Environmental Product Declaration Schindler 5500

More efficiency, less impact. Ecological facts and figures

Schindler Passenger Elevators

Schindler

Glossary

Impact: Environmental impact

Materials: Resource usage

Energy: Energy demand

Additional: Complementary information

LCA – Life-cycle Assessment
Assessment methodology of the environmental impact of all relevant material and energy flows throughout the entire life cycle of a product according to ISO 14040.

EPD – Environmental Product Declaration
A declaration that provides quantified environmental data using predetermined parameters defined in a Product Category Rule according to ISO 14025.

PCR – Product Category Rule
A set of specific rules, requirements and guidelines for developing environmental declarations for one or more product categories.

EMS – Environmental Management System
Covers development, implementation and management of environmental aspects according to ISO 14001.

Ecological Scarcity / UBP 06
Scarcity-oriented method for life-cycle impact assessments. It measures various environmental impacts, and shows the final result in a single score.

ReCiPe
Methodology for life-cycle impact assessments evaluating various environmental impacts and showing the final result in a single score.

VDI4707-1
Independent guideline on how to measure and classify the energy efficiency of elevator systems, published by the Association of German Engineers (Verein Deutscher Ingenieure).

Key figures

Capacity	630 to 2,500 kg
Travel height	Up to 150 m
Door width	800 to 1,400 mm
Door height	2,100 to 2,400 mm
Drive	STM Technology regenerative drive option
Speed	1.0 to 3.0 m/s MMR and MRL
Number of floors	50 floors (60 landings)
Car groups	Up to 8 cars expandable with PORT Technology
Interior	4 deco lines from functional to sophisticated, glas panel option bare car
Fixtures	Mechanical or touch-sensitive buttons dot matrix display or TFT LCD
Door types	T2L, T2R, C2, C4 glass door optional

Representative unit*

Usage period for LCA	20 years**
Load (kg)	1,000
Speed (m/s)	1.6
Travel height (m)	21
Stops/Entrances	8/1
Car W/D/H (mm)	1,100/2,100/2,200
Door W/H (mm)	900/2,100
Operation days/year	365
Usage category***	3
Consolidated data from LCA 2012	

Installation at Paris, France

* Comparability of the environmental data with different elevator systems may not be given.

** Product usage time defined for the LCA. The complete environmental life-cycle impact is included without considering a modernization.

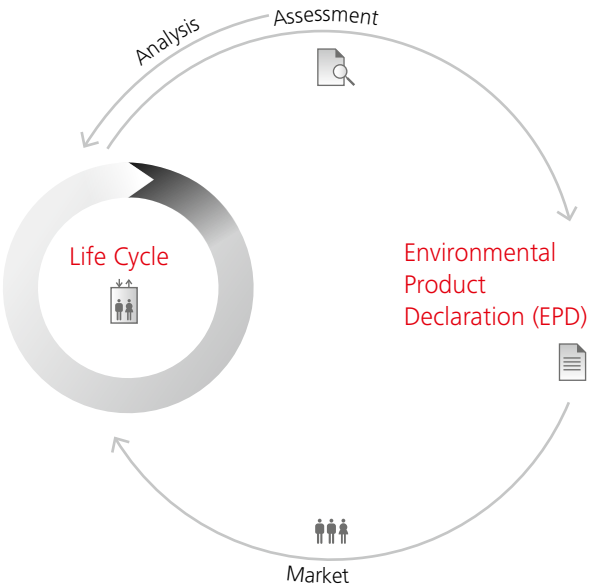
*** according to VDI4707-1

First we analyze, then we improve.

Mobility is essential in the world we live and work. Every day, one billion people all over the world place their trust in Schindler. That's why we are committed to contintuously improve the environmental impact of our products and services along the whole life-cycle.

From design to recycling
From the first sketches in design, right through to disposal and recycling, environmental assessment considerations are an integral part of product development. The assessment rigidly follows the ISO 14040 standard and is embedded in the ISO 14001 Environmental Management System, which is applied at Corporate Research and Development. Providing transparency in all phases.

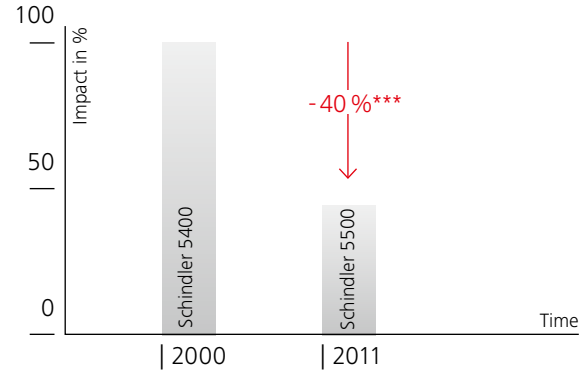
Life-cycle Assessment (LCA)
Schindler conducts Life-cycle Assessments of its products. The objective is to continuously improve the environmental performance of the product assessed. An holistic approach all the way.



Environmental Product Declaration (EPD)
The EPD provides verified information on the environmental impact of a product. The declaration is based on a comprehensive LCA and follows the ISO 14025 guideline. A complex issue made understandable.

Product Category Rules (PCR)
Both the LCA and EPD refer to a pre-defined PCR*. Rules in the PCR are specifically defined for a product and stipulate how to collect data and calculate the climate impact, and how this information has to be presented. Detailed analysis, fact-based communication.

Comparison of environmental impact**



The environmental performance of the Schindler 5500 has improved by approx. 40 % as result from PEcoPIT. The LCA of the latest generation of the Schindler 5500 showed significant improvements compared with the previous product generation.

* Overarching industry related PCR is in development. Currently the PCR is available from Schindler in cooperation with an independent third party.
** Comparison is based on the representative elevator system, see page 4.
*** The PEcoPIT takes material used, energy during usage and disposal into consideration.

Perfectly fitting your environment.

Gearless machine (including brake system*)
– Machine with synchronous or asynchronous motor technology has an efficiency at nominal operation up to 92 %
– Compact design, optimized footprint and reduced weight (about 30 % less weight than the preceding model)
– Major parts are made of steel and cast iron that contain high recycled content and ensure high recyclability
– No machine room required

Frequency converter
Regenerative converter optionally available
– Minimum heat dissipation due to energy recuperation
– Return of regenerated energy to power line during overhauling mode
– Minimal reactive power by use of PF1 converter (Total power factor 1: cos $\phi \geq 0.99$)

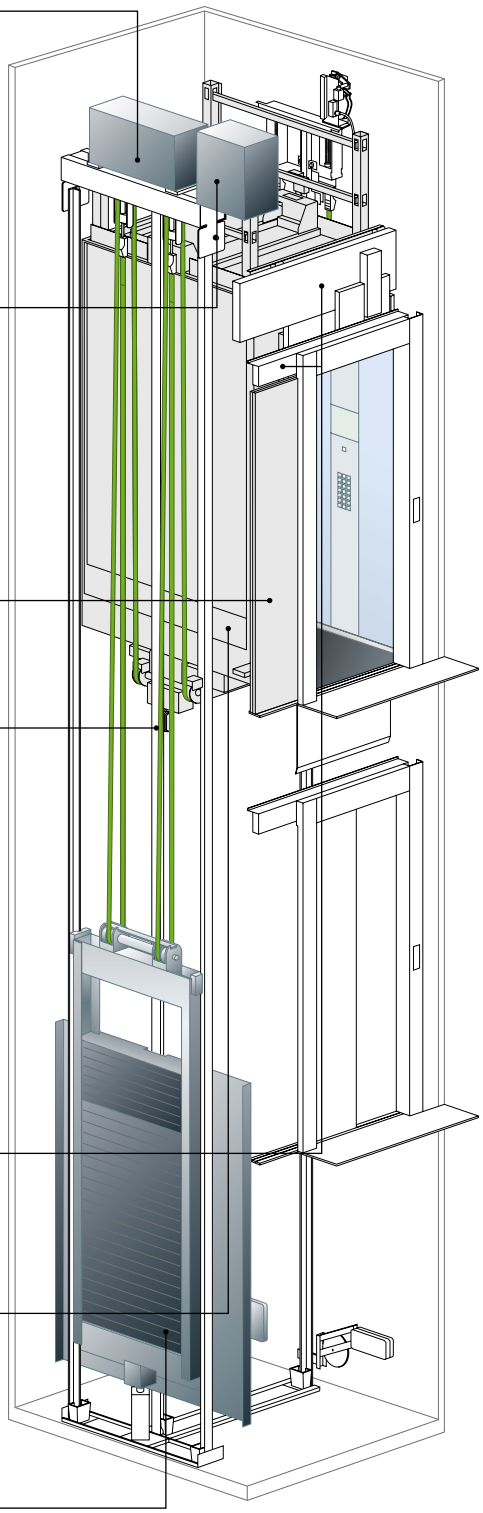
Controller
– Reduced stand-by power
– Halogen free cabling and wiring optionally available

Traction Transmission – Suspension Traction Media (STM):
Saving resources due to:
– Reduced weight (less steel): not only traction media itself but also less compensation chain
– Much smaller traction sheave diameter with STM technology: smaller machine compared to steel rope installations
– More than 3 times longer life time compared to steel ropes
– Oil free traction media: compared to steel ropes the STM is oil free and does not require regular re-lubrication.
– STM is halogen-free

Door system
– High efficiency, low mass Permanent Magnet Synchronous Motor
– Low mass door system and low friction mechanics
– Halogen free cabling and wiring optionally available

Car
– Optimized design resulting in weight reduction
– LED car lighting available
– Car light switches off automatically
– Stand-by function

Counterweight
– Substitution of lead for balancing weight

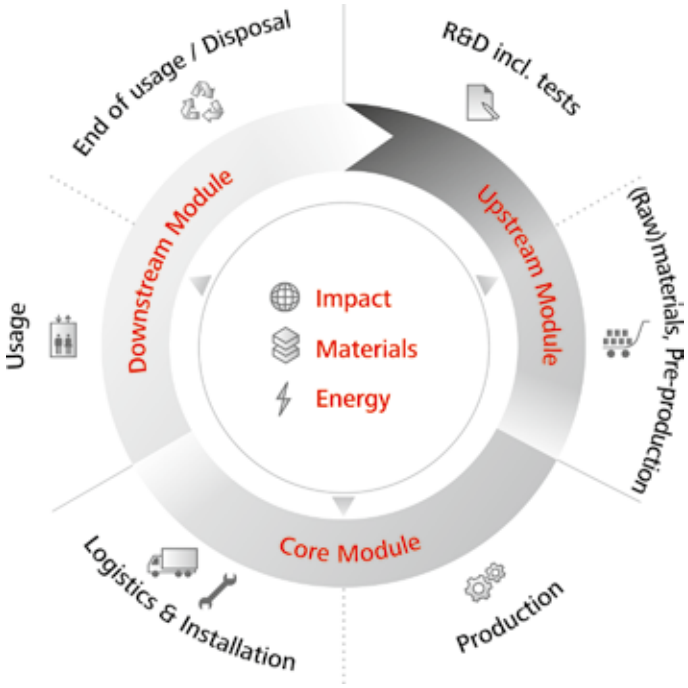


* safety component

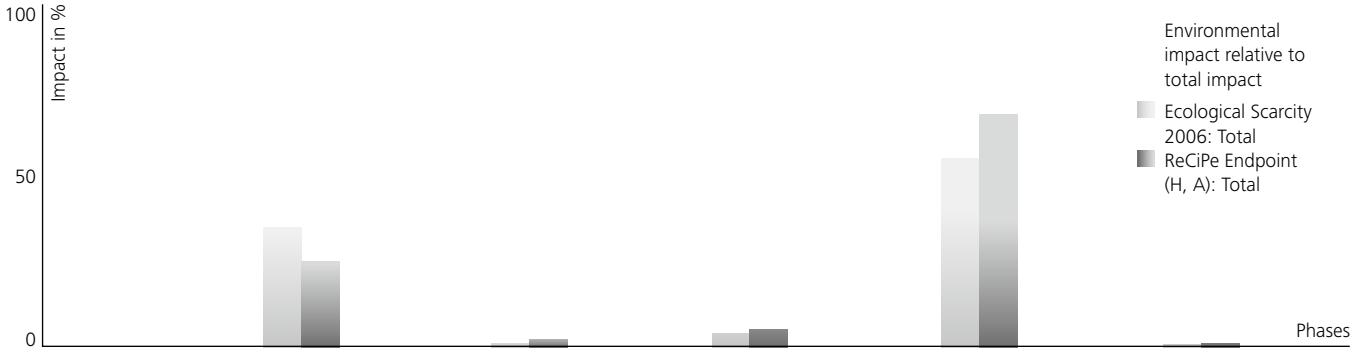
Insights into the life-cycle outcome.

Three-phase approach
The aim is to determine the environmental impact of the elevator system from development to disposal. Based on the PCR, the assessment is separated into three modules – upstream, core and downstream – covering the energy and material flow. The results are shown for a specific function and a representative elevator unit.

Focus on material and energy
Energy efficiency has been improved dramatically, especially compared to the previous product generation. In the past, the operational phase accounted for the main impact, now operation has become less dominant compared to material at a relatively lower level. Thanks to continuous investment and effort in improving both energy and material efficiency.



Consolidated impact based on a lifetime of 20 years*



R&D incl. tests	(Raw) materials, Pre-production	Production	Logistics & Installation	Usage	End of usage/ Disposal
Office Activities	Drive	Drive	Packaging	Energy demand	Recycling
Tests	Controller	Controller	Transport	Preventive &	Incineration
	Traction Media	Traction Media	Installation	Corrective	Landfill
	Door	Door	Others	Maintenance	Transport
	Car	Car		Others	Packaging
	Counterweight	Counterweight			Repl. Mat.
	Others	Others			

Upstream Module | Core Module | Downstream Module

* Values shown refer to the representative unit of the Schindler 5500, as shown on page 4

Our mission. Lower emissions.

Impact per life-cycle phase – representative unit
The representative unit is a typical configuration of the Schindler 5500 (see page 4). The figures shown in the table are based on a lifetime of 20 years, without considering a modernization. The results provide an example of a typical environmental impact. The travel distance over a usage period of 20 years with 365 days of operation is based on the average usage, according to category 3 of VDI 4707-1 and an elevator speed of 1.6 m/s. Over a life cycle of 20 years, the total impact of a Schindler 5500 elevator system is 50.9 t CO_2-equivalent.

		Upstream Module	Core Module	Downstream Module		Total LCA
	Units	R&D, Material demand	Production, Installation	Usage: Stand-by & Travel energy	Maintenance, Disposal	Total elevator life-cycle
Impacts						
Climate change (IPCC 2007, GWP 100a)	kg CO_2-Eq.	10,800	2,500	35,900	1,700	50,900
Acidification potential (CML 2001, European average)	kg SO_2-Eq.	101	11	173	14	299
Eutrophication potential (CML 2001, European average)	kg NOx-Eq.	44	13	74	5	137
Photochemical oxidation, summer smog (CML 2001, low NOx POCP)	kg ethylene Eq.	4.22	0.45	1.50	0.43	6.60
CED*						
Fossil, non-renewable energy resources	MJ eq.	140,000	37,000	436,000	21,000	634,000
Nuclear, non-renewable energy resources	MJ eq.	26,000	8,400	286,000	4,000	324,400
Water, renewable energy resources, potential	MJ eq.	11,400	1,400	32,400	600	45,800
Renewable energy resources, except water (biomass, solar, wind, etc.)	MJ eq.	2,100	17,500	15,300	300	35,200
Total energy resources	MJ eq.	180,000	60,000	770,000	30,000	1,040,000
Aggregated						
ReCiPe Endpoint (H,A): Total	points	1,450	360	3,570	250	5,630
Ecological Scarcity 2006: Total	UBP	25,700,000	3,100,000	38,900,000	3,400,000	71,100,000

Uncertainty of total values estimated about 20 %

* CED (Cumulative Energy Demand): Grey energy

The typical European electricity mix according to UTCE 2004 was applied.

Impact per life-cycle phase – functional unit
The functional unit is defined as:
demand / (rated load [t] × travel distance [km])
The results given in the table cover the total life-cycle impact for a calculated functional unit. Whereby 9 tkm of a Schindler 5500 represent about one day of operation in its representative environment and usage category.

The travel distance refers to a usage period of 20 years and a frequency of daily use as per VDI 4707-1 usage category 3. Applying the functional unit approach permits comparison of different elevator systems per unit of tkm, but the comparison is appropriate only for elevators in the same usage category.

		Upstream Module	Core Module	Downstream Module		Total LCA
	Units/tkm	R&D, Material demand	Production, Installation	Usage: Stand-by & Travel energy	Maintenance, Disposal	Total elevator life-cycle
Impacts						
Climate change (IPCC 2007, GWP 100a)	kg CO_2-Eq.	0.171	0.040	0.569	0.027	0.807
Acidification potential (CML 2001, European average)	kg SO_2-Eq.	0.00161	0.00017	0.00274	0.00023	0.00474
Eutrophication potential (CML 2001, European average)	kg NOx-Eq.	0.00069	0.00021	0.00118	0.00008	0.00216
Photochemical oxidation, summer smog (CML 2001, low NOx POCP)	kg ethylene Eq.	0.000067	0,000007	0.000024	0.000007	0.000105
CED*						
Fossil, non-renewable energy resources	MJ eq.	2.2	0.6	6.9	0.3	10.1
Nuclear, non-renewable energy resources	MJ eq.	0.41	0.13	4.53	0.06	5.14
Water, renewable energy resources, potential	MJ eq.	0.181	0.022	0.514	0.010	0.726
Renewable energy resources, except water (biomass, solar, wind, etc.)	MJ eq.	0.033	0.277	0.243	0.005	0.558
Total energy resources	MJ eq.	2.9	1.0	12.2	0.5	16.5
Aggregated						
ReCiPe Endpoint (H,A): Total	points	0.0230	0.0057	0.0566	0.0040	0.0893
Ecological Scarcity 2006: Total	UBP	410	50	620	50	1,130

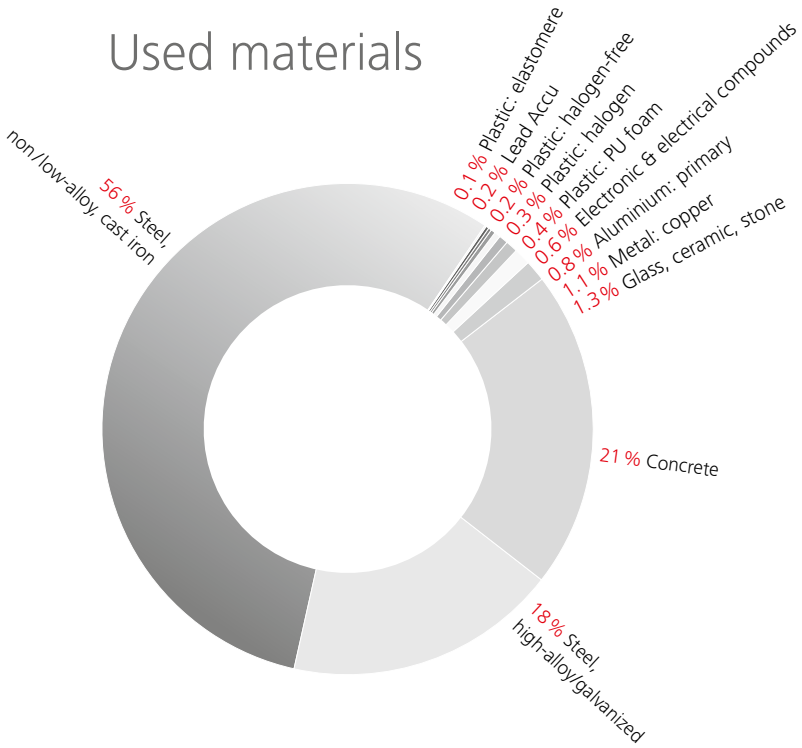
Uncertainty of total values estimated about 20%

* CED (Cumulative Energy Demand): Grey energy

The typical European electricity mix according to UTCE 2004 was applied.

Efficient – in space and material usage.

Used material – an overview
The average recycled content of the European metal supply was considered in the calculations of environmental impact from materials according to the PCR. A cut-off was applied for recycling at the end of life.



Packaging material
The table shows the typical composition of material used for packaging in relation to the total weight of the elevator system – once the elevator arrives on the construction site.

Schindler seeks to maximize the transport capacity per pallet for each delivery. Furthermore, almost all materials are suitable for recycling, e.g. paperboard and wood.

Composition of packaging material*

Packaging material	Material (kg)	Total elevator weight (%)*
Wood	350.40	5.76
Plastic	4.00	0.07
Polystyrene	0.10	0.00
Paperboard	118.20	1.94
Other materials	1.80	0.03

* Relation in reference to the total weight of elevator incl. packaging.

Material that matters

The table shows the material weight of components and replacement material. The total weight installed is about 5.6 tons. An average material loss of 10 % in production was assumed additionally for the consumption of raw materials. The Schindler 5500 emits no Volatile Organic Compounds (VOCs) once it's installed or other harmful substances. The elevator can optionally be ordered halogen free – which includes the cabling and wiring. At the end of usage almost all material is suitable for recycling (approx. 95 %).

Material balance of elevator system	Elevator material (kg)	Replacement material (kg)	Recycled content (%)	End of usage/ Disposal scenario
Steel, non/low-alloy, cast iron	3,126	47	38%	90% recycling/10% landfill
Steel, high-alloy, galvanised	1,027	5	38%	90% recycling/10% landfill
Aluminium: primary	46	4	33%	90% recycling/10% landfill
Metal: Copper	64	0	22%	90% recycling/10% landfill
Electronic/electrical compounds	34	19	average of elements	Return system, i.e. battery; others as above
Plastic: halogen	16	0	none	60% landfill/40% incineration
Plastic: halogen-free	12	7	none	60% landfill/40% incineration
Plastic: elastomere	4	1	none	60% landfill/40% incineration
Plastic: PU foam	21	18	none	60% landfill/40% incineration
Concrete	1,164	0	none	100% landfill
Glass, ceramic, stone	76	1	none	100% landfill
Wood/Fibreboard	0	0	none	100% incineration
Lead Accu	12	36	75%	50% recycling/50% landfill
Others	9	0	none	others as average
Total	**5,611**	**138**	**see elements**	**see elements**

Energy without exposure.

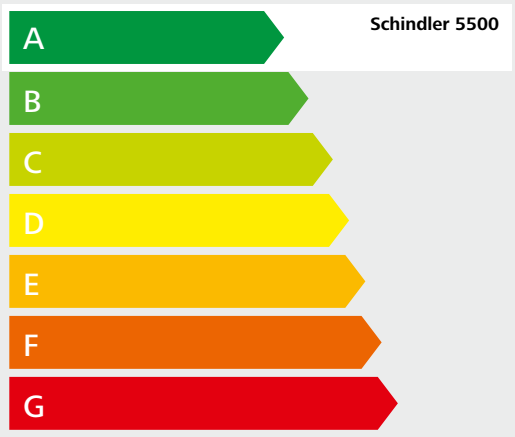
Energy efficiency
Increasing energy efficiency is essential in order to reduce the environmental impact of the elevator and the building. The longest phase in the life cycle is the usage phase, which can be up to 30 years, depending on maintenance and modernization.

Schindler provides data about energy efficiency based on the VDI 4707-1. The two Schindler 5500 examples are classified as A and B, whereby A indicates the best efficiency class. The classification always refers to a specific configuration and is measured at the installation site. Usage pattern, load capacity, energy saving options and site conditions influence the final rating.

Fact-based classification
– Energy efficiency is classified according to the VDI 4707-1
– the usage category is defined as 2 and 3
– stand-by energy accounts for about 25 % – 45 % of the total energy consumption p.a.
– the certificate refers only to a single measured or calculated unit
– energy consumption is influenced considerably by the frequency of use, travel speed and height

Energy efficiency classification

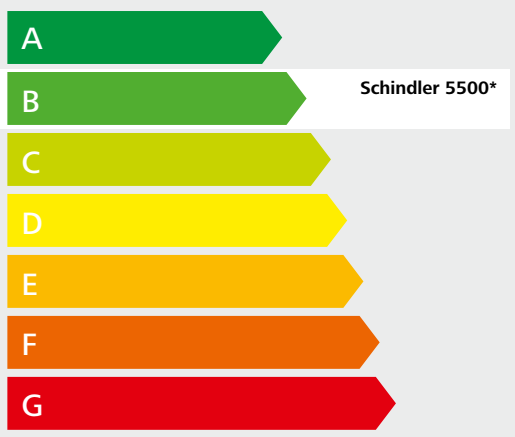
Schindler 5500 – example of typically installed configuration



Certified by TUV SUD for a standard configuration at field installation. Measurements based on the VDI 4707 guideline, issued in March 2010.

Load (kg)	1,000
Speed (m/s)	3.0
Usage category	2
Specific travel demand	A (0.41 mWh/(kgm))
Stand-by demand	B (82 W)
Total demand per year	1,518 kWh

Schindler 5500 – representative elevator as defined for the Life Cycle Assessment*



Load (kg)	1,000
Speed (m/s)	1.6
Usage category	3
Specific travel demand	B (0.74 mWh/(kgm))
Stand-by demand	B (84 W)
Total demand per year	3,020 kWh

* With the "green package" (regenerative drive, stand-by features active) an energy efficiency class A can be achieved.

Sound of silence.

Noise and vibration
The sound made by an elevator can have an impact on the surrounding environment. Not every type of noise is equally disturbing. This depends strongly on the nature of the noise, relative background noise and on psychological aspects.

When it comes to noise and vibration, there are several important aspects: Besides the obvious ones relevant for the whole building concerning the ride quality, such as sound and vibration inside the car, there are others, e.g. door noise and the noise in the elevator shaft. The structure-borne noise in the walls is also important, because it radiates sound into adjacent rooms.

Furthermore, there is noise created during the operation of an elevator, such as the noise of the cooling fan, the drive operation, the relay switching, the door, and the guide shoe sliding (only for a short time after the installation).

Definitions

Sound

L_{pAeq} A-weighted equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring. (Can be interpreted as a mean level and measured directly with an integrating sound level meter.)

L_{pAmax} Maximum A-weighted sound pressure level

All sound pressure level measurements require setting "FAST" of the sound level meter.

Vibration / structure-borne noise

L_{amax} Maximum acceleration level [dB] lin re: $1 \cdot 10^{-6}$ m/s^2

ISO MPtP ISO-weighted Maximum Peak-to-Peak vibration value, according to ISO 18738:2003

ISO A95 ISO-weighted A95 vibration value according to ISO 18738:2003. 95 % of all peaks of the ISO-weighted signal are below this value.

Applicable standards

VDI 2566-2:2004 Acoustical design for lifts without machine room

ISO 2631-1:1997 Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Part 1: General requirements

ISO 18738-1:2012 Lifts (elevators) – Measurements of lift ride quality

ISO 8041:1990 and Amd.1:1999 Human response to vibration – Measuring instrumentation

Noise and vibration performance Schindler 5500 MRL

Adjacent rooms[1]

L_{pmax}	30 dB(A) incl. impulse noise

Shaft[2]

Airborne noise

Shaft head

VKN	≤ 1m/s	1.6 – 1.75 m/s	2 – 3 m/s
L_{Aeq}	≤ 62 dB(A)	≤ 65 dB(A)	≤ 70 dB(A)
L_p	≤ 62 dB(A)	≤ 68 dB(A)	≤ 73 dB(A)

Shaft pit

VKN	≤ 1m/s	1.6 – 1.75 m/s	2 – 3 m/s
L_p	≤ 65 dB(A)	≤ 65 dB(A)	≤ 65 dB(A)

Structure-borne noise[3]

Octave [Hz]	L_{amax} [dB]
63	90
125	90
250	85
500	85

Car

Airborne noise	More than 30 % of total car wall area lined.	Less than or equal to 30 % of total car wall area lined.	
VKN	1 – 3 m/s	≤ 2 m/s	2.5 – 3 m/s
L_{Aeq}	≤ 53 dB(A)	≤ 53 dB(A)	≤ 55 dB(A)
L_p	≤ 55 dB(A)	≤ 55 dB(A)	≤ 58 dB(A)

Vibration		Roller guide shoes	Sliding guide shoes	
VKN		1 – 3 m/s	≤ 1.75 m/s	2.0 – 2.5 m/s
Horizontal vibration at car platform in x-direction*	a_{xA95}	10 – 15 mg	10 mg	15 mg
Horizontal vibration at car platform in y-direction*	a_{yA95}	10 – 15 mg	10 mg	15 mg
Horizontal vibration at car platform in z-direction*	a_{zA95}	10 – 15 mg	10 mg	15 mg

*Tolerance ± 3 mg

Landing

Door noise[4]

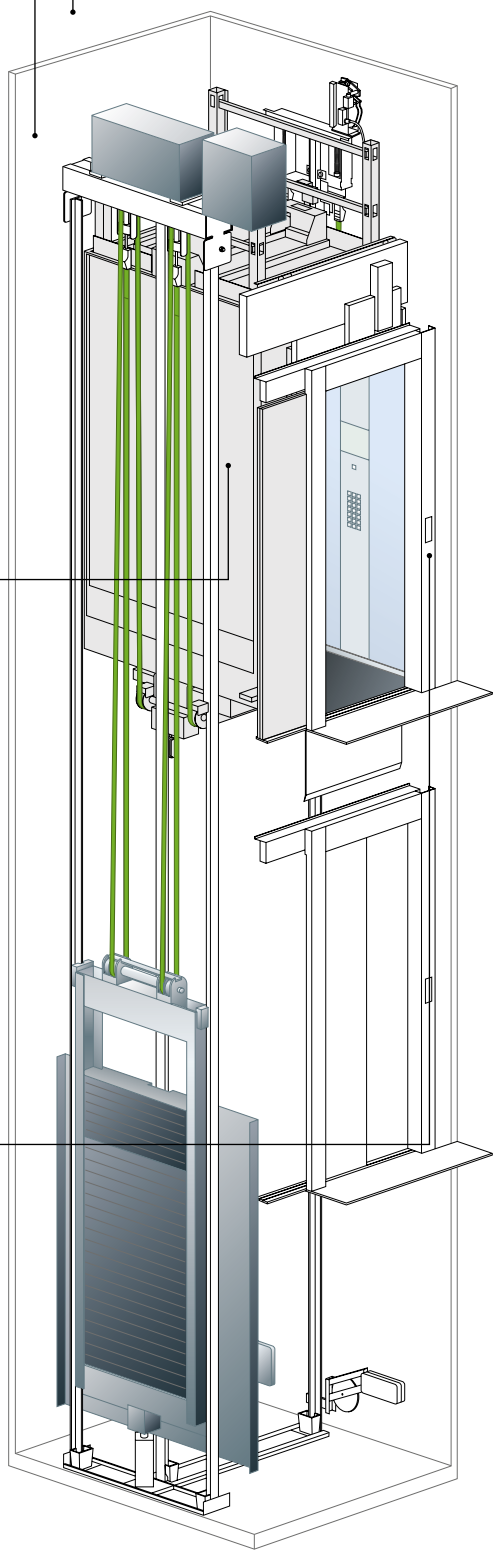
L_{pmax}	55 dB(A)

Pass-by noise

L_{pmax}	50 dB(A)

Noise on top landing including door movement

L_{pmax}	58 dB(A)



[1] VDI 2566-2:2004 prescribes a maximum permissible A-weighted sound level L_{pAmax} in adjacent rooms of 30 dB(A). It is the responsibility of the architect / building designer to ensure that the walls and roof of the shaft provide enough air-borne and structure-borne noise attenuation. The main parameter is the area-specific mass of the hoistway wall. Table 2 of VDI 2566-2:2004 provides rules for the design of the walls depending on the room configuration. These rules are based on standard DIN 4109 supplement 1[a].

[2] VDI 2566-2:2004 specifies a maximum sound pressure level in the hoistway of 75 dB(A).

Schindler 5500 MMR

Adjacent rooms[1]

L_{pmax}	30 dB(A) incl. impulse noise

Machine Room

Airborne noise Machine & Inverter

VKN	≤ 1 m/s	1.6 – 1.75 m/s	2 – 3 m/s
L_{Aeq}	≤ 67 dB(A)	≤ 67 dB(A)	≤ 70 dB(A)
L_p	≤ 70 dB(A)	≤ 75 dB(A)	≤ 75 dB(A)

Shaft[2]

Airborne noise

Shaft head

L_p	≤ 65 dB(A)

Shaft pit

L_p	≤ 65 dB(A)

Structure-borne noise[3]

Octave [Hz]	L_{amax} [dB]
63	90
125	90
250	85
500	85

Car

Airborne noise	More than 30% of total car wall area lined.	Less than or equal to 30 % of total car wall area lined.	
VKN	1 – 3 m/s	≤ 2 m/s	2.5 – 3 m/s
L_{Aeq}	≤ 53 dB(A)	≤ 53 dB(A)	≤ 55 dB(A)
L_p	≤ 55 dB(A)	≤ 55 dB(A)	≤ 58 dB(A)

Vibration		Roller guide shoes	Sliding guide shoes	
VKN		1 – 3 m/s	≤ 1.75 m/s	2.0 – 2.5 m/s
Horizontal vibration at car platform in x-direction*	$\lvert a_{xA95}$	10 – 15 mg	10 mg	15 mg
Horizontal vibration at car platform in y-direction*	$\lvert a_{yA95}$	10 – 15 mg	10 mg	15 mg
Horizontal vibration at car platform in z-direction*	$\lvert a_{zA95}$	10 – 15 mg	10 mg	15 mg

*Tolerance ± 3 mg

Landing

Door noise[4]

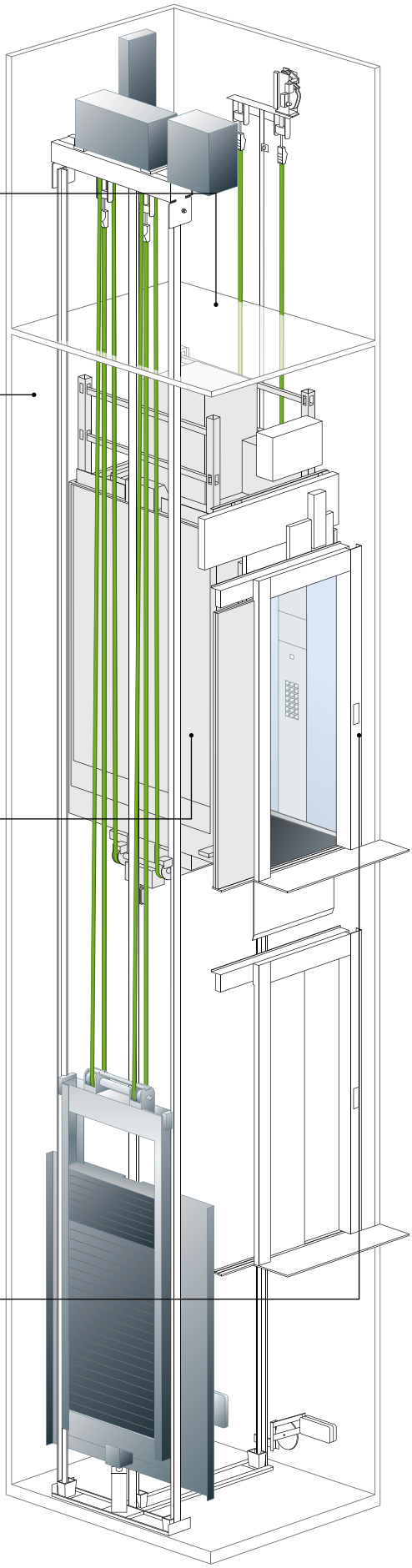
L_{pmax}	55 dB(A)

Pass-by noise

L_{pmax}	50 dB(A)

Noise on top of landing including door movement

L_{pmax}	58 dB(A)



[3] The levels listed are the levels according to VDI 2566-2:2004. The Schindler 5500 elevator system generally fulfills these levels with a large margin, depending on the type of wall.

[4] VDI 2566-2:2004 specifies a maximum A-weighted sound pressure level for door noise of 65 dB(A).

A big step to a small footprint.

Discover more about Schindler´s environmental activities on:
http://ccr.schindler.com

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