Hydraulic Lifts are better!
Facts, arguments and explanations

Costs
...cheaper

Safety
...safer

Speed
...fast

Sustainability
...greener

Energy efficiency
...energy efficient

Standby
...without standby

Overheating
...cool

Frequency control
...powerful

Planning
...easy to plan

Hydraulics/traction
...better!

motion and progress
Leaf through the arguments

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A study carried out by the Swiss Federal Office of Energy is the basis for the following calculation of power costs for a lift in an apartment building in which 40,000 trips are taken per annum, i.e. approx. 100 trips daily.

Based on this study and known maintenance costs of hydraulic and traction lifts, the result is over **€ 800 annual savings** for a hydraulic passenger lift in an apartment building.

### Annual costs

<table>
<thead>
<tr>
<th></th>
<th>Hydraulic lifts</th>
<th>Traction lifts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance of drive system</td>
<td>100 €</td>
<td>1'000 €</td>
</tr>
<tr>
<td>Power costs</td>
<td>260 €</td>
<td>200 €</td>
</tr>
<tr>
<td>Total</td>
<td>360 €</td>
<td>1'200 €</td>
</tr>
</tbody>
</table>

### Hydraulics

- Drive independent costs for maintenance of lift control systems, doors, car and emergency evacuation services.
- Change of oil and seals every 15 years
  - Labour and materials: 1'500 €
  - Annual share: 100 €

### Traction lifts

- Change of ropes and sheaves every 10 years
  - Labour and materials: 10'000 €
  - Annual share: 1'000 €

With a hydraulic lift, oil and seals must be changed every 15 years. Materials are obtainable on the open market for hydraulics.

With a traction lift, ropes and sheaves must be changed on average every 10 years. The parts required are proprietary and expensive.

### Power costs

<table>
<thead>
<tr>
<th></th>
<th>Hydraulic lifts</th>
<th>Traction lifts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive consumption</td>
<td>650kWh²</td>
<td>250kWh</td>
</tr>
<tr>
<td>Standby</td>
<td>650kWh²</td>
<td>750kWh</td>
</tr>
<tr>
<td>Total</td>
<td>1'300kWh³</td>
<td>1'000kWh³</td>
</tr>
<tr>
<td>at € 0.20/ kWh</td>
<td>260 €</td>
<td>200 €</td>
</tr>
</tbody>
</table>

Power costs are made up of the consumption for trips and for standby times.

² By a factor of 2.6 higher power consumption than traction lifts with a typical load factor
³ One quarter of savings with a hydraulic lift is the result based on dispensing with the inverter
* Source: Swiss Federal Office of Energy, study by the S.A.F.E. Schweizerische Agentur für Energieeffizienz (Swiss Agency for Energy Efficiency), final report on power consumption and savings potential with lifts
Hydraulic lifts are safer than traction in all phases of installation and operation:
Safe installation and service, simple emergency rescue without backup power and high earthquake resistance.
All this is good to know, if you do not want to compromise safety in any way.
The new requirements for protection against uncontrolled movement of the cabin (A3 standard) are easy to fulfil with a hydraulic lift.

### Phase / Event

### Your safety dividend with hydraulics

- **Installation**
  - Hydraulic lifts are safer to install
  - No heavy drives to be installed overhead
  - No counterweights (no risk of collisions or uncontrolled upward movement)

- **Service / Repair**
  - All work on the drive can be done while standing safely
  - No risk to service staff from counterweights
  - No replacement of heavy sheaves and ropes required
  - Drive service can be done with shaft doors closed, minimising the risk to the public of an accidental fall

- **Rescue / Evacuation**
  - Fast rescue downwards, independent of load
  - Simple procedure does not require trained staff
  - No danger from counterweights in multiplex systems

- **Fire**
  - Fast evacuation downwards is standard (with traction MRLs, smoke rising up the shaft can hinder access to the rescue elements on the top floor)

- **Earthquake**
  - The shaft head does not carry heavy loads (drive is on the ground)
  - No risk of dangerous counterweight oscillations

### Additional advantages:

- Minimum service requirements ensure cost-effective operation
- Large planning flexibility allows for an efficient and inexpensive solution to your transportation needs
- Highest ride comfort and low noise emissions with a machine room will satisfy the most demanding users

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Safety without compromise: Bucher Hydraulics

More about safety and A3: www.bucherhydraulics.com/A3en
Total ride time counts, not maximum speed

Hydraulic lifts are fast!

Would you fly by airplane to the nearest town?

Your travel speed would be very high, but check-in, security, and downtime at the airports make up most of the travel time, so the high ticket price would not be justified.

Riding a lift is similar: When the travel is short, max. speed is only reached for a short time. A typical „stop and go“ ride up to 6 floors hardly ever justifies a higher max. speed than 0.63 m/s.

58% higher max. speed (v) only results in an 18% reduction in ride time!

The Swiss Dept. of Energy therefore recommends:
„For houses with 6 floors/stops 0.63 m/s nominal speed is normally sufficient“ *

Comparison for a 4-stop system with 9 m travel:

Hardly anyone rides the full height of the lift, most users average about half - in the above example, the nominal speed of 1m/s is reached for no more than 5 seconds - which is not really efficient!
Where it makes sense, a hydraulic lift can run at 1m/s with no problem.
In most cases, it is worth checking if the up speed can be reduced to 0.63 m/s.

* Source: Swiss Federal Office of Energy, study by the S.A.F.E. Schweizerische Agentur für Energieeffizienz (Swiss Agency for Energy Efficiency), final report on power consumption and savings potential with lifts
Hydraulic lifts are greener!

A well-known Swiss Technical University has made - together with Bucher Hydraulics - an interesting study about the ecological footprint of a hydraulic and a traction lift.

Result:
A traction lift needs a bit less energy during the ride, but has a stronger polluting effect over its lifetime.

This study was performed using the Life Cycle Assessment (LCA) method. The data collected allow for a sustainability comparison between a gearless traction MRL drive system and a hydraulic drive system with electronic control. The basis is a standard passenger lift for an apartment building for 8 people, 1.0 m/s over 15 m. Measurement and qualification are done using Eco Indicator Points (EIP), also known as (environmental) impact points. They cover all kinds of environmental impacts such as climate change, health problems, land use or availability of resources.

Comparison of the impact points for the hydraulic drive system and for the traction drive system:

<table>
<thead>
<tr>
<th>EIP Components</th>
<th>Hydraulic EIP</th>
<th>Traction EIP</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>549</td>
<td>45</td>
<td>+27%</td>
</tr>
<tr>
<td>Energy</td>
<td>701</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Disposal</td>
<td>-286</td>
<td>-343</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>308</td>
<td>391</td>
<td>+27%</td>
</tr>
</tbody>
</table>

Conclusions:
- The hydraulic drive system is more sustainable than the traction drive system.
- Complete replacement of a hydraulic lift with a traction lift does not make ecological sense. A partial modernisation is often the more sustainable approach.
- The impact of energy use during the whole lifetime is far smaller than the environmental impact of the manufacture and installation.
Hydraulic lifts are energy efficient!

To use the available energy most efficiently, you need to know how the lift is going to be used: Lifts in usage category 1 are standing for 99% of the time, an airport lift is running all the time!

Energy efficiency therefore primarily means finding the right drive solution for the specific application: Bucher Hydraulics has the optimum energy efficient drive for every usage category.

### Which product for which application?

<table>
<thead>
<tr>
<th>Typical application</th>
<th>Usage category</th>
<th>Bucher Hydraulics product</th>
<th>Technology</th>
<th>Energy Consumption</th>
<th>Power connection</th>
<th>Price level</th>
<th>Payback period thanks to energy savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small residential or office building, small goods lift</td>
<td>1, 2</td>
<td>Comfort Line / Compact Line</td>
<td>electronic valve</td>
<td>medium</td>
<td>low</td>
<td>medium</td>
<td>low</td>
</tr>
<tr>
<td>Large residential or office building, public buildings, large goods lift</td>
<td>3 and higher</td>
<td>Economy Line: Saturn alpha</td>
<td>Variable frequency drive</td>
<td>low</td>
<td>low</td>
<td>medium</td>
<td>medium</td>
</tr>
<tr>
<td>Shopping Centre, Railway Station, Airport</td>
<td>4 and higher</td>
<td>Economy Line: Orion alpha</td>
<td>Variable frequency drive with accumulator</td>
<td>very low</td>
<td>medium</td>
<td>low</td>
<td>high</td>
</tr>
</tbody>
</table>

### Usage categories and their effect on energy efficiency

<table>
<thead>
<tr>
<th>Usage category as per VDI 4707</th>
<th>usage frequency (effective ride time per day)</th>
<th>Important for good energy efficiency</th>
<th>Recommended solution:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 3</td>
<td>very low (12 to 90 min)</td>
<td>low standby power consumption</td>
<td>Compact Line / Comfort Line: Saturn beta</td>
</tr>
<tr>
<td>3 and higher</td>
<td>medium (90 to 360 min)</td>
<td>low drive consumption</td>
<td>Economy Line: Saturn alpha</td>
</tr>
<tr>
<td>4 and higher</td>
<td>high (180 to 360 min)</td>
<td>low drive consumption</td>
<td>Economy Line: Orion alpha</td>
</tr>
</tbody>
</table>

Example:
For a medium sized residential building a lift is required with a comfortable ride but which will not be used very often. For high energy efficiency low standby power consumption is key, therefore the best product for the drive is the Saturn beta from our Comfort Line.

If the lift not used frequently, then look for low standby consumption; if the lift is high use, low drive consumption is important.
Lifts mostly cost when they are not running!

Hydraulic lifts use less standby!

Traction lifts typically have variable frequency drive, with a high standby power consumption. Hydraulic lifts only use drive power in the up direction, but a bit more than traction. Most lifts are not used very often, which is why standby consumption is more important than drive power requirement (Quote from the Swiss Energy Agency):

„Because of the high importance of standby power consumption, the drive power requirement becomes relatively less important.“ *

Conclusions:

• Typically over 50% of overall lift power consumption is used during standby
• Cost effective measures can reduce standby requirement still further:
  • LED lighting vs. older lighting technologies
  • No permanent door power
  • Timer function for lighting and electronics
• Hydraulic drives use less standby power than traction drives
• Modern electronic valve technology (Bucher Hydraulics LRV-1) saves energy, service and operating costs

* Source: Swiss Federal Office of Energy, study by the S.A.F.E. Schweizerische Agentur für Energieeffizienz (Swiss Agency for Energy Efficiency), final report on power consumption and savings potential with lifts
Avoid heat build-up: Variable frequency drive instead of oil cooler

Hydraulic lifts stay cool!

Keep a cool head, even without an oil cooler!
For highly used lifts an oil cooler is an imperfect compromise - it is much better without!

Grab the problem by the roots and solve it without a cooler with a Bucher Hydraulics solution!

Reduce waste heat by using:

- electronic valve technology
- original Bucher Hydraulics variable frequency drive technology

Avoid unnecessary heat build-up (red)

Ride curve «up»

Competitor standard
mechanical valve
high heat build-up
→ oil cooler required

Bucher VF-LRV
variable frequency
controlled valve
low heat build-up
→ no cooler required

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- Power requirement from the grid
- Heat build-up
- Your energy savings
- No heat build-up

Example*:

<table>
<thead>
<tr>
<th>Heat gain:</th>
<th>3.7 kW</th>
<th>1.6 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required cooling:</td>
<td>2.3 kW</td>
<td>0 kW</td>
</tr>
<tr>
<td>Rides possible without cooling:</td>
<td>45 rides/h</td>
<td>140 rides/h</td>
</tr>
<tr>
<td>Power consumption per year:</td>
<td>14310 kWh</td>
<td>6160 kWh</td>
</tr>
<tr>
<td>Energy costs per year:</td>
<td>EUR 1820.-</td>
<td>EUR 778.-</td>
</tr>
<tr>
<td>Your saving per year:</td>
<td>EUR 1042.-</td>
<td></td>
</tr>
</tbody>
</table>

Investment cost:

| Oil cooler: | EUR 800 | VF drive: | EUR 3000 |
| HVAC costs to the building**: | EUR 3450 | VF-valve technology: | EUR 800 |
| Total: | EUR 4250 | Total: | EUR 3800 |
| Your savings per year: | EUR 450 |

Your benefits:

- Up to 200 starts/h without cooler
- Saves up to 80% drive energy
- Up to 10 dBA quieter
- Shorter ride times with a faster start
- Reduced power connection requirement when combined with a hydraulic counterweight
- Reduced wear thanks to lower oil temperatures
- Cost-effective installation with minimal HVAC costs

* 1000 kg contract load, 4 stops, speed 0.63 m/s, 120 rides/h during 9 hours per day
** Cost for HVAC equipment to exhaust heat from the building: Assumption = 1’500.- EUR per kW cooling load
Reach highest number of rides with variable frequency drive

Hydraulic lifts are powerful!

Bucher Hydraulics variable frequency drive products have been on the market for over 10 years. The benefits of this technology are many:

- High number of rides thanks to shorter ride times
- Maximum availability in high use, high load applications such as shopping centres, hospitals, sports stadiums, railway stations, airports etc.
- Low heat build-up allows for up to 200 rides/hour without oil cooler
- Low noise for a better environment

Our competitors offer similar technology, but in a more restricted scope:

Other hydraulic solutions with variable frequency drives (competitors):

- Typically only available for home lift or passenger elevators
- Complex start-up with adaptations specific to the site
- Ride in down direction and levelling accuracy can be unsatisfactory and depend strongly on load, temperature, and pump characteristics
- Complex to handle, limited ride curve adjustability
- Not easily available as an upgrade
- Lower power input goes together with lower speed / performance
- Insufficient integration of hydraulics, VF drive and lift technologies
- Electronics still susceptible to friction, load and temperature variations.

Original Bucher Hydraulics variable frequency drive technology:

- Available for the complete application range from simple passenger lifts to large goods lifts
- Short and easy start-up thanks to pre-programmed site parameters
- Excellent ride quality under all load and temperature conditions
- Simple parameter adjustment on site if required
- Upgrade of existing installations possible without touching the controller (using Bucher Hydraulics Multikit)
- Hydraulic counterweight allows for reduced power connection without compromising speed or performance
- Technology leader for the integration of hydraulics, VF drive and lift technologies
- Proven technology, thousands of systems in service worldwide since over 10 years

Many satisfied customers can confirm the strong performance of the Bucher Hydraulics variable frequency drive technology. Examples of realised projects:

- Railway stations: Network-Rail (U.K.) 10 year program, Deutsche Bahn Düsseldorf, Berlin, Pudong Airport (Shanghai)
- Airports: IKEA, Kaufland-group, Daimler-Benz, Messe Frankfurt, Great Mosque „Kaaba“ in Mecca, etc.
- Others:
Hydraulic lifts are the best for architects & planners!

Hydraulic lift drives by Bucher Hydraulics have proven successful over many years and in many ways:

- Freedom of design for architects, non-proprietary technology, simple installation, ease of maintenance, long service life and the most modern valve technology.

When installing a lift into a building, care must be taken to select the drive best suited to the specific requirements. For buildings up to 5 floors and high loads hydraulic drives are normally most beneficial.

<table>
<thead>
<tr>
<th>Type of building</th>
<th>Special requirements for operation</th>
<th>Transport requirement</th>
<th>The fitting solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport, station, shopping centre</td>
<td>• High load, high use capability • No overheating during peak times</td>
<td>• People</td>
<td>• Economy Line</td>
</tr>
<tr>
<td>Residential development (condominiums)</td>
<td>• Space-saving design • Low noise emissions • Penthouse can be planned without visible shaft head/machine room</td>
<td>• People</td>
<td>• Compact Line, Comfort Line and the Tiger MRL system</td>
</tr>
<tr>
<td>Single family home</td>
<td>• Low maintenance cost</td>
<td>• People</td>
<td>• Simple car frame and Compact Line</td>
</tr>
<tr>
<td>Commercial building</td>
<td>• High load</td>
<td>• People</td>
<td>• Jupiter tandem car frame and Comfort Line</td>
</tr>
<tr>
<td>Hospital, Home for the elderly, hotel</td>
<td>• Maximum availability • Highest ride comfort</td>
<td>• People</td>
<td>• Economy Line or Comfort Line</td>
</tr>
</tbody>
</table>

The Tiger MRL system

Exceptional freedom
The Tiger system is the most adaptable hydraulic drive for your lift installation. Either with a machine room, or without one. Small shaft dimensions? No problem. The Tiger system gives you the freedom you always wanted.

Reduced shaft pit
A minimum shaft pit depth of just 300 mm (TG2-15) opens up new possibilities for you! With both old and new buildings, the costly excavation of a pit is no longer needed. This doesn’t just save time; it saves money as well.

Reduced shaft head
With a minimum shaft head height of only 2 600 mm, troublesome rooftop structures are now a thing of the past. This is particularly beneficial in the case of older buildings, where the scope for changes is very limited.

Largest possible car floor area
With a minimum wall-to-car gap of 260 mm (TG2-15), you can make the best possible use of the shaft’s cross-sectional area. You don’t give away any space unnecessarily, and you can build the largest possible car into the existing shaft.

Tried and tested drive technology
In the Tiger system, we use only the best components! Once again, our LRV-1 electronically controlled valve, with pressure- and temperature-compensated operation, takes over the key functions. The outstanding ride comfort that it provides is a further feature that will inspire you.
## Hydraulic lifts are better than traction lifts!

**Design and space**
- Smaller space requirement in the shaft
- Flexible machine room location
- A great deal of design freedom for architects
- No rooftop structure is required
- No constraints on doorways or the shape of the car
- Machine rooms do not need to be in the immediate vicinity of the shaft
- Elevator designs can be customised

**Traction lifts**
- Smaller car due to the considerable space needed for the sheave assembly and counterweight, alternatively a larger shaft cross-section and head height
- Architectural design scope is very restricted

**Safety**
- Emergency evacuation procedures are very simple and completely safe
- Much safer when used in earthquake zones
- Safety during service and repair work, since there is no moving counterweight

**Hydraulic lifts**
- Complicated, and in some respects hazardous, emergency evacuation procedures
- In an earthquake, the danger from drive components or the counterweight falling on the car

**Performance**
- Particularly high load ratings
- All vertical loads act in the shaft pit only
- Modern technology and weight-optimisation ensure an extremely attractive price/performance ratio

**Traction lifts**
- Poor load ratings

**Maintenance and service**
- Technically straightforward and familiar principle reduces the amount of installation work in the shaft
- Low-maintenance drive technology
- No wear on pulleys and ropes
- Replacement parts are seldom needed
- Free choice of maintenance companies
- Replacement parts are less expensive, not tied to a particular manufacturer, and available on the open market
- Technicians can work on the drive from outside the shaft. They are consequently not exposed to any hazard and thus save time

**Hydraulic lifts**
- Heavy wear on traction sheave and ropes
- Complicated work procedures, and hazardous working situations
- Long repair and maintenance times
- With manufacturer-dependent systems, the operator is „locked in“ for maintenance and repairs; independent service providers are shut out

**Installation**
- Simple and economical assembly
- Hydraulic elevators are particularly suitable for projects where retrofitting is involved

**Traction lifts**
- The drive system in the shaft head is difficult to access and assembly work is hazardous

**Costs**
- For buildings with up to five floors, the cost effectiveness of hydraulic elevators is virtually unbeatable

**Hydraulic lifts**
- Very high costs for service and replacement parts
Recognise trends, develop products, produce quality

Bucher Hydraulics make the best hydraulic drives!

Bucher Hydraulics are the technology leader in hydraulics and continue to build on this strength. Within the Elevator department we focus on the core of the hydraulic lift: the drive and the control valve. For our customers to be successful with our products, we have to continue to develop new and improved systems. As a competence centre we can depend on the knowledge and competence of our staff in all departments:
  • Research and development
  • 3D-CAD and parts machining
  • Assembly
  • Hydraulic testing

Research and Development

Research and development is centralised at Bucher Hydraulics AG, Neuheim and therefore can pool the knowhow and experience from all 3 divisions: Elevator, Mobile Hydraulics and High Voltage Switch Gears.

The design team creates a new product on screen in 3D-CAD and can tailor the product to suit the desired functionality and application.

Using complex simulation programs we test the product before it even exists. We can identify in advance possible stress areas subject to deformation, flow characteristics, pressure conditions, forces and heat gain.

Parts machining

We produce our steel and aluminium valve casings to the most exacting tolerances using the latest machine tools:

The Quality Control dept. with over 2000 different measuring instruments checks form and position tolerances. e.g. the coaxial accuracy of boreholes, and this accurate to one micrometer (1 µm = 1/1000 mm)! If one hair falls into the valve, it produces an alarm message instantly: A hair is around 50 micrometers thick.

Such accuracy is necessary to guarantee a perfect ride under all load and temperature conditions.
Assembly

The assembly of parts to sub-assemblies, valves and power units takes place in several different assembly lines. These are tailored to product and customer requirements, so that „special“ units can be produced on time for shipment.

As in the car industry the end product runs on a main assembly line, while accessories run on other parallel lines. We call the main assembly line for standard power units the „flow assembly“ line, whereas special sizes run on what we call the „single unit assembly“ line.

Valves are assembled on a circular table, one batch of 12 valves at a time. Electronic parts are assembled and programmed in a special static-free section.

The new Hydro Valley building has allowed us to reorganise production and assembly to optimise processes and parts logistics through the plant.

Testing

Every valve produced goes after assembly on to a test stand for the following steps:

- Flushing and de-aeration of the valve
- Pressure testing of the casing up to 3-4 times operating pressure (ca. 200 bar)
- Leak testing of the sliders at 1.5 times operating pressure (ca. 100 bar)
- General and customer-specific adjustments
- Flow curve simulation and parametrisation
- Production of the test protocol

The test stands are custom built by Bucher Hydraulics - something like this cannot be purchased anywhere:

The central oil supply system in the basement (also custom built by Bucher Hydraulics) supplies oil under various pressures to seven test stands for mobile and lift hydraulics. Oil volume is currently 12'000 litres. The system can be expanded to cater for 14 test stands.