

# *KONE EcoDisc® Hoisting Technology*

*Fact Sheet*





## **KONE EcoDisc® gearless elevator hoisting technology**

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**KONE INTRODUCES ECODISC®** Until the early 1990ies the most common gearless machines were direct current DC machines with commutators. Since then, however, asynchronous AC squirrel cage motors controlled by frequency converters (ACVVVF) have replaced them, becoming the dominant solution in gearless - and geared - elevators.

In 1995 KONE installed the first machine-room-less MonoSpace® elevators featuring new revolutionary gearless hoisting technology.

The machine, the EcoDisc®, uses a synchronous, rare earth permanent magnet motor (PMSM) of axial design.

By the turn of the millennium more than twenty thousand elevators powered by the EcoDisc® had been sold and installed. A key element of its success is compact structure. In low-rise elevators, this eliminates the traditional machine room completely. Also in higher rise and speed systems the machine - literally "a motorised traction sheave" - offers remarkable space savings.

### **ECODISC® MACHINE DATA**

Table 1 on the next page provides the main data of the EcoDisc® range, which covers practically all elevator applications from low-rise/speed to high rise heavy-duty double-deckers.

Earlier high rise buildings had to be supplied with a mix of hydraulic, geared and gearless elevators. This mix of different technologies was necessary due to the technical and financial limitations of these different products. Different technologies have different performance characteristics, which do not necessarily match with each other. This is no longer necessary. For the first time it is possible to use gearless technology from the lowest to the highest speeds and loads.

Elevator Type	Machine Type	Machine Weight (kg)	Rated Load (kg)	Max. Rated Speed (m/s)	Blocking Ratio	Traction Sheave (mm)
Without Machine room	MX05	170	400	1.0	2 : 1	340
	MX06	220	630	1.0	2 : 1	400
			1000	0.5	4 : 1	
MX10	320	1000 2000	1.0 0.5	2 : 1 4 : 1	480	
With Machine Room	MX18	700	1800	3.5	2 : 1	650, 690, 750
			1000	5.0	1 : 1	
	MX32	1500	3200	4.0	2 : 1	750
			1350	6.0	1 : 1	
	MX40	2600	4000	4.0	2 : 1	1000
			2000	8.0	1 : 1	
	MX100	5500	10000	4.0	2 : 1	1200
			5000	10.0	1 : 1	
2000			<17.0	1 : 1		

Table 1 EcoDisc® machines

Fig 2a  
MX05, MX06, MX10

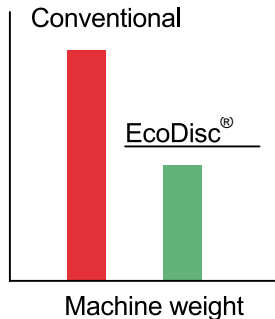
Fig 2b  
MX18

Fig 2c  
MX32, MX40, MX100



## EcoDisc® characteristics:

### SIZE AND WEIGHT:



The unique axial construction makes the EcoDisc® machines very compact. Their power-to-torque ratio is twice that of conventional machines.

For example, a conventional DC or ACVVVF machine lifting a rated load of 1,800 kg at 8 m/s weighs 5,500 to 6,000 kg. The equivalent EcoDisc® MX40 machine weighs 2,600 kg.

A conventional double-decker machine lifting 4,500 kg at 8 m/s weighs about 12,000 kg. A similar duty MX 100 machine weighs only about 5500 kg.

The EcoDisc® motor is integrated with the traction sheave. This results in a flat 'disc' machine shape, which needs less space and fits easily in the machine room.

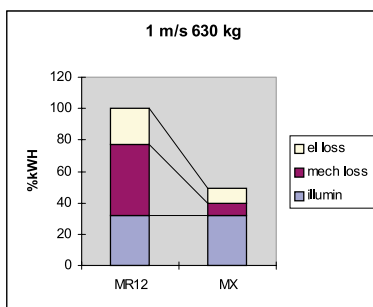
The size and weight advantages offer:

- Construction costs savings
- Machine room space savings
- Increased rentable space



Machine room space

### EFFICIENCY AND POWER FACTOR:



Losses of a geared elevator

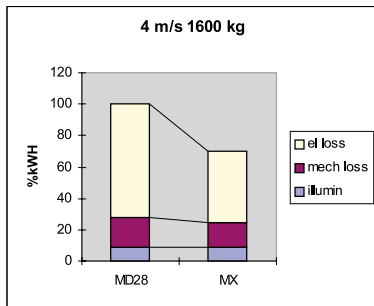
### Geared and hydraulic range:

In low speed applications the gearless EcoDisc® replaces geared traction machines and hydraulic units, eliminating both gear-train efficiency losses or hydraulic unit losses. The synchronous permanent magnet motor of the EcoDisc® in turn does away with electrical losses caused by motor slip and magnetising losses in the rotor.

**The EcoDisc® energy cost savings are up to 50% compared to geared arrangements and up to 60% compared to hydraulic power units.**

Item	Hydraulic	Geared (Worm)	EcoDisc®
Speed (m/s)	0.63	1.0	1.0
Load (kg)	630	630	630
Motor size (output power, kW)	11	5.5	3.5
Main fuse (for riser, A)	50	35	16
Energy Consumption (kWh/year)	7200	6000	3000
Thermal losses (kW)	4.3	3.5	1.0

Table 2 comparison



## Gearless range:

Besides high efficiency, the EcoDisc® machine has also a very high power factor due to magnetisation by permanent magnets. Whereas ACVVVF gearless motors usually have a motor  $\cos\phi$  of 0.75 to 0.85, the corresponding value of the EcoDisc® machine can be as high as 0.95. Combined with zero slip loss this explains its efficiency advantage over conventional gearless machines. With motor efficiencies of up to 93% EcoDisc® lifts use up to 35 % less energy than similar lifts with already very efficient VVVF machines.

## The EcoDisc® efficiency and $\cos\phi$ advantages:

- Save elevator energy costs
  - Up to 60% v. hydraulic units
  - Up to 50% v. geared units and
  - Up to 35% v. VVVF gearless units.(Of total operating energy requirement)
- Save machine room air-conditioning costs
  - due to the small thermal losses of the EcoDisc®.
- Save on cost of machine room risers, emergency power generators and fuses

## SAFETY:

### Ascending Overspeed protection:

The EN81 code has changed in 1998. One of the important improvements in the code is the introduction of Ascending Overspeed Protection. This is explained in paragraph 9.10 of the new code.

In compliance with the paragraph 9.10. of the current EN81 code the EcoDisc® machines are equipped with 2 fully independent brakes each of which is separately able to stop and hold the car under emergency braking conditions.

## RIDE COMFORT:

The excellent controllability of a synchronous motor contributes to superior elevator ride comfort. The frequency converter unit supplying the motor is designed exclusively for elevator application. The synchronous vector-controlled EcoDisc® motor combined with KONE's long experience in AC-drives guarantees a smooth and noiseless run for the most demanding applications.



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