ELMO S.R.L.
Viale Certosa, 8/B – Pavia (Italy)
www.elmoitaly.com

INVERTER
FOR HYDRAULIC LIFTS

ELMO INVERTERS

ELMO, a manufacturer of motors for hydraulic lifts for over 40 years, present with this product on all world markets, has created a series of dedicated inverters (MED) for motor control in hydraulic lifts: **the goal is to reduce both supplier input power both consumption of energy thus achieving a reduction in management costs**.
The inverters have been developed considering two typical situations:

- updated installations;
- new installations.

For updated installations *ELMO offers:*

a) MED for upward only and sensorless (without motor encoder) for 50 Hz motors

It is a ***simplified drive*** *designed specifically* ***for updated installations*** *that* ***use the existing hydraulic power unit****, that is* ***neither the motor nor set of valves have to be replaced****. This type of inverter controls the cabin movement only during the upward, because the downward is fully controlled by the valves. It significantly* ***reduces the starting current*** *and* ***automatically reduces upward speed in some load conditions, so as not to exceed the input power agreed with the energy supplier*** *(function called "committed power limitation"). During the upward* ***this inverter compensates for the pump leakage****; this allows* ***to make the cabin speed insensitive to load and oil temperature variations****. This inverter enables to reduce the cabin positioning time (low speed) in all speed conditions of the cabin and to set maximum, maintenance, positioning/relevelling speeds and cabin deceleration times (the acceleration time is controlled by the hydraulic adjustments of the valve).* ***It guarantees a good alignment of the cabin with the floors during upward****, while the alignment of the cabin with the floors during downward depends on set of valves.*

For new installations*, since it is possible to use a motor with encoder, ELMO offers depending on the type of valve assembly that will be used in the hydraulic power unit:*

b) MED for upward only in closed loop (with digital encoder fitted on the motor) for 50 Hz motors

It is a ***drive for medium-high segment*** *designed specifically* ***for new installations*** *in which, however, you are using a* ***conventional set of valves****. This type of inverter controls the cabin movement only during the upward, because the downward is fully controlled by the valves. It significantly* ***reduces the starting current*** *and* ***automatically reduces upward speed in some load conditions, so as not to exceed the input power agreed with the energy supplier*** *(function called "committed power limitation"). During the upward* ***this inverter compensates for the pump leakage****; this allows* ***to make the cabin speed insensitive to load and oil temperature variations****. This inverter enables to reduce the cabin positioning time (low speed) in all speed conditions of the cabin and to set maximum, maintenance, positioning/relevelling speeds and cabin deceleration times (the acceleration time is controlled by the hydraulic adjustments of the valve).* ***Thanks to the encoder, it enables the motor to operate at the maximum efficiency in all load conditions and to accurately adjust the cabin speed, thus guaranteeing an***

excellent alignment of the cabin with the floors during upward*, while the alignment of the cabin with the floors during downward depends on set of valves.*

c) MED inverter for upward and downward in closed loop (with digital encoder fitted on the motor) for 50 Hz motors

It is a ***drive for high segment*** *designed specifically for* ***new installations****. This type of inverter controls the cabin movement both during the upward and downward. It requires the installation of* ***a dedicated set of valves to ensure the passage of the oil through the pump both during the upward and downward****. It significantly* ***reduces the starting current*** *and* ***automatically reduces upward speed in some load conditions, so as not to exceed the input power agreed with the energy supplier*** *(function called "committed power limitation"). **This inverter compensates for the pump leakage**; this allows **to make the car speed insensitive to load and oil temperature variations**. This inverter enables to reduce the cabin positioning time (low speed) in all speed conditions of the cabin and to set maximum, maintenance, positioning/relevelling speeds and cabin acceleration/deceleration times. **Thanks to the encoder, it enables the motor to operate at the maximum efficiency in all load conditions and to accurately adjust the cabin speed, thus guaranteeing an excellent alignment of the cabin with the floors both during upward and downward.** This inverter **reduces oil heating** obtained by conducting the lift energy potential into braking resistors while the car goes down; this allows to avoid the use of expensive heat exchangers. This solution is suitable for hydraulic systems with high traffic, such as public offices, hotels and big condominiums.*

All MED models:

I) cover the traditional range of 400/690V – 50 Hz motors from 3 kW to 33 kW;
II) thanks to the MED function called "committed power limitation" activated by the user, automatically reduce upward speed in some load conditions, so as not to exceed the input power agreed with the energy supplier, while keeping the motor power to the lift even at greater load than usual. This allows a power smaller than agreed, compared to that usually required by systems using the same motor size directly supplied by the mains, but accepting that the cabin cruise speed is reduced in some load conditions (please see figures 1, 2, 3, 4, 5, 6 and 7). For example from figure 1, you can note that:
- with a power limit set to 10 kW (green curve), upward cabin speed will remain the nominal until there will be in the cabin a load of about 240 kg (3 persons); then upward cabin speed will decrease gradually to about 0,58 m/s when the load in the cabin will be the maximum;
- with a power limit set to 8 kW (red curve), upward cabin speed will remain the nominal until there will be in the cabin a load of about 115 kg; then upward cabin speed will decrease gradually to about 0,46 m/s when the load in the cabin will be the maximum;
- with a power limit set to 6 kW (blue curve), upward cabin speed will vary between 0,57 m/s (empty car) and 0,35 m/s (full load cabin).

Table 1 compares supplier input power with and without MED varying the motor power and shows the possible cabin speed reduction at a full load when the MED function called "committed power limitation" was set to the recommended value. You can note that the supplier input power with traditional set of valves controlled by MED is always lower than that required by the same traditional set of valves directly supplied by the mains even when the

MED function called “committed power limitation” is off and the cabin has no speed reduction at a full load.

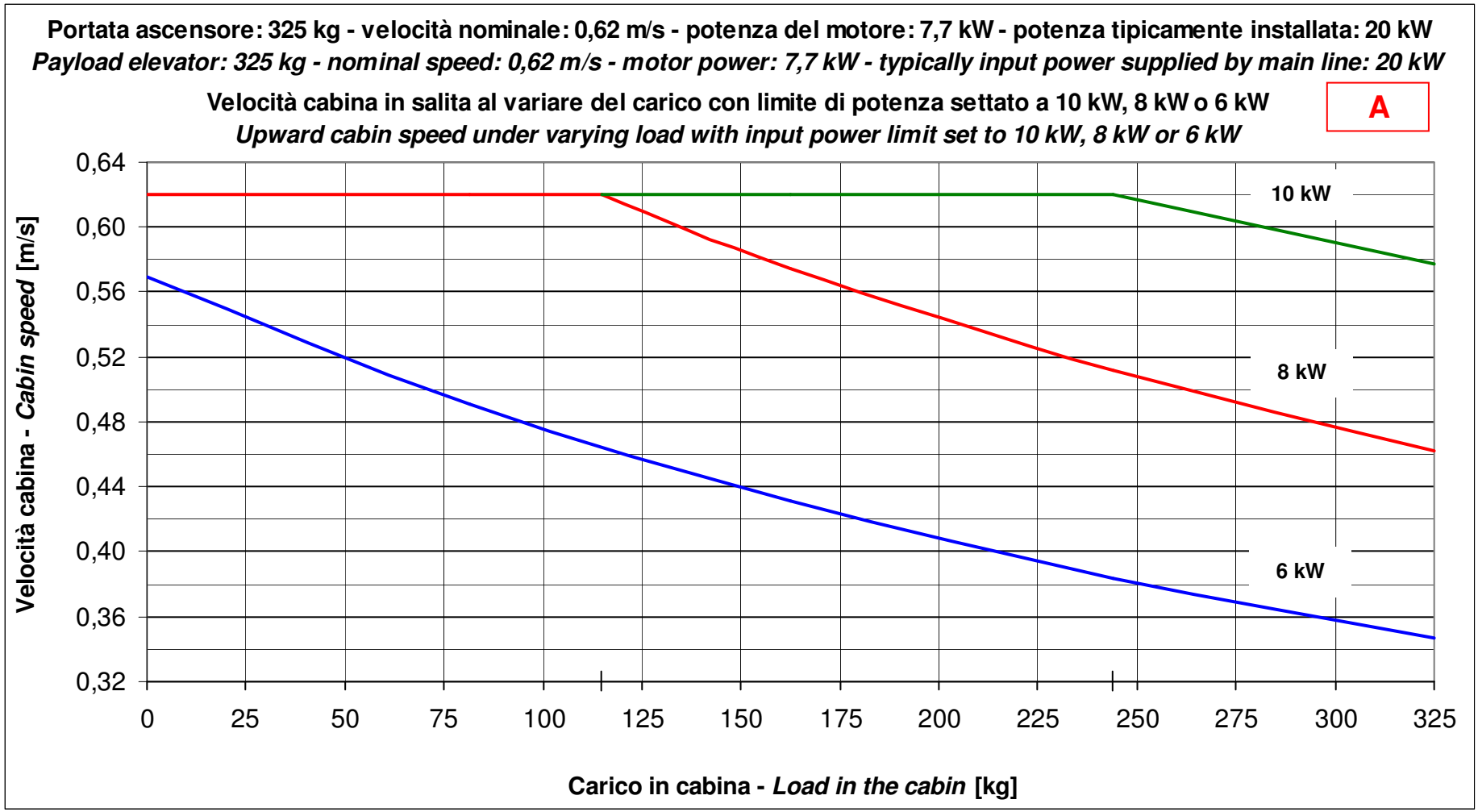
Portata ascensore: 325 kg - velocità nominale: 0,62 m/s - potenza del motore: 7,7 kW - potenza tipicamente installata: 20 kW
Payload elevator: 325 kg - nominal speed: 0,62 m/s - motor power: 7,7 kW - typically input power supplied by main line: 20 kW
Velocità cabina in salita al variare del carico con limite di potenza settato a 10 kW, 8 kW o 6 kW
Upward cabin speed under varying load with input power limit set to 10 kW, 8 kW or 6 kW
A
10 kW
8 kW
6 kW
Velocità cabina - Cabin speed [m/s]
0,64
0,60
0,56
0,52
0,48
0,44
0,40
0,36
0,32
0
25
50
75
100
125
150
175
200
225
250
275
300
325
Carico in cabina - Load in the cabin [kg]

Figure 1

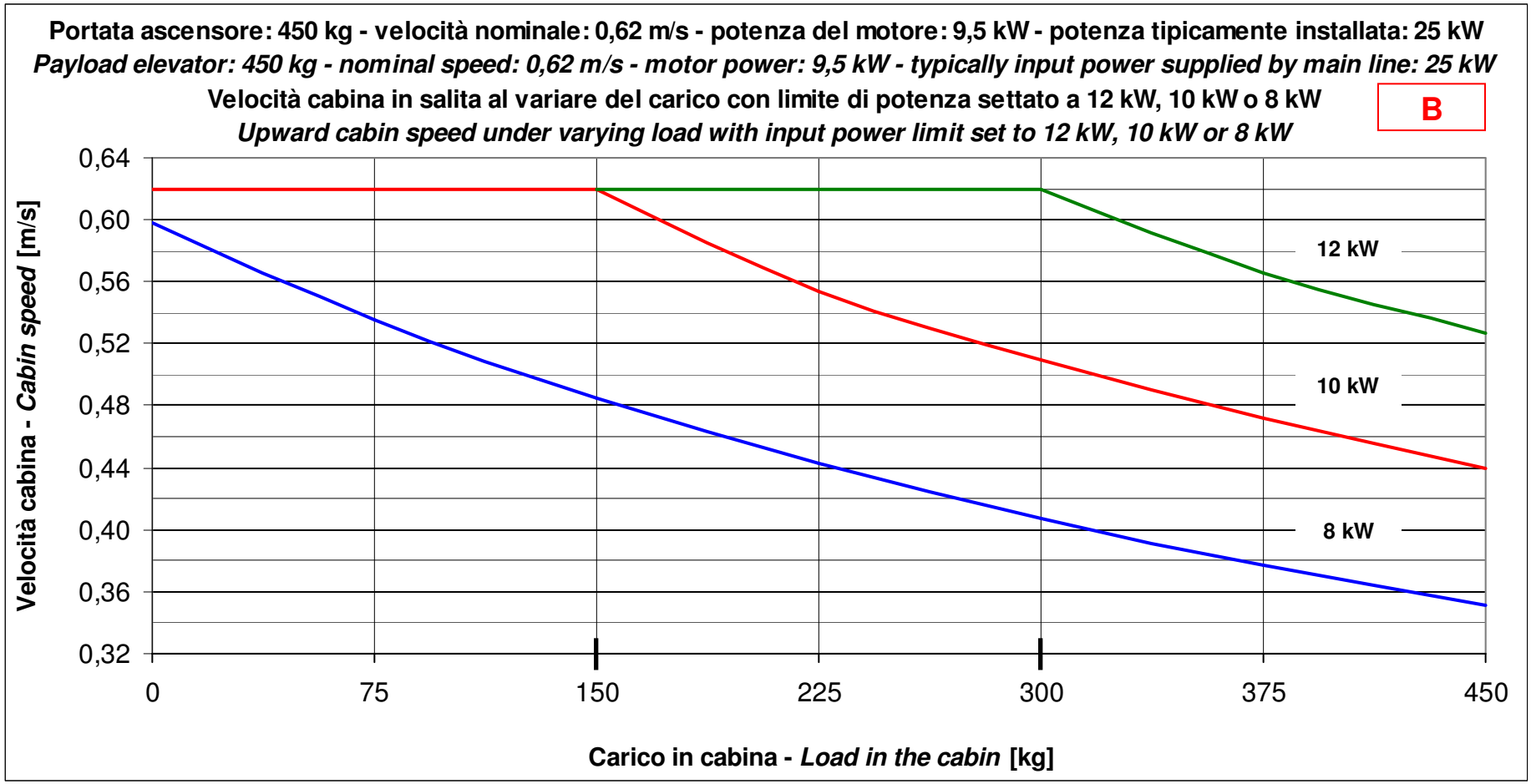
Portata ascensore: 450 kg - velocità nominale: 0,62 m/s - potenza del motore: 9,5 kW - potenza tipicamente installata: 25 kW
Payload elevator: 450 kg - nominal speed: 0,62 m/s - motor power: 9,5 kW - typically input power supplied by main line: 25 kW
Velocità cabina in salita al variare del carico con limite di potenza settato a 12 kW, 10 kW o 8 kW
Upward cabin speed under varying load with input power limit set to 12 kW, 10 kW or 8 kW
B
Velocità cabina - Cabin speed [m/s]
0,64
0,60
0,56
0,52
0,48
0,44
0,40
0,36
0,32
12 kW
10 kW
8 kW
0
75
150
225
300
375
450
Carico in cabina - Load in the cabin [kg]

Figure 2

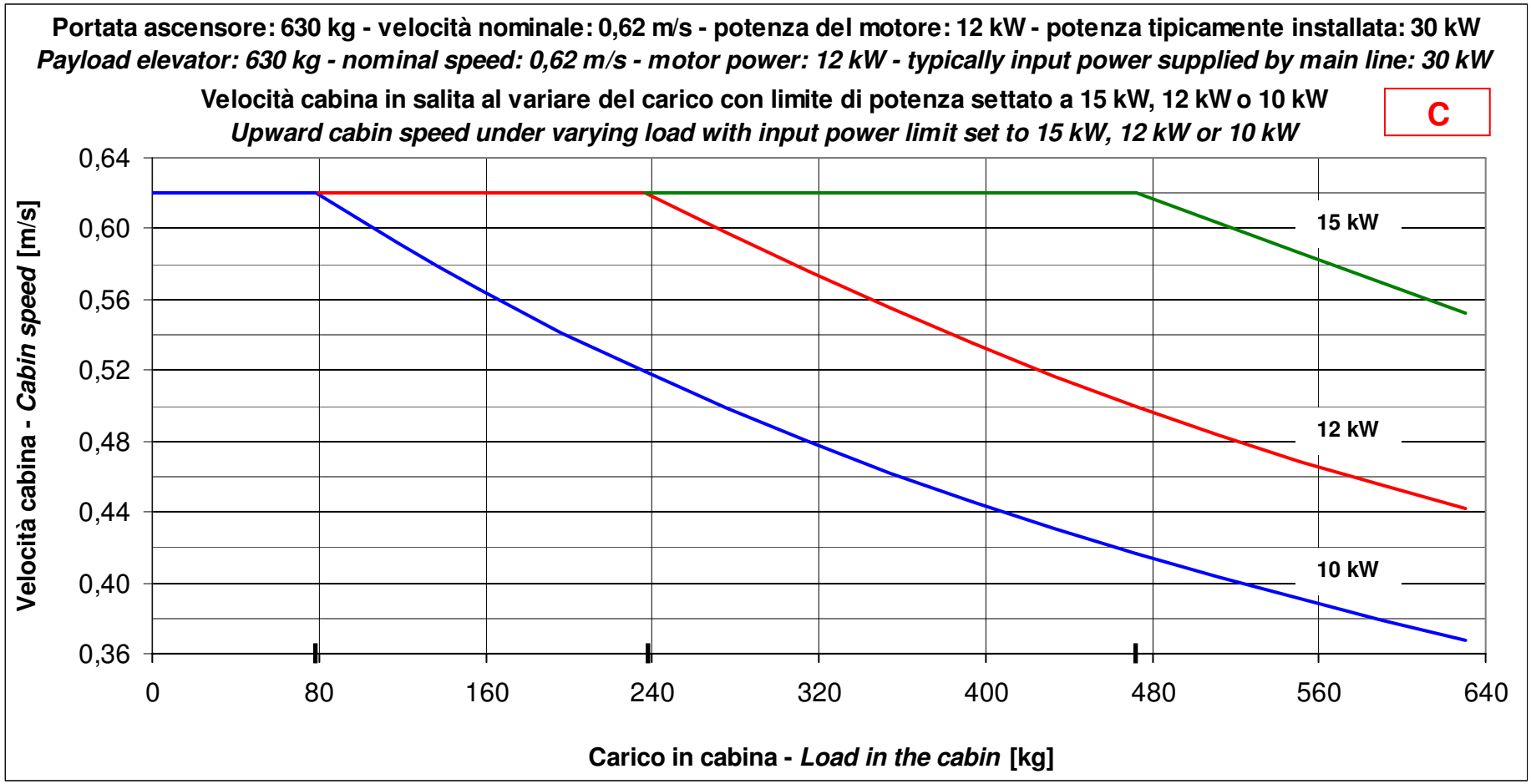
Portata ascensore: 630 kg - velocità nominale: 0,62 m/s - potenza del motore: 12 kW - potenza tipicamente installata: 30 kW
Payload elevator: 630 kg - nominal speed: 0,62 m/s - motor power: 12 kW - typically input power supplied by main line: 30 kW
Velocità cabina in salita al variare del carico con limite di potenza settato a 15 kW, 12 kW o 10 kW
Upward cabin speed under varying load with input power limit set to 15 kW, 12 kW or 10 kW
C
15 kW
12 kW
10 kW
Velocità cabina - Cabin speed [m/s]
0,64
0,60
0,56
0,52
0,48
0,44
0,40
0,36
0
80
160
240
320
400
480
560
640
Carico in cabina - Load in the cabin [kg]

Figure 3

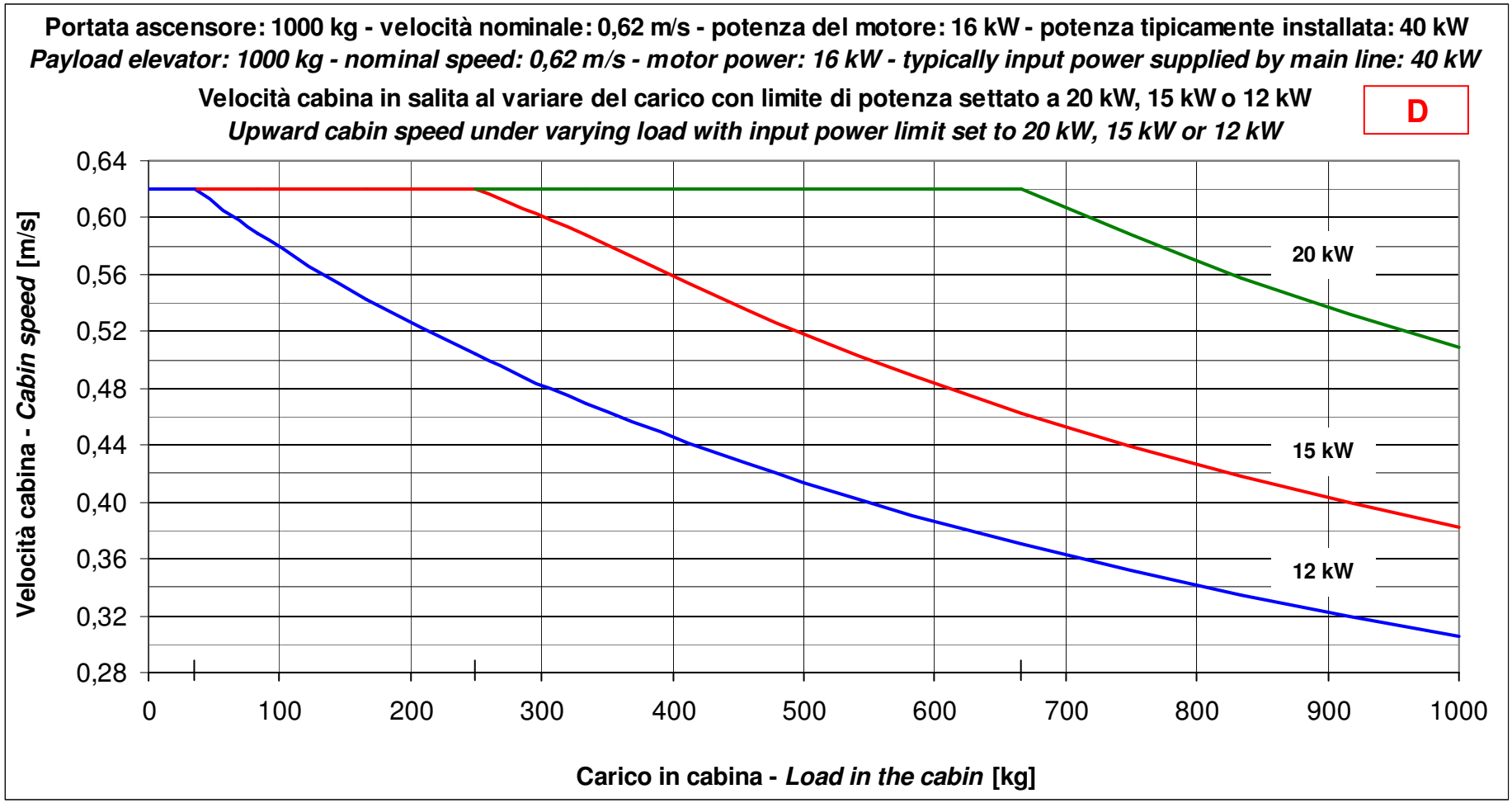
Portata ascensore: 1000 kg - velocità nominale: 0,62 m/s - potenza del motore: 16 kW - potenza tipicamente installata: 40 kW
Payload elevator: 1000 kg - nominal speed: 0,62 m/s - motor power: 16 kW - typically input power supplied by main line: 40 kW
Velocità cabina in salita al variare del carico con limite di potenza settato a 20 kW, 15 kW o 12 kW
Upward cabin speed under varying load with input power limit set to 20 kW, 15 kW or 12 kW
D
Velocità cabina - Cabin speed [m/s]
0,64
0,60
0,56
0,52
0,48
0,44
0,40
0,36
0,32
0,28
0
100
200
300
400
500
600
700
800
900
1000
20 kW
15 kW
12 kW
Carico in cabina - Load in the cabin [kg]

Figure 4

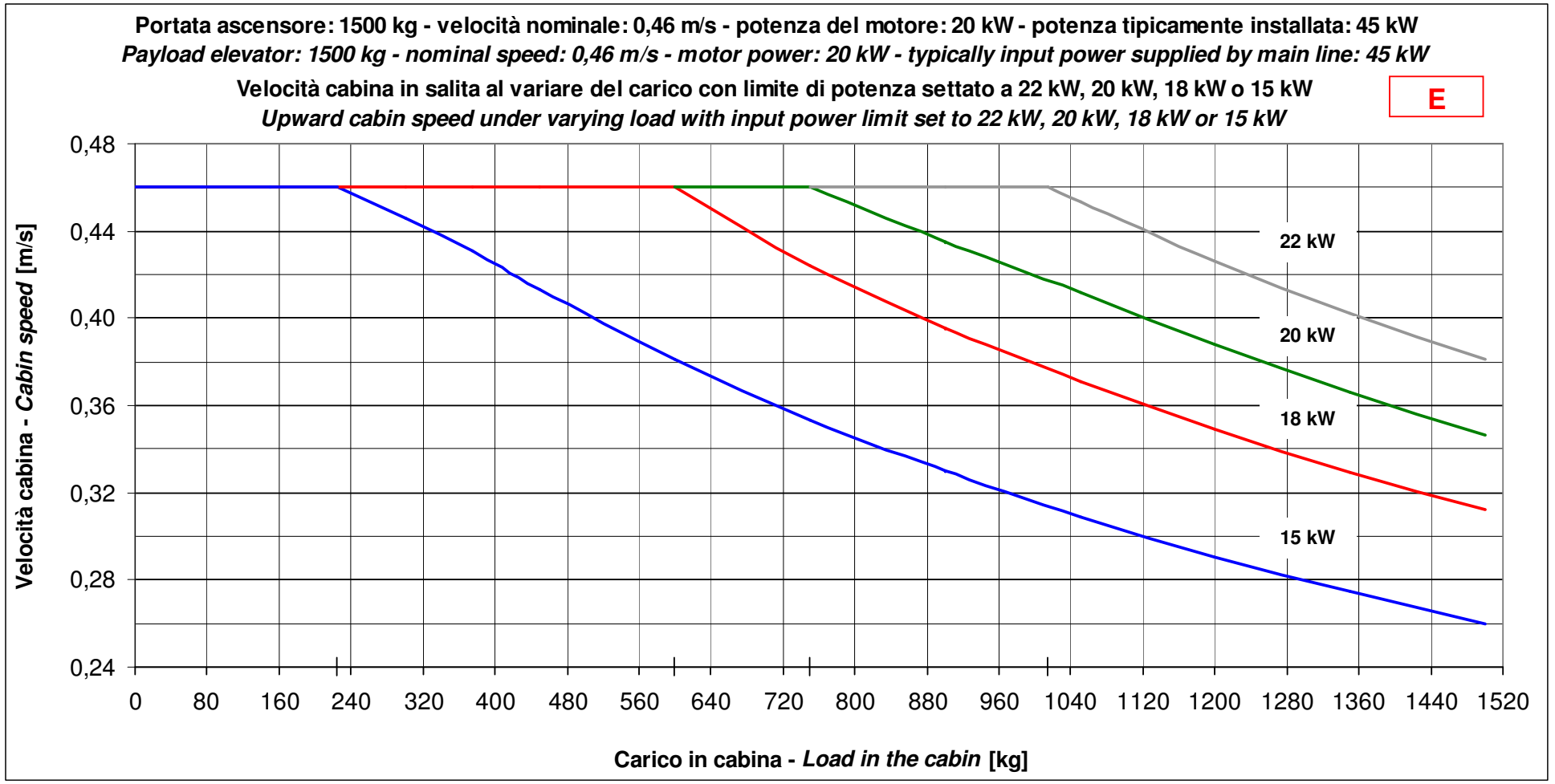
Portata ascensore: 1500 kg - velocità nominale: 0,46 m/s - potenza del motore: 20 kW - potenza tipicamente installata: 45 kW
Payload elevator: 1500 kg - nominal speed: 0,46 m/s - motor power: 20 kW - typically input power supplied by main line: 45 kW
Velocità cabina in salita al variare del carico con limite di potenza settato a 22 kW, 20 kW, 18 kW o 15 kW
Upward cabin speed under varying load with input power limit set to 22 kW, 20 kW, 18 kW or 15 kW
E
Velocità cabina - Cabin speed [m/s]
0,48
0,44
0,40
0,36
0,32
0,28
0,24
22 kW
20 kW
18 kW
15 kW
0
80
160
240
320
400
480
560
640
720
800
880
960
1040
1120
1200
1280
1360
1440
1520
Carico in cabina - Load in the cabin [kg]

Figure 5

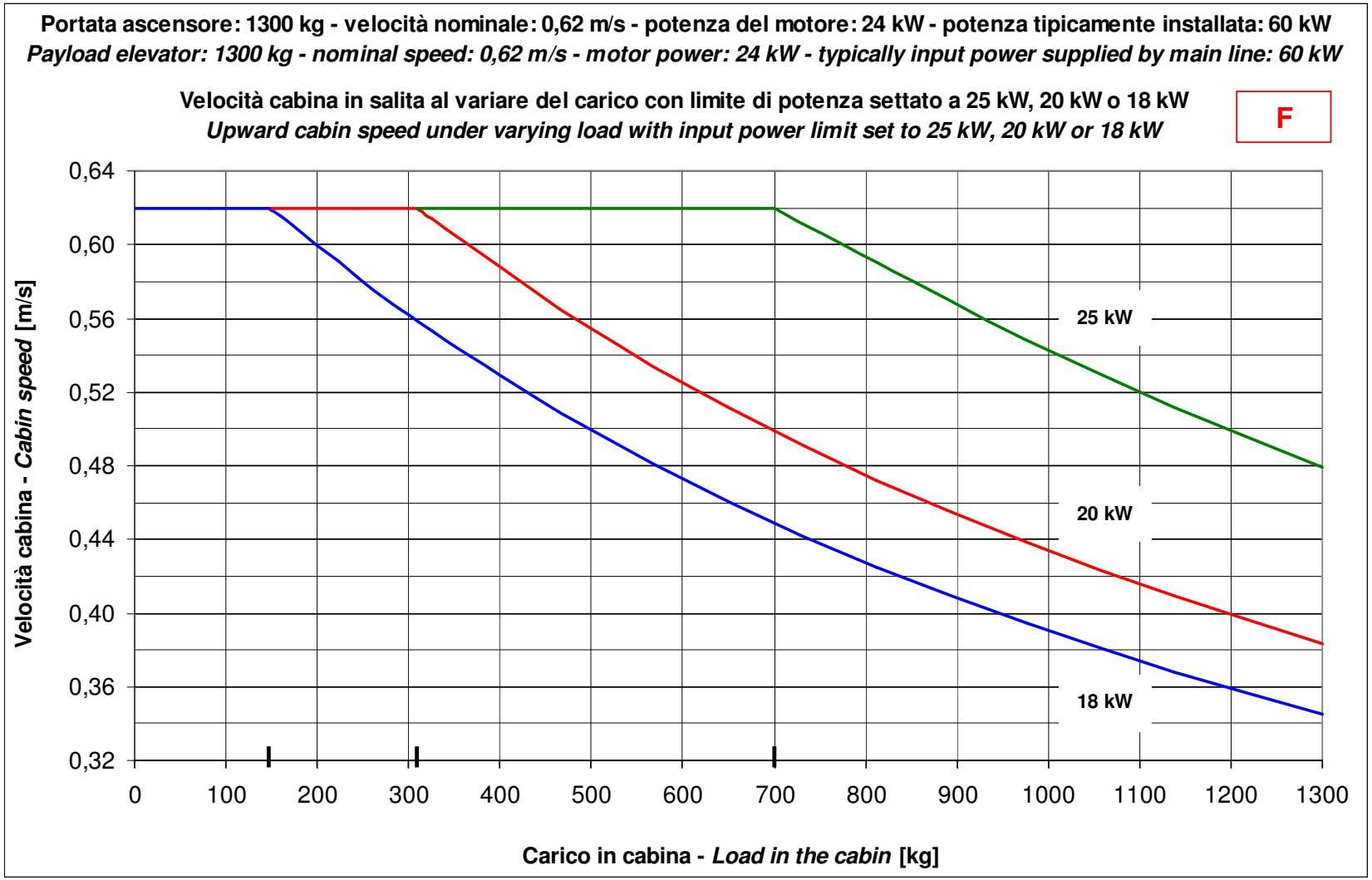
Portata ascensore: 1300 kg - velocità nominale: 0,62 m/s - potenza del motore: 24 kW - potenza tipicamente installata: 60 kW
Payload elevator: 1300 kg - nominal speed: 0,62 m/s - motor power: 24 kW - typically input power supplied by main line: 60 kW
Velocità cabina in salita al variare del carico con limite di potenza settato a 25 kW, 20 kW o 18 kW
Upward cabin speed under varying load with input power limit set to 25 kW, 20 kW or 18 kW
F
Velocità cabina - Cabin speed [m/s]
0,64
0,60
0,56
0,52
0,48
0,44
0,40
0,36
0,32
25 kW
20 kW
18 kW
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Carico in cabina - Load in the cabin [kg]

Figure 6

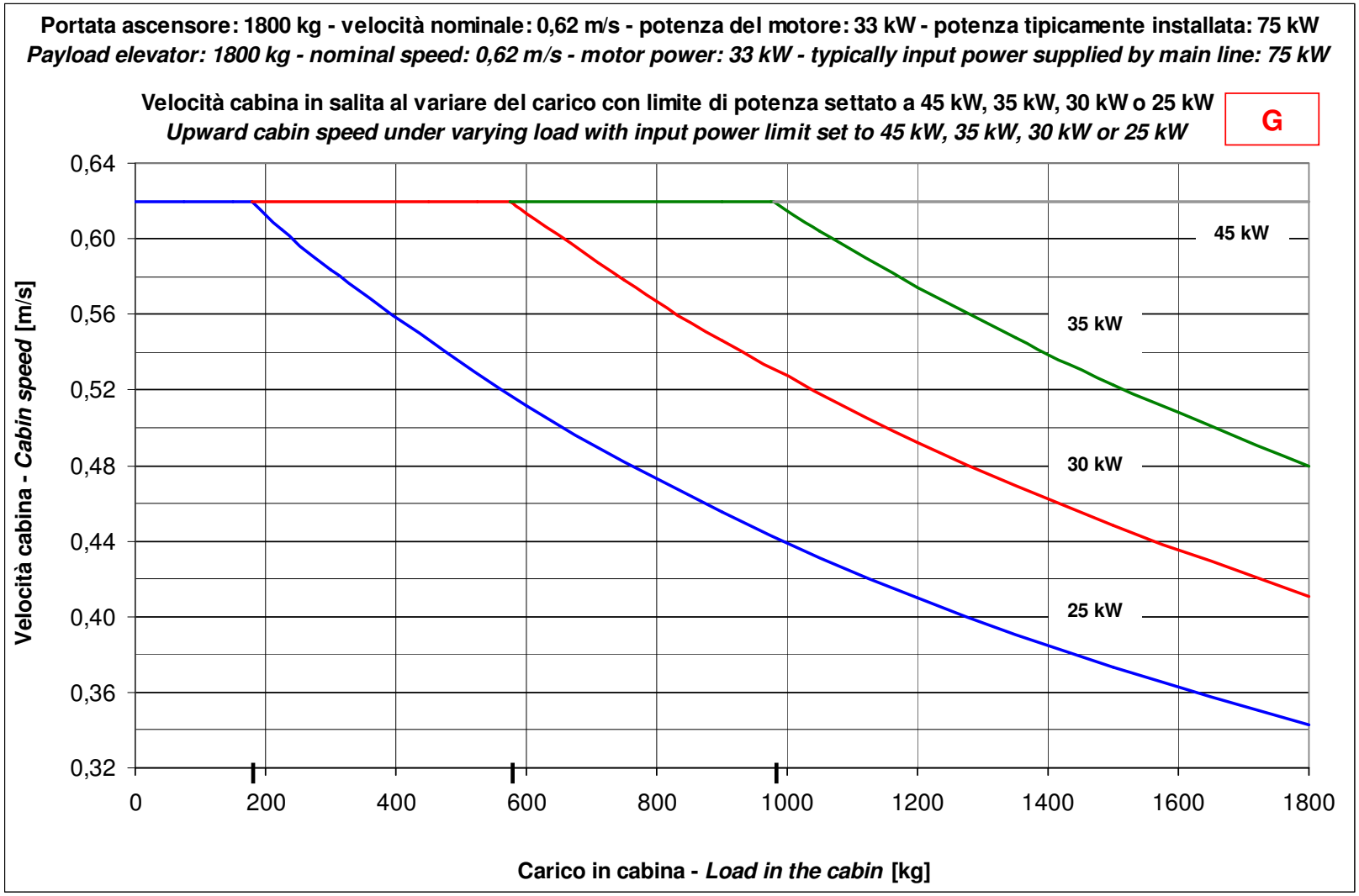
Portata ascensore: 1800 kg - velocità nominale: 0,62 m/s - potenza del motore: 33 kW - potenza tipicamente installata: 75 kW
Payload elevator: 1800 kg - nominal speed: 0,62 m/s - motor power: 33 kW - typically input power supplied by main line: 75 kW
Velocità cabina in salita al variare del carico con limite di potenza settato a 45 kW, 35 kW, 30 kW o 25 kW
Upward cabin speed under varying load with input power limit set to 45 kW, 35 kW, 30 kW or 25 kW
G
45 kW
35 kW
30 kW
25 kW
0,64
0,60
0,56
0,52
0,48
0,44
0,40
0,36
0,32
Velocità cabina - Cabin speed [m/s]
0
200
400
600
800
1000
1200
1400
1600
1800
Carico in cabina - Load in the cabin [kg]

Figure 7

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SUPPLIER INPUT POWER
WITH TRADITIONAL SET OF VALVES AND TRADITIONAL SET OF VALVES CONTROLLED BY INVERTER MED

POWER OF ELMO MOTOR	RATED CURRENT BY THE MAINS			SUPPLIER INPUT POWER WITHOUT CABIN SPEED REDUCTION AT A FULL LOAD (WITHOUT POWER LIMITATION)		SUPPLIER INPUT POWER WITH CABIN SPEED REDUCTION (WITH POWER LIMITATION)			MED SIZE
						MED POWER LIMIT[2]		CABIN SPEED REDUCTION AT A FULL LOAD	
MECHANICAL[1] [kW]	NOMINAL CURRENT [A]	DIRECT STARTING CURRENT [A]	WITH MED (NOMINAL/ STARTING CURRENT) [A]	DIRECT STARTING [kW]	MED [kW]	[kW]	[A]	%	
3	7,4	25	6,4	10	4,5	3	4,6	-28	MED 15
4,4	10	32	9,4	10	6	4,5	6,9	-26	
6	15	48	12,8	15	10	6	9,2	-28	
7,7	18	60	16,4	20	10	6	9,2	-44	MED 25
9,5	23	77	20	25	15	10	15,4	-24	MED 50
11	26	92	23	30	15	10	15,4	-34	
12	28	96	24	30	15	10	15,4	-37	
13	30	99	26	30	20	10	15,4	-43	MED 75
14,7	32	120	30	35	20	15	23	-23	
16	35	123	33	40	20	15	23	-31	
18,4	40	155	38	45	25	15	23	-39	MED 100
20	42	155	41	45	25	15	23	-44	
22,1	47	195	45	60	30	20	30,7	-31	
24	52	195	49	60	30	20	30,7	-37	
29	63	234	59	70	40	30	46,1	-22	MED 160
33	72	260	68	75	45	30	46,1	-33	

[1] the power by the main line is obtained by dividing the mechanical power for the efficiency ("η") of the motor
[2] recommended value

Table 1

ECONOMIC BENEFITS USING MED INVERTERS

1) **Operating power reduction** achieved by:

- reducing the starting current and improving the power factor ("cos ϕ") and efficiency ("η")
  MED inverter reduces the starting current and increases the power factor since it enables to set specific motor speeds for all the upward phases and enables the motor to operate at the maximum efficiency in all load conditions

- reducing the speed in upward direction in some load conditions
  MED inverter measures the power supplied by the main line and automatically reduces the motor speed to maintain the supplied power constant.

2) **Energy consumption reduction** achieved by:

- avoiding the discharge of oil in the tank during deceleration and low speed
  The discharge of oil in the tank during deceleration and low speed can be avoided driving the motor by means of MED inverter that manages all the movements of the cabin and enables specific motor speeds to be set for all operating cycles

- reducing the positioning time
  MED inverter is equipped with the function called "space tune" that allows you to minimize the cabin approaching time to the floor

- optimizing acceleration and deceleration phases
  The cabin acceleration and deceleration can be optimized driving the motor by means of MED inverter that manages all the movements of the cabin and enables specific motor speeds to be set for all operating cycles.

Table 2 describes the benefits that can be obtained by using MED inverter to control hydraulic lifts in different configurations (motor powered directly from the main line, motor powered by soft starter, motor powered by MED inverter); in particular, observing car speed (black and blue lines) and current (red line), you can notice that:

- soft starter can only partially reduce the starting current of the motor powered directly from the mains, while MED inverter **allows you to significantly reduce it and to bring the current supplied by the mains to values significantly lower during deceleration and low speed also**. Moreover it should be noted that soft starter does not automatically reduce upward speed in some load conditions, so as not to exceed the input power agreed with the energy supplier;
- **MED inverter enables to reduce the cabin approaching time to the floor** and find the correct stopping point right at the end of the deceleration, by annulling or limiting the usual long positioning times. This leads to have, being the equal travel, a travelling time greatly reduced;
- **MED inverter which completely manages the movement of the cabin both in upward direction, both in downward direction allows to reduce the oil heating** obtained by

conducting the lift energy potential into braking resistors while the cabin goes down. This solution allows to avoid the use of expensive heat exchangers.

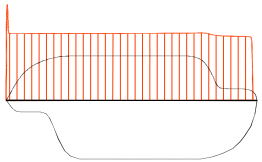
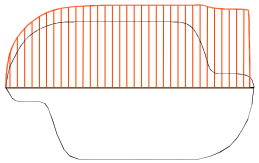
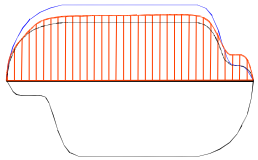
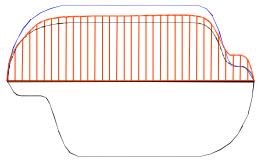
Chosen solution	Energy saving	Reduction of committed power	Reduction of oil heat	Type of valve	Trends of the cabin speed (black and blue lines) and of the current (red line)
Motor powered directly from the main line	**-**	**-**	**-**	Conventional set of valves	
Motor powered by soft starter	**Medium/Low** **5-10%**	**Medium** **20-30%**	**Medium/Low** **10-15%**	Conventional set of valves	
Motor powered by dedicated inverter with power limitation (upward only)	**High** **15-30%**	**High** **30-40%**	**Medium** **15-25%**	Conventional set of valves	
Motor powered by dedicated inverter with power limitation (upward + downward)	**High** **15-30%**	**High** **30-40%**	**High** **30-50%**	Dedicated set of valves that enables the oil to be returned to the tank through the pump both during upward and downward travel (heat exchanger is no longer needed)	

Table 2

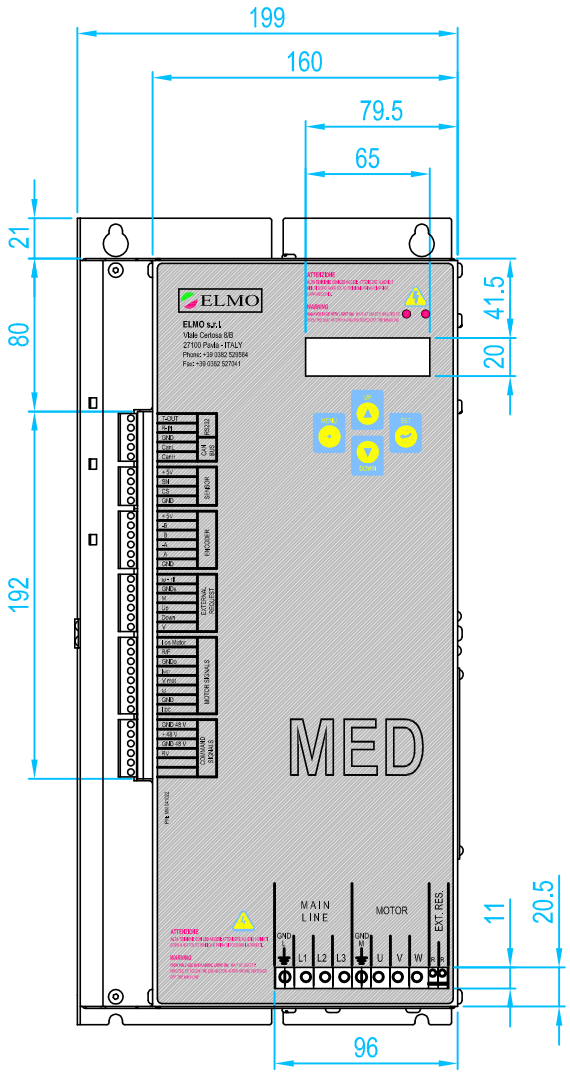
SUMMARY TABLE FOR ELMO INVERTERS

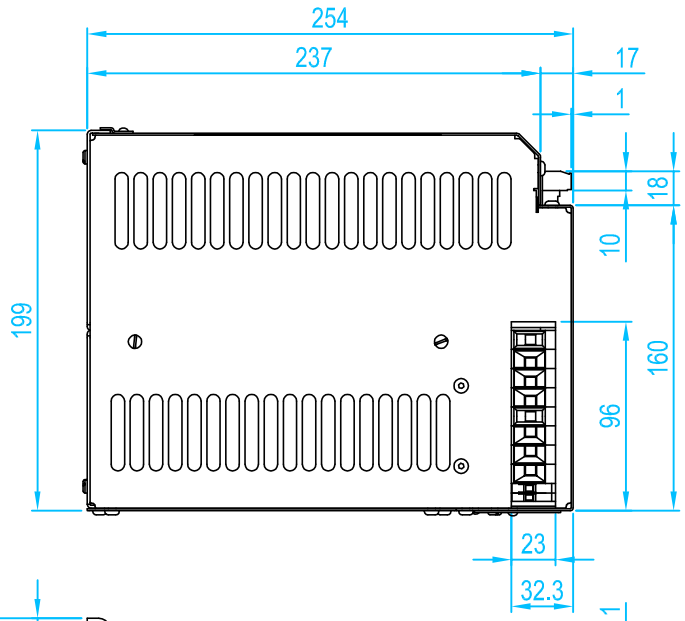
Type of MED inverter	Typical application	Type of valve	Main characteristics
a) Upward only without encoder (sensorless)	Updated installations	Conventional set of valves	- Adjustable maximum, maintenance and positioning/relevelling speeds only in upward direction; - adjustable cabin deceleration time; - reduction of the positioning time; - compensation for the pump leakage to make the car speed insensitive to load and oil temperature variations; - significantly reduction of starting current; - setting of the maximum power supplied by the main line; - good alignment of the cabin with the floors during upward; - comfort of downward race totally committed to the conventional set of valves.
b) Upward only with encoder	New installations	Conventional set of valves	- Adjustable maximum, maintenance and positioning/relevelling speeds only in upward direction; - adjustable cabin deceleration time; - reduction of the positioning time; - compensation for the pump leakage to make the car speed insensitive to load and oil temperature variations; - significantly reduction of starting current; - setting of the maximum power supplied by the main line; - excellent alignment of the cabin with the floors during upward; - comfort of downward race totally committed to the conventional set of valves.
c) Upward+ downward with encoder	New installations	Set of special valves that ensures the return of the oil in the tank through the pump, during both the upward and downward	- Adjustable maximum, maintenance and positioning/relevelling speeds both in upward direction, both in downward direction; - adjustable cabin acceleration/deceleration time; - reduction of the positioning time; - compensation for the pump leakage to make the car speed insensitive to load and oil temperature variations; - significantly reduction of starting current; - setting of the maximum power supplied by the main line; - excellent alignment of the cabin with the floors during upward and downward.

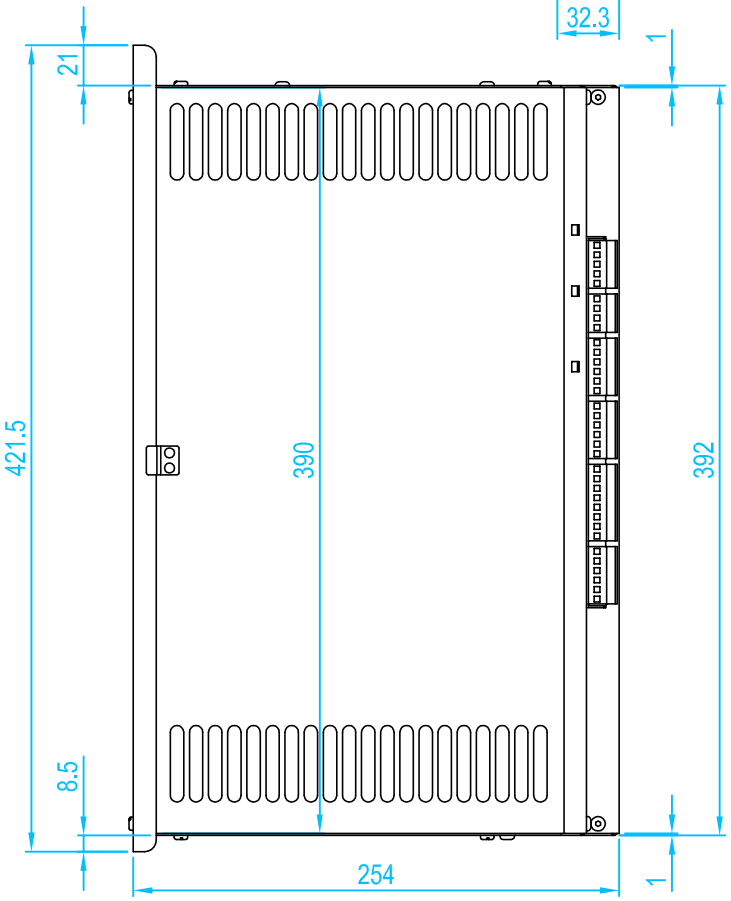
Table 3

ELMO

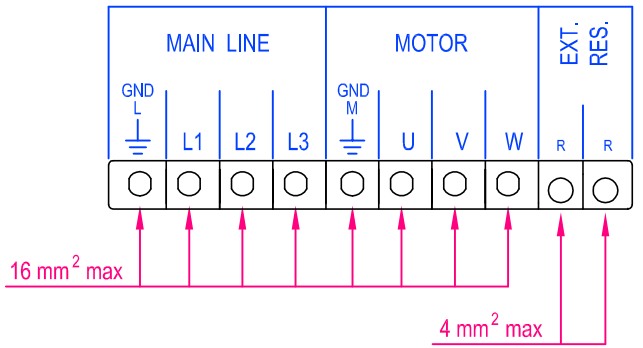
DIMENSIONI INVERTER MED 15, 25, 50, 75, 100 *MED 15, 25, 50, 75, 100* *INVERTER OVERALL DIMENSIONS*	Rev. 171006

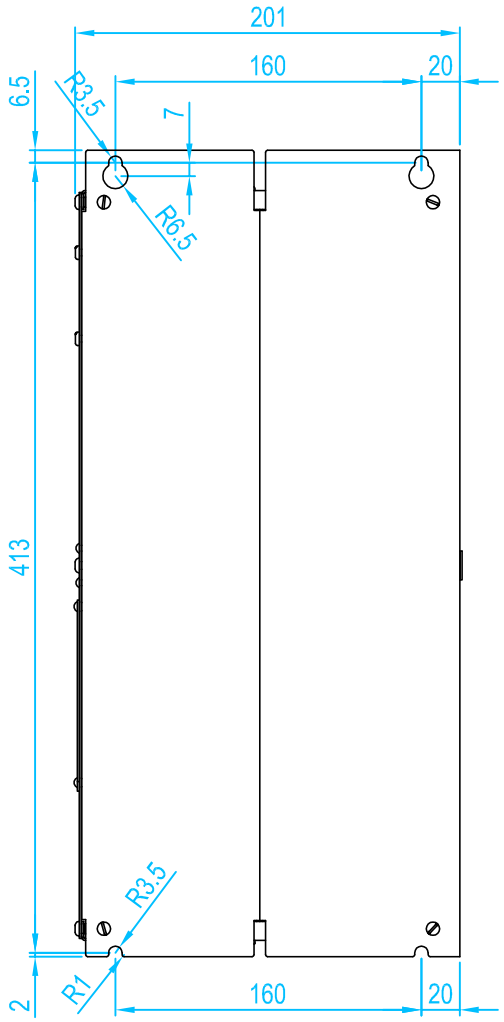




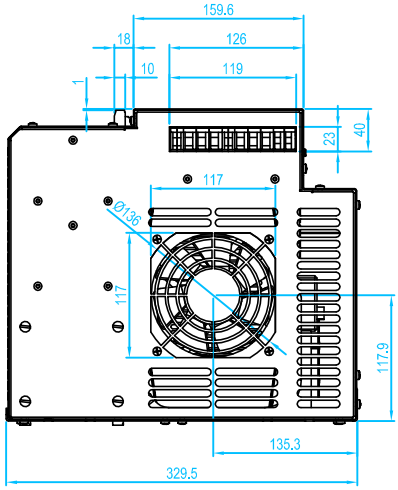


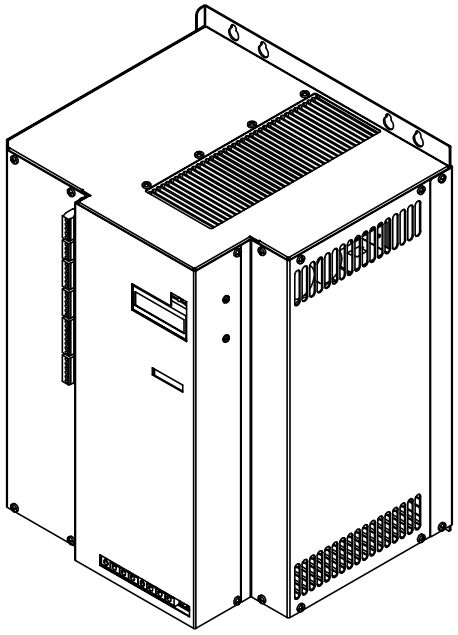
Sezione morsetti di potenza
Power terminal section

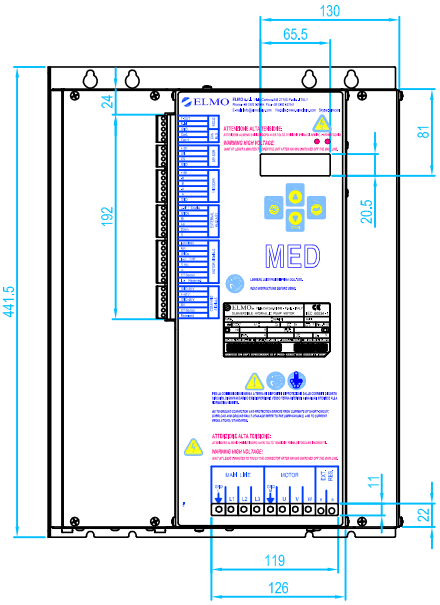


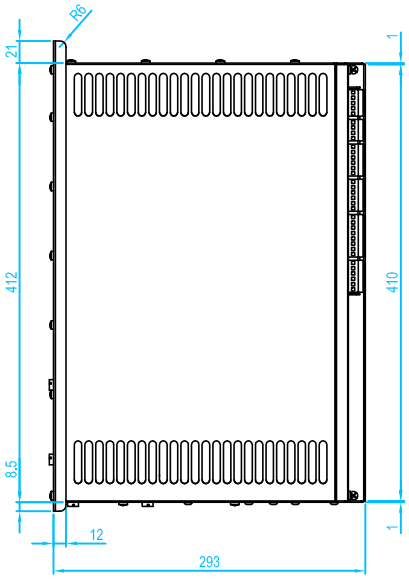


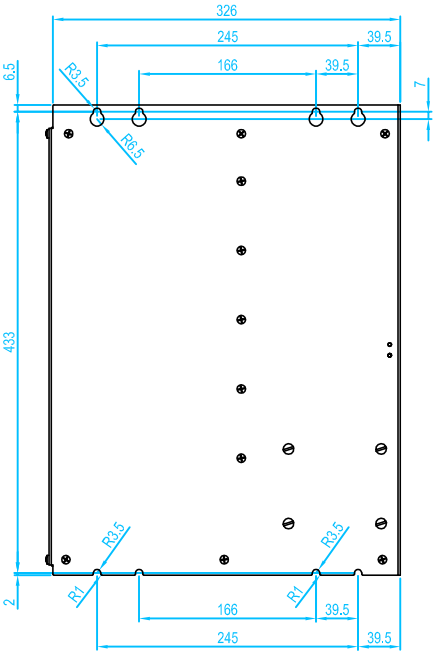
DIMENSIONI INVERTER MED 160 *MED 160 INVERTER* *OVERALL DIMENSIONS*	Rev. 171006



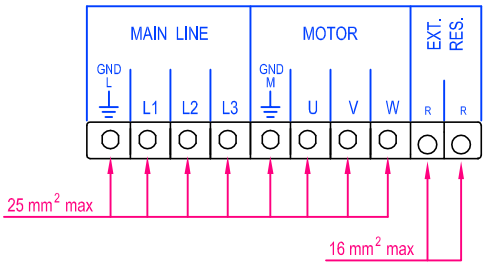


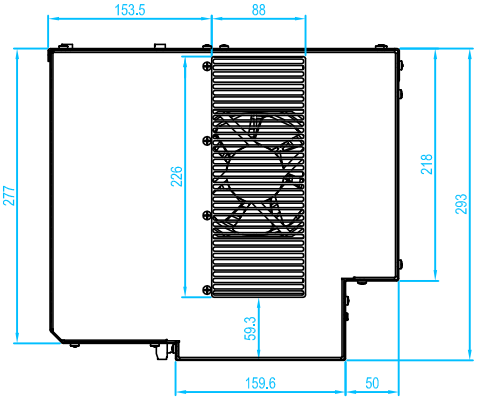


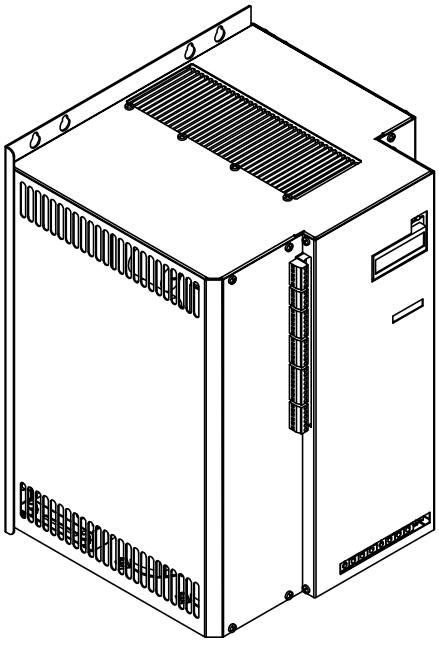


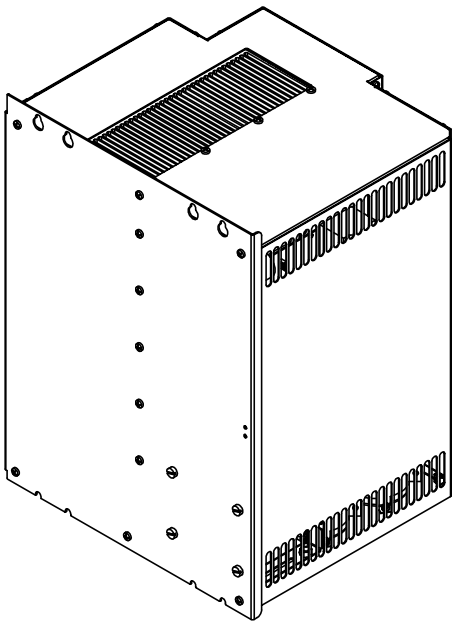


Sezione morsetti di potenza
Power terminal section









ELMO

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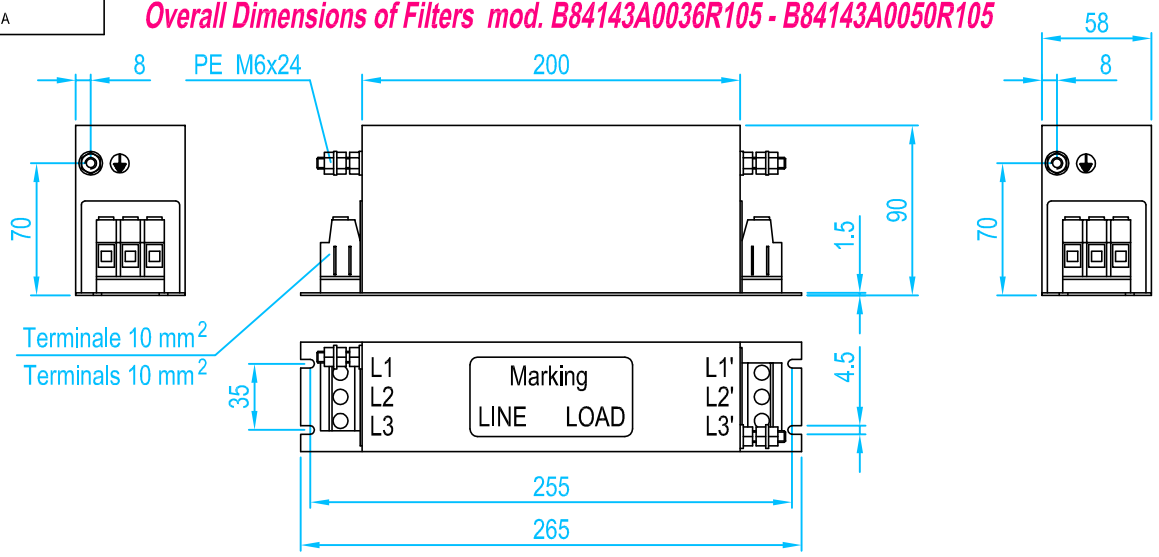
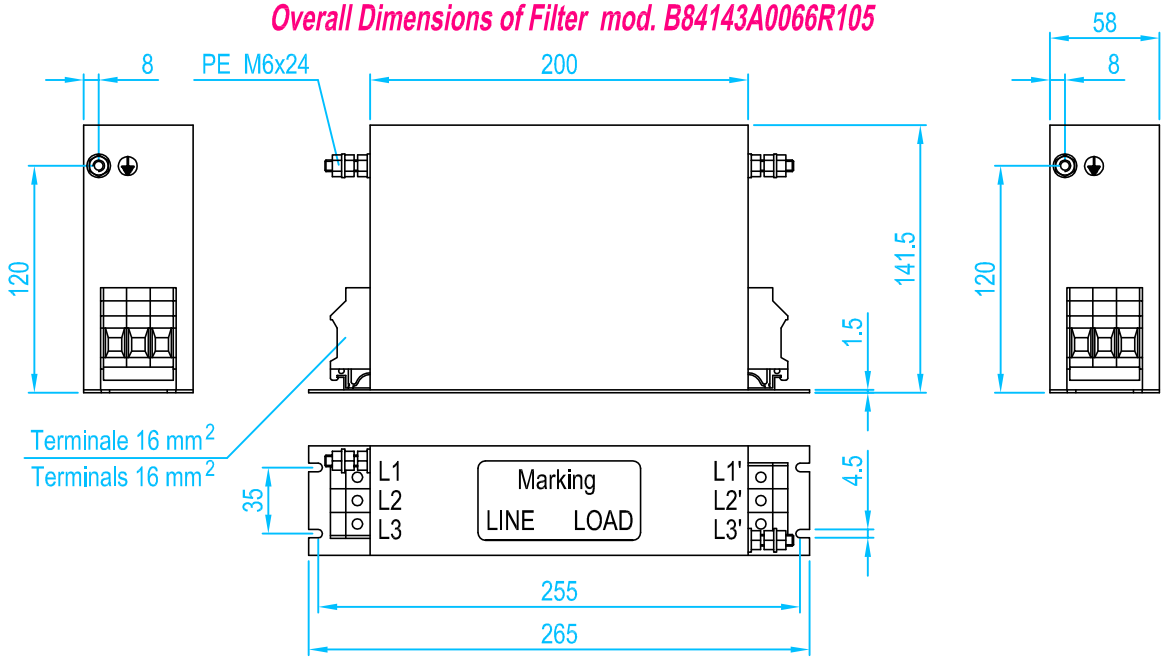
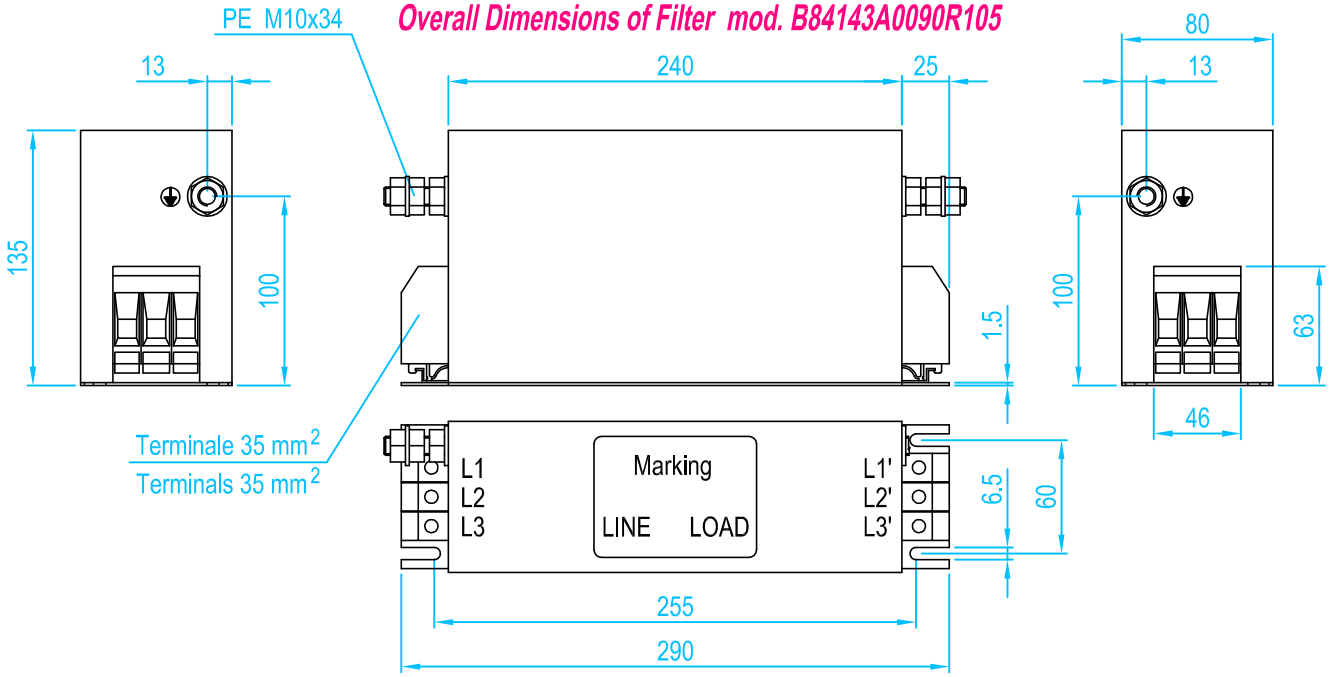
Dimensioni d'ingombro Filtri mod. B84143A0036R105 - B84143A0050R105
Overall Dimensions of Filters mod. B84143A0036R105 - B84143A0050R105



Dimensioni d'ingombro Filtro mod. B84143A0066R105
Overall Dimensions of Filter mod. B84143A0066R105

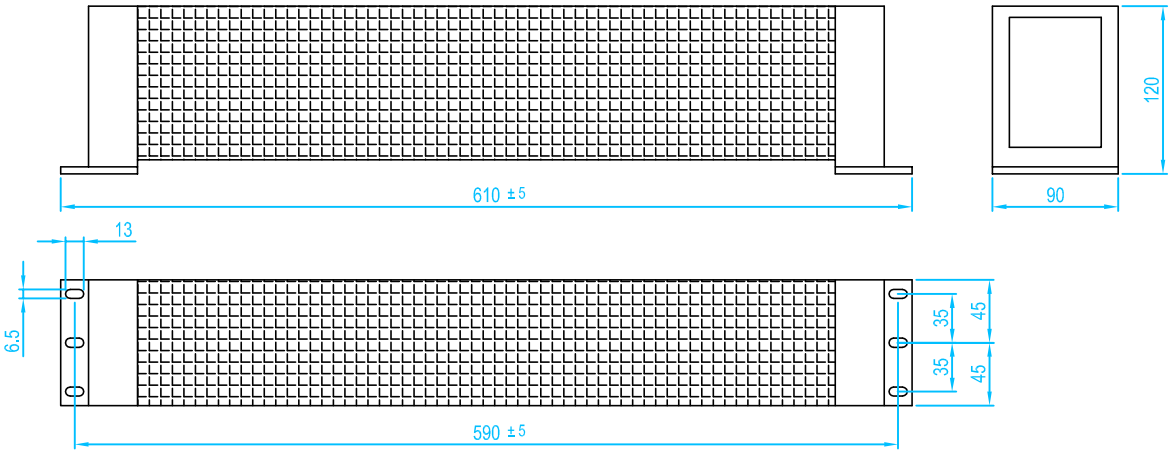


Dimensioni d'ingombro Filtro mod. B84143A0090R105
Overall Dimensions of Filter mod. B84143A0090R105

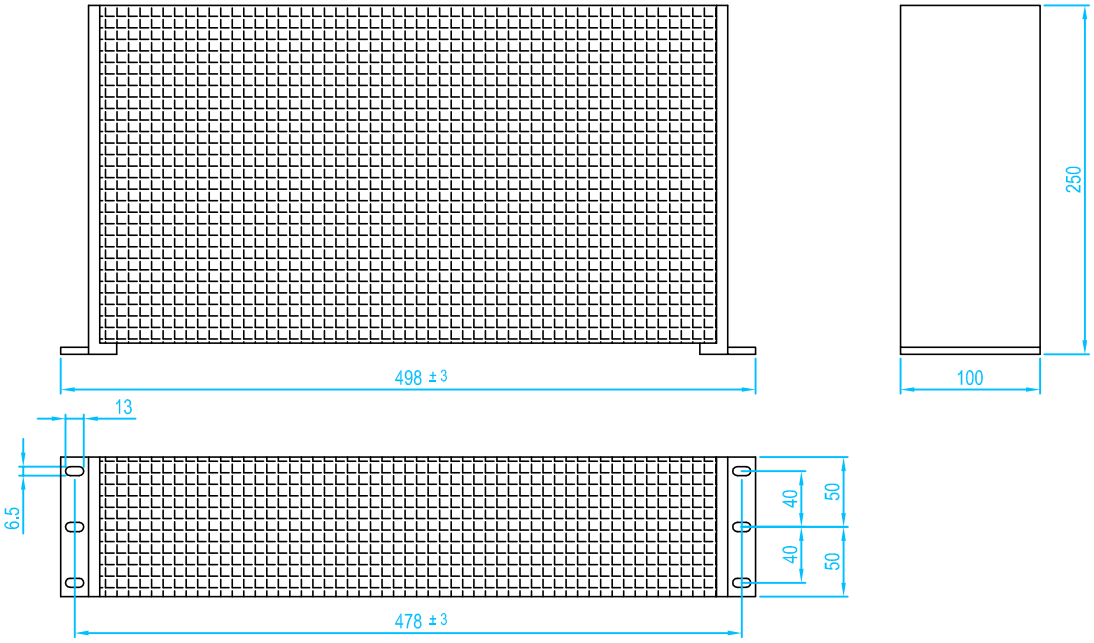


ELMO
PAVIA

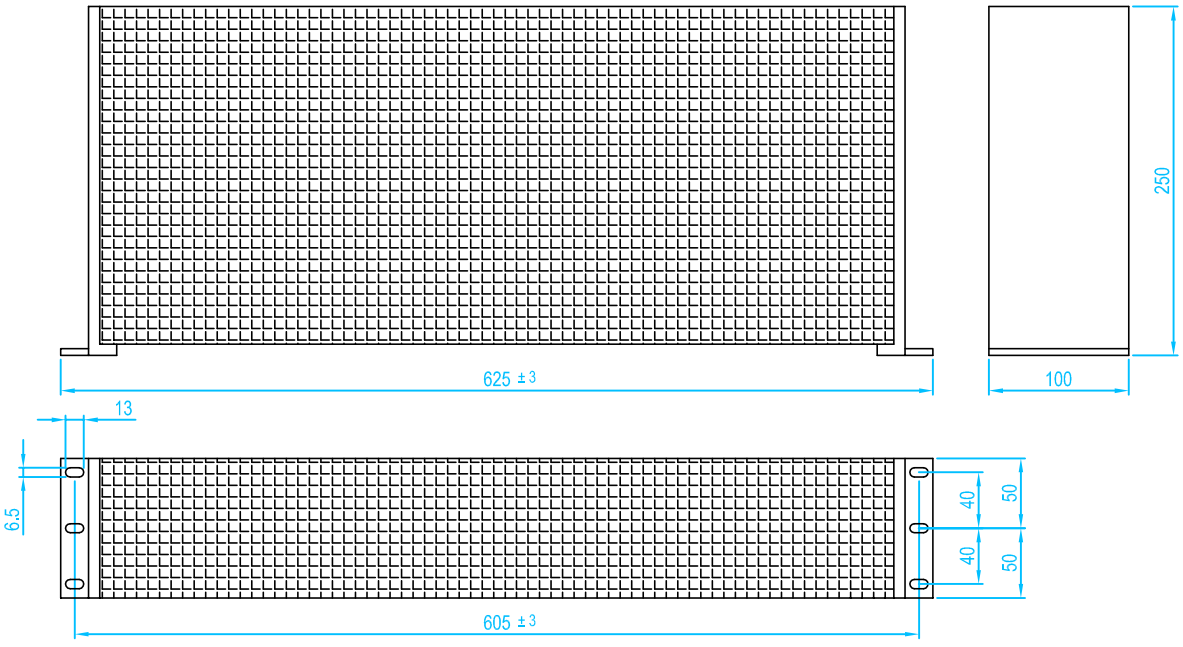
Dimensioni d'ingombro Resistore di Frenatura in custodia metallica mod. BRR1K3-22RJ (1300 W)
Overall Dimensions of Brake Resistor in metallic case mod. BRR1K3-22RJ (1300 W)



Dimensioni d'ingombro Resistore di Frenatura in custodia metallica mod. BDC2K0-16RK (2300 W)
Overall Dimensions of Brake Resistor in metallic case mod. BDC2K0-16RK (2300 W)



Dimensioni d'ingombro Resistore di Frenatura in custodia metallica mod. BDC4K0-16RK (4000 W)
Overall Dimensions of Brake Resistor in metallic case mod. BDC4K0-16RK (4000 W)



I resistori di frenatura sono completi di cavo schermato di collegamento di lunghezza 6000 mm
Braking resistors are equipped with shielded cable (length 6000 mm) to connect them to VVVF drive