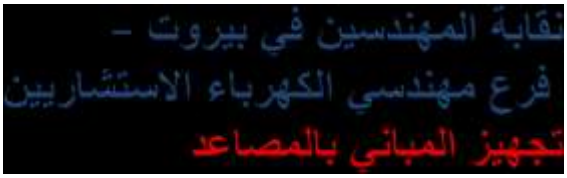


دور مهندس الكهرباء وتقاطعه مع الاختصاصات الاخرى في التصميم

Habib Srour

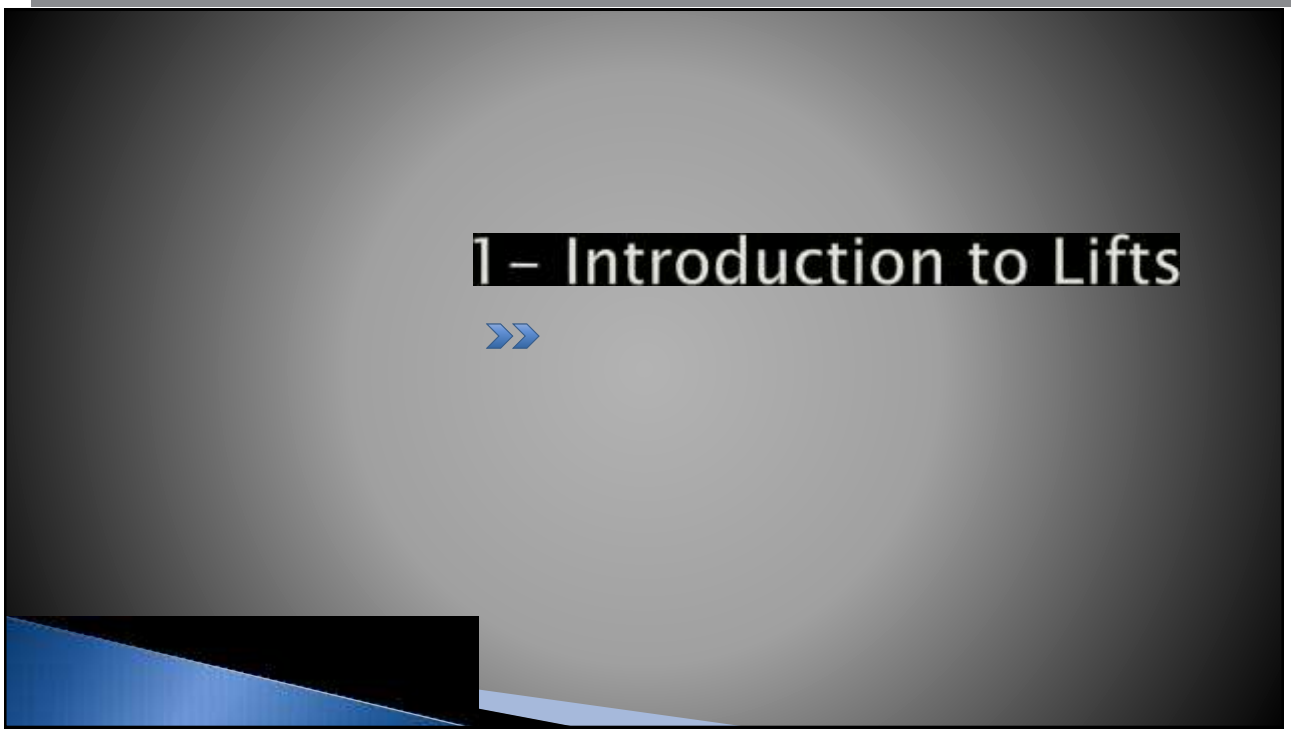
النبطية 22/03/19

1

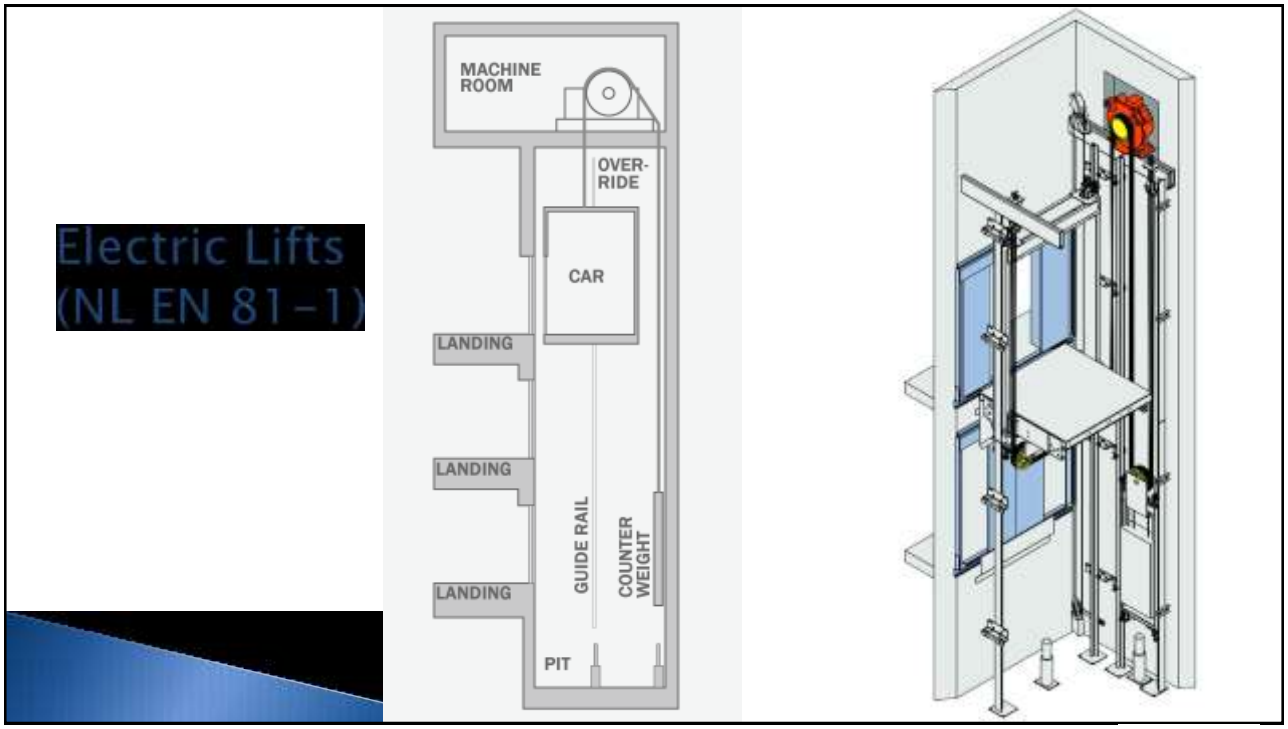
Contents

1. Introduction to lifts
2. Standards
3. Selection and dimensions
4. Design Requirements
5. Lift Documents

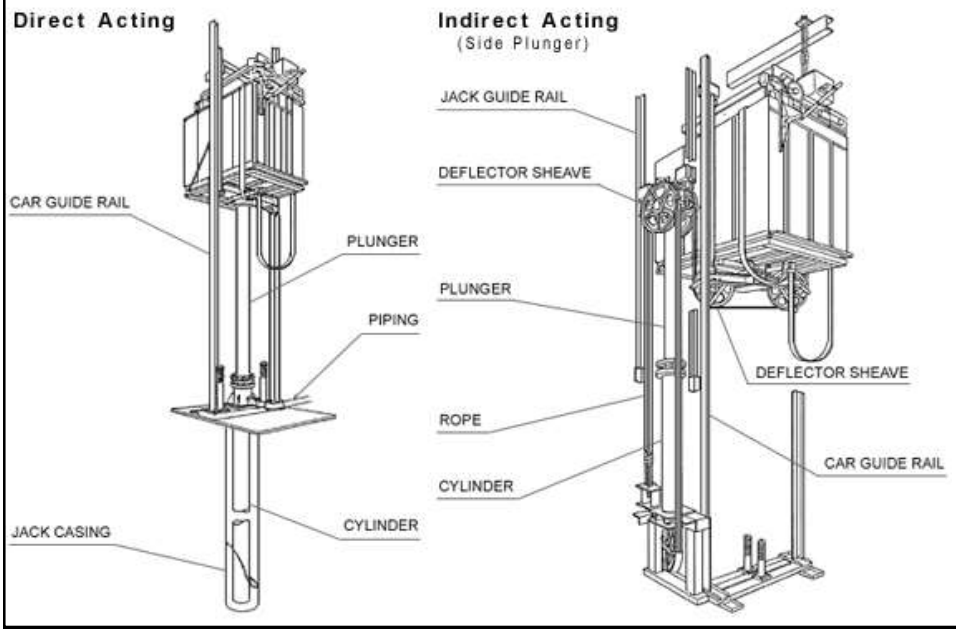
2


1 – Introduction to Lifts

3


Electric Lifts
(NL EN 81-1)
MACHINE ROOM
OVER-RIDE
CAR
LANDING
LANDING
LANDING
GUIDE RAIL
COUNTER WEIGHT
PIT

4



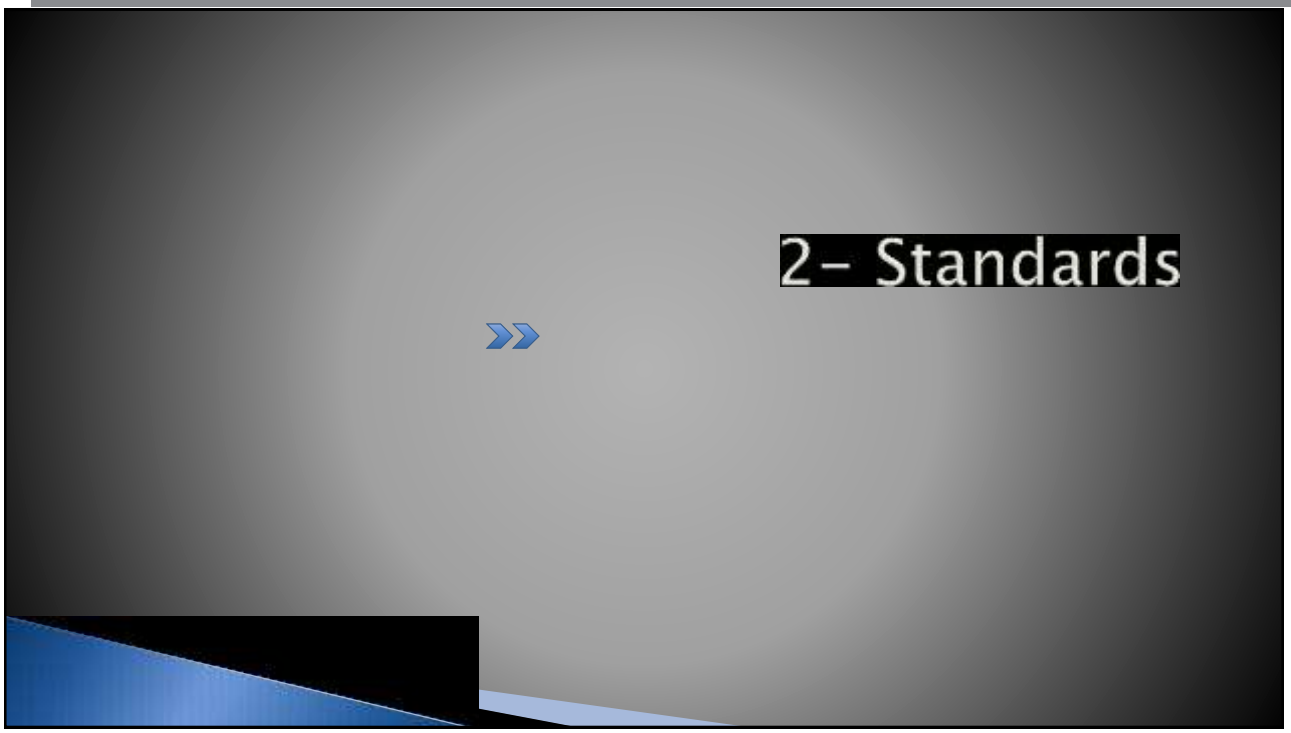
Hydraulic Lifts NL EN81-2

5

Characteristics of each type:

Point	Hydraulic	Electric (Traction)
Speed	Limited to 1 m/s Typical 0.63 (0.5) m/s	Up to 10 m/s and more
Height	Limited to 21 m max Typical: 5 to 6 m	Up to 500 m with conventional ropes
Machine room	Flexible Could be located at 11 m from the well	Typically above but with MRL more flexible
Artistic Flexibility	See photo	Limited due to several mechanism (Counterweight)
Codes Flexibility	Less rated capacity with larger car area for goods lifts	Not Applicable
Electrical Consumption	For the same characteristics, the power demand for a hydraulic lift is 5 times more than electric lifts	
Riding Luxury	The Hydraulic lifts have the issue of adjustment with the change of temperature and viscosity	

6



7

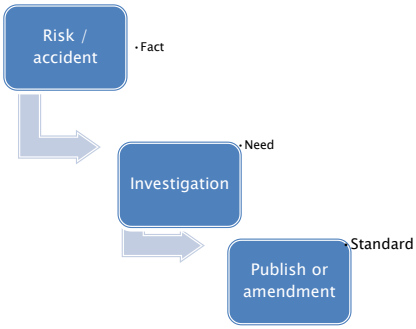
What are Standards

- **Standards** are an agreed way of doing things; whether making or supplying something, managing a process, or delivering a service, to make lives easier and safer. (BSI Group)
- SAFETY IS THE RESPONSIBILITY OF EVERY ENGINEER TOWARDS HIS COMMUNITY

8

Standard and Safety

- Safety is an endless task
- =>
- Continual process of standard amendment
- =>
- Implementation means non recurrence



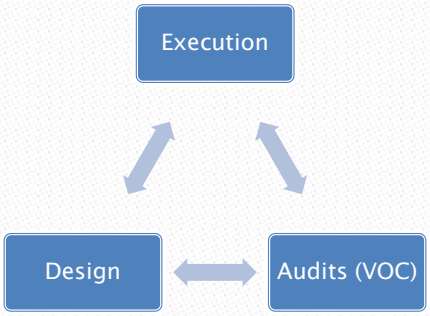
9

Standards Mandating

- Safety Standards shall be mandatory by law
- How?
  Decree stating what and who
- For Buildings: Decree 7964 in 2012
  Technical auditors are the tools

10

Role Playing



Standards (Libnor)
Laboratories
Manufacturers
Authorities
OEA

Direct on site

Other hidden-

11

Deliverables

Role	Deliverables
Design	Drawings and specifications
Execution	Building / Lifts
Technical Auditor	Conformity Reports

- Favorable (Comply)
  مطابق
- Not favorable (Not Complying)
  غير مطابق
- Suspended Waiting
  بانتظار معلومات اضافية

Deliverables

Report Status

12

Lift

- Mandate for inspection of all lifts starting 2017
- What are the applicable codes?
  - Series EN 81
  - Others

15

Main standards

NL EN 81	Safety rules for the construction and installation of lifts –
Part 1	Electric lifts
Part 2	Hydraulic lifts
Part 20	Passenger and goods passenger lifts (*Will replace 1 & 2)*
Part 50	Design rules, calculations Examinations and tests of lift components
Part 21	New lifts in Existing Building
Part 22	Electric lifts with inclined path
Part 3	Service lifts (Dumbwaiters)
Part 31	Accessible goods only lifts

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Standards for special situations

NL EN 81	Safety rules for the construction and installation of lifts
Part 28	Remote alarm
Part 58	Landing doors fire resistance tests
Part 70	Accessibility to lifts for persons with disability
Part 80	Rules for improvement of safety of existing lifts
Part 82	Rules for improvement of accessibility of existing lifts

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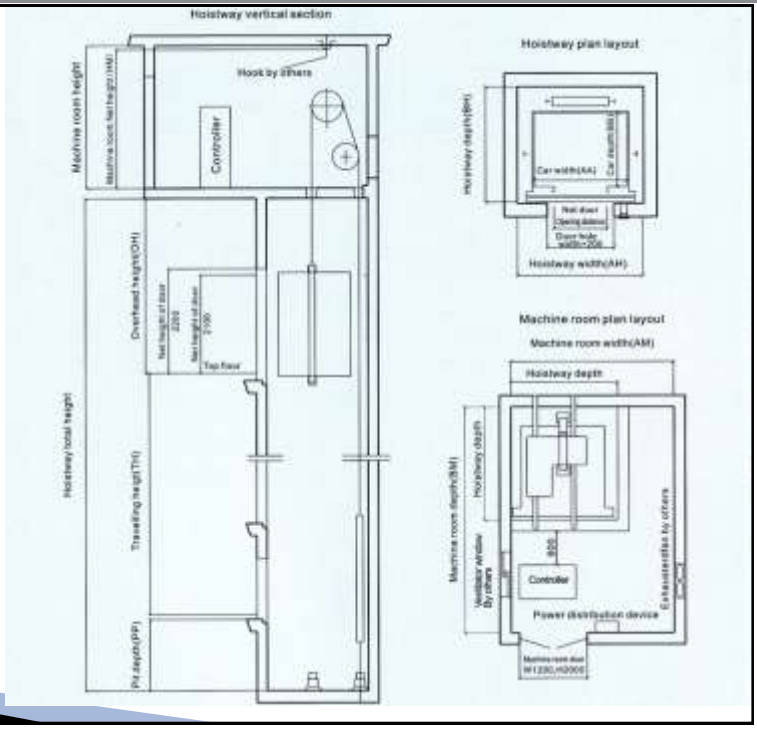
3- Selection and Dimensions

- a) Definitions

18

Parameters

- The dimensions should be known at the design concept stage
- NL ISO 4190-1 includes information related to dimensions
- The dimensions (plan / section) are based on the following parameters:
  - Use of building
  - Number of lifts in the group
  - Capacity
  - Speed



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3- Selection and Dimensions

b) Lifts in Residential Buildings

المباني السكنية

20

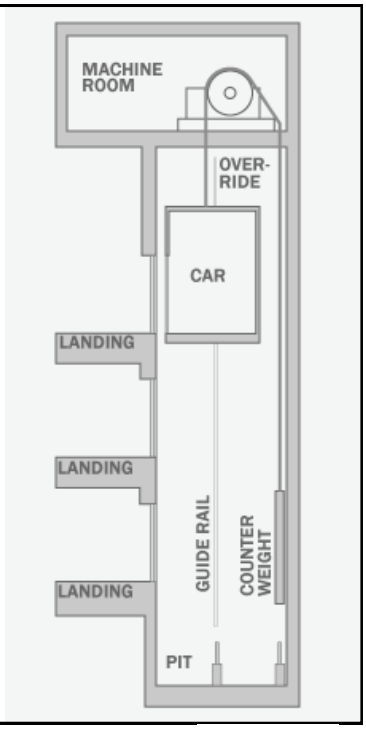
Determination of Parameters: Rule of Thumb

- **Applicable for small buildings only; for complex buildings use the services of VT Engineer**
- Number of lifts
  - One lift per 100 people, minimum 1 lift for every 7 stops or part of.
  - Number of people: 1.75 people per bedroom
- Car capacity
  - Capacity: 1.5 % of the population (rounded up to the nearest digit) with minimum 6 / preferable 8
  - Rated load: 75 kg per person (app)

21

Determination of Parameters: Rule of Thumb (Residential)

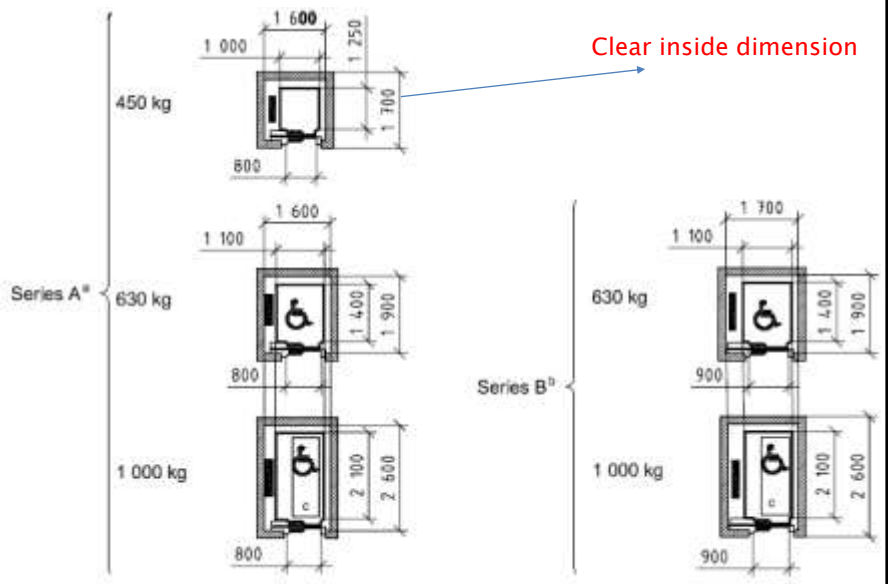
- Speed
  - Travel (FFL of lowest floor to FFL of top floor) divided by 30 sec; and
  - Round to Applicable speeds (1, 1.6, 2, 2.5 m/s)
- Car Height
  - Minimum 2200 mm, depends on decoration requirements



22

NL ISO 4190-1: Residential

- Add 12 cm in width for separating beams (in case of several lifts in the well
- If there is space below the pit add 10 cm for the width



NOTE 1 Lifts suitable for speeds up to and including 2,5 m/s.

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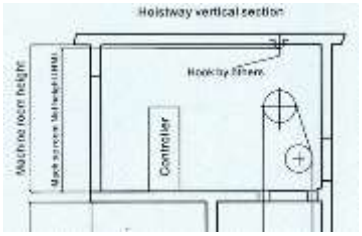
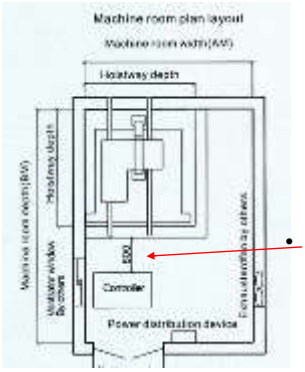
NL ISO 4190-1





- Door open to outside
- min 0.6 (W) x 1.8 (D)
- 0.7 m in front of controller

Dimensions in millimetres

	Rated speed, v_n m/s	Rated load (mass) 320 kg to 630 kg $b_4 \times d_4$	800 kg to 1 000 kg $b_4 \times d_4$	1 275 kg to 1 600 kg $b_4 \times d_4$	1 800 kg to 2 000 kg $b_4 \times d_4$
Machine room for electric lifts	0,63 to 1,6	2 500 × 3 700	3 200 × 4 900	3 200 × 4 900	3 000 × 5 000
	2,0 to 3,0		2 700 × 5 100	3 000 × 5 300	3 300 × 5 700
	3,5 to 6,0		3 000 × 5 700	3 000 × 5 700	3 300 × 5 700
Machine room for hydraulic lifts [a]	0,4 to 1,0	Width or depth of well × 2 000 mm for lifts in residential buildings			
		Non-standard configuration for general-purpose or intensive-use lifts			

[a] Site conditions and national regulations may require different machine room dimensions (b_4, d_4, h_2).

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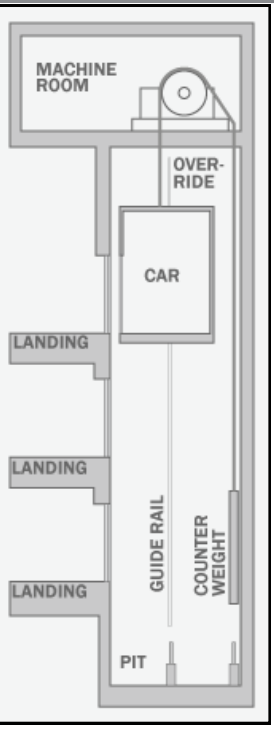
NL ISO 4190-1

Parameter	Rated speed v_n	Lifts in residential buildings				General-purpose lifts				Intensive-use lifts			
		Rated load (mass)											
		kg											
		450	630	1 000	630	800	1 000/ 1 275	1 350	1 275	1 350	1 600	1 800	2 000
Height of car, h_4		2 200					2 300		2 400				
Height of car door and landing doors, h_5		2 000	2 100										
Pit depth [a], d_3	0,40 m/s	1 400											
	0,63 m/s	1 400											
	0,75 m/s												
	1,00 m/s												
	1,50 m/s		1 600										
	1,60 m/s												
	1,75 m/s												
	2,00 m/s		1 750			1 750							
	2,50 m/s		2 200			2 200							
	3,00 m/s									3 200			
	3,50 m/s									3 400			
	4,00 m/s									3 800			
	5,00 m/s									3 800			
	6,00 m/s									4 000			



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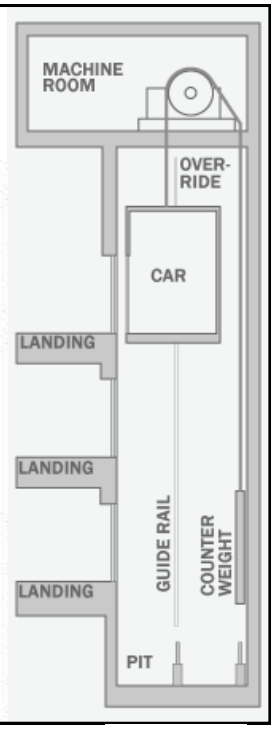
NL ISO 4190-1

Parameter	Rated speed v_n	Lifts in residential buildings				General-purpose lifts				Intensive-use lifts			
		Rated load (mass)											
		kg											
		450	630	1 000	630	800	1 000/ 1 275	1 350	1 275	1 350	1 600	1 800	2 000
Headroom [a], h_1	0,40 m/s	3 600											
	0,63 m/s	3 600				3 800		4 200					
	0,75 m/s												
	1,00 m/s	3 700											
	1,50 m/s	3 800				4 000		4 200					
	1,60 m/s												
	1,75 m/s												
	2,00 m/s		4 300			4 400							
	2,50 m/s		5 000			5 000		5 200		5 500			
	3,00 m/s									5 500			
	3,50 m/s									5 700			
	4,00 m/s									5 700			
	5,00 m/s									5 700			
	6,00 m/s									6 200			

In case of duplex add 40 cm



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3- Selection and Dimensions

c) Lifts for Office Buildings

27

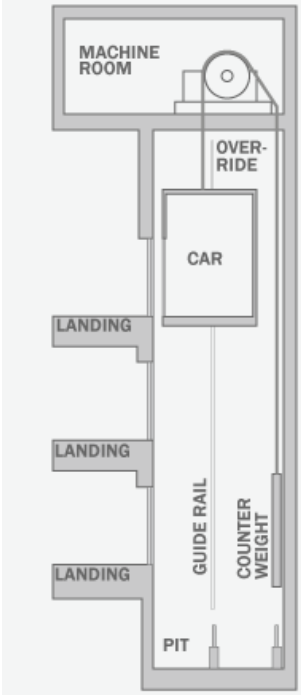
Determination of Parameters: Rule of Thumb

- **Applicable for simple small buildings only; for more complex buildings use the services of a VT engineer**
- Number of lifts
  - One lift per 100 people, Minimum 1 lift for every 5 stops or part of.
  - Number of people: 1 person per 12.5m^2 of net usable area
- Car Dimension
  - Capacity: 1.5% of the population (rounded up to the nearest digit) with minimum of 8
  - Rated load: 75 kg per person

28

Determination of Parameters: Rule of Thumb (Offices)

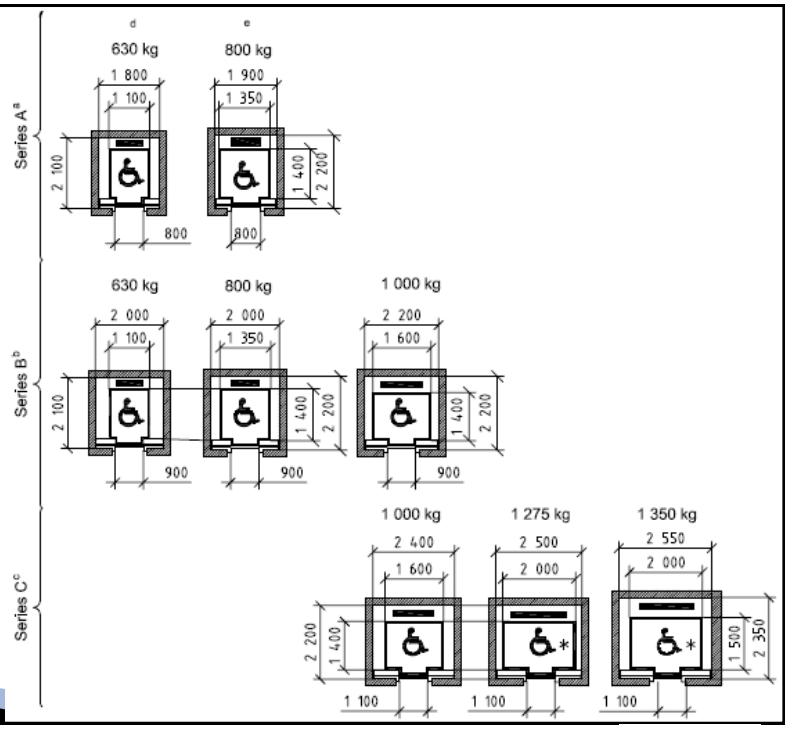
- Speed
  - Travel (Lowest floor FFL to top floor FFL) divided by 20 sec
- Car Height
  - Minimum 2200 mm or 2300 mm, depends on decoration requirements



29

NL ISO 4190-1: General Purpose

- Add 12 to 15 cm in width for separating beams (in case of several lifts in the well
- If there is space below the pit add 10 cm for the width and 10 cm for the depth per lift



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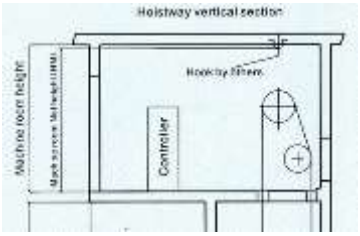
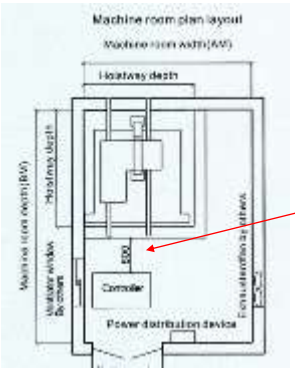
NL ISO 4190-1
Offices





- Door open to outside
- min 0.6 (W) x 1.8 (D)
- Height of M/R min 2 m

- 0.7 m in front of controller

Dimensions in millimetres

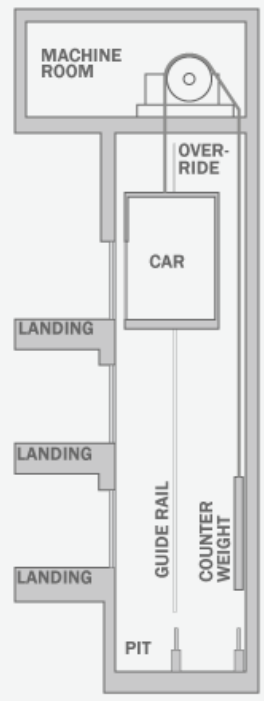
	Rated speed, v_n m/s	Rated load (mass) 320 kg to 630 kg $b_4 \times d_4$	800 kg to 1 000 kg $b_4 \times d_4$	1 275 kg to 1 600 kg $b_4 \times d_4$	1 800 kg to 2 000 kg $b_4 \times d_4$
Machine room for electric lifts	0,63 to 1,6	2 500 × 3 700	3 200 × 4 900	3 200 × 4 900	3 000 × 5 000
	2,0 to 3,0		2 700 × 5 100	3 000 × 5 300	3 300 × 5 700
	3,5 to 6,0		3 000 × 5 700	3 000 × 5 700	3 300 × 5 700
Machine room for hydraulic lifts [a]	0,4 to 1,0	Width or depth of well × 2 000 mm for lifts in residential buildings			
		Non-standard configuration for general-purpose or intensive-use lifts			

[a] Site conditions and national regulations may require different machine room dimensions (b_4, d_4, h_2).

31

NL ISO 4190-1

Parameter	Rated speed v_n	Lifts in residential buildings				General-purpose lifts			Intensive-use lifts			
		Rated load (mass) kg										
		450	630	1 000	630	800	1 000/ 1 275	1 350	1 275	1 350	1 600	1 800	2 000
Height of car, h_1		2 200					2 300		2 400				
Height of car door and landing doors, h_5		2 000	2 100										
Pit depth [a], d_2	0,40 m/s [b]	1 400											
	0,63 m/s	1 400											
	0,75 m/s												
	1,00 m/s												
	1,50 m/s												
	1,60 m/s		1 600										
	1,75 m/s												
	2,00 m/s		1 750			1 750							
	2,50 m/s		2 200			2 200							
	3,00 m/s								3 200				
	3,50 m/s								3 400				
	4,00 m/s [b]								3 800				
	5,00 m/s [b]								3 800				
	6,00 m/s [b]								4 000				



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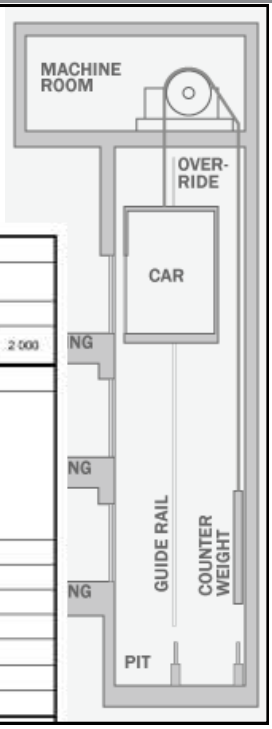
NL ISO 4190-1: Offices

In case of duplex add 40 cm

Parameter	Rated speed v_n	Lifts in residential buildings			General-purpose lifts				Intensive-use lifts			
		Rated load (mass)										
		kg										
		450	630	1 000	630	800	1 000/ 1 275	1 350	1 275	1 350	1 600	1 800	2 000
Headroom[a], A_1	0,40 m/s[b]	3 600			[c]							
	0,63 m/s	3 800			3 800		4 200		[c]			
	0,75 m/s											
	1,00 m/s	3 700										
	1,50 m/s	[c]	3 800		4 000		4 200					
	1,60 m/s											
	1,75 m/s											
	2,00 m/s	[c]	4 300		[c]	4 400						
	2,50 m/s		5 000		[c]	5 000	5 200		5 500			
	3,00 m/s	[c]							5 500			
	3,50 m/s								5 700			
	4,00 m/s[d]								5 700			
	5,00 m/s[d]								5 700			
	6,00 m/s[d]								6 200			



33

3- Selection and Dimensions

- d) Lifts for patients

34

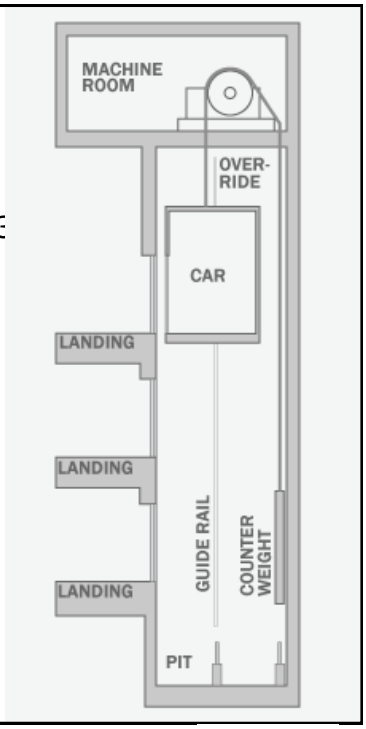
Determination of Parameters: Rule of Thumb (Patient lifts)

- USE THE SERVICES OF VERTICAL TRANSPORTATION ENGINEER
- Number of lifts
  - One lift per 75 beds
  - Minimum 2 lifts is highly recommended
- Car Dimension
  - Depending on the configuration needed (refer to plans)

35

Determination of Parameters: Rule of Thumb (Patient lifts)

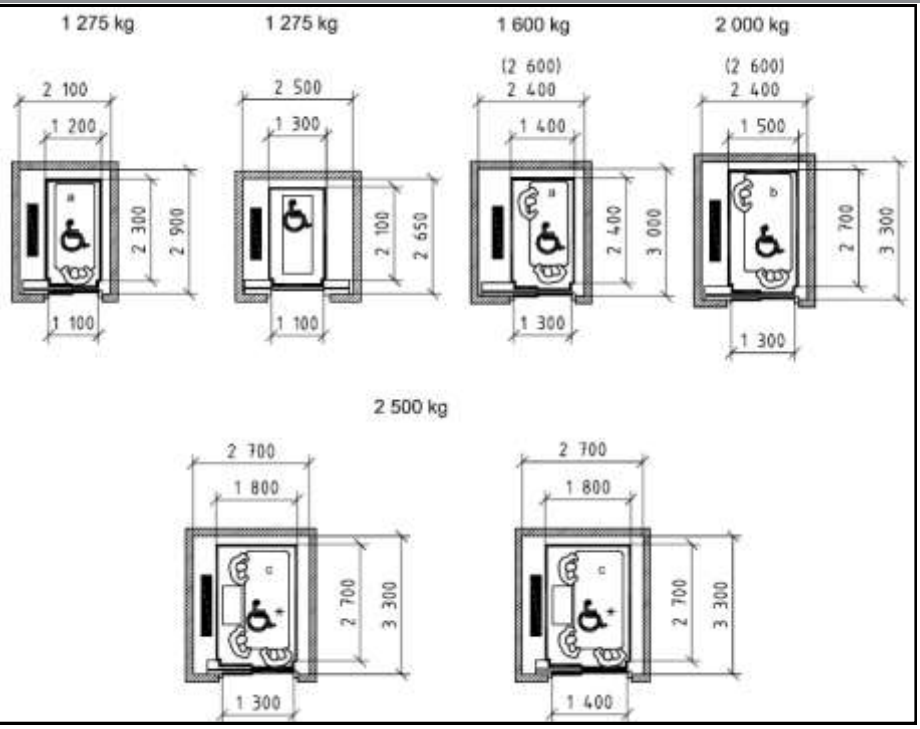
- Speed
  - Travel (Lowest floor FFL to top floor FFL) divided by 3
- Car Height
  - Minimum 2300 mm
  - Door height minimum 2100 mm



36

NL ISO 4190-1: Health-care lift

- Add 12 cm in width for separating beams (in case of several lifts in the well
- If there is space below the pit add 10 cm for the width



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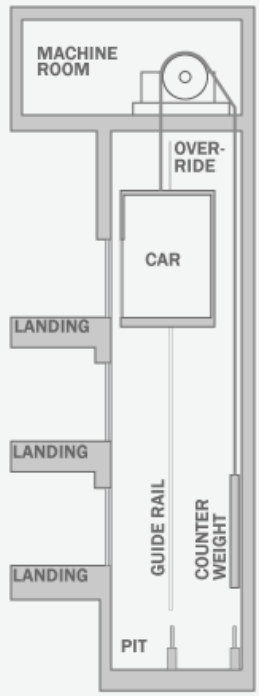
NL ISO 4190-1: Health-car lifts

Parameter	Rated speed v_n m/s		Rated load (mass) kg			
			1 275	1 600	2 000	2 500
Car		Height, h_4 (mm)	2 300			
Car door and landing doors		Height, h_3 (mm)	2 100			
Pit depth, d_3	0,63		1 600			1 800
	1,00		1 700			1 900
	1,60		1900			2 100
	2,00		2 100			2 300
	2,50		2 500			
Headroom, h_1	0,63		4 400			4 600
	1,00		4 400			4 600
	1,60		4 400			1 600
	2,00		4 600			4 800
	2,50		5 400			5 600
Machine room[a] (where needed)	0,63 m/s to 2,50 m/s	Surface, A (m^2)	25		27	29
		Width[b], d_4 (mm)	3 200			3 500
		Depth[b], d_4 (mm)	5 500		5 800	



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2- Selection and Dimensions

e) Lifts for Handicapped

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Special lifts: NL EN 81-40 & 41

41- Vertical lifting platform

40- Stairlift

40

NL EN 81-70: handicapped

- NL EN 81-70: (…)
  Accessibility to lifts for persons including persons with disability
- on one side wall of the car a handrail shall be installed on a height of 900mm
- In case a user of a wheelchair cannot turn it around, a mirror shall be installed to enable this user to observe obstacles behind them when moving backwards out of the car. Where a glass mirror is used it shall be safety glass.
- Indicators and hall lanterns at special heights

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Nl EN 81-70: Main requirements

Minimum car dimensions	Accessibility level
450 kg Car width : 1 000 mm Car depth : 1 250 mm	This car accommodates one wheelchair user.
630 kg **Car width : 1 100 mm** **Car depth : 1 400 mm**	This car accommodates one wheelchair user and an accompanying person.
1 275 kg Car width : 2 000 mm Car depth : 1 400 mm	This car accommodates one wheelchair user and several other users. It also allows a wheelchair to be rotated in the car.

42

4- Standards Requirements

» a) Well Construction

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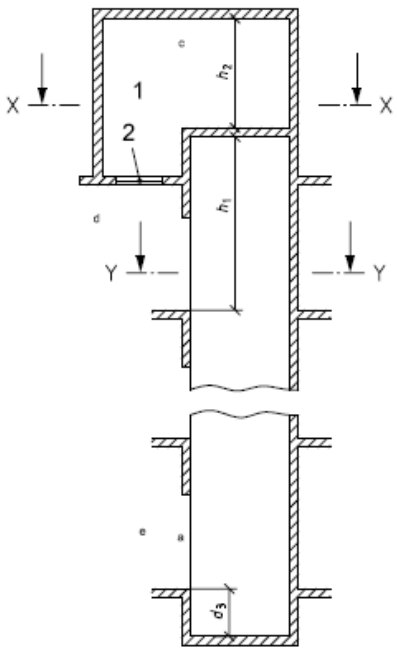
Requirements for the well

- Well, Headroom and pit
- More than 11m between two consecutive stops
  - emergency door
- Accessible space below the well
  - 5000 N/m2
  - Safety gear for counterweight
- Laminated glass
- For speed >2.5 m/s:
  - inspection door to pit



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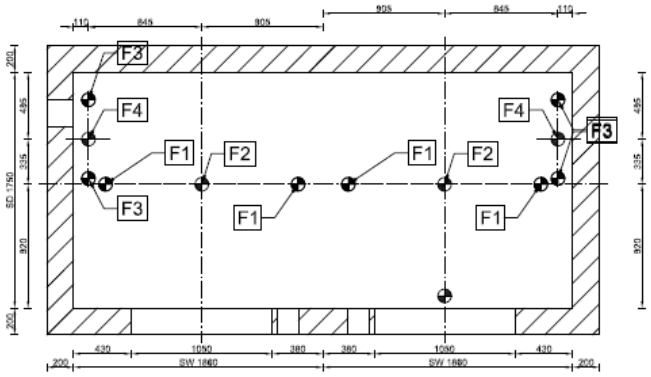
Requirements for the well



- Reaction load:
  - Car buffer (F2): 10 x [rated load]
  - Counterweight buffer (F4): 8 x [rated load]
  - Car rails (F1): 4 x [rated load]
- Well lighting:
  - 50 lux
  - At 50 cm from ceiling and from pit
  - Estimated one lamp 400 lumen every 3 m for every lift
- Two way switching for lights:
  - Pit
  - Machine room

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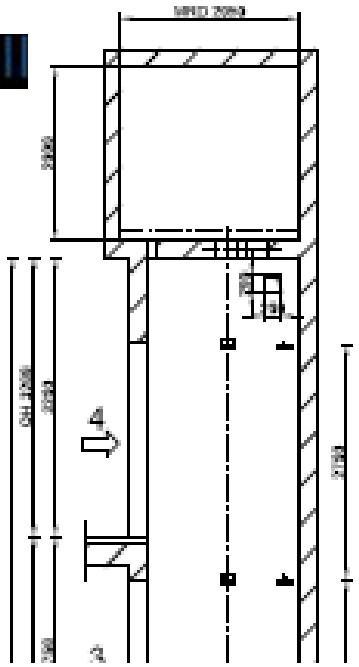
Requirements for the well

- There shall be socket outlet in the pit
- Exclusivity of the well
- There shall be ventilation opening in the top of the well 1% of the area (MRL)



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4- Standards Requirements

b) Machine room construction

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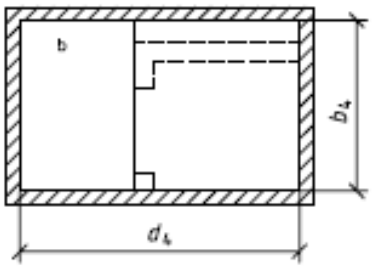
Points to consider

- Machine room lighting:
  - 200 lux
  - Estimated total lamp illumination based on 400 lumen x area of the machine room
- Exclusivity of machine room
- There shall be socket outlet in the machine room



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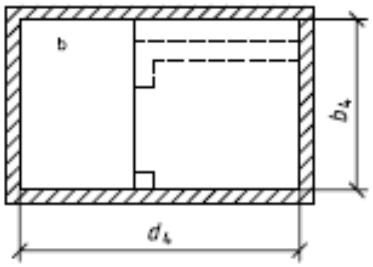
Points to consider

- Machine room Electrical:
  - Near the entrance door
  - Main switch pad lockable
  - Car light switch
  - Well light switch (two-way)
  - Earthing
- Power requirement (in Watt):
  - 10 x [rated load] x [rated speed]
  - Power factor: 0.8



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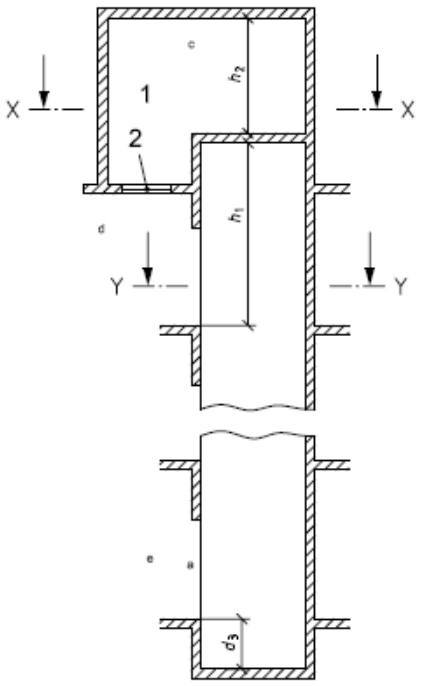
Points to consider

- Machine room accessible by stairs
  (if by ladders 4m max and should be fixed)
- Hooks and signage
  - 2.5 x [rated load]
- Accessibility to staircase from the landing door for all common area use lifts



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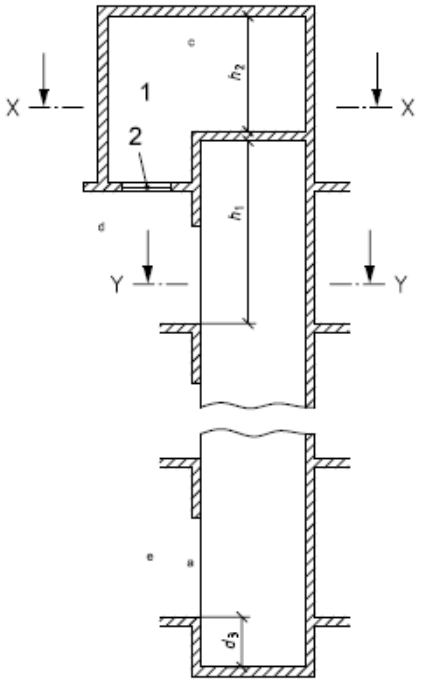
Points to consider

- Load imposed on the Machine room slab
  - 7 x [rated load]
- Door:
  - lockable without key
  - Open from outside with key only
  - Open from inside without key
- Machine room floor non-slippery.



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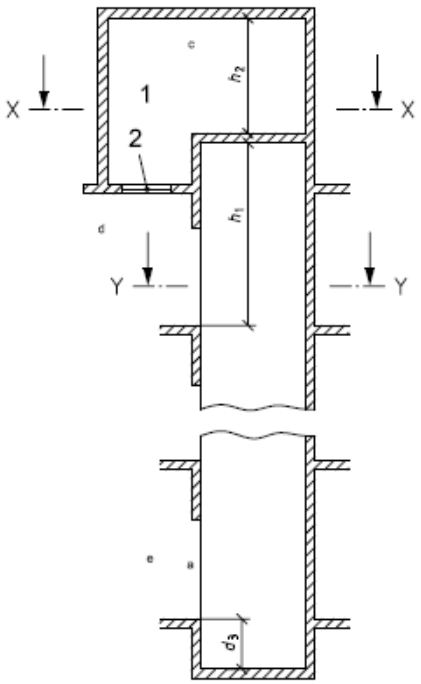
Points to consider

- Temperature in Machine room:
  - to be between +5 C and +40 C
  - Machine heat emission in Watt: 1.5 * [rated load] * [Speed]
- Wiring outside the well:
  - Intercom
  - Fire alarm system
  - …



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Existing Buildings

- For construction constraints in existing buildings there are some solutions in NL EN 81-21:
  - Low headroom
  - Reduced pit depth
  - Small well dimensions
  - Low landing doors

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5- Lift Documents

- a) General

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General information

- Main Specification defined:
  - Applicable codes
  - Speed
  - Capacity
  - Type and dim of doors
  - Car height, …
  - Special requirement for mission F
- Well dimension suitability
  - NL ISO 4190; or
  - Technical dossier of the supplier

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Design Review: Fire requirements

- Fire code requirements:
  - Specific lifts (1600kg, dimension) or firefighter
  - Need for fire rated doors (E, EI, EW, ??minutes)
  - Behavior of lift in case of fire
  - Need for car emergency trap, …
  - Not applicable if the auditor mission is limited to lift inspection only.

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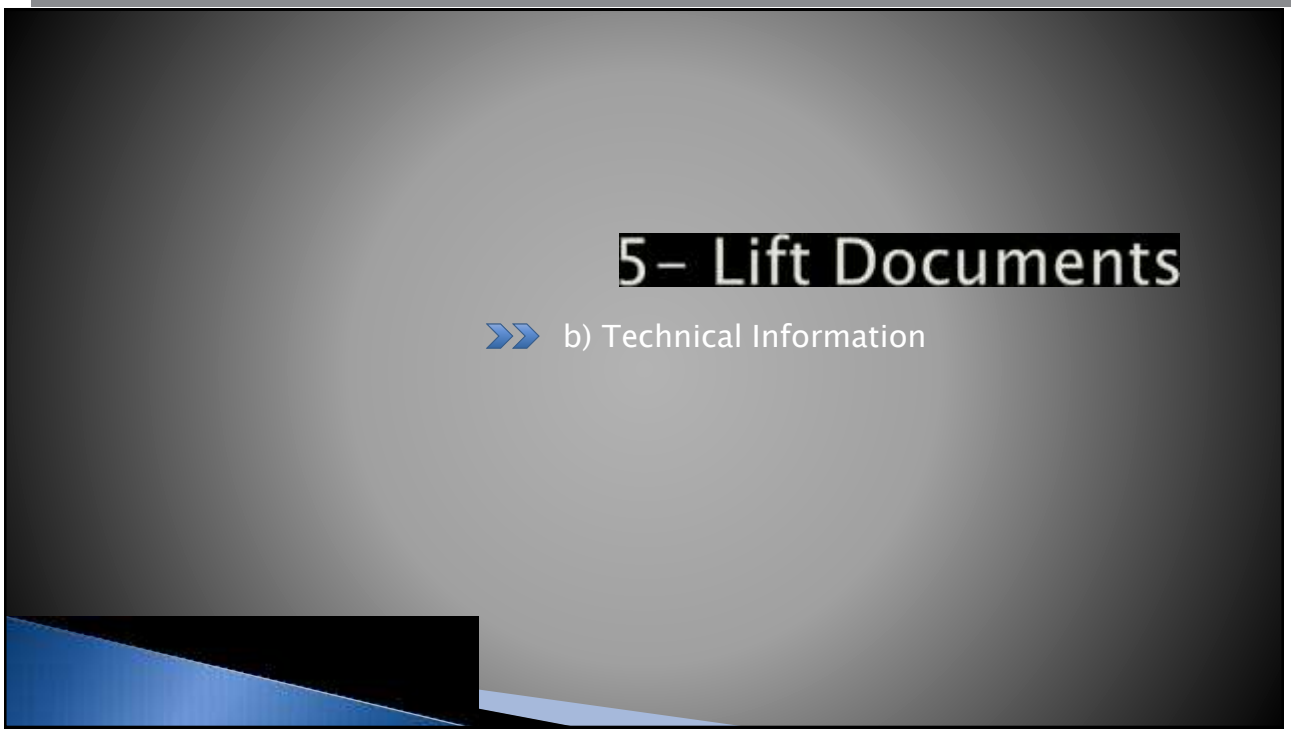

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Technical dossier

- The technical dossier contains:
  - Information about the installation
  - Layout drawings
  - Calculation notes
  - Technical data sheets
  - Schematic diagram for the safety circuit
  - Type examination certificates

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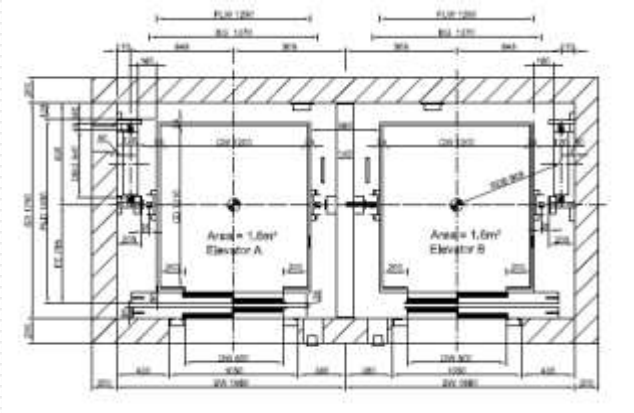
Layout drawings

- Compliance with:
  - Applicable Standards
  - Design drawings
  - Specific requirements of Client



Points to be verified

Check car dim and clearances

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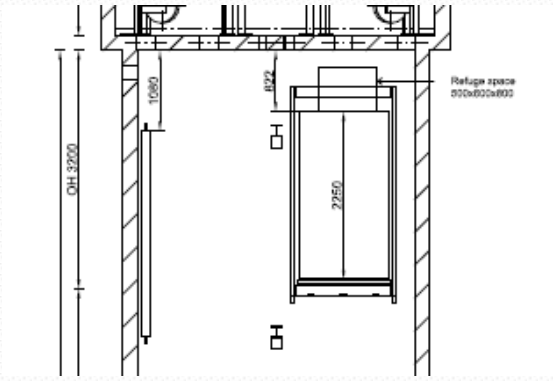
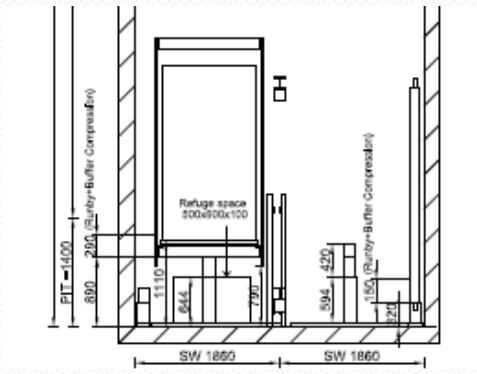
Layout Drawings: Sections





Top clearance

Bottom Clearance

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Calculation notes required

- Guide rails
- Traction Ropes Safety factor
- Evaluation of traction
- Overspeed governor ropes

- The first two can not be verified by tests

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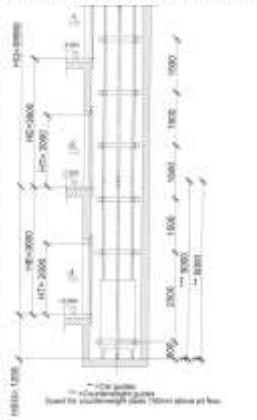
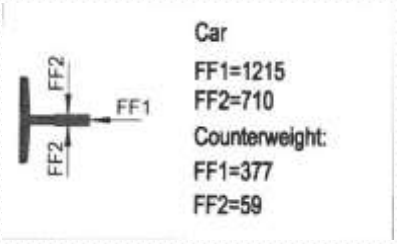
Calculation Notes: Guide Rails



Bracket to bracket distance



Forces on Guide rails

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Certificates for electric lifts

- Lift type examination certificate (if applicable)
- Door locks
- Fire rated doors
- Safety gear
- Overspeed governor
- Buffers
- Safety circuits containing electronic components
- Ascending protection
- UCM

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Type Examination Certificate

LIFTINSTITUUT

CT-01.01.124

EU-TYPE EXAMINATION CERTIFICATE

Issued by Liftinstituut B.V.
identification number Notified Body 0400,
commissioned by Besluit no. 2016-0000038670

Certificate no. : NL12-400-1002-002-48 Revision no.: 10

Description of the product : Traction lift without machine room for persons/goods

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5- Lift Documents

- Coordination

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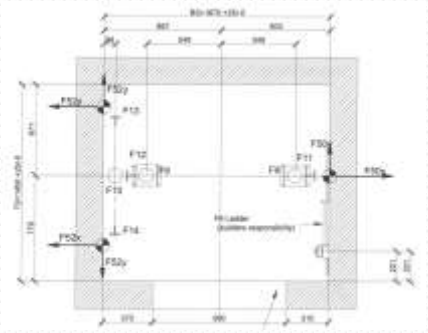
Forward to Structural

- Load on the pit floor
- Forces on the well wall
- Loads on machine room
- load on hooks



Example points

Forces on pit and well

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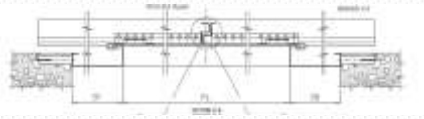
Forward to Architect

- Closing around the fire rated doors
- dimensions and finishing



Example points

Finishing around fire rated doors

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Forward to Electrical

- Wiring outside the well:
  - Intercom
  - Fire alarm systems
- Power demand
- Well lighting + Socket
- Machine room lighting + Socket

ELECTRICAL DATA :	
Nominal Voltage (V)	380 V
Main frequency (Hz)	50 Hz
Voltage and frequency deviation	+10/-10 %
Power supply for light (V)	230 V
Nom. current of installation INN	19,00 A
Start. current of installation INA	23,00 A

Example Points

Electrical requirements

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Forward to Mechanical

- Heat Emission of the machine
- Temperature range: +5 to +40 deg C

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5- Lift Documents

- Final testing

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Final examination

- Examination includes:
  - Visual Inspection
  - Performance checks and test
  - Measurements
  - Availability of User information
- Compliance with:
  - Standards
  - Pre-authorized documents
  - Other client's requirements within the scope

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Main tests

- Safety switches
- Traction
- Safety gear
- Buffers
- Overspeed governor
- Ascending car overspeed protection
- Unintended Car movement
- …

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Final report

- Standard ensures safety of persons:
  - Users;
  - Outside the well; and
  - Technicians
- Before putting the lift into service, the lift shall be safe for use… couple of months could be given to repair items related to safety of the technicians

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Conclusion

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Summary

1. Introduction to lifts
2. Selection and dimensions
3. Applicable Standards
4. Design Requirements
5. Lift Documents

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Conclusion 1: Safety is our role

- Safety is relying on standards
  =>
  engineers are responsible for standards knowledge
- Standards are amended on regular basis
  =>
  updating the knowledge is a must

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Conclusion 2:

- The safety is costly;
  if limited to license only it will be pure expenses
- The need is to go beyond the initial phase and ensure continual safety:
  - Periodical checks for electromechanical items
  - Control of usage of building

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THANKS FOR YOUR ATTENTION

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