vacon

DRIVEN BY DRIVES

USER'S MANUAL

NX FREQUENCY CONVERTERS

BRAKE RESISTORS

INDEX

1. GENERAL

1.1 Requirement for braking

When you want to slow down a running asynchronous motor fed by a frequency converter it turns into a generator, feeding energy back into the frequency converter. The energy increases the voltage in the DC-link. The frequency converter compensates for this increase by increasing the output frequency, decreasing the instantaneous slip and increasing the motor load.
The deceleration is, in this case, dependent on the power losses in the converter and in the motor. This is usually sufficient in most cases, for pumps, fans, conveyors etc. where the kinetic energy in the load is small or the braking time is not critical.
When you have to brake the motor faster than the losses allow, you have to use an external brake resistor for energy dissipation together with an internal, factory-mounted brake chopper. The extra energy from the load is turned into heat in the brake resistor.
Applications where dynamic braking is usually needed include centrifuges, cranes, some conveyors and drives requiring very fast reversing.

1.2 Brake components

The brake chopper is an extra IGBT mounted into the NX frequency converters at the time of manufacturing. Smaller drives (FR4 to FR6 and MF4 to MF6) contain it as standard. If the DC link voltage increases too much, the brake IGBT turns on and discharges the capacitors through the brake resistor. The brake chopper in the NX frequency converter ranges is rated for continuous drive rated power.
The brake resistor is an external, low impedance resistor. In order to achieve the correct power handling capacity for a specific application, resistors can be connected in series and parallel, keeping within the limits in Table 7.

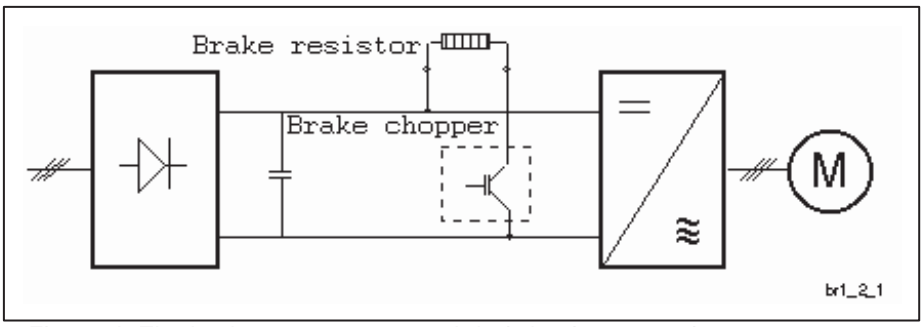


Figure 1. The brake components and their basic connection

1.3 Classes of use

a) Partial use (most typical){tc "a) Partial use (most common)"}
The process requires regular or irregular rapid decelerations, stops or reversings.
b) Continuous use{tc "b) Continuous use"}
The motor continuously brakes with constant torque.
c) Combination use{tc "c) Combination use"}
The motor continuously brakes with variable torque.
d) DC-link voltage smoothing{tc "d) DC-link voltage smoothing"}
The brake resistor smooths overvoltage spikes from the supply.

2. TECHNICAL DATA

2.1 Standard resistors for partial use

Brake resistors for partial use for the NX ranges for 208...240V, 380...500V and 525...690V supply voltages can be chosen from the tables below.
For the NX_5 range we have predefined two ranges of brake resistors, one for heavy duty and one for light duty. The heavy duty resistor is sized for a 3-second full power braking with a 7-second ramp to zero. The light duty resistor is rated for a 5-second ramp from full power to zero. See Figure 2.

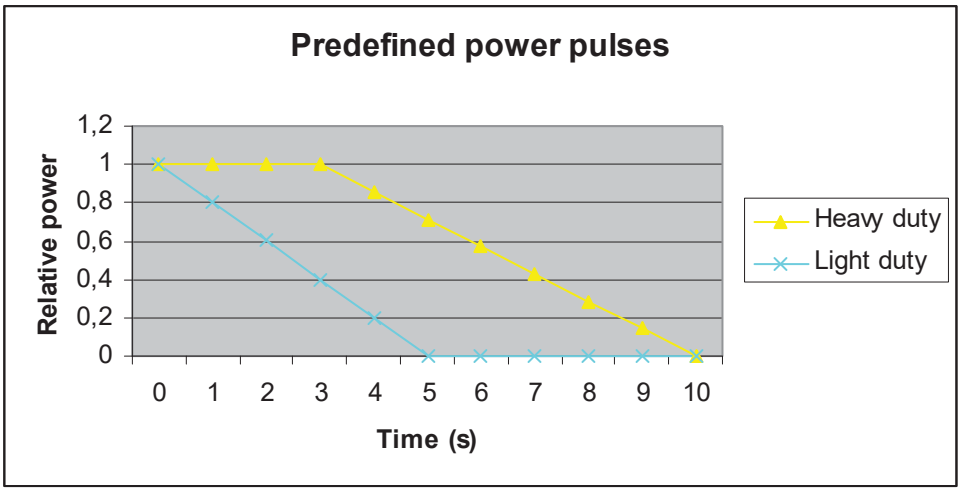


Figure 2. Heavy and light duty braking definitions.

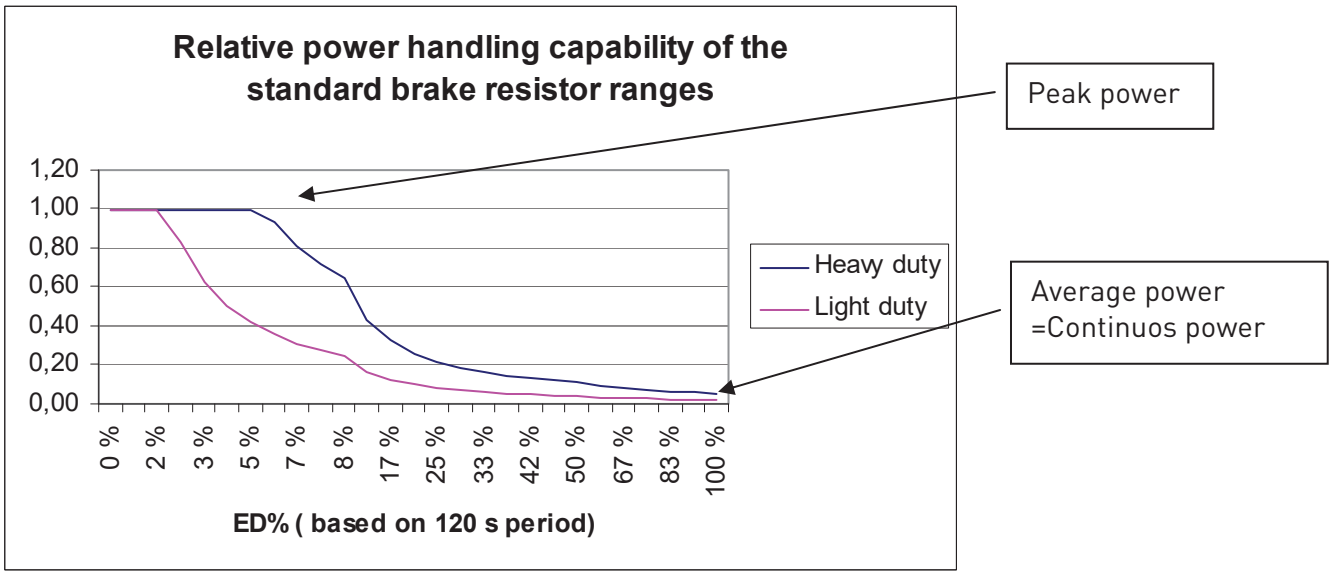


Figure 3. Peak and average power definitions.

2.1.1 380...500V range

Light duty			
		Energy [kJ]	Average power [kW]
Type code	*Resistance*	*5 sec full torque braking*	*1 pulse/2 min*
BRR 0022 LD 5	63	28	0.24
BRR 0031 LD 5	42	42	0.35
BRR 0045 LD 5	21	84	0.71
BRR 0061 LD 5	14	127	1.06
BRR 0105 LD 5	6,5	273	2.28
BRR 0300 LD 5	3.3	547	4.56
BRR 0520 LD 5	1,4	1270	10,6
BRR 0730 LD 5	0,9	1975	16,5
Heavy duty			
		Energy [kJ]	Average power [kW]
Type code	*Resistance*	*3 sec full torque decreasing to zero in 7 sec*	*1 pulse / 2min*
BRR 0022 HD 5	63	73	0.61
BRR 0031 HD 5	42	110	0,91
BRR 0045 HD 5	21	220	1.83
BRR 0061 HD 5	14	330	2,74
BRR 0105 HD 5	6,5	710	5,9
BRR 0300 HD 5	3.3	1421	11,8
BRR 0520 HD 5	1,4	3300	27,4
BRR 0730 HD 5	0,9	5132	43

Table 1. Brake resistors for the voltage range 380...500V

Choose the resistor for all types of frequency converters (NXL, NXS and NXP) according to the table below:

Unit	Frame	Light duty resistor	Heavy duty resistor
NX_ 0003 5 NX_ 0004 5 NX_ 0005 5 NX_ 0007 5 NX_ 0009 5 NX_ 0012 5	FR4	BRR 0022 LD 5	BRR 0022 HD 5
NX_ 0016 5 NX_ 0022 5	FR5	BRR 0022 LD 5	BRR 0022 HD 5
NX_ 0031 5	FR5	BRR 0031 LD 5	BRR 0031 HD 5
NX_ 0038 5 NX_ 0045 5	FR6	BRR 0045 LD 5	BRR 0045 HD 5
NX_ 0061 5	FR6	BRR 0061 LD 5	BRR 0061 HD 5
NX_ 0072 5 NX_ 0087 5	FR7	BRR 0105 LD 5	BRR 0105 HD 5
NX_ 0105 5	FR7	BRR 0105 LD 5	BRR 0105 HD 5

NX_ 0140 5 NX_ 0168 5	FR8	BRR 0300 LD 5	BRR 0300 HD 5
NX_ 0205 5	FR8	BRR 0300 LD 5	BRR 0300 HD 5
NX_ 0261 5 NX_ 0300 5	FR9	BRR 0300 LD 5	BRR 0300 HD 5
NX_0385 5 NX_0460 5 NX_0520 5	FR10	BRR 0520 LD 5	BRR 0520 HD 5
NX_0590 5 NX_0650 5 NX_0730 5	FR11	BRR 0730 LD 5	BRR 0730 HD 5
NX_0820 5 NX_0920 5 NX_1030 5	FR12	2 x BRR 0520 LD 5	2 x BRR 0520 HD 5

Table 2. Brake resistors used with drives

Light duty resistor:IP50 with direct wire connection, BRR0022 LD5 has a thermal protection as option.
Heavy duty resistor:IP20/21, connecting box, thermal protection as standard.

2.1.2 208...240V range

Light duty			
		Energy [kJ]	Average power [kW]
Type code	*Resistance*	*5 sec full torque braking*	*1 pulse/2 min*
BRR 0025 LD2	30	12,55	0,10
BRR 0031 LD2	20	18,8	0,16
BRR 0061 LD2	10	38	0,31
BRR 0114 LD2	3,3	114	0,95
BRR 0205 LD2	1,4	269	2,24
Heavy duty			
		Energy [kJ]	Average power [kW]
Type code	*Resistance*	*3 sec full torque decreasing to zero in 7 sec*	*1 pulse / 2min*
BRR 0025 HD2	30	32,6	0,27
BRR 0031 HD2	20	49	0,41
BRR 0061 HD2	10	98	0,81
BRR 0114 HD2	3,3	297	2,47
BRR 0205 HD2	1,4	699	5,81

Table 3. Brake resistors for the voltage range 208...240V

Choose the resistor for the frequency converter (voltage range 208...240V) according to the table below:

Unit	Frame	Light duty resistor	Heavy duty resistor
NX_ 0003 2 NX_ 0004 2 NX_ 0007 2 NX_ 0008 2 NX_ 0011 2 NX_ 0012 2	FR4	BRR 0025 LD 2	BRR 0025 HD 2
NX_ 0017 2 NX_ 0025 2	FR5	BRR 0025 LD 2	BRR 0025 HD 2
NX_ 0031 2	FR5	BRR 0031 LD 2	BRR 0031 HD 2
NX_ 0048 2 NX_ 0061 2	FR6	BRR 0061 LD 2	BRR 0061 HD 2
NX_ 0075 2 NX_ 0088 2 NX_ 0114 2	FR7	BRR 0114 LD 2	BRR 0114 HD 2
NX_0140 2 NX_0170 2 NX_0205 2	FR8	BRR 0205 LD2	BRR 0205 HD2
NX_0261 2 NX_0300 2	FR9	BRR 0205 LD2	BRR 0205 HD2

Table 4. Brake resistors used with drives

Light duty resistor:IP50 with direct wire connection,
Heavy duty resistor:IP20/21, connecting box, thermal protection as standard.

2.1.3 525...690V range

Light duty			
		Energy [kJ]	Average power [kW]
Type code	*Resistance*	*5 sec full torque braking*	*1 pulse/2 min*
BRR 0013 LD 6	100	34	0,28
BRR 0034 LD 6	30	113	0,94
BRR 0052 LD 6	18	188	1,6
BRR 0100 LD 6	9	376	3,1
BRR 0208 LD 6	7	484	4,0
BRR 0416 LD 6	2,5	1355	11
BRR 0590 LD 6	1,7	1993	17
Heavy duty			
		Energy [kJ]	Average power [kW]
Type code	*Resistance*	*3 sec full torque decreasing to zero in 7 sec*	*1 pulse / 2min*
BRR 0013 HD 6	100	88	0,73
BRR 0034 HD 6	30	294	2,4
BRR 0052 HD 6	18	489	4,1
BRR 0100 HD 6	9	978	8,1
BRR 0208 HD 6	7	1258	10
BRR 0416 HD 6	2,5	3523	29
BRR 0590 HD 6	1,7	5181	43

Table 5. Brake resistors for the voltage range 525...690V

Choose the resistor for the frequency converter (voltage range 208...240V) according to the table below:

Unit	Frame	Light duty resistor	Heavy duty resistor
NX_ 0003 6 NX_ 0004 6 NX_ 0005 6 NX_ 0007 6 NX_ 0010 6 NX_ 0013 6	FR6	BRR 0013 LD 6	BRR 0013 HD 6
NX_ 0018 6 NX_ 0022 6 NX_ 0027 6 NX_ 0034 6	FR6	BRR 0034 LD 6	BRR 0034 HD 6
NX_ 0041 6 NX_ 0052 6	FR7	BRR 0052 LD 6	BRR 0052 HD 6
NX_ 0062 6 NX_ 0080 6 NX_ 0100 6	FR8	BRR 0100 LD 6	BRR 0100 HD 6
NX_ 0144 6	FR9	BRR 0208 LD 6	BRR 0208 HD 6

NX_ 0170 6 NX_ 0208 6			
NX_0261 6 NX_0325 6 NX_0385 6 NX_0416 6	FR10	BRR 0416 LD 6	BRR 0416 HD 6
NX_0460 6 NX_0502 6 NX_0590 6	FR11	BRR 0590 LD 6	BRR 0590 HD 6
NX_0650 6 NX_0750 6 NX_0820 6	FR12	BRR 0416 LD 6	BRR 0416 HD 6

Table 6. Brake resistors used with drives

Light duty resistor:IP50 with direct wire connection.
Heavy duty resistor:IP20/21, connecting box, thermal protection as standard.

2.2 Other resistors

Should other types of resistors be used, make sure that the resistance is higher than the minimum resistance defined. The power handling capacity must be sufficient for the application.
The minimum resistances calculated at the trip level (NX_5: 911VDC, NX_2: 437VDC and NX_6: 1200VDC) can be found in the following tables.

380...500V range			208...240V range		
Frame	Brake chopper I_{nom} @80°C	R_{min} [ ]	Frame	Brake chopper I_{nom} @80°C	R_{min} [ ]
NX_0003 5... NX_0022 5	12	63	NX_0003 2... NX_0025 2	15	30
NX_0031 5	17	42	NX_0031 2	23	20
NX_0038 5... NX_0045 5	35	21	NX_0048 2... NX_0061 2	46	10
NX_0061 5	65	14	NX_0075 2... NX_0114 2	148	3,3
NX_0072 5... NX_0105 5	111	6.5	NX_0140 2... NX_0300 2	296	1,4
NX_0140 5... NX_0300 5	222	3.3			
NX_0385 5... NX_0520 5	570	1.4			
NX_0590 5... NX_0730 5	855	0,9			
NX_0820 5 NX_1030 5	2 x 570	2 x 1,4			

575...690V range		
Frame	Brake chopper I_{nom} @80°C	R_{min} [ ]
NX_0004 6... NX_0013 6	11	100
NX_0018 6... NX_0034 6	37	30
NX_0041 6... NX_0052 6	61	18
NX_0061 6... NX_0100 6	122	9
NX_0125 6... NX_0208 6	157	7
NX_0261 6... NX_0416 6	440	2,5
NX_0460 6... NX_0590 6	647	1.7
NX_0650 6... NX_0820 6	2x 440	2 x2.5

Table 7. Specification for other types of resistors

2.3 Power rating of standard resistors

The power handling capacity of the standard resistors as a function of the duty cycle is shown in Figure 4. The figure shows the relative power handling capacity at various duty cycles, i.e. compared to continuous 120 s braking.

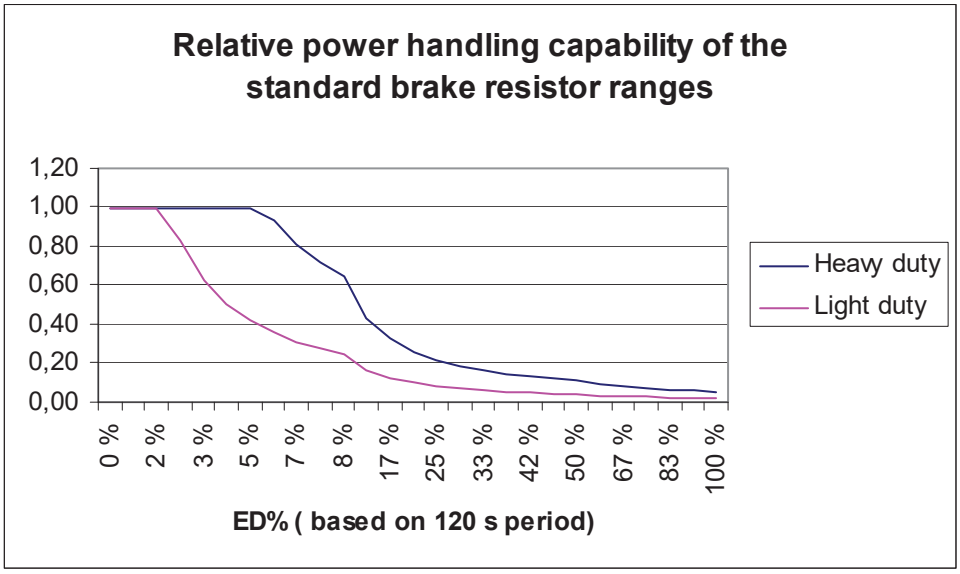


Figure 4. Relative power rating of standard resistors

	Power at different duty cycles based on a 120 sec cycle					
	100% ED	60% ED	40 % ED	25 % ED	10 % ED	5 % ED
	kW					
BRR 0025 LD 2	0,10	0,17	0,26	0,42	1,0	2,1
BRR 0031 LD 2	0,16	0,26	0,39	0,63	1,6	3,1
BRR 0061 LD 2	0,31	0,52	0,78	1,3	3,1	6,3
BRR 0114 LD 2	0,95	1,6	2,4	3,8	9,5	19,0
BRR 0205 LD 2	2,2	3,7	5,6	9,0	22	45
BRR 0022 LD 5	0,24	0,39	0,59	0,94	2,4	4,7
BRR 0031 LD 5	0,35	0,59	0,88	1,41	3,5	7,1
BRR 0045 LD 5	0,71	1,2	1,8	2,8	7,1	14,1
BRR 0061 LD 5	1,1	1,8	2,6	4,2	10,6	21
BRR 0105 LD 5	2,3	3,8	5,7	9,1	23	46
BRR 0300 LD 5	4,6	7,6	11,4	18,2	46	91
BRR 0520 LD 5	11	17,6	26	42	106	212
BRR 0730 LD 5	16	27	41	66	165	329
BRR 0013 LD 6	0,28	0,47	0,71	1,13	2,8	5,6
BRR 0034 LD 6	0,94	1,6	2,4	3,8	9,4	18,8
BRR 0052 LD 6	1,6	2,6	3,9	6,3	15,7	31
BRR 0100 LD 6	3,1	5,2	7,8	12,5	31	63
BRR 0208 LD 6	4,0	6,7	10,1	16,1	40	81
BRR 0416 LD 6	11	19	28	45	113	226
BRR 0590 LD 6	17	28	42	66	166	332
BRR 0025 HD 2	0,27	0,45	0,68	1,1	2,7	5,4
BRR 0031 HD 2	0,41	0,68	1,0	1,6	4,1	8,1
BRR 0061 HD 2	0,81	1,4	2,0	3,3	8,1	16,3
BRR 0114 HD 2	2,5	4,1	6,2	9,9	25	49

BRR 0205 HD 2	5,8	9,7	14,5	23	58	116
BRR 0022 HD 5	0,61	1,02	1,52	2,44	6,1	12,2
BRR 0031 HD 5	0,91	1,5	2,3	3,7	9,1	18,3
BRR 0045 HD 5	1,8	3,0	4,6	7,3	18,3	37
BRR 0061 HD 5	2,7	4,6	6,9	11,0	27	55
BRR 0105 HD 5	5,9	9,8	14,8	24	59	118
BRR 0300 HD 5	11,8	19,7	30	47	118	236
BRR 0520 HD 5	27	46	69	110	274	549
BRR 0730 HD 5	43	71	107	171	427	854
BRR 0013 HD 6	0,73	1,2	1,8	2,9	7,3	14,6
BRR 0034 HD 6	2,4	4,1	6,1	9,8	24	49
BRR 0052 HD 6	4,1	6,8	10,2	16,3	41	81
BRR 0100 HD 6	8,1	13,6	20	33	81	163
BRR 0208 HD 6	10	17,4	26	42	105	209
BRR 0416 HD 6	29	49	73	117	293	586
BRR 0590 HD 6	43	72	108	172	431	862

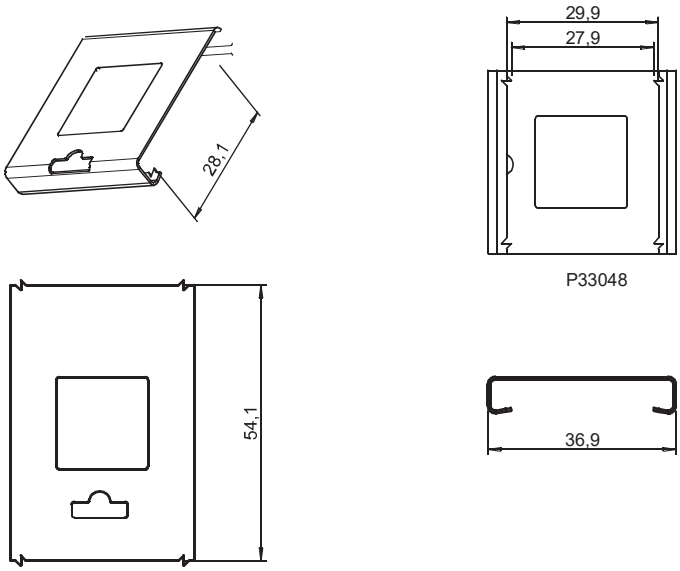
2.4 Environment

Surface temperature of the resistor box	<80°C
Maximum ambient temperature	30°C
Protection class	IP20, IP21, IP50

NOTE: On mounting the resistor package, note the high surface temperature (up to 200 °C). The mounting surface must be non-flammable and there must be sufficient free space around the resistor (100 mm).

The resistors are designed for natural convection cooling in a free space; ensure sufficient ventilation of the area.

2.5 Thermal protection for the LD resistors



Holder for thermal protection

3. CHOICE OF BRAKE RESISTOR

3.1 General

When you choose the brake resistor for your drive, start from the requirements of the process/drive. The choice of brake resistor is influenced by

a) *the average braking power during one cycle*; this defines the power dissipation required of the brake resistor

b) *the maximum power dissipation*; this defines the instantaneous power handling capacity of the brake resistor and

c) *the maximum current of the brake IGBT*; this defines the minimum resistance for the brake resistor.

Vacon Technical Support will assist you in all matters concerning braking.

3.2 Sizing principles

All rotating parts contain kinetic energy. When the load is braked, the energy difference between the higher speed and the lower speed must be dissipated somewhere. Some of the energy is used in the losses of the motor and the frequency converter, but the majority must be dissipated in the brake resistor.
The energy of a load at speed *n* is given by the formula:

$$E = \frac{1}{2} J\omega^2$$

where
J is the moment of inertia of the load (in kgm^2) and
ω is the rotating speed of the load (in radians/s)

In engineering units

$$E = \frac{1}{182{,}3} Jn^2$$

where *n* is the rotating speed (in 1/min)

The difference between the energy at two speeds is thus

$$\Delta E = E_1 - E_2 = \frac{1}{182{,}3} J(n_1^2 - n_2^2) = \frac{1}{2} J(\omega_1^2 - \omega_2^2)$$

The average power required is

$$P = \frac{\Delta E}{t}$$

where *t* is the braking time.

If the load has a cycle with a total cycle time t_c, the average power of the cycle is

$$P = \frac{\Delta E}{t_c}$$

The chosen resistor must be able to handle this power. If the braking time is longer than 1 minute, the resistor must be sized for the continuous braking power.

3.2.1 Calculating braking time

The time required to accelerate or brake a load can be calculated as follows:

The basic equation is:

$$T = J\frac{d\omega}{dt}$$

where T is the required torque.

The time required to change the speed of a load is

$$\Delta t = J\frac{\omega_1 - \omega_2}{T}$$

or the torque required to change the speed in time t is

$$T = J\frac{\omega_1 - \omega_2}{t}$$

The available torque consists of the torque generated by the motor T_{motor} and the braking torque generated by the load and friction in it T_{load}.

$$T_{total} = T_{motor} + T_{load}$$

In many cases the frictional torque is sufficient to brake the load, it might even be too high, so the motor must drive the load even if the speed is slowing down.

This torque required from the motor should be compared to the rated torque of the motor:

$$T = 9550\frac{P}{n}$$

If the rated torque is higher, the motor can perform the required acceleration/deceleration.

3.2.2 Calculating the moment of inertia

The moment of inertia as 'seen' by the motor consists of the motor inertia plus the load inertia, changed by the gear ratio as follows:

$$J_{tot} = J_{motor} + g^2 J_{load}$$

where g is the gear ratio, J_{motor} is the motor inertia and J_{load} is the load inertia. The ratio g is > 1 if the load speed is higher than the motor speed and < 1 if the load speed is lower than the motor speed.

In many cases the moment of inertia of the motor is very small compared to the moment of inertia of the load. Only in cases where the load turns very slowly (i.e. the gear ratio is low) the motor inertia is significant.

The moment of inertia of typical shapes is shown in Figure 5

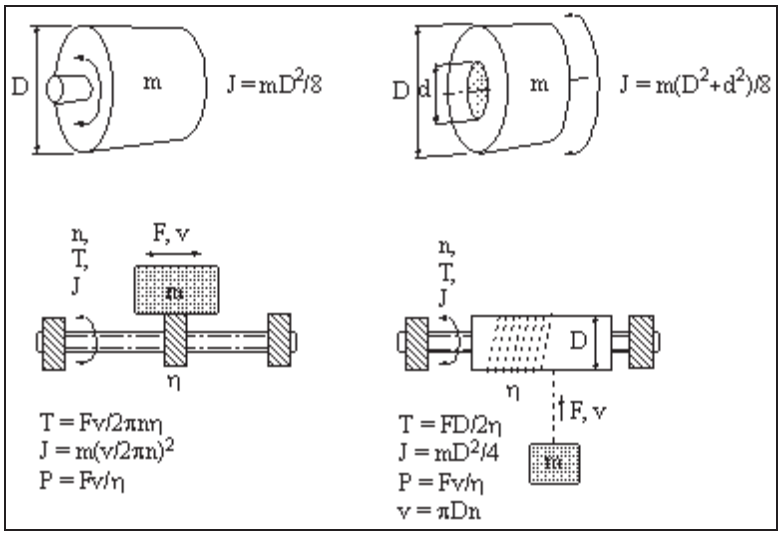


Figure 5.

The moment of inertia of a specific machine is often specified on the rating plate. Otherwise the manufacturer is responsible to give this information.

Sizing procedure:

1. Maximum speed	n_1		rpm
2 Minimum speed	n_2		rpm
3 Moment of inertia = $J_{tot} = J_{motor} + g^2 J_{load}$ g = gear ratio	J		kgm^2
4 Energy to be dissipated	$\Delta E = E_1 - E_2 = \dfrac{\frac{1}{182{,}3} J(n_1^2 - n_2^2)}{1000}$		kJ
5 Braking time	t		s
6 Braking power	$P = \dfrac{\Delta E}{t}$		kW
7 Determine duty cycle for braking t_1 = duration of cycle – assumption 120 s.	$f = \dfrac{t}{t_1}$		

8 Determine average power for the resistor	$P_{ave} = fP$		kW
9 Calculate the relative power required. P_{res} = peak power of chosen resistor	$P_{rel} = \frac{P_{ave}}{P_{res}}$		%
10 Verify that the pair of values in 7 and 9 are within limits for the chosen resistor – see Figure 5			
7 Calculate the braking torque required	$T = J \times 0{,}105 \times \frac{n_1 - n_2}{t}$		Nm
8 Verify motor rated torque > required torque P_M in kW n_M in rpm	$T_M = 9550 \times \frac{P_M}{n_M}$		Nm

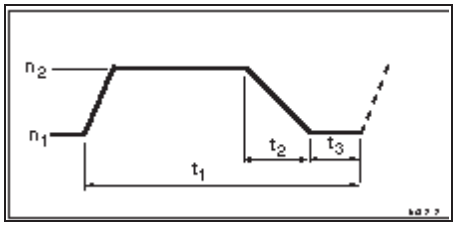


Figure 6. Speed profile of one drive cycle.

t_1 = length of cycle
t_2 = deceleration time
t_3 = stop time
n_1 = minimum speed of motor
n_2 = maximum speed of motor

The relative power handling capability of the standard resistor ranges is shown in the figure below:

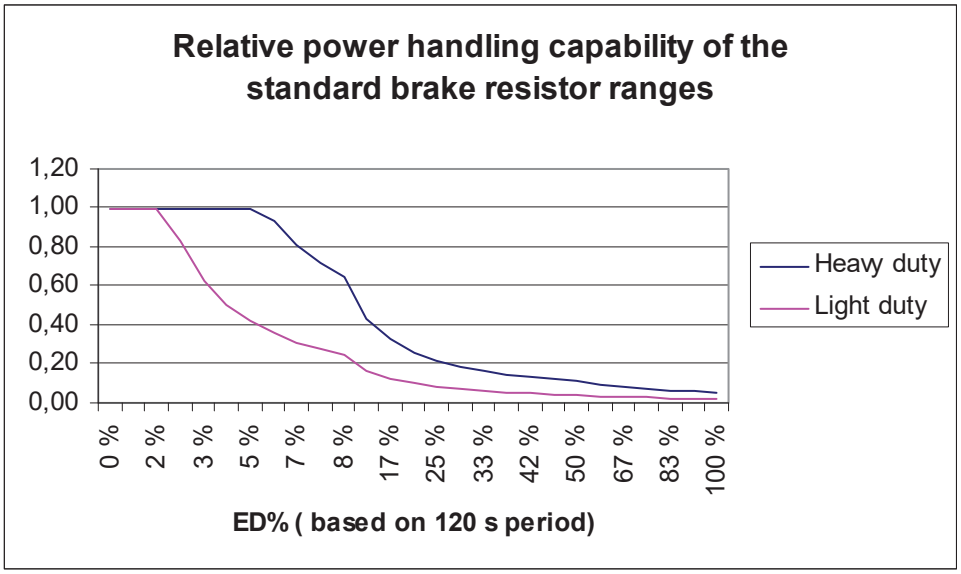


Figure 7.

3

Verify the following:
a) The chosen resistor type can handle the required power (NOTE: As the brake IGBT current is limited by the device, a resistance with a smaller impedance than the minimum specified for the drive cannot be used).

b) If this is not the case, the resistor has to be sized specifically for the application. In many cases a suitable combination of series and parallel connection of standard resistances may be the solution, in others a special resistor must be defined and manufactured.

3.2.3 Internal resistors

Frame sizes FR4, FR5 and FR6 (380...500V) drives can be equipped with an internal brake resistor as a factory option. The resistors are designed for a 2s full torque braking from nominal motor speed to zero or a 1 second full power braking every minute.

Type code	Resistance [ ]	Energy 2s full torque braking [kJ]	Average power 1 pulse/min [W]
NX_5 FR4	120	4	45
NX_5 FR5	55	8.9	100
NX_5 FR6	30	16	175

Table 8.

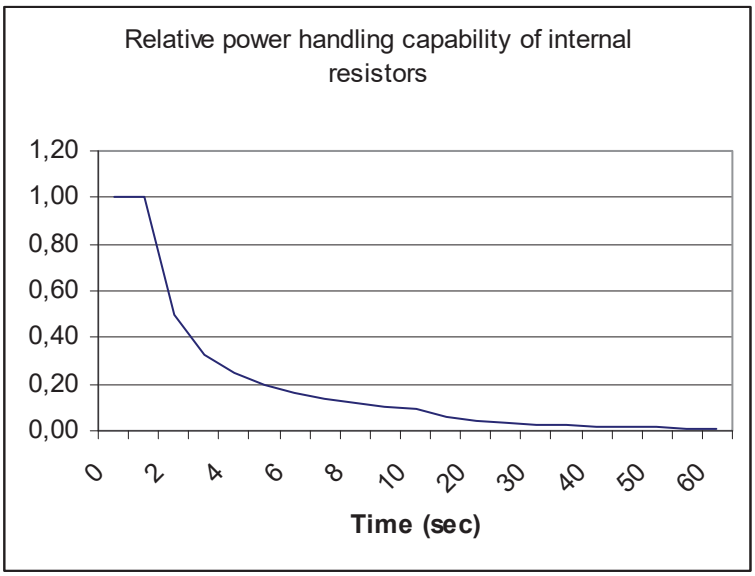


Figure 8.

4. CONNECTIONS

4.1 General

Make sure that your frequency converter is equipped with a brake chopper. This is a factory installed option!
The brake resistor is connected to the DC+ and R– connectors on the frequency converter.
The minimum cable sizes are shown in Table 1 and Table 2. When you size the cables, note that the input fuses f the converter also protect this cable.

Avoid running the brake resistor cable too near other cables. The recommended minimum distance to e.g. the control cables is 0.5 meters.

Note: Disconnect the frequency converter from the mains when connecting the brake resistor. Wait a further 5 minutes before opening the frequency converter cover. Perform measurements to ensure that no voltage is present on the DC and R- connectors.

Read Chapter 1, SAFETY, in Vacon NX User's Manual.

Cable sizing

Resistor	Cable and terminal	Resistor	Cable and terminal
BRR 0025 LD 2	Integral AWG16	BRR 0025 HD 2	6
BRR 0031 LD 2	Integral AWG16	BRR 0031 HD 2	6
BRR 0061 LD 2	Integral AWG16	BRR 0061 HD 2	6
BRR 0114 LD 2	Integral AWG10	BRR 0114 HD 2	16
BRR 0205 LD 2	16-50	BRR 0205 HD 2	16-50
BRR 0022 LD 5	Integral AWG16	BRR 0022 HD 5	6
BRR 0031 LD 5	Integral AWG16	BRR 0031 HD 5	6
BRR 0045 LD 5	Integral AWG16	BRR 0045 HD 5	6
BRR 0061 LD 5	Integral AWG14	BRR 0061 HD 5	16
BRR 0105 LD 5	16	BRR 0105 HD 5	M8 / 3X16+16
BRR 0300 LD 5	16-50	BRR 0300 HD 5	M8 / 3X70+35
BRR 0520 LD 5	M8 / 3X95+50	BRR 0520 HD 5	M8 / 3X95+50
BRR 0730 LD 5	M8 / 3X95+50	BRR 0730 HD 5	M8 / 3X95+50
BRR 0013 LD 6	Integral AWG16	BRR 0013 HD 6	6
BRR 0034 LD 6	Integral AWG16	BRR 0034 HD 6	6
BRR 0052 LD 6	Integral AWG14	BRR 0052 HD 6	6
BRR 0100 LD 6	16-50	BRR 0100 HD 6	M8/3X16+16
BRR 0208 LD 6	16-50	BRR 0208 HD 6	M8/3X50+25
BRR 0416 LD 6	M8/ 3X70+35	BRR 0416 HD 6	M8/ 3X70+35
BRR 0590 LD 6	M8/ 3X70+35	BRR 0590 HD 6	M8/ 3X70+35

M8 = M8 bolt on the resistor

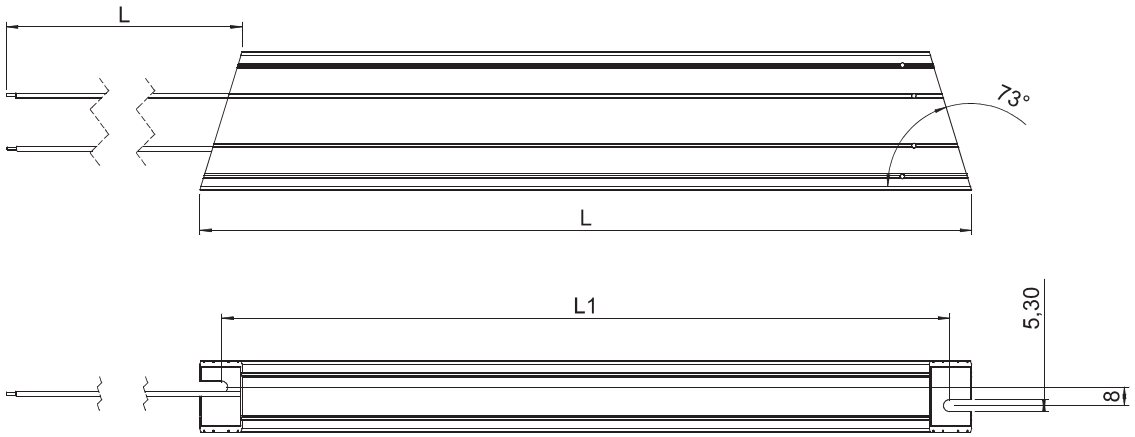
Only two conductors of a normal three phase cable are needed. The shield of the cable should be connected at each end. The third, unused connector should also be grounded by connecting it to ground at one end.

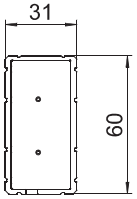
Cable sizes:

AWG Size	mm2
0	0,5
2	0,8
4	1
6	2
8	3
10	5
12	8
14	13
16	19
18	32
20	52

Thermal protection:

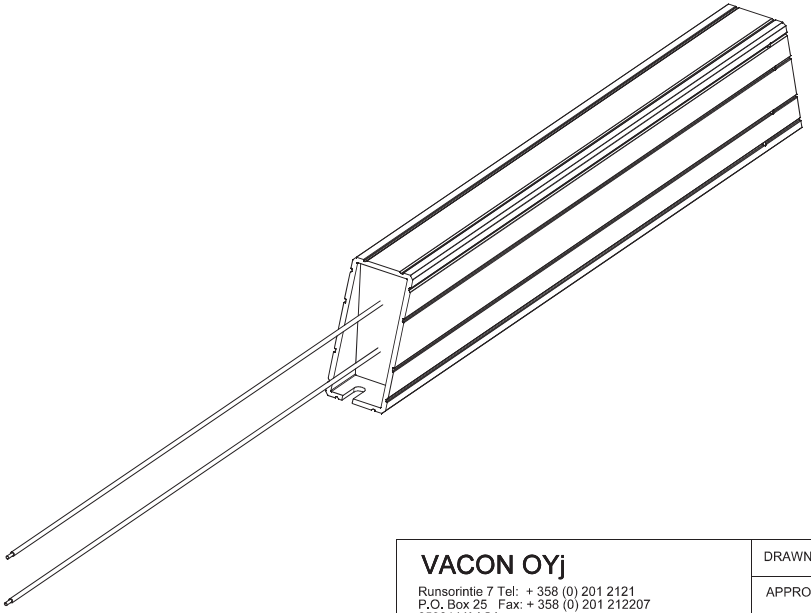
The thermal protection in the resistors should be connected to the external Fault input on the drive.





MOUNTING:
Vertical with
cables down
or
Horizontal

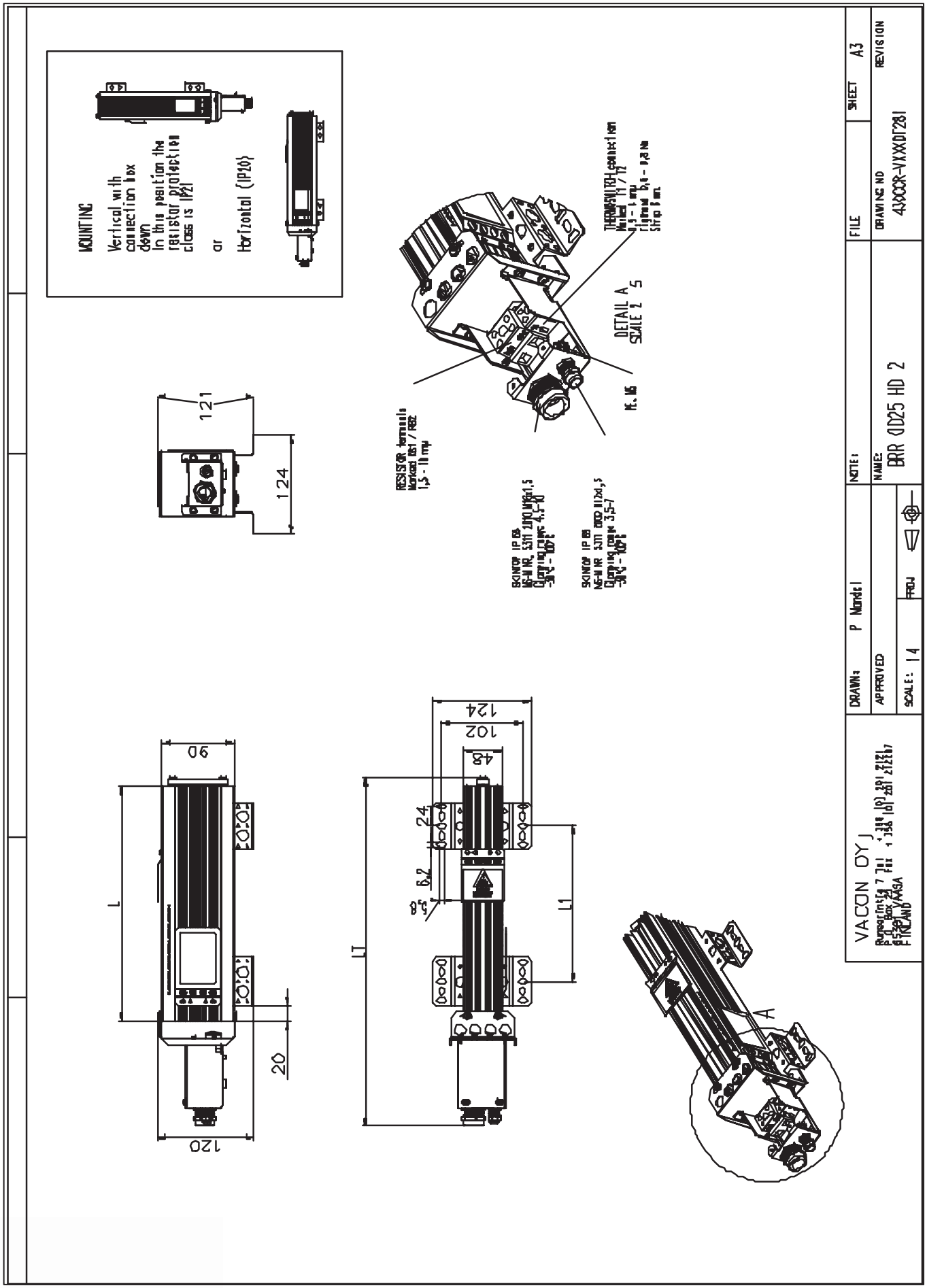
Protection class
IP50

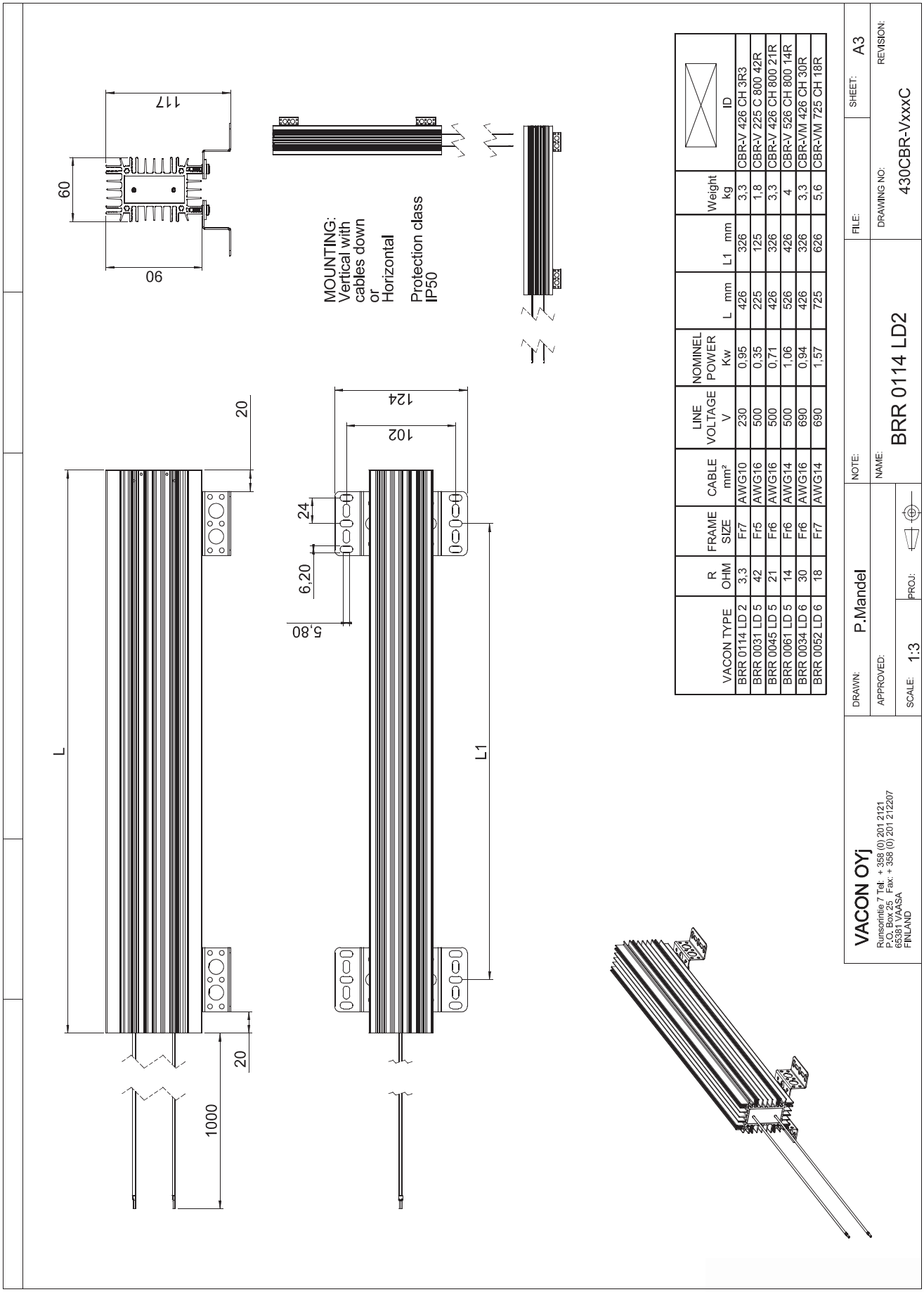


VACON TYPE	R OHM	FRAME SIZE	CABLE mm²	LINE VOLTAGE V	NOMINEL POWER Kw	L mm	L1 mm	Weight kg	[redacted] ID
BRR 0025 LD 2	30	Fr4/Fr5	AWG16	230	0,11	165	146	0,39	CBV 165 C 30R
BRR 0031 LD 2	20	Fr5	AWG16	230	0,2	265	246	0,88	CBV 265 C 20
BRR 0061 LD 2	10	Fr6	AWG16	230	0,33	405	386	1,45	CBV 405 CH 10R
BRR 0022 LD 5	63	Fr4/Fr5	AWG16	500	0,27	335	316	1,2	CBV 335 C 63R
BRR 0013 LD 6	100	Fr6	AWG16	690	0,33	405	386	1,45	CBV 405 C 100R
BRR 0022 FP 5	63		AWG16		0,27	335	316	1,2	CBV 335 C 800 63R

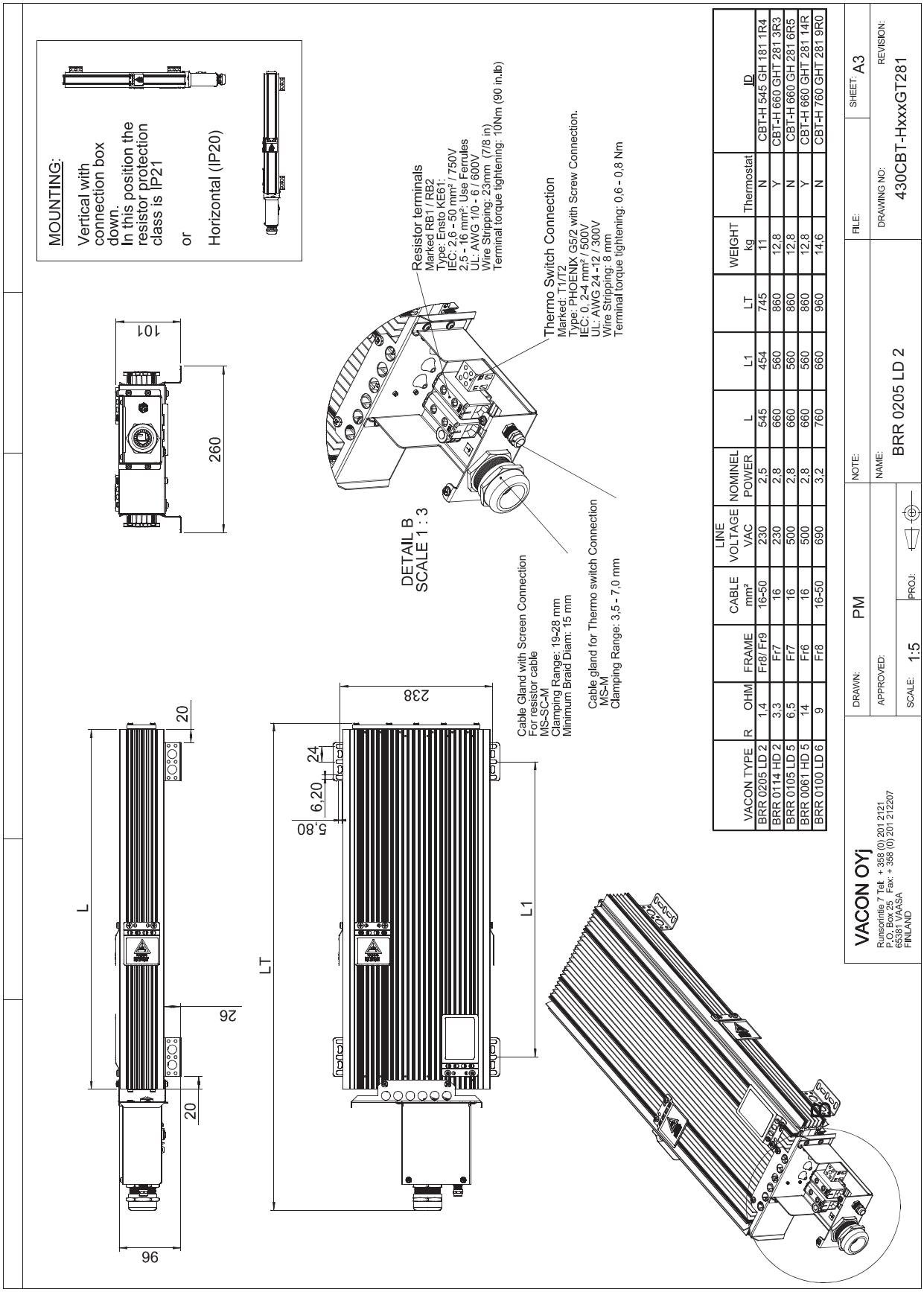
VACON OYj
Runsorintie 7 Tel: + 358 (0) 201 2121
P.O. Box 25 Fax: + 358 (0) 201 212207
65381 VAASA
FINLAND

DRAWN: P. Mandel
APPROVED:
SCALE: 1:2
PROJ:
NOTE:
NAME: BRR 0025 LD 2
FILE:
SHEET: A3
DRAWING NO: 430CBVXXXC
REVISION:

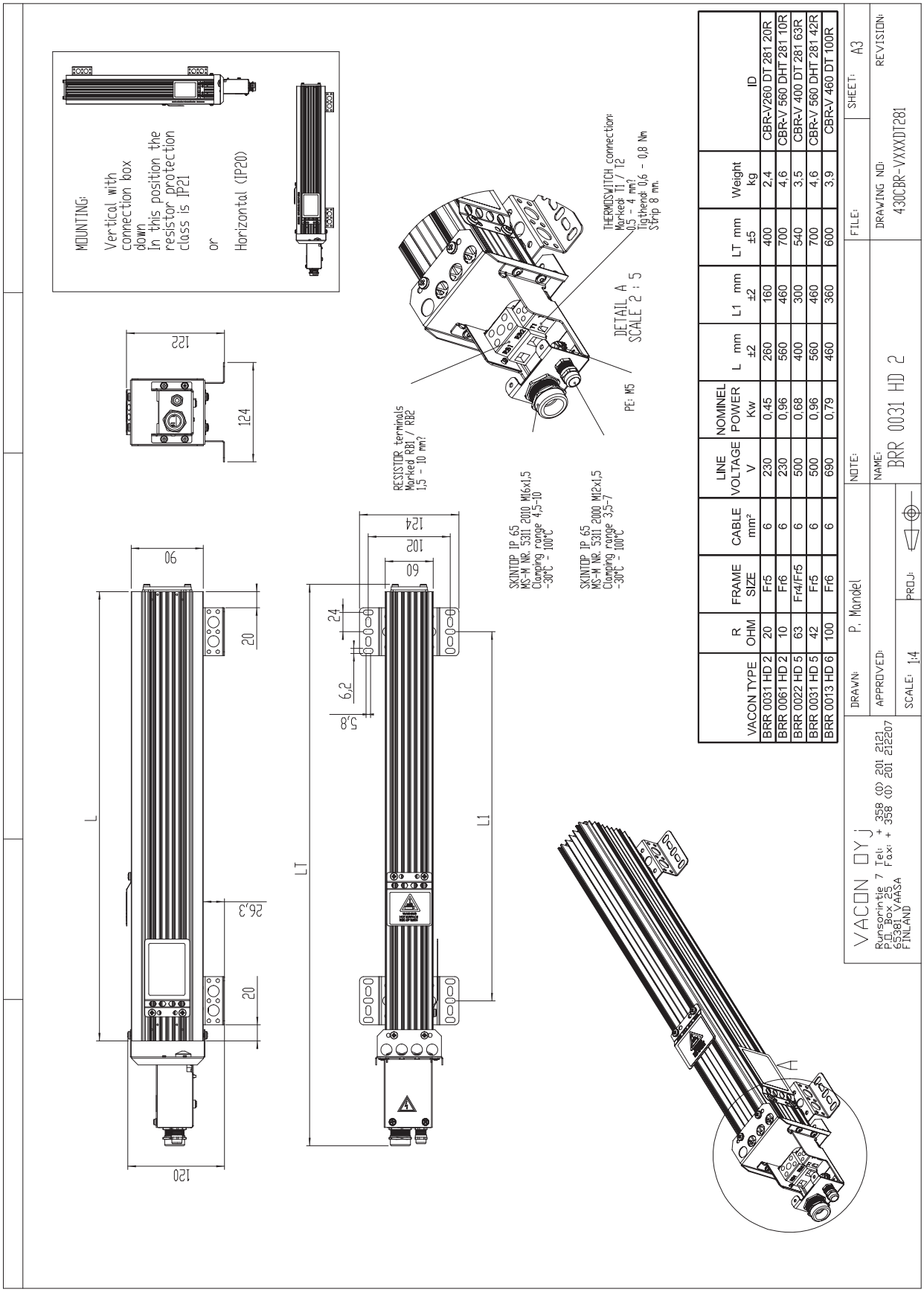

MOUNTING
Vertical with connection box down
In this position the resistor protection class is IP21
or
Horizontal (IP10)
121
124
RESISTOR terminals
Marked R1 / R2
1,5 - 10 mm²
DETAIL A
SCALE 2 : 5
THERMISTOR connection
Marked T1 / T2
0,5 - 1 mm²
Flatcrew 0,6 - 0,8 Nm
Strip 8 mm
SKINTOP IP 68
NEW NR. 5371 2MQ M16x1,5
Clamping range 4,5-10
-30°C - 100°C
SKINTOP IP 68
NEW NR 5371 8MQ M12x1,5
Clamping range 3,5-7
-30°C - 100°C
90
L
20
120
124
102
48
24
6,2
L1
L1
A
VACON OY
Runsorintie 7
P.O. Box 21
65381 VAASA
FINLAND
Tel. +358 (0)201 2121
Fax. +358 (0)201 2121 205
DRAWN: P Nordell
APPROVED
SCALE: 1:4
PROJ
NOTE:
NAME:
BRR 0025 HD 2
FILE
SHEET A3
DRAWING NO
430CCR-VXXDT281
REVISION



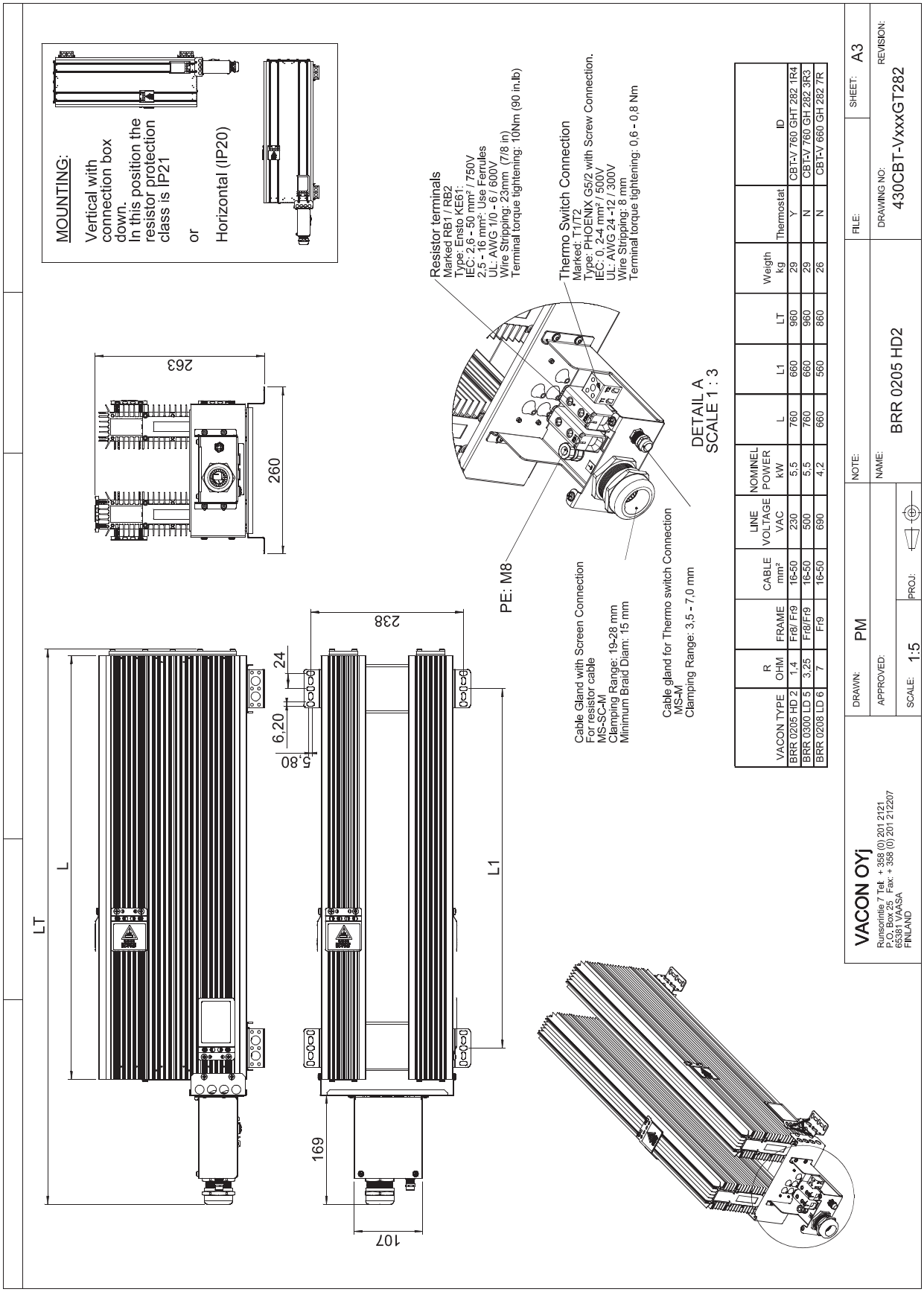
VACON TYPE	R OHM	FRAME SIZE	CABLE mm²	LINE VOLTAGE V	NOMINEL POWER Kw	L mm	L1 mm	Weight kg	ID
BRR 0114 LD 2	3,3	Fr7	AWG10	230	0,95	426	326	3,3	CBR-V 426 CH 3R3
BRR 0031 LD 5	42	Fr5	AWG16	500	0,35	225	125	1,8	CBR-V 225 C 800 42R
BRR 0045 LD 5	21	Fr6	AWG16	500	0,71	426	326	3,3	CBR-V 426 CH 800 21R
BRR 0061 LD 5	14	Fr6	AWG14	500	1,06	526	426	4	CBR-V 526 CH 800 14R
BRR 0034 LD 6	30	Fr6	AWG16	690	0,94	426	326	3,3	CBR-VM 426 CH 30R
BRR 0052 LD 6	18	Fr7	AWG14	690	1,57	725	626	5,6	CBR-VM 725 CH 18R



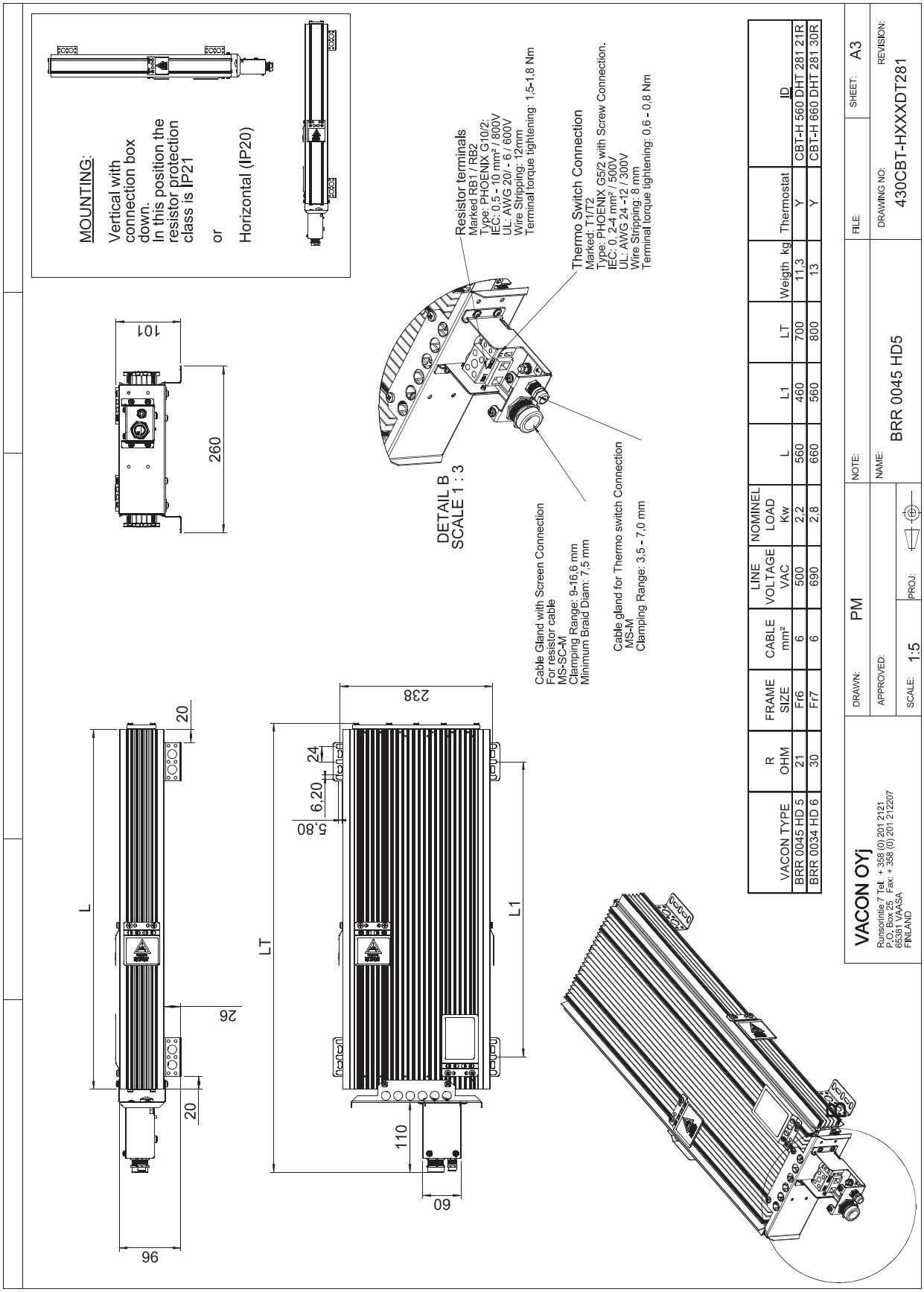
VACON TYPE	R OHM	FRAME	CABLE mm²	LINE VOLTAGE VAC	NOMINEL POWER	L	L1	LT	WEIGHT kg	Thermostat	ID
BRR 0205 LD 2	1,4	Fr8/ Fr9	16-50	230	2,5	545	454	745	11	N	CBT-H 545 GH 181 1R4
BRR 0114 HD 2	3,3	Fr7	16	230	2,8	660	560	860	12,8	Y	CBT-H 660 GHT 281 3R3
BRR 0105 LD 5	6,5	Fr7	16	500	2,8	660	560	860	12,8	N	CBT-H 660 GH 281 6R5
BRR 0061 HD 5	14	Fr6	16	500	2,8	660	560	860	12,8	Y	CBT-H 660 GHT 281 14R
BRR 0100 LD 6	9	Fr8	16-50	690	3,2	760	660	960	14,6	N	CBT-H 760 GHT 281 9R0



VACON TYPE	R OHM	FRAME SIZE	CABLE mm²	LINE VOLTAGE V	NOMINEL POWER Kw	L mm ±2	L1 mm ±2	LT mm ±5	Weight kg	ID
BRR 0031 HD 2	20	Fr5	6	230	0,45	260	160	400	2,4	CBR-V260 DT 281 20R
BRR 0061 HD 2	10	Fr6	6	230	0,96	560	460	700	4,6	CBR-V 560 DHT 281 10R
BRR 0022 HD 5	63	Fr4/Fr5	6	500	0,68	400	300	540	3,5	CBR-V 400 DT 281 63R
BRR 0031 HD 5	42	Fr5	6	500	0,96	560	460	700	4,6	CBR-V 560 DHT 281 42R
BRR 0013 HD 6	100	Fr6	6	690	0,79	460	360	600	3,9	CBR-V 460 DT 100R



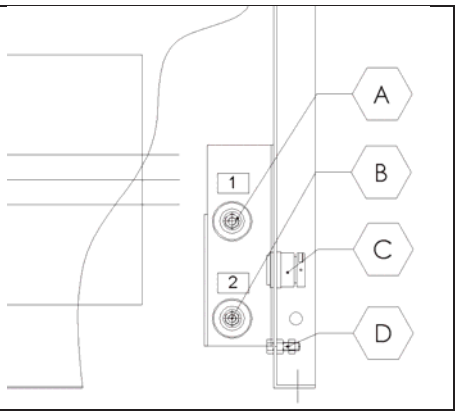
VACON TYPE	R OHM	FRAME	CABLE mm²	LINE VOLTAGE VAC	NOMINEL POWER kW	L	L1	LT	Weigth kg	Thermostat	ID
BRR 0205 HD 2	1,4	Fr8/ Fr9	16-50	230	5,5	760	660	960	29	Y	CBT-V 760 GHT 282 1R4
BRR 0300 LD 5	3,25	Fr8/Fr9	16-50	500	5,5	760	660	960	29	N	CBT-V 760 GH 282 3R3
BRR 0208 LD 6	7	Fr9	16-50	690	4,2	660	560	860	26	N	CBT-V 660 GH 282 7R


MOUNTING:
Vertical with connection box down.
In this position the resistor protection class is IP21
or
Horizontal (IP20)
101
260
DETAIL B
SCALE 1 : 3
Resistor terminals
Marked RB1 / RB2
Type: PHOENIX G10/2:
IEC: 0,5 - 10 mm² / 800V
UL: AWG 20/ - 6 / 600V
Wire Stripping: 12mm
Terminal torque tightening: 1,5-1,8 Nm
Thermo Switch Connection
Marked: T1/T2
Type: PHOENIX G5/2 with Screw Connection.
IEC: 0,2-4 mm² / 500V
UL: AWG 24 -12 / 300V
Wire Stripping: 8 mm
Terminal torque tightening: 0,6 - 0,8 Nm
Cable Gland with Screen Connection
For resistor cable
MS-SC-M
Clamping Range: 9-16,6 mm
Minimum Braid Diam: 7,5 mm
Cable gland for Thermo switch Connection
MS-M
Clamping Range: 3,5 - 7,0 mm
L
20
26
20
96
LT
238
24
6,20
5,80
L1
110
60
VACON TYPE | R OHM | FRAME SIZE | CABLE mm² | LINE VOLTAGE VAC | NOMINEL LOAD Kw | L | L1 | LT | Weigth kg | Thermostat | ID
BRR 0045 HD 5 | 21 | Fr6 | 6 | 500 | 2,2 | 560 | 460 | 700 | 11,3 | Y | CBT-H 560 DHT 281 21R
BRR 0034 HD 6 | 30 | Fr7 | 6 | 690 | 2,8 | 660 | 560 | 800 | 13 | Y | CBT-H 660 DHT 281 30R
VACON OYj
Runsorintie 7 Tel. + 358 (0) 201 2121
P.O. Box 25 Fax: + 358 (0) 201 212207
65381 VAASA
FINLAND
DRAWN: PM
APPROVED:
SCALE: 1:5
PROJ:
NOTE:
NAME: BRR 0045 HD5
FILE:
SHEET: A3
DRAWING NO: 430CBT-HXXXDT281
REVISION:

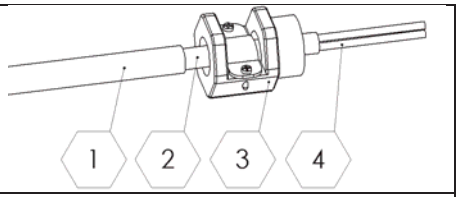
Vacon code	Ohm	FRAME	Connection	Cable mm	Vac	Pn kW	Weight Kg
BRR 0052 HD6	18	Fr7 / 16mm2	M8 / 3X10+10	20	690V	4,0 kW	15

Connection:

A	Terminals for cable M8 Torque moment 4,5 [Nm]
B	Terminals for cable M8 Torque moment 4,5 [Nm]
C	Cable gland SH21, Clamping range 18 – 23,5 mm
D	Connection Earth (PE)



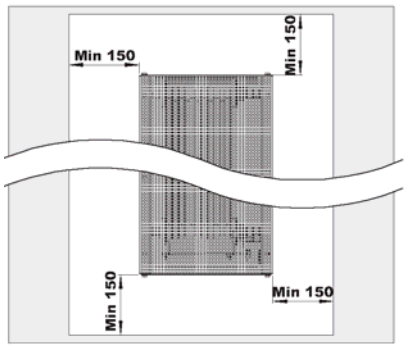
1	Cable
2	Screen braiding
3	Cable gland
4	Core

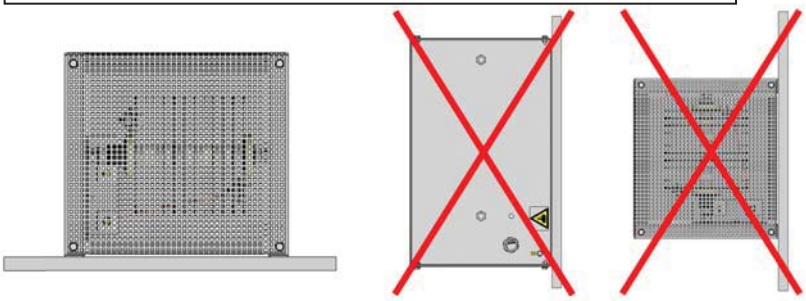


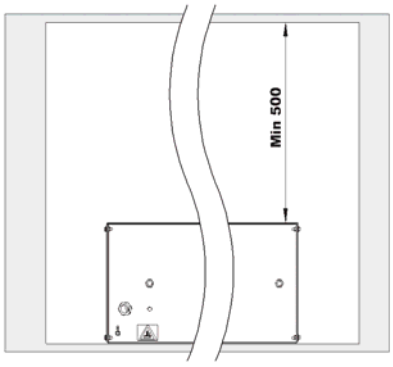
The connection cable to the brake resistor is to be screened/armoured.
Always connect the screen/armouring in both ends.

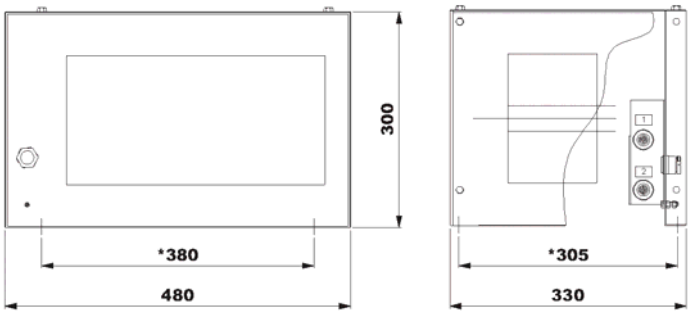
Mounting:

Note: for proper performance the resistor sheets have to be vertical







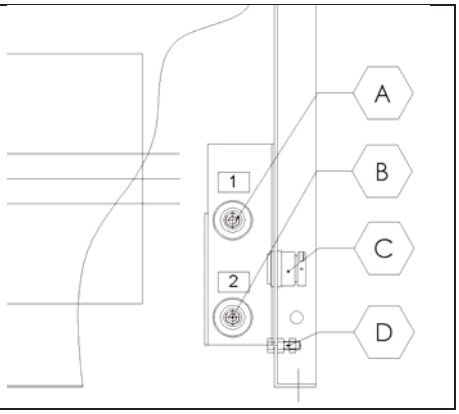


*** Mounting holes**

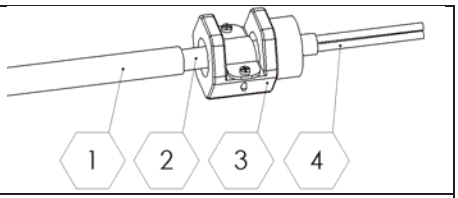
Vacon code	Ohm	FRAME	Connection	Cable mm	Vac	Pn kW	Weight Kg
BRR 0105 HD 5	6,5	Fr7 / 16mm2	M8 / 3X10+10	20	500V	6,92 kW	17
BRR 0100 HD 6	9,0	Fr10/ 16 mm2	M8 / 3X16+16	23	690V	9,4 kW	20

Connection:

A	Terminals for cable M8 Torque moment 4,5 [Nm]
B	Terminals for cable M8 Torque moment 4,5 [Nm]
C	Cable gland M25, Clamping range 18 – 23,5 mm
D	Connection Earth (PE)



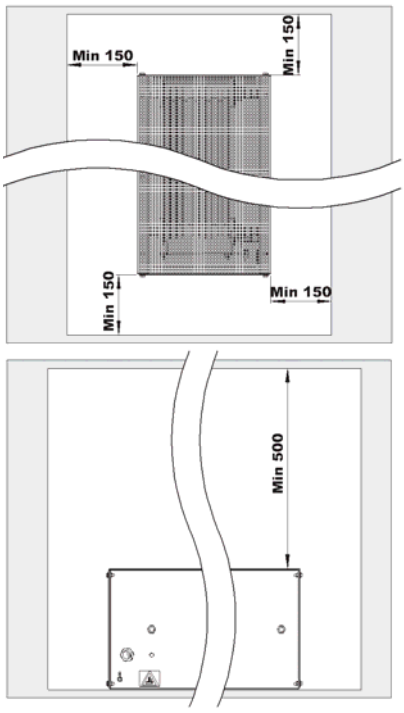
1	Cable
2	Screen braiding
3	Cable gland
4	Core

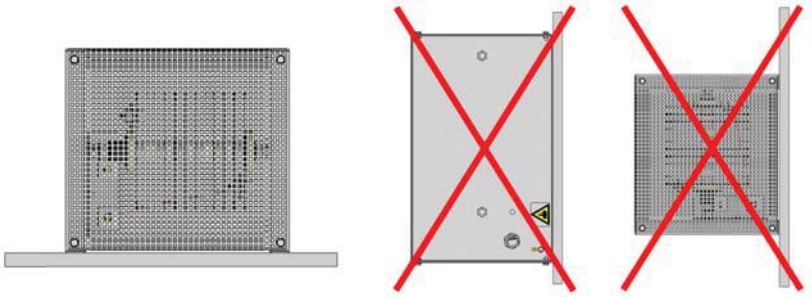


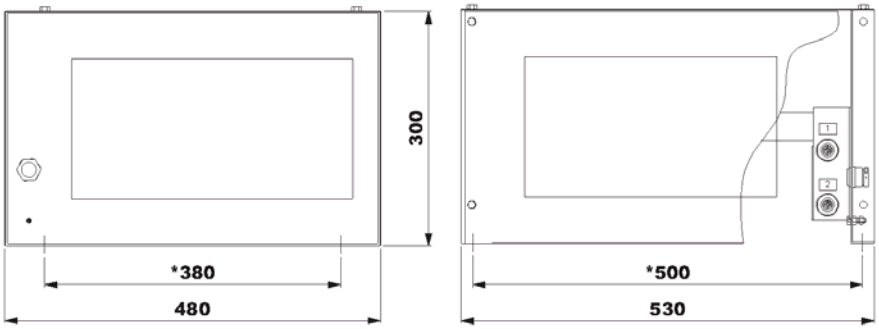
The connection cable to the brake resistor is to be screened/armoured.
Always connect the screen/armouring in both ends.

Note: for proper performance the resistor sheets have to be vertical

Mounting:





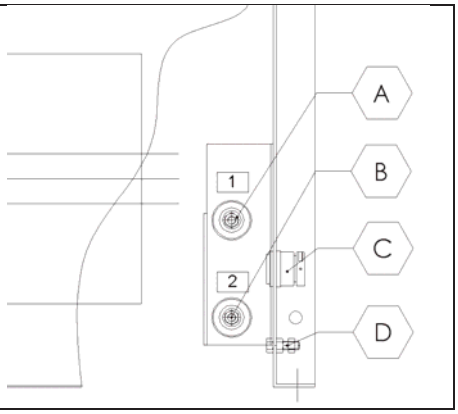


* Mounting holes Ø9

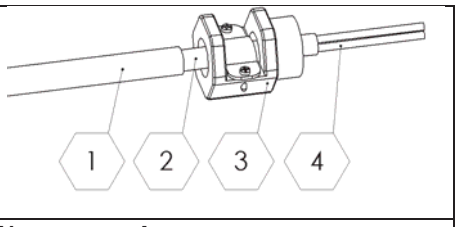
Vacon code	Ohm	Danotherm code	FRAME	Connection	Cable mm	Vac	Pn kW	Weight kg
BRR 0300 HD5	3,25	BRC 17 AT20 3R25 E726	Fr8/Fr9	M8/3x70+35	32	500 V	12,84 kW	30
BRR 0520 LD5	1,4	BRC 17 AT20 1R4 E725	Fr10	M8/3x95+50	37	500 V	12,3 kW	30
BRR 0208 HD6	7	BRC 17 AT20 7R E724	Fr11	M8/3x50+25	28	690 V	12 kW	30
BRR 0416 LD6	2,5	BRC 17 AT20 2R5 E726	Fr10	M8/3x70+35	32	690 V	13 kW	30

Connection:

A	Terminals for cable M8 Torque moment 4,5 [Nm]
B	Terminals for cable M8 Torque moment 4,5 [Nm]
C	Cable gland M25, Clamping range 18 – 23,5 mm
D	Connection Earth (PE)



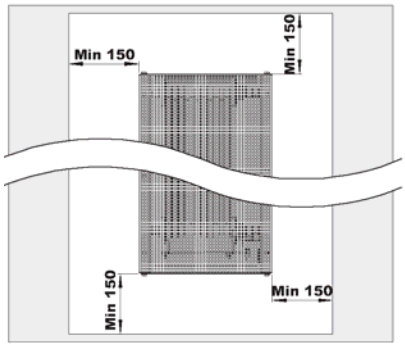
1	Cable
2	Screen braiding
3	Cable gland
4	Core

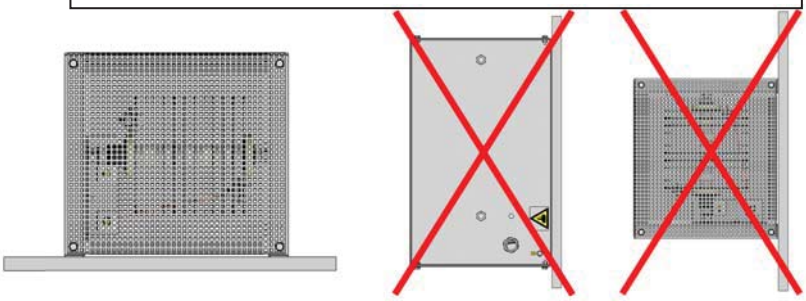


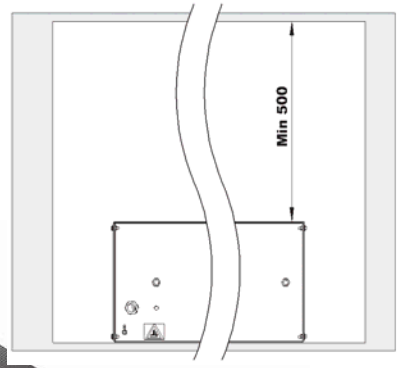
The connection cable to the brake resistor is to be screened/armoured.
Always connect the screen/armouring in both ends

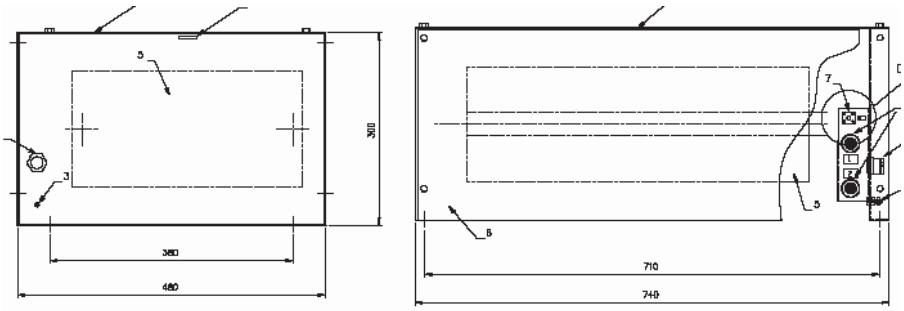
Note: for proper performance the resistor sheets have to be vertical

Mounting:







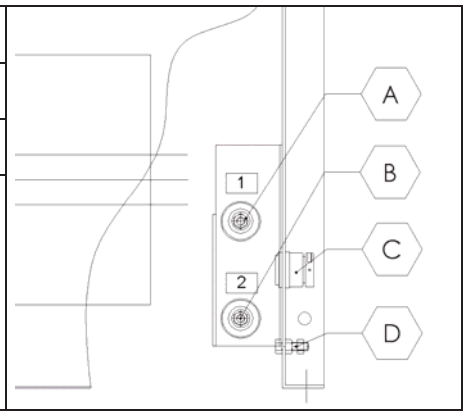


*** Mounting holes Ø9**

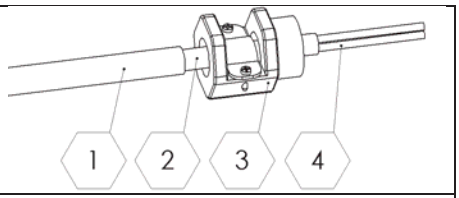
Vacon code	Ohm	FRAME	Connection	Cable mm	Vac	Pn kW	Weight Kg
BRR 0730 LD 5	0,9	Fr11	M8 / 3X95+50	37	500V	19,2 kW	35
BRR 0590 LD 6	1,7	Fr11/ 50 mm2	M8 / 3X70+35	32	690V	19,0 kW	35

Connection:

A	Terminals for cable M8 Torque moment 4,5 [Nm]
B	Terminals for cable M8 Torque moment 4,5 [Nm]
C	Cable gland SH40, Clamping range 29 – 40,5 mm
D	Connection Earth (PE)

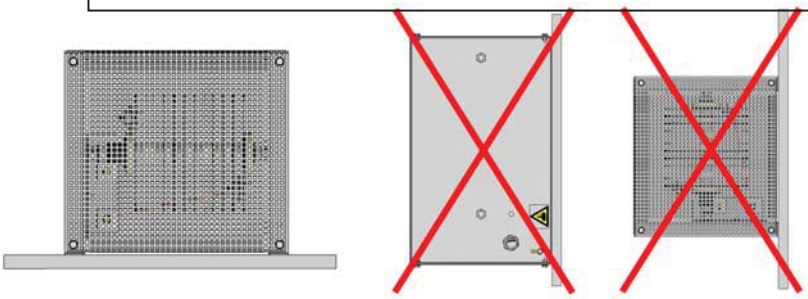


1	Cable
2	Screen braiding
3	Cable gland
4	Core

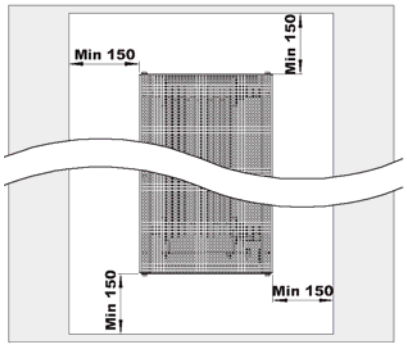


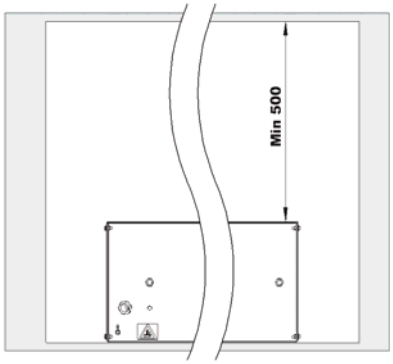
The connection cable to the brake resistor is to be screened/armoured.
Always connect the screen/armouring in both ends.

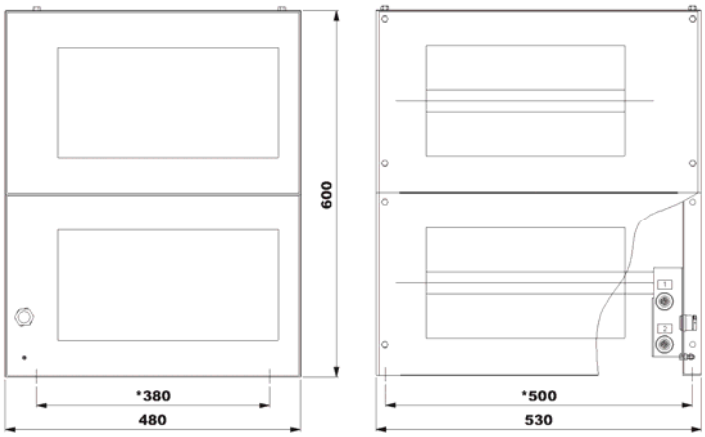
Note: for proper performance the resistor sheets have to be vertical



Mounting:





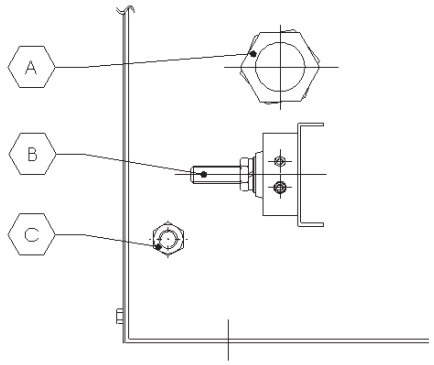


*** Mounting holes Ø9**

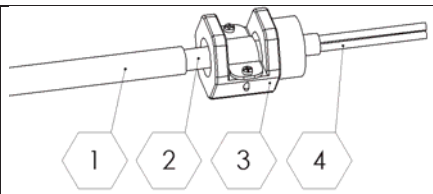
Vacon code	Ohm	FRAME	Connection	Cable mm	Vac	Pn kW	Weight Kg
BRR 0520 HD 5	1,4	Fr10	M8 / 3X95+50	37	500V	32 kW	90
BRR 0416 HD 6	2,5	Fr10	M8 / 3X70+35	32	690V	33,8 kW	90

Connection:

A	Cable gland SH40, Clamping range 29 – 40,5 mm
B	Terminals for cable M 8 Torque moment 4,5 [Nm]
C	Connection Earth (PE)



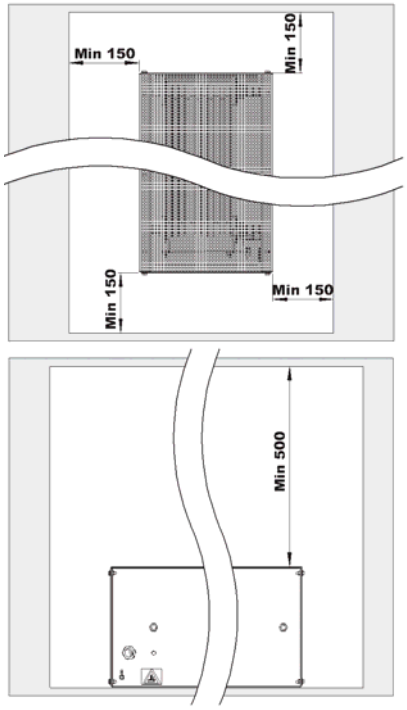
1	Cable
2	Screen braiding
3	Cable gland
4	Core

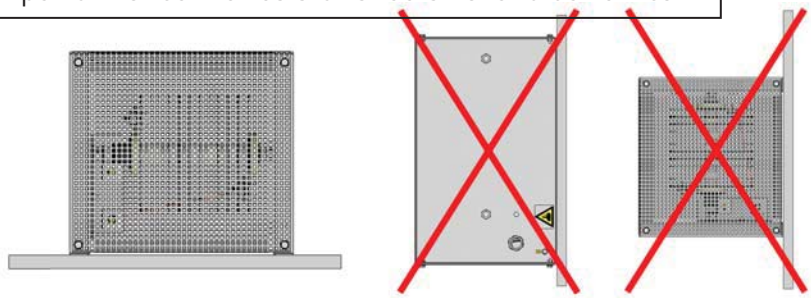


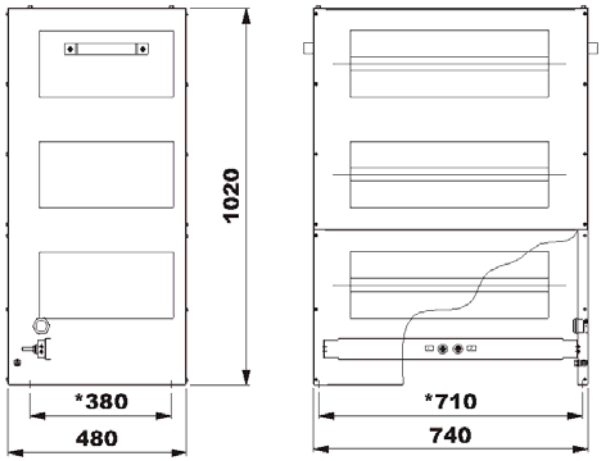
The connection cable to the brake resistor is to be screened/armoured.
Always connect the screen/armouring in both ends.

Note: for proper performance the resistor sheets have to be vertical

Mounting:





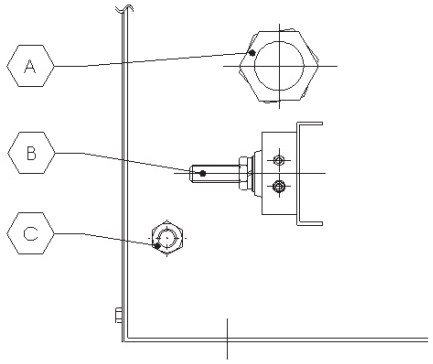


*** Mounting holes Ø9**

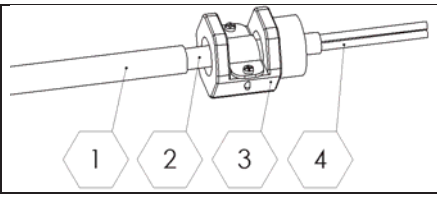
Vacon code	Ohm	FRAME	Connection	Cable mm	Vac	Pn kW	Weight Kg
BRR 0730 HD 5	0,9	Fr11	M8 / 3X95+50	37	500V	49,9 kW	120
BRR 0590 HD 6	1,7	Fr12	M8 / 3X70+35	32	690V	49,7 kW	120

Connection:

A	Cable gland SH40, Clamping range 29,0 – 40,5 mm
B	Terminals for cable M 8 Torque moment 4,5 [Nm]
C	Connection Earth (PE)



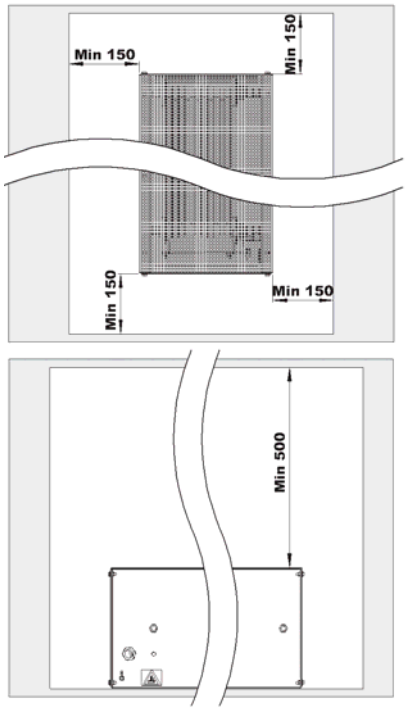
1	Cable
2	Screen braiding
3	Cable gland
4	Core

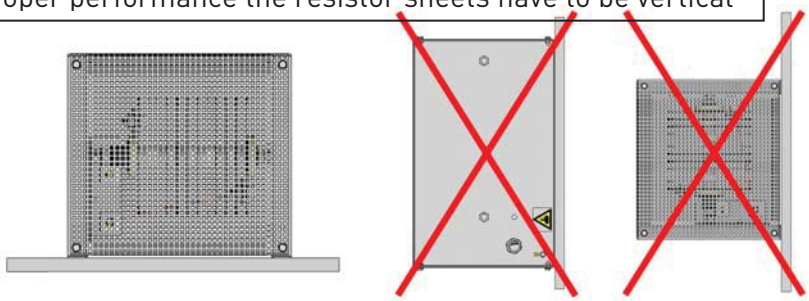


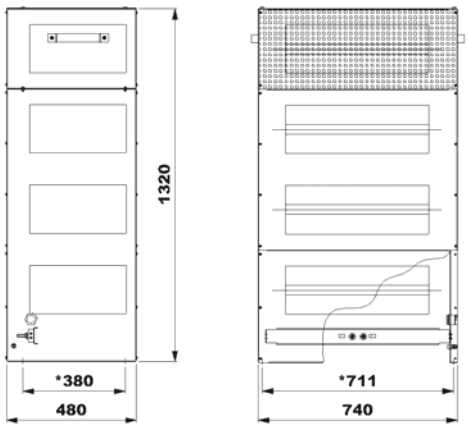
The connection cable to the brake resistor is to be screened/armoured.
Always connect the screen/armouring in both ends.

Note: for proper performance the resistor sheets have to be vertical

Mounting:







*** Mounting holes Ø9**

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