Allen-Bradley 1305 Dynamic Brake

Cat. No. 1305-KAA12
1305-KBA03, KBA06, KBA09

Table of Contents

What These Instructions Contain

These instructions contain the necessary information to select, configure, and install dynamic braking. By completing **How to Select a Brake** first, you will be able to determine whether or not dynamic braking is required for your application.

How Dynamic Braking Works

When a motor turns faster than the synchronous speed set by drive output frequency, the motor can generate power which is returned to the drive. Without dynamic braking, power returned to the drive bus can cause bus voltage to rise above the rated limit of the drive. This condition can occur if power returned to the drive exceeds 20% of drive rating. 1305 drives have an overvoltage trip feature to detect this condition and shut down the drive if necessary.

When dynamic braking is added to 1305 drives, excessive power is dissipated in the brake resistors. Increased braking (over 20%) can now take place and an overvoltage trip condition will not occur within the increased limits of the brake.

The 1305 drive monitors the DC bus. When the drive senses a rise in bus voltage and braking action is required, the brake will be activated. Activating the brake adds resistors in parallel to the DC bus, providing a load to dissipate motor power generated during braking. When the DC bus voltage is lowered to within acceptable limits and braking is no longer required, the dynamic brake will be deactivated and the brake resistors will be disconnect from the DC bus.

The dynamic brake is designed to be activated only when required to dissipate excessive energy returned to the DC bus. Typically the brake should be activated (on) only during deceleration and ramp-to-stop.

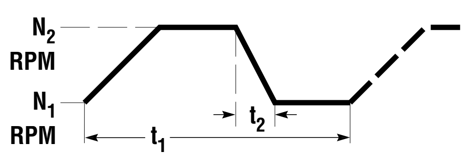
How to Select a Brake

To begin selection the following application information must be obtained.

The Nameplate Horsepower of the motor **HP**.

The nameplate base speed of the motor **H** in **RPM**.

The speed profile of the motor.

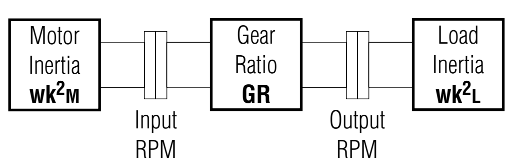


Where:

N_1= The motor's minimum speed in PRM.

N_2= The motor's maximum speed in PRM.

t_1= The motor's cycle time in seconds.



The motor inertia, the nameplate gear reduction ration, and the load inertia.

How to Select a Brake
(continued)

Step 1 — Determine the Rated Motor Torque

$$TQ_M = \frac{5250 \times HP}{N}$$

where:
HP = The nameplate HP of the motor.
N = The nameplate base speed of the motor.

$$TQ_M = \frac{5250 \times \qquad}{\qquad}$$

TQ_M = LB-FT

Step 2 — Determine the Total Inertia

$$wk^2t = wk^2M + [wk^2L \times (GR)^2]$$

where:
wk^2M = The motor inertia.
wk^2L = The load inertia.
GR = The total reduction ratio $\frac{\text{Output RPM}}{\text{Input RPM}}$

$$wk^2t = \qquad + [\qquad \times (\quad)^2]$$

wk^2t = LB-FT^2

Step 3 — Determine the Required Braking Torque

$$TQ_B = \frac{wk^2t \times [N_2 - N_1]}{308 \times t_2}$$

$$TQ_B = \frac{[\qquad] \times [\qquad - \qquad]}{308 \times [\qquad]}$$

where:
wk^2_t = The total inertia.
N_2 = The motor's maximum speed.
N_1 = The motor's minimum speed.
t_2 = The motor's decel time.

TQ_B = LB-FT

Step 4 — Determine the Required Percent of Braking Torque

$$TQ\% = \frac{TQB}{TQM} \times 100$$

where:
TQB = The required braking torque.
TQM = The rated motor torque.

$$TQ\% = \frac{[\qquad]}{[\qquad]} \times 100$$

TQ% = %

If **TQ%** is less than 20%, dynamic braking is not required. The inherent braking of the drive should be sufficient to handle the application requirements.

If **TQ%** is 20% or more, a dynamic brake is required. Continue to **Step 5**.

How to Select a Brake
(continued)

Step 5 — Determine the Maximum Generated Braking Torque

Three factor limit the application

The first is the brake assembly rating **P_T** — The peak power the brake assembly can absorb at any instant regardless of the time limit.

The second is the average power that the brake assembly can absorb during one braking duty cycle — **P_A**.

The third is the duty cycle or the number of times the brake assembly can be operated over a given period of time — **DC**.

$$P_M = \frac{TQ_B \times N_2}{7{,}000}$$

where:
TQ_B = The required braking torque.
N_2 = The motor's maximum speed.

$$P_M = \frac{[\quad] \times [\quad]}{}$$

P_M = kW

P_M must be less than or equal to the brake assembly rating listed in **table 1**. If **P_M** exceeds the **P_T** value shown, the corresponding drive/brake configuration will not be able to produce the braking torque required for your application, and the drive will trip on an overvoltage fault. Increasing the decel time **t_2**, reducing the load inertia **wk^2_L**, or doing both will lower **TQ_B** and **P_M**.

table 1

Drive Output Ratings			P_T
HP	kW	**Dynamic Brake Kits**	**kW**
230V AC			
2	1.5	**1305-KAA12**	**1.7**
3	2.2		
460V AC			
1/2	0.37	**1305-KBA03**	**1.7**
3/4	0.55		
1	0.75		
2	1.5	**1305-KBA06**	**1.7**
3	2.2	**1305-KBA06**	
5	4	**1305-KBA09**	**3.4**

Step 6 — Determine the Average Power Generated in One Cycle

$$P_A = \frac{TQ_B \times [N_1 + N_2]}{14{,}000}$$

where:
TQ_B = The required braking torque.
N_1 = The motor's minimum speed.
N_2 = The motor's maximum speed.

$$P_A = \frac{[\quad] \times [\quad + \quad]}{14{,}000}$$

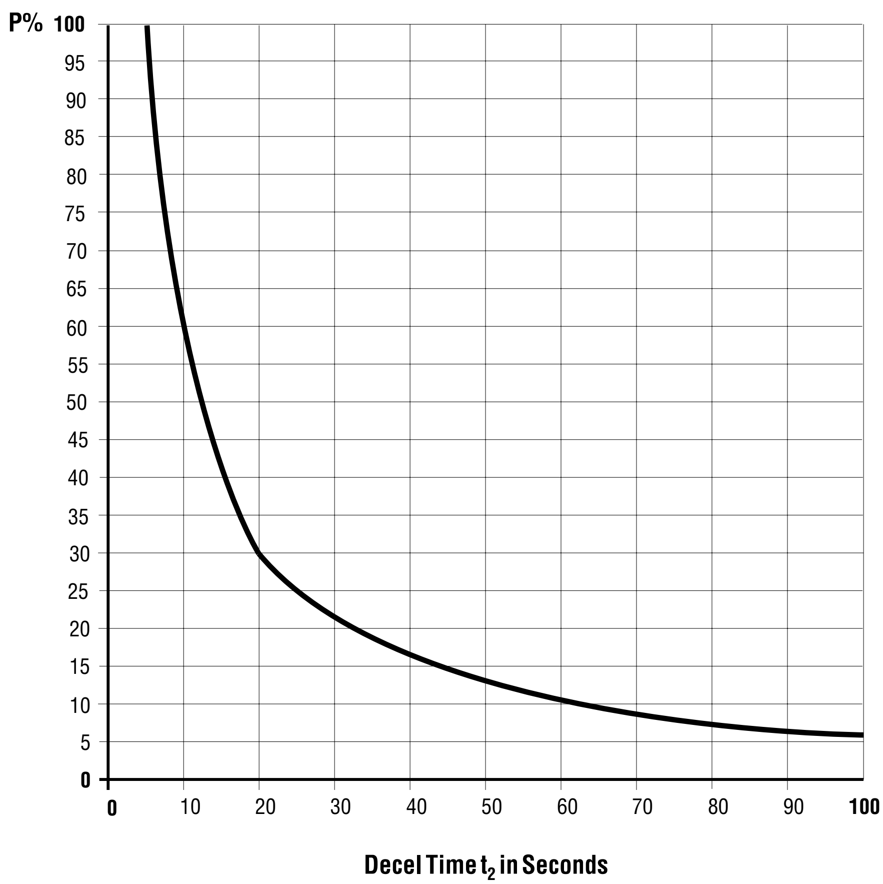
P_A = kW

How to Select a Brake
(continued)

Step 7 — Determine the Ratio of the Average Power to the Brake Assembly Rating.

$P\% = \dfrac{P_A}{P_T}$	where:
	P_A = The average power generated in one cycle.
	N2 = The brake assembly rating from **table 1**.
$P\% = \dfrac{[\quad]}{[\quad]}$	P% = %

Find the intersection of **P%** and the motor's decel time t_2 in the chart below. If the point of intersection is below the curve, the average power of one cycle is within the brake's limits. If the point is above the curve, the average power is beyond the brake's limits but may be reduced by increasing the motor's decel time t_2, reducing the load inertia wk^2_L, or doing both.



How to Select a Brake
(continued)

Determine if the Duty Cycle is within the Brake's Capability.

$$DC = \frac{t_2}{t_1} \times 100$$

where:

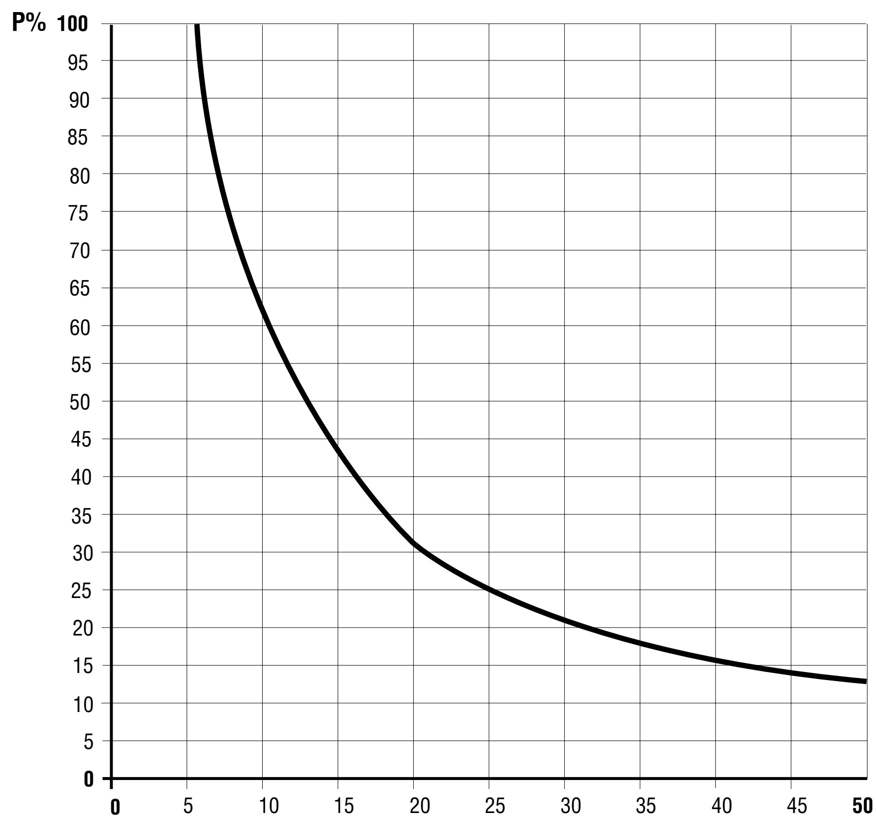
t_1 = The motor's cycle time.

t_2 = The motor's decel time.

$$DC = \frac{[\quad]}{[\quad]} \times 100$$

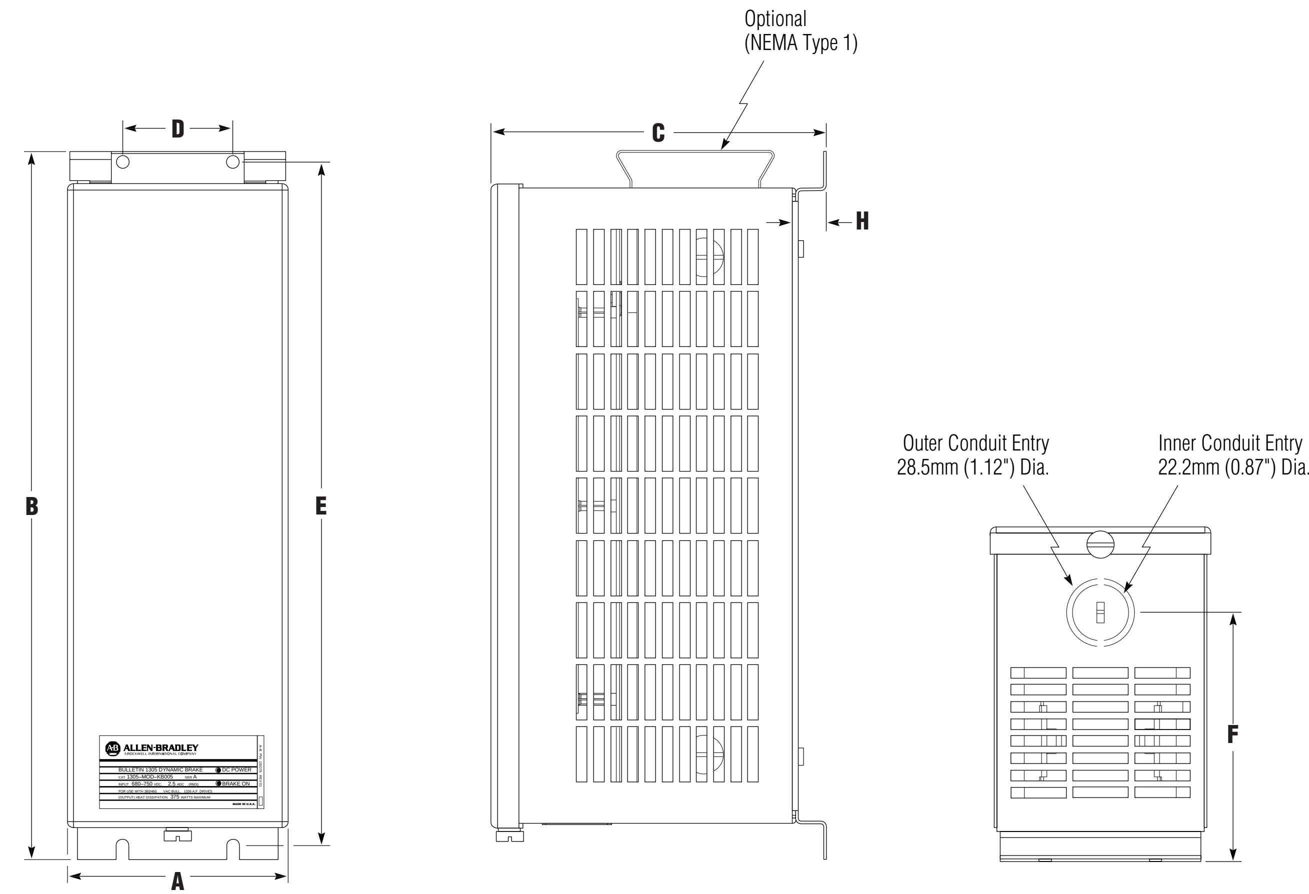
DC = %

Find the intersection of **P%** and the motor's decel time **DC** in the chart below. If the point of intersection is below the curve, the duty cycle is within the brake's limits. If the point is above the curve, the duty cycle is beyond the brake's limits but may be modified by increasing the motor's cycle time t_1.



KAA12, KBA03, KBA06 Dimensions, Weights, and Conduit Entry Locations

Important: Dynamic brakes KAA12, KBA03 and KBA06 can be used with any 1305 drive.



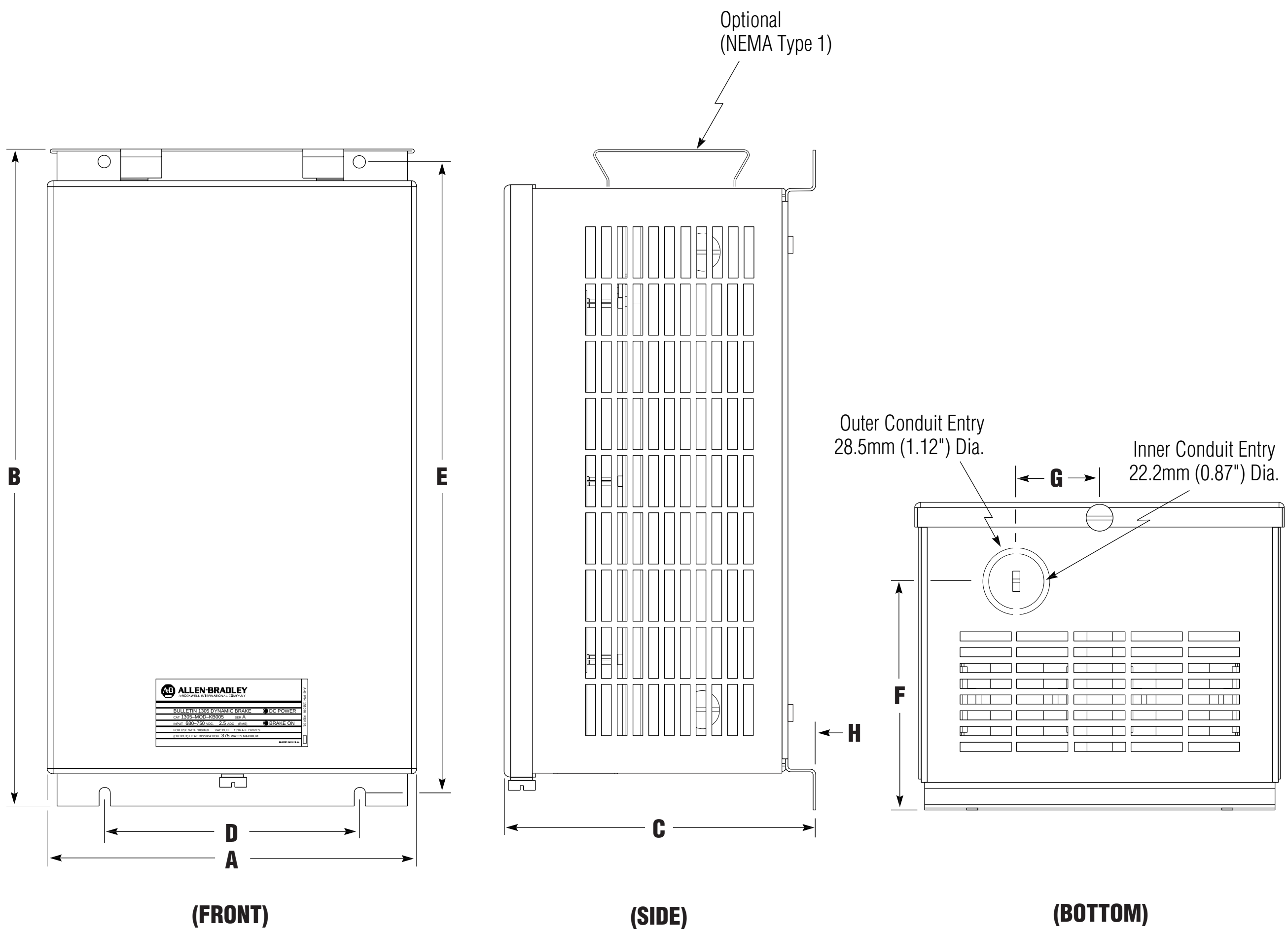
(FRONT) (SIDE) (BOTTOM)

HP	Voltage	**Catalog Number**	Approximate Shipping Wt.	**A Width**	**B Height**	**C Depth**	D	E	F	G	H
2 & 3	230V AC	**1305-KAA12**	3.4 (7.5)								
1/2, 3/4, 1	460V AC	**1305-KBA03**	3.4 (7.5)	**101.6 (4.00)**	**327.7 (12.90)**	**153.9 (6.06)**	50.8 (2.00)	315.0 (12.40)	114.6 (4.51)	N/A	12.7 (0.50)
2 & 3	460V AC	**1305-KBA06**	3.7 (8.1)								

KBA09 Dimensions, Weights, and Conduit Entry Locations

Important: Dynamic brakes KAA12, KBA03 and KBA06 can be used with any 1305 drive.

ATTENTION: Use Dynamic Braking Model KBA09 with Series B of later 1305 Drives only. Component damage or drive failure will occur if Model KBA09 is used with Series A 1305 Drives. Braking Model KBA06 may be used on a 5HP Series A 1305 Drive (3HP braking torque maximum).



HP	Voltage	**Catalog Number**	Approximate Shipping Wt.	**A Width**	**B Height**	**C Depth**	D	E	F	G	H
5	460V AC	**1305-KBA09**	5.9 (13)	**184.2 (7.25)**	**327.7 (12.90)**	**153.9 (6.06)**	127.0 (5.00)	315.0 (12.40)	114.6 (4.51)	41.4 (1.63)	12.7 (0.50)

Specifications

Braking Torque	100% torque for 20 seconds (typical).
Duty Cycle	20% (maximum).
Temperature	0˚C to 50˚C (32˚F to 122˚F).
Humidity	0 to 95% non-condensing.
Atmosphere	Cannot be used in atmospheres having corrosive or hazardous dust, vapor, or gas.
Altitude Derating	0 to 1,000 meters without derating.
Enclosure Type	IP20
Codes and Standards	UL, cUL.

ATTENTION: Electric Shock can cause injury or death. Remove all power before working on this product.

For all dynamic brake ratings, DC brake power is supplied from the drive DC Bus.

Hazards of electrical shock exist if accidental contact is made with parts carrying bus voltage. A bus charged indicator on the drive provides visual indication that bus voltage is present. Before proceeding with any installation or troubleshooting activity, allow at least 60 seconds after input power has been removed for the bus circuit to discharge.

Brake Fuse

All dynamic brakes are internally fused to protect brake components. When replacing the brake fuse, use only the type and size specified below. Replace the brake if the fuse blows repeatedly.

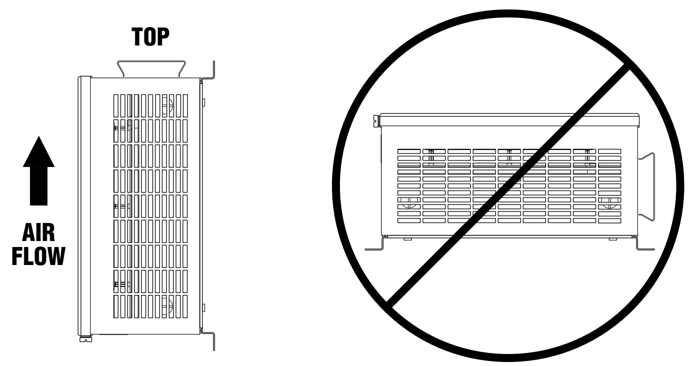
Important: Brakes are not repairable.

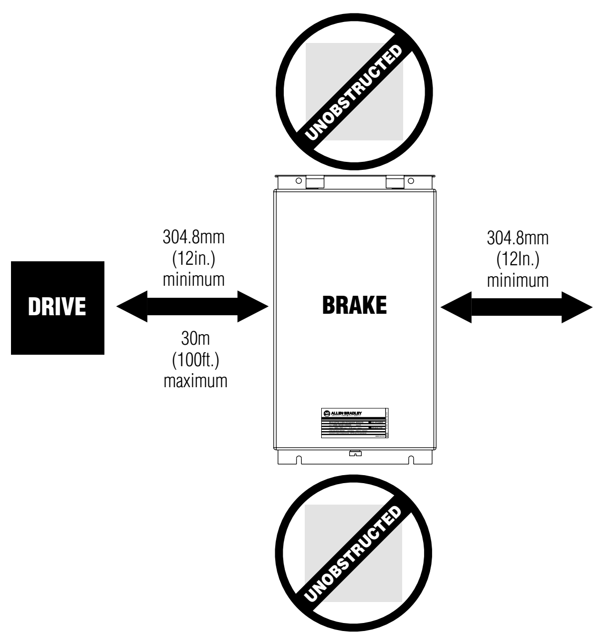
Dynamic Brake	Fuse	Type	Rating
KAA12	F1	Gould Shawmut A60Q15-2	15A, 230V
KBA03	F1	Gould Shawmut A60Q10-2	10A, 460V
KBA06	F1	Gould Shawmut A60Q10-2	10A, 460V
KBA09	F1	Gould Shawmut A60Q10-2	10A, 460V

Mounting Requirements

Dynamic brake enclosures must only be installed in the vertical position. Select a location using the following guidelines.

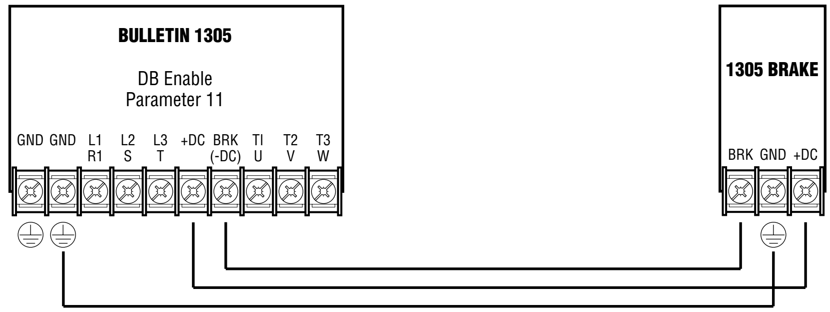
- Each dynamic brake enclosure must be mounted outside of any other enclosure or cabinet and exposed to unrestricted circulating air for proper heat dissipation. Allow a minimum of 304.8 mm (12 in.) between brake enclosures and all other enclosures or cabinets including the drive.
- The brake enclosure must be mounted within 30 m (100 ft.) of the drive.





Recommended Brake Mounting Configuration

Wiring Scheme



Terminal Block Wiring Capacity

Screw Size, Wire Size and Torque Specifications.

Terminal	Screw Size	Maximum/Minimum Wire Size	Maximum Torque
TB1	M4	4/0.75 mm (10/18 AWG)	1.81 N-m (16 lb-ins.)

Setup

ATTENTION: The dynamic brake unit contains a thermostat to guard against overheating and component damage.

If the duty cycle, torque setting and/or ambient temperature exceeds the specifications listed in this publication, the thermostat is designed to trip and disable the brake.

If reduced braking torque represents a potential hazard to personnel, auxiliary stopping methods must be considered in the machine and/or control circuit design.

P.011 — Set **DB Enable** to **Enable**

This parameter must be set to enable when dynamic braking is installed. Refer to your 1305 User Manual for programming procedures and record the changes for future reference.

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