
AHB Series Compressed-air-cooled Hysteresis Brakes

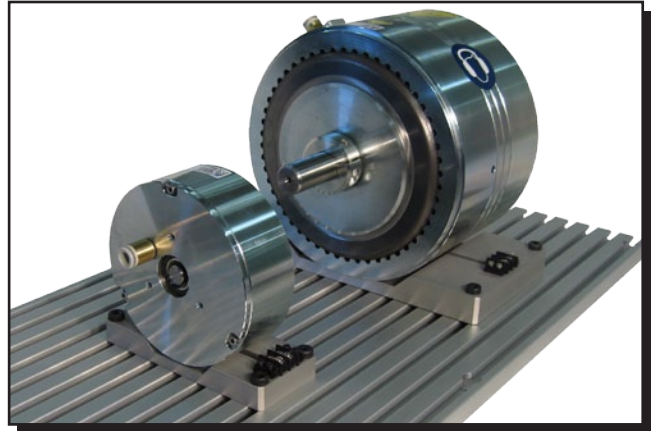
FEATURES

- Ideal for low-torque/high-speed applications with exceptional power ratings
- Torque: 1 N·m to 24 N·m
- Speed: up to 25,000 rpm
- Power: up to 5300 W
- Compressed-air cooling offers excellent heat dissipation
- Allowable input air pressure of up 95 PSI eliminates the need for a regulator
- Magtrol hysteresis braking technology provides precise torque control independent of shaft speed
- EMC susceptibility conforms to European standards
- All metric dimensioning
- Base mounting standard
- Designed for use with Magtrol's PT Series T-slot Base Plate mounting system
- 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 AHB Series Hysteresis Brakes are ideal. Passages running through the brakes enables compressed air cooling, providing excellent heat dissipation. This design allows for continuous power ratings up to 3000 watts (5300 watts intermittent). Use of pre-loaded bearings in the AHB Series Hysteresis Brakes allows operation at speeds of up to 25,000 rpm for extended durations.

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



AHB-3 (front) and AHB-24 (rear) Brakes mounted onto a PT Series T-slot Base Plate

APPLICATIONS

Magtrol's AHB Series Compressed-air-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 AHB Brakes and an AMF Adjustable Motor Fixture mounted onto a PT Base Plate. Adding a TM Series In-Line Torque Transducer, couplings, FR10 Free-Run Speed Sensor, 3410 Torque Display or DSP6001 Controller greatly expands the system's motor testing capabilities.

Other accessories available from Magtrol include: power supplies, air filters, pressure gauge kits, air lines, pipe fittings, jack shafts and risers.

In addition to motor test applications, AHB Series Compressed-air-cooled Hysteresis Brakes can be used for the following:

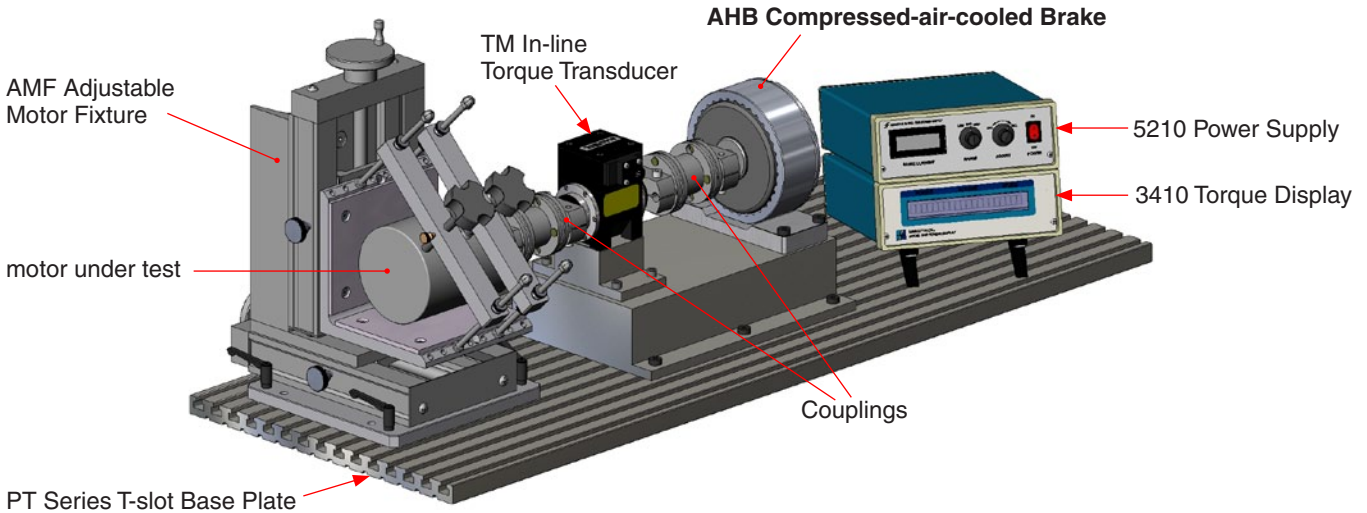
- Durability/reliability verification
- Brush run-in
- Carburetor tuning
- High-speed tension control

AHB 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.

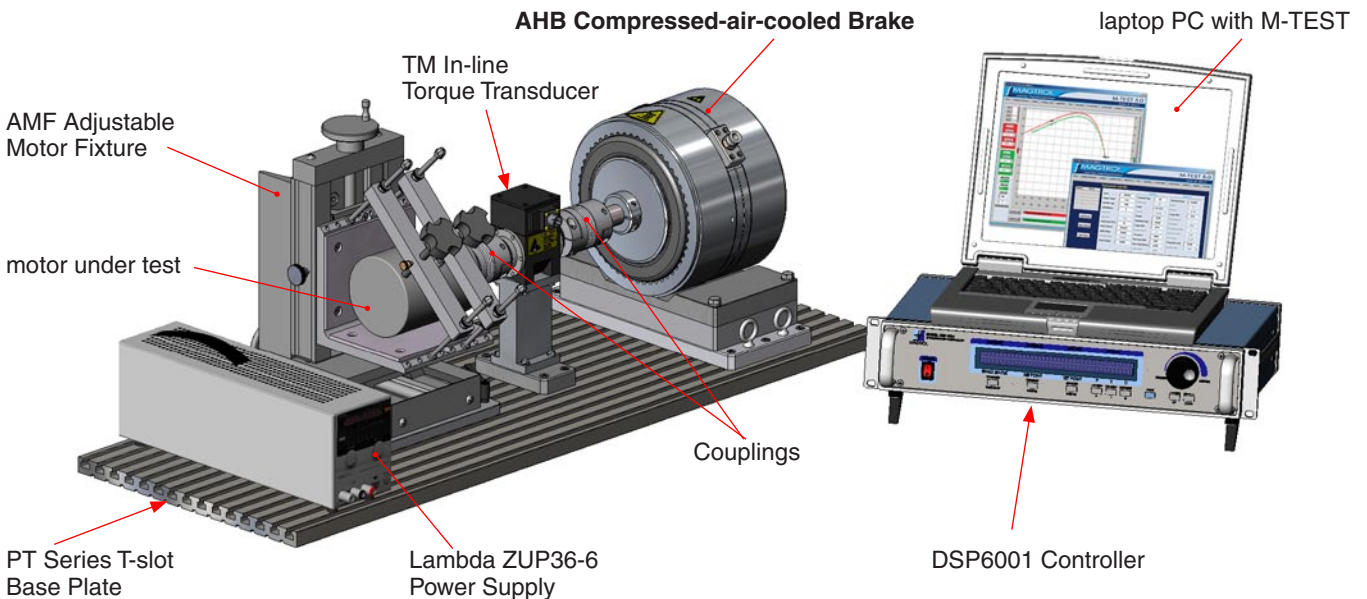
An open-loop controller is often used in simple test setups because of its simplicity and low cost, especially in systems where feedback is not critical. Below is an example of an open-loop system.



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.

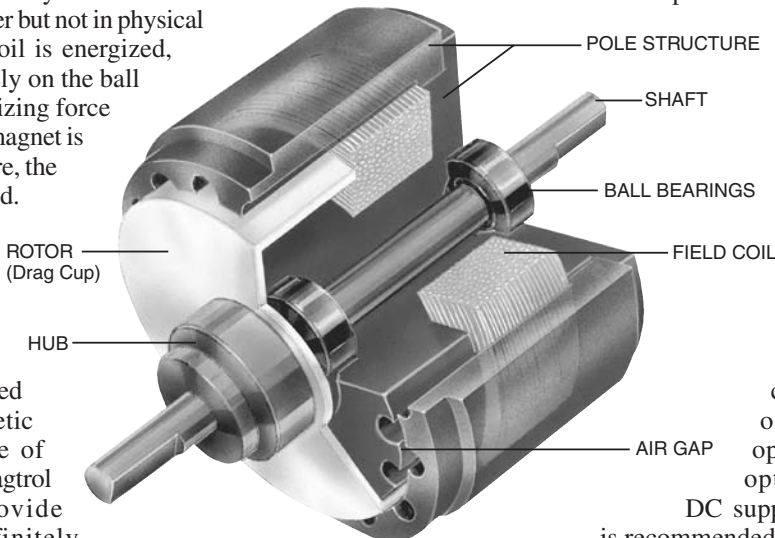


PRINCIPLES OF HYSTERESIS

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	Min. Torque at Rated Current	Rated Current	Maximum Speed	Kinetic Power*			
				With Air		Without Air	
				5 Minutes	Continuous	5 Minutes	Continuous
	<i>Nm</i>	<i>mA</i>	<i>rpm</i>	<i>W</i>	<i>W</i>	<i>W</i>	<i>W</i>
AHB-1	1.00	400	25000	1200	1200	250	55
AHB-1.5	1.50	400	25000	1300	1300	450	70
AHB-3	3.00	750	20000	1800	1800	800	160
AHB-5	5.00	380	15000	2500	1000	1300	120
AHB-6	6.00	1500	20000	3000	3000	1400	225
AHB-12	12.00	1200	12000	2800	1800	2200	250
AHB-24	24.00	2400	12000	5300	3000	4000	450

Model	Drag Torque De-energized @ 1000 rpm	External Inertia	Torque to Inertia Ratio	Nominal Power	Voltage	Resistance at 25 °C ±10%	Weight
	<i>Nm</i>	<i>kg·cm²</i>	<i>rad/s²</i>	<i>W</i>	<i>VDC</i>	Ω	<i>kg</i>
AHB-1	5.42×10^{-3}	8.76×10^{-1}	11 420	9.6	24.0	60.0	2.0
AHB-1.5	7.77×10^{-3}	2.75×10^0	5455	10.24	25.6	64.0	4.2
AHB-3	1.51×10^{-2}	6.89×10^0	4350	18.6	24.8	33.0	6.5
AHB-5	5.00×10^{-2}	1.31×10^1	3830	8.7	22.8	60.0	12.4
AHB-6	2.82×10^{-2}	1.38×10^1	4350	37.1	24.8	16.5	12.7
AHB-12	9.18×10^{-2}	5.60×10^1	2140	28.8	24.0	20.0	24.0
AHB-24	1.36×10^{-1}	1.12×10^2	2140	57.6	24.0	10.0	47.0

* Kinetic power ratings are maximum values based on limiting coil and/or bearing temperature to approximately 100 °C, and should not be exceeded.

ENVIRONMENTAL REQUIREMENTS	
Operating Temperature	-40 °C to +85 °C
Relative Humidity	up to 90% without condensation
Vibration and Shock	In accordance with IEC 68.2
EMC	In accordance with IEC 61326:2002

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

AIR REQUIREMENTS

Model	Air Supply Pressure			Air Volume/Consumption		Supply Tube Fitting	
	PSI*	bar	kPa	SCFM	l/min	Outer Diameter	Pipe Thread Size
						mm	NPT
AHB-1	90	6.21	620.5	10	283	8	1/8"
AHB-1.5	90	6.21	620.5	10	283	8	1/8"
AHB-3	90	6.21	620.5	15	425	10	1/4"
AHB-5	90	6.21	620.5	15	425	10	1/4"
AHB-6	90	6.21	620.5	20	567	10	1/4"
AHB-12	90	6.21	620.5	20	567	10	3/8"
AHB-24	90	6.21	620.5	20	567	10	3/8"

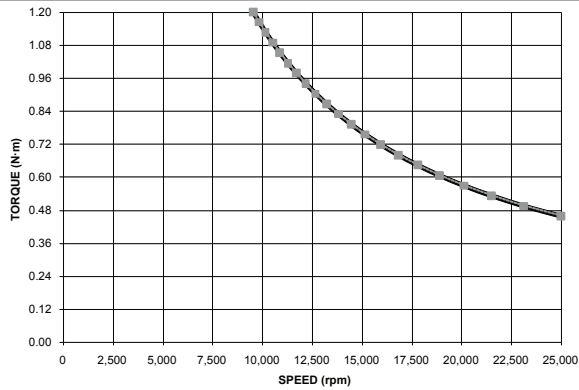
* The air pressure to the (at the) brake will be called out at 85 to 95 PSI. This range is thought to allow a user to directly attach to a compressor line without local regulation and filtering.



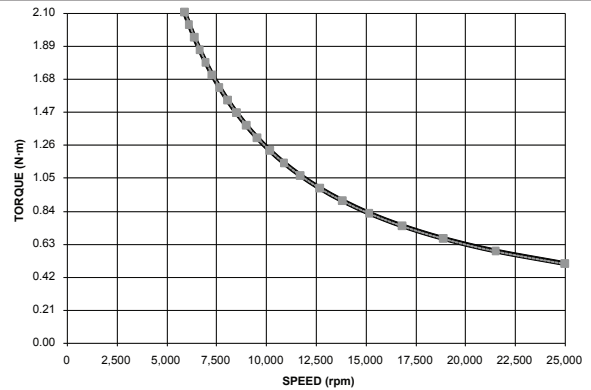
Typical sound pressure at 1 meter: 110 db

Warning: High sound levels can cause permanent hearing loss. Use hearing protection while this product is in use.

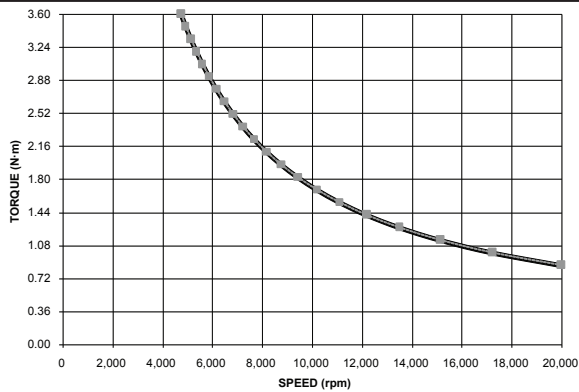
AHB-1



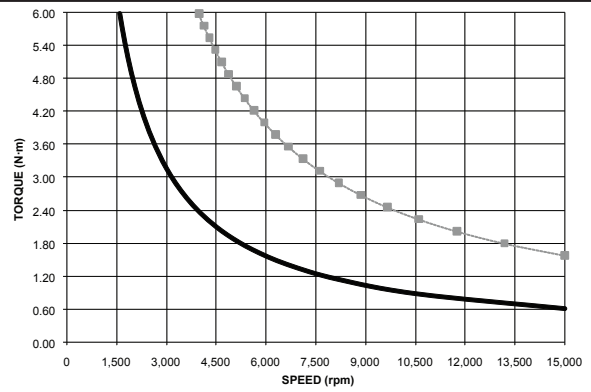
AHB-1.5



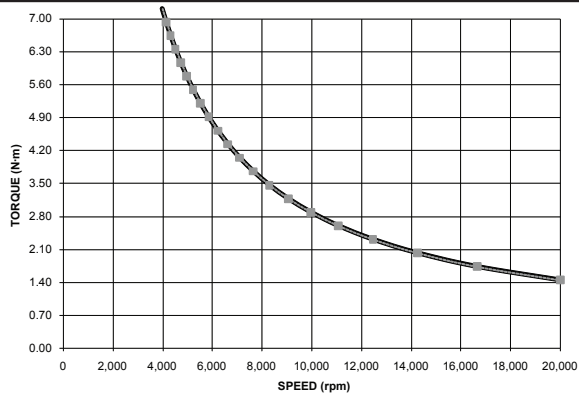
AHB-3



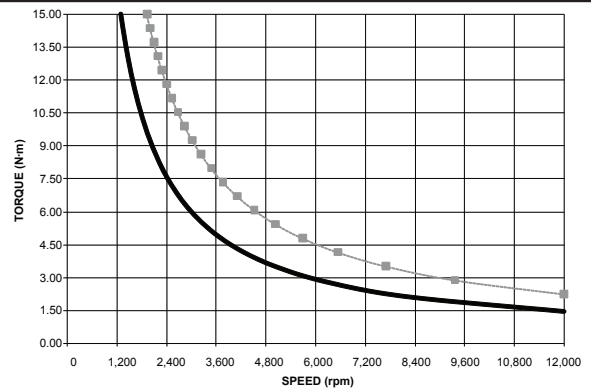
AHB-5



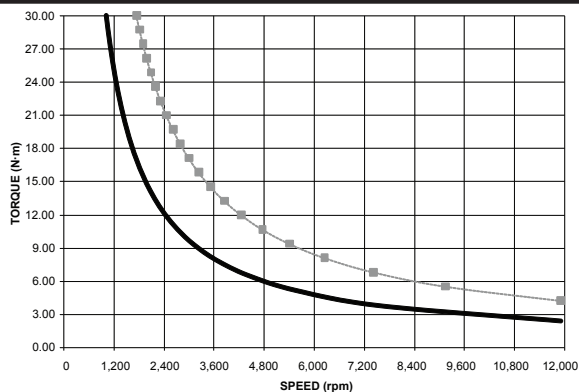
AHB-6



AHB-12



AHB-24



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

—■— 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.

BRAKE SELECTION

Magtrol's AHB Series Compressed-air-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 AHB 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: $P \text{ (watts)} = T \text{ (N}\cdot\text{m)} \times n \text{ (rpm)} \times (1.047 \times 10^{-1})$
 English: $P \text{ (watts)} = T \text{ (lb}\cdot\text{in)} \times n \text{ (rpm)} \times (1.183 \times 10^{-2})$
 Metric: $P \text{ (watts)} = T \text{ (kg}\cdot\text{cm)} \times n \text{ (rpm)} \times (1.027 \times 10^{-2})$

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

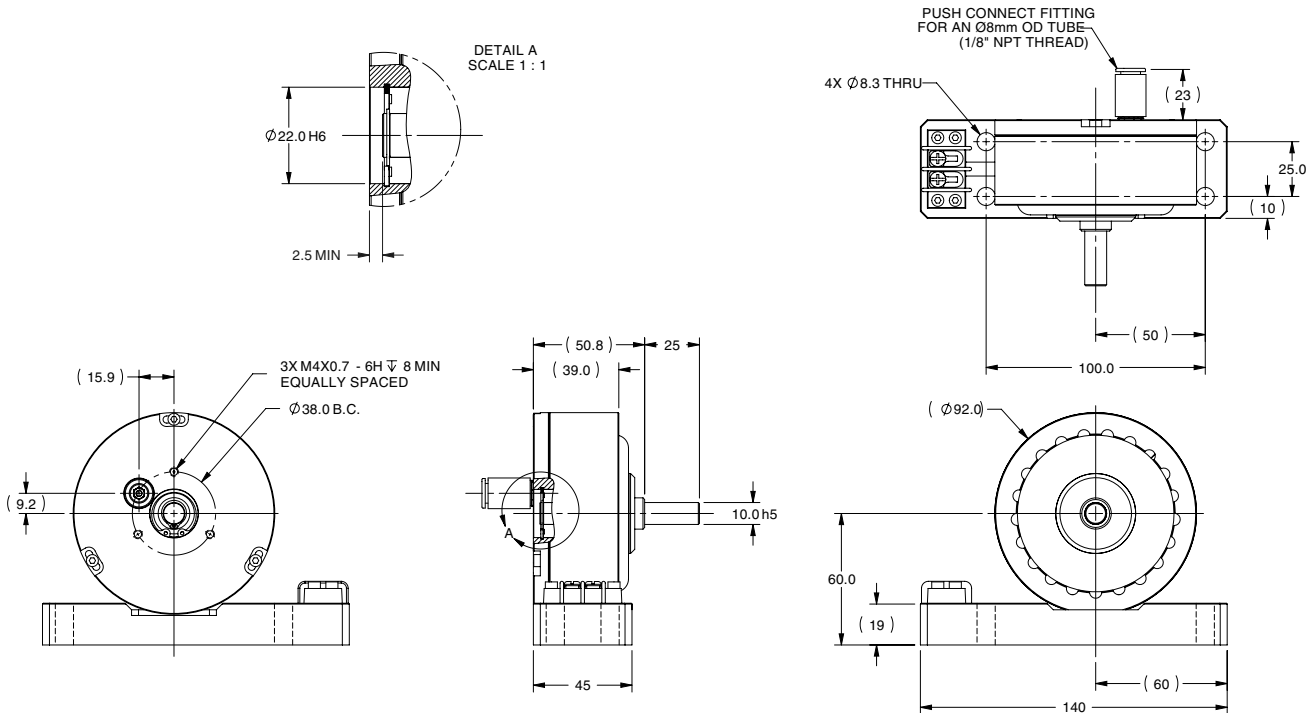
$$\text{hp} = P \text{ (watts)} / 745.7$$

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.

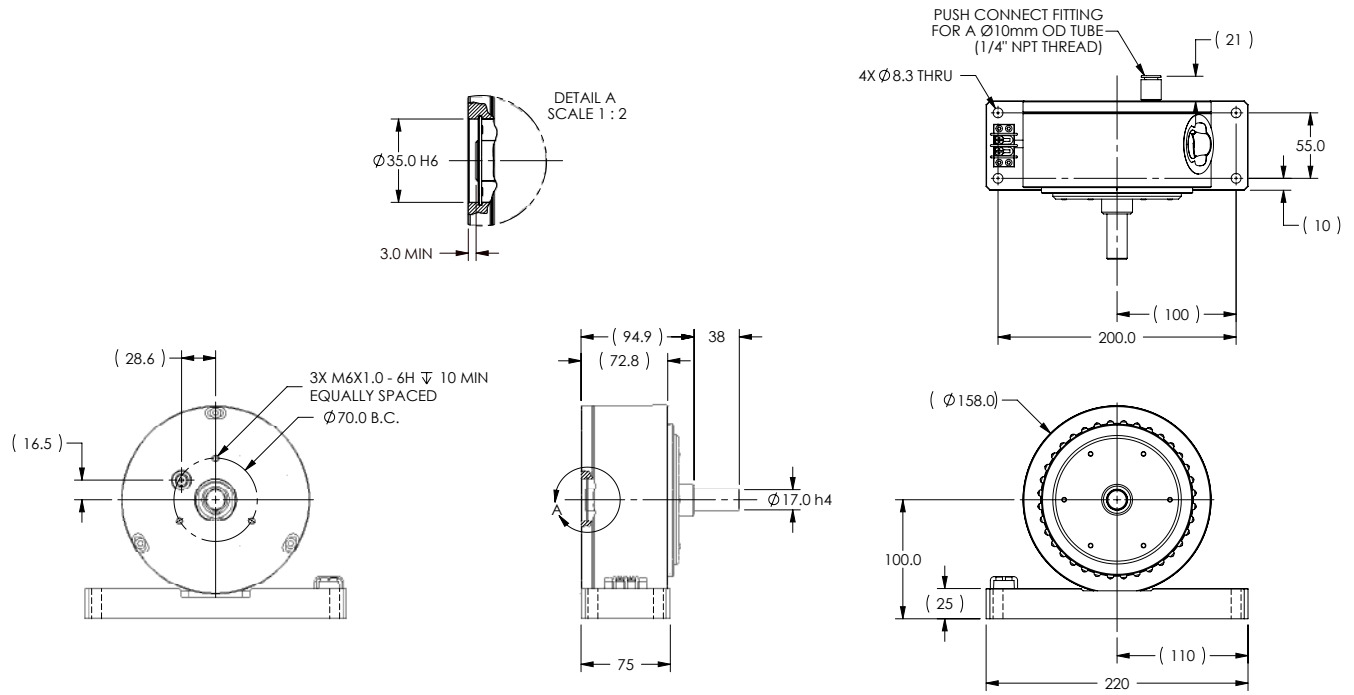
To safely dissipate heat and avoid brake failure, the maximum power rating is the most important consideration in selecting a brake.

Torque vs. Current
 Nominal Performance Characteristic Curves
 are available at Magtrol's website at:
http://www.magtrol.com/motortesting/ahb_ratings.htm

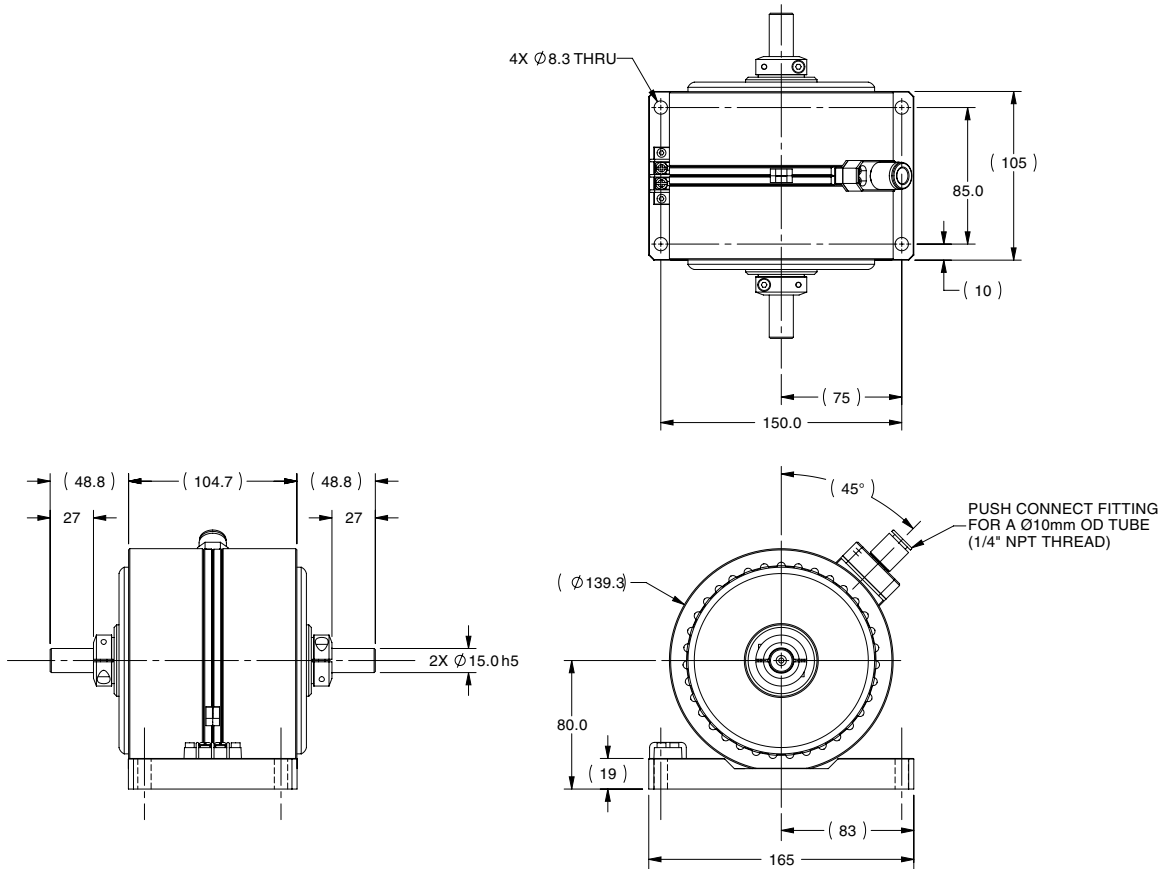
AHB-1



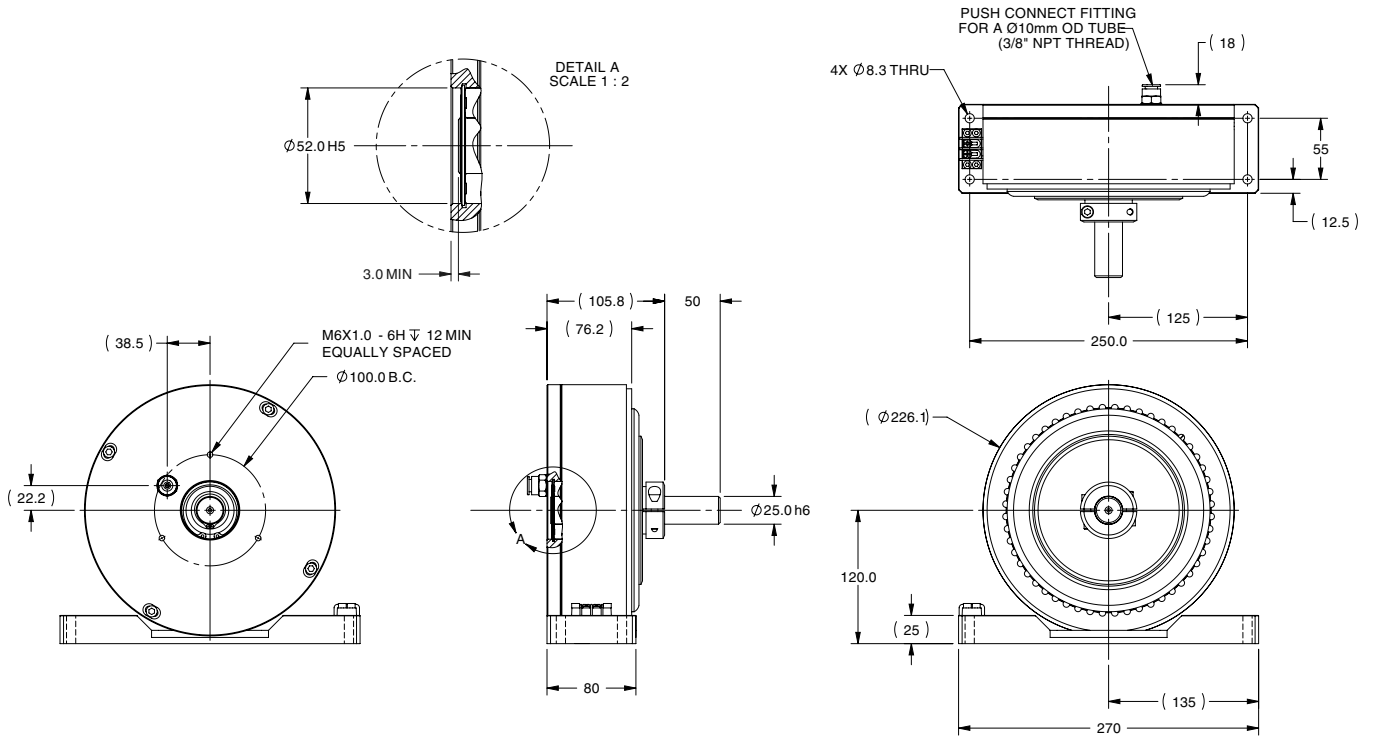
AHB-5



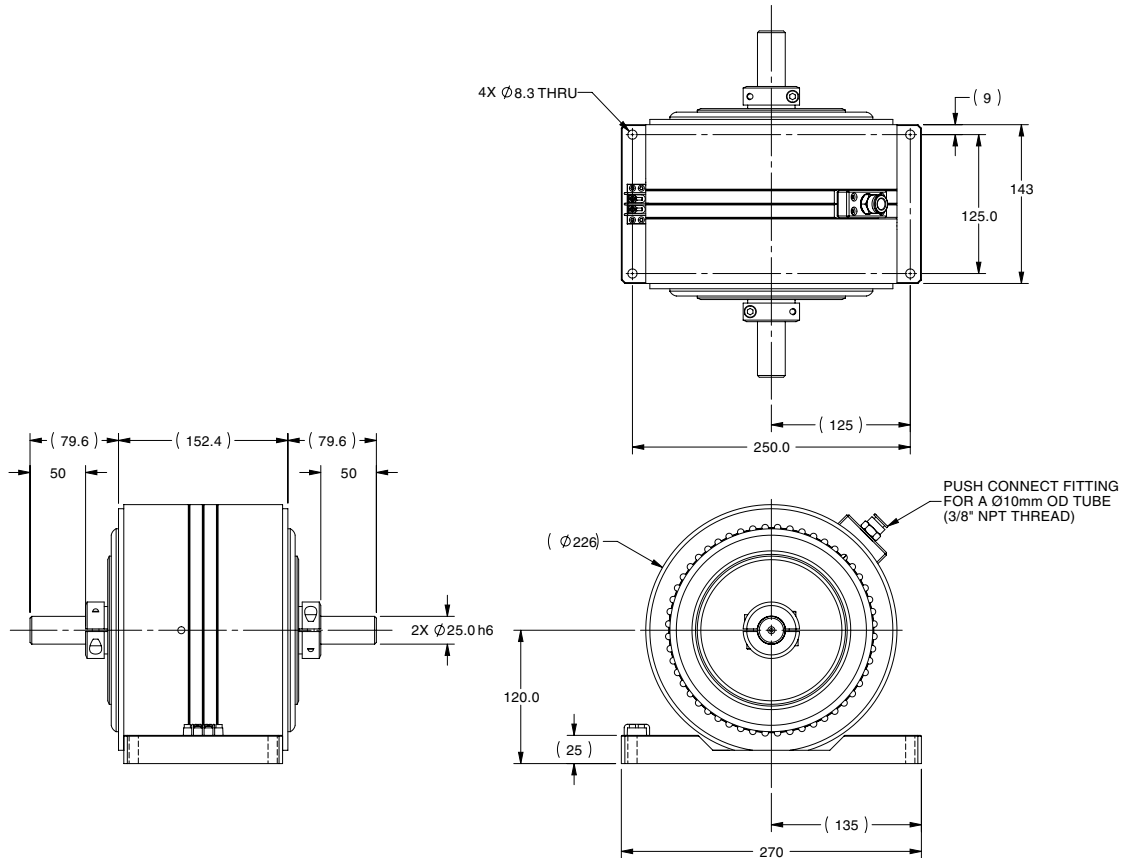
AHB-6



AHB-12



AHB-24



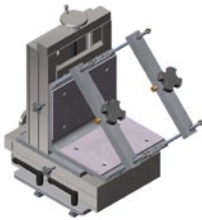
SYSTEM OPTIONS

PT Series T-slot Base Plates



Magtrol's PT Series Base Plates are used for creating a basic test rig by mounting a AHB 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 AHB 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 VDC 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.

FR10 Free Run Speed Sensor



Magtrol's FR10 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 AHB Brake, the free-run speed can be obtained from the FR10 Sensor. With its photoelectric sensor, the FR10 does not need to be attached to the motor but only placed within a $\frac{1}{4}$ inch of the motor shaft. (*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 fiber optic sensor. The raw speed data is then transmitted to either a Magtrol 3410 Torque Display or DSP6001 Dynamometer Controller where it is converted and displayed in rpms.

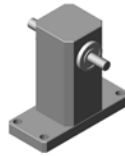
OPTIONAL ACCESSORIES

TM Risers



Many times, the AHB 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.

Air Filter Kit



In order to ensure optimal life, the compressed air supply used to cool AHB Series Hysteresis Brakes must be free of contamination, including water, oil, rust scale, dust, etc. For optimal performance, Magtrol recommends the use of a 5 micron coalescing filter. Air filter kits purchased from Magtrol include the filter and a mounting bracket for attaching the air filter to a PT Base Plate.

Pressure Gauge Kit



To ensure proper air volume Magtrol offers a pressure gauge kit, including "T" connector and tube (*as shown*), to be used in-line with the air supply line.

Power Supplies

AHB Series Compressed-air-cooled Hysteresis Brakes provide torque that is proportional to the current applied. During normal operation, the coil resistance of an AHB Brake will change with temperature. To eliminate the resulting torque drift, Magtrol recommends using a current-regulated power supply, such as the Model 5210 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
- Air Supply Lines: 8 mm and 10 mm outside diameter; sold by the meter
- Pipe Fittings

ACCESSORY ORDERING INFORMATION

Brake Model	Power Supply*				Air Filter Kit	Pressure Gauge Kit	Shaft Height	TM Riser	Jack Shaft Riser
	open-loop control		closed-loop control						
	< 1 A	> 1 A	< 1 A	> 1 A			mm		
AHB-1	5210		DSP6001		AF-1	PG-08	60	RTM-1-060	RJS-1-060
AHB-1.5	5210		DSP6001		AF-1	PG-08	70	RTM-1-070	RJS-1-070
AHB-3	5210		DSP6001		AF-1	PG-10	80	RTM-1-080	RJS-1-080
AHB-5	5210		DSP6001		AF-1	PG-10	100	RTM-1-100	RJS-1-100
AHB-6	5210	ZUP36-6	DSP6001	DSP6001 and ZUP36-6	AF-1	PG-10	80	RTM-1-080	RJS-1-080
AHB-12	5210	ZUP36-6	DSP6001	DSP6001 and ZUP36-6	AF-1	PG-10	120	RTM-1-120	RJS-1-120
AHB-24	5210	ZUP36-6	DSP6001	DSP6001 and ZUP36-6	AF-1	PG-10	120	RTM-2-120	RJS-2-120

* If testing at currents below 1 amp, then the 5210 (open loop) or DSP6001 (closed loop) are sufficient. The DSP6001 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 DSP6001 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	FR 10
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	DSP6001
	Torque Display	3410
BRAKE POWER SUPPLIES	Current-Regulated Power Supply	5210
	Regulated DC Power Supply - 0-36 volts / 6 amps; high accuracy; digital display	Lambda ZUP36-6
CONNECTION CABLES	Connect DSP6001 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 (5 m)
	Connect DSP6001 Controller to ZUP36-6 Power Supply	88M176-0100 (1 m) 88M176-0200 (2 m)
	Connect TM Torque Transducer to DSP6001	ER113/01 (5 m) ER113/02 (10 m) ER113/03 (20 m)
MISC	Air Supply Lines	Contact Magtrol
	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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