Operation Manual

NL-B5

Dynamic Braking Unit

Content

1 Installation guidelines

	✧ Only qualified electricians are allowed to carry out what described in this chapter. Please operate as the instructions in ***Safety Precautions***. Ignoring these may cause physical injury or death or damage to the devices. ✧ Ensure the power supply of the dynamic braking unit is disconnected during the operation. Wait for at least the time designated until the POWER indicator is off after the disconnection if the power supply is applied. It is recommended to use the multimeter to monitor that the DC bus voltage of the drive is under 36V. ✧ The installation and design of the dynamic braking unit should be complied with the requirement of the local laws and regulations in the installation site. If the installation infringes the requirement, our company will exempt from any responsibility. Additionally, if users do not comply with the suggestion, some damage beyond the assured maintenance range may occur.

3.1 Installation environment

The installation environment is the safeguard for a full performance and long-term stable functions of the NLB5. Check the installation environment as followings:

Environment	Conditions
Installation site	Indoor
Environment temperature	✧ -10-+50°C ✧ If the ambient temperature of the dynamic braking unit is above 40°C, de-rate 3% for every additional 1°C. ✧ It is not recommended to use the dynamic braking unit if the ambient temperature is above 50°C. ✧ In order to improve the reliability of the device, do not use the dynamic braking unit if the ambient temperature changes frequently. ✧ Please provide cooling fan or air conditioner to control the internal ambient temperature below the required one if the dynamic braking unit is used in a close space such as in the control cabinet. ✧ When the temperature is too low, if the dynamic braking unit needs to restart to run after a long stop, it is necessary to provide an external heating device to increase the internal temperature, otherwise damage to the devices may occur.
Humidity	✧ RH≤90% ✧ No condensation is allowed. ✧ The maximum relative humility should be equal to or less than 60% in corrosive air.
Storage temperature	-30-+60°C
Running environment condition	The installation site of the NLB5 should: ✧ Keep away from the electromagnetic radiation source; ✧ Keep away from contaminative air, such as corrosive gas, oil

Environment	Conditions
	mist and flammable gas; ✧ Ensure foreign objects, such as metal power, dust, oil, water cannot enter into the NLB5(do not install the NLB5 on the flammable materials such as wood); ✧ Keep away from direct sunlight, oil mist, steam and vibration environment.
Altitude	✧ Below 1000m ✧ If the sea level is above 1000m, please derate 1% for every additional 100m.
Vibration	≤ 5.8m/s^2(0.6g)
Installation direction	The NLB5 should be installed on an upright position to ensure sufficient cooling effect.

Note:

✧ NL-B5 series should be installed in a clean and ventilated environment according to enclosure classification.

✧ Cooling air must be clean, free from corrosive materials and electrically conductive dust.

3.2 Installation direction

NL-B5 must be installed in an upright position.

3.3 Installation mode

NL-B5 can be installed in wall (for all frame sizes)

3.4 External dimensions and weight

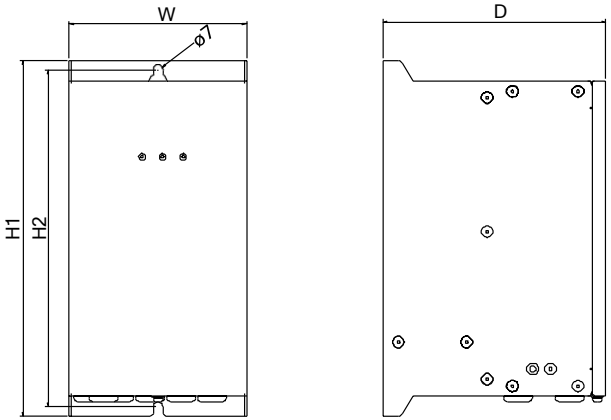


Figure 3-1 Dimensions of 60A NLB5

2 Product name, model definition and usage

3

Instruction:

Table 4-1 Product model instruction

Field identification	Detailed description of the sign
A	NLB5: Dynamic braking unit
B	1: Technical version
C	00: Spare code
D	H: Heavy load type
E	Rated braking current, the unit is A
F	2: Applied on AC 3PH 220V(-15%)–240V(+10%) and the Max. input voltage DC450V 4: Applied on AC 3PH 380V(-15%)–440V(+10%) and the Max. input voltage DC900V

NL-B5 series dynamic braking units are the high-performance and heavy-load dynamic braking units promoted by our company, which can brakes at the rated braking current to meet the application need in the situation of big inertia, crash deceleration and stop. When the NLB5 brakes, momentum will be converted into electric energy because of big inertia, and then the DC bus voltage will increase. The braking unit can consume the regenerative electric energy to ensure normal work of the NLB5; otherwise the NLB5 will carry our overvoltage protection and work abnormally.

4 Installation and parameters setting

5.1 Wiring diagram

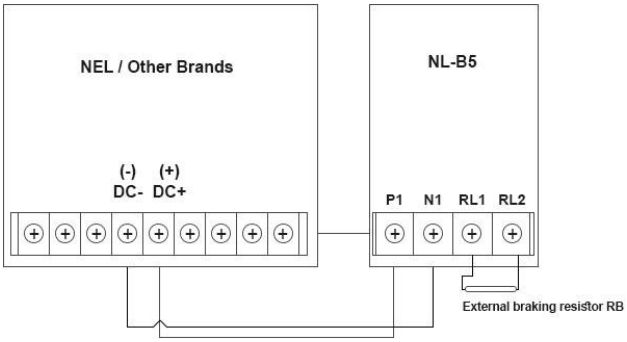


Figure 5-1 Wiring diagram of the main circuit between NLB5 and the VFD

5.2 Terminals of the main circuit

	P1	N1	RL1	RL2

Figure 5-2 Terminals of main circuit 60A-220A

5.3 Main control terminal of the braking unit

M+	M-	S+	S-

1A	/	1B	1C

Functions description:

Sign	Function
M+	Input terminal of the external fault. EFI-COM is defaulted to be short circuited in factory. When the external fault occurs, it will be switched off and the braking unit outputs fault signal.
M-	Slave parallel input terminals of the braking unit
S+	Master parallel output terminals of the braking unit
S-	Common terminal of EFI, PI and PO
1A	1. Fault output terminal. When fault occurs to the braking unit, the fault relay will output fault report signal. 2. ROA NO, ROB NC, ROC is the common terminal 1. Contact Rating: 3A/AC250V, 1A/DC30V 2. Do not use it as the high frequency switch output (with cautions)
1B	
1C	

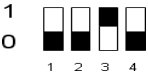
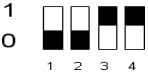
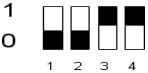
When there is only one braking unit, please connect the VFD, braking unit and braking resistor according to Figure 5-1. It will work after setting the voltage degree and the braking threshold.

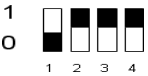
5.4 Adjustment

The braking unit and the braking resistor need not to be adjusted. In special, do not adjust the braking unit on the situation of “voltage selection setting”.

5.5 Voltage selection setting

The setting of braking threshold: set the voltage selection of the braking unit according to the input voltage of the NLB5. The voltage selection can only performed when disconnecting the power supply. Below is the relationship between the voltage selection and the original braking voltage:

Serial No.	S1 selection	220V system (V)	380V system (V)
0		380	760
1		360	730
2		340	690
3		320	660
3		300	630

Serial No.	S1 selection	220V system (V)	380V system (V)
4		390	760
5		400	730
6		410	690
7		420	630
8		430	600
9	1000-1110	Reserved	Reserved
10		Slave mode	Slave mode

Note:

- ✧ If the grid voltage is above more than 20% of the normal supply, please set bigger braking voltage.
- ✧ Please ensure the allowable original braking voltage of the NLB5 comply with this setting.

	Do not operate during powering on. Do not adjust the setting when the POWER LED is not totally off (the voltage is present between (+) and (-)).

5 Parallel running

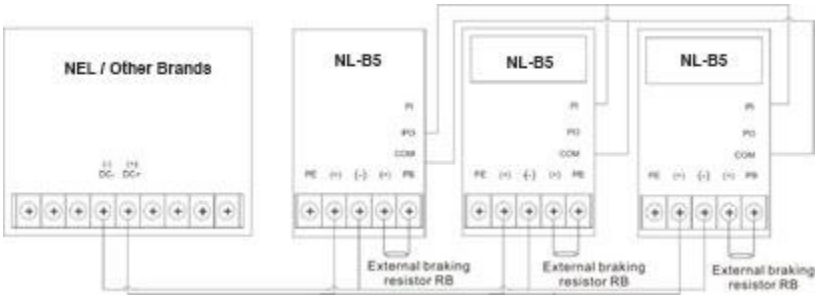


Figure 6-1 Wiring diagram between braking units in parallel operation and the VFD

When there are more than two braking units in parallel operation, connect the VFD, multiple brake units and braking resistors according to Figure 6-1.

Wiring of the control terminals: when parallel braking units are put into use, the first one is the master and the others are the slaves. The parameters setting of the slave are referred to the section 9 of “braking threshold” and the braking rate of the master and the slave need to be kept the same. The PO and COM terminal of the first braking unit is connected to the PI and COM terminal of the second braking unit and the PI and COM terminal of the third braking unit and so forth, the running of the whole parallel braking unit system can be monitored.

6 Fault analysis and solution

The fault can be indicated through LEDs. When the FAULT LED is on, it means the dynamic braking unit is abnormal. Check the faults one by one according to the information in the below table. Find the possible reasons and the solutions. If not, please contact with the local NEL office.

Serial No.	Fault state	Reasons	Solutions
1	Serious heat-releasing of the braking resistor during the braking	The power of the braking resistor is too low.	Change a braking resistor with bigger power.
2	Serious heat-releasing of the braking resistor when not braking	IGBT damage	Change the braking unit
		The voltage selection of the braking unit is not correct.	Reset
		Braking unit fault	Change the braking unit
3	OU of the NLB5	Insufficient braking capacity of the braking resistor	Recheck the braking condition
		Wrong wiring	Check and correct
		The voltage selection of the braking unit is not correct.	Reset
		Braking unit fault	Change the braking unit
4	Output signal of the fault relay	Valid external fault input	Recheck the running condition
		Short circuit of the braking resistor	Change the braking resistor
		The temperature of IGBT is over 85°C	

Note: When the external grid voltage is too high, please set bigger voltage.

Non-isolated circuit is applied in the control circuit of the braking unit. Disconnect the wiring between (+) and (-) and ensure there is no voltage during the operation and checking.

7 Selection

8.1 Guidelines of braking voltage selection

The setting of the braking voltage is low enough to make the NLB5 works around the rated voltage and ensure a safe running. Select high braking voltage can avoid misaction of the braking unit, but too high voltage has impact on the long-term running safety.

8.2 Calculation of the braking resistor and the braking current

(at 100% of the braking torque)

Braking current is the DC current running through the braking unit and the braking resistor during braking.

Calculating at the standard AC motor of 380V:

$\overline{P}$ Rated power of the motor (kW)

$\overline{V}$ DC operating point of the braking unit, usually it is 700V

$\overline{I}$ Braking current (A)

$\overline{\eta}$ Conversion efficiency of the mechanical energy during feedback, usually it is 1.0

Calculation basis: the braking resistor needs to absorb all the regenerative electric energy of the motor.

Absorbed power of the braking resistor (V*I)＝The regenerative electric energy of the motor (W)=1000*P*η

8.3 Calculation and selection of the braking resistor

(at 100% of the braking torque)

The braking resistor reflects the braking torque in the system. If the braking torque is too small, the NLB5 will carry out overvoltage protection.

Calculating at the standard AC motor of 380V:

$\overline{P}$ Rated power of the motor (kW)

$\overline{P_R}$ Rated consumed power of the braking resistor (kW)

$\overline{V}$ DC operating point of the braking unit, usually it is 700V

$\overline{R}$ Equivalent resistance of the braking resistor (Ω)

$\overline{\eta}$ Conversion efficiency of the mechanical energy during feedback, usually it is 1.0

$\overline{\varepsilon}$ Safety coefficient of the power consumption for the braking resistor ε =1.4

$\overline{K_f}$ Braking frequency, the time ratio of the regeneration to the whole working time

Usually, K_f is:

Winding up and winding down	K_f＝50－60%
Oilfield machines	K_f＝10－20%
Elevators	K_f＝10－15%
Centrifuge	K_f＝5－20%
Crane(the height of lifting is more than 100m)	K_f＝20－40%

Occasionally braking load K_f=5%

Others K_f=10%

Basis of resistor calculation: the braking resistor needs to absorb all the regenerative electric energy of the motor.

Absorbed power of the resistor(V*V/R)=The regenerative electric energy of the motor (W)= 1000*P*η

Basis of resistor power calculation:

The regenerative electric energy of the motor needs to be absorbed by the resistor and converted into heat to release.

P_R =P* K_f *η * ε =P* K_f *1.0*1.4

8.4 Usage standard and selection reference of the input voltage degree for adaptation NLB5 (220V)

Below is the selection reference when the DC operating point of the braking unit is 380V:

Power	Model	100% of the adaptation braking resistor of the braking torque(Ω)	Dissipated power of the braking resistor(kW) (10% of the braking)	Dissipated power of the braking resistor(kW) (50% of the braking)	Dissipated power of the braking resistor(kW) (80% of the braking)	Mini allowable braking resistor(Ω)
15kW	NL-B5-60-2	9.6	2	11	18	6.4
18kW		8.0	3	14	22	
22kW		6.5	3	17	26	
30kW	NL-B5-110-2	4.8	5	23	36	3.5
37kW		3.9	6	28	44	
45kW	NL-B5-160-2	3.2	7	34	54	2.4
55kW		2.6	8	41	66	
75kW	NL-B5-220-2	1.9	11	56	90	1.8

8.5 Usage standard and selection reference of the input voltage degree for adaptation NLB5 (380V)

Below is the selection reference when the DC operating point of the braking unit is 700V:

Power	Model	100% of the adaptation braking resistor of the braking torque(Ω)	Dissipated power of the braking resistor(kW) (10% of the braking)	Dissipated power of the braking resistor(kW) (50% of the braking)	Dissipated power of the braking resistor(kW) (80% of the braking)	Mini allowable braking resistor(Ω)
37kW	NL-B5-60-4	13.2	6	28	44	11.7
45kW	NL-B5-110-4	10.9	7	34	54	6.4
55kW		8.9	8	41	66	
75kW		6.5	11	56	90	
90kW	NL-B5-160-4	5.4	14	68	108	4.4
110kW		4.5	17	83	132	
132kW	NL-B5-220-4	3.7	20	99	158	3.2
160kW	NL-B5-320-4	3.1	24	120	192	2.2
200kW		2.5	30	150	240	
220kW	NL-B5-400-4	2.2	33	165	264	1.8
250kW		2.0	38	188	300	
280kW	Two NL-B5-320-4	3.6*2	21*2	105*2	168*2	2.2*2
315kW		3.2*2	24*2	118*2	189*2	
350kW		2.8*2	27*2	132*2	210*2	
400kW		2.4*2	30*2	150*2	240*2	
500kW	Two NL-B5-400-4	2*2	38*2	186*2	300*2	1.8*2

8.6 Usage standard and selection reference of the input voltage degree for adaptation NLB5 (660V)