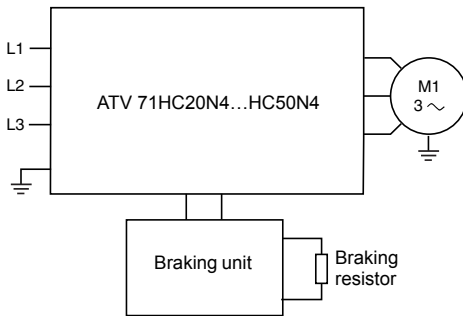


Variable speed drives for asynchronous motors

Altivar 71

Option: resistance braking units

Presentation



Resistance braking enables the Altivar 71 drive to operate while braking to a standstill or during “generator” operation, by dissipating the energy in the braking resistor.

ATV 71H●●●M3, ATV 71H●●●M3X, ATV 71H075N4...HC16N4, ATV 71W●●●N4 and ATV 71P●●●N4Z drives have a built-in dynamic brake transistor.

For ATV 71HC20N4...HC50N4 drives, a braking unit must be used. This is controlled by the drive:

- For ATV 71HC20N4...HC28N4 drives, the braking unit is mounted directly on the left-hand side of the drive, see dimensions page 60294/3
- For ATV 71HC40N4, HC50N4 drives, the braking unit is an external module, see dimensions page 60294/12

Applications

High-inertia machines, machines with cycles and fast cycles, high-power machines performing vertical movements.

Characteristics

Type of braking unit			VW3 A7 101	VW3 A7 102
Ambient air temperature around the device	Operation	°C	-10...+50	
	Storage	°C	-25...+70	
Degree of protection of enclosure			IP 20	
Degree of pollution			2 according to standard EN 50178	
Relative humidity			Class 3K3 without condensation	
Maximum operating altitude		m	2000	
Vibration resistance			0.2 gn	
Nominal line supply voltage and drive supply voltage (rms value)		V	380 – 15%...480 + 10% ~	
Engage threshold		V	785 ± 1% ---	
Maximum DC bus voltage		V	850	
Maximum braking power on 400 V~ line supply	785 V --- (1)	kW	420	750
Percentage of conduction time at constant power at 785 V---			5% at 420 kW	5% at 750 kW
			15% at 320 kW	15% at 550 kW
			50% at 250 kW	50% at 440 kW
Cycle time		s	≤ 240	
Maximum continuous power		kW	200	400
Braking power on a vertical movement (values given for a cycle time of 240 s)				
Thermal protection			Integrated, via thermal probe	
Forced ventilation		m³/h	100	600
Mounting			Vertical	
Minimum resistance value to be associated with the braking unit		Ω	1.05	0.7

(1) Braking unit engage threshold

Variable speed drives for asynchronous motors

Altivar 71

Option: resistance braking units

Braking units									
Supply voltage: 380...480 V 50/60 Hz									
For drives	Power		Loss	Cable (drive-braking unit)		Cable (braking unit-resistors)		Reference	Weight
	Contin.	Max.	Con- tinuous power	Cross- section	Max. length	Cross- section	Max. length		
	kW	kW	W	mm ²	m	mm ²	m		kg
ATV 71HC20N4... HC28N4	200	420	550	–	–	2 x 95	50	VW3 A7 101	30.000
				Internal connections					
ATV 71HC31N4... HC50N4	400	750	750	2 x 150	1	2 x 150	50	VW3 A7 102	80.000

Note: To increase the braking power, several braking resistors can be mounted in parallel on the same braking unit. In this case, do not forget to take account of the minimum resistance value on each unit, see characteristics page 60288/2.

Presentation

The braking resistor enables the Altivar 71 drive to operate while braking to a standstill or during slowdown braking, by dissipating the braking energy. It enables maximum transient braking torque.

The resistors are designed to be mounted on the outside of the enclosure, but should not inhibit natural cooling. Air inlets and outlets must not be obstructed in any way. The air must be free of dust, corrosive gas and condensation.

Applications

Inertia machines, machines with cycles

General characteristics

Type of braking resistor		VW3 A7 701...709	VW3 A7 710...718
Ambient air temperature around the device	Operation	°C	0...+50
	Storage	°C	-25...+70
Degree of protection of enclosure		IP 20	IP 23
Thermal protection		Via temperature controlled switch or via the drive	Via thermal overload relay
Temperature controlled switch (1)	Tripping temperature	°C	120
	Max. voltage – max. current		250 V ~ -1 A
	Min. voltage – min. current		24 V ~ -0.1 A
	Maximum contact resistance	mΩ	60
Operating factor for the dynamic brake transistors		The internal circuits of Altivar 71 drives rated 160 kW or less have a built-in dynamic brake transistor	
ATV 71H●●●M3, ATV 71H●●●M3X, ATV 71H075N4...HD75N4 ATV 71W●●●N4 ATV 71P●●●N4Z ATV 71HD90N4...HC16N4		The dynamic brake transistor is sized so that it can tolerate: <ul style="list-style-type: none"> ■ the nominal motor power continuously ■ 150% of the nominal motor power for 60 s 	
		The dynamic brake transistor is sized so that it can tolerate: <ul style="list-style-type: none"> ■ 75% of the nominal motor power continuously ■ 150% of the nominal motor power for 10 s 	

Connection characteristics

Type of terminal	Drive connection	Temperature-controlled switch
Maximum connection capacity	VW3 A7 701...703	4 mm ² (AWG 28)
	VW3 A7 704...709	Bar connection, M6
	VW3 A7 710...718	Bar connection, M10
		1.5 mm ² (AWG 16)
		2.5 mm ² (AWG 14)
		–

Minimum ohmic value of the resistors to be associated with the Altivar 71 drive, at 20°C (2)

ATV 71H●●●M3, ATV 71H●●●M3X and ATV 71H●●●N4 drives

Type of drive	ATV 71H	037M3, 075M3	U15M3	U22M3, U30M3	U40M3	U55M3	U75M3				
Minimum value	Ω	44	33	22	16	11	8				
Type of drive	ATV 71H	D11M3X, D15M3X	D18M3X	D22M3X, D30M3X	D37M3X... D55M3X	D75M3X					
Minimum value	Ω	3	4	3.3	1.7	1.3					
Type of drive	ATV 71H	075N4... U22N4	U30N4, U40N4	U55N4	U75N4	D11N4	D15N4, D18N4	D22N4, D30N4	D37N4	D45N4, D55N4	D75N4
Minimum value	Ω	56	34	23	19	12	7	13.3	6.7	5	3.3
Type of drive	ATV 71H	D90N4	C11N4... C16N4	C20N4... C28N4	C31N4... C50N4						
Minimum value	Ω	2.5	1.9	1.05	0.7						

ATV 71W●●●N4 drives

Type of drive	ATV 71W	075N4... U22N4	U30N4, U40N4	U55N4	U75N4	D11N4	D15N4, D18N4	D22N4, D30N4	D37N4	D45N4, D55N4	D75N4
Minimum value	Ω	56	34	23	19	12	7	13.3	6.7	5	3.3

ATV 71P●●●N4Z drives

Type of drive	ATV 71P	075N4Z... U22N4Z	U30N4Z... U40N4Z	U55N4Z	U75N4Z						
Minimum value	Ω	56	34	23	19						

(1) The switch should be connected in the sequence (use for signalling, or in the line contactor control).

(2) The minimum ohmic value is determined at a temperature of 20°C. In an environment where the temperature is below 20°C, make sure that the minimum ohmic value recommended in the table is observed.

Variable speed drives for asynchronous motors

Altivar 71

Option: braking resistors

Braking resistors				
For drives	Ohmic value at 20°C	Average power available at 50°C (1)	Reference	Weight
	Ω	kW		kg
Supply voltage: 200...240 V 50/60 Hz				
ATV 71H037M3, H075M3	100	0.05	VW3 A7 701	1.900
ATV 71HU15M3, HU22M3	60	0.1	VW3 A7 702	2.400
ATV 71HU30M3, HU40M3	28	0.2	VW3 A7 703	3.500
ATV 71HU55M3, HU75M3	15	1	VW3 A7 704	11.000
ATV 71HD11M3X	10	1	VW3 A7 705	11.000
ATV 71HD15M3X	8	1	VW3 A7 706	11.000
ATV 71HD18M3X, HD22M3X	5	1	VW3 A7 707	11.000
ATV 71HD30M3X	4	1	VW3 A7 708	11.000
ATV 71HD37M3X, HD45M3X	2.5	1	VW3 A7 709	11.000
ATV 71HD55M3X	1.8	15.3	VW3 A7 713	50.000
ATV 71HD75M3X	1.4	20.9	VW3 A7 714	63.000
Supply voltage: 380...480 V 50/60 Hz				
ATV 71H075N4...HU40N4 ATV 71W075N4, WU40N4 ATV 71P075N4Z, PU40N4Z	100	0.05	VW3 A7 701	1.900
ATV 71HU55N4, HU75N4 ATV 71WU55N4, WU75N4 ATV 71PU55N4Z, PU75N4Z	60	0.1	VW3 A7 702	2.400
ATV 71HD11N4, HD15N4 ATV 71WD11N4, WD15N4	28	0.2	VW3 A7 703	3.500
ATV 71HD18N4...HD30N4 ATV 71WD18N4...WD30N4	15	1	VW3 A7 704	11.000
ATV 71HD37N4 ATV 71WD37N4	10	1	VW3 A7 705	11.000
ATV 71HD45N4...HD75N4 ATV 71WD45N4...WD75N4	5	1	VW3 A7 707	11.000
ATV 71HD90N4	2.75	25	VW3 A7 710	80.000
ATV 71HC11N4, HC13N4	2.1	37	VW3 A7 711	86.000
ATV 71HC16N4	2.1	44	VW3 A7 712	104.000
ATV 71HC20N4	1.05	56	VW3 A7 715	136.000
ATV 71HC25N4, HC28N4	1.05	75	VW3 A7 716	172.000
ATV 71HC31N4, HC40N4	0.7	112	VW3 A7 717	266.000
ATV 71HC50N4	0.7	150	VW3 A7 718	350.000

(1) Operating factor for resistors: the value of the average power that can be dissipated at 50°C from the resistor into the casing is determined for an operating factor during braking that corresponds to the majority of normal applications.

For VW3 A7 701...709:

- 2 s braking with 0.6 T_n braking torque for a 40 s cycle

- 0.8 s braking with 1.5 T_n braking torque for a 40 s cycle.

For VW3 A7 710...71:

- 10 s braking with 2 T_n braking torque for a 30 s cycle.

Presentation

The hoist resistor is a braking resistor which enables the Altivar 71 drive to operate while braking to a standstill or during slowdown braking, by dissipating the braking energy.

It enables maximum transient braking torque.

The resistors are designed to be mounted on the outside of the enclosure, but should not inhibit natural cooling. Air inlets and outlets must not be obstructed in any way. The air must be free of dust, corrosive gas and condensation.

Applications

Machines performing vertical movements, machines with fast cycles, high-inertia machines.

General characteristics

Type of hoist resistor		VW3 A7 801	VW3 A7 802...A7 808	VW3 A7 809...A7 817
Ambient air temperature around the device	Operation	°C 0...+50		
	Storage	°C -25...+75		-25...+65
Degree of protection of enclosure		IP 23 if horizontal mounting IP 20 in other cases	IP 23	
Thermal protection		Via thermal overload relay		
Operating factor for the dynamic brake transistors		The internal circuits of Altivar 71 drives rated 160 kW or less have a built-in dynamic brake transistor		
ATV 71H●●●M3, ATV 71H●●●M3X, ATV 71H075N4...HD75N4 ATV 71W●●●N4 ATV 71P●●●N4Z ATV 71HD90N4...HC50N4 (1)		The dynamic brake transistor is sized so that it can tolerate: <ul style="list-style-type: none"> ■ the nominal motor power continuously ■ 150% of the nominal motor power for 60 s 		
		The dynamic brake transistor is sized so that it can operate on a 240 s cycle at: <ul style="list-style-type: none"> ■ 88% of the nominal motor power for 50% of the cycle time ■ 150% of the nominal motor power for 5% of the cycle 		

Connection characteristics

Maximum connection capacity	VW3 A7 801	Bar connection, M6
	VW3 A7 802...817	Bar connection, M10

Minimum ohmic value of the resistors to be associated with the Altivar 71 drive, at 20°C (2)

ATV 71H●●●M3, ATV 71H●●●M3X and ATV 71H●●●N4 drives

Type of drive	ATV 71H	037M3, 075M3	U15M3	U22M3, U30M3	U40M3	U55M3	U75M3				
Minimum value	Ω	44	33	22	16	11	8				
Type of drive	ATV 71H	D11M3X, D15M3X	D18M3X	D22M3X, D30M3X	D37M3X... D55M3X	D75M3X					
Minimum value	Ω	3	4	3.3	1.7	1.3					
Type of drive	ATV 71H	075N4... U22N4	U30N4, U40N4	U55N4	U75N4	D11N4	D15N4, D18N4	D22N4, D30N4	D37N4	D45N4, D55N4	D75N4
Minimum value	Ω	56	34	23	19	12	7	13.3	6.7	5	3.3
Type of drive	ATV 71H	D90N4	C11N4... C16N4	C20N4... C28N4	C31N4... C50N4						
Minimum value	Ω	2.5	1.9	1.05	0.7						

ATV 71W●●●N4 drives

Type of drive	ATV 71W	075N4... U22N4	U30N4, U40N4	U55N4	U75N4	D11N4	D15N4, D18N4	D22N4, D30N4	D37N4	D45N4, D55N4	D75N4
Minimum value	Ω	56	34	23	19	12	7	13.3	6.7	5	3.3

ATV 71P●●●N4Z drives

Type of drive	ATV 71P	075N4Z... U22N4Z	U30N4Z... U40N4Z	U55N4Z	U75N4Z						
Minimum value	Ω	56	34	23	19						

(1) For ATV 71HC20N4...HC50N4 drives, a braking unit must be used, see page 60288/2.

(2) The minimum ohmic value is determined at a temperature of 20°C. In an environment where the temperature is below 20°C, make sure that the minimum ohmic value recommended in the table is observed.

Variable speed drives for asynchronous motors

Altivar 71

Option: hoist resistors

Hoist resistors				
For drives	Ohmic value at 20°C	Average power available at 50°C (1)	Reference	Weight
	Ω	kW		kg
Supply voltage: 200...240 V 50/60 Hz				
ATV 71H037M3, H075M3	100	1.6	VW3 A7 801	6.000
ATV 71HU15M3	60	5.6	VW3 A7 802	21.000
ATV 71HU22M3...HU40M3	24.5	9.8	VW3 A7 803	28.000
ATV 71HU55M3, HU75M3	14	22.4	VW3 A7 804	54.000
ATV 71HD11M3X, HD15M3X	8.1	44	VW3 A7 805	92.000
ATV 71HD18M3X	4.2	62	VW3 A7 806	126.000
ATV 71HD22M3X, HD30M3X	3.5	19.5	VW3 A7 807	51.000
ATV 71HD37M3X, HD45M3X	1.85	27.4	VW3 A7 808	94.000
ATV 71HD55M3X	1.8	30.6	VW3 A7 809	103.000
ATV 71HD75M3X	1.4	44	VW3 A7 810	119.000
Supply voltage: 380...480 V 50/60 Hz				
ATV 71H075N4...HU22N4 ATV 71W075N4...WU22N4 ATV 71P075N4Z...PU22N4Z	100	1.6	VW3 A7 801	6.000
ATV 71HU30N4...HU55N4 ATV 71WU30N4...WU55N4 ATV 71PU30N4Z...PU55N4Z	60	5.6	VW3 A7 802	21.000
ATV 71HU75N4, HD11N4 ATV 71WU75N4, WD11N4 ATV 71PU75N4Z	24.5	9.8	VW3 A7 803	28.000
ATV 71HD15N4...HD30N4 ATV 71WD15N4...WD30N4	14	22.4	VW3 A7 804	54.000
ATV 71HD37N4...HD55N4 ATV 71W37N4...WD55N4	8.1	44	VW3 A7 805	92.000
ATV 71HD75N4 ATV 71WD75N4	4.2	62	VW3 A7 806	126.000
ATV 71HD90N4	2.75	56	VW3 A7 811	130.000
ATV 71HC11N4, HC13N4	2.1	75	VW3 A7 812	181.000
ATV 71HC16N4	2.1	112	VW3 A7 813	250.000
ATV 71HC20N4	1.05	112	VW3 A7 814	280.000
ATV 71HC25N4, HC28N4	1.05	150	VW3 A7 815	362.000
ATV 71HC31N4, HC40N4	0.7	225	VW3 A7 816	543.000
ATV 71HC50N4	0.7	330	VW3 A7 817	642.000

(1) Operating factor for hoist resistors: the value of the average power that can be dissipated at 50°C from the resistor is determined by an operating factor during braking.

For VW3 A7 801...808:

- 100 s braking with 1 T_n braking torque for a 200 s cycle
- 20 s braking with 1.6 T_n braking torque for a 200 s cycle.

For VW3 A7 809...817:

- 110 s braking with 1.25 T_n braking torque for a 240 s cycle
- 10 s braking with 2 T_n braking torque for a 240 s cycle.

Variable speed drives for asynchronous motors

Altivar 71

Option: braking units and resistors

Determining the braking unit and resistor

Calculating the various braking powers makes it possible to determine the braking unit and the braking resistor.

Presentation of the two main types of operation: A and B

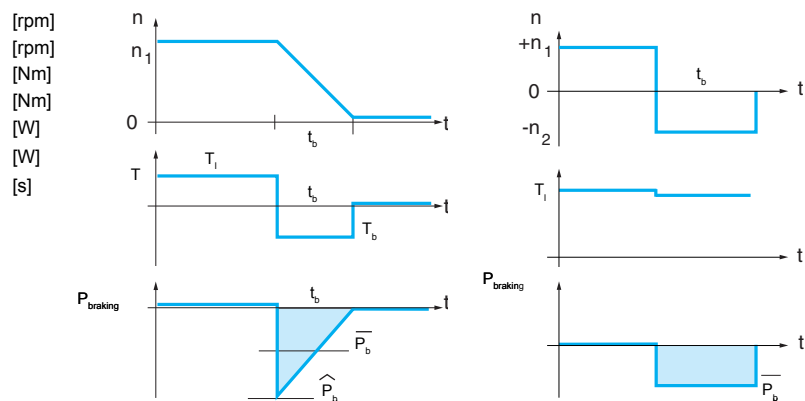
A The braking power during deceleration is characterized by a peak power \hat{P}_f obtained at the start of deceleration, which decreases to 0 in proportion with the speed.

Example: Stopping centrifuges, translational movement, change of direction, etc

B Braking power at constant speed n_2 .

Example: Vertical downward movement, motor/generator test bench, gravity conveyors, etc.

- n_1 Motor speed [rpm]
- n_2 Motor speed during deceleration [rpm]
- T_l Load torque [Nm]
- T_b Braking torque [Nm]
- \hat{P}_b Maximum braking power [W]
- \bar{P}_b Average braking power during time t_b [W]
- t_b Braking time [s]



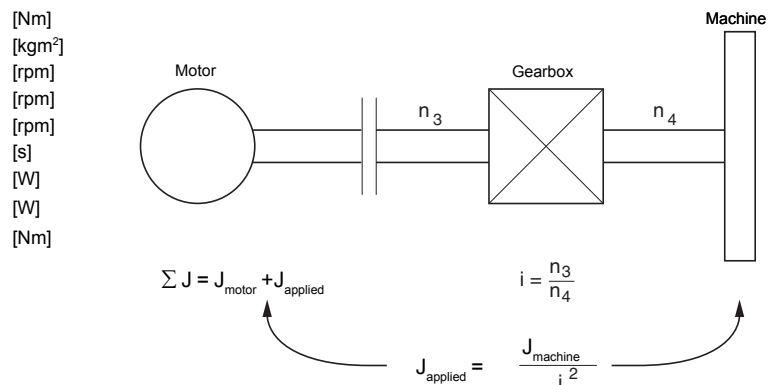
Note: These two types of operation can be combined.

Type A operation

Calculating the braking time from the inertia.

$t_b = \frac{J \cdot \omega}{T_b + T_r}$	$\omega = \frac{2\pi \cdot n}{60}$	$T_b = \frac{\Sigma J \cdot (n_3 - n_4)}{9.55 \cdot t_b}$	$\hat{P}_b = \frac{T_b \cdot n_3}{9.55}$
			$\bar{P}_b = \frac{\hat{P}_b}{2}$

- T_b Motor braking torque [Nm]
- ΣJ Total inertia applied to the motor [kgm²]
- n Motor speed [rpm]
- n_3 Motor speed ahead of gearbox [rpm]
- n_4 Motor speed after gearbox [rpm]
- t_b Braking time [s]
- \hat{P}_b Peak braking power [W]
- \bar{P}_b Average braking power during time t_b [W]
- T_r Resistive torque [Nm]



Variable speed drives for asynchronous motors

Altivar 71

Option: braking units and resistors

W	Kinetic energy	[Joule]
m	Weight	[kg]
v	Speed	[m/s]
t_b	Braking time	[s]
\hat{P}_b	Peak braking power	[W]
\bar{P}_b	Average braking power during time t_b	[W]
T_b	Braking torque	[Nm]
n	Motor speed	[rpm]
g	Acceleration	9.81 m/s ²
a	Deceleration	[m/s ²]
v	Linear downward speed	[m/s]
J	Moment of inertia	[kgms ²]
ω	Angular speed	[rad/s]
t_b	Downward stopping time	[s]

\hat{P}_{bR}	Maximum actual braking power	[W]
\bar{P}_{bR}	Continuous actual braking power	[W]
η_{total}	Total efficiency	
P_{load}	Braking power connected with the resistive or driving torque (not taken into account in the calculation). P_{load} can be positive or negative.	[W]
η_{drive}	Drive efficiency = 0.98	
η_{mec}	Mechanical efficiency	
η_{mot}	Motor efficiency	

U_{dc}	Braking unit engage threshold	[V]
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t_c	Cycle time	[s]
\bar{P}_{b0}	Upward braking power, therefore zero	[W]
t_0	Rise time	[s]
\bar{P}_{b1}	Average braking power during downward movement	[W]
t_1	Downward movement time	[s]
\hat{P}_b	Peak braking power	[W]
\bar{P}_{b2}	Average power during braking to a standstill	[W]
t_2	Standstill braking time	[s]
$P_{continuous}$	$= \frac{\bar{P}_{b0} \times t_0 + \bar{P}_{b1} \times t_1 + \bar{P}_{b2} \times t_2}{t_c}$	[W]

Type B operation

1 Braking power of a load moving horizontally with constant deceleration (e.g.: carriage)

$$W = \frac{m \cdot v^2}{2} \quad \bar{P}_b = \frac{W}{t_b} \quad \hat{P}_b = \bar{P}_b \cdot 2$$

2 Braking power for an active load (e.g.: test bench)

$$\bar{P}_b = \frac{T_b \cdot n}{9.95}$$

3 Braking power for a downward vertical movement

$$\bar{P}_b = m \cdot g \cdot v \quad \hat{P}_b = m \cdot (g + a) \cdot v + \frac{J \cdot \omega^2}{t_f} \quad \omega = \frac{2\pi \cdot n}{60}$$

All the braking power calculations are only true if it is assumed that there are no losses ($\eta = 1$) and that there is no resistive torque.

To be even more precise, the following must be considered:

- the losses and the resistive torque of the system, which reduce the necessary braking power
- the driving torque (the wind, for example) which increases the braking power

The required braking power is calculated as follows:

$$\hat{P}_{bR} = (\hat{P}_b - P_{load}) \times \eta_{total} \quad \bar{P}_{bR} = (\bar{P}_b - P_{load}) \times \eta_{total}$$

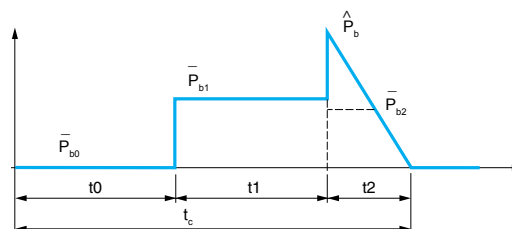
$$\eta_{total} = \eta_{mec} \times \eta_{mot} \times 0.98$$

For braking, the value of the braking resistor is selected to match the required power and the braking cycle.

In general:

$$\hat{P}_{bR} = \frac{U_{dc}^2}{R} \Rightarrow R = \frac{U_{dc}^2}{\hat{P}_{bR}}$$

Continuous power is obtained by taking the operating cycle into account.



The braking unit is selected taking the following into account:

- the continuous power \bar{P}_{r1}
- the average braking power during downward movement \bar{P}_{r2}
- the peak power \hat{P}_r .

Depending on these elements, select the braking unit according to the characteristics on page 60288/2.

The braking resistor is selected taking account of the same elements listed above, but with the addition of a check to ensure that the resistance value will allow the peak power to be exceeded ($R = \frac{U_{dc}^2}{\hat{P}_r}$)

Note: The resistance value must always be greater than or equal to the values given in the tables on pages 60288/4 and 60288/6.

Variable speed drives for asynchronous motors

Altivar 71

Characteristics curves for resistors

Example of using characteristics curves

VW3 A7 710 (P continuous = 25 kW) for 2.75 Ω at 20°C

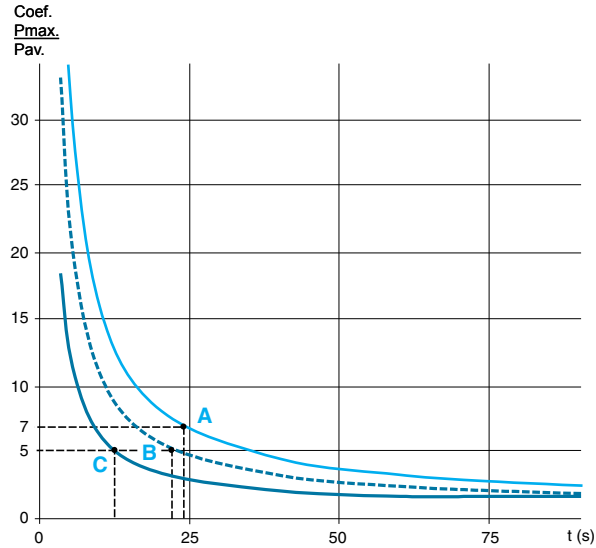
Example of using curves:

Point A For a 200 s cycle, the resistance of 2.75 Ω accepts an overload of 7 x 25 kW (continuous power) for 24 s, i.e. braking 175 kW every 200 s.

Point B For a 120 s cycle, the resistance of 2.75 Ω accepts an overload of 5 x 25 kW (continuous power) for 20 s, i.e. braking 125 kW every 120 s.

Point C For a 60 s cycle, the resistance of 2.75 Ω accepts an overload of 5 x 25 kW (continuous power) for 10 s, i.e. braking 125 kW every 60 s.

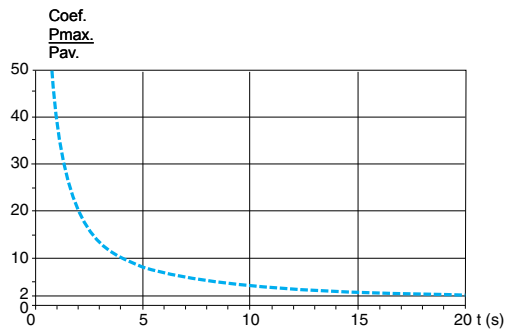
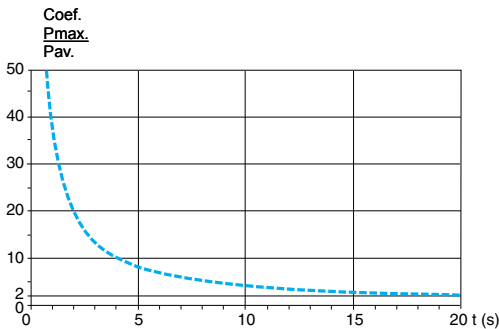
- P max./P av. (60 s cycle)
- - - P max./P av. (120 s cycle)
- P max./P av. (200 s cycle)



Braking resistors

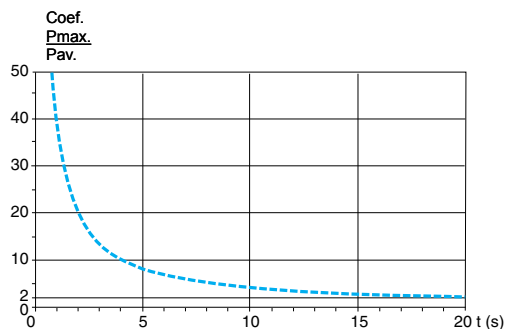
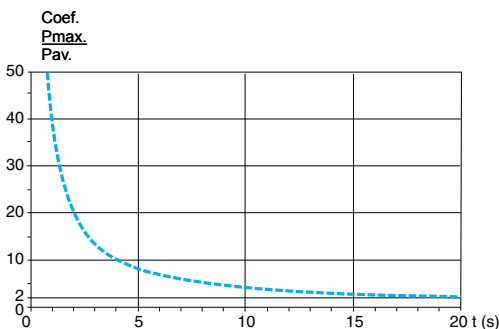
VW3 A7 701 (P continuous = 0.05 kW)

VW3 A7 702 (P continuous = 0.1 kW)



VW3 A7 703 (P continuous = 0.2 kW)

VW3 A7 704...709 (P continuous = 1 kW)



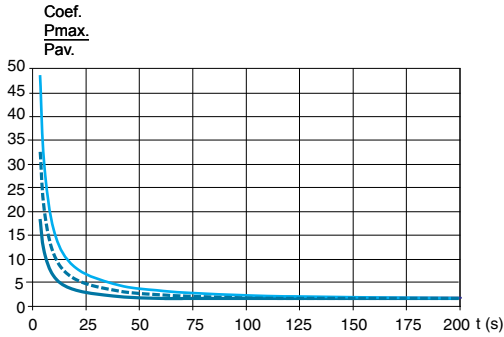
Variable speed drives for asynchronous motors

Altivar 71

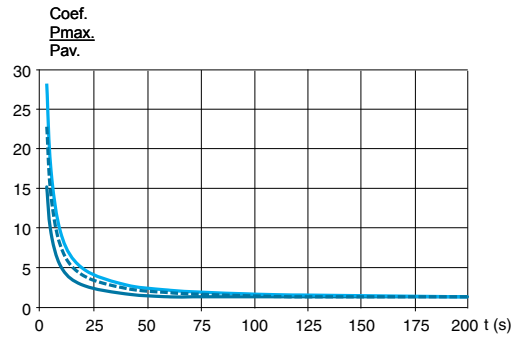
Characteristics curves for resistors

Braking resistors (continued)

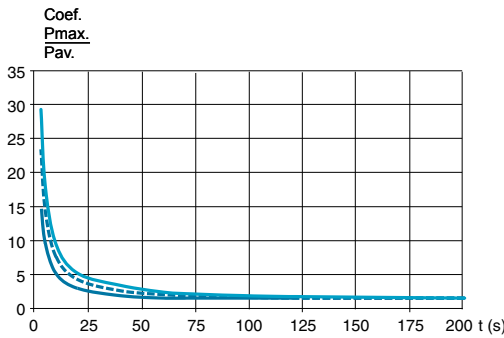
VW3 A7 710 (P continuous = 25 kW)



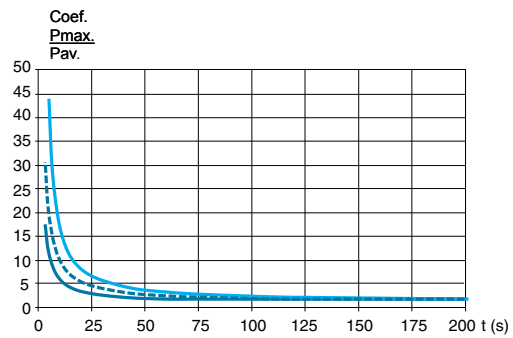
VW3 A7 711 (P continuous = 37 kW)



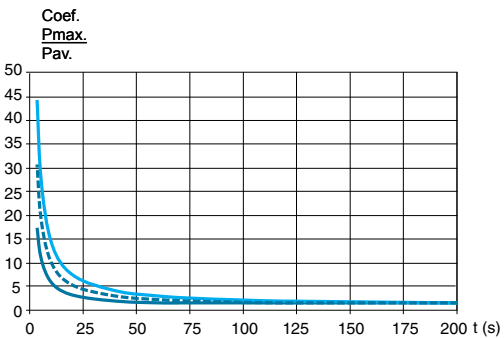
VW3 A7 712 (P continuous = 44 kW)



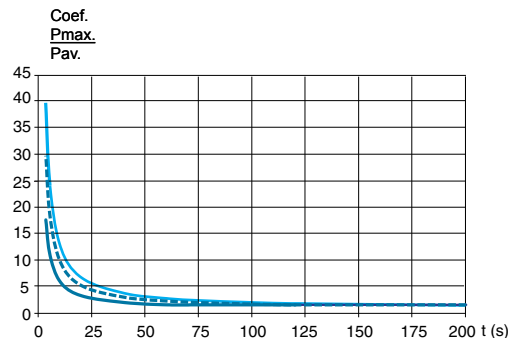
VW3 A7 713 (P continuous = 15.3 kW)



VW3 A7 714 (P continuous = 20.9 kW)



VW3 A7 715 (P continuous = 56 kW)



— P max./P av. (60 s cycle)
 - - - P max./P av. (120 s cycle)
 . . . P max./P av. (200 s cycle)

Variable speed drives for asynchronous motors

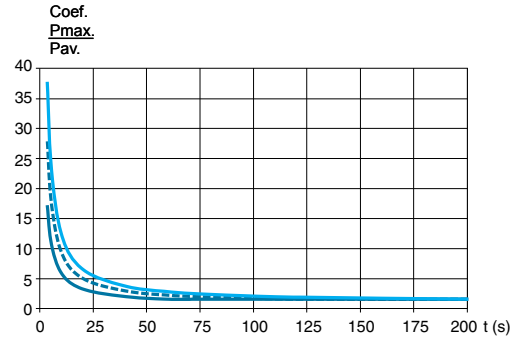
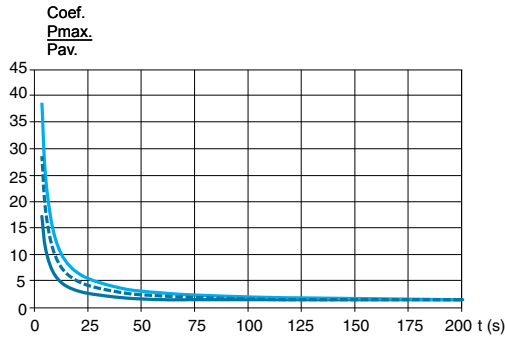
Altivar 71

Characteristics curves for resistors

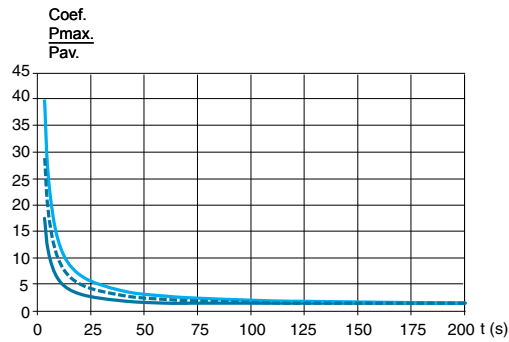
Braking resistors (continued)

VW3 A7 716 (P continuous = 75 kW)

VW3 A7 717 (P continuous = 112 kW)



VW3 A7 718 (P continuous = 150 kW)



- P max./P av. (60 s cycle)
- - - P max./P av. (120 s cycle)
- P max./P av. (200 s cycle)

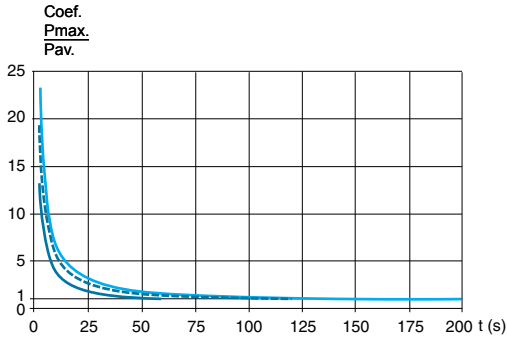
Variable speed drives for asynchronous motors

Altivar 71

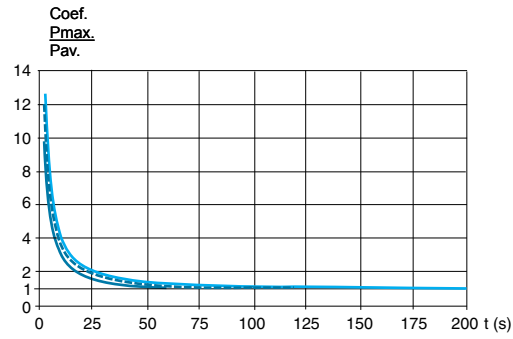
Characteristics curves for resistors

Hoist resistors

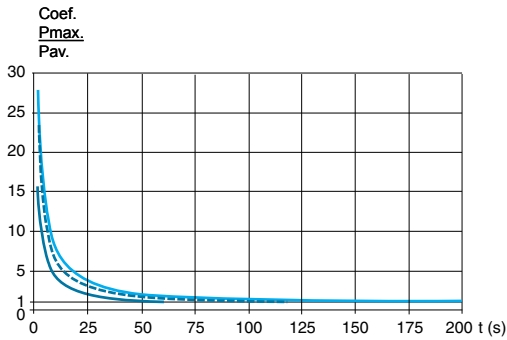
VW3 A7 801 (P continuous = 1.6 kW)



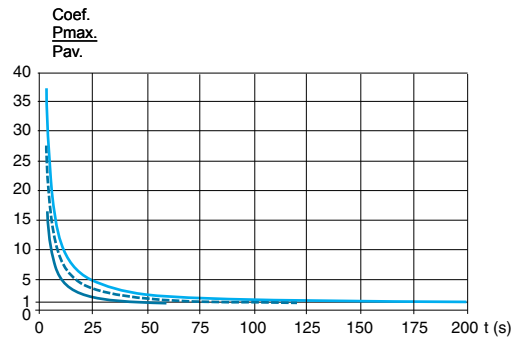
VW3 A7 802 (P continuous = 5.6 kW)



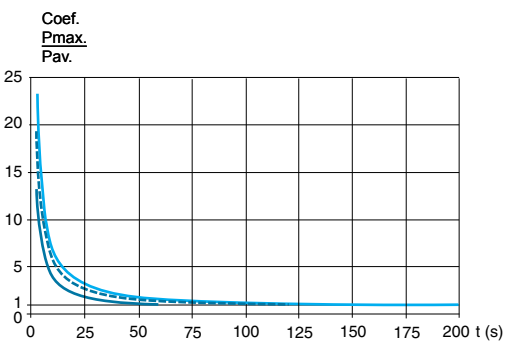
VW3 A7 803 (P continuous = 9.8 kW)



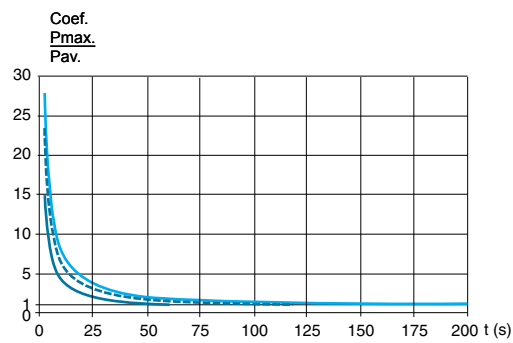
VW3 A7 804 (P continuous = 22.4 kW)



VW3 A7 805 (P continuous = 44 kW)



VW3 A7 806 (P continuous = 62 kW)



— P max./P av. (60 s cycle)
 - - - P max./P av. (120 s cycle)
 . . . P max./P av. (200 s cycle)

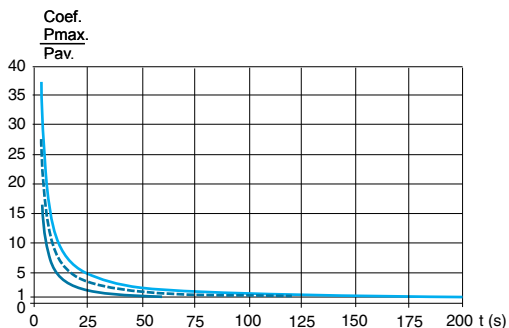
Variable speed drives for asynchronous motors

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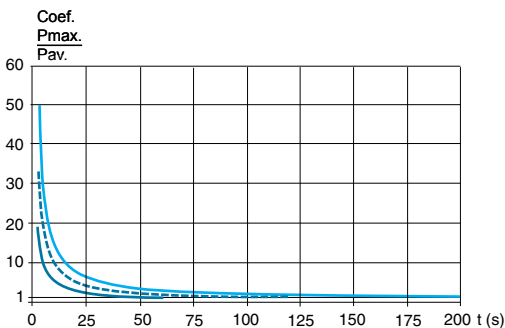
Characteristics curves for resistors

Hoist resistors (continued)

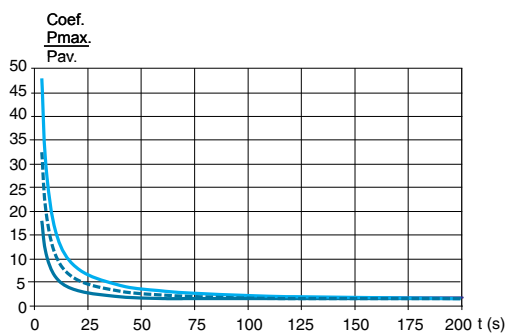
VW3 A7 807 (P continuous = 19.5 kW)



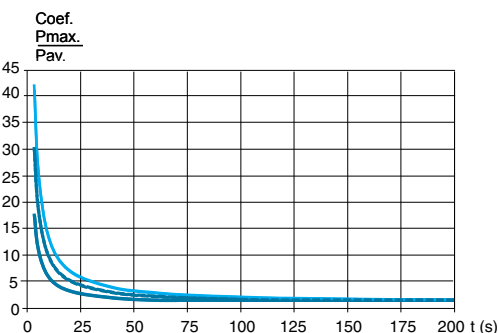
VW3 A7 808 (P continuous = 27.4 kW)



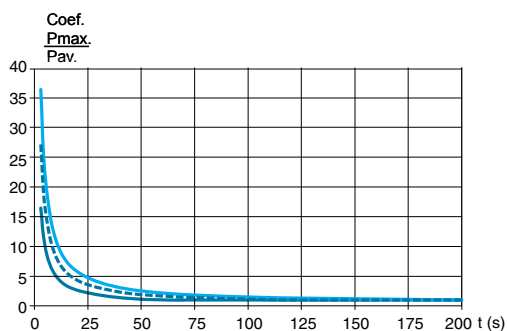
VW3 A7 809 (P continuous = 30.6 kW)



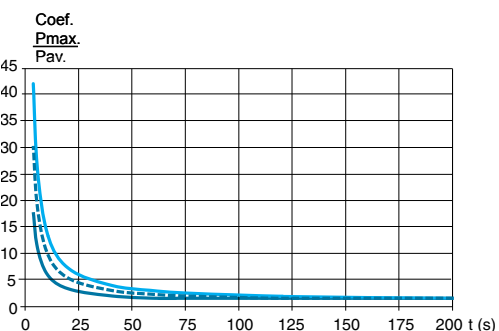
VW3 A7 810 (P continuous = 44 kW)



VW3 A7 811 (P continuous = 56 kW)



VW3 A7 812 (P continuous = 75 kW)



- P max./P av. (60 s cycle)
- - - P max./P av. (120 s cycle)
- ... P max./P av. (200 s cycle)

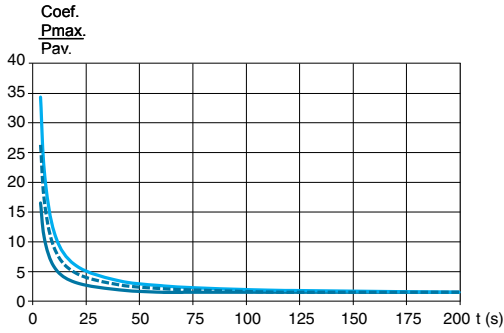
Variable speed drives for asynchronous motors

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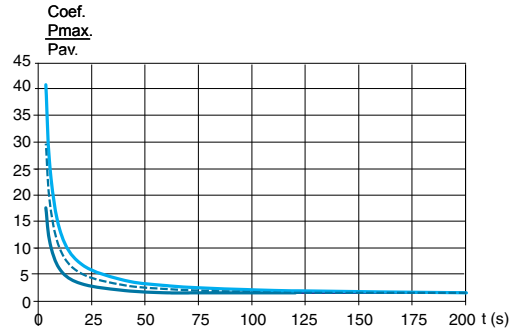
Characteristics curves for resistors

Hoist resistors (continued)

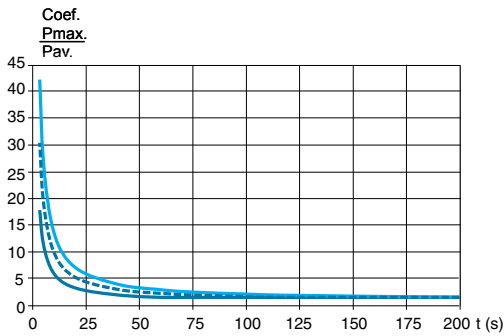
VW3 A7 813 (P continuous = 112 kW)



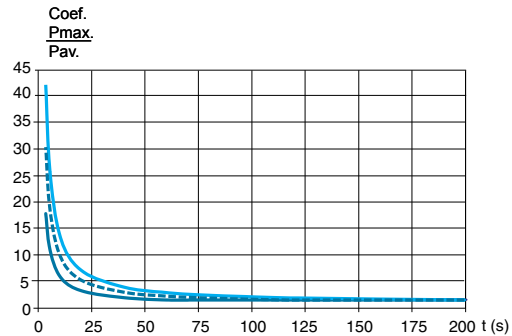
VW3 A7 814 (P continuous = 112 kW)



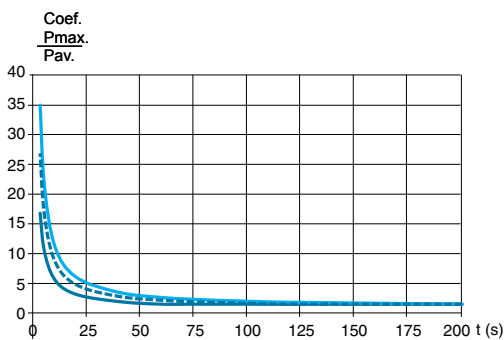
VW3 A7 815 (P continuous = 150 kW)



VW3 A7 816 (P continuous = 225 kW)



VW3 A7 817 (P continuous = 330 kW)



- P max./P av. (60 s cycle)
- - - P max./P av. (120 s cycle)
- P max./P av. (200 s cycle)