

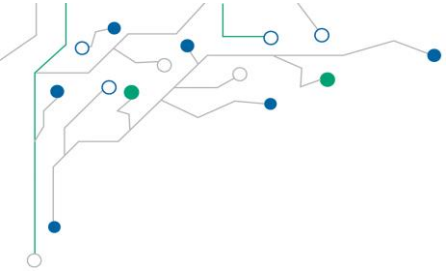
ANIE
AUTOMAZIONE



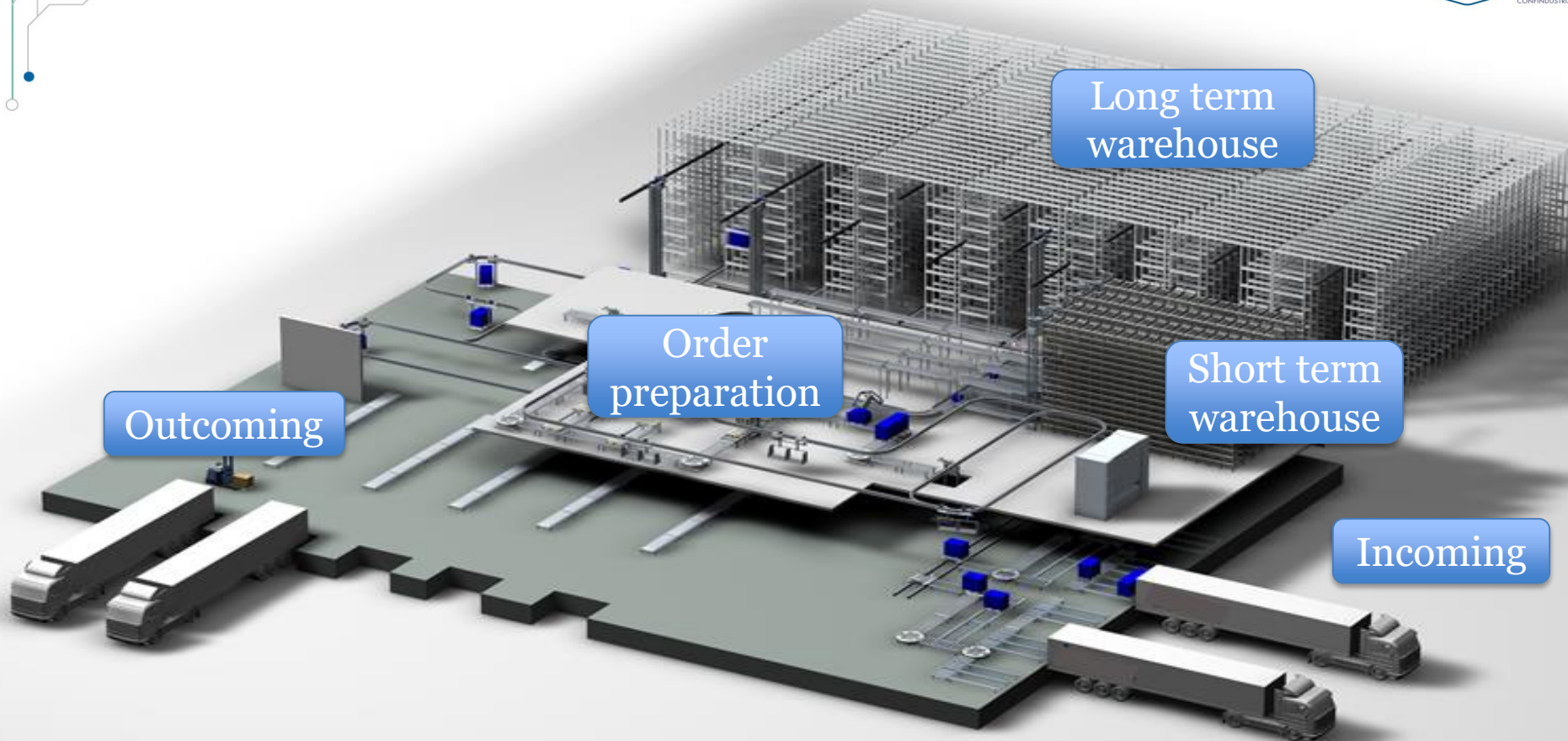
KINEMATIC CHAIN & DIMENSIONING

Marco Lombardi

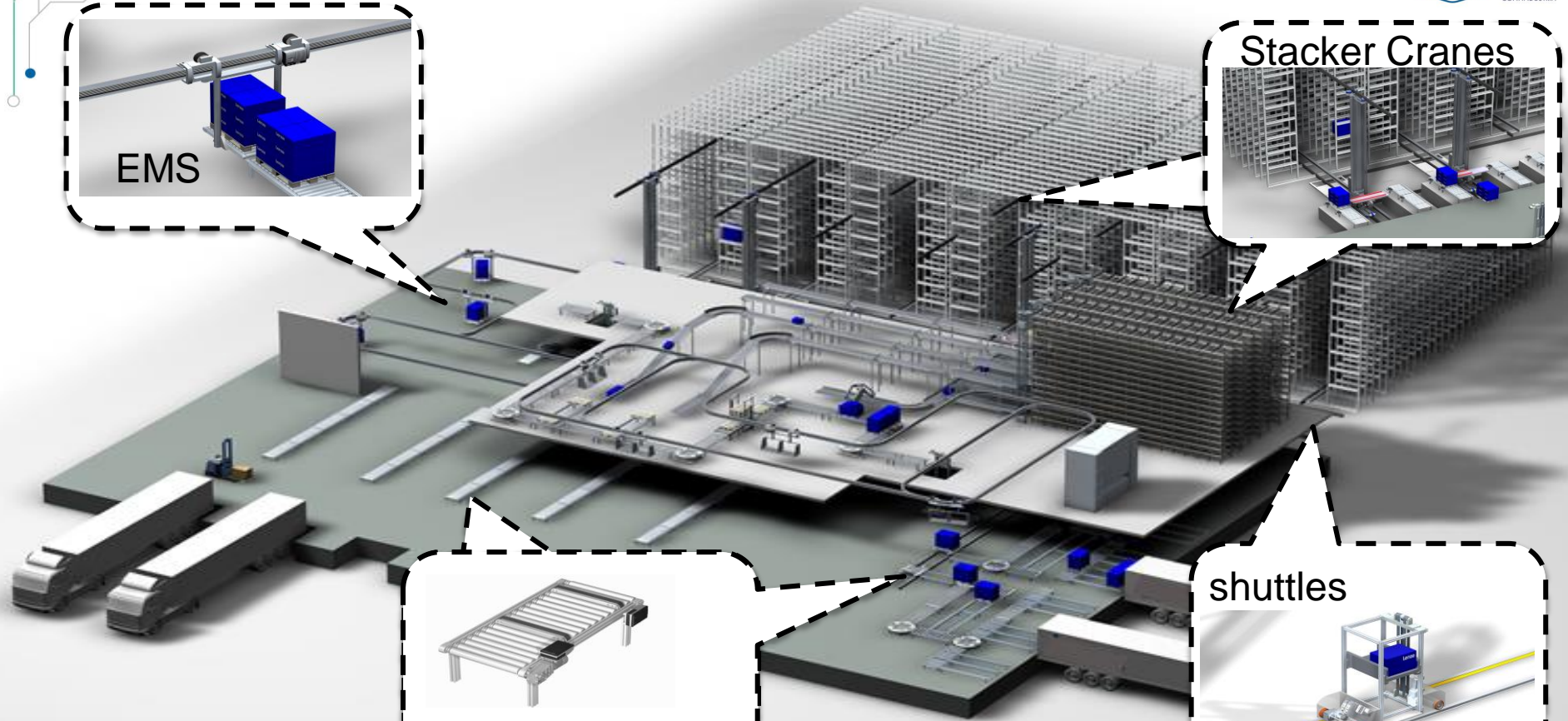
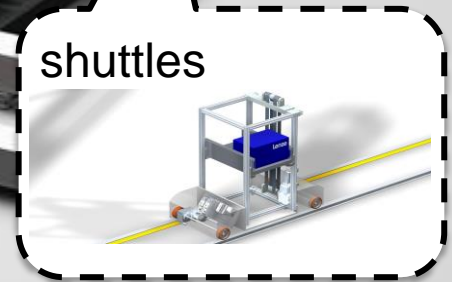
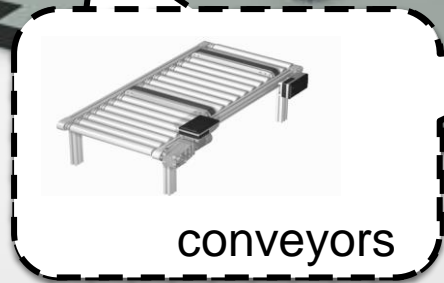
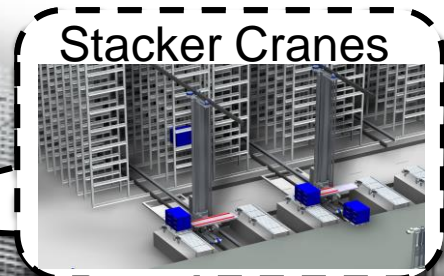
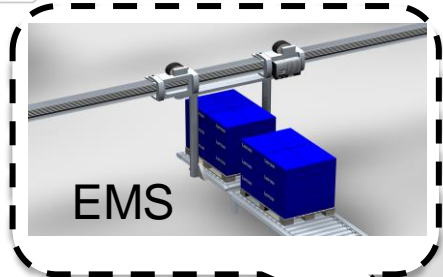
Lenze



Typical E-commerce distribution center



Typical E-commerce distribution center

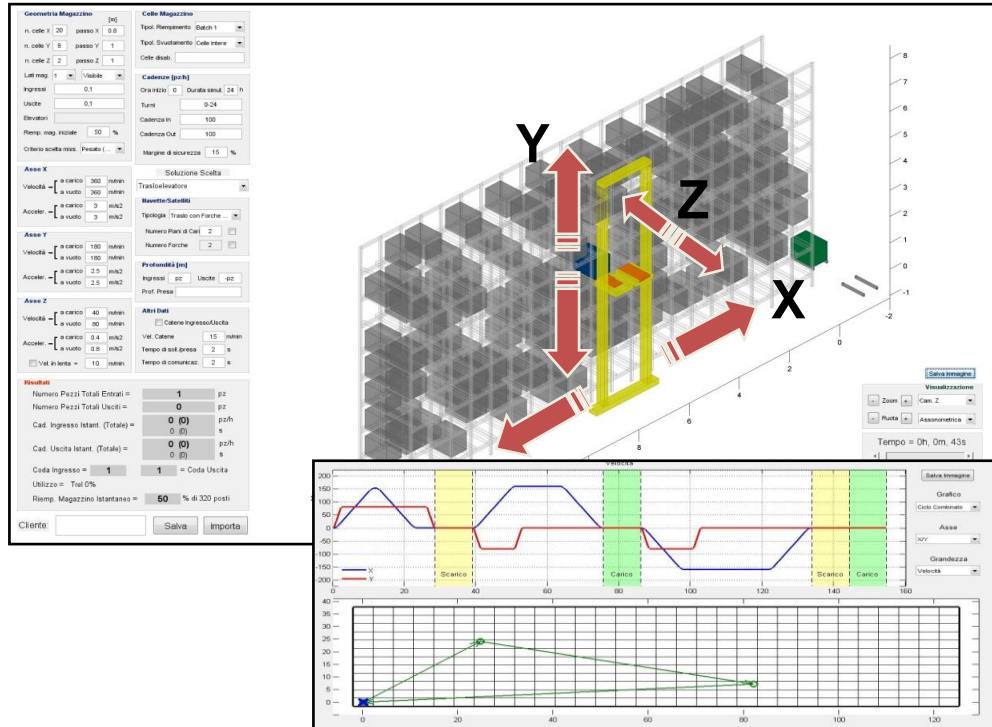


KEY FEATURES



- High speeds to reduce operation timing
- Energy saving
- Safety: high levels because of interaction
- Innovation in technology: RFID, WIFI or inductive solution, Supercapacitors
- System Management by “expert controller units”
- Proactive maintenance, KPI monitoring
- Cloud

APPLICATION SIZING: ASRS



Right-sizing to satisfy cycle times
(conformity FEM 9.851)

X - $V=6\text{m/s}$ $a=5,5\text{m/s}^2$ $P=2000\text{Kg}$

Y - $V=4\text{m/s}$ $a=3\text{m/s}^2$ $P=600\text{Kg}$

Z - $V=4\text{m/s}$ $a=4\text{m/s}^2$ $P=80\text{Kg}$

Process analysis: In /Out
management by internal software

SIMULATION: TRAVELLING

Customer: University of PAVIA

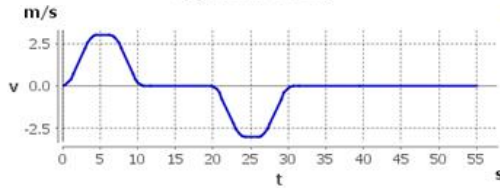
Contacts: Students
Phone:
E-mail:

Project: Automatic warehouse
Drive axis: ASSE X - Travelling

Kinematic key data

Cycle time	t	55.0 s
Max. velocity	v_{max}	3.00 m/s
Max. acceleration	a_{max}	1.00 m/s ²
Max. mass in motion	$m_{mov,max}$	6000 kg

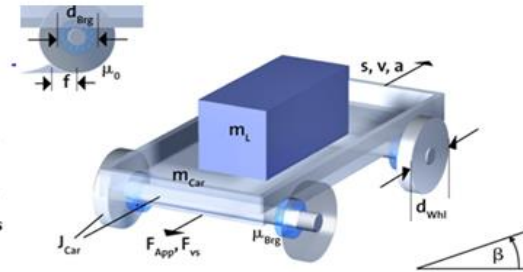
Application: Velocity



Travelling drive

Wheel diameter
Mass of the vehicle
Additional moment of inertia
Angle of tilt
Specific travelling resistance

d_{WHL}	500 mm
m_{Car}	6000 kg
J_{Car}	0 kgm ²
β	0°
F'	100 N/t



Electrical supply and ambient conditions

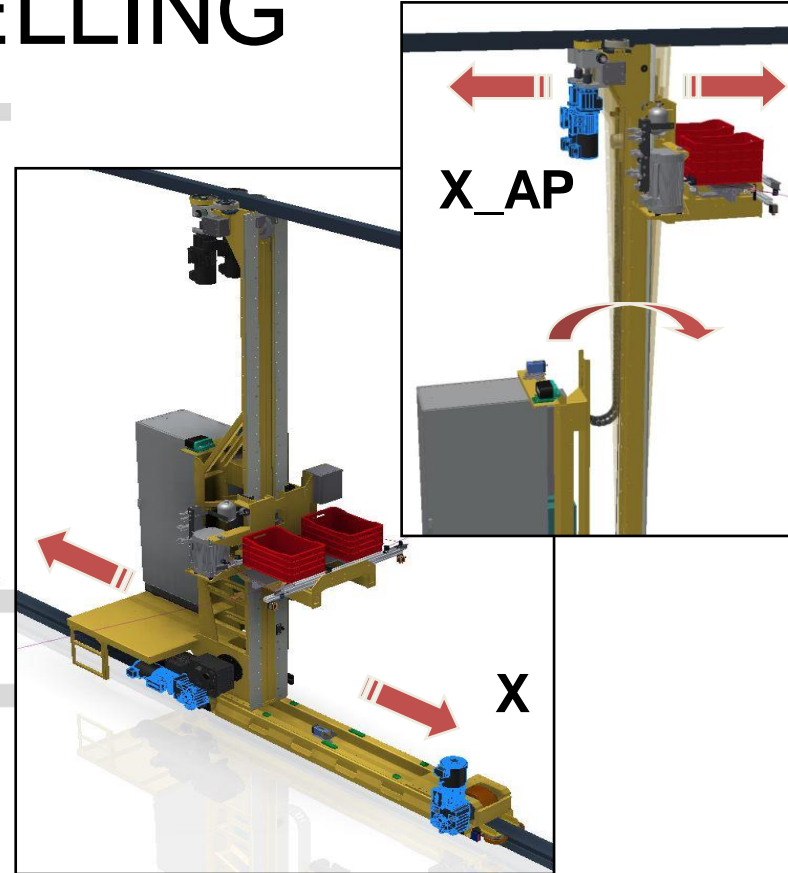
Electrical supply system
Max. motor/inverter ambient temperature
Site altitude

g	3AC 400 V 50 Hz
t_{amb}	30 °C / 40 °C
h	1000 m

Calculated requirement of the application

Max. working point
Effective base process power of the application
Moment of inertia application
Max. load-matching factor

$Q_{T,max}$	115 1/min / 1650 Nm / 15.1 kW
$P_{base,calc}$	7.73 kW
J_{app} / J_{mov}	375 kgm ² / 375 kgm ²
$K_{L,max}$	12



SIMULATION: LIFTING

Customer: University of PAVIA

Contacts: Students

Phone:

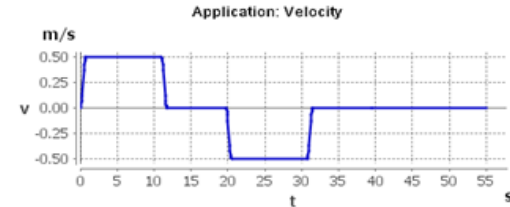
E-mail:

Project: Automatic warehouse

Drive axis: ASSE Y - Lifting

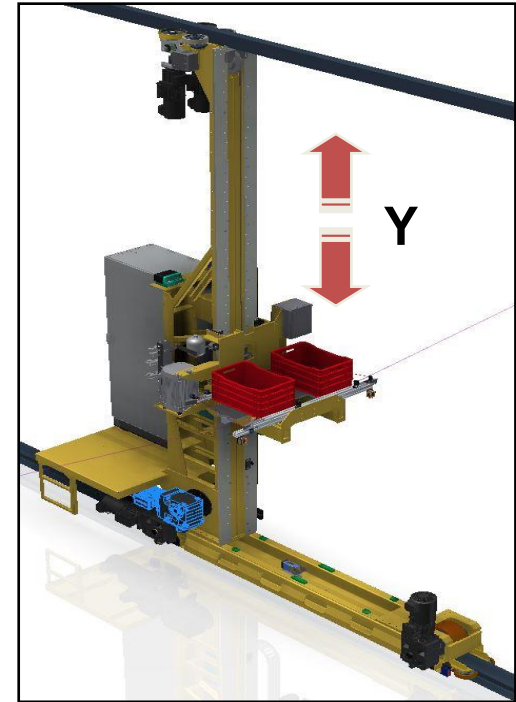
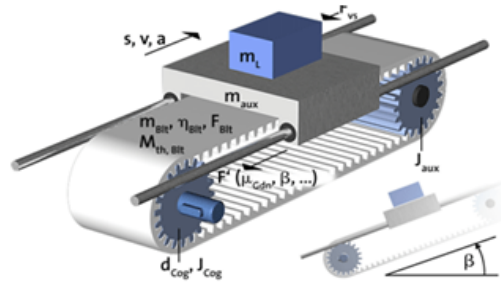
Kinematic key data

Cycle time	t	55.0 s
Max. velocity	v_{max}	0.500 m/s
Max. acceleration	a_{max}	1.00 m/s ²
Max. mass in motion	$M_{max,app}$	1800 kg



Linear axis with belt drive

Belt pulley diameter	d_{Cog}	178 mm
Moment of inertia, deflection pulleys	J_{aux}	0 kgm ²
Moment of inertia of belt pulley	J_{Cog}	0 kgm ²
Mass of the slide	M_{aux}	1800 kg
Angle of tilt	β	90.0 °
Transmission efficiency of toothed belt	η_{aux}	0.950
Mass of toothed belts	M_{aux}	0 kg
Specific travelling resistance	F'	0.100 N/kg



Electrical supply and ambient conditions

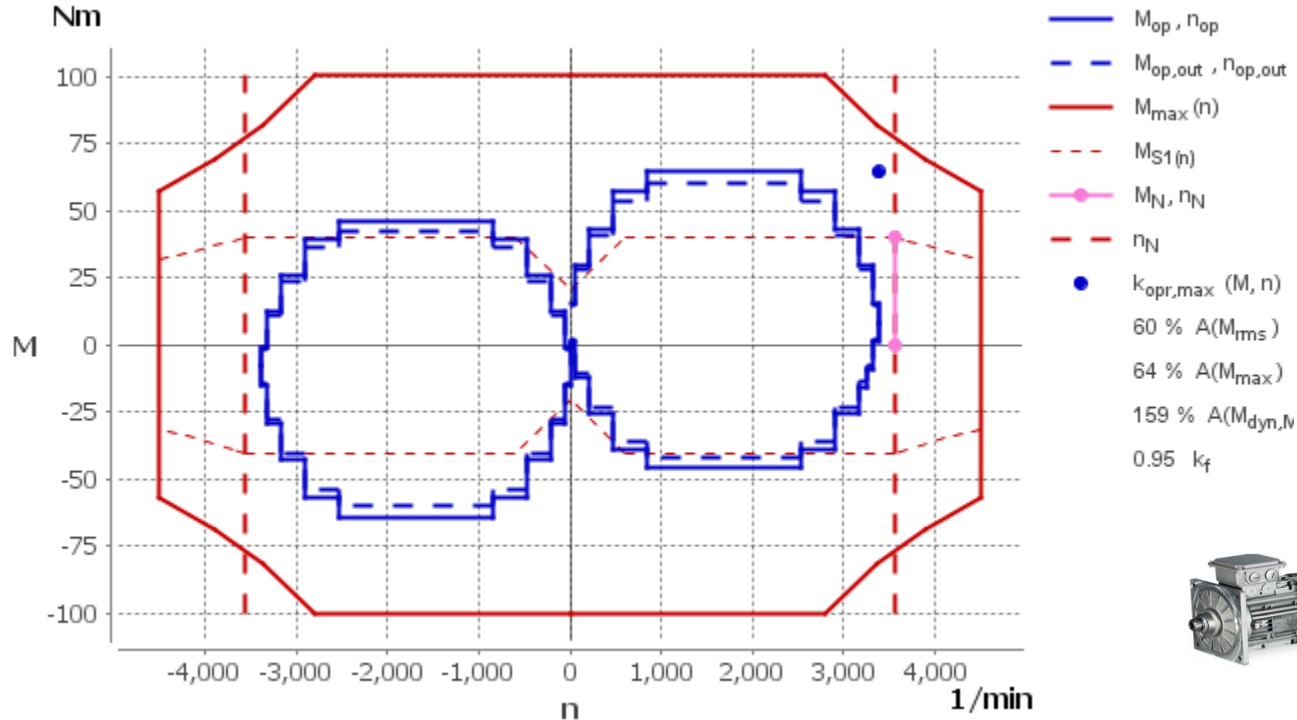
Electrical supply system		3AC 400 V 50 Hz
Max. motor/inverter ambient temperature	s_{amb}	30 °C / 40 °C
Site altitude	h	1000 m

Calculated requirement of the application

Max. working point	n_{req}	53.6 1/min / 1841 Nm / 9.62 kW
Effective base process power of the application	$P_{req,eff}$	8.84 kW
Moment of inertia application	J_{app} / J_{max}	14.3 kgm ² / 14.3 kgm ²
Max. load-matching factor	K_{max}	0.35

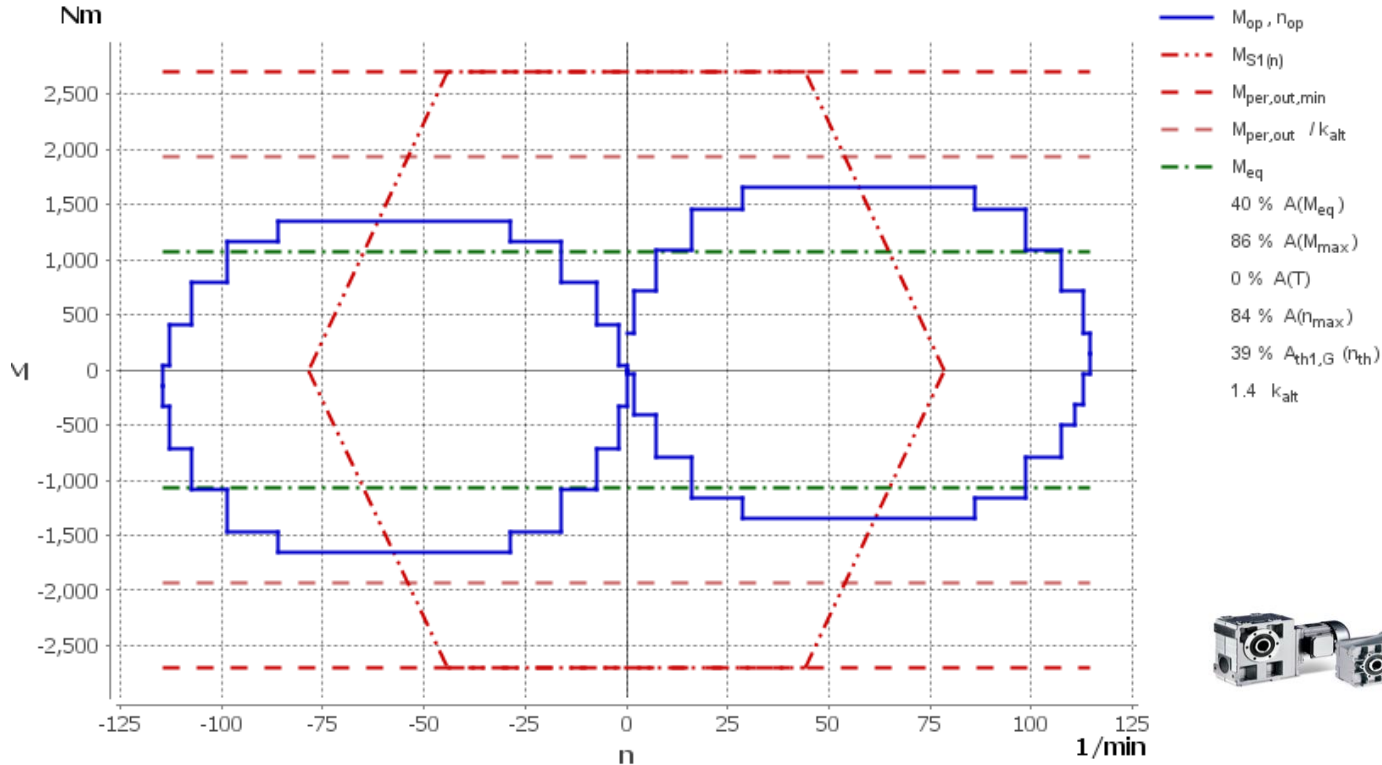
MOTOR IDENTIFICATION

Motor: M-n characteristic



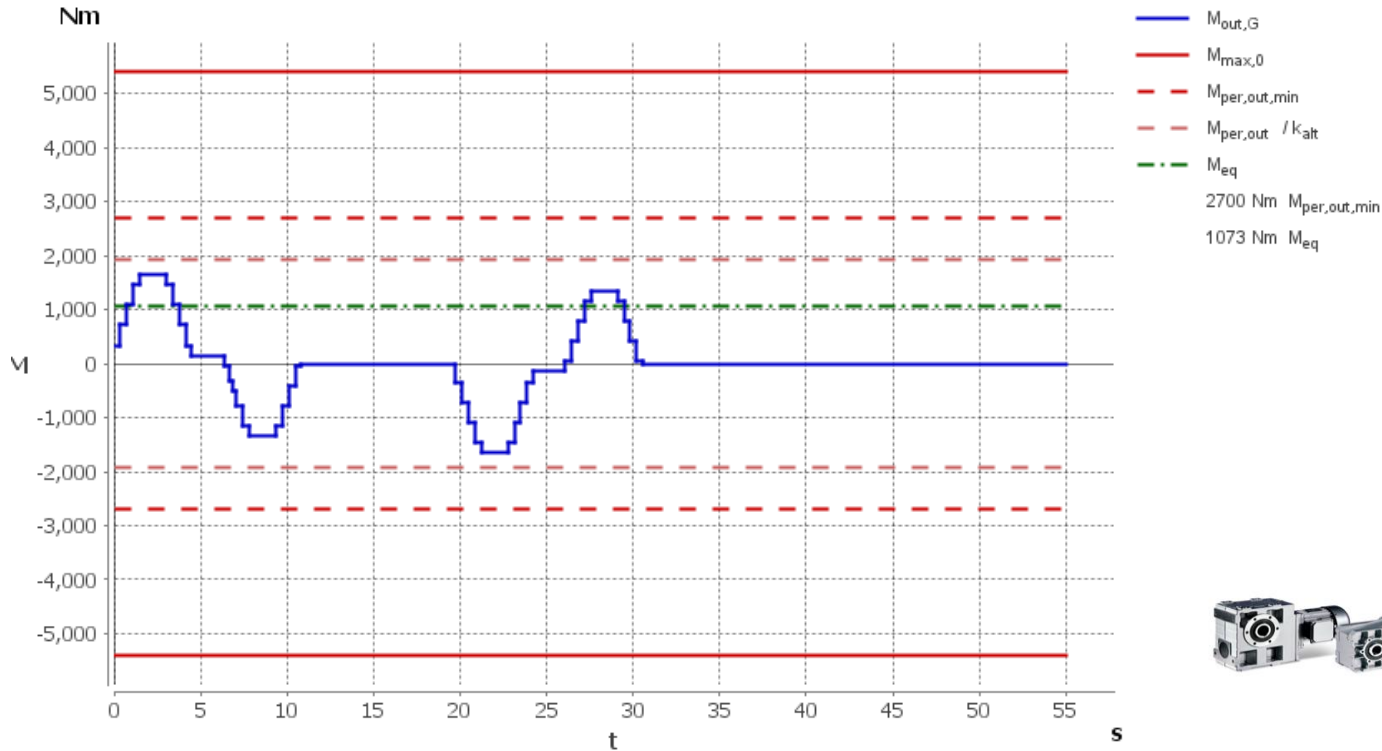
GEAR BOX IDENTIFICATION

Gearbox: M-n characteristic (output)



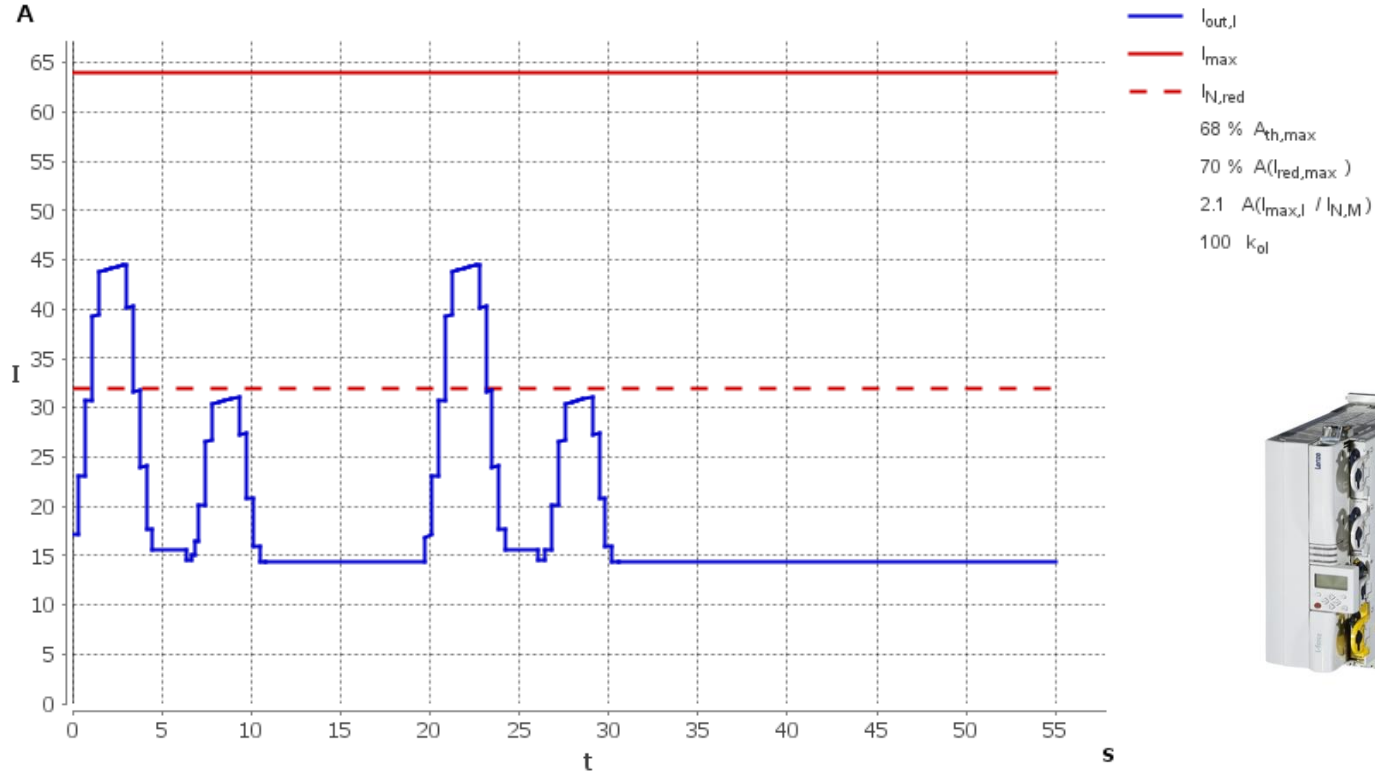
GEAR BOX IDENTIFICATION

Gearbox: Output torque



DRIVE IDENTIFICATION

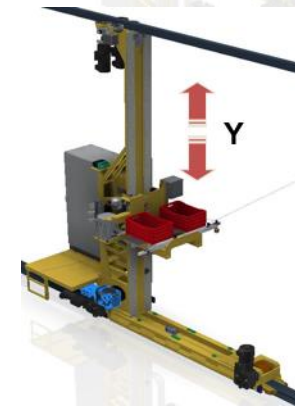
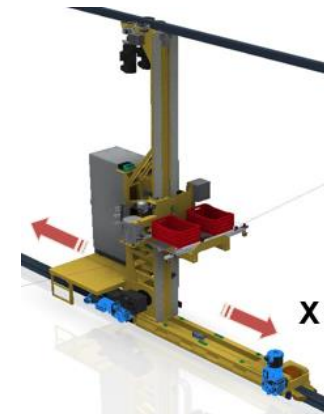
Inverter: Output current



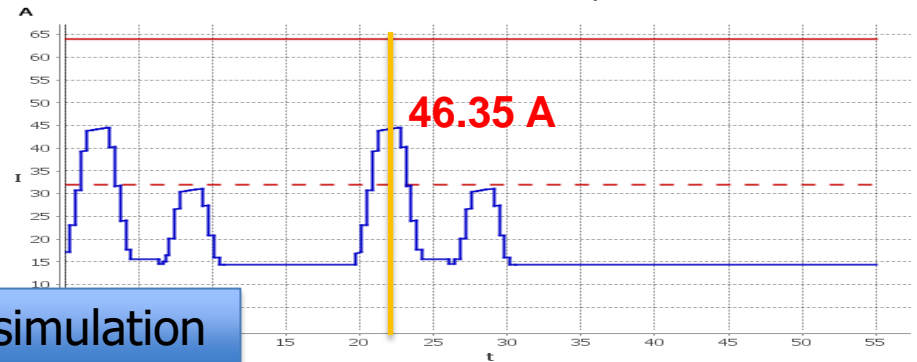
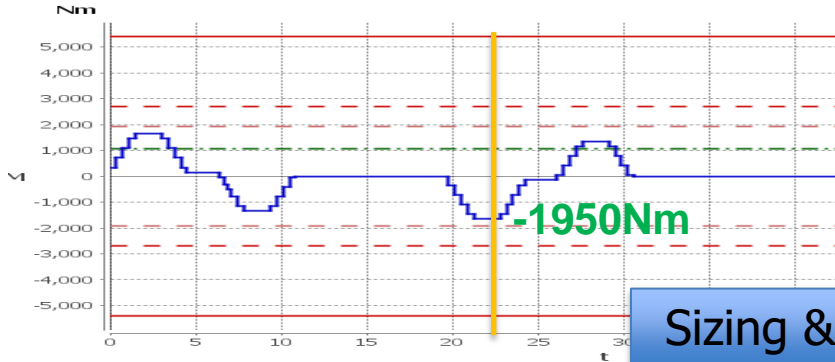
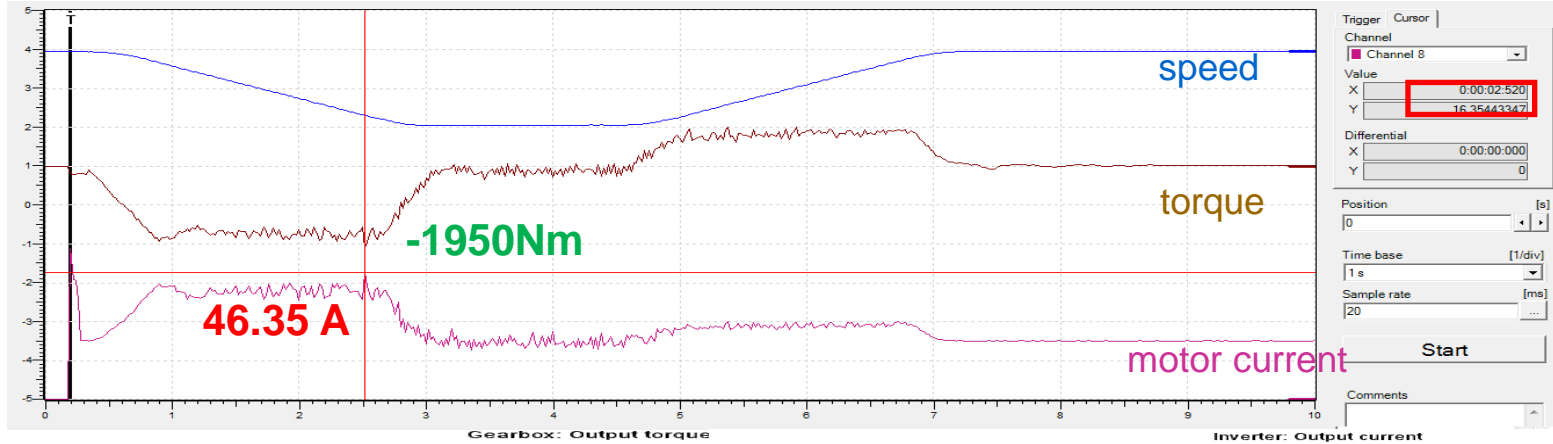
PRODUCT SUMMARY

Selected products	Rated data	Utilisation	
		Thermal	Maximum
Motor	1 x MF 132-12 P_N, D_{90}, M_N 15 kW / 3560 1/min / 40.3 Nm	M 60 %	64 %
Gearbox	1 x g500-B2700 (Direct mounting) $i_g, M_{max,out}$ 29.4470 / 2700 Nm	M 40 % n 39 %	86 % 84 %
Inverter	1 x i950-C15/400-3 I_N, I_{max} 32.0 A / 64.0 A	I 68 % P 4 %	70 % 37 %
Integrated brake transistor		P 52 %	40 %
Brake resistor	1 x ERBD018R01K6		
Electromechanical brake	without brake		
Feedback	1 x Incr. encoder IG1024-24V-H		

Selected products	Rated data	Utilisation	
		Thermal	Maximum
Motor	1 x MF 112-22 P_N, D_{90}, M_N 11 kW / 3530 1/min / 29.7 Nm	M 86 %	43 %
Gearbox	1 x g500-B2700 (Direct mounting) $i_g, M_{max,out}$ 59.3930 / 2700 Nm	M 59 % n 48 %	68 % 71 %
Inverter	1 x i950-C15/400-3 I_N, I_{max} 32.0 A / 64.0 A	I 76 % P 8 %	48 % 27 %
Integrated brake transistor		P 55 %	29 %
Brake resistor	1 x ERBD018R03K0		
Electromechanical brake	1 x Spring-applied brake 14 / 60.0 Nm		
Feedback	1 x Incr. encoder IG1024-24V-H		



In field recording



Sizing & simulation

DRIVES COMPARISON

ApplicationTuner

Modifica dati dell'applicazione:

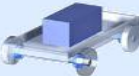



$d_{Whl} = 550,0$ $550,0$ mm
 $m_{Car} = 9500$ **11000** kg
 $J_{add} = 0$ 0 kgm²
 $\beta = 0$ 0 60,00
 $F' = 43,88$ $43,88$ NA

Modifica movimento:

MotionDesigner

Confronto risultati

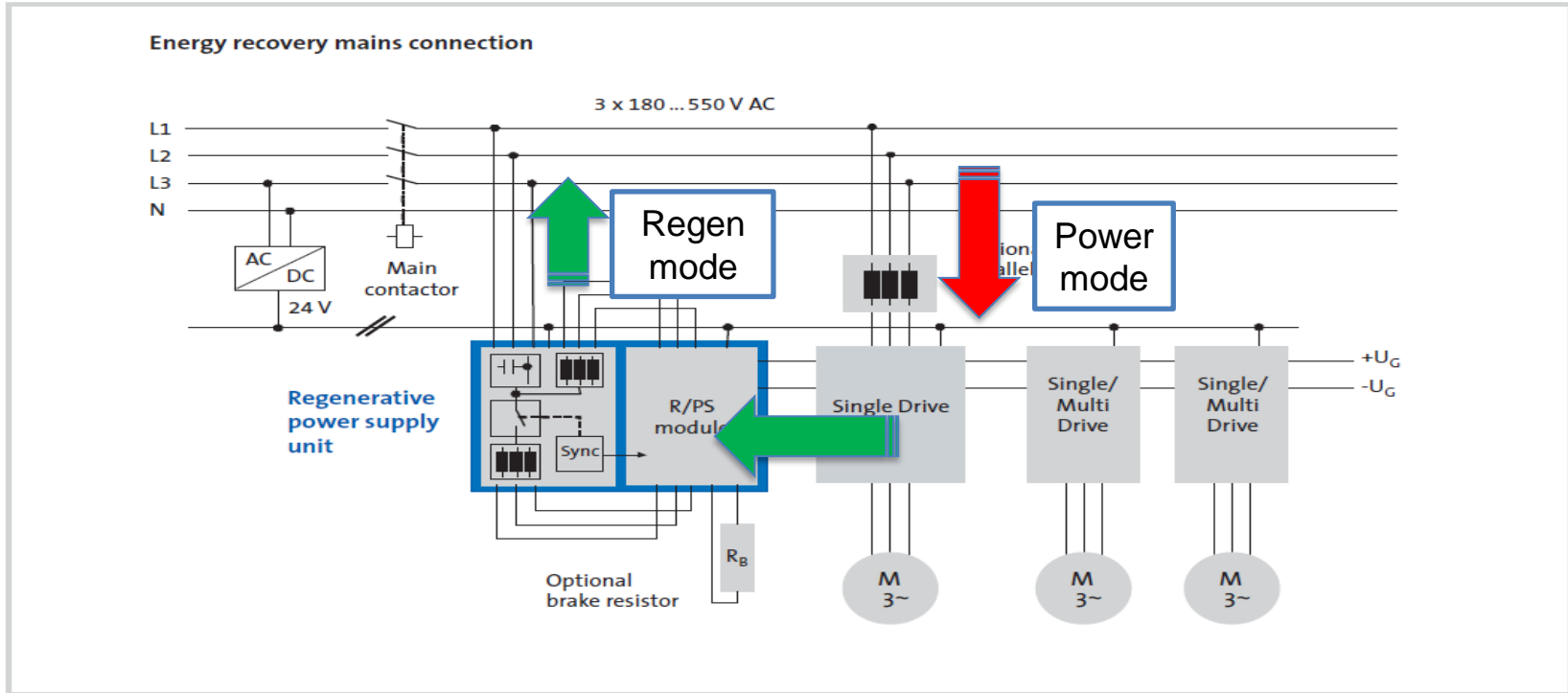
: Panoramica : Applicazione : Riduttore : Motore : Inverter : Costi energetici : Cor < ▶ |

	GKS09-3		
	MFFMA 132-22		
	E94ASHE0324		
			

P_{cto}	20 kW	22 kW
$P_{rms,cto}$	9,37 kW	10,8 kW
P_{max}	20 kW	22 kW
M_{max}	1793 Nm	2058 Nm
n_{max}	104 1/min	104 1/min
a_{rovy}	0,600 m/s ²	0,600 m/s ²
f_{req}	34,174	34,174
$i_{act,G}$	32,940	32,940
Esecuzione	Accoppiamento diretto	Accoppiamento diretto
$M_{per,out}$	2984 Nm	2984 Nm
k_G	0,953	0,953
$n_{max,inv}$	4000 1/min	4000 1/min
P_N	18,5 kW	18,5 kW
n_N	3560 1/min	3560 1/min
M_N	49,6 Nm	49,6 Nm
I_N	39,0 A	39,0 A
$A(M_{rms})$	64 %	62 %
$A(M_{max})$	64 %	73 %
P_N	15,0 kW	15,0 kW
I_N	32,0 A	32,0 A
I_{max}	76,8 A	76,8 A
$A_{th,max}$	81,9 %	87,5 %
$A(I_{imp,max})$	71,2	78,3
$A(I_{load,max})$	63,5 %	71,6 %

Guida Speichern Chiudi

ENERGY SAVING: REGEN



ENERGY SAVING: STORAGE

