



ThyssenKrupp Aufzugswerke



TWIN® -

A revolution in elevator construction

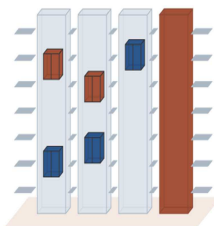
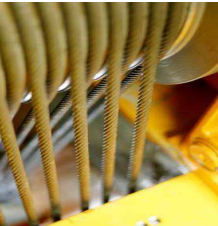
A Company
of ThyssenKrupp
Elevator

ThyssenKrupp Aufzugswerke



ThyssenKrupp



					
The Idea	The Advantages	Our Security	The References	The Details	The Films
History					
Characteristics					
Condition					

TWIN® -

A revolution in elevator construction



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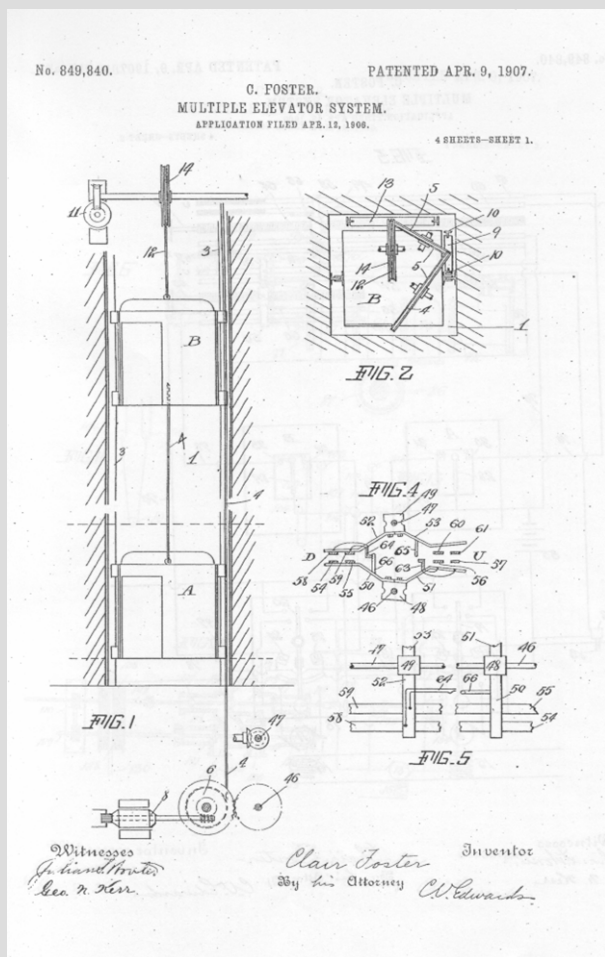
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TWIN®.

A very old Dream of Elevator Constructors.



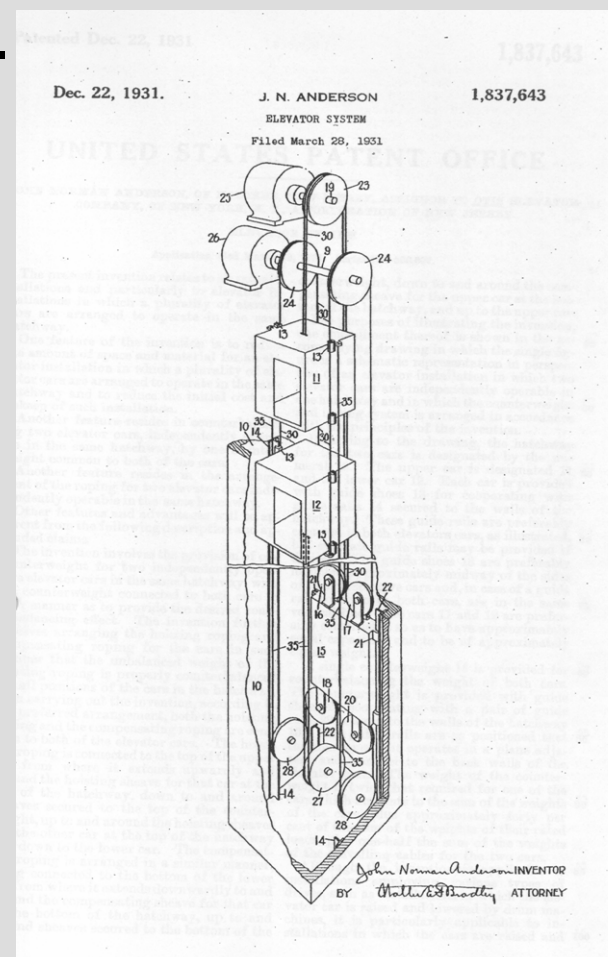
1907

upper car:
traction drive elevator

lower car:
drum drive elevator

1931

one counter weight
for two traction elevators



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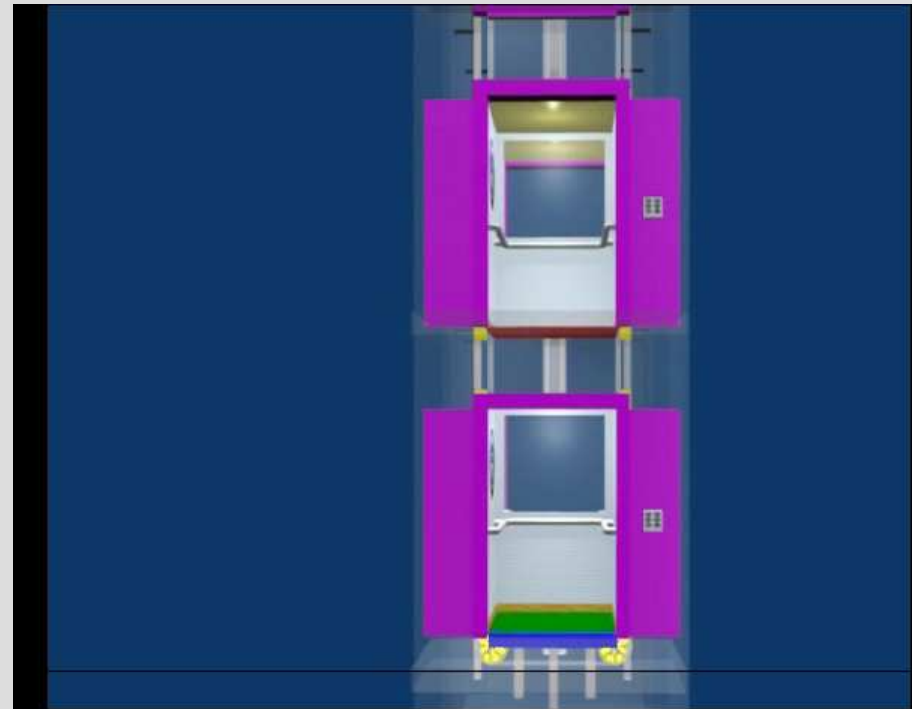


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TWIN®.

Two cars. One shaft.
The quantum leap.

- Two cars are arranged on top of each other in one shaft using the same guide rails.
- Both cars can move independently in the shaft
- The cars can also travel in opposite directions, which means that the cars can travel towards each other!
- Each elevator has its own traction drive and counterweight.



Click on the button to open the TWIN animation with Windows Media Player:



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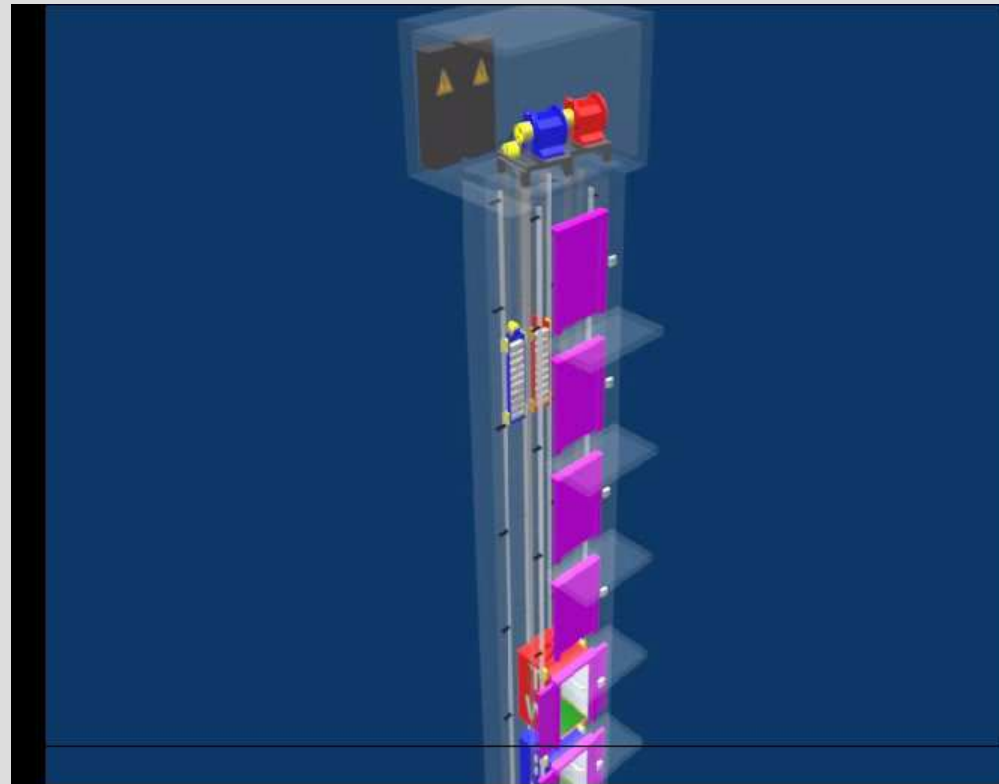


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TWIN®.

Further characteristics.

- Each elevator has its own over speed governor.
- The suspension is installed 1:1 or 2:1, depending on speed and travel height.
- The call assignment is generally performed by the Destination Selection Control DSC, which assigns each call intelligently.



Click on the button to open the TWIN animation with Windows Media Player:



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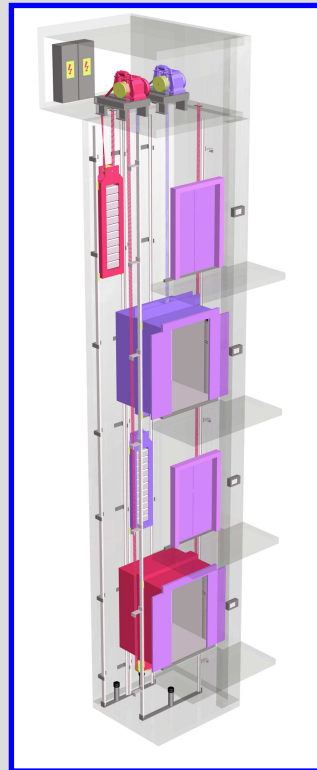
Which are alternative solutions?

...more cars one upon the other !



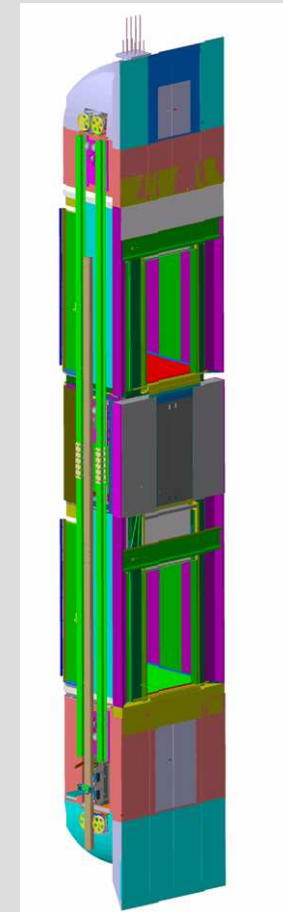
Historical Paternoster

👉 No approval anymore



TWIN®

Double-
Decker
Elevator



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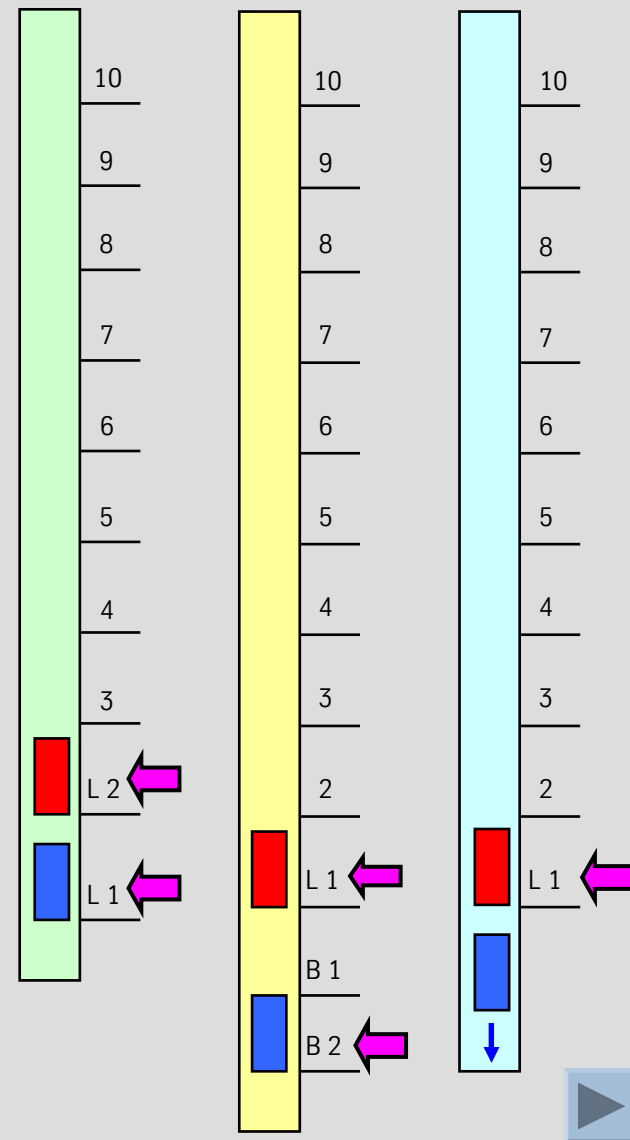
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TWIN®.

Operative range.

Use of TWIN® is favorable,

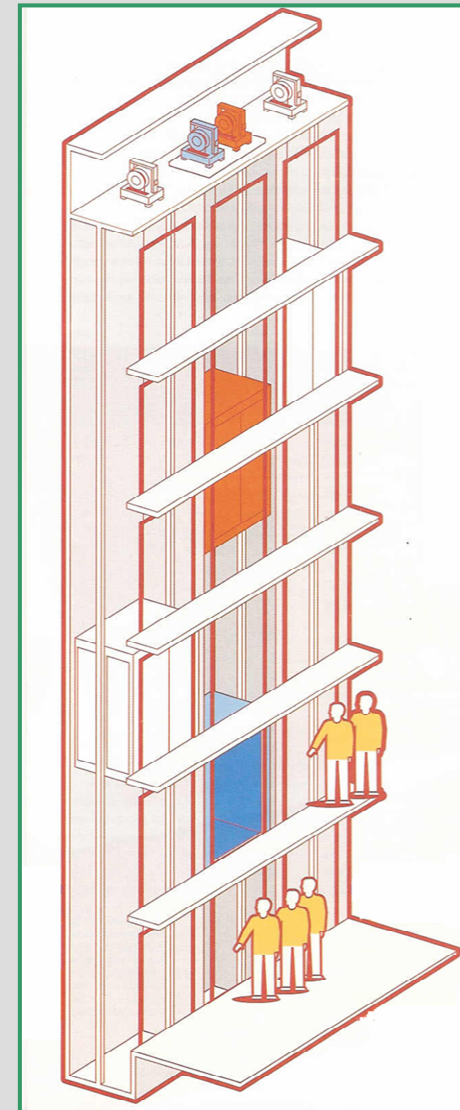
- if there are two main access landings (lobby/reception, parking areas, subway, 2nd street level).
- in case of intermittent traffic between floors.



TWIN®.

Operative range.

- The TWIN® system, combined with at least one conventional elevator is recommended. This makes sure that travel from the lowest to the top floor is possible at all times (e.g. handicapped persons, VIP, ...).
- Call assignment will operate automatically.





TWIN® -

A revolution in elevator construction

The Idea The Advantages Our Security The References The Details The Films

Modernization
New Systems
Double-decker
High-rise Building

Navigation icons: back, forward, search, and a play button.

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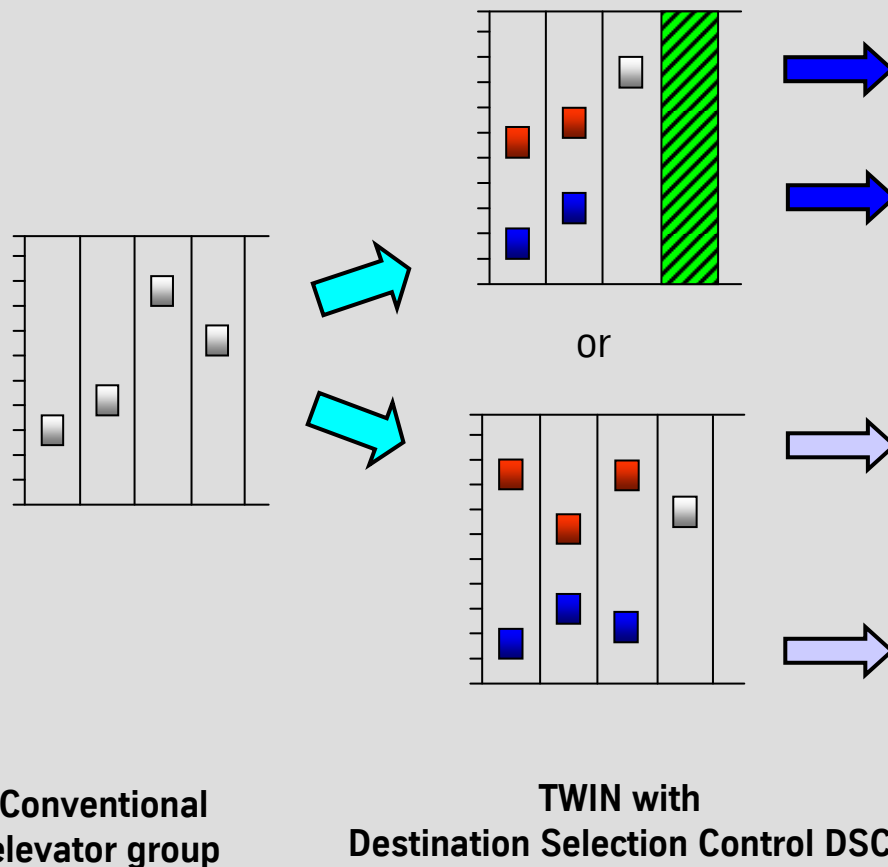
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TWIN®.

Goal: Shaft economizing!



Economizing of construction volume

Additional available floor space

⇒ more rental space,
additional technical equipments,
like Air Con, IT- data cables, etc.

New installations:

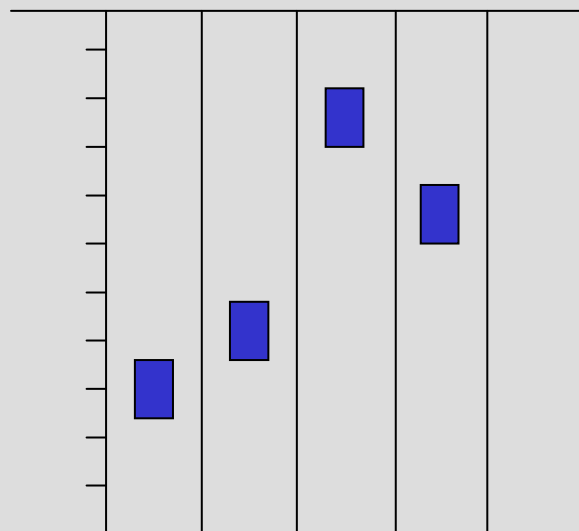
Higher handling capacity with
the same number of lift shafts.

Modernization:

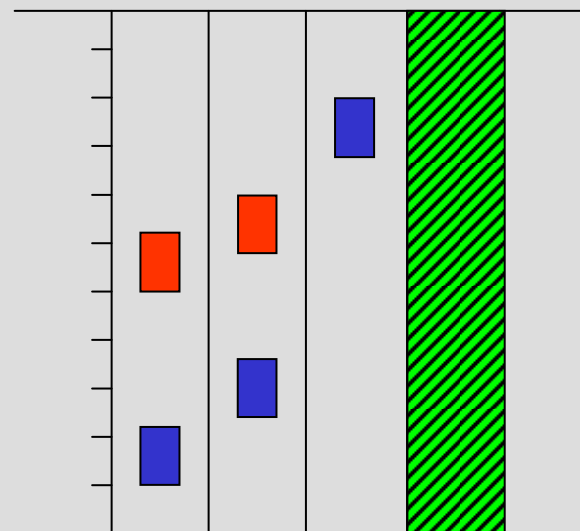
Increasing of handling capacity
in existing buildings.

TWIN®.

Goal: Shaft economizing!



Conventional elevator group
with 4 elevators.



New group with 5 cars consisting of 2
TWIN and 1 conventional elevator:
At least equal handling capacity
with fewer shafts!

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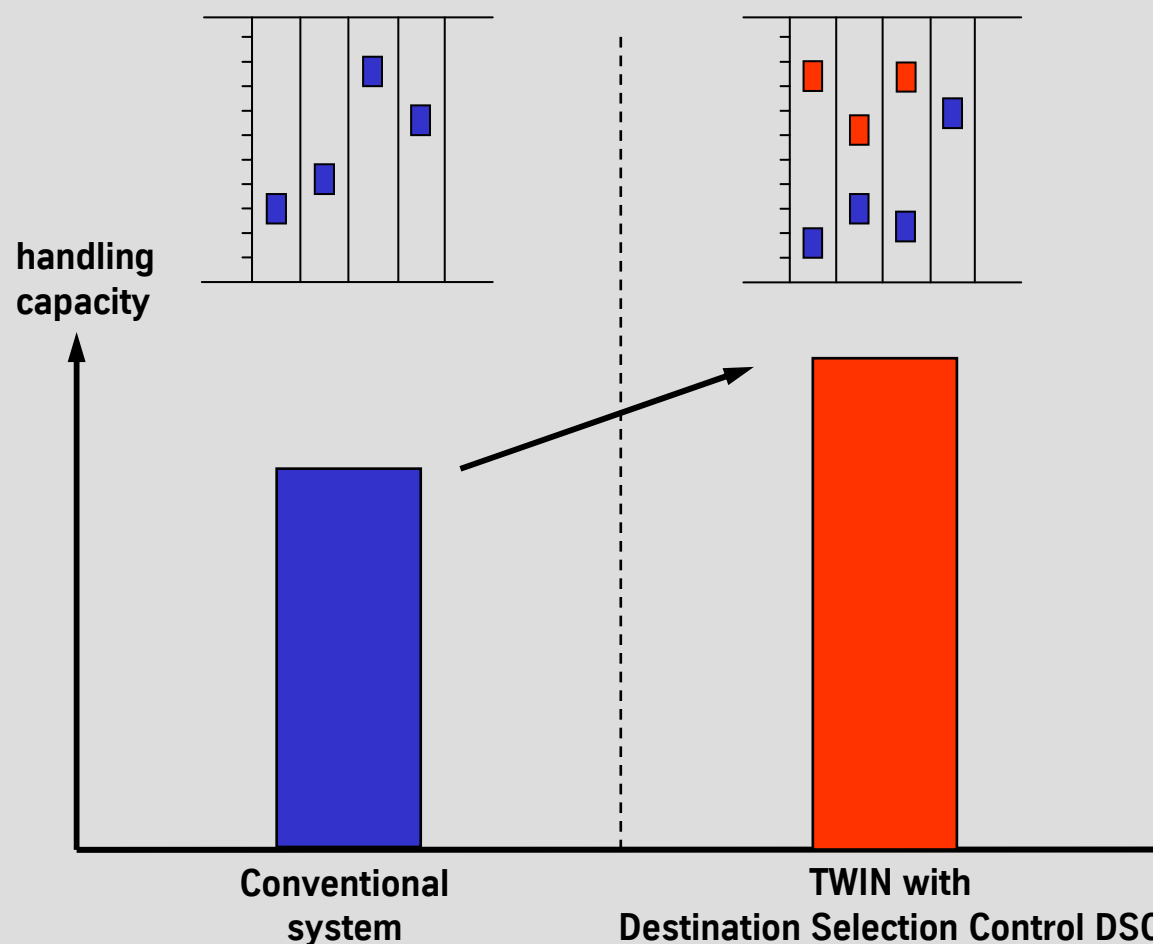
ThyssenKrupp Aufzugswerke



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TWIN®.

New systems & modernization: Increased handling capacity.



Significantly higher handling capacity with the same number of elevator shafts.

Significantly higher handling capacity in installed buildings:

To solve problems if the use of the building has changed and current systems no longer meet the demands with regard to handling capacity.

Values are rough values for orientation.



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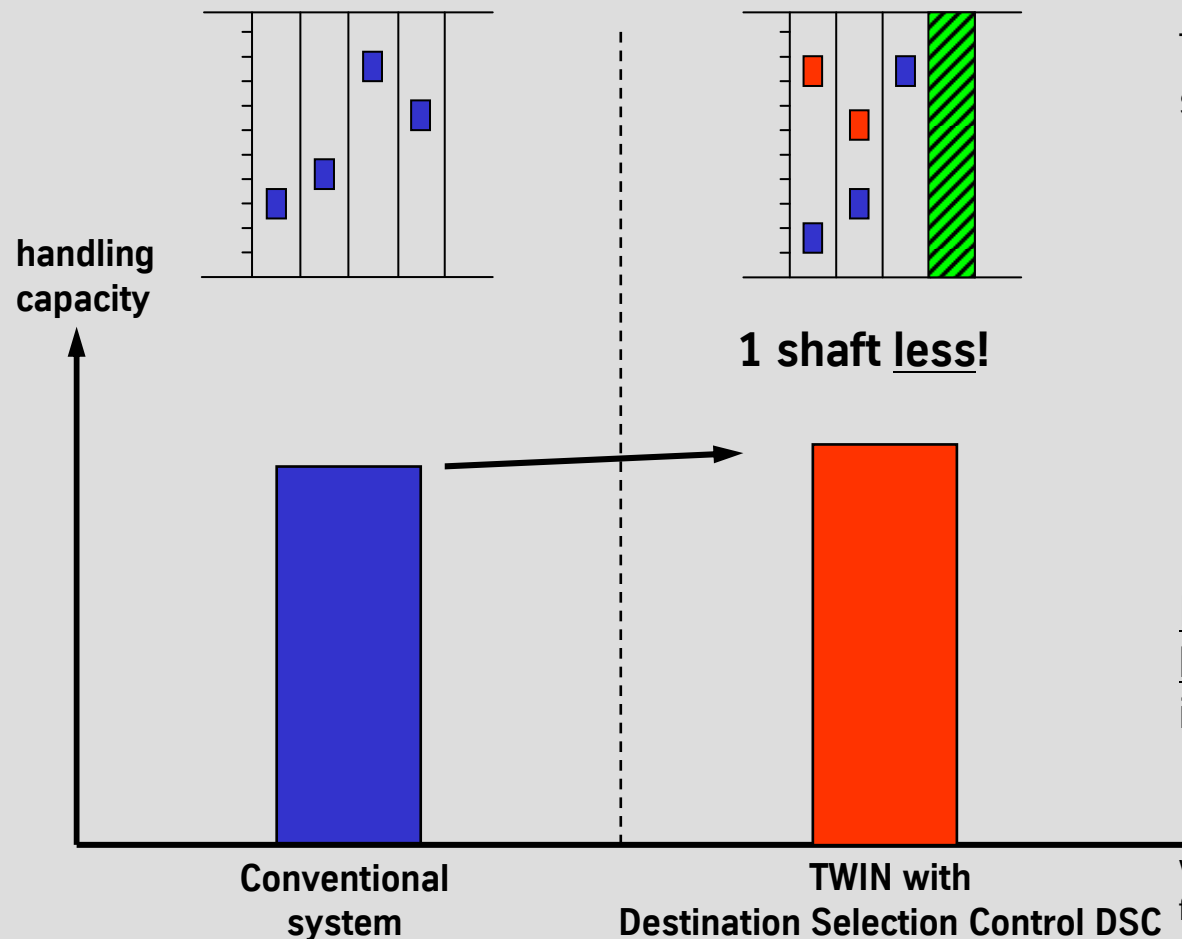
ThyssenKrupp Aufzugswerke



ThyssenKrupp

TWIN®.

New systems & modernization: Increased floor space.



Through omission of elevator shafts:

- economizing on construction volume

or:

- additional available floor space (more rental space).

Handling capacity remains at least equal or is additionally improved.

Values are rough values for orientation.

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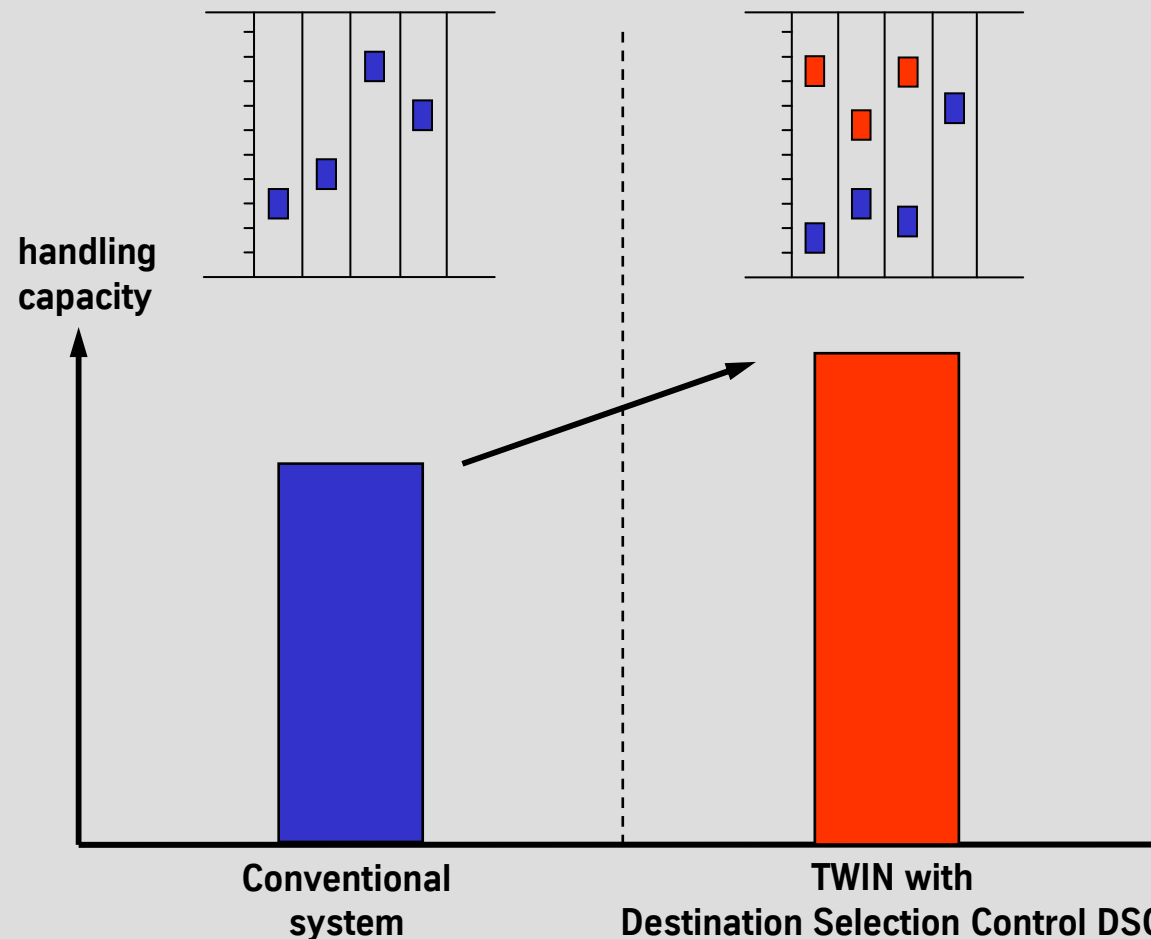
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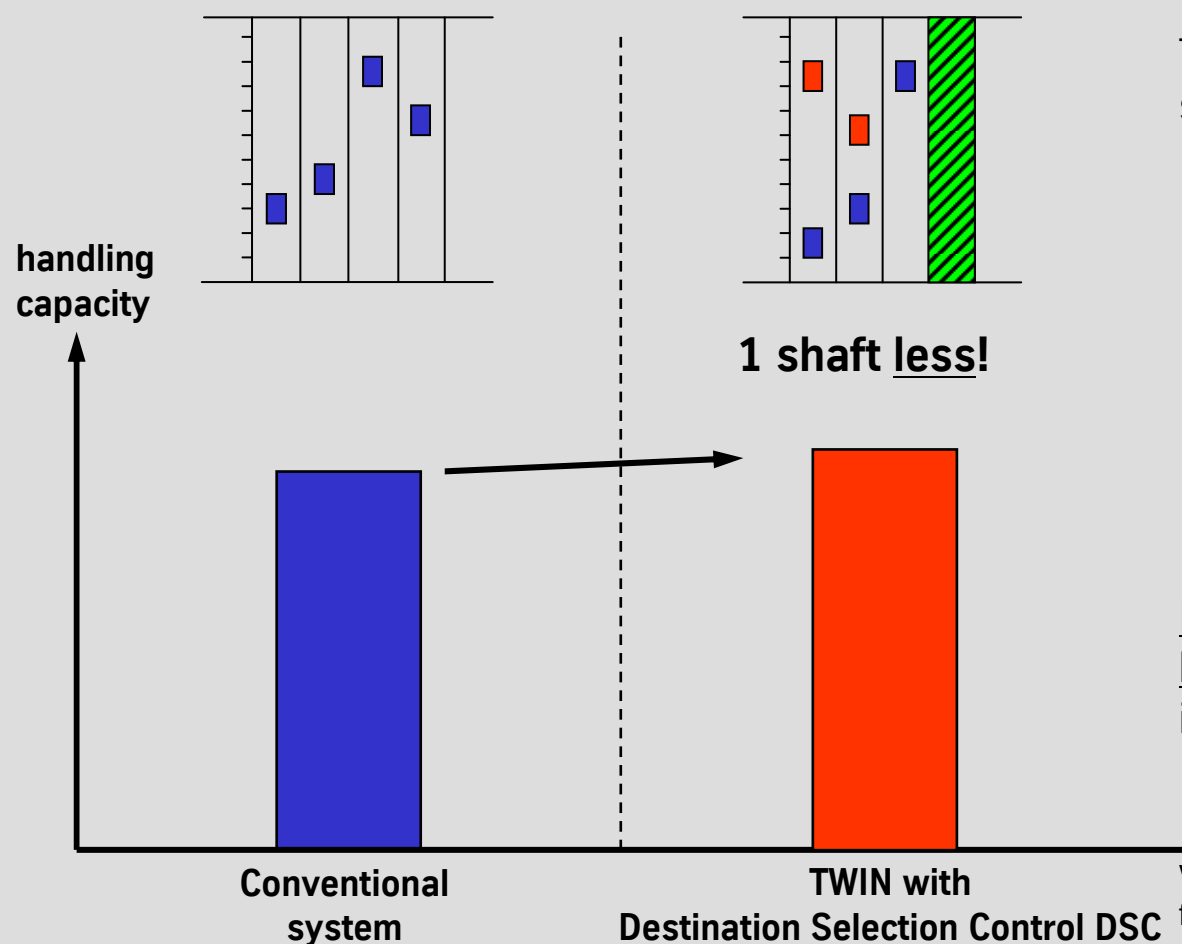
ThyssenKrupp Aufzugswerke



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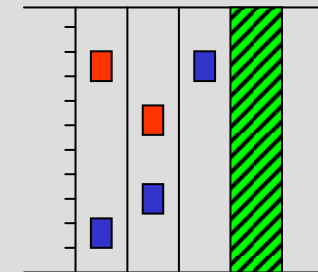
TWIN®.

Profitability with new systems: Economizing on shafts.

**Example: Building with 15 landings:
Instead of 4 elevators in 4 shafts
2 TWIN and 1 single elevator are installed in 3 shafts.**

**→ 1 elevator shaft less with at least equal handling capacity.
This provides additional floor space in the building of approximately 56 m².**

City	Prime office rent in € *	
	Per month / m ²	1 year / 56 m ²
Frankfurt /M.	33.-	22,100.-
Boston	23.-	15,400.-
Zurich	35. -	23,500.-
Paris	52.-	34,900.-
Hong Kong	50. -	33,600.-
London, City	104.-	69,900.-



* C&W/H&B, 04/2005

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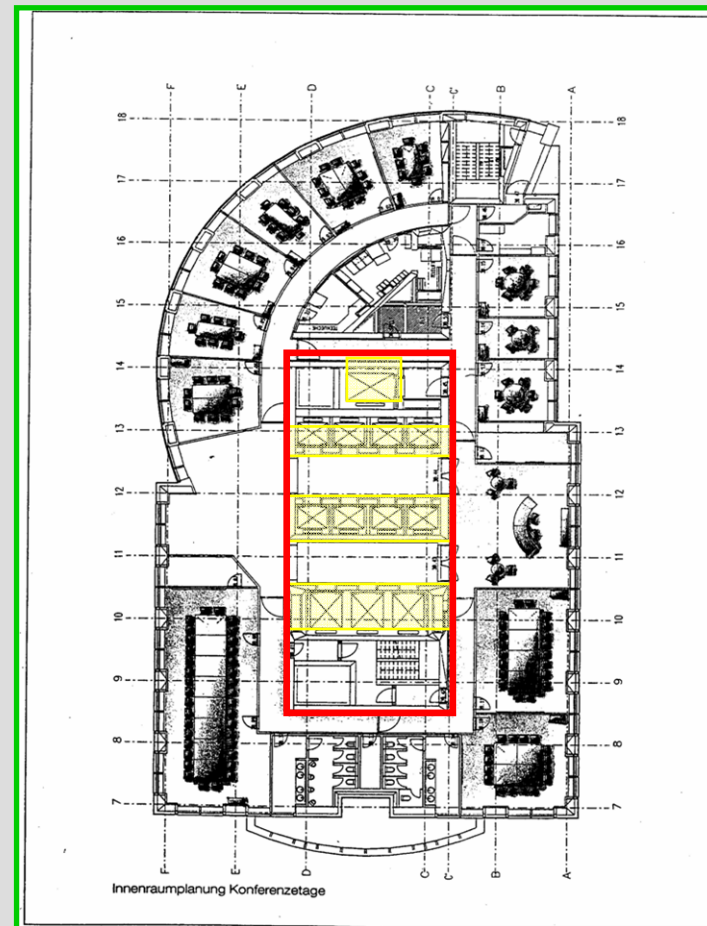
Needed space for shafts in a high-rise building.

DG-Bank, Frankfurt, Germany.

Volume of shaft areas and other facility devices often cover a major amount of space within tall buildings.



Major part of the shaft is not used, while the car is serving the destination calls in the remaining part of the shaft.



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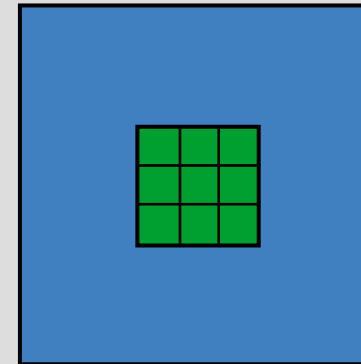


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TWIN®.

High-rise Buildings.

- **Building core**
 - elevator
 - air conditioning technology
 - cabling
 - sanitary engineering
 - ...



supporting and reinforcing element of building static's as the rule.

- **Economic effective area.**

The proportion between economic effective area and the building core has also an effect on the economic efficiency of the building.



TWIN®.

Number of elevators in highest high-rise buildings of the world.

Financial Center
Taipeh
63 elevators



Petronas Towers
Kuala Lumpur
39 elevators for each tower



Sears Tower
Chicago
104 elevators



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TWIN®.

Number of elevators in highest high-rise buildings of the world.

Jin Mao Building
Shanghai
130 elevators



Shanghai World
Financial Centre
92 elevators



Empire State Building
New York
72 elevators



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TWIN®.

Number of elevators in highest high-rise buildings of the world.

Commerzbank
Frankfurt
30 elevators



Messturm
Frankfurt
24 elevators



Canary Wharf
London
36 elevators



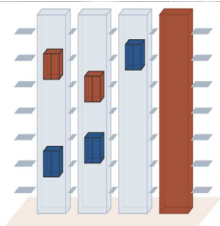
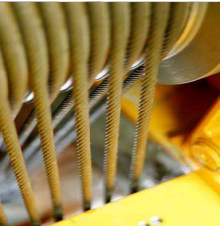
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The Idea	The Advantages	Our Security	The References	The Details	The Films

TWIN® -

A revolution in elevator construction

Concept in Overview
 Step 1
 Step 2
 Step 3
 Step 4
 High speed
 Components

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The safety concept - a 4-level safety chain.

Level 1: Clearance relevant assignment of calls

Destination calls are assigned so that the cars do not hinder each other and a minimum clearance is maintained at all times (DSC).

Level 2: Monitoring of minimum clearances

While the cars approach each other, the speed is reduced so that an operational stop is possible at any time without exceeding the required safety clearance (bar code system).

Level 3: Emergency stop

The drives are stopped and the operating brakes activated.

Level 4: Triggering of safety gear operation

If there is no slowing down of the cars, the safety gear is forced to engage cars.

⇒ **Cars will never touch!**



TWIN®.

Safety concept for collision prevention.

Safety level 1

- Destinations will be called before entering the cabin
→ Destination Selection Control DSC.
- Destination calls are assigned so that the minimum clearance is maintained between the cars at all times.
- Passengers will be informed after choosing the destination which elevator car should be used.
- Journey to destination runs without any additional activation of a car calls.

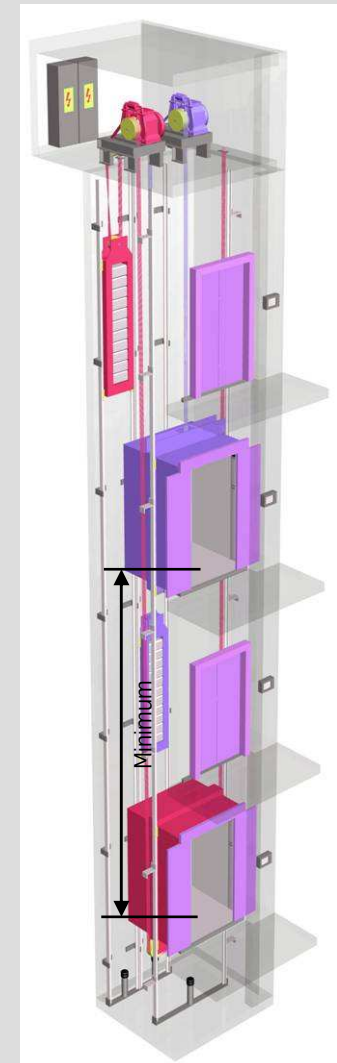


TWIN®.

Safety concept for collision prevention.

Safety level 2

- Each elevator control receive signals as actual position, direction of travel and speed of both cars. The remaining clearance is calculated with these datas.
- If minimum clearance falls short, the speed for both cars will be decelerated and stop at the next landing.
- The minimum clearance depends on the speed, which means that the minimum clearance increases with higher speeds.



TWIN®.

Safety concept for collision prevention.

Safety level 3 + 4

Safety level 3 + 4 will be monitored by an independent control system according to the highest safety classification of

Safety Integrity Level 3 (SIL3)

Relevant Systems will be used in case of safety functions for

- fly by wire (Airbus, Boeing 777)
- Automatic train systems
- Chemical industry



Maintrian elevator Frankfurt a.M.

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TWIN®.

Safety concept for collision prevention.

Safety level 3

- If level 2 does not result in a deceleration of the cars, activation of the operating brakes for the drives initiates an emergency stop.
- The initiation is effected by the electronic logic control system according to IEC/EN61508, which interrupts the electrical safety circuits of both elevators.
- The logic control systems work independently from the lift controls.



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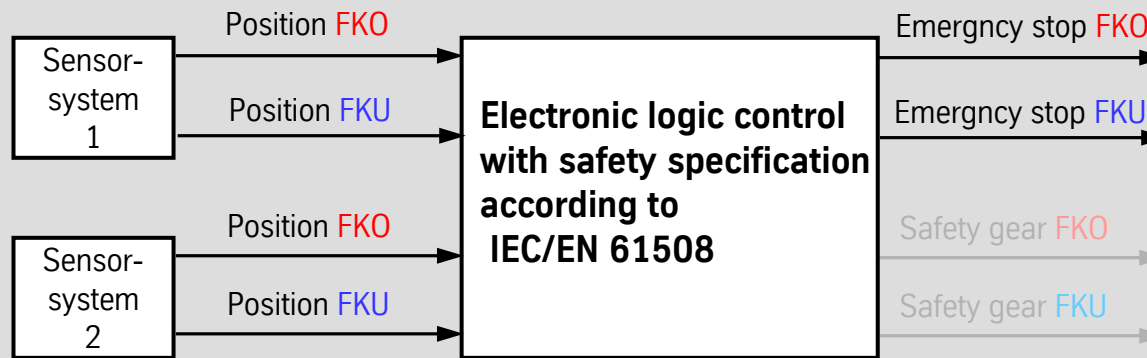


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Safety concept for collision prevention.

Safety level 3



- Decision of initiation of emergency stop depends on **the actual car position,**
the actual speed of the car,
the direction of travel
of both cars .
- Emergency stop opens the safety circuit of both controls.



A Segment of
ThyssenKrupp AG

ThyssenKrupp Elevator



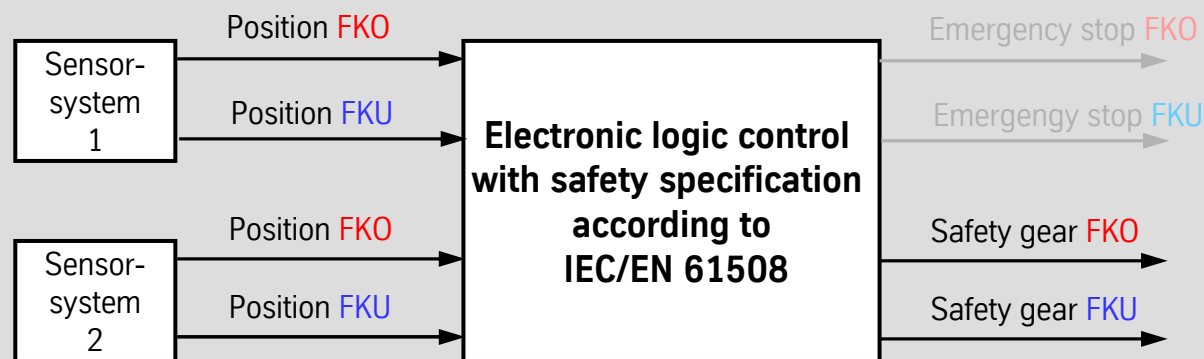
ThyssenKrupp

TWIN®.

Safety concept for collision prevention.

Safety level 4

- If level 3 does not result in a sufficient deceleration, **triggering of the safety gear** in down direction at the upper car and **triggering of the safety gear** in up direction at the lower car will be activated.
- The cars will come to a stop by braking of the safety gears at the guide rails.
- The trigger is effected by electronic logic control systems according to IEC/EN 61508 (SIL 3).



A Segment of
ThyssenKrupp AG

ThyssenKrupp Elevator

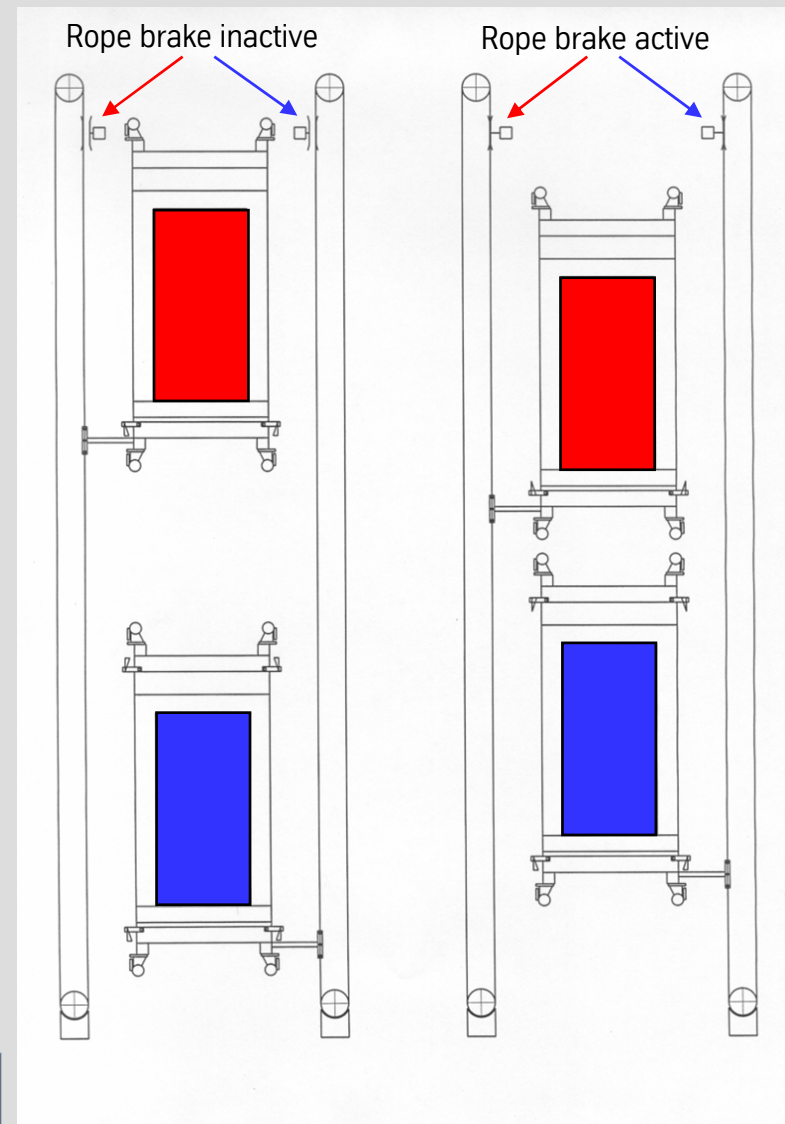


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Safety level 4.

- Decision of activation of the safety gear depends on
 - the actual car position
 - the actual speed of the car
 - the direction of travel
 of both cars.
- Activation of the safety gear is effected by braking the governor ropes.



TWIN®.

Certification of the safety concept.

- 2004 advancement of the security systems, steps 3 and 4

Electronic control systems
acc. to IEC/EN 61508

- April 2006 TÜV-Certification of latest safety system

	
EG-Entwurfsprüfbescheinigung nach Aufzugsrichtlinie 95 / 16 / EG Anhang XIII, Ziffer 3.3	
Bescheinigungs-Nr.:	Thyssen EPR 008 / 2
Benannte Stelle:	TÜV SÜD Industrie Service GmbH Zertifizierungsstelle für Aufzüge und Sicherheitsbauteile Westendstraße 195, D-80686 München
Antragsteller/ Bescheinigungsinhaber:	ThyssenKrupp Aufzugswerke GmbH Bernhäuser Str. 45 D-73765 Neuhausen
Antragsdatum:	2006-11-21
Hersteller:	ThyssenKrupp Aufzugswerke GmbH Bernhäuser Str. 45 D-73765 Neuhausen
Produkt, Typ:	Mehrkabinensystem TWIN mit elektronischem Kollisionsverhinderingssystem Geschwindigkeit: Maximal 8 m/s (oberer Fahrkorb) Maximal 8 m/s (unterer Fahrkorb) Triebschelenantrieb jeweils im Triebwerksraum über dem Schacht
Prüflaboratorium:	TÜV SÜD Industrie Service GmbH Abteilung Aufzüge und Sicherheitsbauteile Gottlieb-Daimler-Str. 7, D-70794 Filderstadt
Datum und Nummer des Prüfberichtes:	2007-01-23 Thyssen EPR 008 / 2
EU-Richtlinie:	95 / 16 / EG
Ergebnis:	Der Entwurf des Mehrkabinensystems TWIN (mit elektronischem Kollisionsverhinderingssystem) erfüllt für den im Anhang zu dieser Entwurfsprüf- bescheinigung angegebenen Anwendungsbereich unter Einhaltung der genannten Bedingungen die grundlegenden Sicherheitsanforderungen der Rich- tlinie
Ausstellungsdatum:	2007-01-23
Zertifizierungsstelle für Aufzüge und Sicherheitsbauteile EU-Kennnummer: 0036  Dieter Roas	
	

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Components Details.

Sensor System 1

- Bar Code Tape
- IR – Laser beam
- Barcode reader with self test functions



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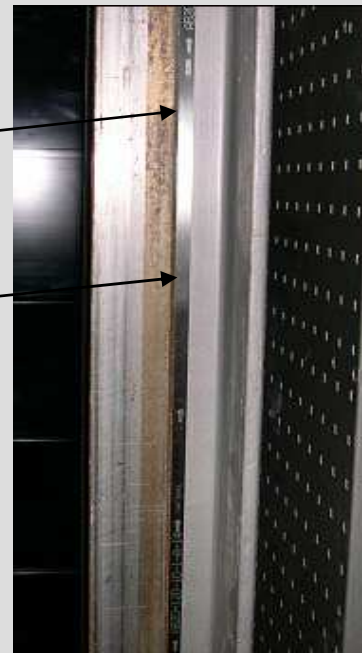
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Components Details.

Sensor System 2

- Magnetic Sensor
- Magnetic tape with programmed absolute positions
- Fixed at guide rail



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Components Details.

Overspeed governor and rope brake device

- for collision prevention



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Components Details.

Safety trigger device

- electric magnet
- automatic test equipment



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Components Details.

**Counterweight at rear wall
and rope arrangement**



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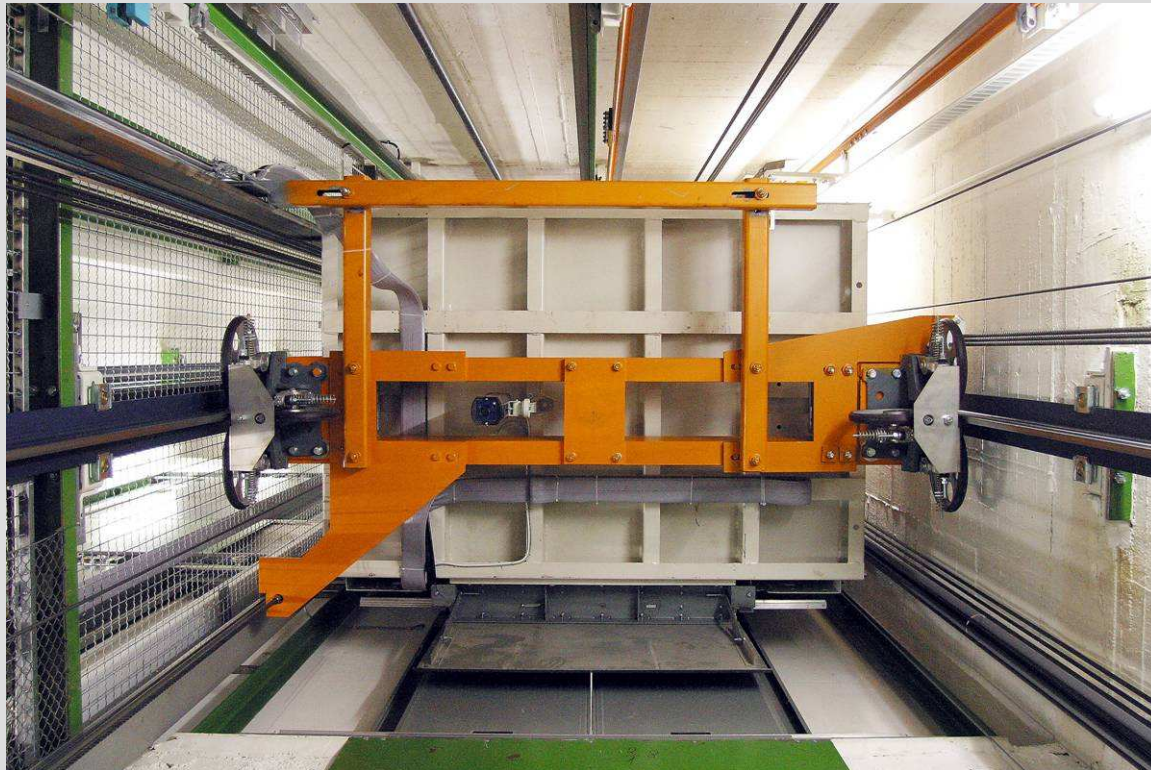
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Components Details.

Upper car

with compensation
rope suspension



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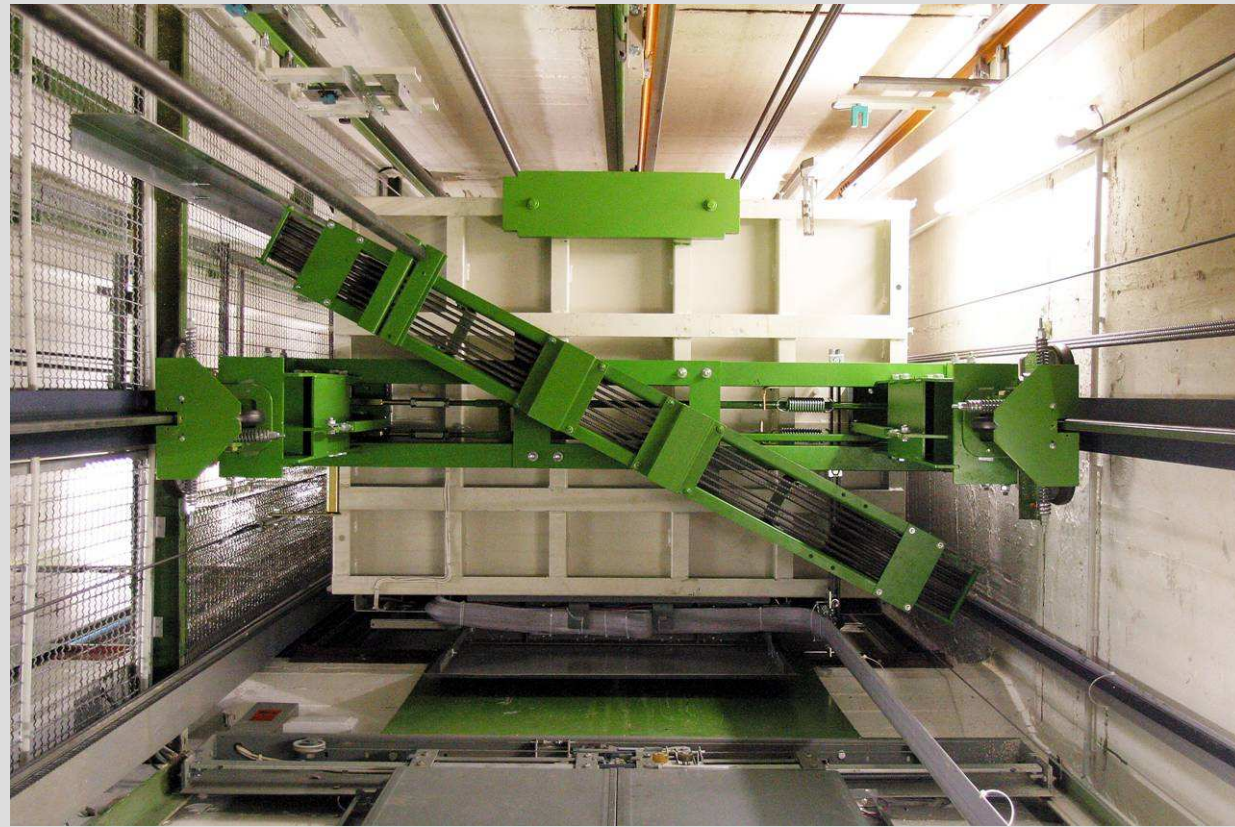
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Components Details.

Lower car

- undersling roping 2:1



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TWIN® - Modernization.

University Stuttgart, Germany. (detailed)



University Stuttgart, Germany.



„Dreischeibenhaus“ Düsseldorf, Germany.
Headquarter ThyssenKrupp AG



„Vierzylindergebäude“ Munich, Germany.
Headquarter BMW



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Reference system Stuttgart University.

Elevator World
Project of the Year
2004



University building Stuttgart, city centre:

- The elevator system from the sixties was no longer sufficient for the active traffic in the building prior to modernization. Originally planned attendance of the building of 800 students has grown to 2,000 students today.
- The building of Stuttgart University, which is open to the public, has 11 floors.
- The elevator system is equipped with the Destination Selection Control DSC.
- The group of 6 was expanded to a „group of 7“. The TWIN® system was installed in one of the shafts in addition to the already existing elevator car.



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Reference system Stuttgart University.



Upper car with both counterweights



Lower car

**Elevator World
Project of the Year
2004**

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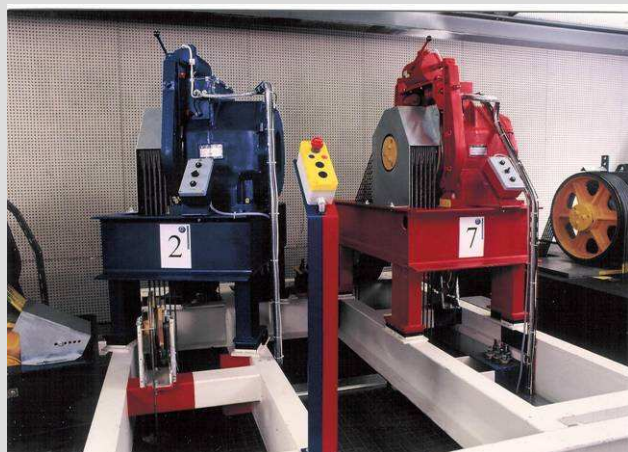


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TWIN®.

Reference system Stuttgart University.

**Elevator World
Project of the Year
2004**



University building Stuttgart, city centre:

- Shafts: 6
- Elevator cars: 7
- Rated loads: 5 elevators at **1,000 kg**
1 elevator at 1,125 kg
1 elevator at 2,100 kg
- Landings: 11
- Speed: **2.0 m/s**
- Travel heights: 4 shafts at **44.5 m**
1 shaft at 45.9 m
1 shaft at 51.3 m
- TWIN® drives: SC 300, 2 each

TWIN® system (elevator 2)

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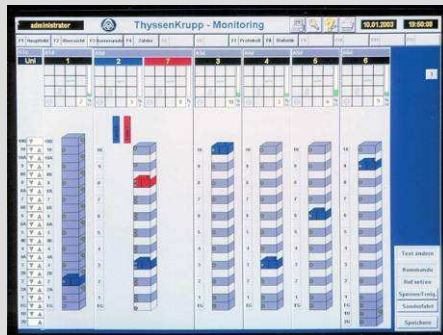
ThyssenKrupp

TWIN®.

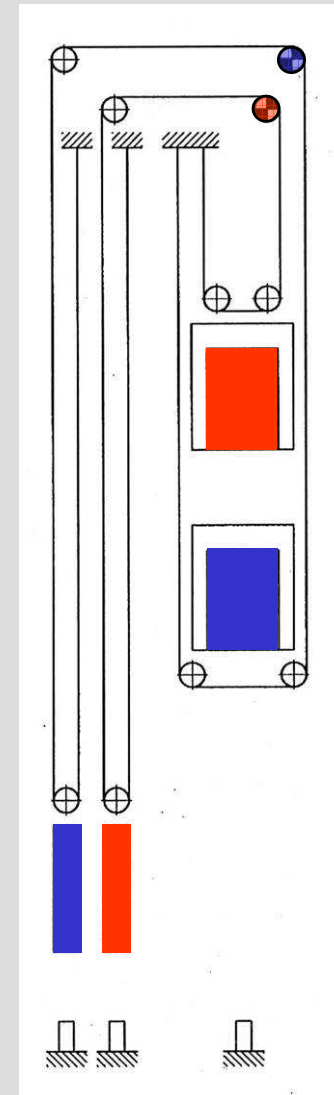
Reference system Stuttgart University.

TWIN® system, Lift number 2:

- Each elevator has its own drive and counterweight.
- Both cars are suspended 2:1.
- The overhead pulleys for the upper car are arranged on top, the diverter pulleys for the lower car are arranged on the bottom.
- Each elevator has its own over speed governor and over speed governor rope.
- Each elevator has its own control.



Elevator group
visualized through
monitoring



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TWIN® Reference project.

University Stuttgart, Germany.

Elevator World
Project of the Year
2004



- 1 TWIN® system in operation.
- Speed: upper car 2 m/s,
lower car 2 m/s.
- Building height 44.5 m, 11 stops.
- Nominal load 1,000 kg.
- Modernization project:
higher handling capacity.

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TWIN® Reference project.

ThyssenKrupp AG, Düsseldorf, Germany.



- 2 TWIN® systems in operation.
- Speed: upper car 4 m/s,
lower car 2.5 m/s.
- Building height 94 m, 22 stops.
- Nominal load 1,350 kg.
- Modernization project:
before modernization 8 shafts – now 6 shafts.
- Architect: HPP Hentrich-Petschnigg & Partner KG.



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ThyssenKrupp Aufzugswerke



ThyssenKrupp

TWIN® Reference project.

BMW head office “Vierzylindergebäude” Munich, Germany.



- 4 TWIN® systems.
- Speed: upper car 4 m/s,
lower car 2.5 m/s.
- Building height 101 m, 23 stops.
- Nominal load 1,425 kg.
- Modernization project:
higher handling capacity,
2 of 8 existing shafts can be used as one
fire fighting elevator;
completion in 2006.
- Architect: Prof. Karl Schwanzer.

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ThyssenKrupp Aufzugswerke



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TWIN® - New Systems.

Maintriangel Frankfurt a.M., Germany.



Oceanic-Center Valencia, Spain.



FTM Tower Moscow, Russia.



Trumpf Trutec-Building, Seoul, Korea



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TWIN® Reference project.

Maintriangel Frankfurt a.M., Germany.



- 2 scenic TWIN® outriders inside the atrium.
- Speed: upper car 2.5 m/s,
lower car 2.5 m/s.
- Building height 60 m, 9 stops.
- Nominal load 1,350 kg.
- New building project;
completion at the beginning of 2006.
- Architect: Novotny Mähner Assoziierte
Gesamtplanungsgesellschaft mbH.
- Elevator Consultant: Jappsen+Stangier Oberwesel
GmbH

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TWIN® Reference project.

Oceanic-Center Valencia, Spain.



- 1 TWIN® system.
- Speed: upper car 2.5 m/s,
lower car 2.5 m/s.
- Building height 99.60 m, 22 stops.
- Nominal load 1,600 kg.
- New building project;
completion in 2006.
- Architect: Schweger+Partner.
- Architect: Nps+Partner GbR.



TWIN® - References.

Federation Tower Moscow, Russia.



- 10 TWIN® - Systems in Tower A
- 11 TWIN® - Systems in Tower B

- Speed: upper car: 6,0 m/s and 7,0 m/s
lower car: 4,0 m/s and 6,0 m/s

- Building high: Tower A: 350 m, 93 stops
Tower B: 250 m, 54 stops

- Nominal load: 1.600 kg.

- New building project;
Completion of Tower A at the end of 2007.
Completion of Tower B at the end of 2006.

- Architect: Schweger+Partner.
- Architect: Nps+Partner GbR.



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TWIN® Reference project.

Trumpf Headquarter Office Seoul / South Korea.



- 1 TWIN® system.
- Speed: upper car: 2.5 m/s,
lower car: 2.0 m/s.
- Travel height 67.90 m, 22 stops.
- Nominal load 1,600 kg.
- New building project;
completion in 2006.

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The Idea

The Advantages

Our Security

The References

The Details

The Films

Safety specifics

Shaft

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Safety specifics.

Over speed governor with

- additional trigger device
- automatic test equipment



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Safety specifics.

PM Motor Gearless with

- absolute encoder



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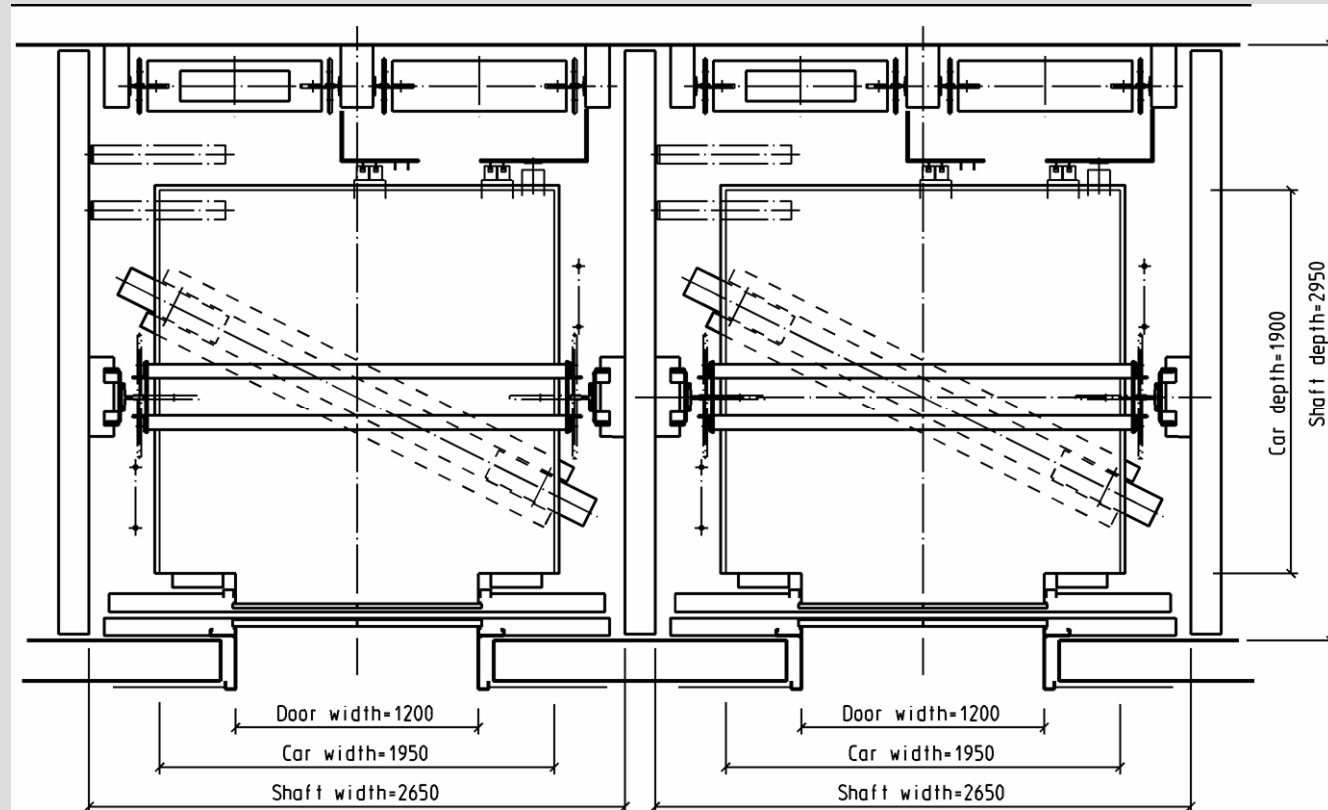
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Example of shaft dimensions.

Shaft plan:

- Load:
1800 kg
- Speed:
4 / 2,5 m/s



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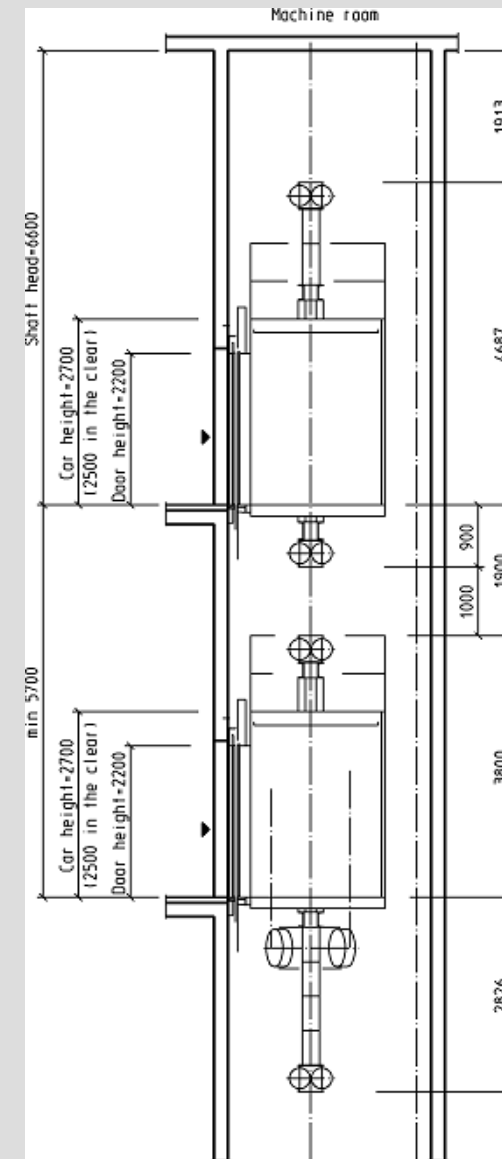


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Example of shaft dimensions.

Headroom and top level situation



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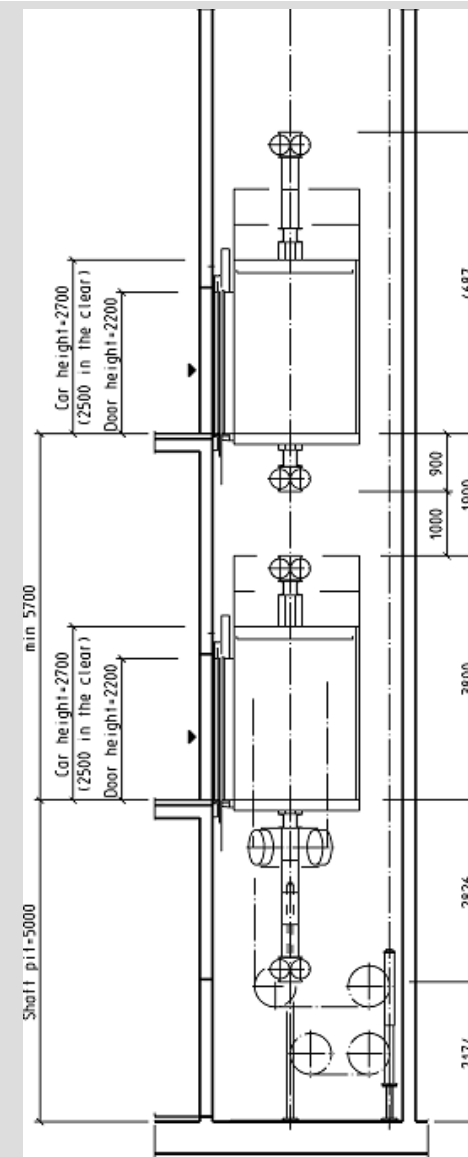


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Example of shaft dimensions.

Shaft pit and lower level situation



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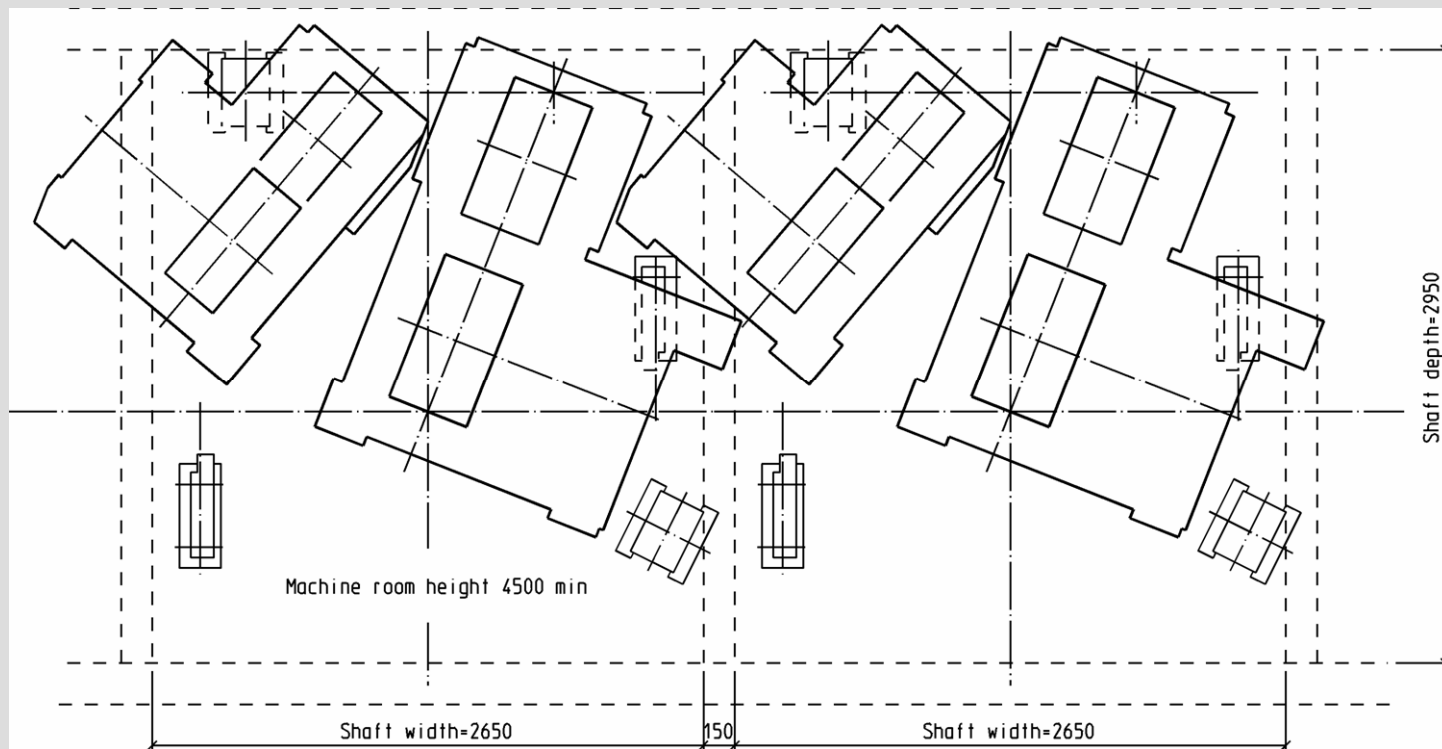


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Example of shaft dimensions.

Location of machines



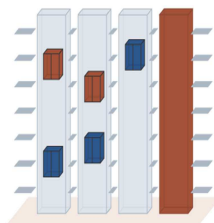
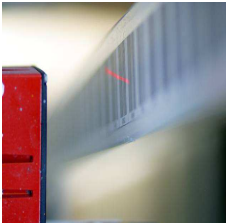
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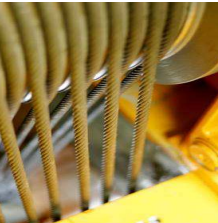
ThyssenKrupp Aufzugswerke



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The Idea	The Advantages	Our Security	The References	The Details	The Films
					TWIN®
					TWIN® Chinese
					DSC

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