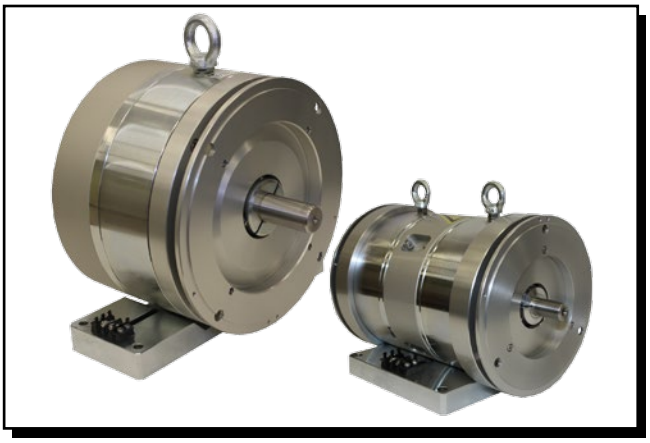
BHB Series Blower Cooled Hysteresis Brakes

FEATURES

- Ideal for low-torque/high-speed applications with exceptional power ratings
- Torque: 3 N·m to 24 N·m
- Speed: up to 20,000 rpm
- Power: up to 7000 W
- Included blowers eliminate the need for additional air supply equipment
- Includes air deflectors to guide exhaust air away from the motor under test
- Magtrol hysteresis braking technology provides precise torque control independent of shaft speed
- EMC conforms to European standards
- All metric dimensioning
- Base mounting standard
- Designed for use with Magtrol's PT Series T-slot Base Plate mounting system (sold separately)
- A variety of accessories and system options to choose from to create a simple and cost-effective test system



DESCRIPTION

When torque control/torque measurement must be performed at the highest possible power, Magtrol BHB Series Hysteresis Brakes are ideal. This design allows for continuous power ratings up to 6000 watts (7000 watts intermittent). Use of pre-loaded bearings in the BHB Series Hysteresis Brakes allows operation at speeds of up to 20,000 rpm for extended durations.

BHB Brakes are conveniently base mounted. Base mounting, with integral barrier type terminal strip, provides easy mounting and wiring.

APPLICATIONS

Magtrol's BHB Series Blower Cooled Hysteresis Brakes can function in either torque measurement or torque control applications. When mounted to a PT Series T-slot Base Plate, a cost-effective, basic motor test rig can be easily configured. For this purpose, Magtrol offers several accessories and system options to choose from. The simplest test bench may include one or two BHB Brakes and an AMF Adjustable Motor Fixture mounted onto a PT Base Plate. Adding a TM Series In-Line Torque Transducer, couplings, FRS Free-Run Speed Sensor, 3411 Torque Display or DSP7000 Controller greatly expands the system's motor testing capabilities.

Other accessories available from Magtrol include: power supplies, pipe fittings, jack shafts and risers.

In addition to motor test applications, BHB Series Blower Cooled Hysteresis Brakes can be used for the following:

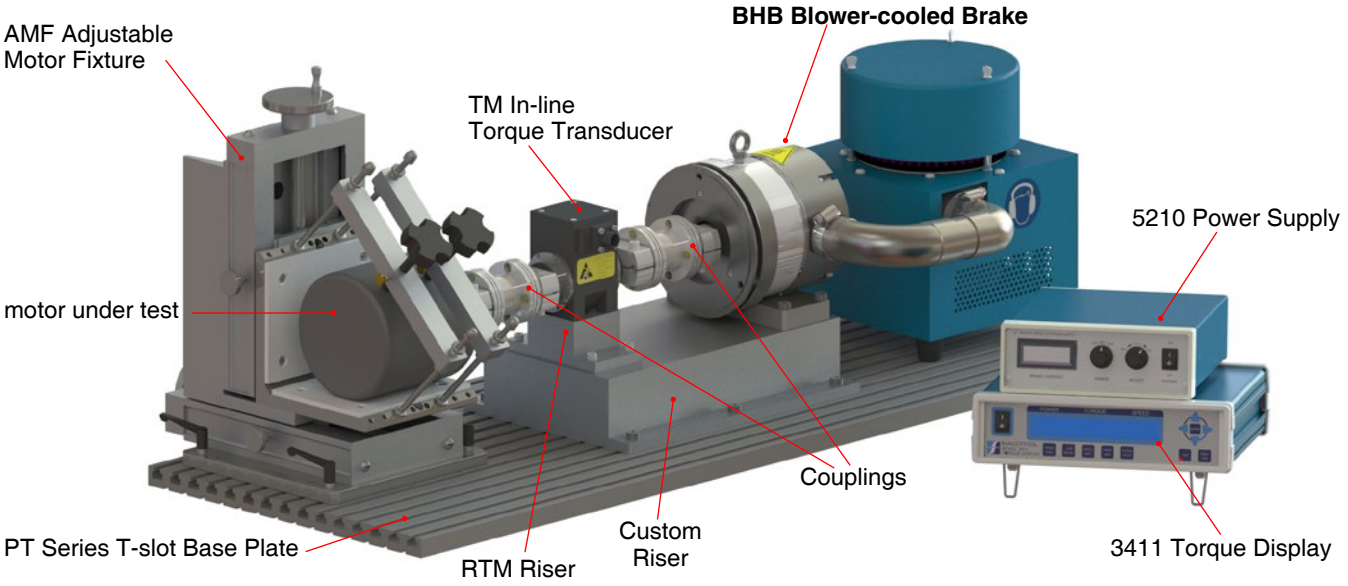
- Durability/reliability verification
- Brush run-in
- Carburetor tuning
- High-speed tension control

BHB Series Hysteresis Brakes are versatile enough to be specified for use in simple open-loop systems or more complex closed-loop systems.

OPEN-LOOP SYSTEMS

A characteristic of the open-loop system is that it does not use feedback to determine if its input has achieved the desired goal. This means that the system does not react to the output of the processes that it is controlling.

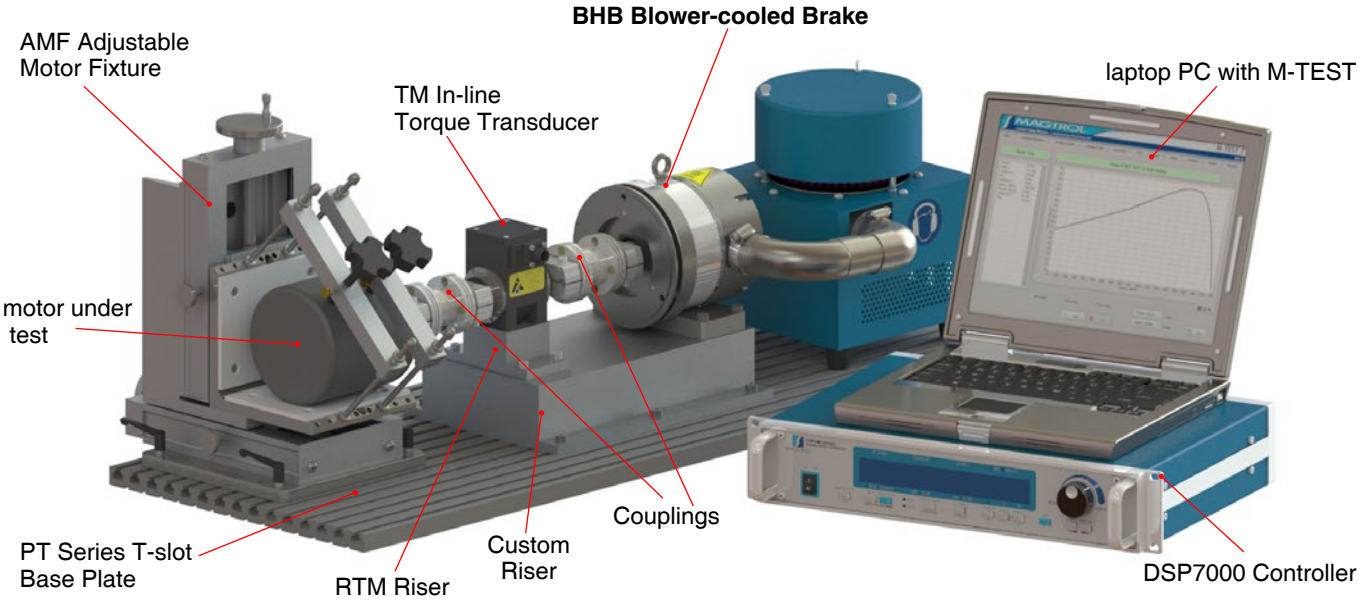
An open-loop controller is often used in simple test setups because of its simplicity and low cost, especially in systems where feedback is not critical. Below is an example of an open-loop system.



CLOSED-LOOP SYSTEMS

A characteristic of the closed-loop system is that it uses feedback to determine if its input has achieved the desired goal. This means that the system reacts to the output of the processes that it is controlling.

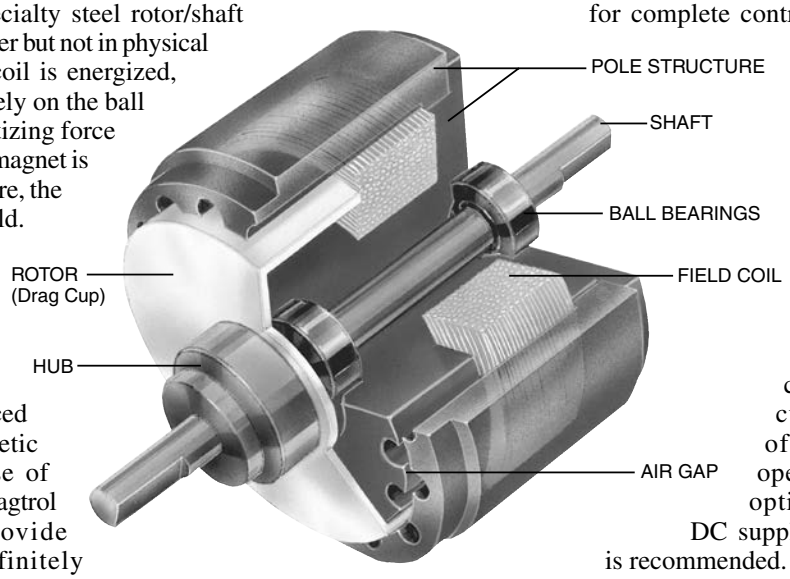
A closed-loop controller is often used because of its ability to repeatedly return to a desired controlled point. Below is an example of a closed-loop system.



PRINCIPLES OF HYSTERESIS

Overview

The hysteresis effect in magnetism is applied to torque control by the use of two basic components –a reticulated pole structure and a specialty steel rotor/shaft assembly–fastened together but not in physical contact. Until the field coil is energized, the drag cup can spin freely on the ball bearings. When a magnetizing force from either a field coil or magnet is applied to the pole structure, the air gap becomes a flux field. The rotor is magnetically restrained, providing a braking action between the pole structure and rotor.



Because torque is produced strictly through a magnetic air gap, without the use of friction or shear forces, Magtrol Hysteresis Brakes provide absolutely smooth, infinitely controllable torque loads, independent of speed, and they operate quietly without any physical contact of interactive members. As a result, with the exception of shaft bearings, no wear components exist.

Control

In an electrically operated Hysteresis Brake, adjustment and control of torque is provided by a field coil. This allows for complete control of torque by adjusting DC current to the field coil. Adjustability from a minimum value (bearing drag) to a maximum value of rated torque is possible.

The amount of braking torque transmitted by the brake is proportional to the amount of current flowing through the field coil. The direction of current flow (polarity) is of no consequence to the operation of the brake. For optimum torque stability, a DC supply with current regulation is recommended. This will help to minimize torque drift attributable to changes in coil temperature and in-line voltage, which can result in changes in coil current, and consequently, in torque.

ADVANTAGES OF HYSTERESIS DEVICES

Long, Maintenance-Free Life

Magtrol Hysteresis Brakes produce torque strictly through a magnetic air gap, making them distinctly different from mechanical-friction and magnetic particle devices. Because hysteresis devices do not depend on friction or shear forces to produce torque, they do not suffer the problems of wear, particle aging, and seal leakage. As a result, hysteresis devices typically have life expectancies many times that of friction and magnetic particle devices.

Life Cycle Cost Advantages

While the initial cost of hysteresis devices may be the same or slightly more than that of their counterparts, the high cost of replacing, repairing and maintaining friction and magnetic particle devices often makes hysteresis devices the most cost-effective means of tension and torque control available.

Excellent Environmental Stability

Magtrol hysteresis devices can withstand significant variation in temperature and other operating conditions. In addition, because they have no particles or contacting active parts, Hysteresis Brakes are extremely clean. Magtrol devices are used in food and drug packaging operations, in clean rooms, and environmental test chambers.

Operational Smoothness

Because they do not depend on mechanical friction or particles in shear, Hysteresis Brakes are absolutely smooth at any speed. This feature is often critical in wire drawing, packaging and many other converting applications.

Superior Torque Repeatability

Because torque is generated magnetically without any contacting parts or particles, Hysteresis Brakes provide superior torque repeatability. Friction and magnetic particle devices are usually subject to wear and aging with resultant loss of repeatability. Magtrol devices will repeat their performance precisely, to ensure the highest level of process control.

Broad Speed Range

Magtrol hysteresis devices offer the highest slip speed range of all electric torque control devices. Depending on size, kinetic power requirements and bearing loads, many Magtrol Brakes can be operated at speeds up to 25,000 rpm. In addition, full torque is available even at zero slip speed and torque remains absolutely smooth at any slip speed.

BRAKE RATINGS

Model	Included Blower		Min. Torque at Rated Current	Rated Current	Maximum Speed	Kinetic Power With Blower	
	Model	Voltage				5 Minutes	Continuous
		VAC	*N·m*	*mA*	*rpm*	*W*	*W*
BHB-3B	BL-001	120	3	750	20,000	1,500	935
BHB-3BA	BL-001-A	240	3	750	20,000	1,500	935
BHB-6B	BL-001	120	6	1,500	20,000	3,400	3,000
BHB-6BA	BL-001-A	240	6	1,500	20,000	3,400	3,000
BHB-12B	BL-001	120	12	1,200	12,000	3,500	3,000
BHB-12BA	BL-001-A	240	12	1,200	12,000	3,500	3,000
BHB-24B	BL-002	120	24	2,400	12,000	7,000	6,000
BHB-24BA	BL-002-A	240	24	2,400	12,000	7,000	6,000

Model	Resistance ± 10% @ 25°C	Voltage	Nominal Power	De-energized Drag Torque @ 1000 RPM	External Inertia	Torque to Inertia Ratio	Weight With Blower
	Ohms	*VDC*	*W*	*N·m*	*kg·cm²*	*rad/s²*	*kg*
BHB-3B	33	24	18.56	1.51×10^{-2}	6.91	4,340	17
BHB-3BA	33	24	18.56	1.51×10^{-2}	6.91	4,340	17
BHB-6B	16.5	24	37.13	2.82×10^{-2}	13.82	4,340	21
BHB-6BA	16.5	24	37.13	2.82×10^{-2}	13.82	4,340	21
BHB-12B	20	24	28.8	9.18×10^{-2}	56	2,140	35
BHB-12BA	20	24	28.8	9.18×10^{-2}	56	2,140	35
BHB-24B	10	24	57.6	14×10^{-2}	112	2,140	68
BHB-24BA	10	24	57.6	14×10^{-2}	112	2,140	68

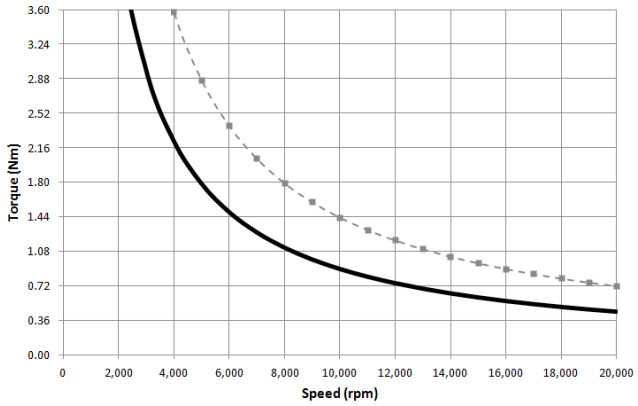
ENVIRONMENTAL REQUIREMENTS	
Operating Temperature	-40 °C to +85 °C
Relative Humidity	up to 90% without condensation

ELECTRICAL CHARACTERISTICS	
Max. Compliance Voltage	36 V DC
ADDITIONAL MECHANICAL CHARACTERISTICS	
Shaft Ends	smooth
Balancing Quality	G6.3 in accordance with ISO 1940-1

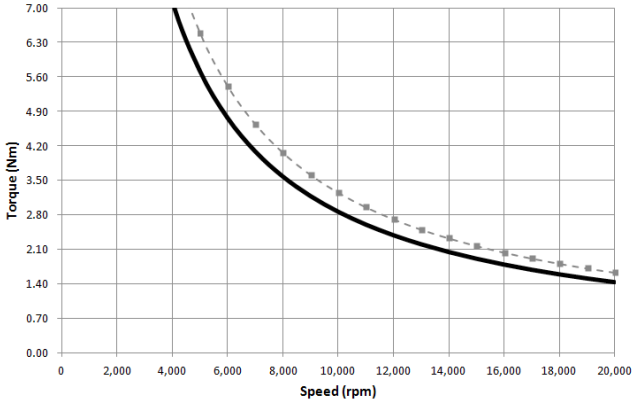
NOTE: To prevent damage to the power supply from inductive kickback, connect a diode rated at greater than or equal to the power supply's output voltage and current across the brake leads. Connect the cathode to the positive lead and the anode to the negative lead.

Power Absorption Curves (Preliminary)

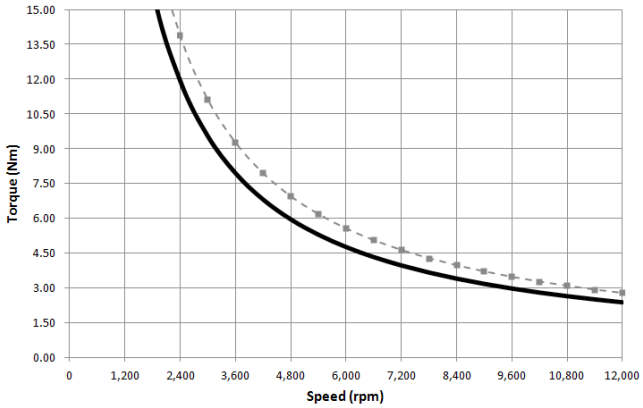
BHB-3B / BHB-3BA



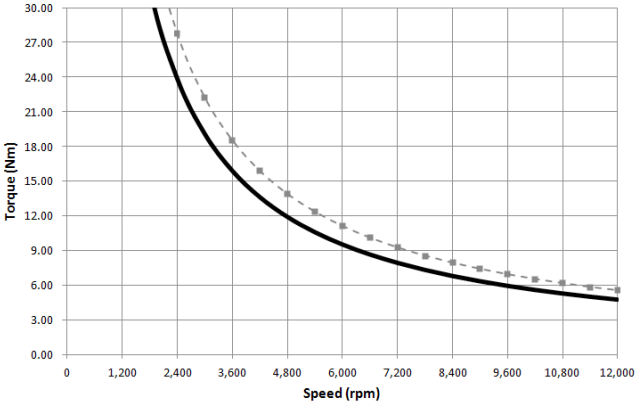
BHB-6B / BHB-6BA



BHB-12B / BHB-12BA



BHB-24B / BHB-24BA



Maximum Kinetic Power Rating Curve for Less Than Five Minutes: Area under curve equals the maximum speed and torque combinations for a motor test of less than five minutes.

Maximum Kinetic Power Rating Curve for Continuous Duty: Area under curve equals the maximum speed and torque combinations for a continuous duty motor test.

The power absorption curves represent the maximum power (heat) that the brake can dissipate over time.

BRAKE SELECTION

Magtrol's BHB Series Blower Cooled Hysteresis Brakes cover a wide range of Torque, Speed and Mechanical Power ratings. To select the appropriate size brake for your motor testing needs, you will need to determine the **Maximum Torque, Speed and Power** applied to the brake.

Maximum Torque

The BHB Brake will develop braking torque at any speed point, including low speed and stall conditions ("0" rpm). It is important to consider all torque points that are to be tested, not only rated torque, but also locked rotor and breakdown torque. Brake selection should initially be based on the maximum torque requirement, subject to determining the maximum power requirements.

Maximum Speed

This rating is to be considered independent of torque and power requirements, and is the maximum speed at which the brake can be safely run under free-run or lightly loaded conditions. It is not to be considered as the maximum speed at which full braking torque can be applied.

Maximum Power Ratings

These ratings represent the maximum capability of the braking system to absorb and dissipate heat generated when applying a braking load to the motor under test. The power absorbed and the heat generated by the brake is a function of the Torque (T) applied to the motor under test, and the resulting Speed (n) of the motor. This is expressed in the power (P) formulas to the right.

SI: $P\ (watts) = T\ (N{\cdot}m) \times n\ (rpm) \times (1.047 \times 10^{-1})$

English: $P\ (watts) = T\ (lb{\cdot}in) \times n\ (rpm) \times (1.183 \times 10^{-2})$

Metric: $P\ (watts) = T\ (kg{\cdot}cm) \times n\ (rpm) \times (1.027 \times 10^{-2})$

All of Magtrol's controllers, readouts and software calculate horsepower as defined by 1 hp = 550 lb·ft / s. Using this definition:

$$hp = P\ (watts) / 745.7$$

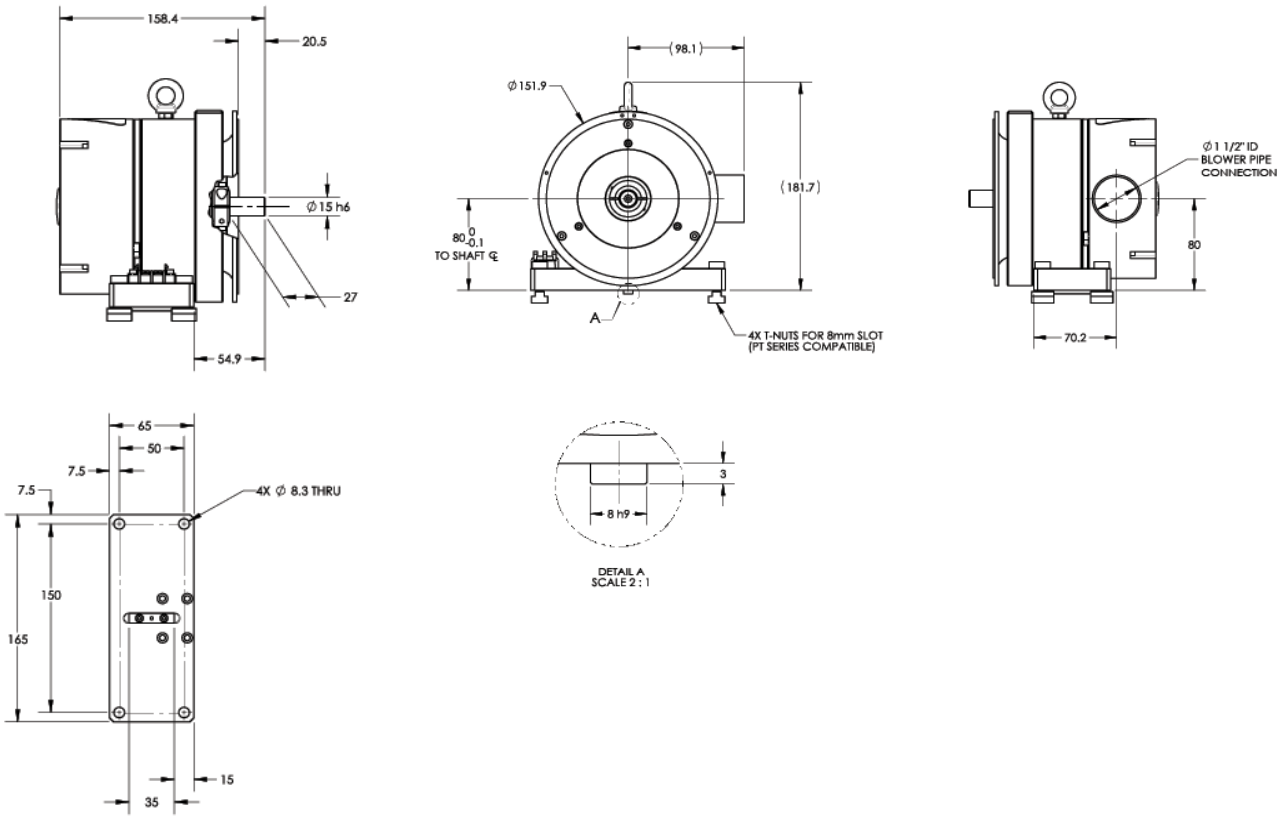
The brake's ability to dissipate heat is a function of how long a load will be applied. For this reason, the maximum power ratings given are based on continuous operation under load, as well as a maximum of 5 minutes under load.

To safely dissipate heat and avoid brake failure, the maximum power rating is the most important consideration in selecting a brake.

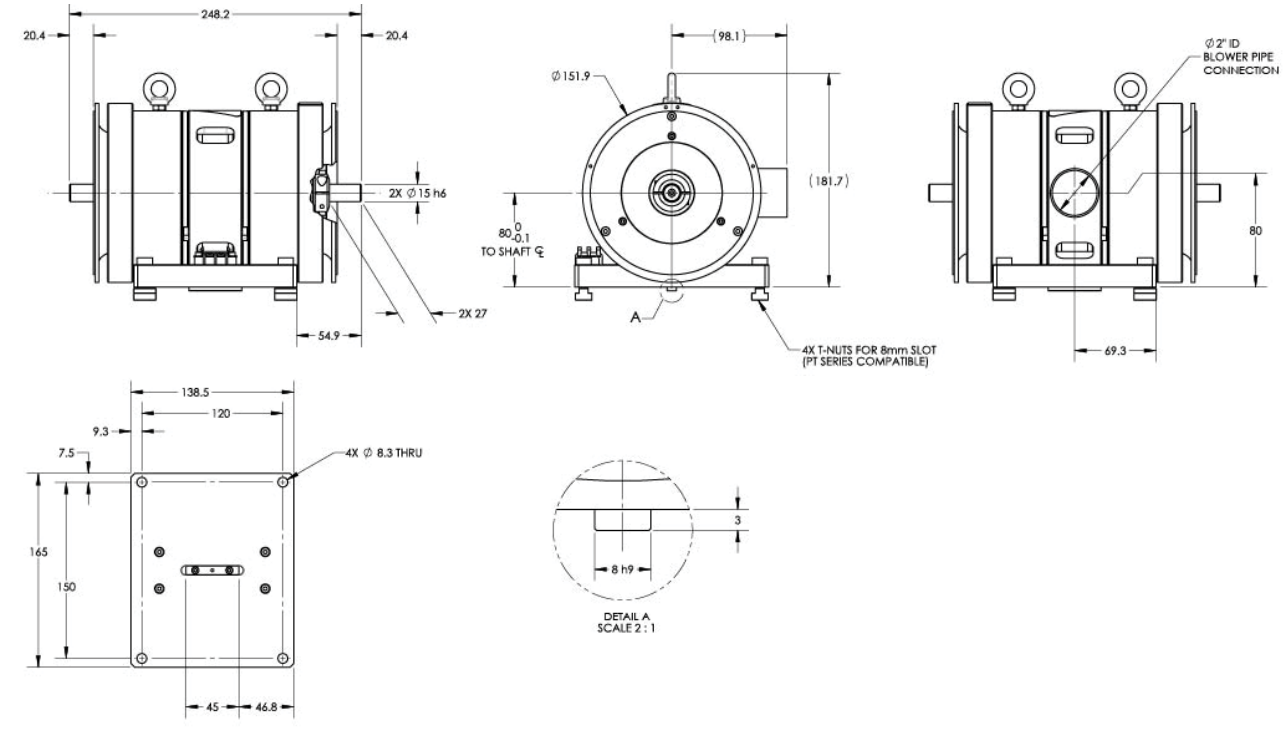
Torque vs. Current
Nominal Performance Characteristic Curves
are available at Magtrol's website at:

http://www.magtrol.com/brakesandclutches/blower_cooled_brakes.html

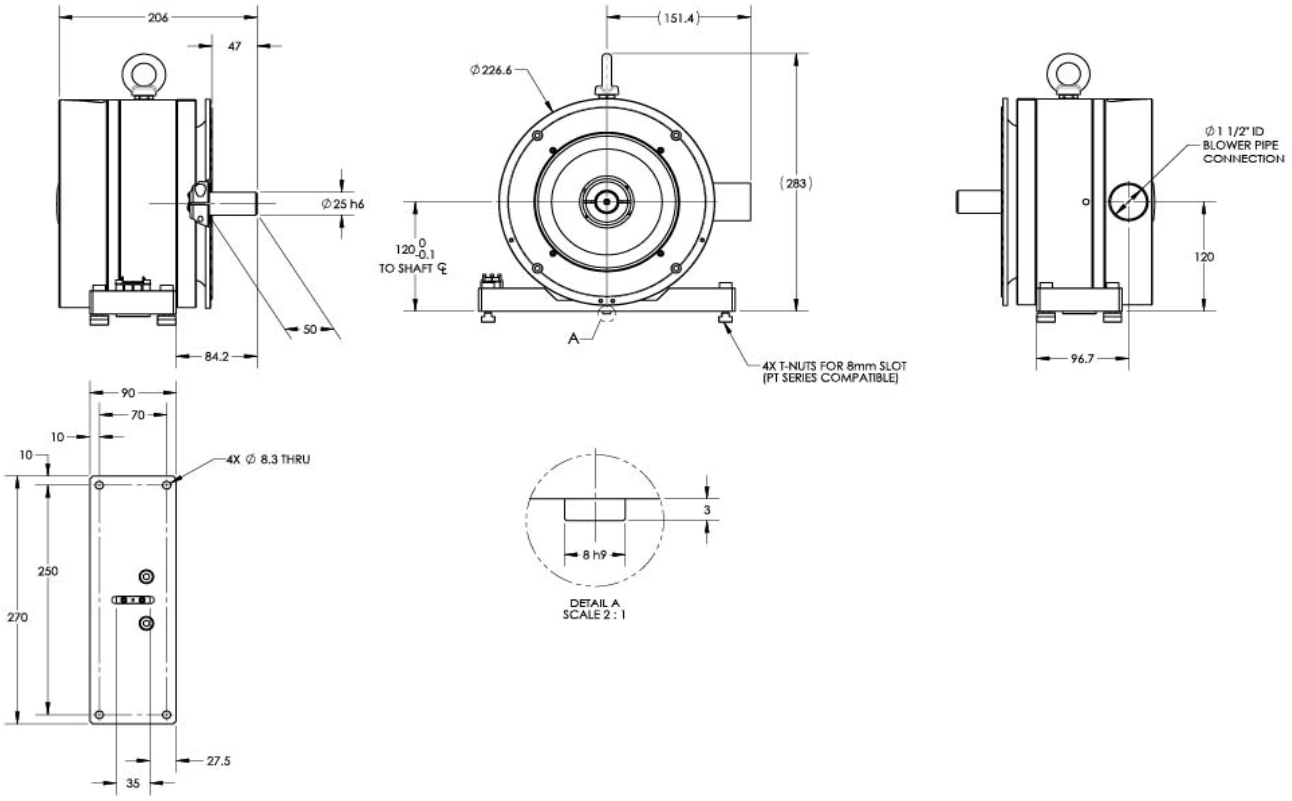
BHB-3B / BHB-3BA



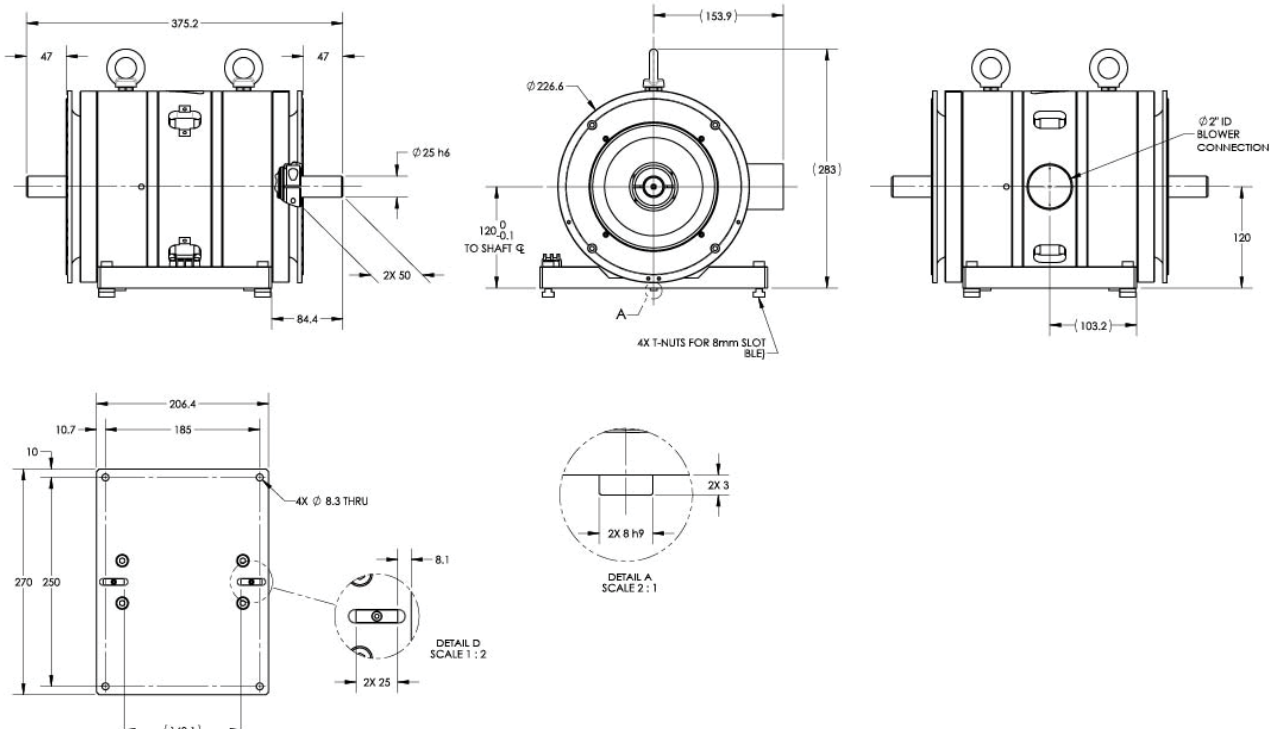
BHB-6B / BHB-6BA



BHB-12B / BHB-12BA



BHB-24B / BHB-24BA

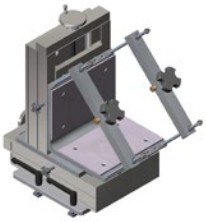


SYSTEM OPTIONS

PT Series T-slot Base Plates

Magtrol's PT Series Base Plates are used for creating a basic test rig by mounting a BHB Brake and/or TM Torque Transducer in line with the unit to be tested. Its solid, warp-resistant structure and multiple, single-sided T-slots enable modular construction that is cost-effective and easy to assemble.

AMF Series Adjustable Motor Fixtures



Magtrol's AMF Series Adjustable Motor Fixtures are used to secure small to medium-sized motors in place while running any test. These extremely versatile fixtures also enable easy motor centering for coupling to an BHB Brake. (Couplings can be supplied upon request.) The AMF-1, -2 and -3 Fixtures feature one or two adjustable bridges, each fitted with a fluted knob clamp screw, to allow clamping anywhere along the axis of the motor. To safeguard the motor, locking thumb screws provide protection against vibration and all motor-to-fixture contact surfaces are nylon padded for scratch-free clamping.

TM Series In-Line Torque Transducers

Magtrol's In-Line Torque Transducers deliver precise torque and speed measurement over a very broad range. Each model has an integrated conditioning electronic module providing 0 to ±10 V DC torque output and an open collector speed output. All TM In-Line Transducers employ Magtrol's unique non-contact differential transformer torque measuring technology which makes them very reliable, providing high overload protection, excellent long-term stability and high noise immunity.

FRS Free Run Speed Sensor

Magtrol's FRS Free-Run Speed Sensor is designed for applications where it is necessary to acquire speed readings that are unaffected by drag load. Before connecting a motor to the dynamometer, the free-run speed can be obtained from the FRS Sensor. With its reflective sensor, the FRS does not need to be attached to the motor but only placed close to the motor shaft (as shown in the photo to the right). Note: For best contrast, the shaft should be marked with reflective tape. The sensing end of the fiber optic assembly emits and receives light reflected from the shaft, and sends the speed signal to the digital fiber sensor.

The raw speed data is then transmitted to either a Magtrol 3411 Torque Display or DSP7000 Dynamometer Controller where it is converted and displayed in rpm

OPTIONAL ACCESSORIES

TM Risers

Many times, the BHB Brake will be used with one of Magtrol's TM Series In-Line Torque Transducers. Risers lift the appropriate TM from the PT to the shaft height of the brake. The riser is complete with attachment hardware for the TM and T-Nuts and shoulder bolts for attachment to a PT Base Plate.

Jack Shafts

For each brake there is an appropriately sized hardened jack shaft, complete with T-Nuts and shoulder bolts, that will mount to a PT Base Plate.

Power Supplies

BHB Series Blower Cooled Hysteresis Brakes provide torque that is proportional to the current applied. During normal operation, the coil resistance of an BHB Brake will change with temperature. To eliminate the resulting torque drift, Magtrol recommends using a current-regulated power supply, such as the Model 5210, VM Series or the Lambda ZUP36-6. Refer to the note about power supplies under "Accessory Ordering Information" for more details.

Also Available

- Connection Cables: brake to controller; power supply to brake; controller to power supply
- Couplings: brake to in-line torque transducer
- Pipe Fittings

ACCESSORY ORDERING INFORMATION

Brake Model	Power Supply*				Shaft Height	TM Riser	Jack Shaft
	open-loop control		closed-loop control				
	< 1 A	*> 1 A*	*< 1 A*	*> 1 A*	*mm*		
BHB-3B	5210	NA	DSP7000	NA	80	RTM-1-080	JS-10-080
BHB-3BA	5210	NA	DSP7000	NA	80	RTM-1-080	JS-10-080
BHB-6B	5210	ZUP36-6	DSP7000	DSP7000 and ZUP36-6	80	RTM-1-080	JS-10-080
BHB-6BA	5210	ZUP36-6	DSP7000	DSP7000 and ZUP36-6	80	RTM-1-080	JS-10-080
BHB-12B	5210	ZUP36-6	DSP7000	DSP7000 and ZUP36-6	120	RTM-1-120	JS-10-120
BHB-12BA	5210	ZUP36-6	DSP7000	DSP7000 and ZUP36-6	120	RTM-1-120	JS-10-120
BHB-24B	5210	ZUP36-6	DSP7000	DSP7000 and ZUP36-6	120	RTM-2-120	JS-20-120
BHB-24BA	5210	ZUP36-6	DSP7000	DSP7000 and ZUP36-6	120	RTM-2-120	JS-20-120

* *If testing at currents below 1 amp, then the 5210 (open loop) or DSP7000 (closed loop) are sufficient. The DSP7000 Controller supplies power to the brake in a closed-loop system.*
At currents above 1 amp, a 36 volt-3 amp current-controlled power supply is suggested. Magtrol recommends the Lambda ZUP36-6 Regulated DC Power Supply or similar. The ZUP36-6 also has a voltage input to control the output current, which is required if used with the DSP7000 in a closed-loop system.

SYSTEM OPTIONS

CATEGORY	DESCRIPTION	MODEL / PART #
TORQUE MEASUREMENT	In-Line Torque Transducers	TM/TMHS/TMB series
SPEED MEASUREMENT	Free-Run Speed Sensor	FRS
MOUNTING	T-slot Base Plate - available in lengths from 400 mm to 1500 mm	PT Series
	Couplings	Contact Magtrol
ADJUSTABLE MOTOR FIXTURES	Motor Fixture for motors up to 4 inches in diameter	AMF-1
	Motor Fixture for motors up to 6 inches in diameter	AMF-2
	Motor Fixture for motors up to 8¼ inches in diameter	AMF-3
CONTROLLERS & DISPLAYS	High-Speed Programmable Dynamometer Controller	DSP7000
	Torque Display	3411
BRAKE POWER SUPPLIES	Current-Regulated Power Supply	5210
	Regulated DC Power Supply - 0-36 volts / 6 amps; high accuracy; digital display	Lambda ZUP36-6
	VM Series Proportional Amplifier/Controller	VM Series
CONNECTION CABLES	Connect DSP7000 Controller to Brake	88M085-0150 (1.5 m) 88M085-0200 (2 m) 88M085-0500 (5 m) 88M085-1000 (10 m)
	Connect 5210 Power Supply to Brake	88M085-0150 (1.5 m) 88M085-0200 (2 m) 88M085-0500 (5 m) 88M085-1000 (10 m)
	Connect ZUP36-6 Power Supply to Brake	88M175-0200 (2 m) 88M175-0500 (5m)
	Connect DSP7000 Controller to ZUP36-6 Power Supply	88M176-0100 (1 m) 88M176-0200 (2 m)
	Connect TM Torque Transducer to DSP7000	ER113/01 (5 m) ER113/02 (10 m) ER113/03 (20 m)
MISC	Pipe Fittings	Contact Magtrol

Due to the continual development of our products, we reserve the right to modify specifications without forewarning.

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