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VFDB 4132 Series Brake Modules

Instruction Sheet

❶ Preface

Thank you for choosing DELTA's brake module. VFDB brake units are applied to absorb the motor regeneration energy when the three-phase induction motor stops by deceleration. With VFDB brake unit, the regeneration energy will be dissipated in dedicated brake resistors. To prevent mechanical or human injury, please refer to this instruction sheet before wiring. VFDB brake units are suitable for DELTA AC Motor Drives VFD Series 230V/460V/575V. VFDB brake units need to be used in conjunction with BR series brake resistors to provide the optimum brake characteristics. VFDB brake units (4132) are approved by Underwriters Laboratories, Inc. (UL) and Canadian Underwriters Laboratories (cUL). The content of this instruction sheet may be revised without prior notice. Please consult our distributors or download the most updated version at http://www.delta.com.tw/industrialautomation.

❷ Specifications

VFDB 4132 Brake Units

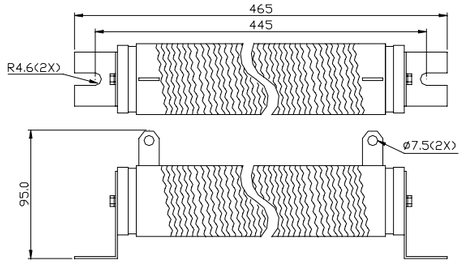
Specification		460V Series
Max. Motor Capacity (kW)		132
Output Rating	Max. Discharge Current (A) 10%ED	240
	Continuous Discharge Current (A)	75
	Braking Start-up Voltage (DC)	618/642/667/690/725/750±6V
Input Rating	DC Voltage	480-750VDC
Min. Equivalent Resistor for Each Brake Unit		3.4Ω
Protection	Heat Sink Overheat Temperature	Temperature exceeds +95°C (203°F)
	Alarm Output for Overheat	Relay contact 3A250VAC/30VDC (RA, RC)
	Power Charge Display	ON until the bus (P-N) voltage is below 50VDC
	Over-current Protection Level	320A
Environment	Installation Location	Indoor (no corrosive gases, metallic dust)
	Operating Temperature	-10°C~+50°C (14°F to 122°F)
	Storage Temperature	-20°C ~+60°C (-4°F to 140°F)
	Humidity	Less than 90% Non-condensing
	Vibration	9.8m/s² (1G) under 20Hz / 2m/s² (0.2G) at 20~50Hz
Mechanical Configuration		Wall-mounted enclosed type IP10

Brake Resistors

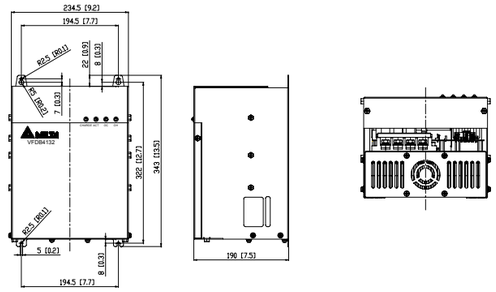
Model no.	Specification
BR1K5W005	1500W 5.0Ω
BR1K2W6P8	1200W 6.8Ω
BR1K2W008	1200W 8.0Ω
BR1K5W040	1500W 40Ω
BR1K0W050	1000W 50Ω
BR1K0W075	1000W 75Ω

❸ Dimensions

3.1 Brake resistor

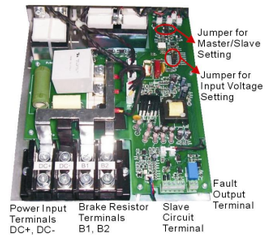


3.2 Brake unit



❹ Internal Components and Terminals

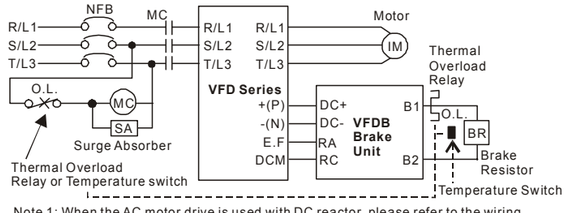
4.1 Internal Components



4.2 Wire Gauge for Terminals

Circuit	Terminals		Wire Gauge AWG (mm²)	Screw	Torque
Power Input Circuit	DC+, DC-		4~6AWG (13.3~21.2mm²)	M8	30 kgf-cm (26 in-lbf)
Brake Resistor	B1, B2		4~6AWG (13.3~21.2mm²)	M8	30 kgf-cm (26 in-lbf)
SLAVE Circuit	Output	M1, M2	18~20AWG (0.8~0.5mm²) (With shielded wires)	M2	4 kgf-cm (3 in-lbf)
	Input	S1, S2			
Fault Circuit	RA, RC		18~20AWG (0.8~0.5mm²)	M2	4 kgf-cm (3 in-lbf)

❺ Basic Wiring Diagram



Note 1: When the AC motor drive is used with DC reactor, please refer to the wiring diagram in the AC drive user manual for wiring terminal DC+ of brake unit.

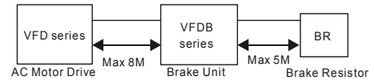
Note 2: **DO NOT** wire terminal DC- to the neutral point of power system.

NOTE

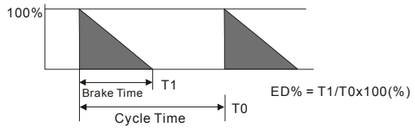
- For safety consideration, install an overload relay between the brake unit and the brake resistor. In conjunction with the magnetic contactor (MC) prior to the drive, it can perform complete protection against abnormality.
- The purpose of installing the thermal overload relay is to protect the brake resistor from damage due to frequent brake, or due to brake unit keeping operating resulted from unusual high input voltage. Under such circumstance, just turn off the power to prevent damaging the brake resistor.
- Please refer to the specification of the thermal overload relay.
- The alarm output terminals (RA, RC) of the brake unit will be activated when the temperature of the heat sink exceeds 95°C. It means that the temperature of the installation environment may exceed 50°C, or the brake %ED may exceed 10%ED. With this kind of alarm, please install a fan to force air-cooling or reduce the environment temperature. If the condition not due to the temperature, the control circuit or the temperature sensor may have been damaged. At this time, please send the brake unit back to the manufacturer or agency for repair.
- The AC Motor Drive and brake unit will be electrified at the same time while turning on the NFB (No-fuse breaker). For the operation/stop method of the motor, please refer to the user manual of the AC Motor Drives VFD Series. The brake unit will detect the inner DC voltage of the AC motor drive when it stops the motor by deceleration. The extra regeneration will be dissipated away rapidly by the brake resistor in the form of heat. It can ensure the stable deceleration characteristic.
- Besides, using thermal overload relay to be the protection system and brake resistor, temperature switch can be installed on brake resistor side as the protection. The temperature switch must comply with the brake resistor specification or contact your dealer.

❻ Wiring Warnings

- Do not proceed with wiring while power is applied to the circuit.
- The wiring gauge and distance must comply with the local regulations.
- The +(P), -(N) terminals of the AC motor drive (VFD Series), connected to the brake unit (VFDB), must be confirmed for correct polarity lest the drive and the brake unit be damaged when power on.
- When the brake unit performs braking, the wires connected to DC+, DC-, B1 and B2 would generate a powerful electromagnetic field for a moment due to high current passing through. These wires should be wired separately from other low voltage control circuits lest they make interference or mis-operation.
- Inflammable solids, gases or liquids must be avoided at the location where the brake resistor is installed. The brake resistor had better be installed in individual metallic box with forced air-cooling.
- Connect the ground terminal to the Earth Ground. The ground lead must be at least the same gauge wire as leads DC+, DC-.
- Please install the brake resistor with forced air-cooling or the equivalent when frequent deceleration braking is performed (over 10%ED).
- Do NOT change any wirings and settings and touch any terminals and components while power is applied to avoid electric shock.
- It is recommended to use the ring terminals for main circuit wiring. Make sure the terminals are fastened before power on.
- Wiring distance



❼ Definition for the Brake Usage ED%



The definition of the brake usage ED(%) is to assure having enough time for the brake unit and brake resistor to dissipate the heat generated by brake. When the brake resistor heats up, the resistance would increase with temperature, and brake torque would decrease accordingly.

❽ The Voltage Settings

1. Voltage setting: the power source of the brake unit is DC voltage from +(P), -(N) terminals of the AC motor drive. It is very important to set the voltage of the brake unit based on the actual input power of the AC motor drive before operation. The setting has a great influence on the potential of the operation voltage for the brake unit. Please refer to the table below.

NOTE

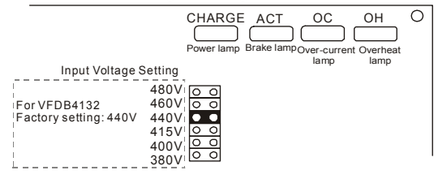
- Before changing the setting of the power voltage, make sure the power has been turned off. Please set power voltage as the possible highest voltage for unstable power system. Take 380VAC power system for example. If the voltage may be up to 410VAC, 415VAC should be set.
- For DELTA's AC motor drive (VFD Series), please set parameter (Over Voltage Stall Prevention) as "close" to disable over-voltage stall prevention, to ensure stable deceleration characteristic.

Table 1: The Selection of AC Power Voltage and Voltage Setting

AC Power Voltage	Brake Start-up voltage DC Bus (DC+, DC-) Voltage
380VAC (460V Mode)	618VDC
400VAC (460V Mode)	642VDC
415VAC (460V Mode)	667VDC
440VAC (460V Mode)	690VDC
460VAC (460V Mode)	725VDC
480VAC (460V Mode)	750VDC

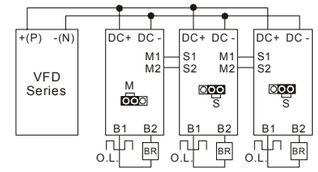
NOTE: Input Power With Tolerance ±10%

Input voltage setting for VFDB 4132



2. MASTER (M) /SLAVE (S) setting: the factory setting is "M". The "S" setting is applied to two or more brake units in parallel, making these brake units be enabled/disabled synchronously. Then the power dissipation of each unit will be equivalent so that they can perform the brake function completely.

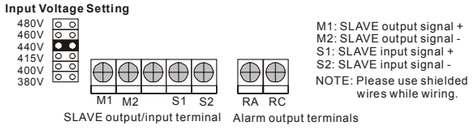
In the following diagram, it shows jumper setting for the application of three brake units. After wiring, the jumper in the first brake unit should be set to "M" and others must be set to "S" to complete the system setting.



The Position of the Jumper

MASTER/SLAVE Setting Jumper

Input Voltage Setting



SLAVE output/input terminal

Alarm output terminals

NOTE

- Please make sure that power is OFF before setting the jumper.
- The steps for jumper setting:
  Step 1. Remove the top cover.
  Step 2. Remove the screws on the side case (3 screws for each side).
  Step 3. Remove the screws that connected bottom case to the side case (2 screws for each side).
  Step 4. After removing the power line of the fan, pull out the heat sink slowly until the jumper can be seen. Then the jumper can be set.

❾ Brake Resistors/Units for Delta VFD AC Motor Drives Series

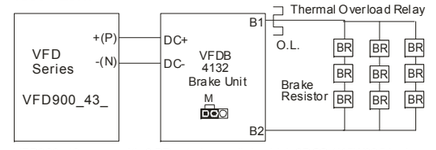
Voltage	Applicable Motor HP	Applicable Motor kW	Full-load Torque kg-M	Resistor Value Spec. for Each AC Motor Drive	Brake Unit Part No. and Quantity		Brake Resistors Part No. and Quantity		Brake Torque 10%ED	Min. Equivalent Resistor Value for Each AC Motor Drive	Typical Thermal Overload Relay Value
460V	120	90	52.5	13500W 5Ω	4132	1	BR1K5W005	9	120	5Ω	110A
	150	110	61	21600W 4Ω	4132	1	BR1K2W008	18	120	4Ω	135A
	175	132	73.5	21600W 4Ω	4132	1	BR1K2W008	18	100	4Ω	135A
	215	160	89	21600W 3.4Ω	4132	1	BR1K2W6P8	18	97	3.4Ω	160A
	250	185	103	27000W 2.5Ω	4132	2	BR1K5W005	18	115	2.5Ω	220A
	300	220	122.5	27000W 2.5Ω	4132	2	BR1K5W005	18	96	2.5Ω	220A

❿ Examples

NOTE

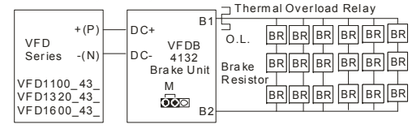
- Before wiring, please notice equivalent resistors value shown in the column "Equivalent resistors specification for each brake unit" in the above table to prevent damage.

460V 120HP



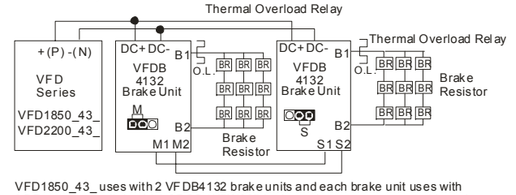
VFD900_43_ uses with 3 BR sets in parallel, which 3PCS 1K5W005 brake resistors are connected in series.

460V 150HP, 175HP, 215HP



VFD1100_43_ uses with 6 BR sets in parallel, which 3PCS 1K2W008 brake resistors are connected in series.
VFD1320_43_ uses with 6 BR sets in parallel, which 3PCS 1K2W008 brake resistors are connected in series.
VFD1600_43_ uses with 6 BR sets in parallel, which 3PCS 1K2W6P8 brake resistors are connected in series.

460V 250HP, 300HP



VFD1850_43_ uses with 2 VFDB4132 brake units and each brake unit uses with 3 BR sets in parallel, which 3PCS 1K5W005 brake resistors are connected in series.
VFD2200_43_ uses with 2 VFDB4132 brake units and each brake unit uses with 3 BR sets in parallel, which 3PCS1K5W005 brake resistors are connected in series.

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VFDB4132 系列刹车模块

说明书

❶前言

感谢您选用台达 VFDB 动力制动刹车模块。本产品主要应用于当三相感应电机由交流电机驱动器所驱动，在减速停止时用以吸收由电机侧所回生的能量。藉由 VFDB 制动单元将此能量以热能的方式消耗在刹车电阻上。本产品在安装使用前，请详细参阅本说明书再进行施工配线，以免造成机械或人员的伤害。VFDB 动力制动刹车模块适用于本公司 VFD 所有系列的交流电机驱动器。VFDB 制动单元需搭配刹车电阻 BR 系列，才能发挥优异的制动特性，详细的规格及使用方法请继续参阅本说明书。由于产品精益求精，当内容规格有所修正时，请洽询代理商或至台达网站（http://www.delta.com.tw/industrialautomation/）下载最新版本。

❷规格

VFDB 4132 制动单元规格

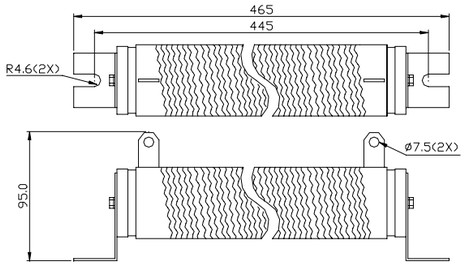
使用电压等级		460V 系列
最大适用电机容量 (kW)		132
输出额定	最大放电电流(A peak) 10%ED	240
	连续放电电流 (A)	75
	制动起始电压 (DC)	618/642/667/690/725/750±6V
电源	直流电压	480-750VDC
每台等效最小电阻		3.4Ω
保护	散热片过热温度	温度超过 +95℃ (203°F)
	过热故障输出	RELAY 接点 3A250Vac/30Vdc(RA.RC)
	充电中显示	主回路 (P-N) 电压在 50VDC 以下熄灭
	过电流 OC 保护准位	320A
使用环境	安装场所	屋内（无腐蚀性气体、金属粉尘）
	环境温度	-10℃~+50℃ (14°F to 122°F)
	储存温度	-20℃~+60℃ (-4°F to 140°F)
	湿度	90%RH 以下不结露
	振动	20Hz 以下 9.8m/S²(1G)，20～50Hz 2m/S²(0.2G)
机构构造		壁挂型 IP10

刹车电阻

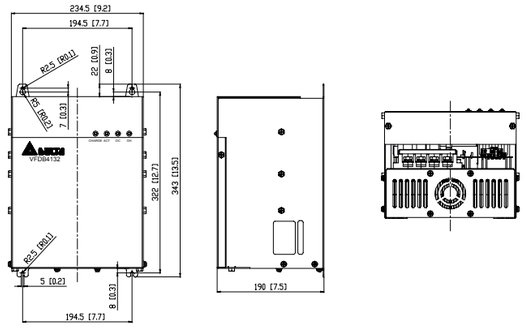
型号	规格
BR1K5W005	1500W 5.0Ω
BR1K2W6P8	1200W 6.8Ω
BR1K2W008	1200W 8.0Ω
BR1K5W040	1500W 40Ω
BR1K0W050	1000W 50Ω
BR1K0W075	1000W 75Ω

❸尺寸

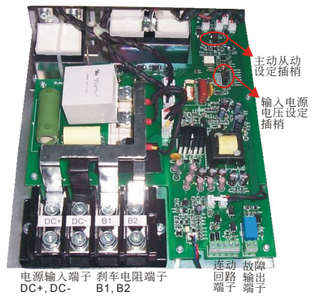
3.1 刹车电阻



3.2 VFDB 4132 制动单元



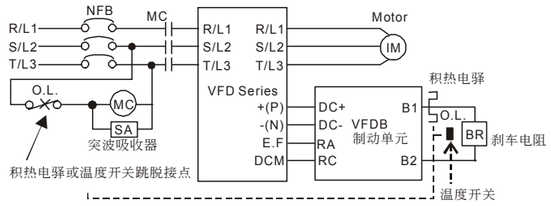
❹各部名称及功能说明



4.1 各端子使用线径

回路名称	端子记号		导线线径 AWG (mm²)	螺丝规格	扭力
电源输入回路	DC+, DC-		4~6AWG (13.3~21.2mm²)	M8	30 kgf-cm (26 in-lbf)
刹车电阻回路	B1, B2		4~6AWG (13.3~21.2mm²)	M8	30 kgf-cm (26 in-lbf)
连动回路	输出	M1, M2	18~20AWG (0.8~0.5mm²) (需用屏蔽线)	M2	4 kgf-cm (3 in-lbf)
	输入	S1, S2			
故障回路	RA, RC		18~20AWG (0.8~0.5mm²)	M2	4 kgf-cm (3 in-lbf)

❺基本配线图



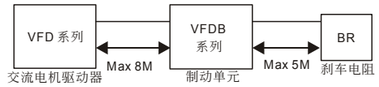
- 当交流电机驱动器有加装直流电抗器(DC Reator)时，其刹车模块的电源输入回路DC+端的配线方法，可参考交流电机驱动器手册。
- 请勿将电源输入回路DC-端，接至电力系统的中性点。

NOTE

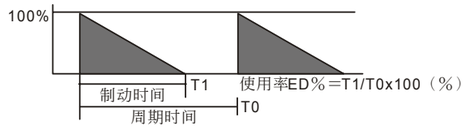
- 在安装制动单元的应用中为了安全的考量，在制动单元与刹车电阻之间加装一积热电驿（O.L）；并与交流电机驱动器前端的电磁接触器（MC）作一连锁的异常保护。
- 加装积热电驿的主要目的是为了保护刹车电阻不因刹车频繁过热而烧毁，或是因输入电源电压异常过高导致制动单元连续导通烧毁刹车电阻，此时只有将交流电机驱动器的电源关闭才可避免刹车电阻烧毁。
- 积热电驿规格的选用请参考制动单元与放电电阻适用一览表。
- 制动单元中的故障输出端子（RA、RC）在散热装置温度高于 95℃时会动作，表示安装环境温度可能超过 50℃以上，或是刹车制动 ED%超过 10%ED；若是此类的故障请自行加装风扇强制风冷或改善环境温度。若非温度原因，可能控制电路受损或温度感测器故障，此时请送厂维修。
- 本配线电路在电源开关（NFB）开启时交流电机驱动器与制动单元便同时通上电源，电机的运转／停止的方式请参考 VFD 系列的使用手册；制动单元会在交流电机驱动器对电机作减速刹车时自动侦测交流电机驱动器内部的直流电压，自动将过多的回生能量藉由刹车电阻以热能的方式迅速消耗以达平稳的减速特性。
- 除了使用积热电驿作为保护系统及制动电阻外，尚可加装温度开关于制动电阻端作为保护。温度开关的动作温度需配合制动电阻规格，或咨询经销商。

❻配线注意事项

- 进行配线施工时务必确认相关回路电源均为关闭状态；配线的线径及距离亦务必按照规定选用及施工。
- 交流电机驱动器（VFD）连接至制动单元（VFDB）的 DC+、DC- 端子有极性之分，千万要确认再确认，否则电源一开启制动单元立即炸毁，请务必注意。
- 制动单元在执行刹车时，DC+、DC-、B1、B2 因有大电流通过所连接的导线瞬间将产生能量很大的电磁场；故在初期配线施工规划时，应与其它低电压的控制线路分离配线，以免造成不必要的干扰或误动作。
- 刹车电阻安装的场所不能有任何易燃性的物体、气体、液体，最好能安装在独立的金属箱内并加以风扇散热。
- 制动单元的接地工程 230V 级请依第三种接地施工，460V 级请依特别第三种接地施工。
- 在减速刹车频繁的场合（超过 10%ED）刹车电阻请加装风扇强制风冷或其它冷却设备。
- 在通电中严禁修改任何配线及制动单元内部设定，更严禁在通电中碰触相关配线的端子及 PCB 板中的任一元件，以免因通电中遭极度危险的直流高压感电造成人员伤害。
- 所有的主回路端子请使用 O 型端子配线，并确认端子已锁紧方可送电运行。
- 配线距离



❼ 刹车使用率 ED%的定义



制定刹车使用率 ED%，主要是为了能让制动单元及刹车电阻有充份的时间来散除因制动而产生的热量；当刹车电阻发热时，电阻值将会随温度的上升而变高，制动转矩亦随之减少。

❽ 设定与调整

1. 电源电压的调整：制动单元的电力来源是接受接交流电机驱动器+ (P)、 - (N)两端供应的直流电源。因此，在配线完成准备运转时，依交流电机驱动器的实际输入电源来设定制动单元的电源电压是非常重要的步骤；此设定将会影响制动单元动作电压的准位，下表为各个电压动作准位。

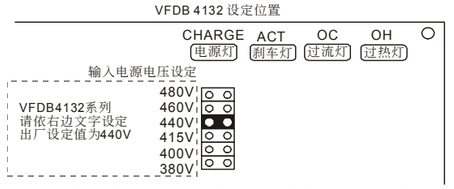
NOTE

- 设定电源电压时，请务必先将电源关闭后才可更改设定值。若在电源电压不稳定的区域，请将电源电压设定在可能出现的最高电压。例如：380Vac 的电源系统，若电压变动达到 410Vac，请设定在 415Vac。
- 使用本公司 VFD 系列交流电机驱动器，请将参数的过电压失速防止功能设定为关闭状态，使失速防止功能失效，如此可得稳定的减速特性。

表一：电源电压的选择与 PN 直流电压的动作准位

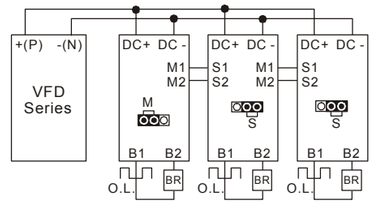
AC 电源电压	制动开始电压 DC+、DC- 母线 DC 电压
380Vac（460V Mode）	618Vdc
400Vac（460V Mode）	642Vdc
415Vac（460V Mode）	667Vdc
440Vac（460V Mode）	690Vdc
460Vac（460V Mode）	725Vdc
480Vac（460V Mode）	750Vdc

注：容许输入电源有±10%的变动



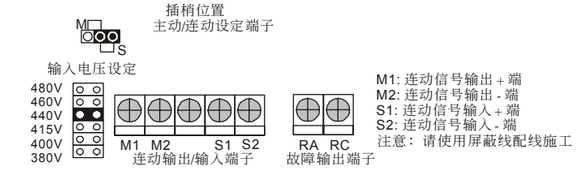
2. 主动（M）／连动（S）的设定：制动单元在出厂时均设定在“M”主动刹车的位置。“S”连动位置的功能主要是应用于两台以上制动单元。

如下图所示为三台制动单元连动制动的应用；当配线完成后需将第一台设为“M”主动的设定，其馀的一定要将插销设定在“S”连动的位置上，如此即可完成动力制动系统的配线。



VFDB 4132 设定位置

插销位置
主动/连动设定端子



NOTE

- 必须在关电的状态下，才能切换插销位置。
- 切换插销位置动作顺序：卸下上盖，然后卸下外壳两旁螺丝共六颗（左右各三颗），再卸下风扇组与外壳间的螺丝共四颗（左右各二颗）。此时，须拔除风扇组的电源线后，将散热片缓慢抽出至露出插销即可，然后切换插销位置。

❾ 制动单元与放电电阻适用一览表

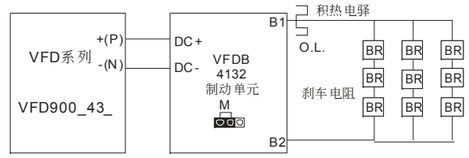
电压	适用电机 HP	适用电机 kW	全载输出转矩 kg-M	每台交流电机驱动器等效刹车电阻规格	制动单元		制动电阻料号		制动转矩 10%ED	每台交流电机驱动器等效最小电阻值	积热电驿规格中心值
460V	120	90	52.5	13500W 5Ω	4132	1	BR1K5W005	9	120	5Ω	110A
	150	110	61	21600W 4Ω	4132	1	BR1K2W008	18	120	4Ω	135A
	175	132	73.5	21600W 4Ω	4132	1	BR1K2W008	18	100	4Ω	135A
	215	160	89	21600W 3.4Ω	4132	1	BR1K2W6P8	18	97	3.4Ω	160A
	250	185	103	27000W 2.5Ω	4132	2	BR1K5W005	18	115	2.5Ω	220A
	300	220	122.5	27000W 2.5Ω	4132	2	BR1K5W005	18	96	2.5Ω	220A

❿ 制动电阻配线图例

NOTE

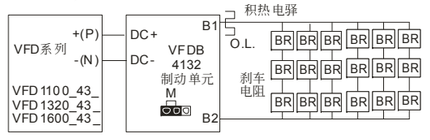
- 在配线前，注意：每台刹车模块的等效刹车电阻不能低于每台制动单元最小等效电阻值（参阅制动单元与放电电阻适用一览表）。

460V 120HP



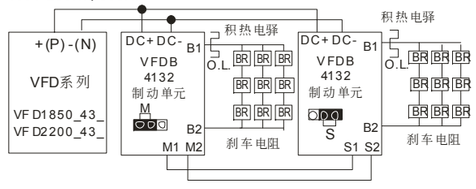
VFD900_43_使用BR1K5W005 9PCS，每3PCS串联后再并联接线

460V 150，175HP, 215HP



VFD1100_43_使用1K2W008 18PCS， 每3PCS串联后再并联接线
VFD1320_43_使用1K2W008 18PCS，每3PCS串联后再并联接线
VFD1600_43_使用1K2W6P8 18PCS，每3PCS串联后再并联接线

460V 250HP, 300HP



VFD1850_43_使用2台 VFDB4132制动单元，
每台使用BR1K5W005 9PCS，每3PCS 串联后再并联接线

VFD2200_43_使用2台 VFDB4132制动单元，
每台使用BR1K5W005 9PCS，每3PCS 串联后再并联接线