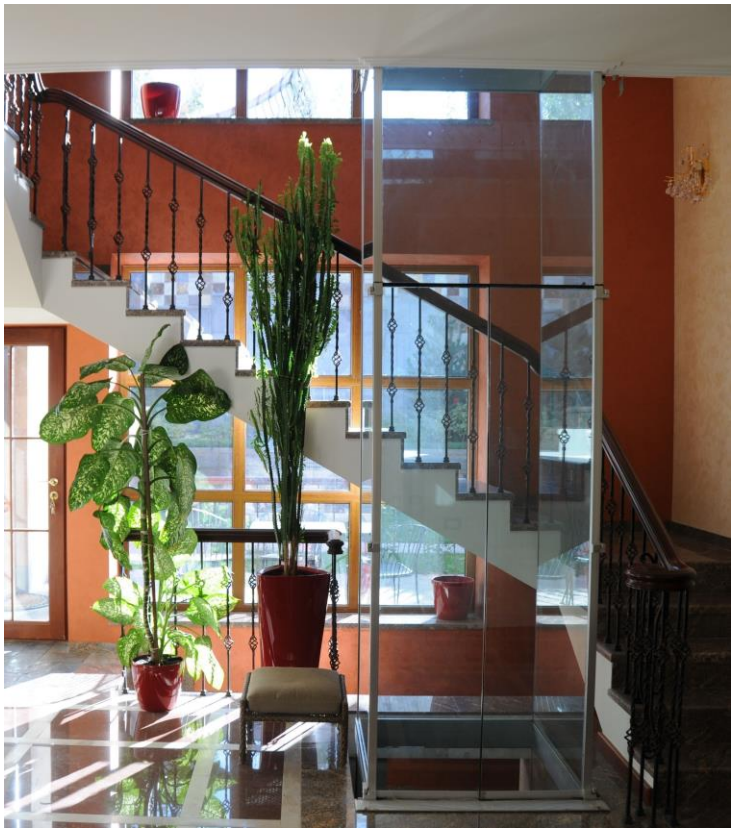
shaft assembly has a doorway entry on one side, “sitting” atop the “Hoistway Ring” and allowing people, animals and things to enter in and exit out of the elevator Cabin.

Multiple one-story elevator shaft assemblies are stacked atop each other, forming an elevator Hoistway, having a doorway entry at each floor level and a uniformly flat surface inside the Hoistway shaft for smooth Cabin ride and proper vacuum operation.

Hoistway Rings at each floor level may be leveled-up with the floor and affixed to the floor, making the whole construction steady. The Hoistway Rings are situated within the thickness of the floor, thus making the glass panels appear to run from floor to ceiling, adding to the sexy appeal.

The walls of the elevator Cabin are also made of tempered glass and are affixed to the Cabin floor and the Cabin top (ceiling) and carry the weight of the Cabin together with its load.

The glass-made Cabin is sliding in a glass-made Hoistway shaft (Hoistway Shaft), supported by vacuum forces via a creation of lower air pressure above the Cabin, allowing the higher atmospheric pressure below the Cabin to push the Cabin up, overcoming the gravity forces imposed on the Cabin and its load.



The Cabin has an embedded docking mechanism allowing the Cabin to dock to the destination floor by means of self-guided extendable and retractable pins, that extend from the Cabin floor and dock to the Hoistway, when the Cabin arrives at the destination floor. After docking, the vacuum compressor shuts down, thus keeping the entire system in low-energy idle mode, awaiting passengers. The Cabin incorporates a single docking mechanism, thus having one docking mechanism working for all floors.

In higher, more luxury models, both the Cabin and the Hoistway have double-leaf doors. The double pair doors are opening in an outward swing and take less space compared to single-leaf option.

In one embodiment, the doorway entries at each floor level of the Hoistway and the Cabin – are facing the same

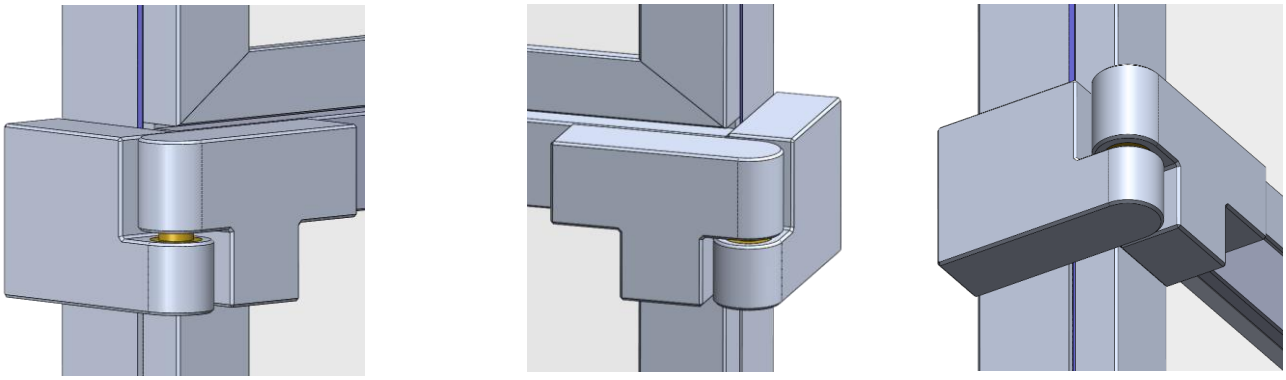
direction. In such an embodiment, people need to enter and exit the Cabin from the same side at each floor level.

In an alternate embodiment the doorway entries at each floor level may be facing different directions depending on the architectural requirements and the layout ergonomics of the living space (opposite side entry).

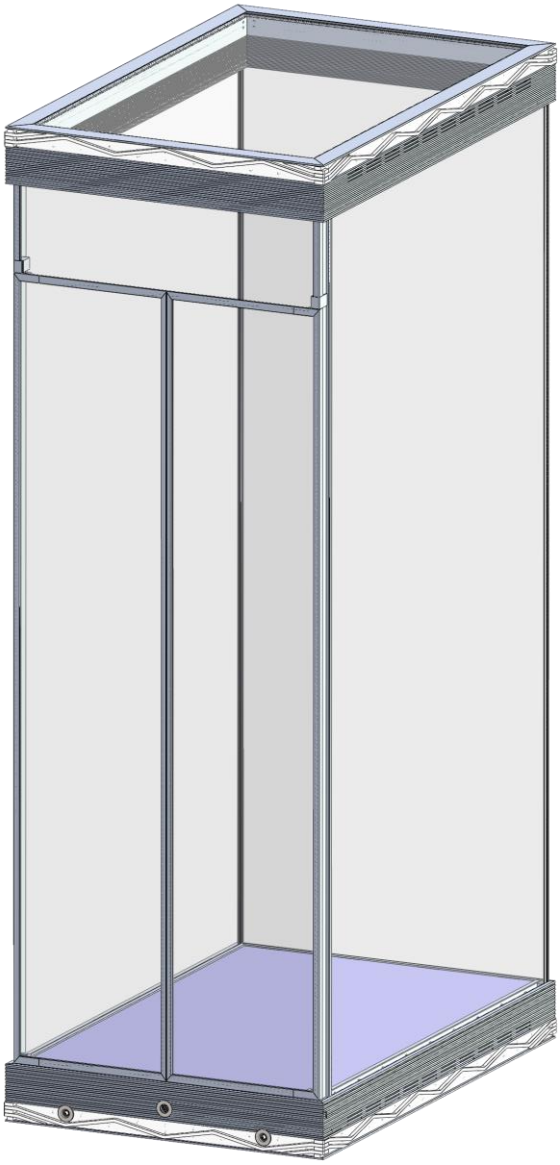
Multitude of sensors are constantly reading states and conditions of different mechanisms and Cabin's position, in order to control the Cabin movement smoothly. In fact, the Cabin "ride smoothness" is measured at 5 champaign glasses. This measurement term is suggested by Blissera. It means that 5 champaign glasses stacked atop each other and placed on the Cabin floor will remain intact and the tower will not collapse during Cabin's undocking, takeoff, ride, docking to a floor and closing/opening the Cabin and Hoistway doors. This is unimaginably good smooth ride indeed.

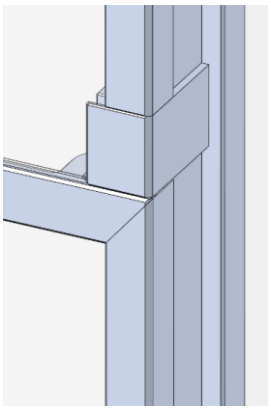
Constant monitoring of the system components through sensors, constant diagnostics of the system health and automated reporting to the Customer Support team any errors and warnings – makes AirLift™ Elevators the most technologically advanced system on the elevator market. The automation in the system diagnostics allows reducing the cost of maintenance and making it affordable for elevator users, especially for private house elevators, where the cost of maintenance is covered by a single family.

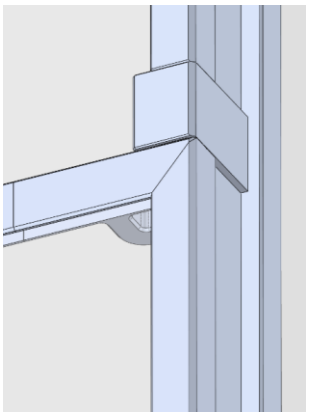
The elevator system includes large translucent glass panels running from floor to ceiling, translucent Cabin with glass walls and glass ceiling, and thin aluminum profiles. In addition, the system does not exhibit any visible means of bolts and nuts both from the outside and from the inside of the Hoistway or the Cabin. Yet the system incorporates hundreds of bolts connecting structural pieces together. This challenging task was carried out to improve the design aesthetics of the system and it puts the present solution in the class of luxury machinery and luxury property.

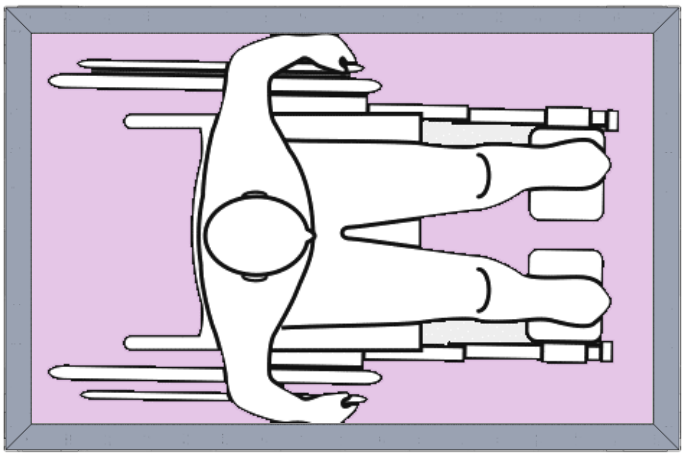


Hoistway door hinges





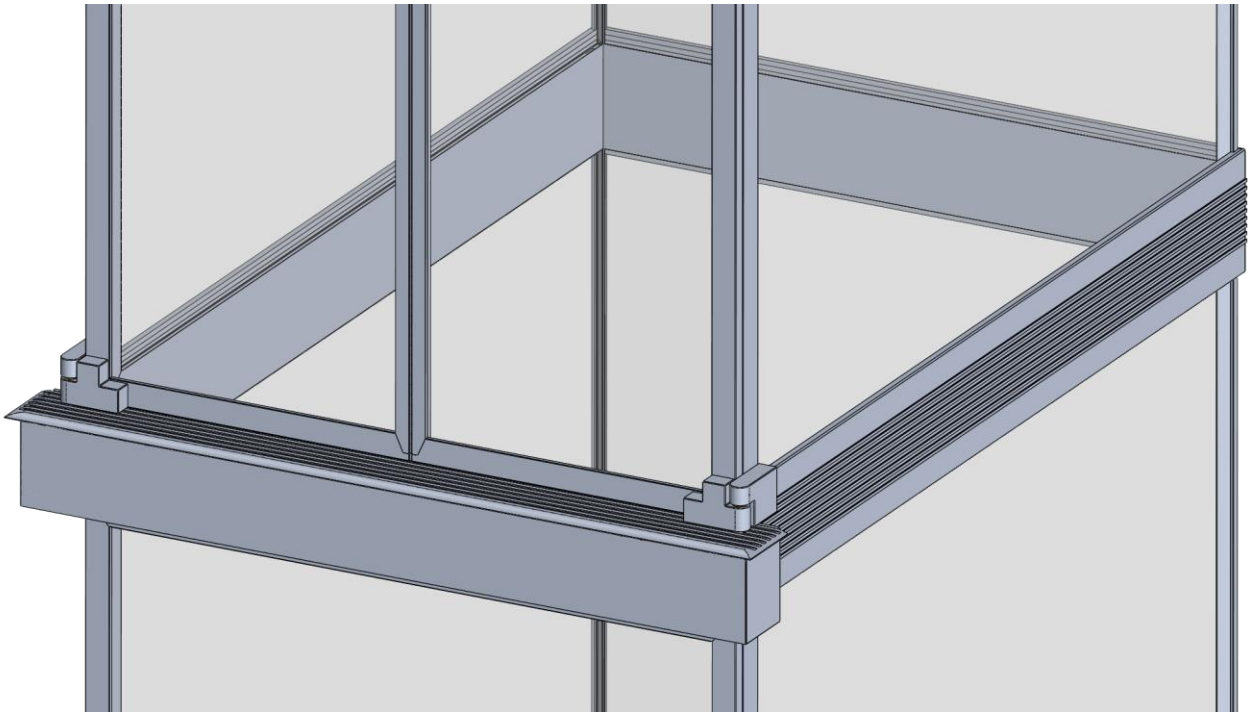




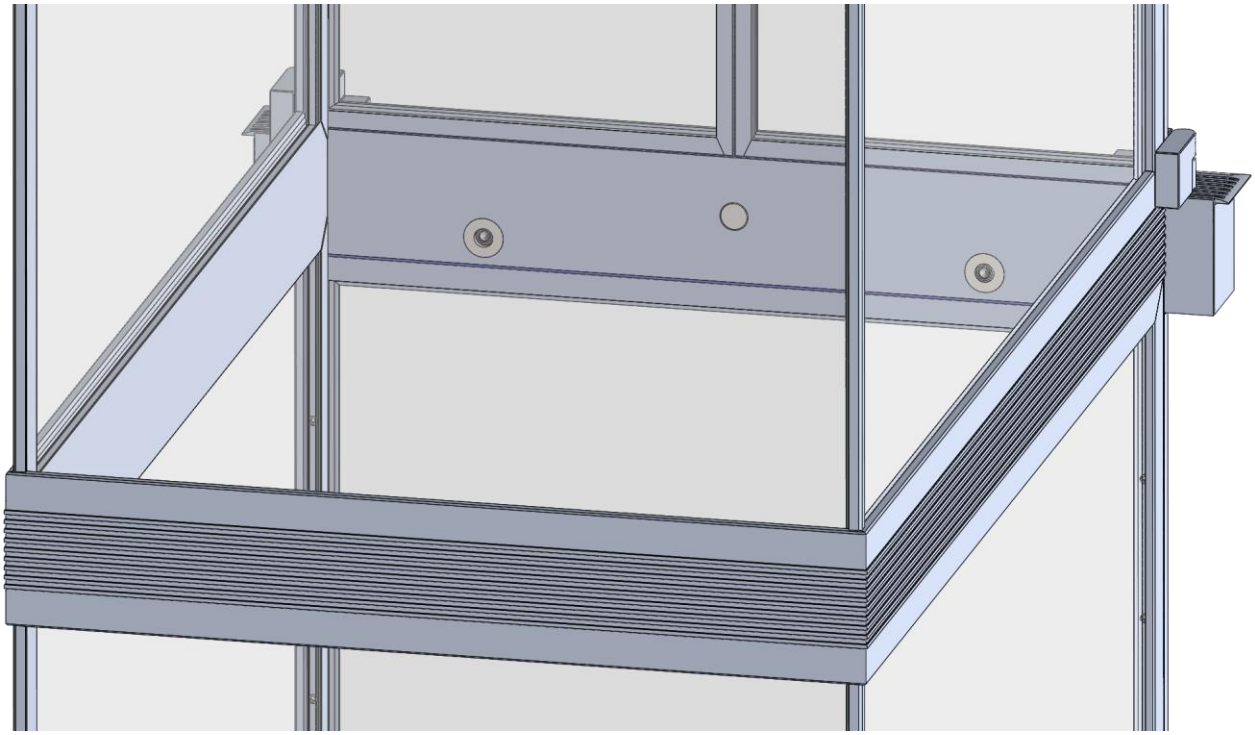
ADA-compliant Cabin

This boltless design allows achieving smooth surfaces in the entire construction. Large glass panels and sleek aluminum frames – is one of the unique aesthetic design features of the present solution.

Lastly, the design features of the metal frames, lines, curves and angles are smoothly transitioning and continuing a design pattern, even at sharp edges, thus, complementing the boltless design style.



Boltless design style of the Hoistway (front)



Boltless design style of the Hoistway (back)

Through the Hoistway glass panels the Hoistway Base is visible (at the back of the above figure), with docking plates on the left and right of the Hoistway Base and the door plate in the middle. These

plates are serving as receptacles, accommodating extending and retracting docking pins from the Cabin during Cabin's docking operation and opening/closing of the Hoistway and Cabin doors.

The system comes with multiple options, based on personal taste, needs and preferences:

- Speed rating – 3 different speed ratings to choose from
- Opposite side entry package – can accommodate complex layouts, also serve 2 dwelling units
- Additional noise reduction – 2 times noise reduction of air movement and compressor humming
- Choice of structural glass: floating, super-white (Pyrex), bulletproof (laminated, multi-layer)
- Choice of glass treatment: transparent, matte, tinted or colored
- Choice of handrails in the Cabin with different textures
- Emergency phone
- Choice of Cabin controls with push-button, touch-button and sensor touch behind the glass
- Choice of antiseptic package, including HEPA filters, air UV light treatment and voice control

Enjoy your magical vertical ride

Very truly Yours,

The Blissera Team