



1332 MOD K-K5

Heavy Duty Dynamic Braking

Description

The Bulletin 1332 Heavy Duty Dynamic Braking Option Kit contains the components necessary to increase the dynamic braking performance of the Bulletin 1332 Adjustable Speed Drive. The kit is rated to increase the Drive braking torque capability from 20% to 100% torque. The kit is available in several different configurations matched to the various Drive power ratings as shown below:

MOD Kit Catalog Number	Drive Description			Component Part Numbers	
	Voltage	Model	Nominal HP	Dynamic Brake Unit	Brake Resistor Unit
1332 MOD-K	230	ZAA	3/4	117771	40415-001
		AAA	1		
		YAA	2		
		BAA	3		
		CAA	5		
1332 MOD-K2	230	DAA	7.5	117771	40415-003
		EAA	10		
		FAA	15		
		GAA	20		
1332 MOD-K3	460	AAB	1	117772	40415-002
		YAB	2		
		BAB	3		
		CAB	5		
1332 MOD-K4	575	AAC	1	119840	40415-004
		YAC	2		
		BAC	3		
		CAC	5		
1332 MOD-K5	575	DAC	7.5	119840	40415-005
		EAC	10		
		FAC	15		

The kit consists of two units that function together to provide the braking action.

1. The Dynamic Brake Unit - controls the braking action and provides protection against brake overload.
2. The Brake Resistor Unit - provides the braking load and dissipates the power generated by the braking action. Both units are supplied loose for customer mounting. Field interconnection between each unit and the Drive is required.

These instructions include information on specifications, installation, operation, troubleshooting and application.

Specifications

Braking Torque	100% Torque for 20 seconds (typical)
Duty Cycle	20% typical (4 seconds between braking cycles for every second of brake operation)
Input Power Requirements	MOD K, K2 - 208/220/230V AC, ± 10%, Single-Phase, 50/60 Hz, 20 VA MOD K3 - 380/415/460V AC, ± 10%, Single-Phase, 50/60 Hz, 20 VA MOD K4, K5 - 575V AC, ± 10%, Single-Phase, 50/60 Hz, 20 VA
Temperature	-10° to 50° C (14° to 122° F)
Humidity	5% to 95% non-condensing
Atmosphere	No corrosive gas or excessive dust
Vibration	Below 0.56
Altitude	3,300 Feet (1000m) maximum without derating
Enclosure Type	NEMA Type 1

Installation



WARNING: To avoid a shock hazard, ensure that all power to the Drive has been removed and that the bus is discharged before performing the following connections.

Both the Dynamic Brake and Brake Resistor Units require field mounting and interconnection. The Dynamic Brake Unit must be mounted in an area where the environment does not exceed the values listed in the specifications. Refer to Figure 1 for Dynamic Brake Unit dimensions. The Brake Resistor Unit must be mounted on the outside of any enclosure and exposed to free circulating air for proper heat dissipation. Refer to Figure 2 for Brake Resistor Unit dimensions and Figure 3 for mounting location recommendations and constraints.

IMPORTANT: Follow local codes and industry standards regarding wire color, gauge, insulation rating/type, and use of conduit or raceways.

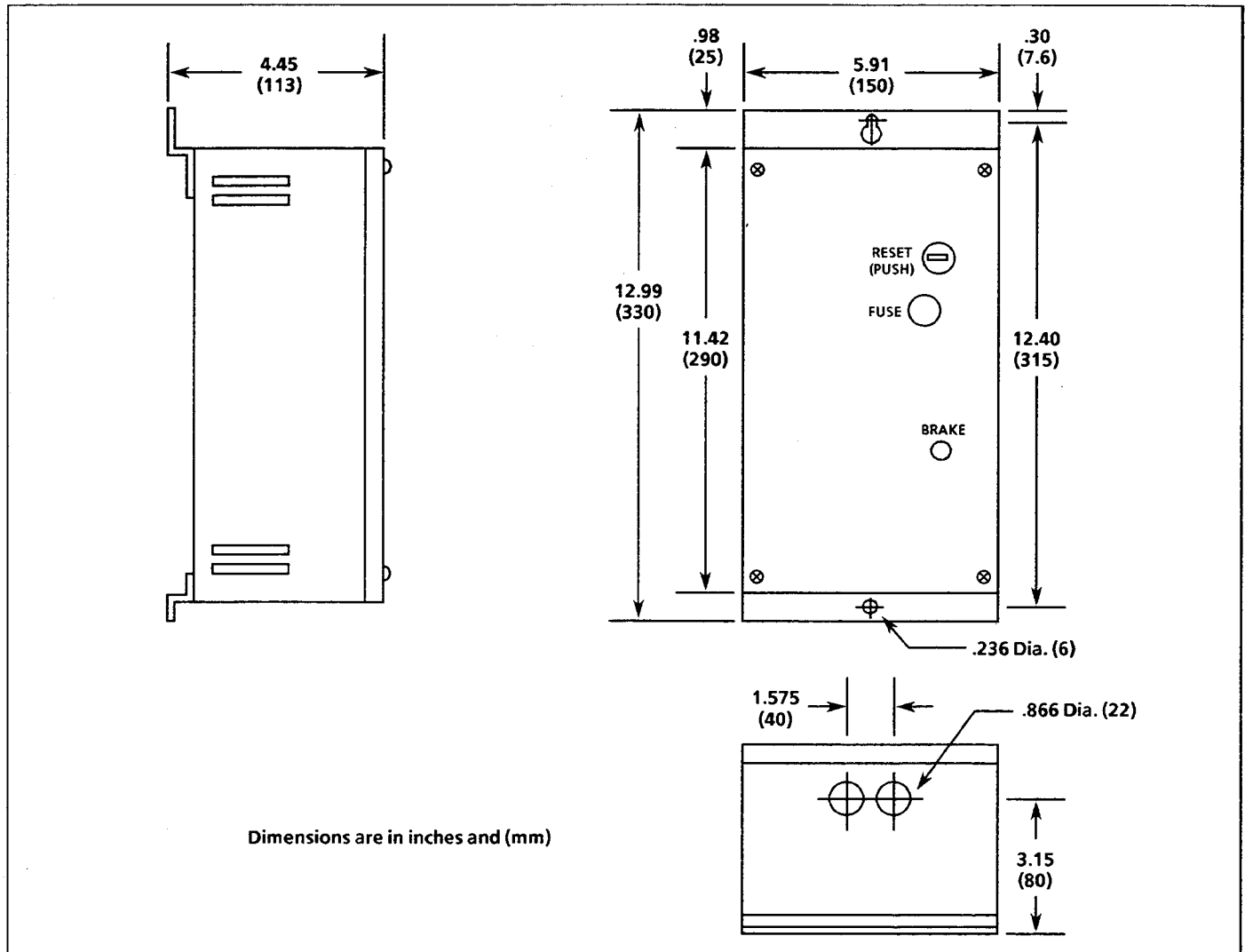


Figure 1 – Dynamic Brake Unit Dimensions (all units)

Installation
(Continued)

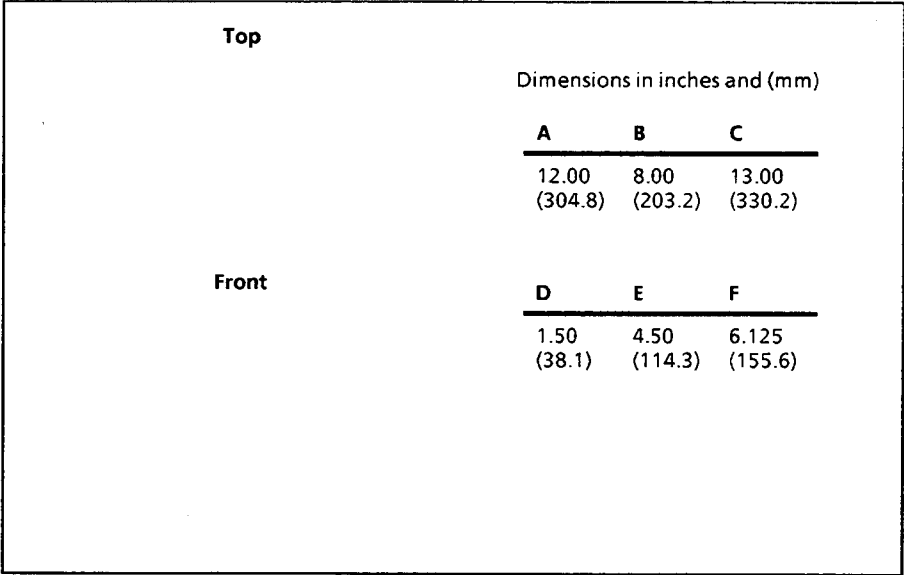


Figure 2 – Brake Resistor Unit Dimensions (all units)

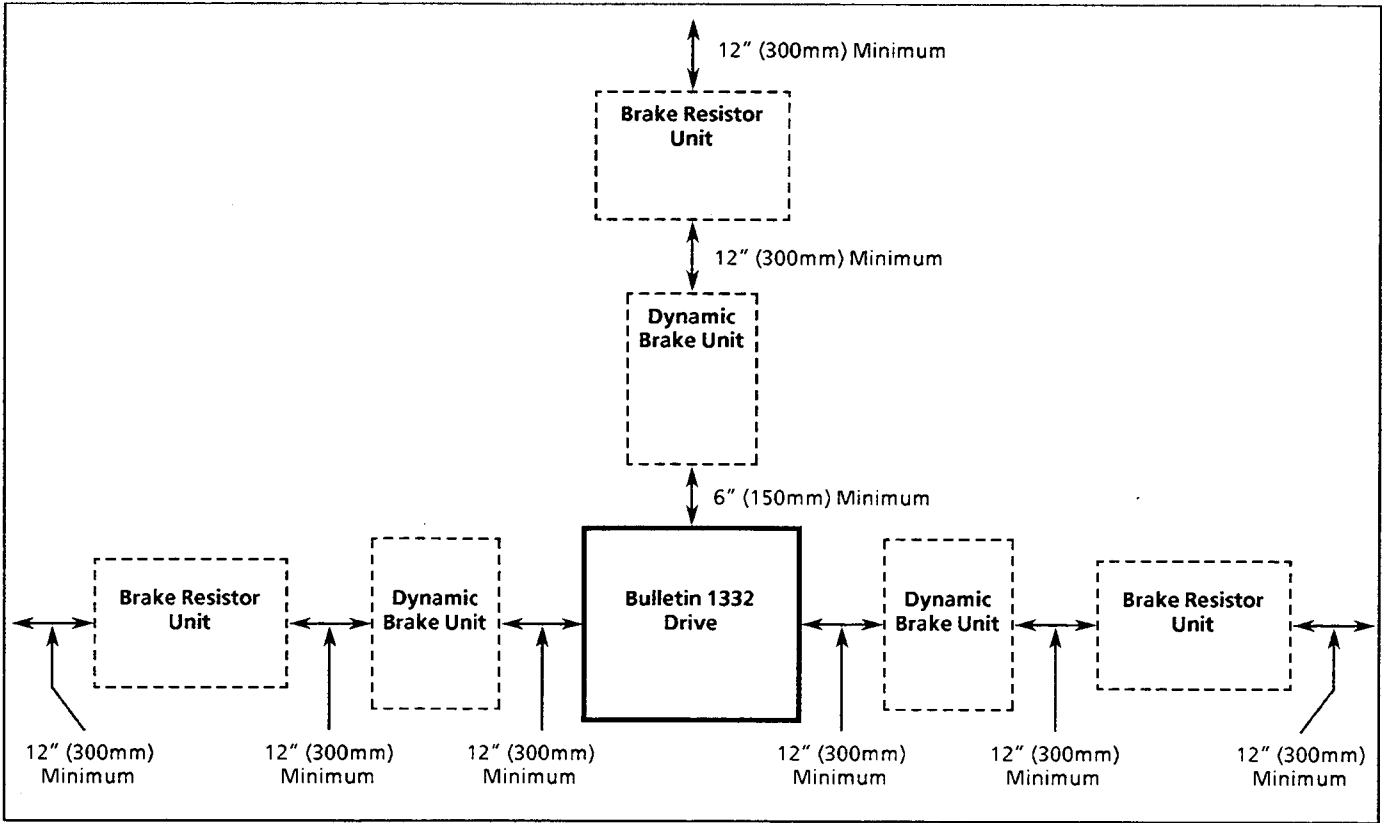


Figure 3 – Recommended Mounting Locations

Installation
(Continued)

- 1. Using the following instructions, construct two (2) power cable assemblies. Each assembly will be made up of one (1) red and one (1) black wire twisted together. The wires must be 12 gauge (minimum), 600V AC insulation, and a maximum length of 10 feet (twisted).

Wiring from the Dynamic Brake Unit to the Brake Resistor Unit

- 2. Connect the red wire of one assembly to terminal "P" of the Dynamic Brake Unit.
Connect the black wire to terminal "PR" of the Dynamic Brake Unit. Refer to Figure 4.
- 3. Carefully route the cable assembly to the Brake Resistor Unit and trim the wires to the appropriate length.

IMPORTANT: The Brake Resistor Unit does not contain polarity sensitive devices. Selection of wire terminations at this unit is not critical. However, the Dynamic Brake Unit *does* contain polarity sensitive devices. Careful attention to polarity and wire terminations is required.

- 4. Splice one wire of the cable to one of the leads in the Brake Resistor Unit conduit box. Splice the remaining cable wire and lead. Insulate the splices as required.

Wire Interconnections from the Dynamic Brake Unit to the Drive



CAUTION: The Bulletin 1332 Drive and Dynamic Brake Unit both contain polarity sensitive devices. Damage to the Drive may occur from incorrect terminations.

- 5. Connect the red wire of the second cable assembly to terminal "P" of the Dynamic Brake Unit.
Connect the black wire to terminal "N" of the Dynamic Brake Unit. Refer to Figure 4.
- 6. Carefully route the cable assembly from the Dynamic Brake Unit to the Drive. Trim wires to appropriate length.
- 7. Connect the remaining end of the red wire to terminal "P" of the Drive power terminal block.
Connect the black wire to terminal "N" of the Drive power terminal block.
- 8. Construct a two-wire *twisted* cable assembly for the interconnection between the AC input and the Dynamic Brake Unit. The wires must be 16 gauge (minimum), 600V AC insulation and a maximum length of 10 feet (twisted).

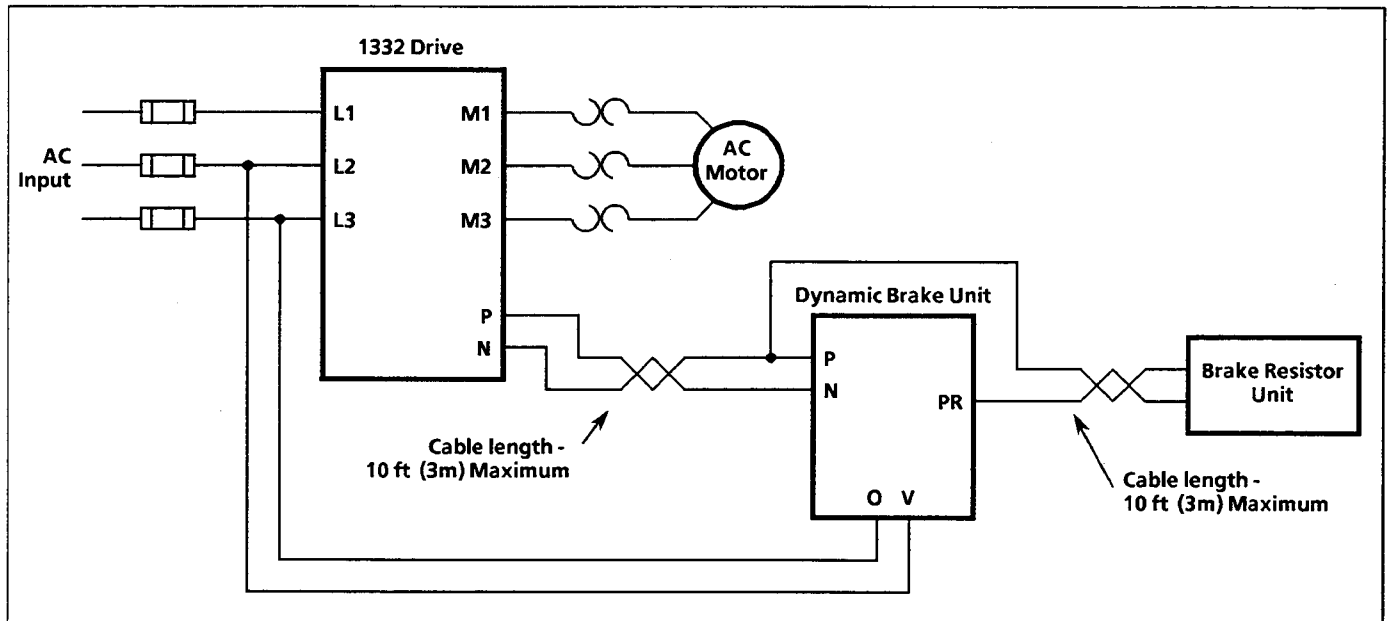


Figure 4 – Interconnection Diagram

Installation
(Continued)

- 9. Using the Table below, select the correct Dynamic Brake Unit “V” terminal (based on input voltage) to be used for interconnection.

Table 1
Terminal Selection

1332-Mod	AC Input Voltage	Terminal
K & K2	208V AC, 50/60 Hz	V-200
	220V AC, 50/60 Hz	V-220
	230V AC, 60 Hz	V-230
K3	380V AC, 50 Hz	V-380
	415V AC, 50 Hz	V-415
	460V AC, 60 Hz	V-460
K4 & K5	575V AC, 50/60 Hz	V-575

Connect one wire of the assembly to the “V” terminal selected above.

Connect the other assembly wire to terminal “O” of the Dynamic Brake Unit. Refer to Figure 4.

- 10. Route the cable assembly to the Drive and trim the cable to the appropriate length.
- 11. Connect the remaining ends of the cable assembly to terminals “L2” and “L3” of the Drive power terminal block. See Figure 4.



CAUTION: Proper polarity of some connections between the Dynamic Brake Unit and the Bulletin 1332 Drive is critical. Verify that terminal “P” of the Drive is connected to terminal “P” of the Dynamic Brake Unit. Verify that terminal “N” of the Drive is connected **only** to terminal “N” of the Dynamic Brake Unit. If proper connections are not made, damage will occur to the Drive.

Adjustments



WARNING: To avoid a shock hazard, **REMOVE DRIVE POWER** before performing the following adjustments.

Using Table 2, properly set switch SW1 and the thermal overload setting on the Dynamic Brake Unit. Refer to Figure 5 for component locations.

Table 2
Dynamic Brake Unit Adjustments

1332 Model	HP	Input Voltage	Dynamic Brake Unit	
			SW1 Position	Overload Current Setting
ZAA	3/4	230V AC	1	7.5 A
AAA	1			
YAA	2			
BAA	3			
CAA	5			
DAA	7.5	230V AC	2	10.0 A
EAA	10			
FAA	15			
GAA	20	230V AC	3	10.0 A
AAB	1	460V AC	1	3.5 A
YAB	2			
BAB	3			
CAB	5			
AAC	1	575V AC	1	3.0 A
YAC	2			
BAC	3			
CAC	5			
DAC	7.5	575V AC	2	4.0 A
EAC	10			
FAC	15			

Perform the following adjustments on the Bulletin 1332 Drive:

1. Set switch 2 of switch assembly DSW1 to *OFF*. This turns the Overvoltage Stall Protection off to avoid interference with the dynamic braking action.
2. Select the stopping mode desired:
 - a) If braking action is desired when the Drive is stopped, then "Ramp to Stop" must be selected. Set switch 1 of DSW1 to *OFF*.
 - b) If braking action is desired on speed changes only and not when the Drive is stopped, then "Coast to Stop" must be selected. Set switch 1 of DSW1 to *ON*.

Replace and secure all covers previously removed.

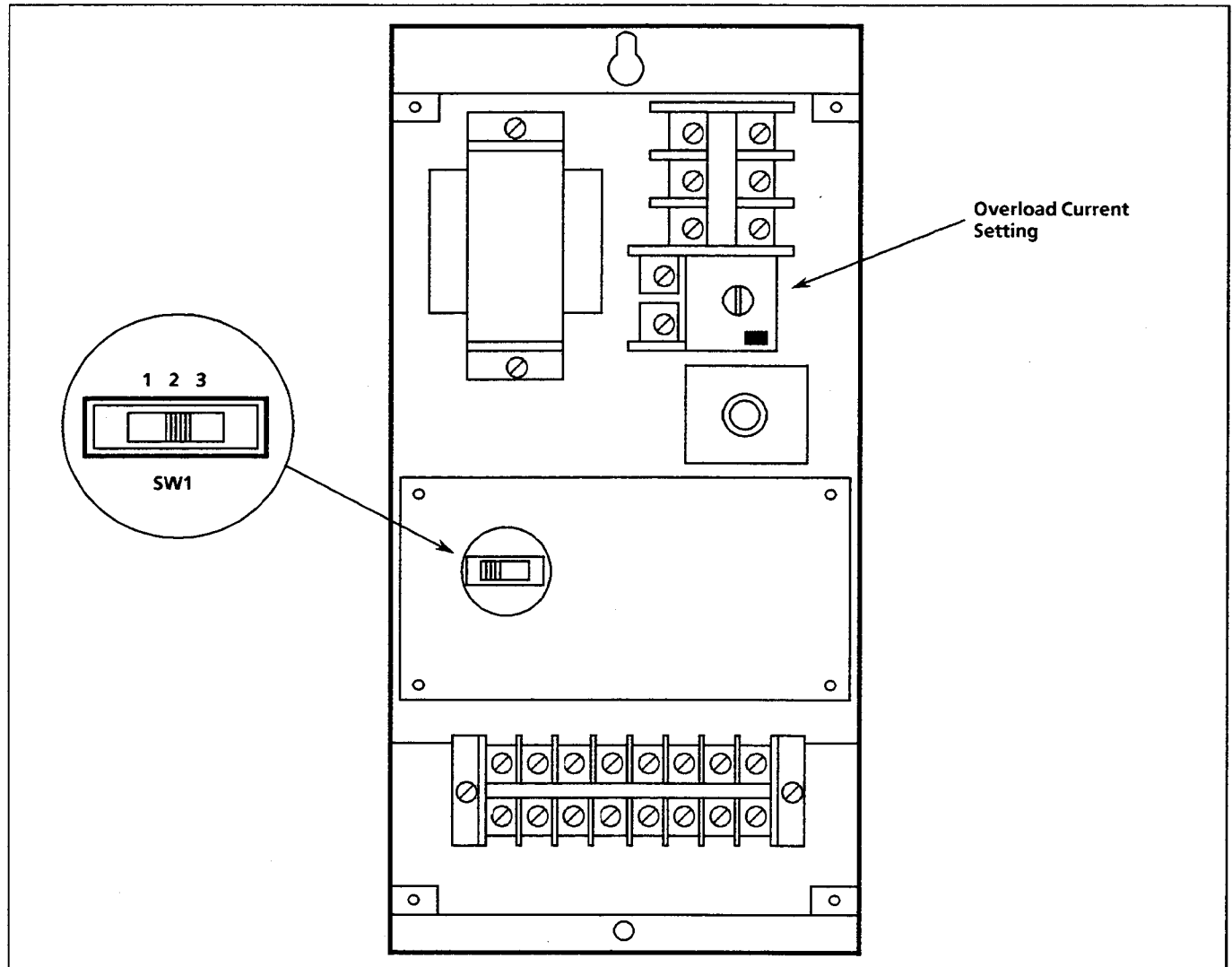


Figure 5 – Dynamic Brake Unit Component Locations

Operation

Refer to the Dynamic Braking Circuit Block Diagram presented in Figure 6. When a motor is in the braking mode, it generates power which is returned to the Drive. Without the Heavy Duty Dynamic Braking Kit, power returning to the bus can cause the voltage to rise above the rated capacity of the Drive. The Drive has an Overvoltage Trip feature to detect this condition and shut the Drive down, if necessary.

Excessive power is dissipated in the brake resistors (external to the Drive) when the Heavy Duty Dynamic Braking Kit is employed. Increased braking action can now take place since an Overvoltage Trip condition will not occur (unless the load inertia or duty cycle is beyond the limits of this option).

The Dynamic Brake Unit monitors the DC bus in the Drive. When braking action is required, the Dynamic Brake Unit will sense a rise in the DC bus and activate a transistor. The transistor will then place the resistors in the Brake Resistor Unit across the DC bus. This action will give the Drive a "load" to dissipate the motor power generated during braking.

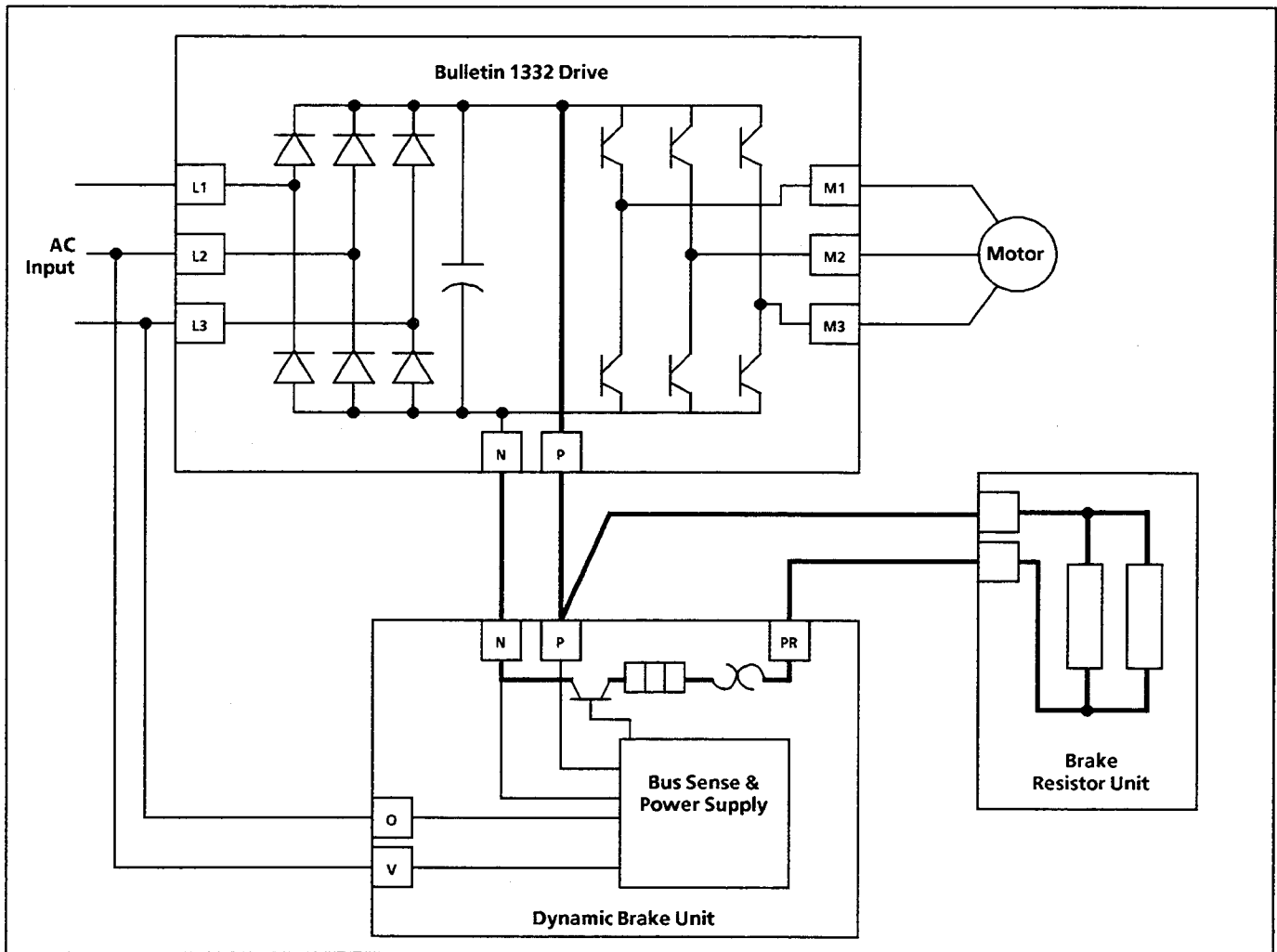


Figure 6 – Dynamic Braking Circuit Block Diagram

Operation
(Continued)

When the DC bus voltage is lowered to within acceptable limits, the Dynamic Brake Unit will shut the transistor off, disconnecting the brake resistors from the DC bus.

During normal operation, the Dynamic Brake Unit is designed to be activated when the Drive is in a decelerating or stopping mode. The **only** exception is if the motor connected to the Drive has an overhauling load.

The Dynamic Brake Unit *must not* be on during the following conditions:

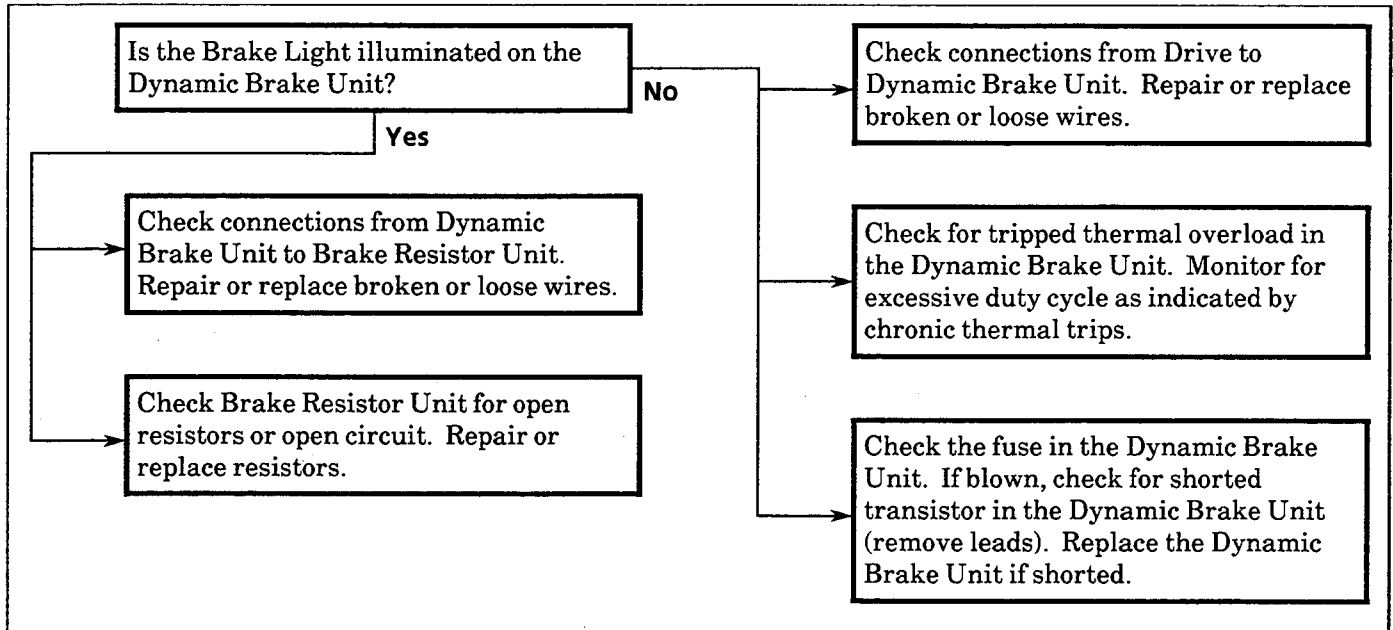
1. The motor is stopped (deceleration completed).
2. The motor is accelerating.
3. The motor is at set speed (no overhauling load).

If the Dynamic Brake Unit is on during any of the above conditions, improper brake operation has occurred and corrective action must be taken.

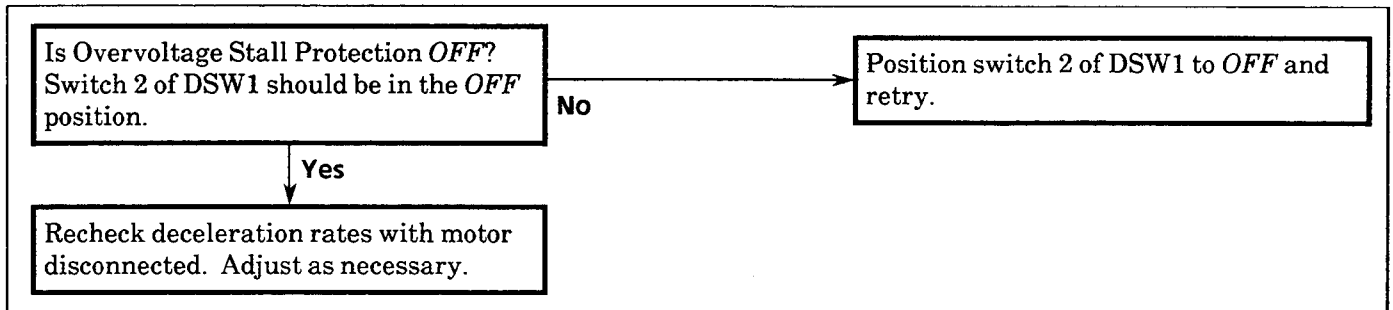
Troubleshooting

The following charts indicate several malfunctions and the approved procedure for correcting these malfunctions.

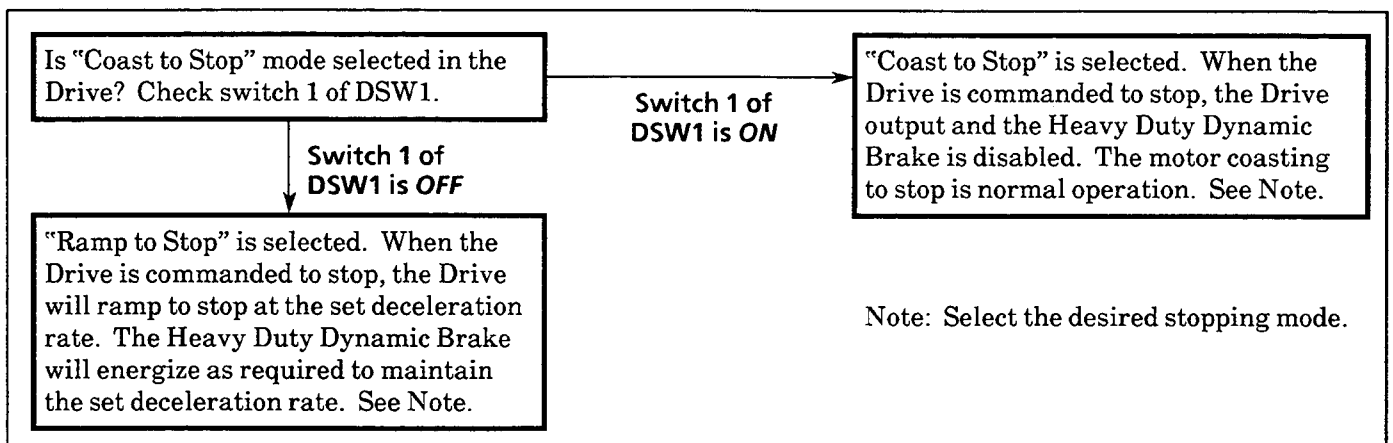
1. Drive Shuts Down on an Overvoltage Trip during Deceleration.



2. Drive Decelerates but Slower than the Set Deceleration Rate – No Overvoltage Trip.



3. No Braking Action when a Drive Stop is Initiated – Motor Coasts to a Stop.



Application

This section will help the user determine if the Heavy Duty Dynamic Braking Kit is required and if his application is within the capability of the kit.

1. Is a Braking Kit required?

- a) Determine speed profile and times for the application. See Figure 7.

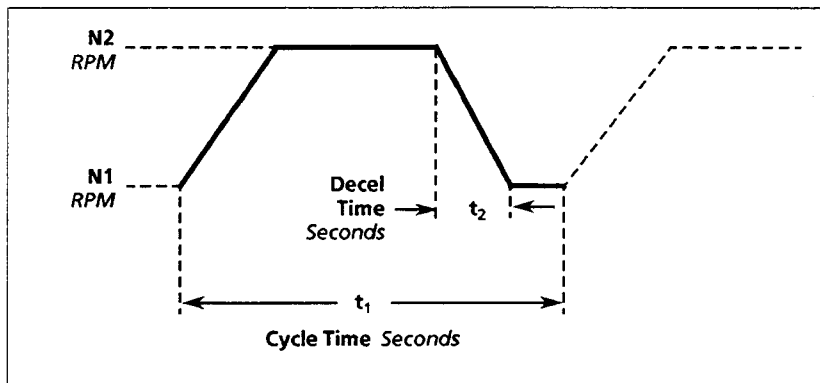


Figure 7 – Speed Profile

- b) Calculate the inertia of the system in relation to the motor shaft. See Figure 8.

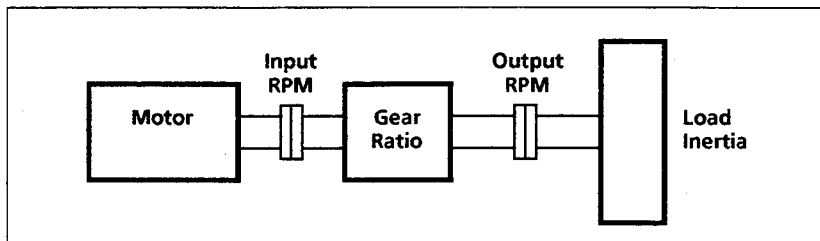


Figure 8 – System Block Diagram

Motor Inertia (wk^2_m) = _____

Load Inertia (wk^2_L) = _____

Gear Ratio (GR) = _____ $\frac{\text{Output RPM}}{\text{Input RPM}}$

Total Inertia (wk^2_t) = $wk^2_m + wk^2_L \times (GR)^2$

- c) Determine the Braking Torque required.

Braking Torque (TQb) = $\frac{wk^2_t \times (N2 - N1)}{308 \times t_2}$ Lb-Ft

Application
(Continued)

d) Determine if a Braking Kit is required.

Calculate the motor rated torque.

$$TQ_m = \frac{5250 \times \text{HP}}{\text{RPM}} \text{ Lb-Ft}$$

HP = Motor Rated HP
RPM = Motor Base Speed

Determine the braking torque percentage.

$$\%TQ = \frac{TQ_b}{TQ_m} \%$$

If %TQ is less than 20%, then a Braking Kit may not be required. The inherent braking in the Drive may be sufficient to handle the braking requirement.

If %TQ is greater than 20%, a Braking Kit is required.

2. Determine if the generated braking power is within the limits of a Braking Kit.

Three factors limit the application of a Braking Kit. One is the peak power the brake can handle at any instant (regardless of time limit). The second is the power the brake can handle during one braking cycle. The third factor is the brake duty cycle or the number of times the brake can be operated over a given period of time. The calculations below are used to determine if a given operation is within the required limits. The calculations can also be used to determine if any change is required to keep operation within the brake limits.

a) Determine if the generated braking power is within the peak power rating of the Braking Kit.

Calculate the maximum generated braking power (P_{max}).

$$P_{max} = \frac{TQ_b \times N2}{7} \text{ Watts}$$

P_{max} must be less than or equal to the values listed in Table 3. If P_{max} exceeds the values listed, contact your Allen-Bradley sales office for assistance.

Table 3
Maximum Power (P_{max}) Limits

1332-Mod	Drive HP	P_{max} Limit
K, K3 & K4	3/4 to 5	5,100 Watts
K2 & K5	7.5 to 15	10,250 Watts
	20	13,650 Watts

Application
(Continued)

b) Calculate the average power (P_{av}) in one cycle and duty cycle.

$$P_{av} = \frac{TQb \times (N1 + N2)}{14} \text{ Watts}$$

Calculate the duty cycle.

$$\text{Duty Cycle (D)} = \frac{t_2}{t_1} \%$$

3. Locate the graphs on the following pages which correspond to the horsepower of the Drive being used.

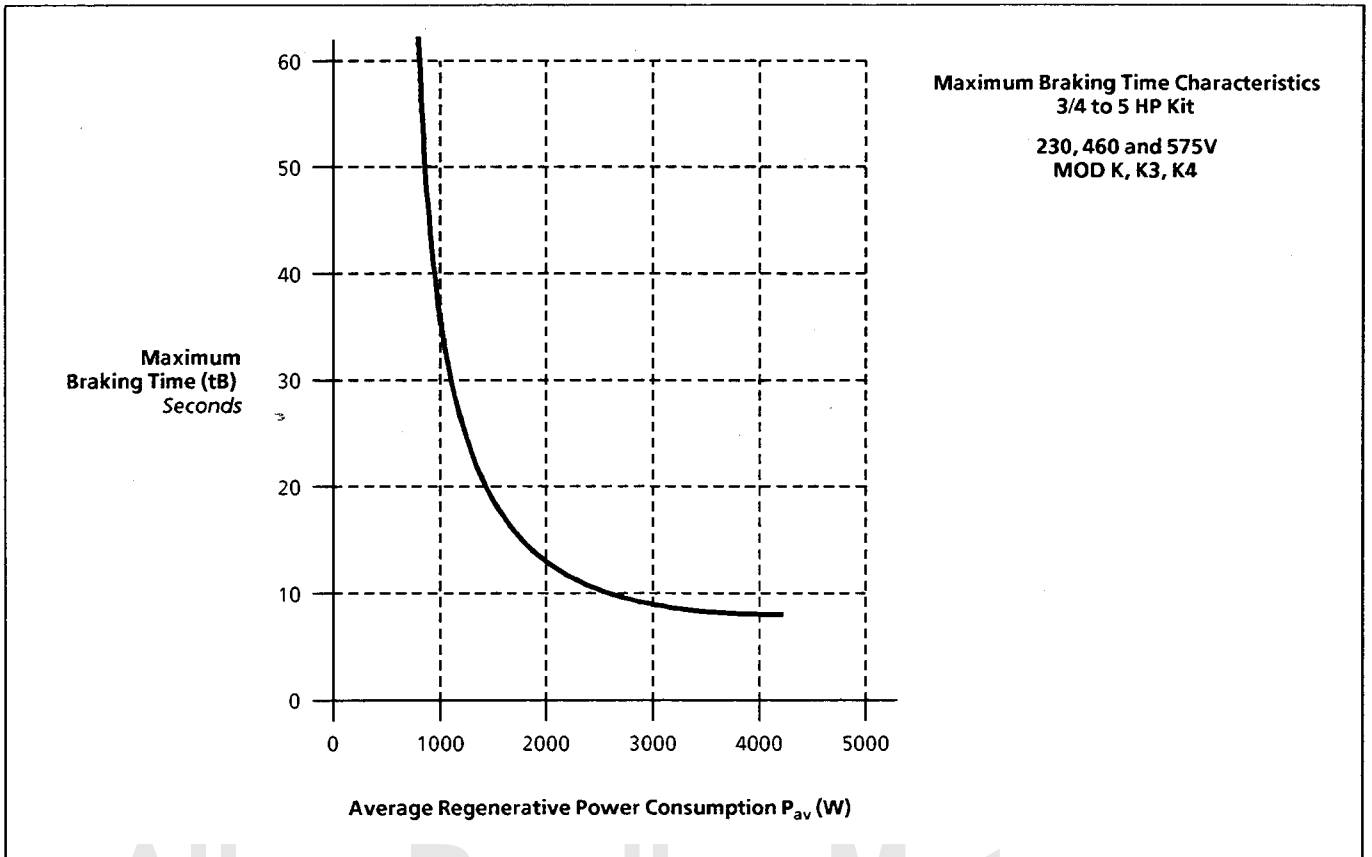
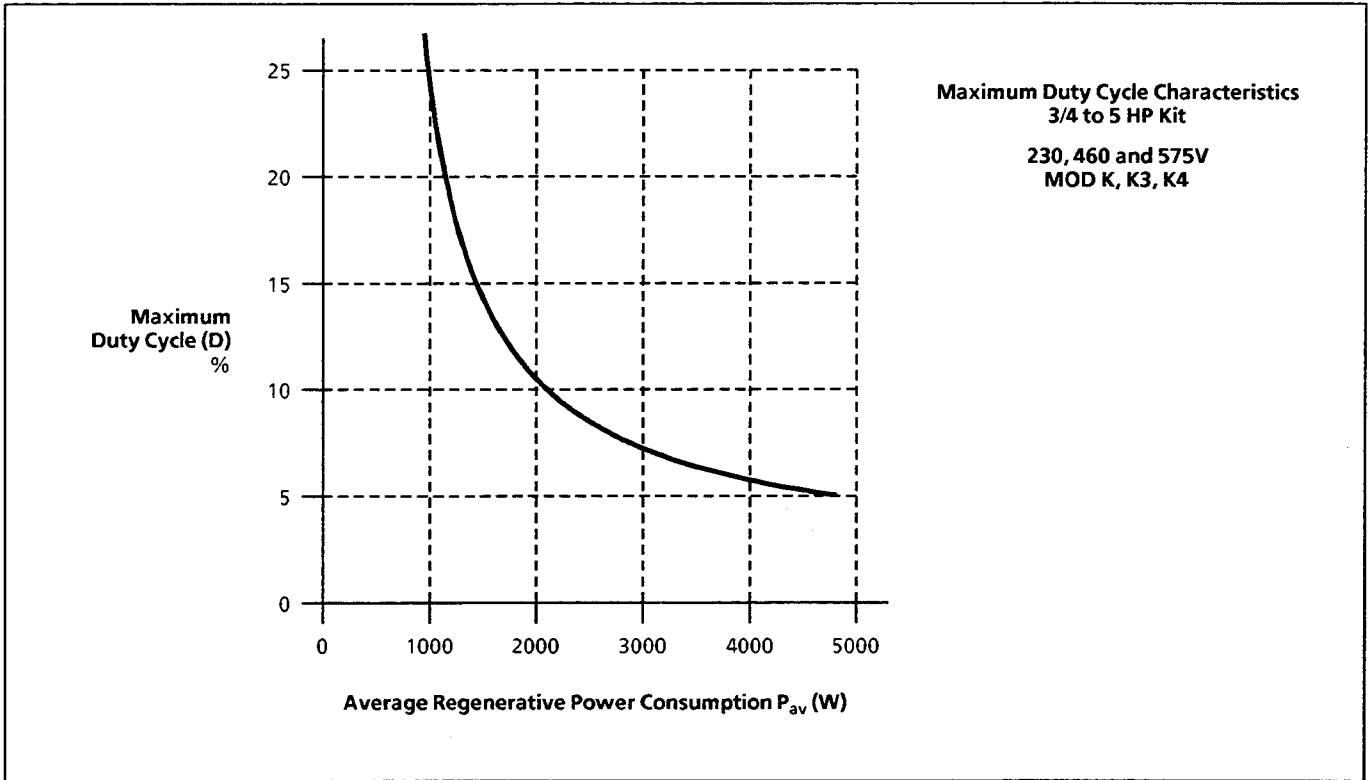
a) Plot the value calculated for average power (P_{av}) on both graphs of that particular page.

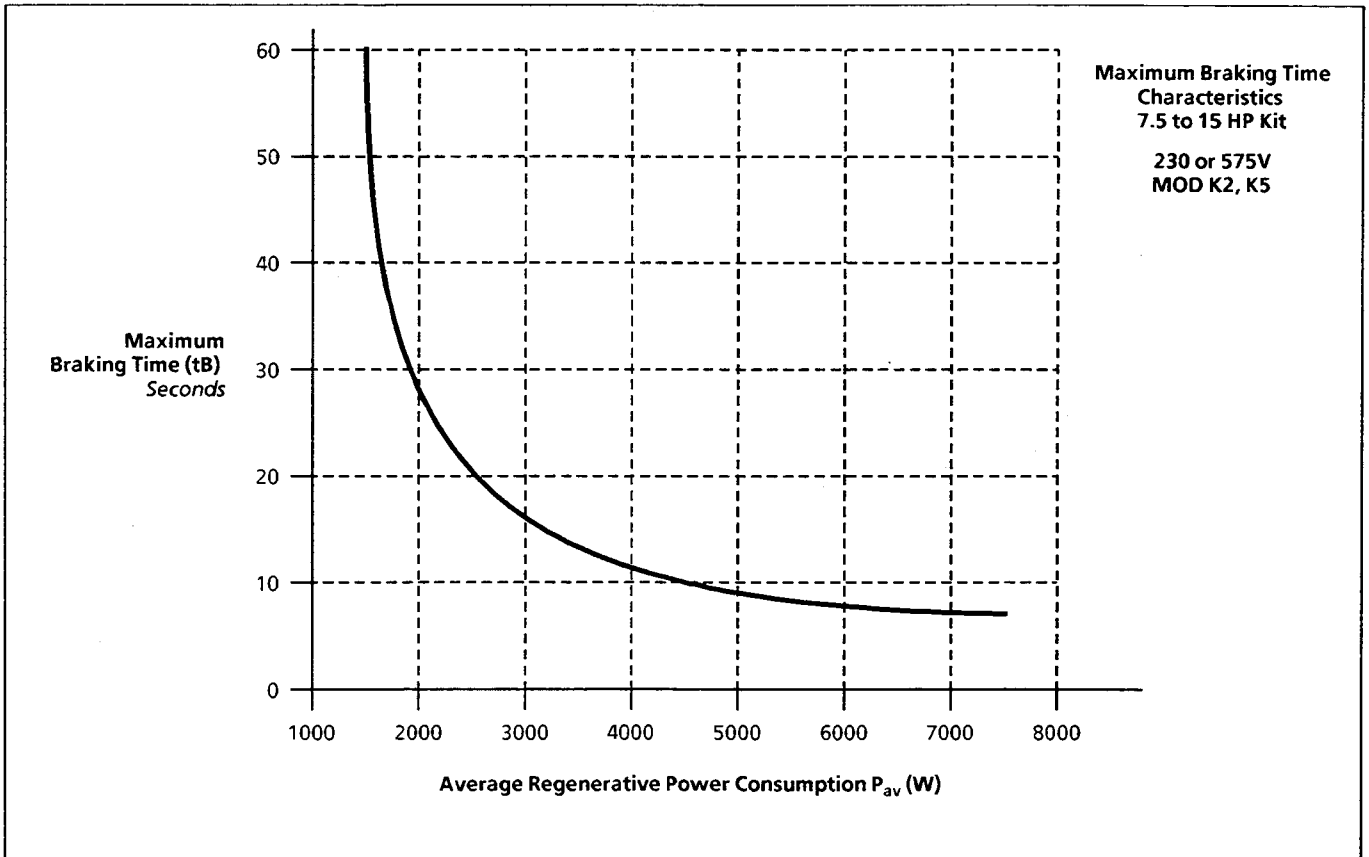
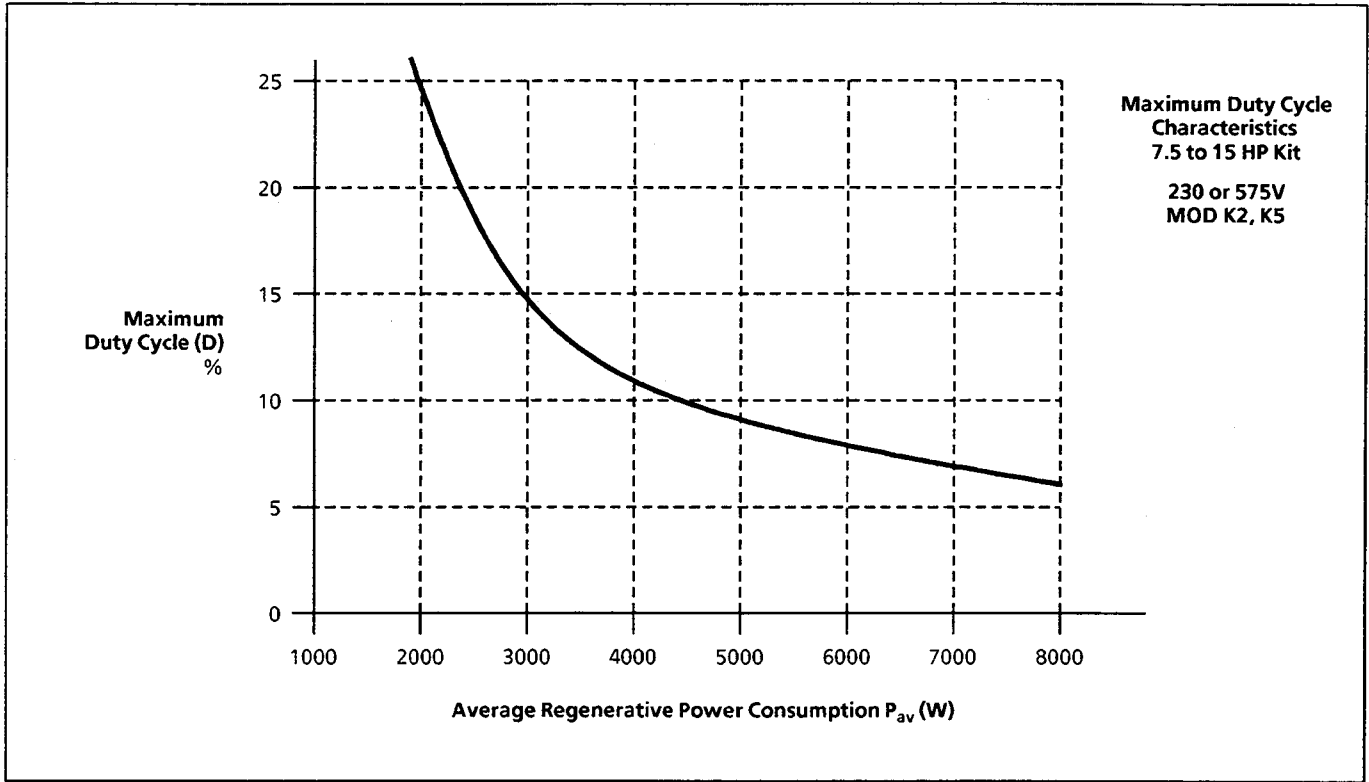
b) Plot the value calculated for the duty cycle (D) on the appropriate graphs.

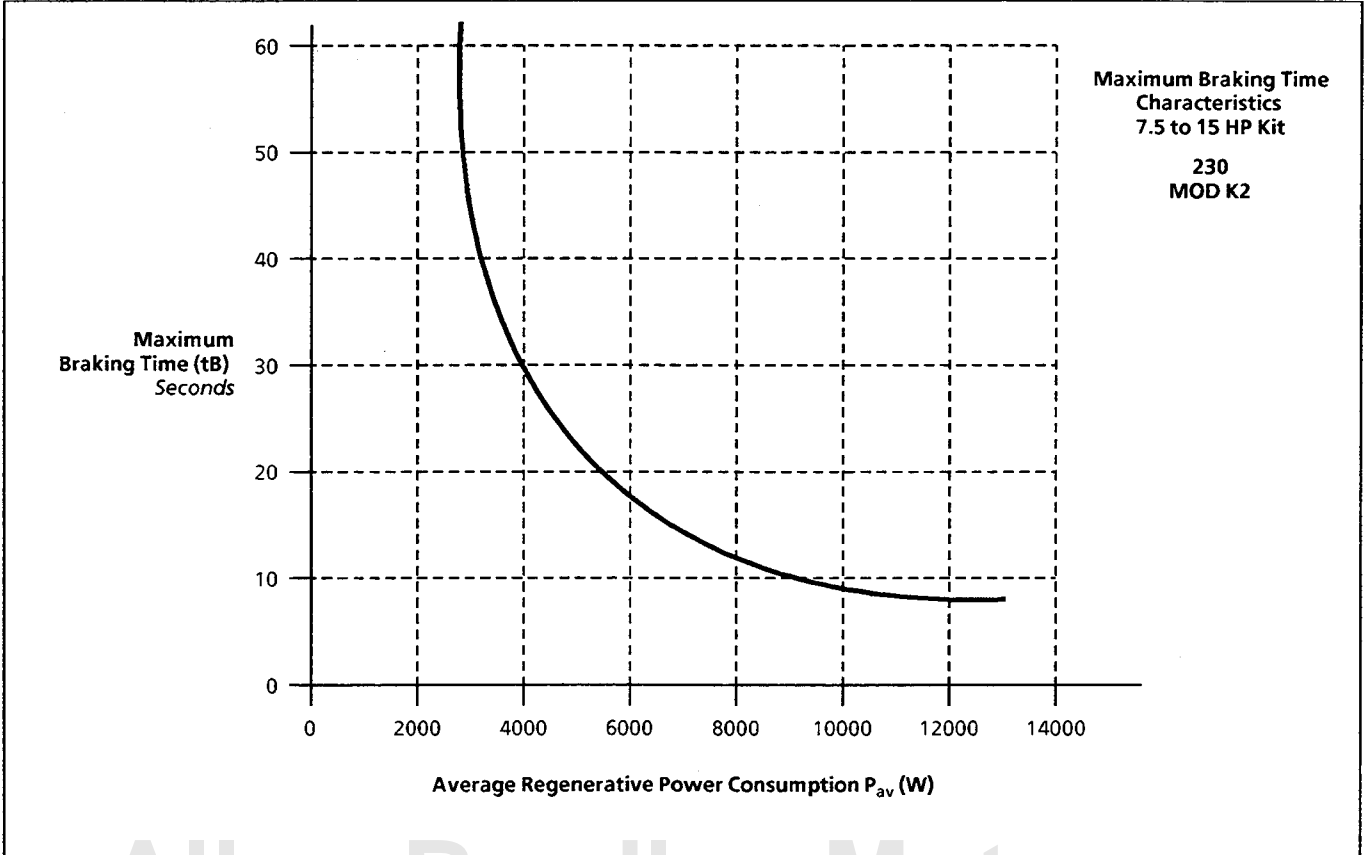
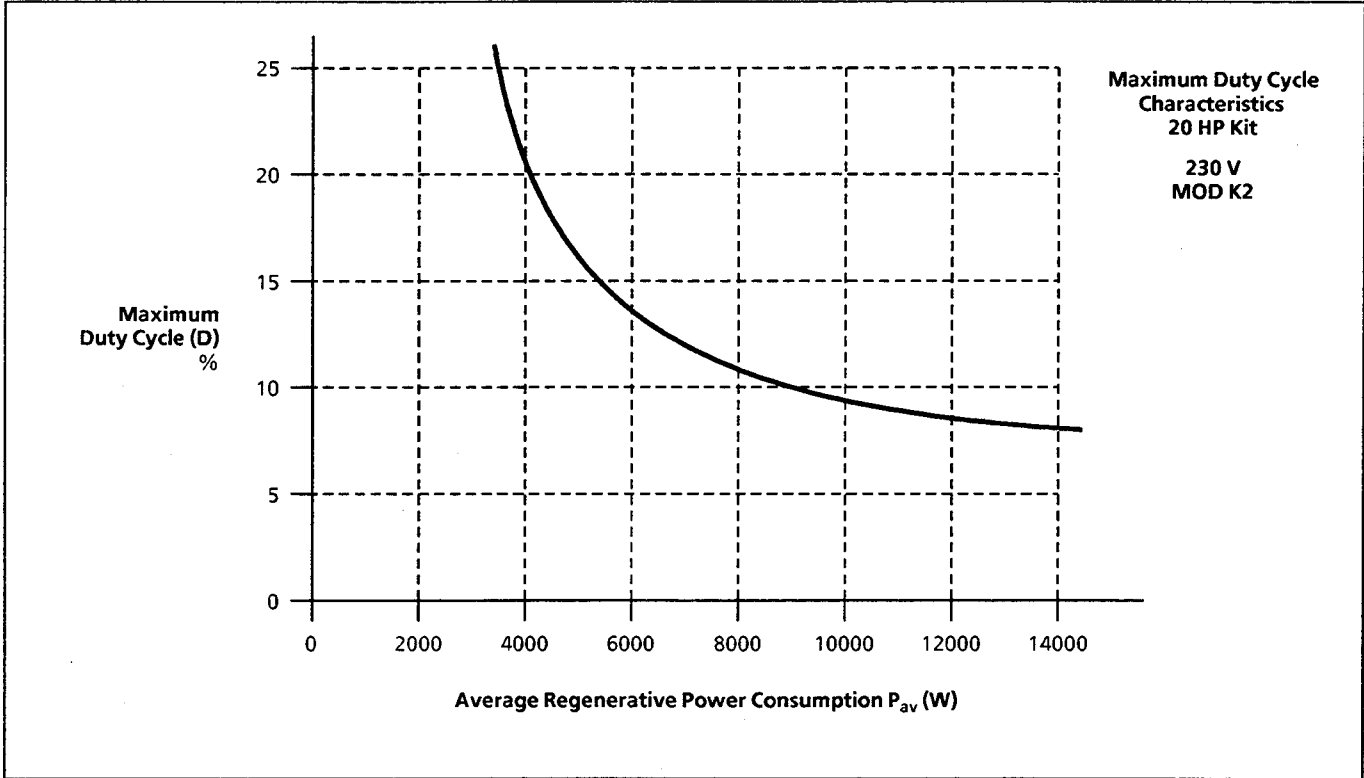
If the intersection of the plots lies above the curve shown, the braking cycle is excessive. The average power or duty cycle must be decreased until the intersection falls below the curve. Contact your Allen-Bradley sales office for assistance.

c) Plot the value of the stopping time (t_2) on the appropriate graph.

If the intersection of the plots lies above the curve shown, the braking cycle is excessive. The average power or braking time must be decreased until the intersection falls below the curve. Contact your Allen-Bradley sales office for assistance.









ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY

Drives Division
Cedarburg, Wisconsin 53012-0005

Publication 1332-5.0.6 – April, 1987
Supersedes October, 1986

P/N 201407-124

Printed in U.S.A