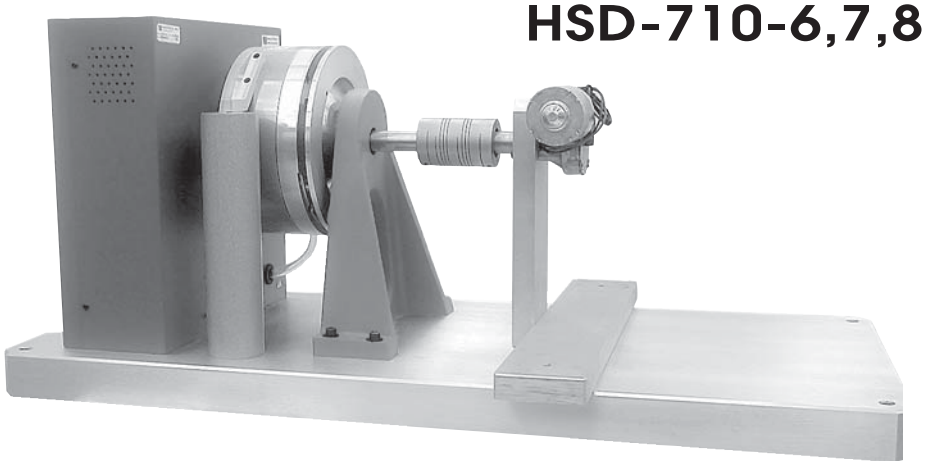
MAGTROL

HYSTERESIS DYNAMOMETERS

HD-100-6,7,8
HD-106-6,7,8
HD-400-6,7,8
HD-500-6,7,8
HD-505-6,7,8
HD-510-6,7,8
HD-700-6,7,8
HD-705-6,7,8
HD-710-6,7,8
HD-715-6,7,8
HD-800-6,7,8
HD-805-6,7,8
HD-810-6,7,8
HD-815-6,7,8
HD-825-6,7,8
ED-715-6,7,8
ED-815-6,7,8
HSD-610M-6,7,8
HSD-710-6,7,8



User's Manual

While every precaution has been exercised in the compilation of this document to ensure the accuracy of its contents, Magtrol, Inc. assumes no responsibility for errors or omissions. Additionally, no liability is assumed for any damages that may result from the use of the information contained within this publication.

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2nd Edition, revision E – October 2003

MAGTROL

Safety Precautions

Several warning labels are affixed directly to the dynamometer. These warnings are discussed in further detail below. Please take the time to read this page thoroughly before connecting and using your dynamometer.

1. Make sure that all Magtrol dynamometers and electronic products are earth-grounded, to ensure personal safety and proper operation.

2. Check line voltage before operation on any dynamometer that uses AC input power.
3. Make sure that dynamometers are equipped with a protective cover to prevent contact with the rotating shaft and coupling. The protective cover must be equipped with a safety interlock to disable the test motor if the cover is removed.

4. Make sure that all motors under test are equipped with appropriate safety guards.
5. Use caution with exposed brake surfaces. They have a tendency to become very hot during long periods of operation.

⚠ CAUTION ⚠
BRAKE SURFACES MAY BECOME HOT

6. Do not lift the unit by the brake assembly, as it may cause damage to the torque sensor.

⚠ CAUTION ⚠
LIFTING BY BRAKE ASSEMBLY MAY CAUSE DAMAGE TO TORQUE SENSOR

Revisions To This Manual

The contents of this manual are subject to change without prior notice. Should revisions be necessary, updates to all Magtrol User's Manuals can be found at Magtrol's web site at www.magtrol.com/support/manuals.htm.

Please compare the date of this manual with the revision date on the web site, then refer to the manual's Table of Revisions for any changes/updates that have been made since this edition.

REVISION DATE

2nd Edition, revision E – October 2003

TABLE OF REVISIONS

Date	Edition	Change	Section(s)
10/27/03	2nd Edition - rev. E	Change in maximum torque rating for HSD-710-8N	1.3.5, 4.1.3.1
10/27/03	2nd Edition - rev. E	Added shortened base plate option	1.3.1–1.3.3
10/27/03	2nd Edition - rev. E	Change in speed encoder options	1.3.1–1.3.4
10/02/03	2nd Edition - rev. D	New dimensions for HD-700 series dynamometers	1.3.2
09/25/03	2nd Edition - rev. C	New "B" dimension for HD-400	1.3.1
09/25/03	2nd Edition - rev. C	New "B" and "E" dimensions for HD-106	1.3.1
08/19/03	2nd Edition - rev. B	New schematic drawing for HD-800–815 Brake Control Supply	B.4
03/17/03	2nd Edition - rev. A	New "F" dimension for HSD-610M	1.3.5
03/17/03	2nd Edition - rev. A	New Dynamometer Table added to System Options and Accessories	1.3.1–1.3.5
01/03/03	2nd Edition	Added more information about air cooling – air flow sensor now standard	3.3.3
01/03/03	2nd Edition	Inserted new chapter about optional features	chapter 7
01/03/03	2nd Edition	HSD High Speed Dynamometer information added	throughout manual
06/11/02	1st Edition - rev. B	Air flow sensor option added to all 4 data sheets	1.3
05/10/02	1st Edition - rev. A	HD-700 Series dimensions changed	1.3.2

Table of Contents

TABLE OF FIGURES

Preface

PURPOSE OF THIS MANUAL

This manual contains all the information required for the setup and general use of Magtrol's Hysteresis Dynamometers. To achieve maximum capability and ensure proper use of the dynamometer, please read this manual in its entirety before operating. Keep the manual in a safe place for quick reference whenever a question should arise.

WHO SHOULD USE THIS MANUAL

This manual is intended for those operators who are planning to use any of Magtrol's Hysteresis Dynamometers.

MANUAL ORGANIZATION

This section gives an overview of the structure of the manual and the information contained within it. Some information has been deliberately repeated in different sections of the document to minimize cross-referencing and to facilitate understanding through reiteration.

The structure of the manual is as follows:

Chapter 1: INTRODUCTION – Contains the technical data sheets for Magtrol's Hysteresis Dynamometers, which describe the units and provide detailed technical characteristics.

Chapter 2: INPUTS/OUTPUTS – Description of the elements located on the rear panel of the dynamometer.

Chapter 3: INSTALLATION/CONFIGURATION – Provides information needed for setup of the dynamometer. This includes load cell shipping/restraining bolt removal, earth ground instruction and configurations for manual, computer-controlled and air-cooled test setups.

Chapter 4: TESTING – Provides information on how to run a test along with considerations that should be taken when operating the dynamometer.

Chapter 5: OPERATING PRINCIPLES – Information pertaining to theory of operation including speed, torque, torque signal amplification, decimal point control, damper cylinder and brake control power.

Chapter 6: CALIBRATION – Provides recommended calibration schedules along with step-by-step instructions for the calibration procedure.

Chapter 7: OPTIONAL FEATURES – Provides information regarding various optional features available to enhance the capability of Magtrol’s Hysteresis Dynamometers including speed encoders and analog outputs.

Chapter 8: TROUBLESHOOTING – Solutions to common problems encountered during setup and testing.

Appendix A: CALIBRATION RECORD – Data sheet for tracking calibration results.

Appendix B: SCHEMATICS – For the torque amplification board, speed sensor board, load cell and brake control power supplies.

CONVENTIONS USED IN THIS MANUAL

The following symbols and type styles may be used in this manual to highlight certain parts of the text:

Note: This is intended to draw the operator's attention to complementary information or advice relating to the subject being treated. It introduces information enabling the correct and optimal function of the product.

CAUTION: THIS IS USED TO DRAW THE OPERATOR'S ATTENTION TO INFORMATION, DIRECTIVES, PROCEDURES, ETC. WHICH, IF IGNORED, MAY RESULT IN DAMAGE TO THE MATERIAL BEING USED. THE ASSOCIATED TEXT DESCRIBES THE NECESSARY PRECAUTIONS TO TAKE AND THE CONSEQUENCES THAT MAY ARISE IF THESE PRECAUTIONS ARE IGNORED.

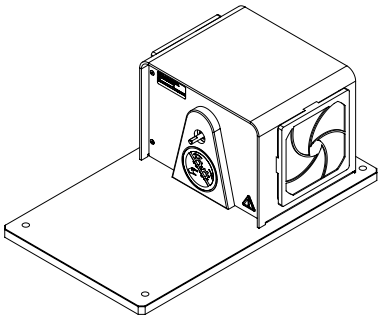
WARNING! THIS INTRODUCES DIRECTIVES, PROCEDURES, PRECAUTIONARY MEASURES, ETC. WHICH MUST BE EXECUTED OR FOLLOWED WITH THE UTMOST CARE AND ATTENTION, OTHERWISE THE PERSONAL SAFETY OF THE OPERATOR OR THIRD PARTY MAY BE AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

1. Introduction

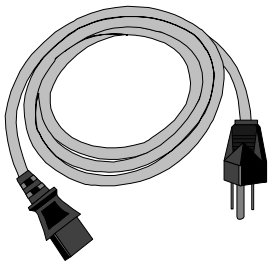
1.1 UNPACKING YOUR HYSTERESIS DYNAMOMETER

Your Hysteresis Dynamometer was packaged in reusable, shock resistant packing material that will protect the instrument during normal handling.

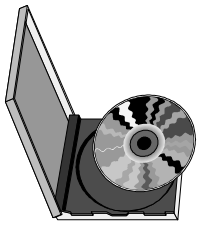
1. Make sure the carton contains the following:



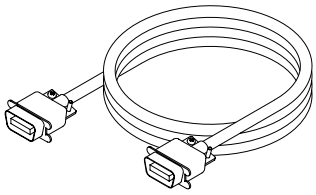
Hysteresis Dynamometer



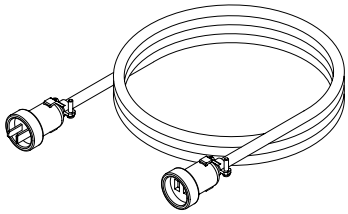
Line Cord
(not included with 700 series or HD-825)



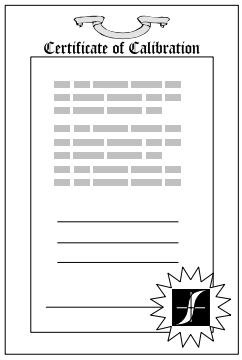
Magtrol User Manual CD-Rom



14-Pin Instrument Cable



Brake Cable



Calibration Certificate

2. Inspect the contents for any evidence of damage in shipping. In the event of shipping damage, immediately notify the carrier and Magtrol's Customer Service Department.

Note: Save all shipping cartons and packaging material for reuse when returning the instrument for calibration or servicing.

3. Remove the Shipping Bolt

PLEASE TAKE NOTICE!

Before proceeding any further, you will need to remove the load cell shipping/restraining bolt if you have just unpacked a new:

HD-100	HD-500	HD-700	HD-715	HSD-710
HD-106	HD-505	HD-705	ED-715	
HD-400	HD-510	HD-710	HSD-610M	

This does not apply to HD-800, HD-805, HD-810, HD-815, HD-825 or ED-815 Dynamometers. For further instruction see *Section 3.1 Removal of the Load Cell Shipping/ Restraining Bolt.*

Note: Retain the shipping/restraining bolt for future use when moving or shipping your Magtrol Dynamometer.

1.2 FEATURES OF THE HYSTERESIS DYNAMOMETER

All Magtrol Hysteresis Dynamometers (HD, ED and HSD Series) feature the following:

- **Hysteresis Braking System:** The dynamometers do not require speed to create torque, and therefore can provide a full motor ramp from free-run to locked rotor along with precise torque loading.
- **Air Flow Sensor:** Any Magtrol Hysteresis Dynamometer that is internally ported for compressed air and/or blower cooling contains an air flow sensor that provides protection against overheating and operator error
- **Standard Torque Units:** English, metric and SI are available.
- **Easy Calibration**

Unique features of each series are listed below.

1.2.1 HD SERIES

Magtrol's HD Series Dynamometers are versatile and ideal for testing in low to medium power ranges. Features include:

- **Accuracy:** ±0.25% to ±0.5% full scale, depending on size and system configuration.
- **Custom Dynamometers:** For special torque and speed requirements.
- **Encoder Switch:** Optional feature that allows the user to switch between a 60 and 600-bit encoder or a 60 and 6000-bit encoder.

1.2.2 ED SERIES

Magtrol's ED Series Dynamometers are high performance dynamometers specifically designed to address the severe, high vibration conditions inherent in internal combustion engine testing. Features include:

- **Accuracy:** ±0.25% full scale.
- **High Speed Capabilities:** 12,000 to 25,000 rpm, depending on model.
- **Rugged Stainless Steel Shaft:** Larger shaft for additional strength.
- **Specially Reinforced Load Cell:** Stainless steel pin used at contact point to prevent premature wear from excess vibration.
- **Gusseted Pillow Blocks:** Adds additional front and rear support.
- **Brake Cooling:** Blower cooled to maximize heat dissipation.

1.2.3 HSD SERIES

Magtrol's HSD Series Dynamometers are high-speed dynamometers designed to withstand high free-run speeds up to 35,000 rpm. Features include:

- **Accuracy:** ± .25% full scale
- **High Speed Capabilities:** up to 35,000 rpm.
- **Rugged Stainless Steel Shaft:** Larger shaft for additional strength.
- **Specially Reinforced Load Cell:** Stainless steel pin used at contact point to prevent premature wear from excess vibration.
- **Gusseted Pillow Blocks:** Adds additional front and rear support.
- **Brake Cooling:** Blower cooled to maximize heat dissipation.
- **High Speed Bearings:** Provides desired preload and allows for thermal expansion without increasing preload.
- **Speed Pickup:** Minimizes windage.

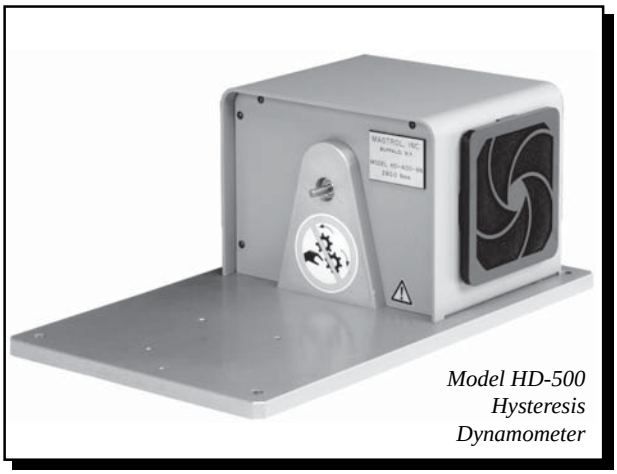
1.3 DATA SHEETS

1.3.1 HD-100, -400 AND -500 SERIES HYSTERESIS DYNAMOMETERS

HD-100, 400 & 500 Series Hysteresis Dynamometers

FEATURES

- 6 Standard Models with Maximum Torque from 2.5 oz·in to 240 oz·in (18 mN·m to 1700 mN·m)
- Hysteresis Braking System: Provides precise torque loading independent of shaft speed
- Motor Testing from No Load to Locked Rotor
- Accuracy: ±0.25% to ± 0.5% (Full Scale)
- Air Flow Sensor: For protection against overheating and operator error
- Standard Torque Units: English, Metric and SI are available
- Custom Dynamometers: For special torque and speed requirements
- Easy Calibration



Model HD-500 Hysteresis Dynamometer

DESCRIPTION

Hysteresis Brake Dynamometers (HD-100, 400 & 500 Series) are versatile and ideal for testing in the low power range (maximum 800 watts intermittent duty). With a Hysteresis Braking system, the Dynamometers do not require speed to create torque, and therefore can provide a full motor ramp from free-run to locked rotor. Brake cooling is provided by convection (no external source) or by compressed air, depending on the model. All Magtrol Hysteresis Dynamometers have accuracy ratings of ± 0.25% to ± 0.5% full scale — depending on size and system configuration.

Magtrol offers three types of dynamometer brakes to absorb load: Hysteresis, Eddy Current and Magnetic Powder. Each type of Dynamometer has advantages and limitations and choosing the correct one will depend largely on the type of testing to be performed. With over 50 models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

APPLICATIONS

Magtrol motor test systems can be found in test labs, at inspection stations, and on the manufacturing floors of most of the world's leading manufacturers, users and certifiers of small to medium sized electric, pneumatic and hydraulic motors, as well as internal combustion engines. Magtrol supplies motor test systems for a wide array of industries including: Appliance, Automotive, Aviation, Computer, HVAC, Lawn and Garden, Medical and Dental, Electric Motor, Office Equipment and Power Tools.

COMPLETE PC CONTROL

Magtrol's M-TEST 4.0 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol Programmable Dynamometer Controller, Magtrol M-TEST 4.0 Software provides the control of any Magtrol Dynamometer and runs test sequences in a manner best suited to the overall accuracy and efficiency of the Magtrol Motor Test System. The data that is generated by Magtrol's Motor Testing Software can be stored, displayed and printed in tabular or graphic formats, and can be easily imported into a spreadsheet.

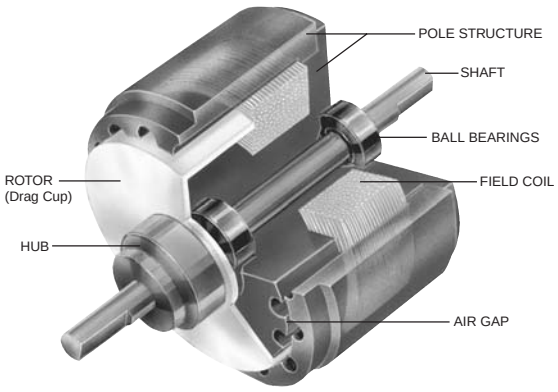
Written in LabVIEW™, M-TEST 4.0 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermocouples), controlling motor power and providing audio/visual indicators is relatively easy.

Magtrol's M-TEST 4.0 Software is ideal for simulating loads, cycling the unit under test and motor ramping. Because it is easy to gather data and duplicate tests, the software is ideal for use in engineering labs. Tests can be programmed to run on their own and saved for future use allowing for valuable time savings in production testing and incoming/outgoing inspection.

Specifications

HD-100, 400 & 500 Series

OPERATING PRINCIPLES



Magtrol Hysteresis Dynamometers absorb power with a unique Hysteresis Braking System which provides frictionless torque loading independent of shaft speed. The Hysteresis Brake provides torque by the use of two basic components—a reticulated pole structure and a specialty steel rotor/shaft assembly—fitted together but not in physical contact. Until the pole structure is energized, the drag cup can spin freely on its shaft bearings. When a magnetizing force from the field coil is applied to the pole structure, the air gap becomes a flux field and the rotor is magnetically restrained, providing a braking action between the pole structure and rotor.

ITEMS TO CONSIDER WHEN SELECTING A DYNAMOMETER:

TYPE OF MOTORS TO BE TESTED

•

MAXIMUM TORQUE, SPEED AND POWER OF THE MOTOR UNDER TEST

•

MOTOR TESTING PARAMETERS

•

DYNAMOMETER CONTROL & DATA COLLECTION

DYNAMOMETER SELECTION

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

Maximum Torque

The Magtrol Hysteresis Absorption Dynamometer 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. Dynamometer 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 Dynamometer 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 Dynamometer 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 Dynamometer 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 basic horsepower formula:

English: $hp = T\ (lb{\cdot}in) \times n\ (rpm) \times (1.59 \times 10^{-5})$

Metric: $hp = T\ (kg{\cdot}cm) \times n\ (rpm) \times (1.38 \times 10^{-5})$

SI: $hp = T\ (N{\cdot}m) \times n\ (rpm) \times (1.4 \times 10^{-4})$

watts = hp × 746
(All power ratings are expressed in watts.)

The Dynamometer'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 Dynamometer failure, the maximum power rating is the most important consideration in selecting a Dynamometer.

Specifications

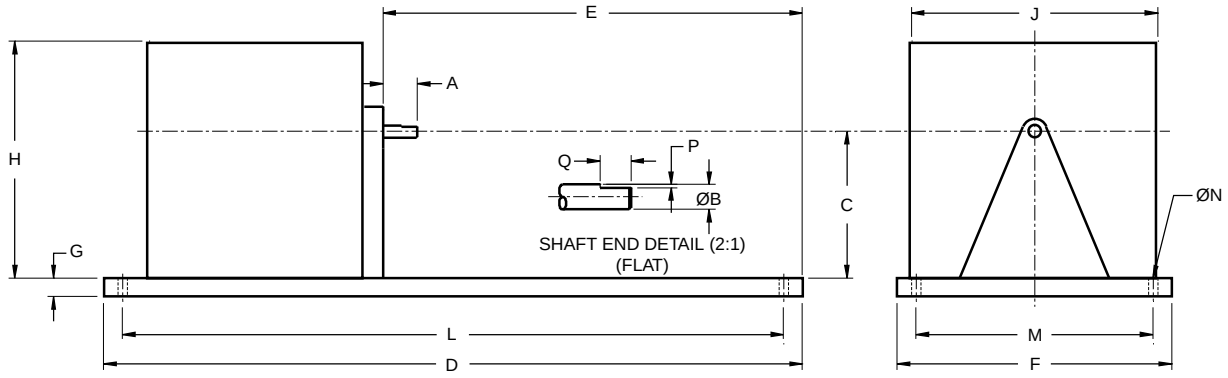
HD-100, 400 & 500 Series

RATINGS

MODEL	Torque Measure Unit Code	Maximum Torque Range	Drag Torque De-Energized at 1000 rpm	Digital Torque Resolution	Nominal Input Inertia		Max. Power Ratings		Maximum Speed	Brake Cooling Method
					lb·ft·s²	*kg·m²*	5 minute *watts*	continuous *watts*	*rpm*	
HD-106	6N	2.5 oz·in	0.008 oz·in	0.01 oz·in	7.04×10^{-7}	9.54×10^{-7}	35	7	30,000	Convection
	7N	180 g·cm	0.57 g·cm	0.1 g·cm						
	8N	18 mN·m	0.056 mN·m	0.01 mN·m						
HD-100	6N	11 oz·in	0.09 oz·in	0.01 oz·in	3.40×10^{-6}	4.61×10^{-6}	75	20	25,000	Convection
	7N	800 g·cm	6.5 g·cm	1.0 g·cm						
	8N	80 mN·m	0.64 mN·m	0.1 mN·m						
HD-400	6N	40 oz·in	0.25 oz·in	0.1 oz·in	1.55×10^{-5}	2.10×10^{-5}	200	55	25,000	Convection
	7N	2.8 kg·cm	0.02 kg·cm	0.01 kg·cm						
	8N	280 mN·m	2 mN·m	1 mN·m						
HD-500	6N	120 oz·in	0.5 oz·in	0.1 oz·in	8.05×10^{-5}	1.09×10^{-4}	400	80	20,000	Convection
	7N	8.5 kg·cm	0.05 kg·cm	0.01 kg·cm						
	8N	850 mN·m	5 mN·m	1 mN·m						
HD-510	6N	120 oz·in	0.5 oz·in	0.1 oz·in	8.05×10^{-5}	1.09×10^{-4}	750	375	25,000	Compressed Air*
	7N	8.5 kg·cm	0.05 kg·cm	0.01 kg·cm						
	8N	850 mN·m	5 mN·m	1 mN·m						
HD-505	6N	240 oz·in	1.0 oz·in	0.1 oz·in	1.61×10^{-4}	2.18×10^{-4}	800	160	20,000	Convection
	7N	17 kg·cm	0.1 kg·cm	0.01 kg·cm						
	8N	1700 mN·m	10 mN·m	1 mN·m						

** Model HD-510 requires air cooling provided by user. Cooling requirements are 7 CFM at 1.75 PSIG for the HD-510. Regulator and filter package is provided as standard equipment on these units..*

DIMENSIONS



NOTE: *Original dimensions are in English units. Dimensions converted to Metric have been rounded up to 1 decimal place.*

MODEL	units	A	B	C	D	E	F	G	H	J	L**	M**	N	P	Q	Weight
HD-106	*in*	0.50	Ø 0.1245/0.1247	3.5	17	9.38	10	0.5	6.3	8.5	15.5	8.5	Ø 0.37	0.015	0.375	12.0 lb
	mm	12.7	Ø 3.162/3.167	89	432	238.3	254	13	159	216	394	216	Ø 9.4	0.38	9.53	5.4 kg
HD-100	*in*	0.75	Ø 0.1870/0.1875	3.5	17	9.13	10	0.5	6.3	8.5	15.5	8.5	Ø 0.37	0.025	0.375	12.5 lb
	mm	19.1	Ø 4.750/4.763	89	432	231.9	254	13	159	216	394	216	Ø 9.4	0.64	9.53	5.7 kg
HD-400	*in*	0.67	Ø 0.2495/0.2497	3.5	17	9.13	10	0.5	6.3	8.5	15.5	8.5	Ø 0.37	0.03	0.438	15.0 lb
	mm	17.0	Ø 6.337/6.342	89	432	231.9	254	13	159	216	394	216	Ø 9.4	0.76	11.13	6.8 kg
HD-500	*in*	0.88	Ø 0.3745/0.3750	4.0	17	9.13	10	0.5	6.3	8.5	15.5	8.5	Ø 0.37	0.047	0.375	16.0 lb
	mm	22.2	Ø 9.512/9.525	102	432	231.9	254	13	159	216	394	216	Ø 9.4	1.19	9.53	7.3 kg
HD-510	*in*	0.88	Ø 0.3745/0.3750	4.0	17	9.13	10	0.5	6.3	8.5	15.5	8.5	Ø 0.37	N/A		16.0 lb
	mm	22.2	Ø 9.512/9.525	102	432	231.9	254	13	159	216	394	216	Ø 9.4			7.3 kg
HD-505	*in*	0.88	Ø 0.3745/0.3750	4.0	20	9.64	10	0.5	6.3	8.5	18.5	8.5	Ø 0.37	0.05	0.375	18.0 lb
	mm	22.2	Ø 9.512/9.525	102	508	244.9	254	13	159	216	470	216	Ø 9.4	1.27	9.53	8.1 kg

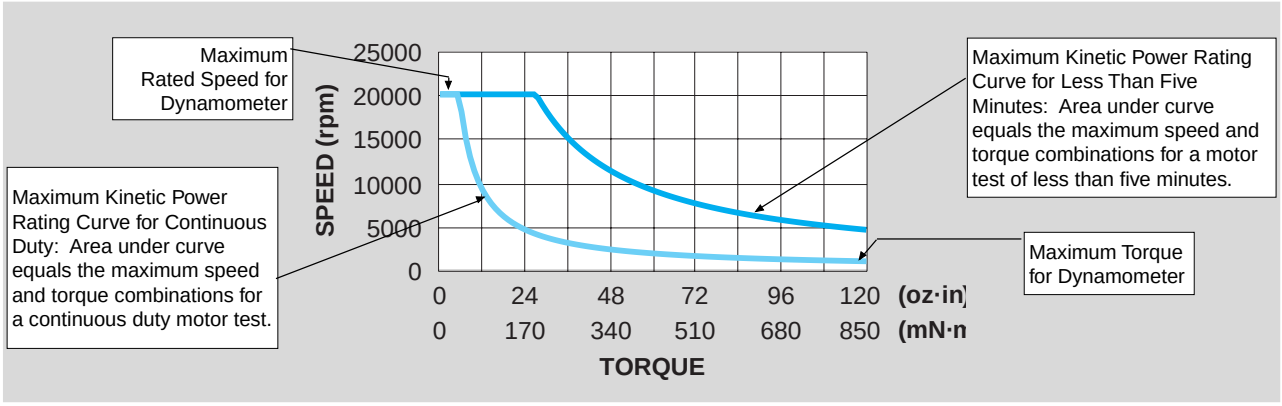
*** These dimensions represent the distance between mounting holes. There are four (4) mounting holes on each base plate.*

Specifications

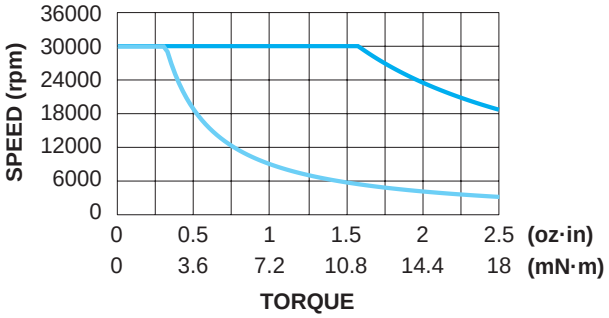
HD-100, 400 & 500 Series

POWER ABSORPTION CURVES

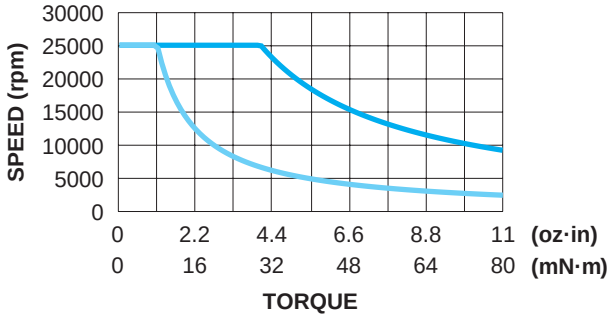
The power absorption curves represent the maximum power (heat) that the dynamometer can dissipate over time.



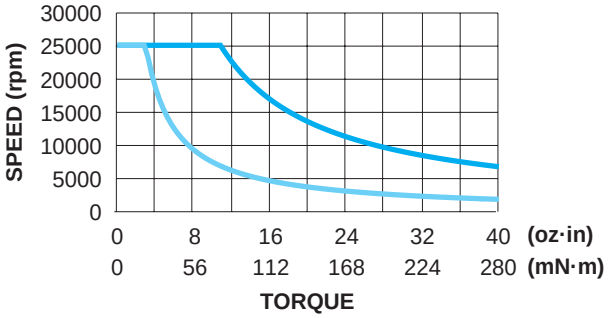
HD-106



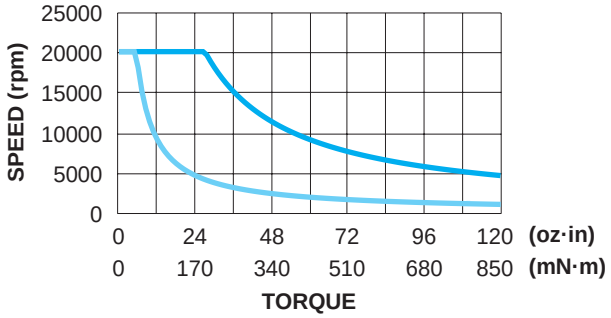
HD-100



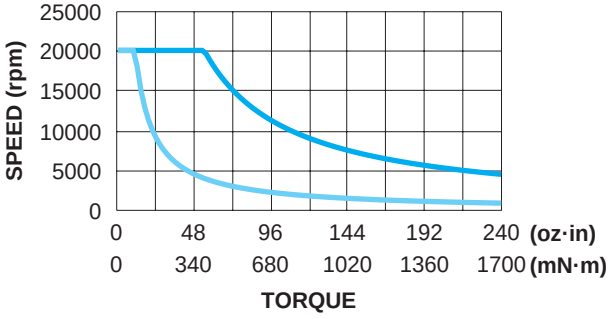
HD-400



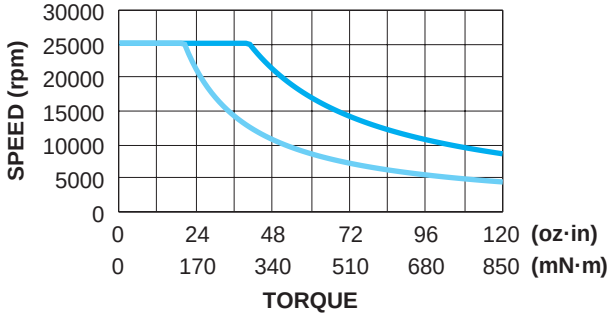
HD-500



HD-505



HD-510

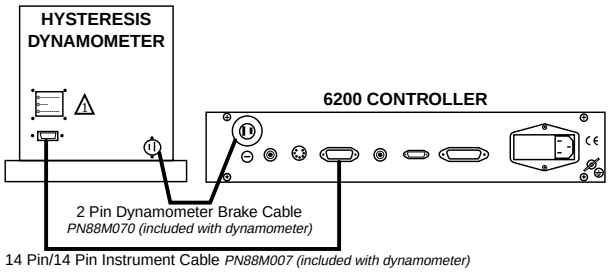


System Configurations

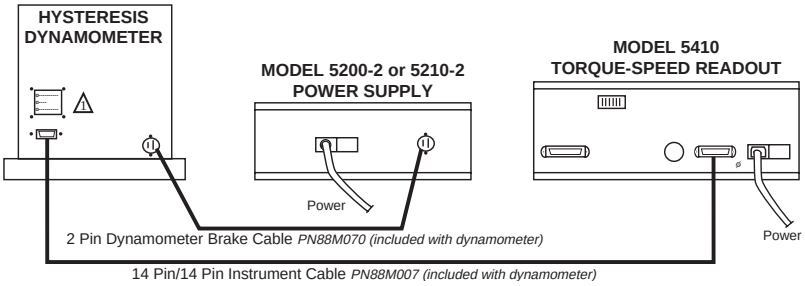
HD-100, 400 & 500 Series

OPEN LOOP SYSTEMS

Dynamometer with 6200 Controller



Dynamometer with 5410 Readout and 5200 Power Supply

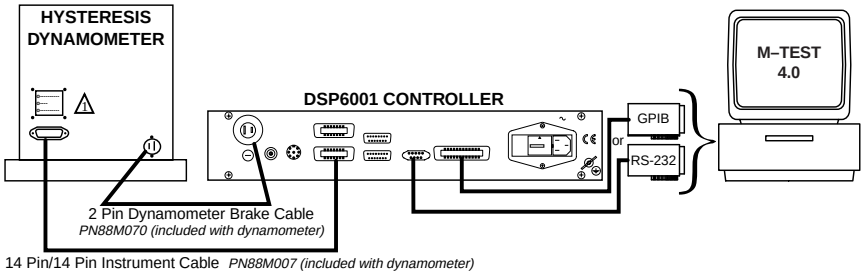


Magtrol offers both open loop manual test systems and PC-based closed loop test systems. A typical open loop system will consist of a Dynamometer and a Magtrol 6200 Open Loop Controller or a Magtrol Power Supply and Model 5410 Readout. A Magtrol Single or Three Phase Power Analyzer, which allows for the capturing of volts, amps, watts and power factor, can be included as an option. An open loop system is often used for quick pass/fail testing on the production line or at incoming inspection. Magtrol's 6200 Controller provides pass/fail testing as a standard feature.

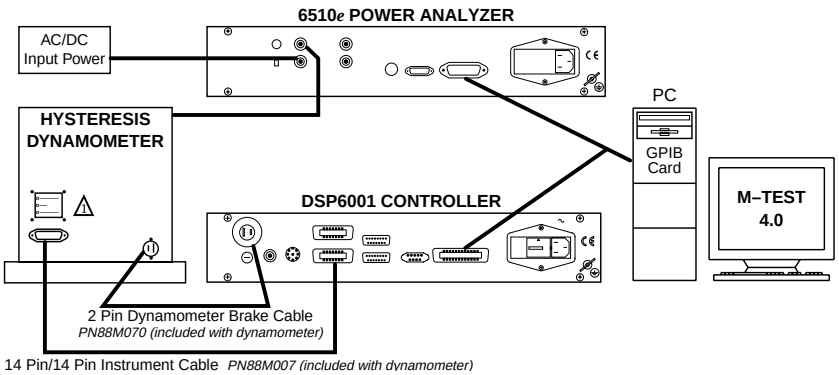
In a closed loop motor test system, data is collected on a PC using Magtrol's M-Test Software, DSP6001 Programmable Dynamometer Controller, and requisite interface cards and cables. Magtrol's Model 6200 and DSP6001 Controllers compute and display mechanical power (in horsepower or watts) in addition to torque and speed. A Single or Three Phase Power Analyzer, a required component in a test system measuring motor efficiency, can be integrated into this system as well as Magtrol's Temperature Testing Hardware and Software.

CLOSED LOOP SYSTEMS

Dynamometer with DSP6001 Controller and M-Test Software



Dynamometer with 6510*e* Power Analyzer, DSP6001 Controller and M-Test Software



Ordering Information

HD-100, 400 & 500 Series

DYNAMOMETER OPTIONS

Encoder Options For Low Speed Testing

For low speed motors, such as gear motors with maximum speeds of less than 200 rpm, Magtrol offers additional encoder options that allow for increased resolution of the speed signal.

Shortened Base Plate

A shortened base plate, cut off at the pillow block, is available. With 4 metrically-spaced holes, the dynamometer can be easily mounted to a T-slot table plate.

Analog Output

Magtrol can provide a 0-5 VDC analog output for the torque signal and a TTL speed signal from the Dynamometer.

CUSTOM DYNAMOMETERS

High Speed Testing

For certain models, Magtrol can provide Dynamometers which can operate at higher than rated speeds.

Mechanical Modifications

Magtrol can provide customized base plates, riser blocks and shaft modifications.

ORDERING INFORMATION

MODEL NUMBER: HD – □□□ – □□□ – 0□□□

- Model: HD100–510

TORQUE UNITS
- English (U.S.) — 6N
- Metric — 7N
- SI — 8N

POWER OPERATION
- 120 VAC (standard) — *(blank)*
- 240 VAC (option) — A

BASE PLATE
- standard — 0
- short — 1

SPEED ENCODER
- 60 bit (standard) — 00
- 60 and 600 bit — 30
- 60 and 6000 bit — 40

Example: For a 240 VAC Model 510 Hysteresis Dynamometer in metric torque units, with shorter base plate and 60/6000-bit speed encoder option, order Model HD-510-7NA-0140.

SYSTEM OPTIONS AND ACCESSORIES

CATEGORY	DESCRIPTION	MODEL / PART #
CONTROLLERS AND READOUTS	High Speed Programmable Dynamometer Controller	DSP6001
	Open Loop Dynamometer Controller	6200
	Torque/Speed Readout	5410
	Direction Indicator	5600
POWER ANALYZERS	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
MOTOR TESTING SOFTWARE	M-TEST 4.0 Motor Testing Software	SW-M-TEST-WE4.0
	M-TEST 4.0 Motor Testing Software with Source Codes	SW-M-TEST-WS4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option*	SW-MT-TEST-WE4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option & Source Codes*	SW-MT-TEST-WS4.0
	Temperature Testing Hardware*	HW-TTEST
POWER SUPPLIES	Closed Loop Speed Control/Power Supply	6100
	Power Supply	5200
	Current Regulated Power Supply	5210
MISC.	Dynamometer Table (with drilled table top and tap for one or more dynamometers)	005032

** Please refer to the M-TEST 4.0 Data Sheet for additional temperature testing software/hardware options and order information.*

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

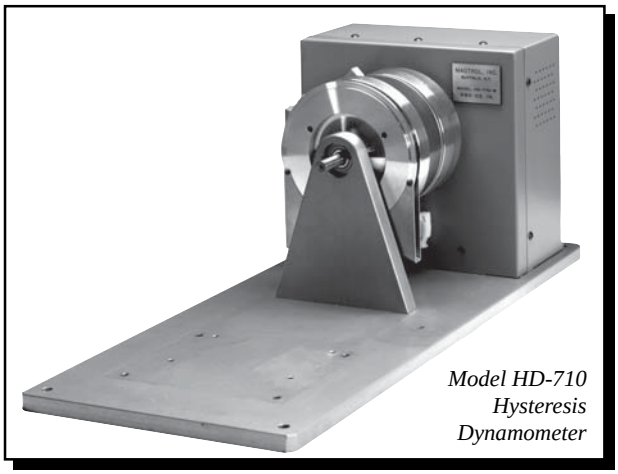
HD145DS-US www 10/03

1.3.2 HD-700 Series Hysteresis Dynamometers

HD-700 Series Hysteresis Dynamometers

FEATURES

- 4 Standard Models with Maximum Torque from 425 oz·in to 55 lb·in (3 N·m to 6.5 N·m)
- Hysteresis Braking System: Provides precise torque loading independent of shaft speed
- Motor Testing from No Load to Locked Rotor
- Accuracy: ±0.25% to ± 0.5% (Full Scale)
- Air Flow Sensor: For protection against overheating and operator error
- Standard Torque Units: English, Metric and SI are available
- Custom Dynamometers: For special torque and speed requirements
- Easy Calibration



Model HD-710 Hysteresis Dynamometer

DESCRIPTION

Hysteresis Brake Dynamometers (HD-700 Series) are versatile and ideal for testing in the low to medium power range (maximum 3360 watts intermittent duty). With a Hysteresis Braking system, the Dynamometers do not require speed to create torque, and therefore can provide a full motor ramp from free-run to locked rotor. Brake cooling is provided by convection (no external source) or by air with a dedicated blower, depending on the model. All Magtrol Hysteresis Dynamometers have accuracy ratings of ± 0.25% to ± 0.5% full scale—depending on size and system configuration.

Magtrol offers three types of dynamometer brakes to absorb load: Hysteresis, Eddy Current and Magnetic Powder. Each type of Dynamometer has advantages and limitations and choosing the correct one will depend largely on the type of testing to be performed. With over 50 models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

APPLICATIONS

Magtrol motor test systems can be found in test labs, at inspection stations, and on the manufacturing floors of most of the world's leading manufacturers, users and certifiers of small to medium sized electric, pneumatic and hydraulic motors, as well as internal combustion engines. Magtrol supplies motor test systems for a wide array of industries including: Appliance, Automotive, Aviation, Computer, HVAC, Lawn and Garden, Medical and Dental, Electric Motor, Office Equipment and Power Tools.

COMPLETE PC CONTROL

Magtrol's M-TEST 4.0 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol Programmable Dynamometer Controller, Magtrol M-TEST 4.0 Software provides the control of any Magtrol Dynamometer and runs test sequences in a manner best suited to the overall accuracy and efficiency of the Magtrol Motor Test System. The data that is generated by Magtrol's Motor Testing Software can be stored, displayed and printed in tabular or graphic formats, and can be easily imported into a spreadsheet.

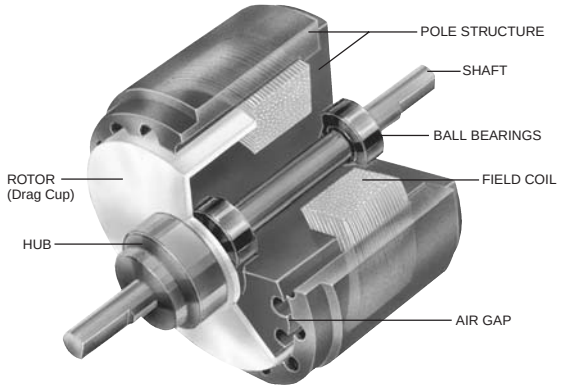
Written in LabVIEW™, M-TEST 4.0 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermocouples), controlling motor power and providing audio/visual indicators is relatively easy.

Magtrol's M-TEST 4.0 Software is ideal for simulating loads, cycling the unit under test and motor ramping. Because it is easy to gather data and duplicate tests, the software is ideal for use in engineering labs. Tests can be programmed to run on their own and saved for future use allowing for valuable time savings in production testing and incoming/outgoing inspection.

Specifications

HD-700 Series

OPERATING PRINCIPLES



Magtrol Hysteresis Dynamometers absorb power with a unique Hysteresis Braking System which provides frictionless torque loading independent of shaft speed. The Hysteresis Brake provides torque by the use of two basic components—a reticulated pole structure and a specialty steel rotor/shaft assembly—fitted together but not in physical contact. Until the pole structure is energized, the drag cup can spin freely on its shaft bearings. When a magnetizing force from the field coil is applied to the pole structure, the air gap becomes a flux field and the rotor is magnetically restrained, providing a braking action between the pole structure and rotor.

ITEMS TO CONSIDER WHEN SELECTING A DYNAMOMETER:

TYPE OF MOTORS TO BE TESTED

•

MAXIMUM TORQUE, SPEED AND POWER OF THE MOTOR UNDER TEST

•

MOTOR TESTING PARAMETERS

•

DYNAMOMETER CONTROL & DATA COLLECTION

DYNAMOMETER SELECTION

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

Maximum Torque

The Magtrol Hysteresis Absorption Dynamometer 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. Dynamometer 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 Dynamometer 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 Dynamometer 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 Dynamometer 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 basic horsepower formula:

English: $hp = T\ (lb \cdot in) \times n\ (rpm) \times (1.59 \times 10^{-5})$

Metric: $hp = T\ (kg \cdot cm) \times n\ (rpm) \times (1.38 \times 10^{-5})$

SI: $hp = T\ (N \cdot m) \times n\ (rpm) \times (1.4 \times 10^{-4})$

watts = hp × 746
(All power ratings are expressed in watts.)

The Dynamometer'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 Dynamometer failure, the maximum power rating is the most important consideration in selecting a Dynamometer.

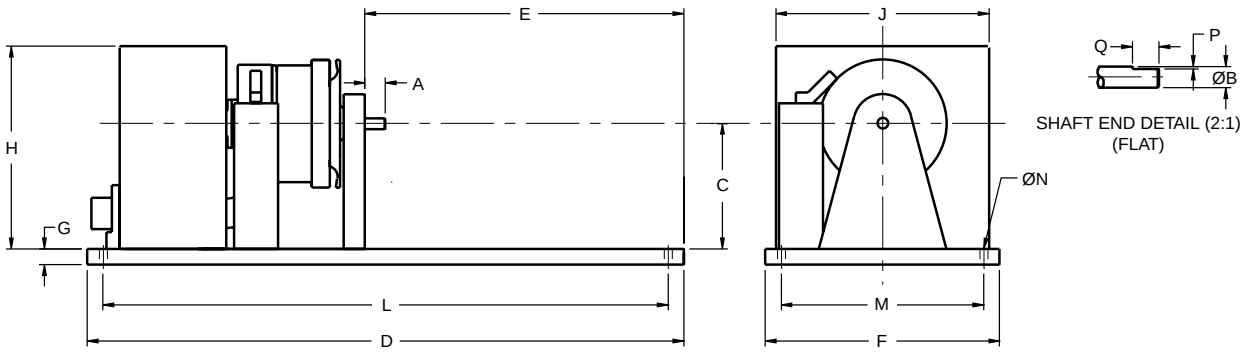
Specifications HD-700 Series

RATINGS

MODEL	Torque Measure Unit Code	Maximum Torque Range	Drag Torque De-Energized at 1000 rpm	Digital Torque Resolution	Nominal Input Inertia		Max. Power Ratings		Maximum Speed	Brake Cooling Method
							5 minute	continuous		
					lb·ft·s²	*kg·m²*	*watts*	*watts*	*rpm*	
HD-700	6N	425 oz·in	2.0 oz·in	1.0 oz·in	5.51×10^{-4}	7.47×10^{-4}	700	150	15,000	Convection
	7N	30 kg·cm	0.14 kg·cm	0.1 kg·cm						
	8N	3 N·m	0.013 N·m	0.01 N·m						
HD-710	6N	480 oz·in	2.0 oz·in	1.0 oz·in	5.51×10^{-4}	7.47×10^{-4}	1500	935	25,000	Blower*
	7N	32.5 kg·cm	0.14 kg·cm	0.1 kg·cm						
	8N	3.25 N·m	0.013 N·m	0.01 N·m						
HD-705	6N	50 lb·in	0.2 lb·in	0.1 lb·in	1.10×10^{-3}	1.49×10^{-3}	1400	300	10,000	Convection
	7N	60 kg·cm	0.24 kg·cm	0.1 kg·cm						
	8N	6 N·m	0.023 N·m	0.01 N·m						
HD-715	6N	55 lb·in	0.2 lb·in	0.1 lb·in	1.10×10^{-3}	1.49×10^{-3}	3360	2985	25,000	Blower*
	7N	65 kg·cm	0.24 kg·cm	0.1 kg·cm						
	8N	6.5 N·m	0.023 N·m	0.01 N·m						

***** *Blower package is included as standard equipment with Models HD-710 and HD-715.*

DYNAMOMETER DIMENSIONS



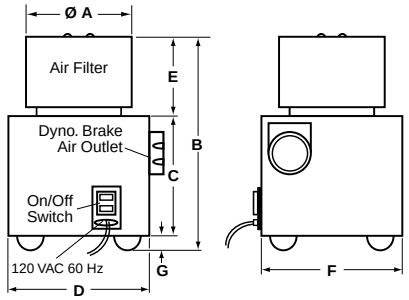
NOTE: *Original dimensions are in English units. Dimensions converted to Metric have been rounded up to 1 decimal place.*

MODEL	units	A	B	C	D	E	F	G	H	J	L**	M**	N	P	Q	Weight
HD-700	*in*	1.31	Ø 0.4995/0.4997	5.875	24	12.75	11	0.625	9.5	10	22.5	9.5	Ø 0.375	0.062	0.625	39.0 lb
	mm	33.3	Ø 12.687/12.692	149.2	609.6	323.9	279.4	15.9	241.3	254	571.5	241.3	Ø 9.5	1.57	15.88	17.63 kg
HD-710	*in*	1.25	Ø 0.4995/0.4999	5.875	26	13.59	11	0.625	9.5	10	24.5	9.5	Ø 0.375	N/A		45.0 lb
	mm	31.8	Ø 12.687/12.697	149.2	660.4	345.2	279.4	15.9	241.3	254	622.3	241.3	Ø 9.5			20.30 kg
HD-705	*in*	1.19	Ø 0.4995/0.4997	5.875	28	13.62	11	0.625	9.5	10	26.5	9.5	Ø 0.375	0.060	0.620	52.0 lb
	mm	30.2	Ø 12.687/12.692	149.2	711.2	346.0	279.4	15.9	241.3	254	673.1	241.3	Ø 9.5	1.52	15.70	23.5 kg
HD-715	*in*	1.36	Ø 0.4995/0.4999	5.875	30	14.29	11	0.625	9.5	10	28.5	9.5	Ø 0.375	N/A		59.0 lb
	mm	34.5	Ø 12.687/12.697	149.2	762	363.0	279.4	15.9	241.3	254	723.9	241.3	Ø 9.5			26.60 kg

****** *These dimensions represent the distance between mounting holes. There are four (4) mounting holes on each base plate.*

BLOWER DIMENSIONS

- Dynamometer Models HD-710 and HD-715 include BL-001 Blower.
- Allow approximately 6 to 8 in (152 to 203 mm) between rear of Dynamometer base plate and blower for connection hardware. Required hardware is supplied with the Dynamometer.
- 120 VAC 60 Hz 1 phase power required for brake cooling blower package; 240 VAC available as special order.



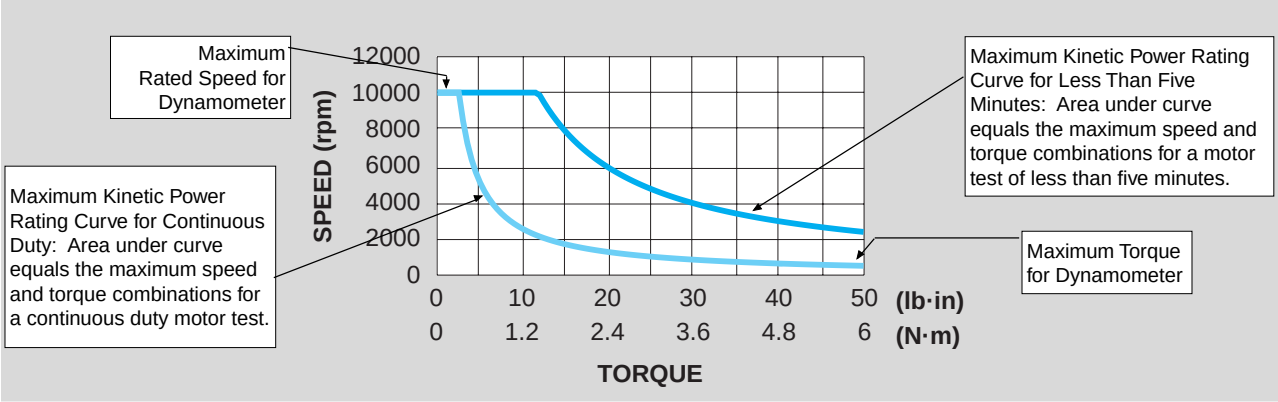
Model	BL-001	
	in	*mm*
A	Ø 6	Ø 152.4
B	11	279
C	6	152
D	8	203
E	4	102
F	8	203
G	1	25
Weight	8.5 lb	3.9 kg

Specifications

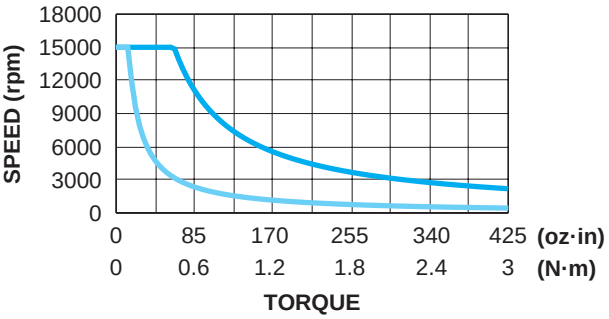
HD-700 Series

POWER ABSORPTION CURVES

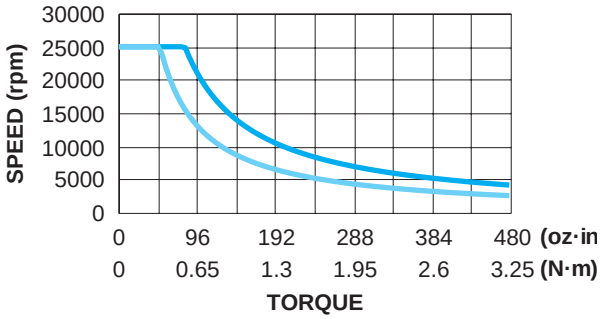
The power absorption curves represent the maximum power (heat) that the dynamometer can dissipate over time.



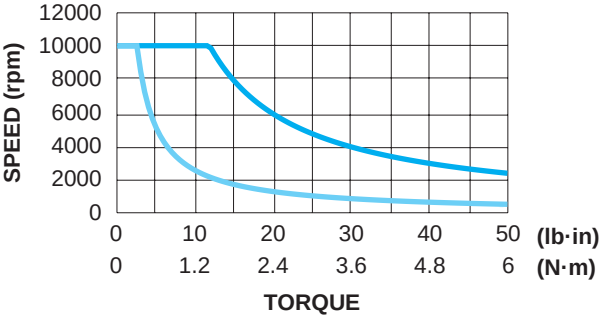
HD-700



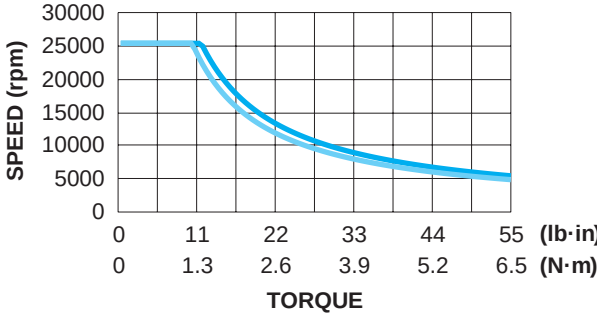
HD-710



HD-705



HD-715

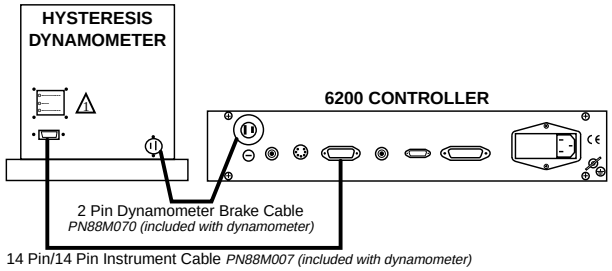


System Configurations

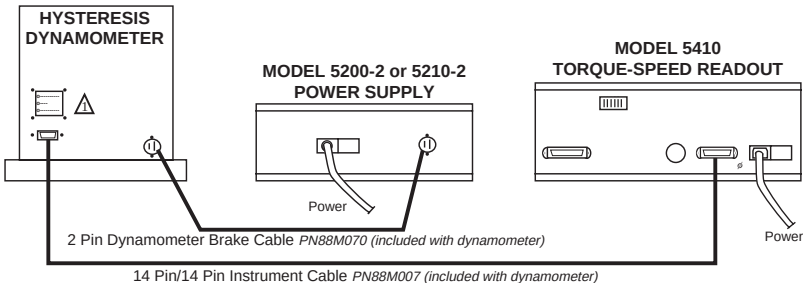
HD-700 Series

OPEN LOOP SYSTEMS

Dynamometer with 6200 Controller



Dynamometer with 5410 Readout and 5200 Power Supply

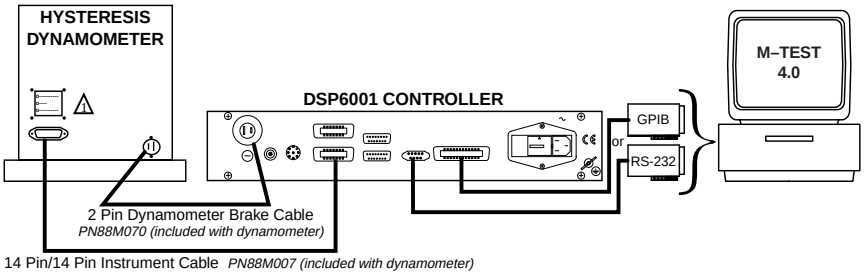


Magtrol offers both open loop manual test systems and PC-based closed loop test systems. A typical open loop system will consist of a Dynamometer and a Magtrol 6200 Open Loop Controller or a Magtrol Power Supply and Model 5410 Readout. A Magtrol Single or Three Phase Power Analyzer, which allows for the capturing of volts, amps, watts and power factor, can be included as an option. An open loop system is often used for quick pass/fail testing on the production line or at incoming inspection. Magtrol's 6200 Controller provides pass/fail testing as a standard feature.

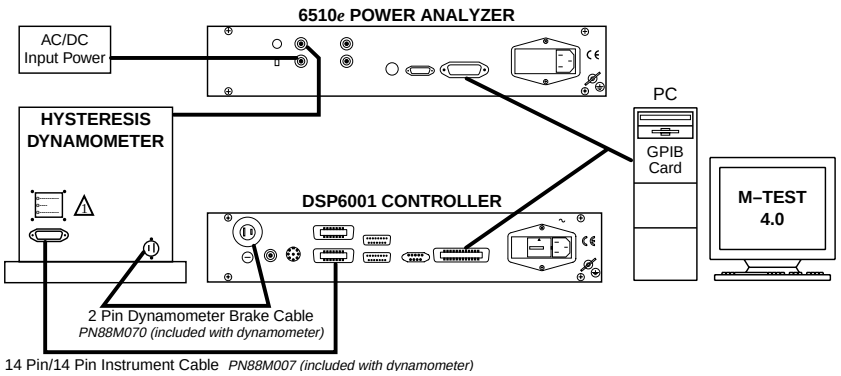
In a closed loop motor test system, data is collected on a PC using Magtrol's M-Test Software, DSP6001 Programmable Dynamometer Controller, and requisite interface cards and cables. Magtrol's Model 6200 and DSP6001 Controllers compute and display mechanical power (in horsepower or watts) in addition to torque and speed. A Single or Three Phase Power Analyzer, a required component in a test system measuring motor efficiency, can be integrated into this system as well as Magtrol's Temperature Testing Hardware and Software.

CLOSED LOOP SYSTEMS

Dynamometer with DSP6001 Controller and M-Test Software



Dynamometer with 6510*e* Power Analyzer, DSP6001 Controller and M-Test Software



Ordering Information

HD-700 Series

DYNAMOMETER OPTIONS

Encoder Options For Low Speed Testing

For low speed motors, such as gear motors with maximum speeds of less than 200 rpm, Magtrol offers additional encoder options that allow for increased resolution of the speed signal.

Shortened Base Plate

A shortened base plate, cut off at the pillow block, is available. With 4 metrically-spaced holes, the dynamometer can be easily mounted to a T-slot table plate.

Analog Output

Magtrol can provide a 0-5 VDC analog output for the torque signal and a TTL speed signal from the Dynamometer.

CUSTOM DYNAMOMETERS

High Speed Testing

For certain models, Magtrol can provide Dynamometers which can operate at higher than rated speeds.

Mechanical Modifications

Magtrol can provide customized base plates, riser blocks and shaft modifications.

ORDERING INFORMATION

MODEL NUMBER: **HD – □□□ – □□□ – 0 □□□**

- Model: HD700–715

TORQUE UNITS
- English (U.S.) — 6N
- Metric — 7N
- SI — 8N

POWER OPERATION
- 120 VAC (standard) — *(blank)*
- 240 VAC (option) — A

BASE PLATE
- standard — 0
- short — 1

SPEED ENCODER
- 60 bit (standard) — 00
- 60 and 600 bit — 30
- 60 and 6000 bit — 40

Example: For a 240 VAC Model 710 Hysteresis Dynamometer in metric torque units, with shorter base plate and 60/6000-bit speed encoder option, order Model HD-710-7NA-0140.

SYSTEM OPTIONS AND ACCESSORIES

CATEGORY	DESCRIPTION	MODEL / PART #
CONTROLLERS AND READOUTS	High Speed Programmable Dynamometer Controller	DSP6001
	Open Loop Dynamometer Controller	6200
	Torque/Speed Readout	5410
	Direction Indicator	5600
POWER ANALYZERS	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
MOTOR TESTING SOFTWARE	M-TEST 4.0 Motor Testing Software	SW-M-TEST-WE4.0
	M-TEST 4.0 Motor Testing Software with Source Codes	SW-M-TEST-WS4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option*	SW-MT-TEST-WE4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option & Source Codes*	SW-MT-TEST-WS4.0
	Temperature Testing Hardware*	HW-TTEST
POWER SUPPLIES	Closed Loop Speed Control/Power Supply	6100
	Power Supply	5200
	Current Regulated Power Supply	5210
MISC.	Dynamometer Table (with drilled table top and tap for one or more dynamometers)	005032

** Please refer to the M-TEST 4.0 Data Sheet for additional temperature testing software/hardware options and order information.*

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

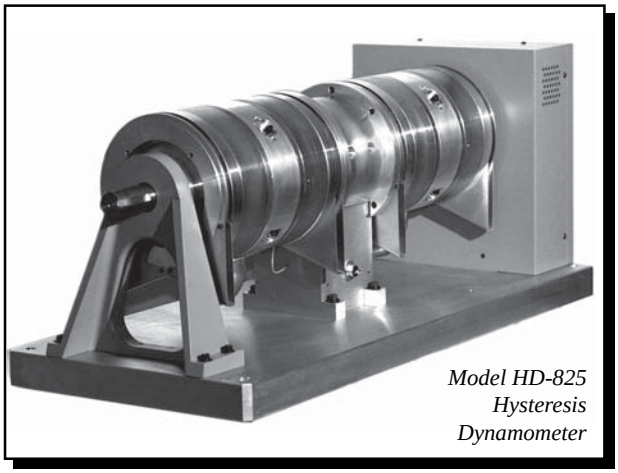
HD700SS-US www 10/03

1.3.3 HD-800 Series Hysteresis Dynamometers

HD-800 Series Hysteresis Dynamometers

FEATURES

- 5 Standard Models with Maximum Torque from 100 lb·in to 500 lb·in (12 N·m to 56.5 N·m)
- Hysteresis Braking System: Provides precise torque loading independent of shaft speed
- Motor Testing from No Load to Locked Rotor
- Accuracy: ±0.25% to ± 0.5% (Full Scale)
- Air Flow Sensor: For protection against overheating and operator error
- Standard Torque Units: English, Metric and SI are available
- Custom Dynamometers: For special torque and speed requirements
- Easy Calibration



Model HD-825 Hysteresis Dynamometer

DESCRIPTION

Hysteresis Brake Dynamometers (HD-800 Series) are versatile and ideal for testing in the medium power range (maximum 14 kW intermittent duty). With a Hysteresis Braking system, the Dynamometers do not require speed to create torque, and therefore can provide a full motor ramp from free-run to locked rotor. Brake cooling is provided by compressed air or dedicated blower depending on the model. All Magtrol Hysteresis Dynamometers have accuracy ratings of ± 0.25% to ± 0.5% full scale—depending on size and system configuration.

APPLICATIONS

Magtrol motor test systems can be found in test labs, at inspection stations, and on the manufacturing floors of most of the world's leading manufacturers, users and certifiers of small to medium sized electric, pneumatic and hydraulic motors, as well as internal combustion engines. Magtrol supplies motor test systems for a wide array of industries including: Appliance, Automotive, Aviation, Computer, HVAC, Lawn and Garden, Medical and Dental, Electric Motor, Office Equipment and Power Tools.

Magtrol offers three types of dynamometer brakes to absorb load: Hysteresis, Eddy Current and Magnetic Powder. Each type of Dynamometer has advantages and limitations and choosing the correct one will depend largely on the type of testing to be performed. With over 50 models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

COMPLETE PC CONTROL

Magtrol's M-TEST 4.0 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol Programmable Dynamometer Controller, Magtrol M-TEST 4.0 Software provides the control of any Magtrol Dynamometer and runs test sequences in a manner best suited to the overall accuracy and efficiency of the Magtrol Motor Test System. The data that is generated by Magtrol's Motor Testing Software can be stored, displayed and printed in tabular or graphic formats, and can be easily imported into a spreadsheet.

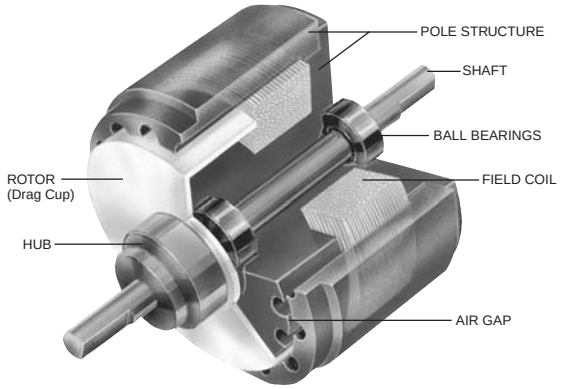
Written in LabVIEW™, M-TEST 4.0 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermocouples), controlling motor power and providing audio/visual indicators is relatively easy.

Magtrol's M-TEST 4.0 Software is ideal for simulating loads, cycling the unit under test and motor ramping. Because it is easy to gather data and duplicate tests, the software is ideal for use in engineering labs. Tests can be programmed to run on their own and saved for future use allowing for valuable time savings in production testing and incoming/outgoing inspection.

Specifications

HD-800 Series

OPERATING PRINCIPLES



Magtrol Hysteresis Dynamometers absorb power with a unique Hysteresis Braking System which provides frictionless torque loading independent of shaft speed. The Hysteresis Brake provides torque by the use of two basic components—a reticulated pole structure and a specialty steel rotor/shaft assembly—fitted together but not in physical contact. Until the pole structure is energized, the drag cup can spin freely on its shaft bearings. When a magnetizing force from the field coil is applied to the pole structure, the air gap becomes a flux field and the rotor is magnetically restrained, providing a braking action between the pole structure and rotor.

ITEMS TO CONSIDER WHEN SELECTING A DYNAMOMETER:

TYPE OF MOTORS TO BE TESTED

•

MAXIMUM TORQUE, SPEED AND POWER OF THE MOTOR UNDER TEST

•

MOTOR TESTING PARAMETERS

•

DYNAMOMETER CONTROL & DATA COLLECTION

DYNAMOMETER SELECTION

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

Maximum Torque

The Magtrol Hysteresis Absorption Dynamometer 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. Dynamometer 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 Dynamometer 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 Dynamometer 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 Dynamometer 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 basic horsepower formula:

English: $hp = T\ (lb \cdot in) \times n\ (rpm) \times (1.59 \times 10^{-5})$

Metric: $hp = T\ (kg \cdot cm) \times n\ (rpm) \times (1.38 \times 10^{-5})$

SI: $hp = T\ (N \cdot m) \times n\ (rpm) \times (1.4 \times 10^{-4})$

watts = hp × 746
(All power ratings are expressed in watts.)

The Dynamometer'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 Dynamometer failure, the maximum power rating is the most important consideration in selecting a Dynamometer.

Specifications HD-800 Series

RATINGS

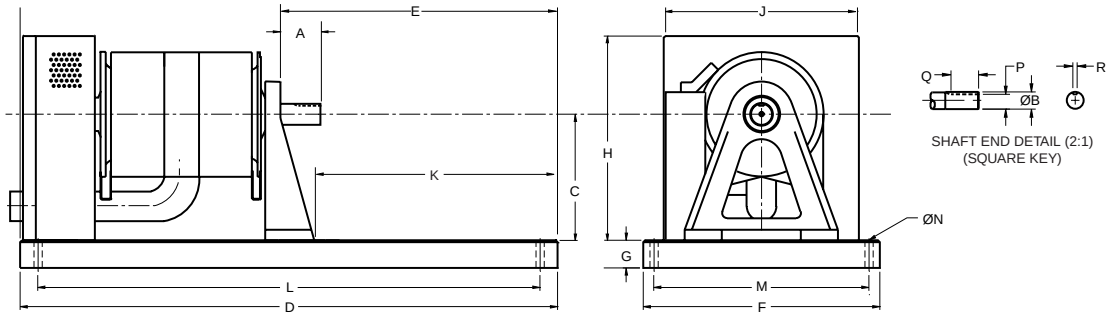
MODEL	Torque Measure Unit Code	Maximum Torque Range	Drag Torque De-Energized at 1000 rpm	Digital Torque Resolution	Nominal Input Inertia		Max. Power Ratings		Maximum Speed	Brake Cooling Method
					lb·ft·s²	*kg·m²*	5 minute *watts*	continuous *watts*	*rpm*	
HD-800	6N	100 lb·in	0.8 lb·in	0.1 lb·in	4.43×10^{-3}	6.01×10^{-3}	3000	1800	12,000	Compressed Air[1]
	7N	120 kg·cm	1.0 kg·cm	0.1 kg·cm						
	8N	12 N·m	0.10 N·m	0.01 N·m						
HD-810	6N	125 lb·in	0.8 lb·in	0.1 lb·in	4.43×10^{-3}	6.01×10^{-3}	3510	3000	12,000	Blower[2]
	7N	140 kg·cm	1.0 kg·cm	0.1 kg·cm						
	8N	14 N·m	0.10 N·m	0.01 N·m						
HD-805	6N	200 lb·in	1.2 lb·in	1.0 lb·in	8.81×10^{-3}	1.19×10^{-2}	6000	3600	12,000	Compressed Air[1]
	7N	240 kg·cm	1.5 kg·cm	1.0 kg·cm						
	8N	24 N·m	0.14 N·m	0.10 N·m						
HD-815	6N	250 lb·in	1.2 lb·in	1.0 lb·in	8.81×10^{-3}	1.19×10^{-2}	7025	6000	12,000	Blower[2]
	7N	280 kg·cm	1.5 kg·cm	1.0 kg·cm						
	8N	28 N·m	0.14 N·m	0.10 N·m						
HD-825	6N	500 lb·in	3.5 lb·in	1.0 lb·in	1.85×10^{-2}	2.51×10^{-2}	14,000	12,000	8,000	Blower[2]
	7N	560 kg·cm	4.0 kg·cm	1.0 kg·cm						
	8N	56.5 N·m	0.22 N·m	0.10 N·m						

[1] Models HD-800 and HD-805 require air cooling provided by user. Cooling requirements are 7.5 CFM at 7 PSIG for the HD-800; and 15 CFM at 7 PSIG for the HD-805. Regulator and filter package is provided as standard equipment on these units.

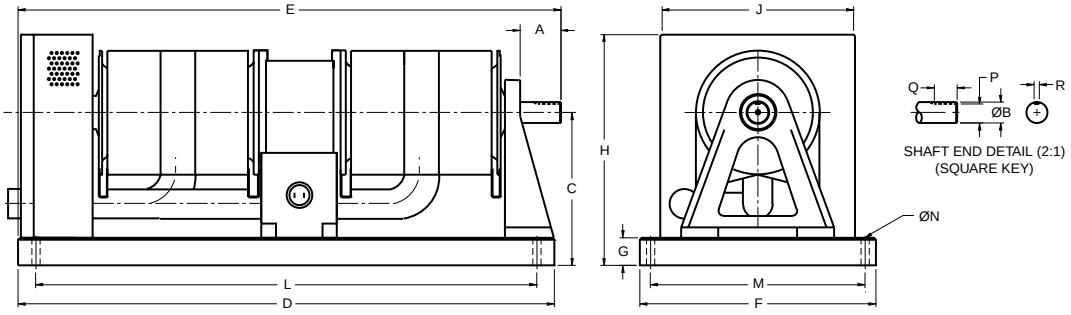
[2] Blower package is included as standard equipment with Models HD-810, HD-815 and HD-825.

DYNAMOMETER DIMENSIONS

NOTE: *Original dimensions are in English units. Dimensions converted to Metric have been rounded up to 1 decimal place.*



MODEL	units	A	B	C	D	E	F	G	H	J	K	L**	M**	N	P	Q	R	Weight
HD-800	*in*	2.94	Ø 0.9995/1.0000	9	38.5	23.38	17	2	14.6	14	20.9	36.5	15	Ø 0.54	0.859	1.65	0.251	237.0 lb
	mm	75	Ø 25.387/25.400	229	978	593.9	432	51	371	356	530	927	381	Ø 13.7	21.82	41.91	6.38	107.2 kg
HD-810	*in*	2.09	Ø 0.9995/1.0000	9	38.5	23.19	17	2	14.6	14	20.7	36.5	15	Ø 0.54	N/A			233.0 lb
	mm	53.1	Ø 25.387/25.400	229	978	589	432	51	371	356	526	927	381	Ø 13.7				105.3 kg
HD-805	*in*	2.94	Ø 0.9995/1.0000	9	38.5	20.38	17	2	14.6	14	17.9	36.5	15	Ø 0.54	0.859	1.65	0.251	287.0 lb
	mm	75	Ø 25.387/25.400	229	978	517.7	432	51	371	356	454	927	381	Ø 13.7	21.82	41.91	6.38	129.7 kg
HD-815	*in*	2.25	Ø 0.9995/1.0000	9	38.5	18.19	17	2	14.6	14	15.7	36.5	15	Ø 0.54	N/A			288.0 lb
	mm	57.2	Ø 25.387/25.400	229	978	462	432	51	371	356	399	927	381	Ø 13.7				130.1 kg



MODEL	units	A	B	C	D	E	F	G	H	J	L**	M**	N	P	Q	R	Weight
HD-825	*in*	2.83	Ø 1.4995/1.5000	11	38.5	38.93	17	2	16.6	14	36.5	15	Ø 0.54	1.287	2	0.376	400.0 lb
	mm	71.9	Ø 38.087/38.100	279	978	988.8	432	51	422	356	927	381	Ø 13.7	32.69	50.8	9.53	181.4 kg

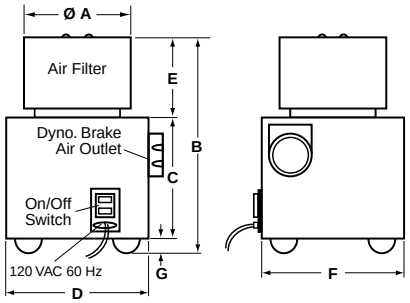
***** *These dimensions represent the distance between mounting holes. There are four (4) mounting holes on each base plate.*

Specifications

HD-800 Series

BLOWER DIMENSIONS

- BL-002 Blower has two filter elements.
- Dynamometer Model 810 includes BL-001 Blower, Model HD-815 includes BL-002 Blower. The HD-825 uses two BL-002 blowers for cooling its two brake sets.
- Allow approximately 6 to 8 in (152 to 203 mm) between rear of Dynamometer base plate and blower for connection hardware. Required hardware is supplied with the Dynamometer.
- 120 VAC 60 Hz 1 phase power required for brake cooling blower package; 240 VAC available as special order.

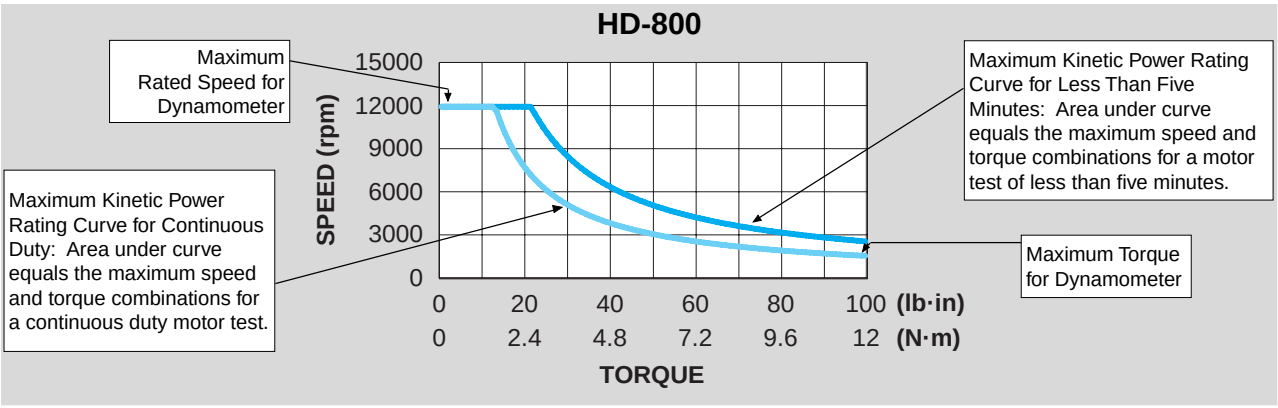


Model	BL-001		BL-002	
	in	*mm*	*in*	*mm*
A	Ø 6	Ø152.4	Ø 6	Ø152.4
B	11	279	11	279
C	6	152	6	152
D	8	203	15	381
E	4	102	4	102
F	8	203	12	305
G	1	25	1	25
Weight	8.5 lb	3.9 kg	18 lb	8.1 kg

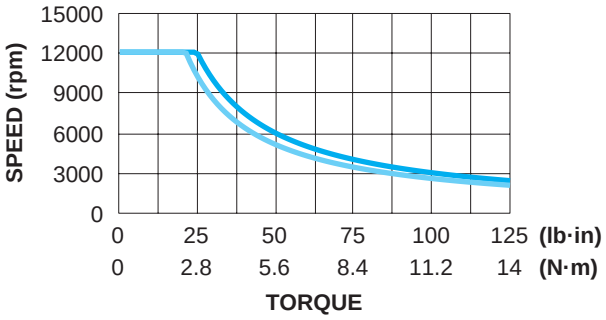
POWER ABSORPTION CURVES

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

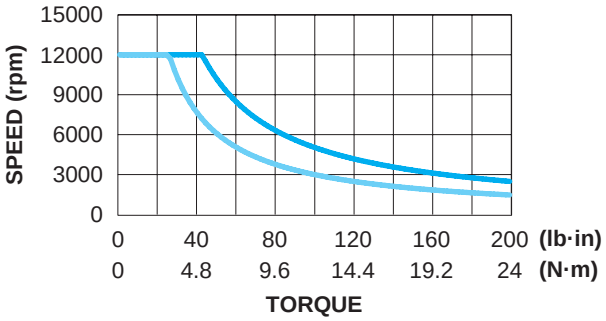
HD-800



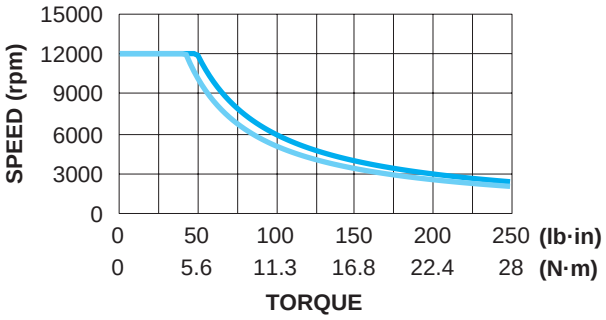
HD-810



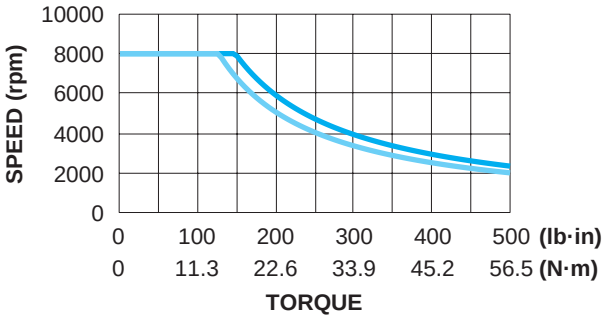
HD-805



HD-815



HD-825

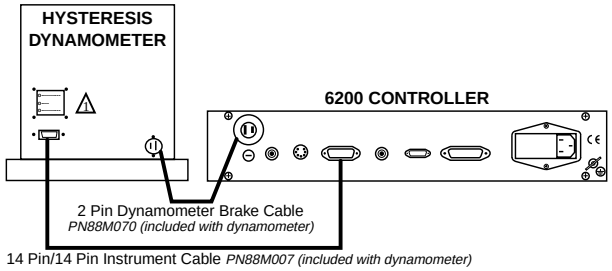


System Configurations

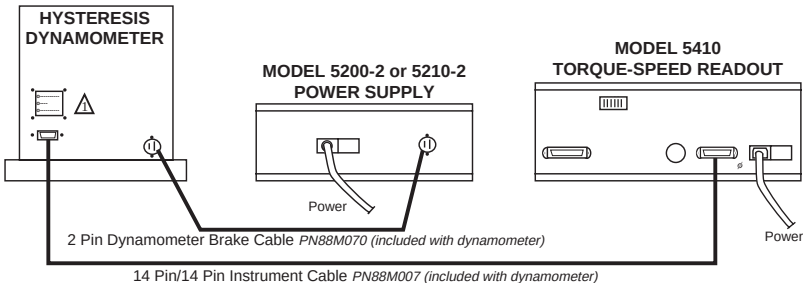
HD-800 Series

OPEN LOOP SYSTEMS

Dynamometer with 6200 Controller



Dynamometer with 5410 Readout and 5200 Power Supply

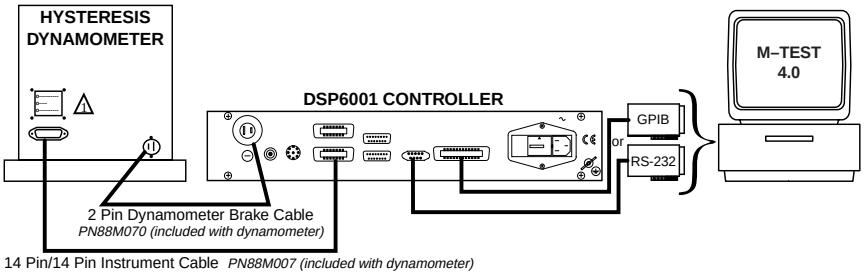


Magtrol offers both open loop manual test systems and PC-based closed loop test systems. A typical open loop system will consist of a Dynamometer and a Magtrol 6200 Open Loop Controller or a Magtrol Power Supply and Model 5410 Readout. A Magtrol Single or Three Phase Power Analyzer, which allows for the capturing of volts, amps, watts and power factor, can be included as an option. An open loop system is often used for quick pass/fail testing on the production line or at incoming inspection. Magtrol's 6200 Controller provides pass/fail testing as a standard feature.

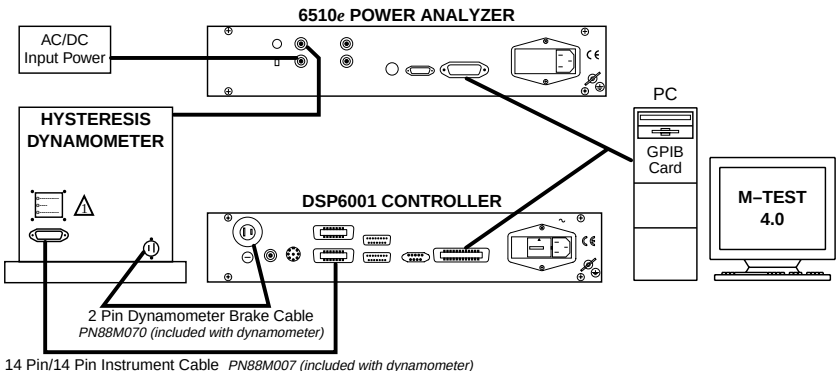
In a closed loop motor test system, data is collected on a PC using Magtrol's M-Test Software, DSP6001 Programmable Dynamometer Controller, and requisite interface cards and cables. Magtrol's Model 6200 and DSP6001 Controllers compute and display mechanical power (in horsepower or watts) in addition to torque and speed. A Single or Three Phase Power Analyzer, a required component in a test system measuring motor efficiency, can be integrated into this system as well as Magtrol's Temperature Testing Hardware and Software.

CLOSED LOOP SYSTEMS

Dynamometer with DSP6001 Controller and M-Test Software



Dynamometer with 6510*e* Power Analyzer, DSP6001 Controller and M-Test Software



Ordering Information

HD-800 Series

DYNAMOMETER OPTIONS

Encoder Options For Low Speed Testing

For low speed motors, such as gear motors with maximum speeds of less than 200 rpm, Magtrol offers additional encoder options that allow for increased resolution of the speed signal.

Shortened Base Plate

A shortened base plate, cut off at the pillow block, is available for all models except the HD-825 (which already has a shortened base plate). With 4 metrically-spaced holes, the dynamometer can be easily mounted to a T-slot table plate.

Analog Output

Magtrol can provide a 0-5 VDC analog output for the torque signal and a TTL speed signal from the Dynamometer.

CUSTOM DYNAMOMETERS

High Speed Testing

For certain models, Magtrol can provide Dynamometers which can operate at higher than rated speeds.

Mechanical Modifications

Magtrol can provide customized base plates, riser blocks and shaft modifications.

ORDERING INFORMATION

MODEL NUMBER: HD – □□□ – □□□ – 0□□

- Model: HD 8 0 0 – 8 2 5

TORQUE UNITS
- English (U.S.) — 6N
- Metric — 7N
- SI — 8N

POWER OPERATION
- 120 VAC (standard) — *(blank)*
- 240 VAC (option) — A

BASE PLATE
- standard — 0
- short — 1

SPEED ENCODER
- 60 bit (standard) — 00
- 60 and 600 bit — 30
- 60 and 6000 bit — 40

Example: For a 240 VAC Model 810 Hysteresis Dynamometer in metric torque units, with shorter base plate and 60/6000-bit speed encoder option, order Model HD-810-7NA-0140.

SYSTEM OPTIONS AND ACCESSORIES

CATEGORY	DESCRIPTION	MODEL / PART #
CONTROLLERS AND READOUTS	High Speed Programmable Dynamometer Controller	DSP6001
	Open Loop Dynamometer Controller	6200
	Torque/Speed Readout	5410
	Direction Indicator	5600
POWER ANALYZERS	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
MOTOR TESTING SOFTWARE	M-TEST 4.0 Motor Testing Software	SW-M-TEST-WE4.0
	M-TEST 4.0 Motor Testing Software with Source Codes	SW-M-TEST-WS4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option*	SW-MT-TEST-WE4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option & Source Codes*	SW-MT-TEST-WS4.0
	Temperature Testing Hardware*	HW-TTEST
POWER SUPPLIES	Closed Loop Speed Control/Power Supply	6100
	Power Supply	5200
	Current Regulated Power Supply	5210
MISC.	Dynamometer Table (base of dynamometer also serves as the table top)	005033

** Please refer to the M-TEST 4.0 Data Sheet for additional temperature testing software/hardware options and order information.*

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

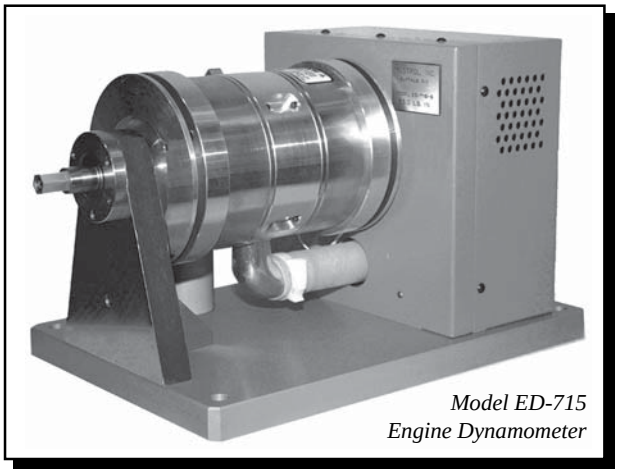
HD800DS-US www 10/03

1.3.4 ED SERIES ENGINE DYNAMOMETERS

ED-715 and ED-815 Engine Dynamometers

FEATURES

- **Maximum Torque:** From 55 lb·in to 250 lb·in (6.5 N·m to 28 N·m)
- **Hysteresis Braking System:** Provides precise torque loading independent of shaft speed
- **Motor Testing:** From no load to locked rotor
- **Accuracy:** ±0.25% (full scale)
- **High Speed Capabilities:** 12,000 to 25,000 rpm, depending on model
- **Rugged Stainless Steel Shaft:** Larger shaft for additional strength
- **Specially Reinforced Load Cell:** Stainless steel pin used at contact point to prevent premature wear from excess vibration
- **Gusseted Pillow Blocks:** Adds additional front and rear support
- **Brake Cooling:** Blower cooled to maximize heat dissipation



Model ED-715
Engine Dynamometer

- **Air Flow Sensor:** For protection against overheating and operator error
- **Standard Torque Units:** English, Metric & SI available
- **Easy Calibration**

DESCRIPTION

With Magtrol's Engine Dynamometers, high performance motor testing is available to manufacturers and users of small engines. Magtrol's Engine Dynamometers have been designed to address the severe, high vibration conditions inherent in internal combustion engine testing.

Magtrol's Engine Dynamometers are highly accurate (± 0.25% of full scale) and can be controlled either manually or via a PC based Controller. For a small engine test stand, Magtrol offers a full line of controllers, readouts and software.

As with all Magtrol Hysteresis Dynamometers, engine loading is provided by Magtrol's Hysteresis Brake, which provides: torque independent of speed, including full load at 0 rpm; excellent repeatability; frictionless torque with no wearing parts (other than bearings); and long operating life with low maintenance. Magtrol provides a NIST traceable certificate of calibration, and calibration beam with each Engine Dynamometer.

Magtrol offers three types of dynamometer brakes to absorb load: Hysteresis, Eddy Current and Magnetic Powder. Each type of Dynamometer has advantages and limitations and choosing the correct one will depend largely on the type of testing to be performed. With over 50 models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

APPLICATIONS

The Engine Dynamometers are ideally suited for emissions testing as set forth in CARB and EPA Clean Air Regulations. The Dynamometers will offer superior performance on the production line, at incoming inspection or in the R&D lab.

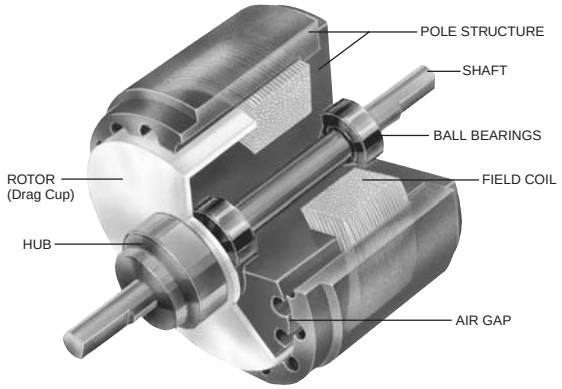
COMPLETE PC CONTROL

Magtrol's M-TEST 4.0 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol Programmable Dynamometer Controller, Magtrol M-TEST 4.0 Software provides the control of any Magtrol Dynamometer and runs test sequences in a manner best suited to the overall accuracy and efficiency of the Magtrol Motor Test System. The data that is generated by Magtrol's Motor Testing Software can be stored, displayed and printed in tabular or graphic formats, and can be easily imported into a spreadsheet.

For more information on Magtrol's M-TEST 4.0 Motor Testing Software, please visit http://www.magtrol.com/motortesting/mtest.htm on Magtrol's web site.

Specifications ED-715/ED-815

OPERATING PRINCIPLES



Magtrol Hysteresis Dynamometers absorb power with a unique Hysteresis Braking System which provides frictionless torque loading independent of shaft speed. The Hysteresis Brake provides torque by the use of two basic components—a reticulated pole structure and a specialty steel rotor/shaft assembly—fitted together but not in physical contact. Until the pole structure is energized, the drag cup can spin freely on its shaft bearings. When a magnetizing force from the field coil is applied to the pole structure, the air gap becomes a flux field and the rotor is magnetically restrained, providing a braking action between the pole structure and rotor.

ITEMS TO CONSIDER WHEN SELECTING A DYNAMOMETER:

TYPE OF MOTORS TO BE TESTED

•

MAXIMUM TORQUE, SPEED AND POWER OF THE MOTOR UNDER TEST

•

MOTOR TESTING PARAMETERS

•

DYNAMOMETER CONTROL & DATA COLLECTION

DYNAMOMETER SELECTION

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

Maximum Torque

The Magtrol Hysteresis Absorption Dynamometer 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. Dynamometer 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 Dynamometer 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 Dynamometer 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 Dynamometer 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 basic horsepower formula:

English: $hp = T\ (lb \cdot in) \times n\ (rpm) \times (1.59 \times 10^{-5})$

Metric: $hp = T\ (kg \cdot cm) \times n\ (rpm) \times (1.38 \times 10^{-5})$

SI: $hp = T\ (N \cdot m) \times n\ (rpm) \times (1.4 \times 10^{-4})$

watts = hp × 746
(All power ratings are expressed in watts.)

The Dynamometer'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 Dynamometer failure, the maximum power rating is the most important consideration in selecting a Dynamometer.

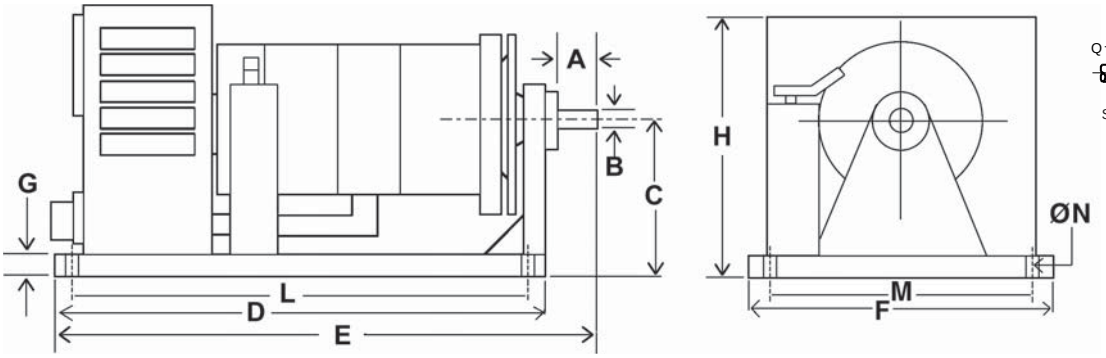
Specifications ED-715/ED-815

RATINGS

MODEL	Torque Measure Unit Code	Maximum Torque Range	Drag Torque De-energized at 1000 rpm	Digital Torque Resolution	Nominal Input Inertia		Maximum Power Ratings				Maximum Speed*
							5 minute		continuous		
					lb·ft·s²	*kg·m²*	*hp*	*W*	*hp*	*W*	*rpm*
ED-715	6N	55 lb·in	0.3 lb·in	0.1 lb·in	1.27×10^{-3}	1.72×10^{-3}	5	3800	4	3000	25,000
	7N	65 kg·cm	0.36 kg·cm	0.1 kg·cm							
	8N	6.5 N·m	0.035 N·m	0.01 N·m							
ED-815	6N	250 lb·in	1.2 lb·in	1 lb·in	9.61×10^{-3}	1.30×10^{-2}	10	7500	8	6000	12,000
	7N	280 kg·cm	1.4 kg·cm	1 kg·cm							
	8N	28 N·m	0.14 N·m	0.1 N·m							

** The maximum speed will depend on what type of keyway (if any) is used on the shaft. Unless specified, the dynamometer shaft will be made without a keyway.*

DYNAMOMETER DIMENSIONS



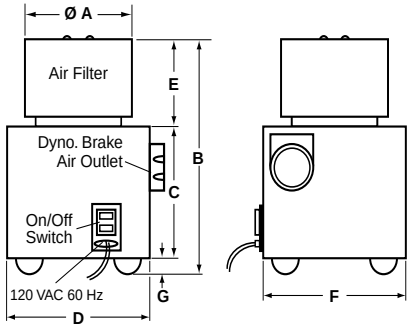
NOTE:
Original dimensions are in English units. Dimensions converted to Metric have been rounded up to 1 decimal place.

MODEL	units	A	B	C	D	E	F	G	H	L**	M**	N	P	Q	R	Weight
ED-715	*in*	1.72	Ø 0.7490/0.7495	6.87	16.00	18.13	11.00	1.00	10.50	14.50	9.50	Ø 0.37	0.64	1.00	0.187	75 lb
	mm	43.7	Ø 19.025/19.037	174.5	406.4	460.5	279.4	25.4	266.7	368.3	241.3	Ø 9.4	16.35	25.4	4.83	34 kg
ED-815	*in*	3.02	Ø 1.4995/1.5000	11.00	23.30	23.27	17.00	2.00	16.63	20.80	15.00	5/8-11 THD	1.287	2.00	0.375	285 lb
	mm	76.7	Ø 38.087/38.100	279.4	591.8	591.1	431.8	50.8	422.4	528.3	381.0		32.7	50.8	9.53	129.3 kg

*** These dimensions represent the distance between mounting holes. There are four (4) mounting holes on each base plate.*

BLOWER DIMENSIONS

- Dynamometer Model ED-715 includes BL-001 Blower and Model ED-815 includes BL-002 Blower.
- Allow approximately 6 to 8 in (152 to 203 mm) between rear of Dynamometer base plate and blower for connection hardware. Required hardware is supplied with the Dynamometer.
- 120 VAC 60 Hz 1 phase power required for brake cooling blower package; 240 VAC available as special order.

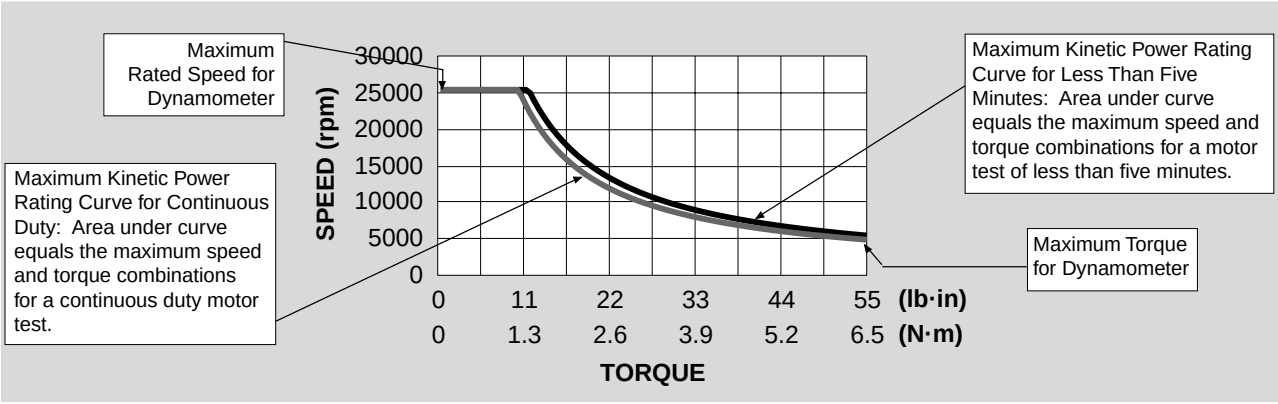


Model	BL-001		BL-002	
	in	*mm*	*in*	*mm*
A	Ø 6	Ø152.4	Ø 6	Ø152.4
B	11	279	11	279
C	6	152	6	152
D	8	203	15	381
E	4	102	4	102
F	8	203	12	305
G	1	25	1	25
Weight	8.5 lb	3.9 kg	18 lb	8.1 kg

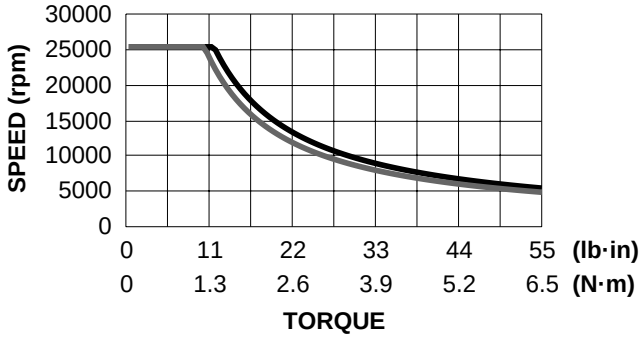
Specifications ED-715/ED-815

POWER ABSORPTION CURVES

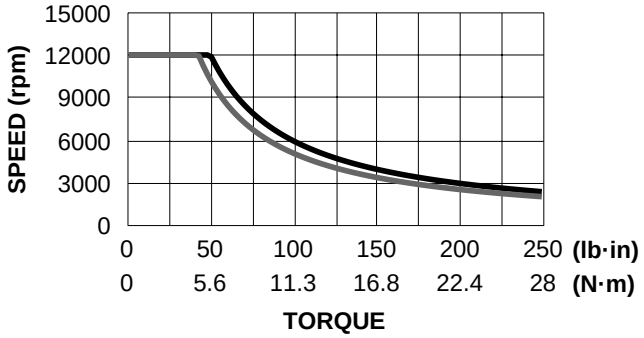
The power absorption curves represent the maximum power (heat) that the dynamometer can dissipate over time.



ED-715



ED-815

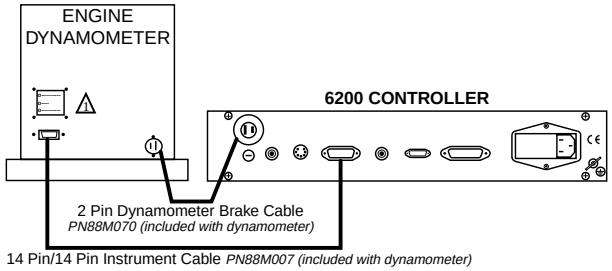


System Configurations

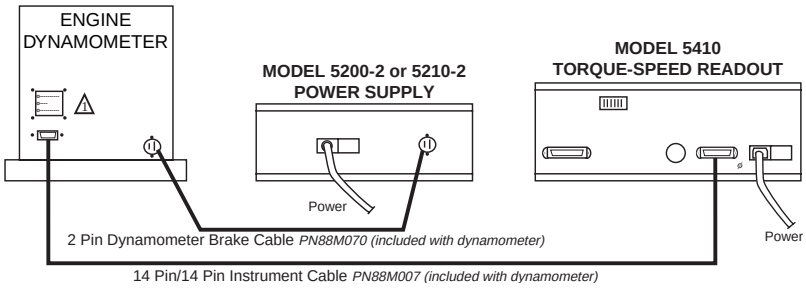
ED-715/ED-815

OPEN LOOP SYSTEMS

Dynamometer with 6200 Controller



Dynamometer with 5410 Readout and 5200 Power Supply

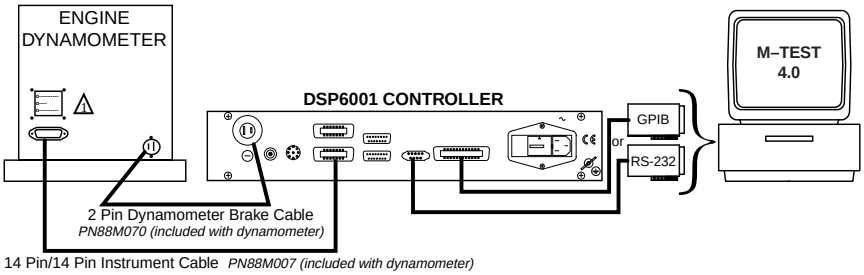


Magtrol offers both open loop manual test systems and PC-based closed loop test systems. A typical open loop system will consist of a Dynamometer and a Magtrol 6200 Open Loop Controller or a Magtrol Power Supply and Model 5410 Readout. A Magtrol Single or Three Phase Power Analyzer, which allows for the capturing of volts, amps, watts and power factor, can be included as an option. An open loop system is often used for quick pass/fail testing on the production line or at incoming inspection. Magtrol's 6200 Controller provides pass/fail testing as a standard feature.

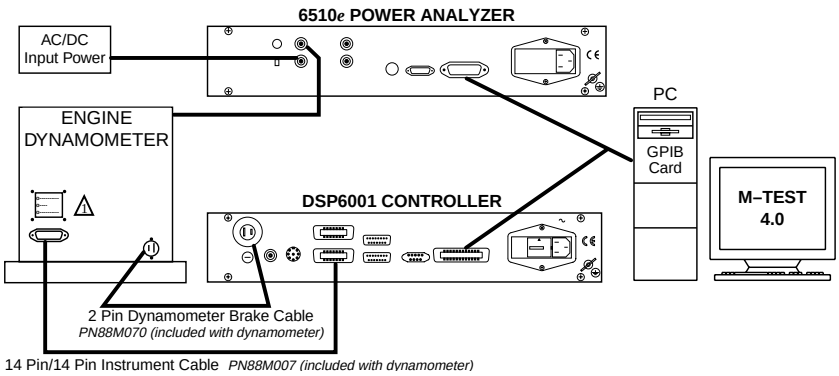
In a closed loop motor test system, data is collected on a PC using Magtrol's M-Test Software, DSP6001 Programmable Dynamometer Controller, and requisite interface cards and cables. Magtrol's Model 6200 and DSP6001 Controllers compute and display mechanical power (in horsepower or watts) in addition to torque and speed. A Single or Three Phase Power Analyzer, a required component in a test system measuring motor efficiency, can be integrated into this system as well as Magtrol's Temperature Testing Hardware and Software.

CLOSED LOOP SYSTEMS

Dynamometer with DSP6001 Controller and M-Test Software



Dynamometer with 6510*e* Power Analyzer, DSP6001 Controller and M-Test Software



Ordering Information ED-715/ED-815

DYNAMOMETER OPTIONS

Encoder Options For Low Speed Testing

For low speed motors, such as gear motors with maximum speeds of less than 200 rpm, Magtrol offers additional encoder options that allow for increased resolution of the speed signal.

Analog Output

Magtrol can provide a 0-5 VDC analog output for the torque signal and a TTL speed signal from the Dynamometer.

CUSTOM DYNAMOMETERS

High Speed Testing

For certain models, Magtrol can provide Dynamometers which can operate at higher than rated speeds.

Mechanical Modifications

Magtrol can provide customized base plates, riser blocks and shaft modifications.

ORDERING INFORMATION

MODEL NUMBER: ED – □□□ – □□□ – 0 0 □□

- Model: ED715–815

TORQUE UNITS
- English (U.S.) — 6N
- Metric — 7N
- SI — 8N

POWER OPERATION
- 120 VAC (standard) — *(blank)*
- 240 VAC (option) — A

SPEED ENCODER
- 60 bit (standard) — 00
- 60 and 600 bit — 30
- 60 and 6000 bit — 40

Example: For a 240 VAC Model 715 Engine Dynamometer in metric torque units, with a 60/6000-bit speed encoder option, order Model ED-715-7NA-0040.

SYSTEM OPTIONS AND ACCESSORIES

CATEGORY	DESCRIPTION	MODEL / PART #
CONTROLLERS AND READOUTS	High Speed Programmable Dynamometer Controller	DSP6001
	Open Loop Dynamometer Controller	6200
	Torque/Speed Readout	5410
	Direction Indicator	5600
POWER ANALYZERS	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
MOTOR TESTING SOFTWARE	M-TEST 4.0 Motor Testing Software	SW-M-TEST-WE4.0
	M-TEST 4.0 Motor Testing Software with Source Codes	SW-M-TEST-WS4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option*	SW-MT-TEST-WE4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option & Source Codes*	SW-MT-TEST-WS4.0
	Temperature Testing Hardware*	HW-TTEST
POWER SUPPLIES	Closed Loop Speed Control/Power Supply	6100
	Power Supply	5200
	Current Regulated Power Supply	5210
MISC.	Dynamometer Table for ED-715 (with drilled table top & tap for 1+ dynamometers)	005032
	Dynamometer Table for ED-815 (base of dynamometer also serves as the table top)	005033

ED-US www 10/03

** Please refer to the M-TEST 4.0 Data Sheet for additional temperature testing software/hardware options and order information.*

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

1.3.5 HSD Series High Speed Dynamometers

HSD-610M and HSD-710 High Speed Dynamometers

FEATURES

- **Maximum Torque:** From 15.5 lb·in to 26 lb·in (1.75 N·m to 2.9 N·m)
- **Hysteresis Braking System:** Provides precise torque loading independent of shaft speed
- **Motor Testing:** From no load to locked rotor
- **Accuracy:** ±0.25% (full scale)
- **Maximum Speed:** 30,000 to 35,000 rpm
- **High Speed Bearings:** Provides desired preload and allows for thermal expansion without increasing preload
- **Speed Pickup:** Minimizes windage
- **Rugged Stainless Steel Shaft:** Larger shaft for additional strength
- **Specially Reinforced Load Cell:** Stainless steel pin used at contact point to prevent premature wear from excess vibration
- **Gusseted Pillow Blocks:** Adds additional front and rear support
- **Brake Cooling:** Blower cooled to maximize heat dissipation
- **Air Flow Sensor:** For protection against overheating and operator error
- **Standard Torque Units:** English, Metric and SI are available
- **Easy Calibration**

Model HSD-710 High Speed Dynamometer

DESCRIPTION

Magtrol's High Speed Dynamometers (HSD Series) are versatile and ideal for testing in the low to medium power range (maximum 1500 watts intermittent duty). With a hysteresis braking system, the dynamometers do not require speed to create torque, and therefore can provide a full motor ramp from free-run to locked rotor. Brake cooling is provided by air with a dedicated blower. All Magtrol HSD Dynamometers have accuracy ratings of ±0.25% full scale.

Magtrol offers three types of dynamometer brakes to absorb load: Hysteresis, Eddy Current and Magnetic Powder. Each type of Dynamometer has advantages and limitations and choosing the correct one will depend largely on the type of testing to be performed. With over 50 models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

APPLICATIONS

Magtrol's High Speed Dynamometers are ideally suited for high speed motors, commonly found in vacuum cleaners and blowers. The dynamometers are equipped to handle the high vibration conditions inherent in high speed motor testing.

COMPLETE PC CONTROL

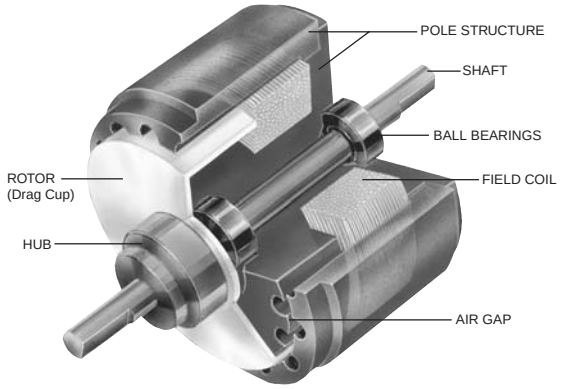
Magtrol's M-TEST 4.0 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol Programmable Dynamometer Controller, Magtrol M-TEST 4.0 Software provides the control of any Magtrol Dynamometer and runs test sequences in a manner best suited to the overall accuracy and efficiency of the Magtrol Motor Test System. The data that is generated by Magtrol's Motor Testing Software can be stored, displayed and printed in tabular or graphic formats, and can be easily imported into a spreadsheet.

Written in LabVIEW™, M-TEST 4.0 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermocouples), controlling motor power and providing audio/visual indicators is relatively easy.

Magtrol's M-TEST 4.0 Software is ideal for simulating loads, cycling the unit under test and motor ramping. Because it is easy to gather data and duplicate tests, the software is ideal for use in engineering labs. Tests can be programmed to run on their own and saved for future use allowing for valuable time savings in production testing and incoming/outgoing inspection.

Specifications HSD-610M/HSD-710

OPERATING PRINCIPLES



Magtrol Hysteresis Dynamometers absorb power with a unique Hysteresis Braking System which provides frictionless torque loading independent of shaft speed. The Hysteresis Brake provides torque by the use of two basic components—a reticulated pole structure and a specialty steel rotor/shaft assembly—fitted together but not in physical contact. Until the pole structure is energized, the drag cup can spin freely on its shaft bearings. When a magnetizing force from the field coil is applied to the pole structure, the air gap becomes a flux field and the rotor is magnetically restrained, providing a braking action between the pole structure and rotor.

ITEMS TO CONSIDER WHEN SELECTING A DYNAMOMETER:

TYPE OF MOTORS TO BE TESTED

•

MAXIMUM TORQUE, SPEED AND POWER OF THE MOTOR UNDER TEST

•

MOTOR TESTING PARAMETERS

•

DYNAMOMETER CONTROL & DATA COLLECTION

DYNAMOMETER SELECTION

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

Maximum Torque

The Magtrol Hysteresis Absorption Dynamometer 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. Dynamometer 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 Dynamometer 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 Dynamometer 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 Dynamometer 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 basic horsepower formula:

English: $hp = T\ (lb{\cdot}in) \times n\ (rpm) \times (1.59 \times 10^{-5})$

Metric: $hp = T\ (kg{\cdot}cm) \times n\ (rpm) \times (1.38 \times 10^{-5})$

SI: $hp = T\ (N{\cdot}m) \times n\ (rpm) \times (1.4 \times 10^{-4})$

watts = hp × 746

(All power ratings are expressed in watts.)

The Dynamometer'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.

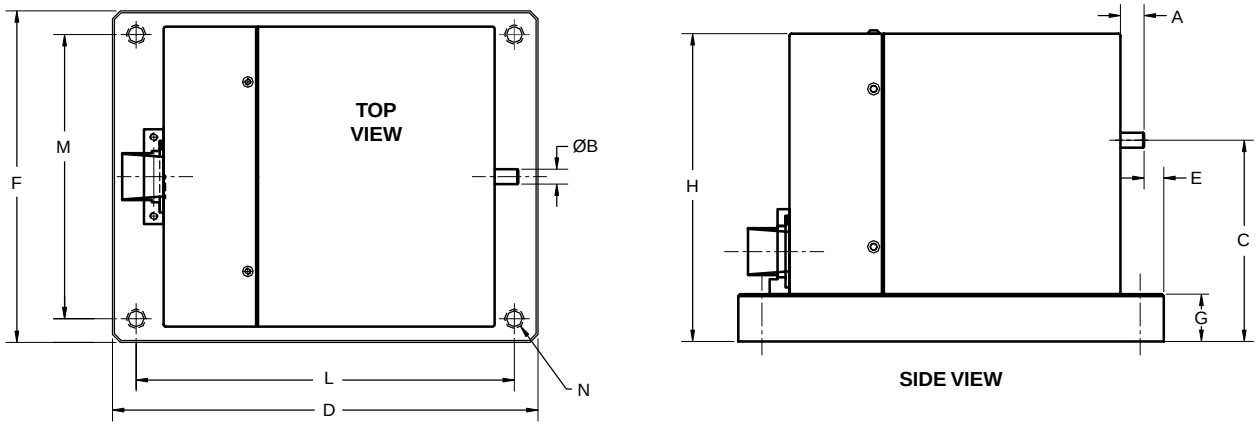
To safely dissipate heat and avoid Dynamometer failure, the maximum power rating is the most important consideration in selecting a Dynamometer.

Specifications HSD-610M/HSD-710

RATINGS

MODEL	Torque Measure Unit Code	Maximum Torque Range	Drag Torque De-energized at 1000 rpm	Digital Torque Resolution	Nominal Input Inertia		Maximum Power Ratings				Maximum Speed
							5 minute		continuous		
					lb·ft·s²	*kg·m²*	*hp*	*W*	*hp*	*W*	*rpm*
HSD-610M	6N	15.5 lb·in	1.1 oz·in	0.1 lb·in	2.54×10^{-4}	3.44×10^{-4}	1.5	1120	1.0	750	35,000
	7N	18.0 kg·cm	79.2 g·cm	0.1 kg·cm							
	8N	1.75 N·m	7.77 mN·m	0.01 N·m							
HSD-710	6N	26 lb·in	2.0 oz·in	0.1 lb·in	5.51×10^{-4}	7.47×10^{-4}	2.0	1500	1.25	935	30,000
	7N	30 kg·cm	0.14 kg·cm	0.1 kg·cm							
	8N	2.9 N·m	0.013 N·m	0.01 N·m							

DYNAMOMETER DIMENSIONS



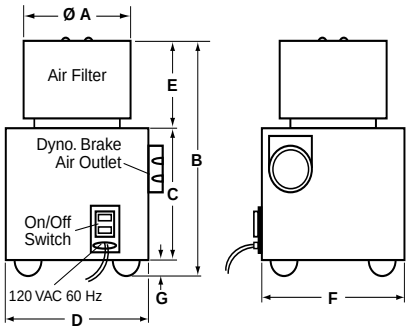
NOTE:
Original dimensions for HSD-610M are in Metric units. Dimensions converted to English have been rounded up to 3 or 4 decimal places.
Original dimensions for HSD-710 are in English units. Dimensions converted to Metric have been rounded up to 1 decimal place.

MODEL	units	A	B	C	D	E	F	G	H	L*	M*	N
HSD-610M	*mm*	19.0	Ø 11.999/12.000	162.0	343.0	327.0	266.5	38.0	247.6	305.0	228.5	5/8-11 THD
	in	0.75	Ø 0.4724/0.4727	6.375	13.504	12.874	10.490	1.496	9.748	12.008	8.996	
HSD-710	*in*	0.875	Ø 0.4995/0.5000	7.375	14.500	13.625	11.000	1.500	11.000	13.000	9.500	5/8-11 THD
	mm	22.2	Ø 12.688/12.700	187.3	368.3	346.1	279.4	38.1	279.4	330.2	241.3	

** These dimensions represent the distance between mounting holes. There are four (4) mounting holes on each base plate.*

BLOWER DIMENSIONS

- Dynamometer Model HSD-610M and HSD-710 both include BL-001 Blower.
- Allow approximately 6 to 8 in (152 to 203 mm) between rear of dynamometer base plate and blower for connection hardware. Required hardware is supplied with the dynamometer.
- 120 VAC 60 Hz 1 phase power required for brake cooling blower package; 240 VAC available as special order.

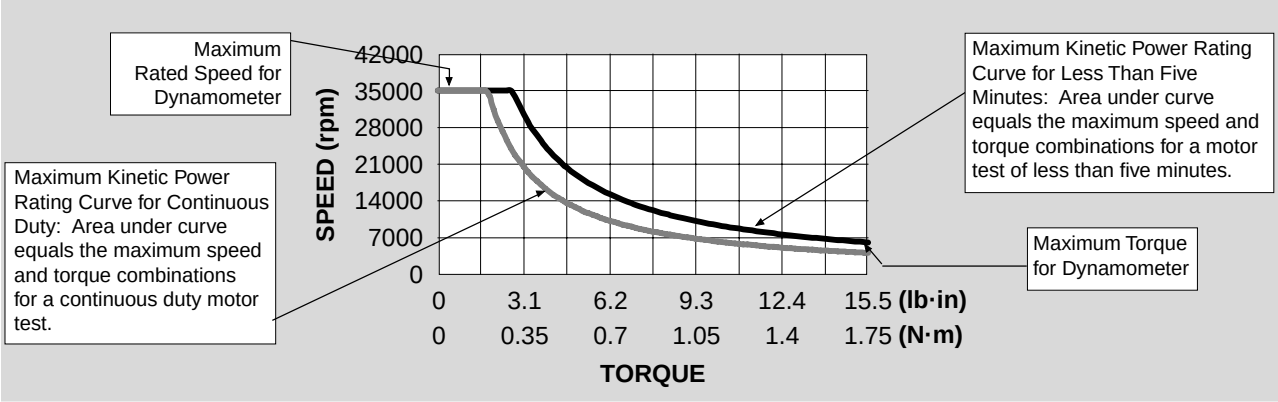


	in	*mm*
A	Ø 6	Ø 152.4
B	11	279
C	6	152
D	8	203
E	4	102
F	8	203
G	1	25
Weight	8.5 lb	3.9 kg

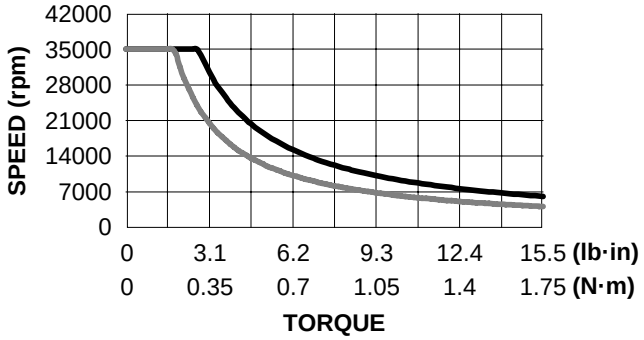
Specifications HSD-610M/HSD-710

POWER ABSORPTION CURVES

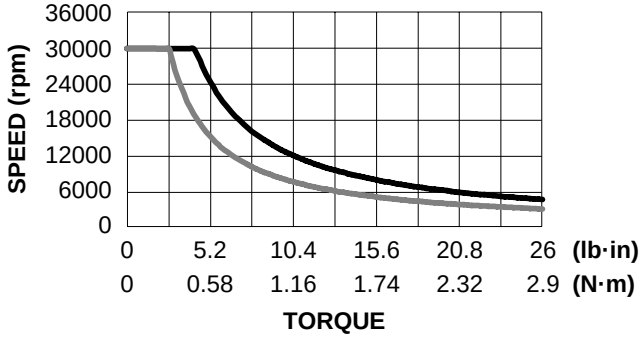
The power absorption curves represent the maximum power (heat) that the dynamometer can dissipate over time.



HSD-610M



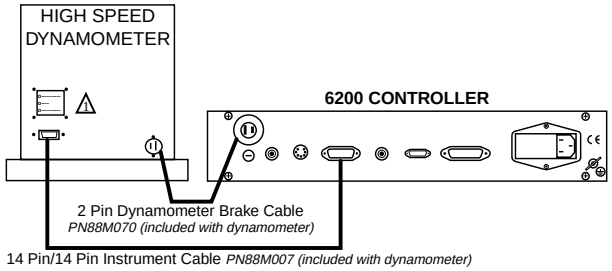
HSD-710



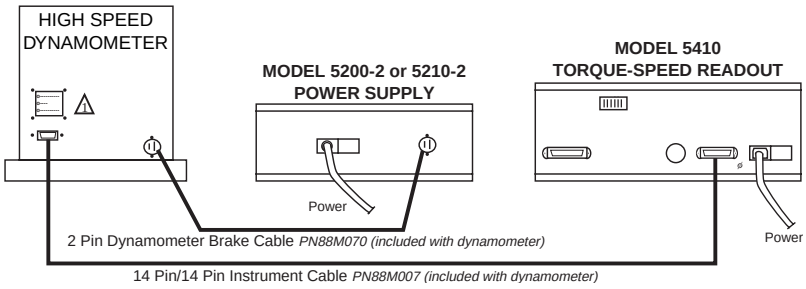
System Configurations HSD-610M/HSD-710

OPEN LOOP SYSTEMS

Dynamometer with 6200 Controller



Dynamometer with 5410 Readout and 5200 Power Supply

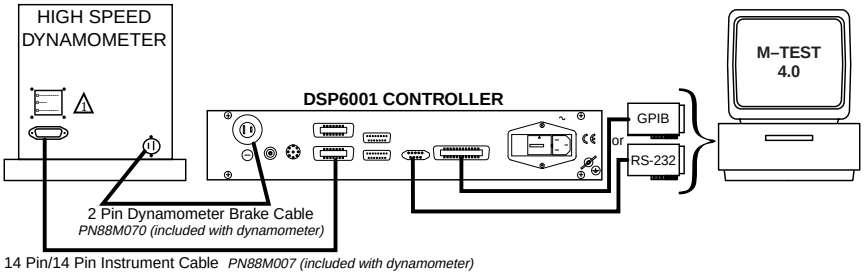


Magtrol offers both open loop manual test systems and PC-based closed loop test systems. A typical open loop system will consist of a Dynamometer and a Magtrol 6200 Open Loop Controller or a Magtrol Power Supply and Model 5410 Readout. A Magtrol Single or Three Phase Power Analyzer, which allows for the capturing of volts, amps, watts and power factor, can be included as an option. An open loop system is often used for quick pass/fail testing on the production line or at incoming inspection. Magtrol's 6200 Controller provides pass/fail testing as a standard feature.

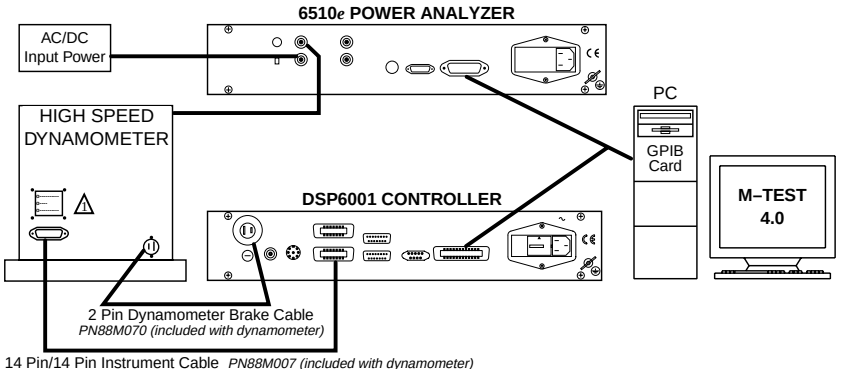
In a closed loop motor test system, data is collected on a PC using Magtrol's M-Test Software, DSP6001 Programmable Dynamometer Controller, and requisite interface cards and cables. Magtrol's Model 6200 and DSP6001 Controllers compute and display mechanical power (in horsepower or watts) in addition to torque and speed. A Single or Three Phase Power Analyzer, a required component in a test system measuring motor efficiency, can be integrated into this system as well as Magtrol's Temperature Testing Hardware and Software.

CLOSED LOOP SYSTEMS

Dynamometer with DSP6001 Controller and M-Test Software



Dynamometer with 6510*e* Power Analyzer, DSP6001 Controller and M-Test Software



Ordering Information HSD-610M/HSD-710

DYNAMOMETER OPTIONS

Analog Output

Magtrol can provide a 0-5 VDC analog output for the torque signal and a TTL speed signal from the Dynamometer.

CUSTOM DYNAMOMETERS

High Speed Testing

For certain models, Magtrol can provide Dynamometers which can operate at higher than rated speeds.

Mechanical Modifications

Magtrol can provide customized base plates, riser blocks and shaft modifications.

ORDERING INFORMATION

MODEL NUMBER: HSD – □□□ – □□□ – 0 0 0 0

- Model: HSD 6 1 0M or 7 1 0

TORQUE UNITS
- English (U.S.) — 6N
- Metric — 7N
- SI — 8N

POWER OPERATION
- 120 VAC (standard) — *(blank)*
- 240 VAC (option) — A

Example: For a 240 VAC Model 710 High Speed Dynamometer in metric torque units, order Model HSD-710-7NA-0000.

SYSTEM OPTIONS AND ACCESSORIES

CATEGORY	DESCRIPTION	MODEL / PART #
CONTROLLERS AND READOUTS	High Speed Programmable Dynamometer Controller	DSP6001
	Open Loop Dynamometer Controller	6200
	Torque/Speed Readout	5410
	Direction Indicator	5600
POWER ANALYZERS	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
MOTOR TESTING SOFTWARE	M-TEST 4.0 Motor Testing Software	SW-M-TEST-WE4.0
	M-TEST 4.0 Motor Testing Software with Source Codes	SW-M-TEST-WS4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option*	SW-MT-TEST-WE4.0
	MT-TEST 4.0 Motor Testing Software with Temperature Testing Option & Source Codes*	SW-MT-TEST-WS4.0
	Temperature Testing Hardware*	HW-TTEST
POWER SUPPLIES	Closed Loop Speed Control/Power Supply	6100
	Power Supply	5200
	Current Regulated Power Supply	5210
MISC.	Dynamometer Table (with drilled table top and tap for one or more dynamometers)	005032

HSD-US www 10/03

2. Inputs/Outputs

2.1 REAR PANEL

The rear panel provides connectors and receptacles for connecting to appropriate equipment.

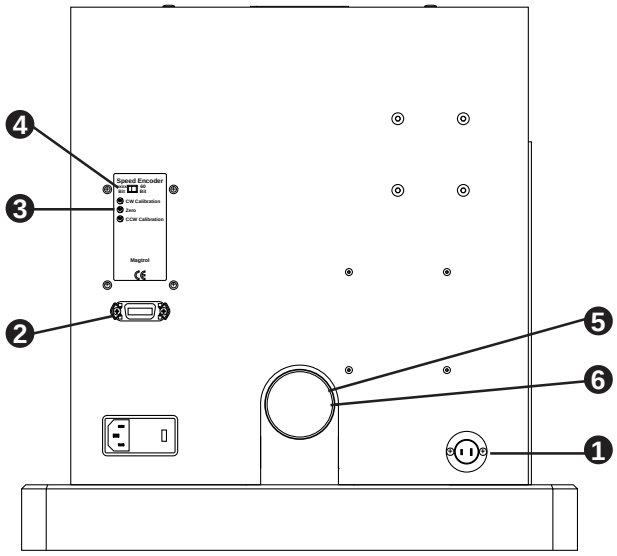


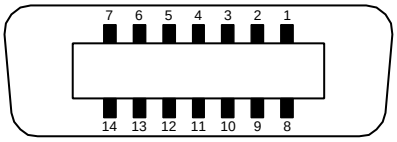
Figure 2–1 Rear Panel

2.2 REAR PANEL INPUTS AND OUTPUTS

1 DYNAMOMETER BRAKE INPUT — Connect dynamometer brake cable here.

Figure 2–2 Dynamometer Brake Input

2 DYNAMOMETER CONNECTOR — Connect dynamometer signal cable here.



1. FLOW/CLUTCH	8. +5.0 VDC COM
2. TACH. B	9. D.P. A
3. +24 VDC	10. TACH. A
4. +24 VDC COM	11. INDEX
5. -24 VDC COM	12. D.P. B
6. -24 VDC	13. TORQUE COMMON
7. +5.0 VDC	14. TORQUE SIGNAL

Figure 2–3 Dynamometer Connector

❸ CALIBRATION POTENTIOMETER

Adjust clockwise (CW), zero and counterclockwise (CCW) calibration here.

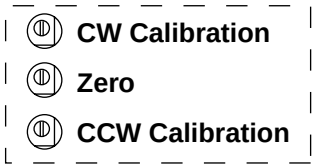


Figure 2–4 Calibration Potentiometers

❹ ENCODER SWITCH

Optional feature switches between a 60 and 600-bit encoder or a 60 and 6000-bit encoder.

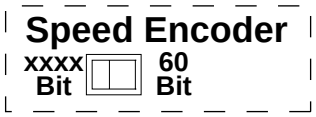


Figure 2–5 Speed Encoder Switch

❺ BLOWER INPUT

Connect blower tube here.

☞ Note: Only for use with HD Series (Model 710, 715, 810, 815, 825), ED Series (Model 715, 815) and HSD Series (Model 610M, 710) Hysteresis Dynamometers.

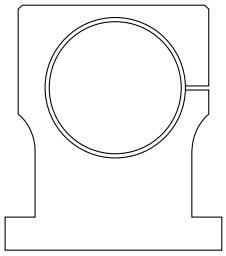


Figure 2–6 Blower Input

❻ COMPRESSED AIR INPUT

Connect compressed shop air line here.

☞ Note: Only for use with a Model 510, 800 or 805 Hysteresis Dynamometer.

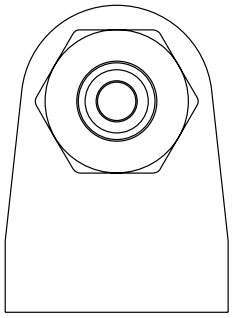


Figure 2–7 Compressed Air Input

3. Installation/Configuration

3.1 REMOVAL OF THE LOAD CELL SHIPPING/RESTRAINING BOLT

Within the dynamometer enclosure there is a load cell shipping/restraining bolt that must be removed before dynamometer operation. The bolts are identified with red heads. Refer to the diagrams below for the bolt location on your model.

Note: Retain the shipping/restraining bolt for future use when moving or shipping your Magtrol Dynamometer.

3.1.1 HD-100, -400 AND -500 SERIES

The shipping/restraining bolt is located on the bottom of the HD 100-500 Series Hysteresis Dynamometers as shown in Figure 3–1.

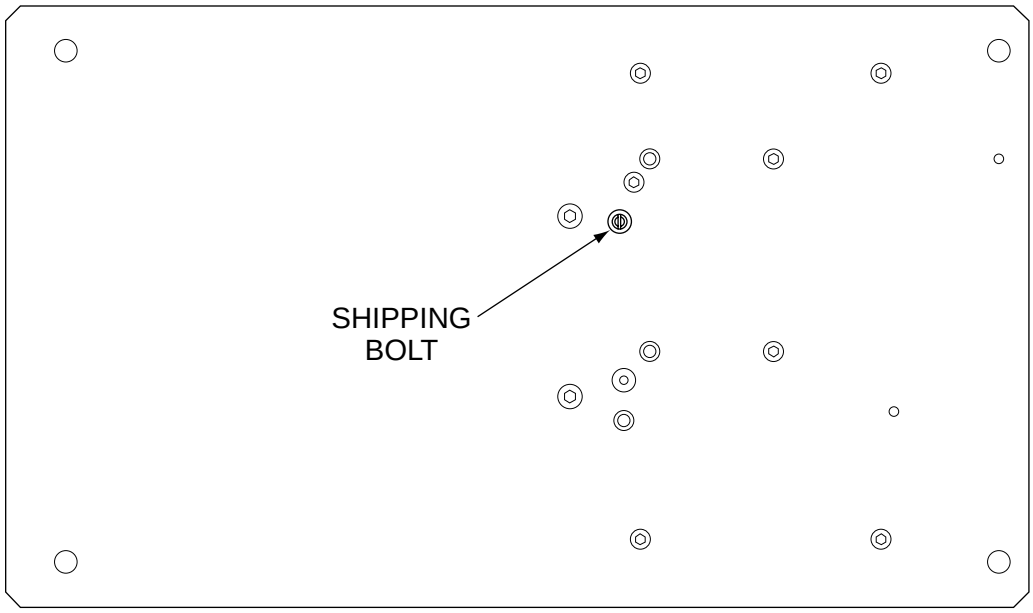


Figure 3–1 HD 100–500 Series Shipping/Restraining Bolt Location

3.1.2 HD-700 SERIES

The shipping/restraining bolt is located on the front side of the HD-700 Series Hysteresis Dynamometers as shown in Figure 3–2.

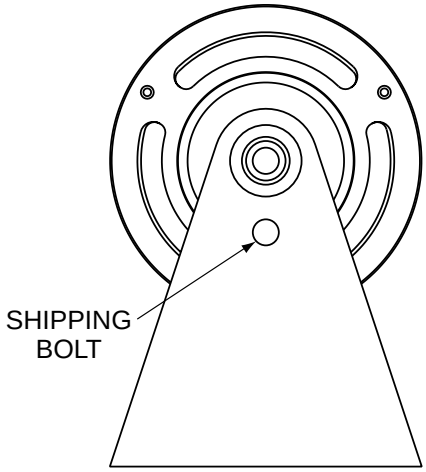


Figure 3–2 HD-700 Series Shipping/Restraining Bolt Location

3.1.3 HD-800 SERIES

There is no shipping/restraining bolt on an HD-800 Series Hysteresis Dynamometer.

3.1.4 ED-715

The shipping/restraining bolt is located on the front side of the ED-715 dynamometer as shown in Figure 3–3.

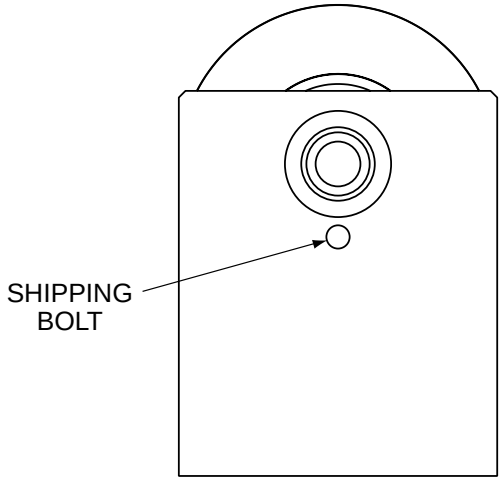


Figure 3–3 ED-715 Shipping/Restraining Bolt Location

3.1.5 ED-815

There is no shipping/restraining bolt on an ED-815 dynamometer.

3.1.6 HSD SERIES

The shipping/restraining bolt is located on the front side of the HSD-610M and HSD-710 dynamometers as shown in Figure 3–4.

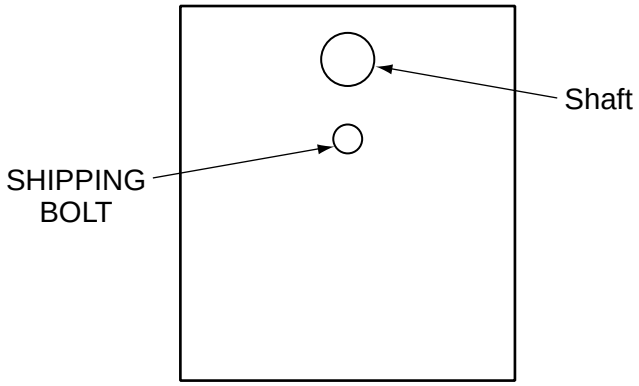


Figure 3–4 HSD Series Shipping/Restraining Bolt Location

3.2 EARTH GROUND

Before proceeding any further, the dynamometer must be connected to earth ground. The earth ground is located on the top of the dynamometer as indicated in the following diagrams by the earth ground symbol.

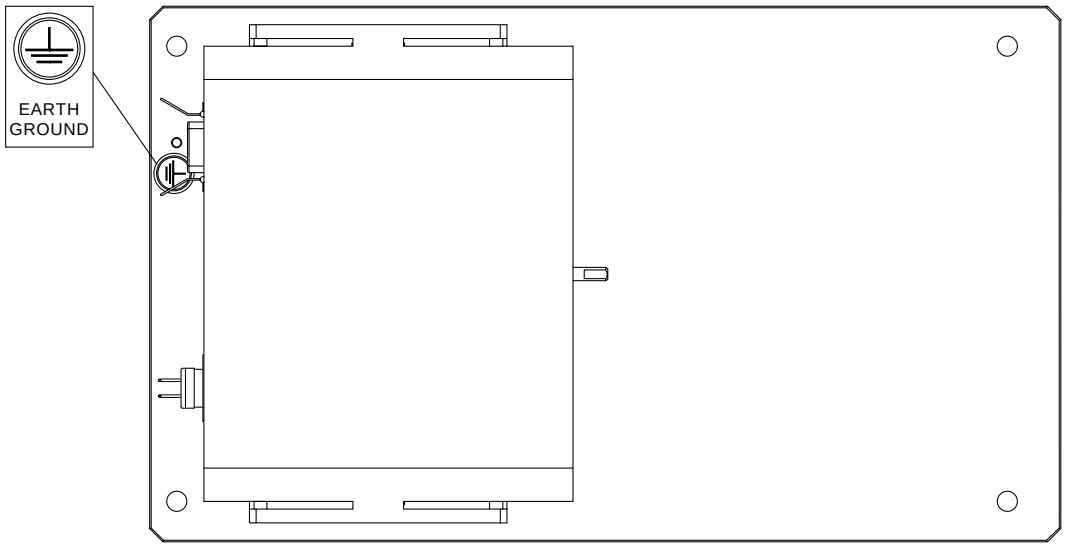


Figure 3–5 HD 100–500 Series Top View

The following diagram is to be referenced for all HD-700, -800 series and ED dynamometers.

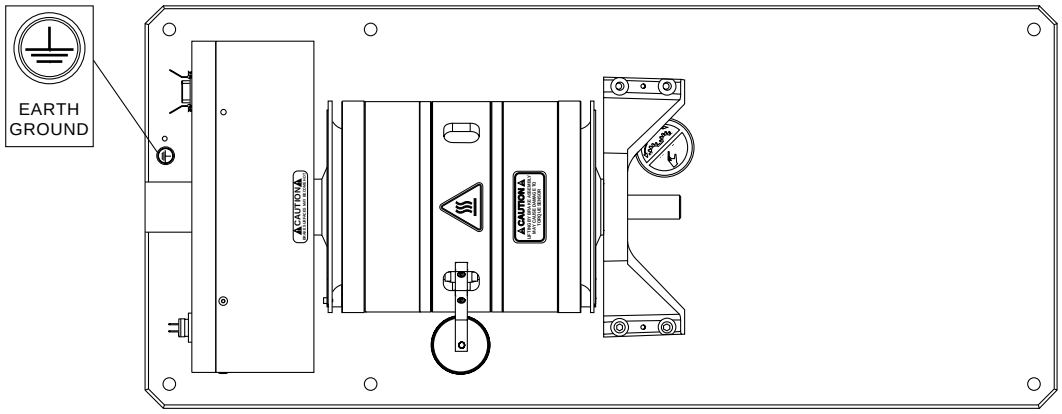


Figure 3–6 HD-800 Series Top View

The following diagram is to be referenced for all HSD Series Dynamometers.

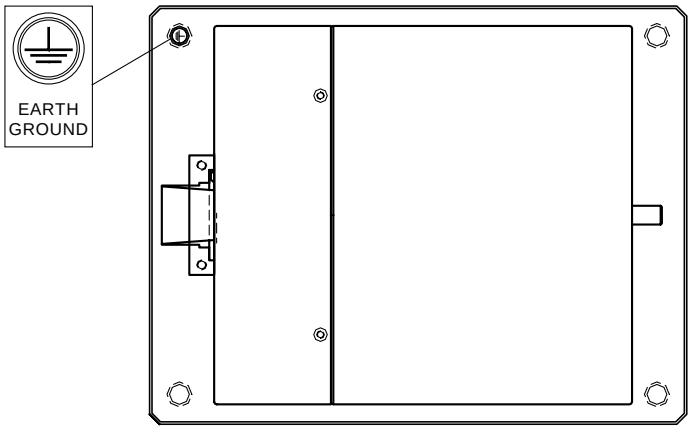


Figure 3–7 HSD Series Top View

3.3 SYSTEM CONFIGURATIONS

After the load cell shipping/restraining bolt has been removed and the dynamometer has been earth grounded, the unit is ready for connection to the appropriate readout instrument and power supply.

3.3.1 MANUAL TEST SYSTEMS

The dynamometer can be set up as a manual test system for quick pass/fail testing on the production line or at incoming inspection. A typical manual test system will consist of a Magtrol Hysteresis Dynamometer used in conjunction with a Magtrol 6200 Controller or a Magtrol Power Supply and Model 5410 Readout.

Note: Magtrol's Single or Three-Phase Power Analyzer may be included as an option.

The following diagrams illustrate the required cable sets and connections for a manual test system setup.

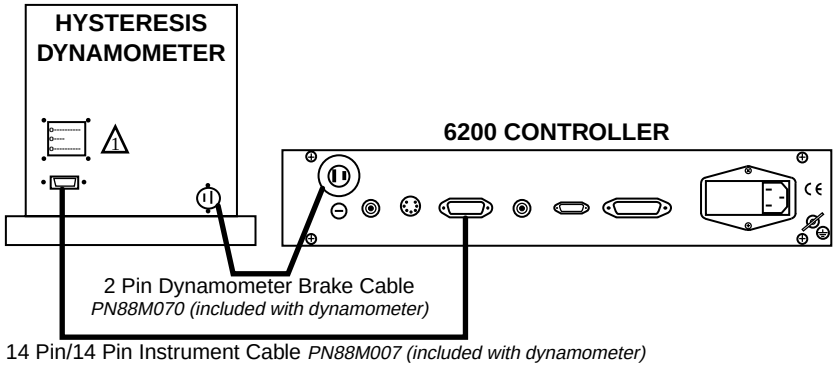


Figure 3–8 Dynamometer with 6200 Controller

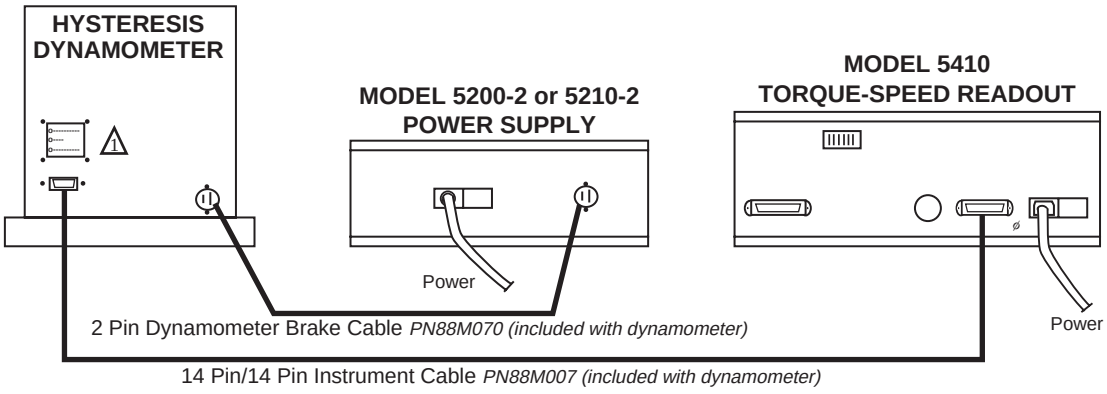


Figure 3–9 Dynamometer with 5410 Readout and 5200/5210 Power Supply

3.3.2 PC-BASED TEST SYSTEMS

In a PC-based motor test system, data is collected on a personal computer using Magtrol's M-TEST 4.0 Software, a DSP6001 Programmable Dynamometer Controller and requisite interface cards and cables.

Note: Magtrol's Single or Three-Phase Power Analyzer can be integrated into this system as well as Magtrol's Temperature Testing Hardware and Software.

The following diagrams illustrate the required cable sets and connections for a PC-based test system setup.

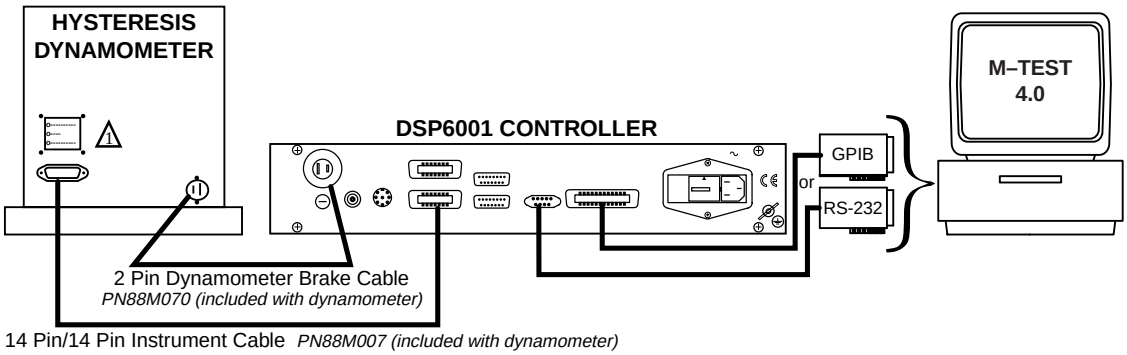


Figure 3–10 Dynamometer with DSP6001 Controller and M-TEST 4.0 Software

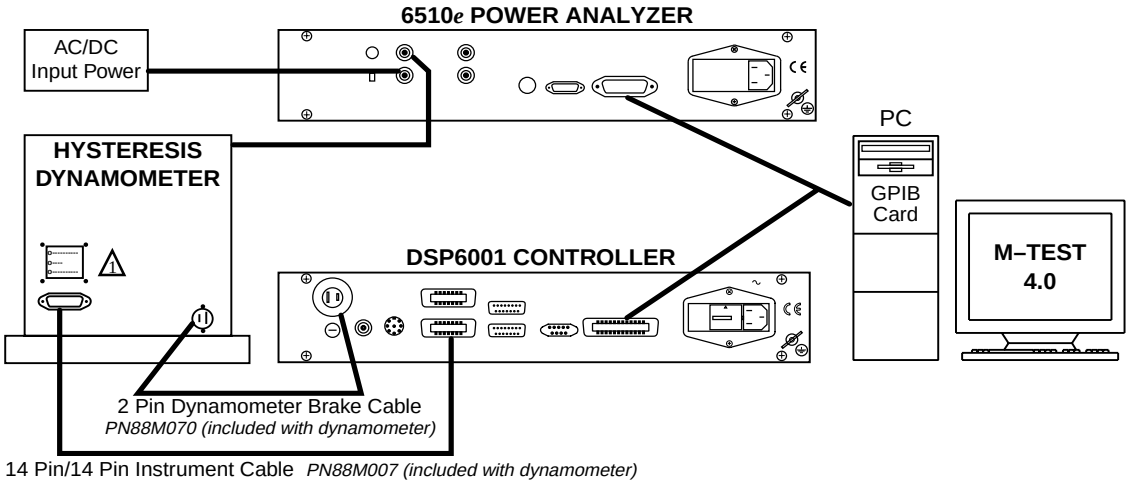


Figure 3–11 Dynamometer with 6510e Power Analyzer, DSP6001 Controller and M-TEST 4.0 Software

3.3.3 AIR COOLING

Magtrol's HD-510/710/715, ED-715, HSD-610M/710 and any 800 Series Dynamometer are all internally ported for compressed air or blower cooling and may be integrated with a manual or PC-based test setup in order to provide air cooling of the dynamometer brake. An air flow sensor has been added to these dynamometers to protect against operator error. With the air flow sensor, the dynamometer comes equipped with a pressure sensor ported into the cooling airway. The sensor, when used in combination with Magtrol's DSP6001 Dynamometer Controller, prevents the dynamometer brake from being energized until the blower or air supply has been turned on.

When the air supply to the dynamometer is turned on, the pressure sensor closes an electrical contact. Two wires from the sensor run internally to the dynamometer and attach to the torque amplification board. One of the wires from the sensor is then passed directly to the back panel connector (14-pin connector, pin 1). The other wire is tied on the board to +5 VDC COM (14-pin connector, pin 8).

When used with the DSP6001, pin 1 is internally pulled high with a resistance to 5 volts. If not using a Magtrol controller, it is assumed the user will pull pin 1 to the 5 volts supplied to the amplifier board (pin 7) with a 1 K to 10 K resistor.

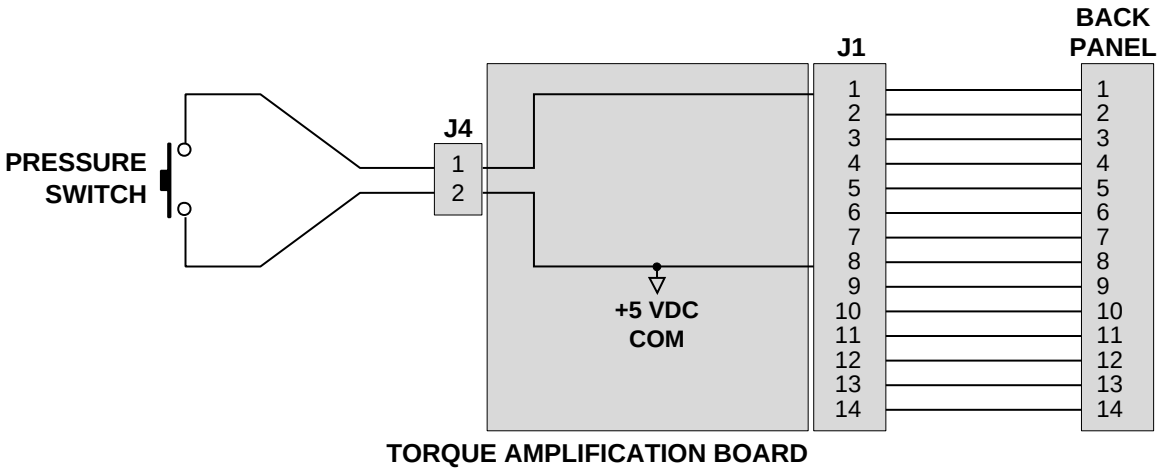


Figure 3–12 Air Flow Sensor Schematic

3.3.3.1 Blower Setup

If an HD-710, 715, 810, 815, ED-715, 815, HSD-610M or 710 dynamometer is being used, a blower input is integrated into the unit.

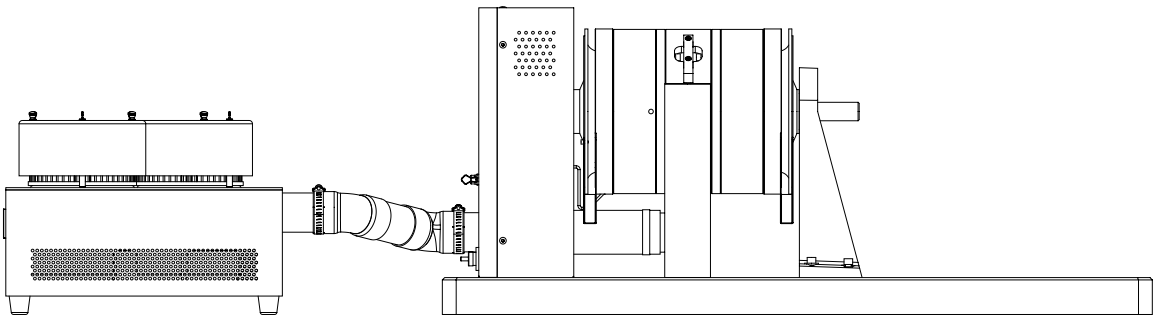


Figure 3–13 Dynamometer with Blower Connection

For more information, see *Section 4.1.3.2.2 – Blower*.

3.3.3.2 Compressed Air Setup

If a Model 510, 800 or 805 dynamometer is being used, a compressed air input is integrated into the unit. The connection is illustrated in the following diagram.

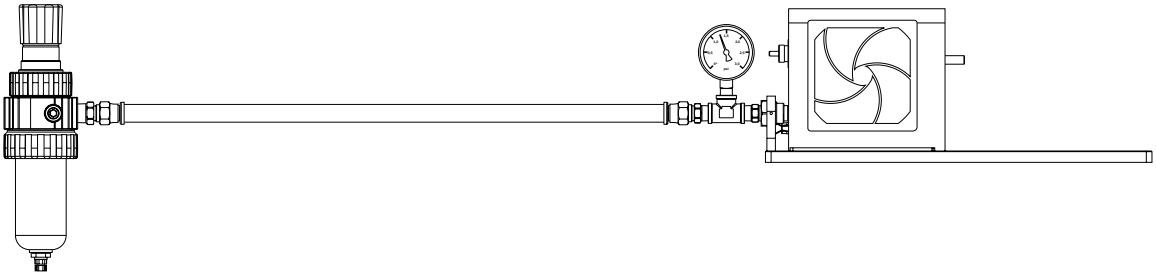


Figure 3–14 Dynamometer with Compressed Air Connection

For more information, see *Section 4.1.3.2.1 – Compressed Air*.

4. Testing

4.1 TESTING CONSIDERATIONS

A number of factors must be taken into consideration before running a test including safety, accuracy, power dissipation, fixturing, couplings, windage, friction, vibration, cogging, eddy currents and temperature rise. The following sections describe these factors, and their effects, in further detail.

4.1.1 SAFETY

For general safety considerations, please follow these few common-sense rules:

- Be sure that your coupling is adequately rated for the speed and torque that you intend to run.
- Make sure all rotating elements are covered.
- Always wear safety glasses when working around dynamometer test equipment.
- Do not wear loose clothing or ties when working around dynamometer test equipment.
- Never allow anyone to stand close to the side of, or lean over, a rotating shaft coupling.
- Insulate electrical (internal and external) motor connections.

CAUTION: A POWER-LINE FAULT INTO THE DYNAMOMETER FRAME COULD PASS A TRANSIENT SURGE THROUGH ALL INTERCONNECTED INSTRUMENTS, ANY COMPUTER IN USE OR OPERATING PERSONNEL WITH DANGEROUS AND COSTLY CONSEQUENCES!

- Always connect the motor frame to a high current capacity (water pipe) earth ground.
- Be sure the motor control circuit breakers cannot be bypassed by accident. Variable auto-transformers are especially hazardous!

4.1.2 ACCURACY

Following, is a list of several factors that affect the apparent accuracy of the torque readout.

- **Full Scale Torque Calibration:** This setting will be affected by an internal temperature rise of up to ±0.0015% FS/°C. For more information on full-scale torque setup and troubleshooting, refer to *Section 6.2 – Calibration Procedure* and *Section 7.1.3 – Full Scale Torque*.
- **Zero Offset:** This setting is affected by an internal temperature rise of up to ±0.002% Reading/°C. For more information on zero offset setup and troubleshooting, refer to *Section 6.2 – Calibration Procedure* and *Section 7.1.2 – Zero Balance*.
- **Coupling Losses:** If the coupling becomes hot to the touch, or if the dynamometer or motor vibrate after a period of running, coupling loss error could occur up to several percent depending on the size of the motor and dynamometer. For more detail, refer to *Section 4.1.4 – Fixtures and Couplings*.
- **Windage:** Negligible at speeds up to 6000 rpm. This effect is described more extensively in *Section 4.1.5 – Windage*.

- **Mechanical Friction:** Generally negligible on HD-400 series dynamometers and larger. On HD-106 and HD-100 the user is cautioned to be aware of the effects that friction may cause. For more detail, refer to *Section 4.1.6 – Friction*.

Note: None of the above take into account the long-term drift effects on digital readout instrumentation. This is covered for each instrument by their individual specifications. Also, many of the above factors are dependent upon the motor horsepower, fixturing and other circumstances beyond the control of Magtrol. As a general rule, based upon over 50 years of motor test equipment manufacturing, if reasonable care, calibration and maintenance is exercised, motor test data accuracy better than 0.25% of torque-speed value may be expected.

4.1.3 POWER DISSIPATION

All Magtrol HD Dynamometers are power absorption instruments. A Hysteresis Brake, within the dynamometer, loads a test motor converting mechanical energy into heat.

There are finite limits to the amount of energy and resulting temperature rise that any absorption brake can withstand. Rapidly rising operating temperatures from excessive power input can cause severe mechanical distortion of the rotor assembly. This in turn may cause the rotating assembly to contact the stationary members that surround it. Once this happens, metal transfer and ultimately seizing of the brake assembly may occur.

Excessive power over extended periods of time may result in more obscure damage including breakdown of bearing lubricants and degradation of magnetic coil insulation. Also, exposure to temperatures over 690°C (1275°F) will alter the rotor's magnetic properties.

Note: Do not instantaneously apply maximum power (torque-speed) to a cold dynamometer. High temperature gradients cause differential expansions resulting in misalignment of the running air gaps between the rotor and stator assembly on the load brake. Allow all dynamometers to warm up before heavy loading. This is accomplished by gradually increasing the load to the motor. If a motor must be tested cold, warm up the dynamometer with a different motor first.

4.1.3.1 Power Absorption Curves

The following graphs (*Figures 4–1 through 4–15*) represent the maximum power (heat) that the dynamometer can dissipate over time. The specifications shown are conditional upon the following:

- Maximum brake temperature = 100°C (212°F)
- Maximum rotor temperature = 510°C (950°F)
- Ambient temperature = 25±5°C (77±9°C)
- The dynamometer cooling system is running

The following values are sufficiently accurate (within 1%) to establish horsepower (hp) for use in the heat rise curves.

where T = torque, and n = speed (rpm)

$hp = T\ (oz{\cdot}in) \times n \times 10^{-6}$
$hp = T\ (lb{\cdot}ft) \times n \times (1.0 \times 10^{-4})$
$hp = T\ (oz{\cdot}ft) \times n \times (1.19 \times 10^{-5})$
$hp = T\ (lb{\cdot}in) \times n \times (1.59 \times 10^{-5})$
$hp = T\ (g{\cdot}cm) \times n \times (1.38 \times 10^{-8})$
$hp = T\ (N{\cdot}m) \times n\ (1.4 \times 10^{-4})$

Note: Please take a moment to familiarize yourself with any limitations that may apply to your specific dynamometer and motor testing requirements.

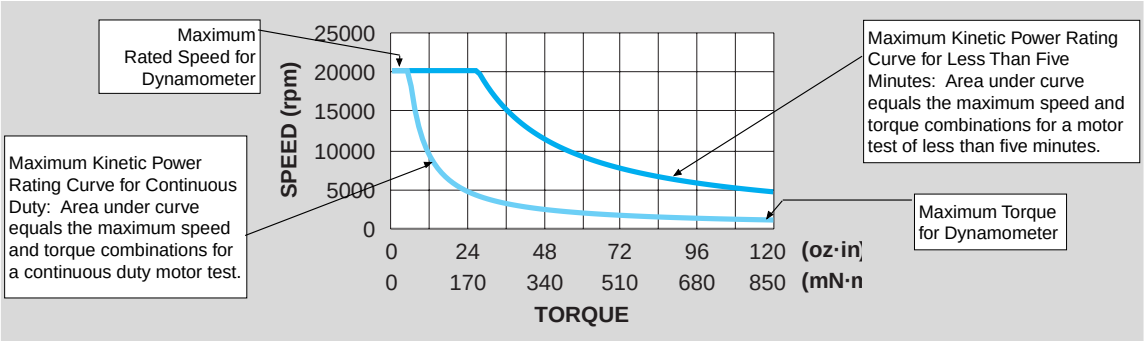


Figure 4–1 Power Absorption Curve Parameters

HD-100

Shaft Diameter	0.1870"/0.1875" (4.750 mm/4.763 mm)
Shaft Height	3.50" (88.9 mm)
Torque Range	11 oz·in, 800 g·cm, 80 mN·m
Input Inertia	3.40×10^{-6} lb·ft·s²
Maximum Speed	25,000 rpm
Maximum Input Power	20 W (continuous duty) 75 W (< 5 minutes)

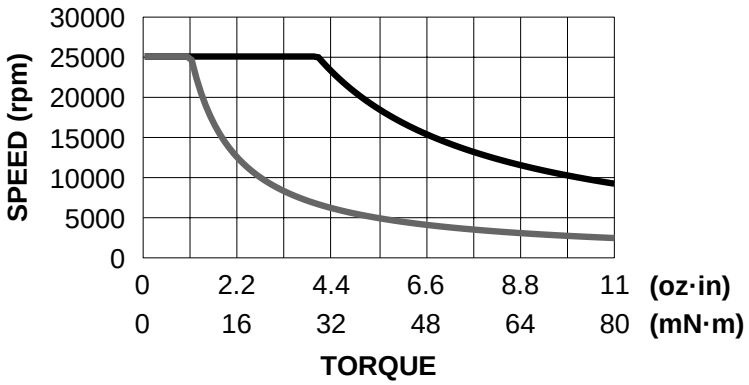


Figure 4–2 HD 100 Power Absorption Curve

OPERATION

HD-106

Shaft Diameter	0.1245"/0.1250" (3.163 mm/3.175 mm)
Shaft Height	3.50" (88.9 mm)
Torque Range	2.5 oz·in, 180 g·cm, 18.0 mN·m
Input Inertia	7.04 ×10^{-7} lb·ft·s²
Maximum Speed	30,000 rpm
Maximum Input Power	7 W (continuous duty) 35 W (< 5 minutes)

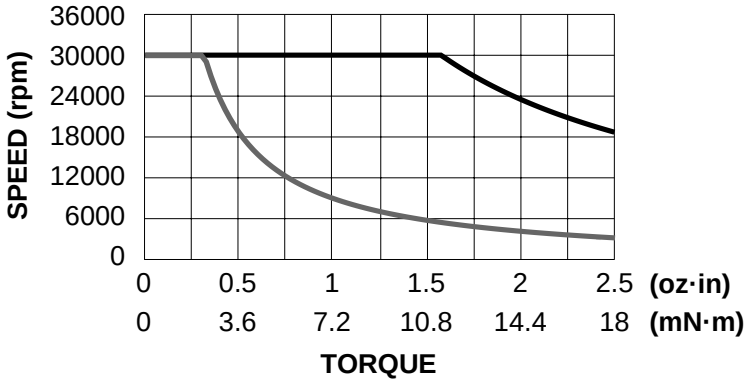


Figure 4–3 HD 106 Power Absorption Curve

HD-400

Shaft Diameter	0.2495"/0.2500" (6.338 mm/6.350 mm)
Shaft Height	3.50" (88.9 mm)
Torque Range	40 oz·in., 2.8 kg·cm, 280 mN·m
Input Inertia	1.55 × 10^{-5} lb·ft·s²
Maximum Speed	25,000 rpm
Maximum Input Power	55 W (continuous duty) 200 W (< 5 minutes)

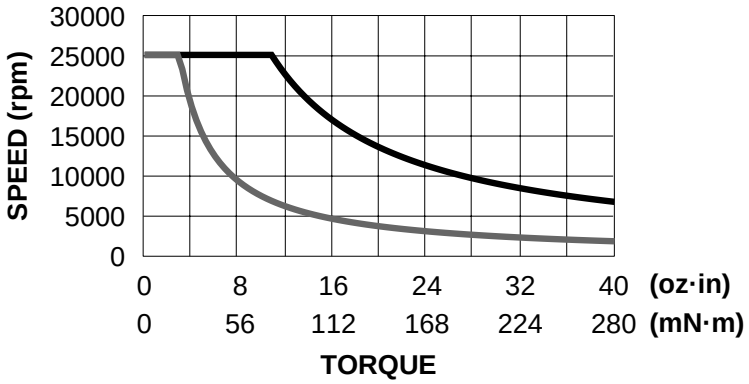


Figure 4–4 HD 400 Power Absorption Curve

HD-500

Shaft Diameter	0.3745"/0.3750" (9.512 mm/9.525 mm)
Shaft Height	4.00" (101.6 mm)
Torque Range	120 oz·in, 8.5 kg·cm, 850 mN·m
Input Inertia	8.05×10^{-5} lb·ft·s²
Maximum Speed	20,000 rpm
Maximum Input Power	80 W (continuous duty) 400 W (< 5 minutes)

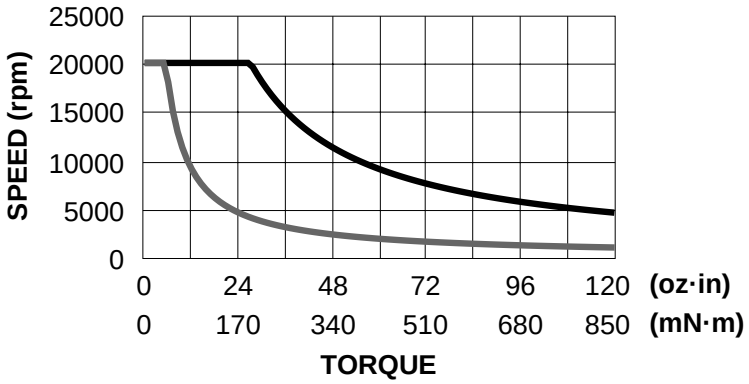


Figure 4–5 HD 500 Power Absorption Curve

HD-505

Shaft Diameter	0.3745"/0.3750" (9.512 mm/9.525 mm)
Shaft Height	4.00" (101.6 mm)
Torque Range	240 oz·in, 17 kg·cm, 1700 mN·m
Input Inertia	1.61×10^{-4} lb·ft·s²
Maximum Speed	20,000 rpm
Maximum Input Power	160 W (continuous duty) 800 W (< 5 minutes)

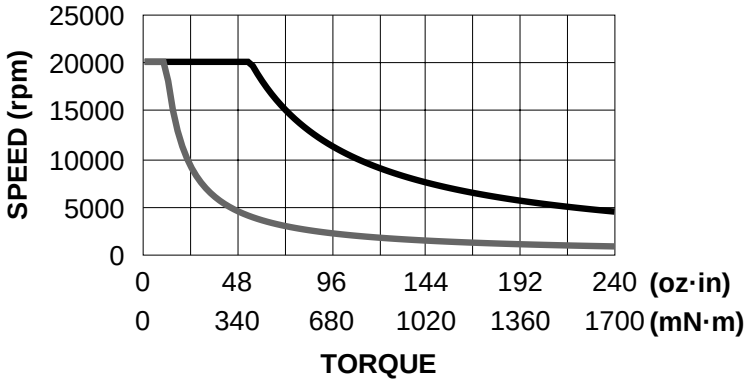


Figure 4–6 HD 505 Power Absorption Curve

HD-510

Shaft Diameter	0.3745"/0.3750" (9.512 mm/9.525 mm)
Shaft Height	4.00" (101.6 mm)
Torque Range	120 oz·in, 8.5 kg·cm, 850 mN·m
Input Inertia	8.05 ×10^{-5} lb·ft·s²
Maximum Speed	25,000 rpm
Maximum Input Power	375 W (continuous duty) 750 W (< 5 minutes)

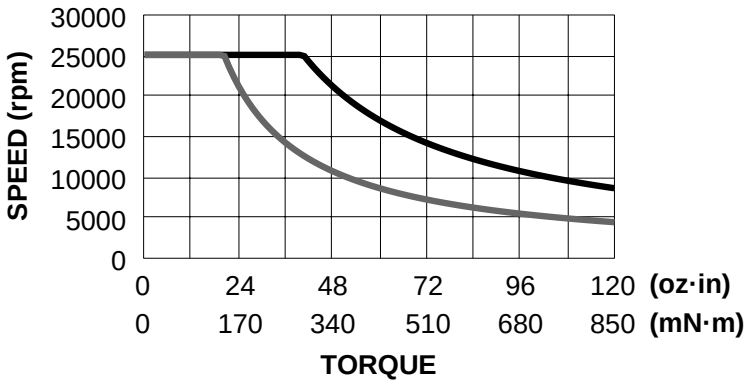


Figure 4–7 HD 510 Power Absorption Curve

HD-700

Shaft Diameter	0.4995"/0.5000" (12.687 mm/12.700 mm)
Shaft Height	5.875" (149.2 mm)
Torque Range	425 oz·in, 30 kg·cm, 3 N·m
Input Inertia	5.51 × 10^{-4} lb·ft·s²
Maximum Speed	15,000 rpm
Maximum Input Power	150 W (continuous duty) 700 W (< 5 minutes)

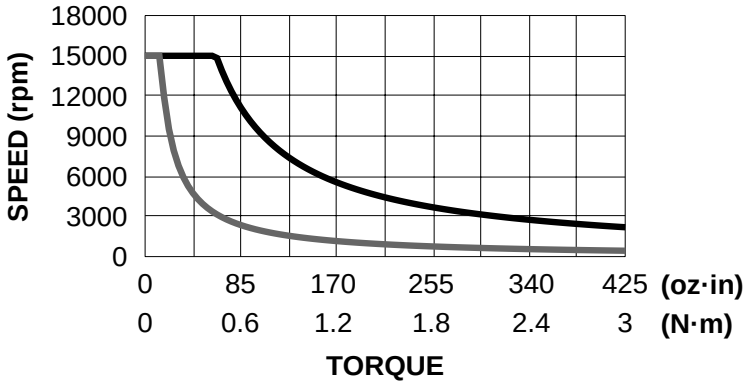


Figure 4–8 HD 700 Power Absorption Curve

HD-705

Shaft Diameter	0.4995"/0.5000" (12.687 mm/12.700 mm)
Shaft Height	5.875" (149.2 mm)
Torque Range	50 lb·in, 60 kg·cm, 6 N·m
Input Inertia	1.101×10^{-3} lb·ft·s²
Maximum Speed	10,000 rpm
Maximum Input Power	300 W (continuous duty) 1400 W (< 5 minutes)

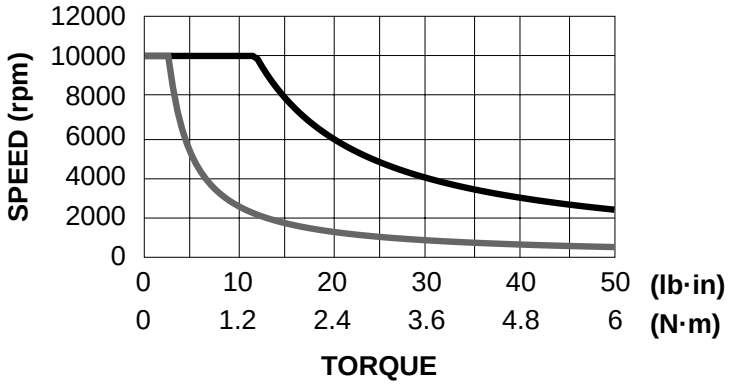


Figure 4–9 HD 705 Power Absorption Curve

HD-710

Shaft Diameter	0.4995"/0.5000" (12.687 mm/12.700 mm)
Shaft Height	5.875" (149.2 mm)
Torque Range	480 oz·in, 32.5 kg·cm, 3.25 N·m
Input Inertia	5.51×10^{-4} lb·ft·s²
Maximum Speed	25,000 rpm
Maximum Input Power	935 W (continuous duty) 1500 W (< 5 minutes)

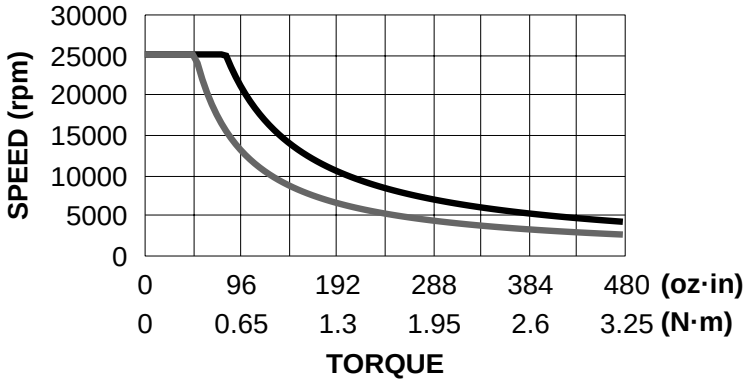


Figure 4–10 HD 710 Power Absorption Curve

HD-715

Shaft Diameter	0.4995"/0.5000" (12.687 mm/12.700 mm)
Shaft Height	5.875" (149.2 mm)
Torque Range	55 lb·in, 65 kg·cm, 6.5 N·m
Input Inertia	1.101 × 10^{-3} lb·ft·s²
Maximum Speed	25,000 rpm
Maximum Input Power	2985 W (continuous duty) 3360 W (< 5 minutes)

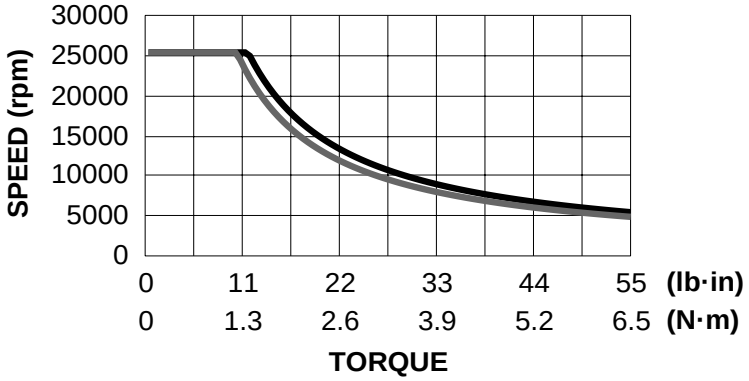


Figure 4–11 HD 715 Power Absorption Curve

HD-800

Shaft Diameter	0.9995"/1.0000" (25.387 mm/25.400 mm)
Shaft Height	9.00" (228.6 mm)
Torque Range	100 lb·in, 120 kg·cm, 12 N·m
Input Inertia	4.43 × 10^{-3} lb·ft·s²
Maximum Speed	12,000 rpm
Maximum Input Power	1800 W (continuous duty) 3000 W (< 5 minutes)

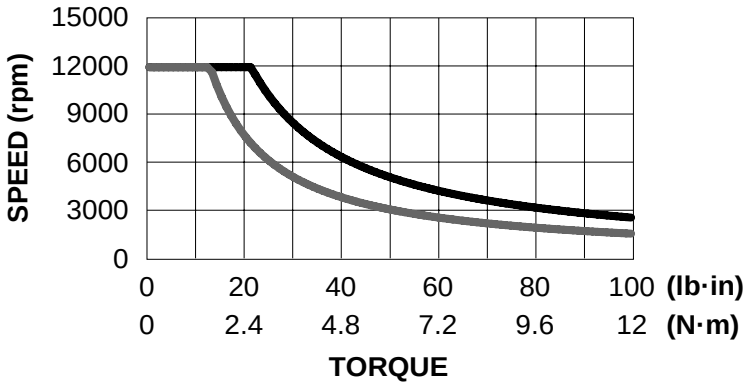


Figure 4–12 HD 800 Power Absorption Curve

HD-805

Shaft Diameter	0.9995"/1.0000" (25.387 mm/25.400 mm)
Shaft Height	9.00" (228.6 mm)
Torque Range	200 lb·in, 240 kg·cm, 24 N·m
Input Inertia	8.81×10^{-3} lb·ft·s²
Maximum Speed	12,000 rpm
Maximum Input Power	3600 W (continuous duty) 6000 W (< 5 minutes)

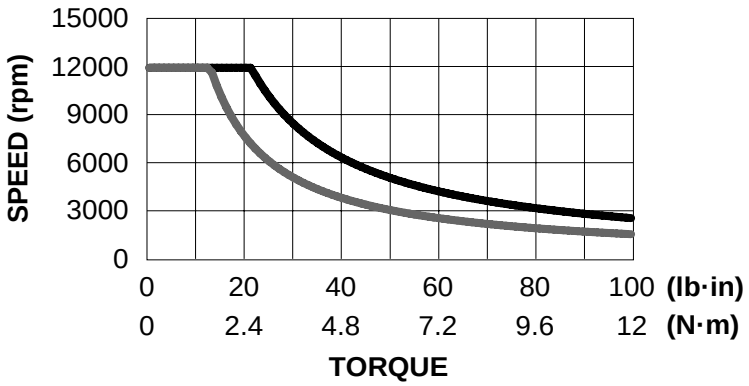


Figure 4–13 HD 805 Power Absorption Curve

HD-810

Shaft Diameter	0.9995"/1.0000" (25.387 mm/25.400 mm)
Shaft Height	9.00" (228.6 mm)
Torque Range	125 lb·in, 140 kg·cm, 14 N·m
Input Inertia	4.43×10^{-3} lb·ft·s²
Maximum Speed	12,000 rpm
Maximum Input Power	3000 W (continuous duty) 3510 W (< 5 minutes)

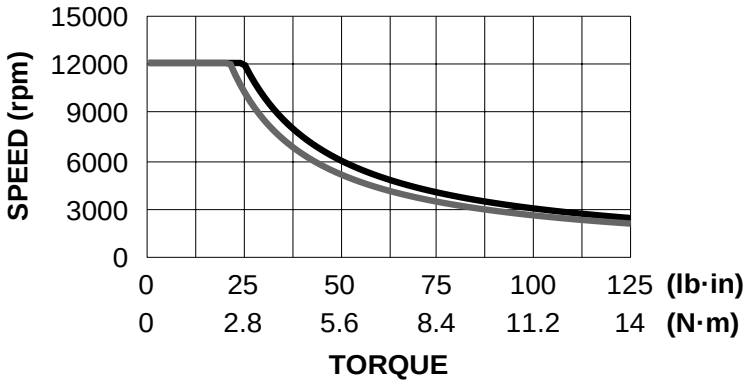


Figure 4–14 HD 810 Power Absorption Curve

HD-815

Shaft Diameter	0.9995"/1.0000" (25.387 mm/25.400 mm)
Shaft Height	9.00" (228.6 mm)
Torque Range	250 lb·in, 280 kg·cm, 28 N·m
Input Inertia	8.81 × 10^{-3} lb·ft·s²
Maximum Speed	12,000 rpm
Maximum Input Power	6000 W (continuous duty) 7025 W (< 5 minutes)

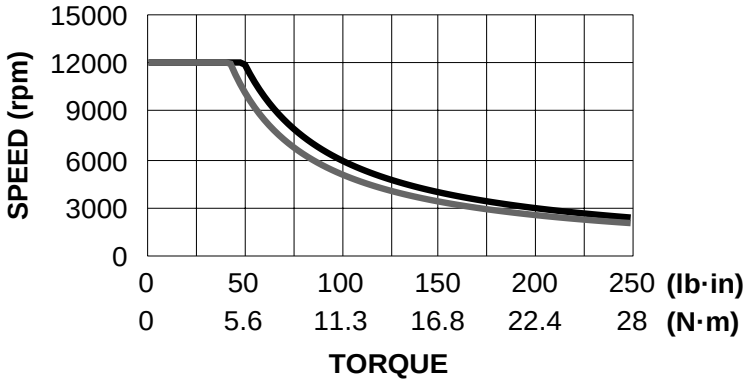


Figure 4–15 HD 815 Power Absorption Curve

HD-825

Shaft Diameter	1.4995"/1.5000" (38.087 mm/38.100 mm)
Shaft Height	9.00" (228.6 mm)
Torque Range	500 lb·in, 560 kg·cm, 56.5 N·m
Input Inertia	1.85 × 10^{-2} lb·ft·s²
Maximum Speed	8,000 rpm
Maximum Input Power	12,000 W (continuous duty) 14,000 W (< 5 minutes)

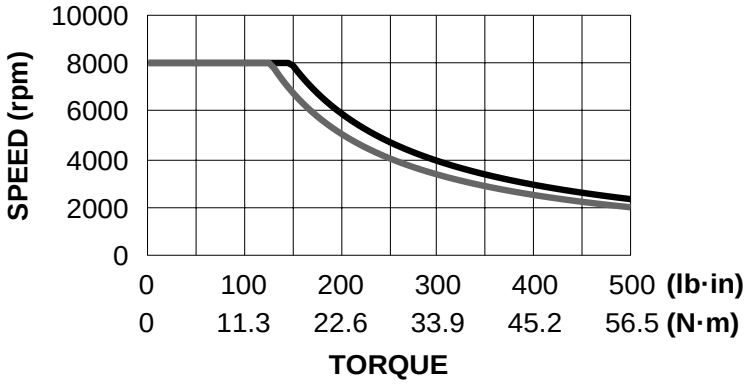


Figure 4–16 HD 825 Power Absorption Curve

ED-715

Shaft Diameter	0.7490"/0.7495" (19.025 mm/19.037 mm)
Shaft Height	6.87" (174.5 mm)
Torque Range	55 lb·in, 65 kg·cm, 6.5 N·m
Input Inertia	1.27×10^{-3} lb·ft·s²
Maximum Speed	25,000 rpm
Maximum Input Power	3000 W (continuous duty) 3800 W (< 5 minutes)

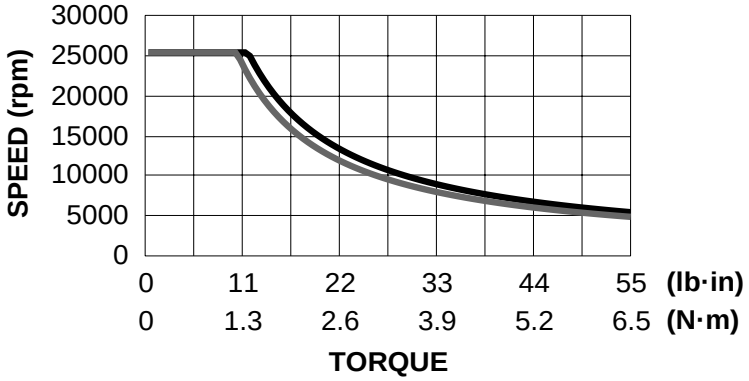


Figure 4–17 ED 715 Power Absorption Curve

ED-815

Shaft Diameter	1.4995"/1.5000" (38.087mm/38.100mm)
Shaft Height	11.00" (279.4 mm)
Torque Range	250 lb·in, 280 kg·cm, 28 N·m
Input Inertia	9.61×10^{-3} lb·ft·s²
Maximum Speed	12,000 rpm
Maximum Input Power	6000 W (continuous duty) 7500 W (< 5 minutes)

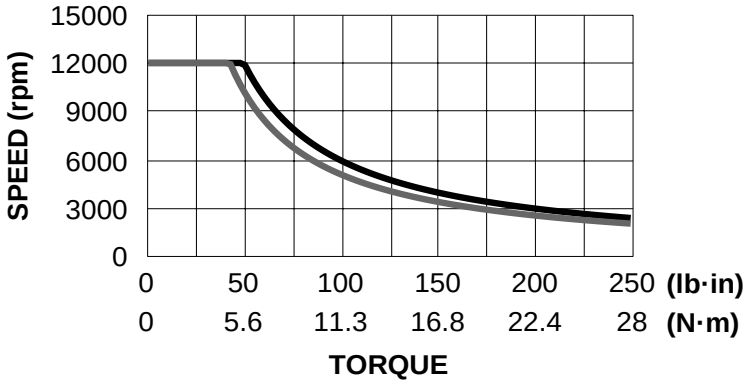


Figure 4–18 ED 815 Power Absorption Curve

HSD-610M

Shaft Diameter	0.4724"/0.4727" (11.999 mm/12.006 mm)
Shaft Height	6.375" (162 mm)
Torque Range	15.5 lb·in, 18 kg·cm, 1.75 N·m
Input Inertia	2.54×10^{-4} lb·ft·s²
Maximum Speed	35,000 rpm
Maximum Input Power	750 W (continuous duty) 1120 W (< 5 minutes)

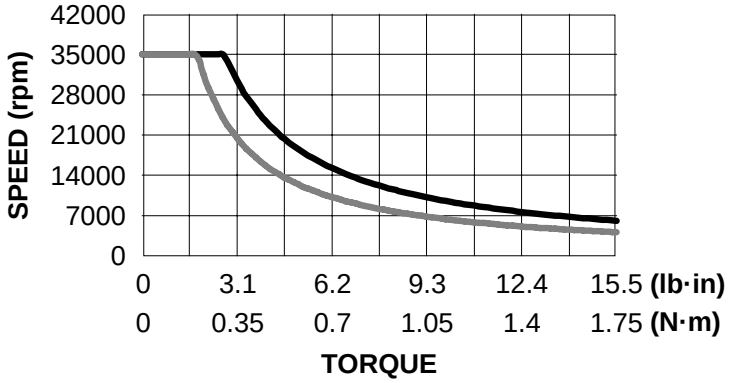


Figure 4–19 HSD 610M Power Absorption Curve

HSD-710

Shaft Diameter	0.4995"/0.5000" (12.688 mm/12.700 mm)
Shaft Height	7.375" (187.3 mm)
Torque Range	26 lb·in, 30 kg·cm, 2.9 N·m
Input Inertia	5.51×10^{-4} lb·ft·s²
Maximum Speed	30,000 rpm
Maximum Input Power	935 W (continuous duty) 1500 W (< 5 minutes)

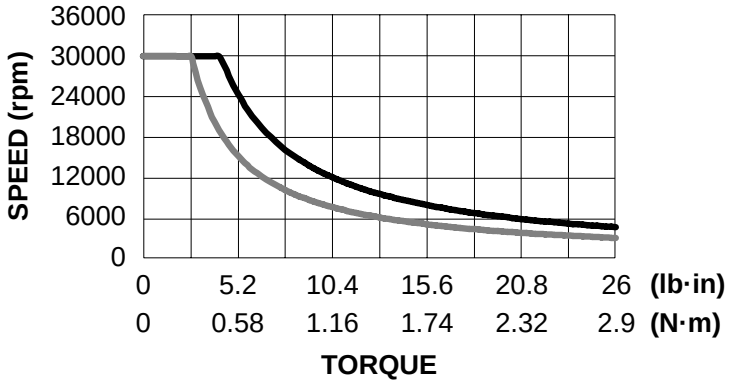


Figure 4–20 HSD 710 Power Absorption Curve

4.1.3.2 Cooling Methods

Note: For additional details on compressed air and blower setup along with extensive information on the Air Flow Sensor feature, refer to *Section 3.3.3 – Air Cooling*.

4.1.3.2.1 Compressed Air

Magtrol's HD-510, 800 and 805 dynamometers are internally ported for compressed air cooling. Always use the filter and line regulator supplied with the unit. These elements should be installed as shown in the following diagram.

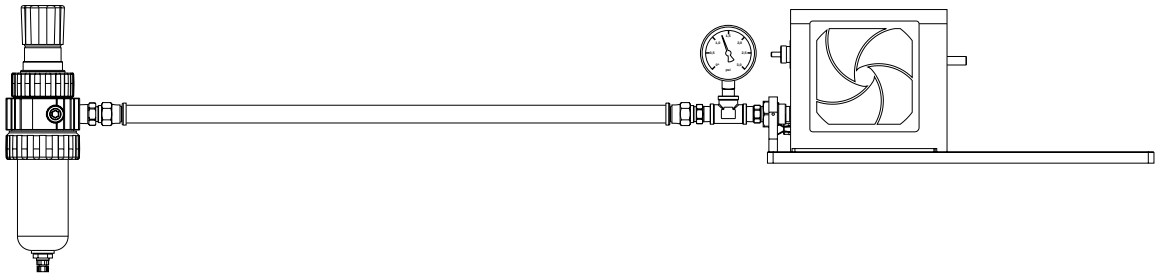


Figure 4–21 Dynamometer with Compressed Air Connection

For maximum air flow and cooling, set the regulator to the following:

HD Model	CFM (Cubic Feet per Minute)	PSI (Pounds per Square Inch)
HD-510	7	1.75
HD-800	7.5	7
HD-805	15	7

WARNING! DO NOT EXCEED THE PRESSURES GIVEN.

The air supply should be enabled whenever the unit is in operation.

4.1.3.2.2 Blower

Magtrol's HD-710, 715, 810, 815, 825, ED-715 and 815, and HSD-610M and 710 dynamometers are internally ported for blower cooling. The following diagram illustrates the connection.

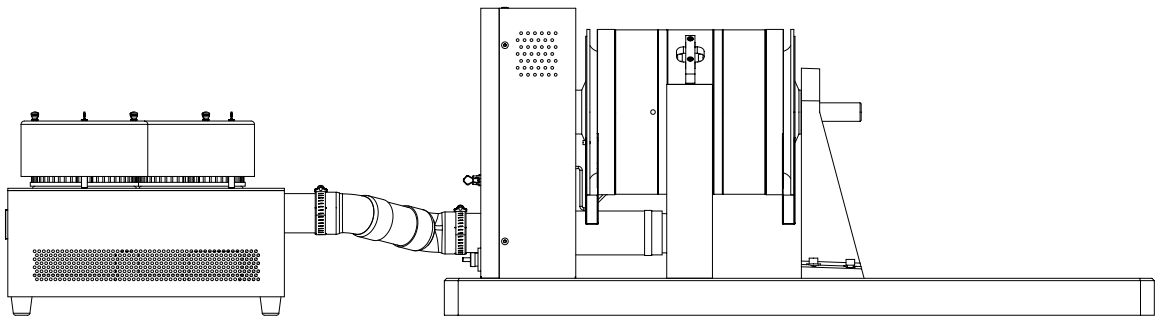


Figure 4–22 Dynamometer with Blower Connection

4.1.4 FIXTURES AND COUPLINGS

When mounting the test motor, please consider the following:

- Construct precise fixtures that provide proper shaft alignment.
- Secure the test motor in the fixture to prevent torsional movement and bolt the fixture to the dynamometer base plate.
- Give consideration to the interaction of materials between the motor and test fixture. For example, a (magnetic) steel plate placed against the exposed lamination of an open frame motor can significantly influence performance. Some thin shell PM (permanent magnet) motors may be similarly affected.
- The dynamometer base plate material is an aluminum tool plate that is easily drilled and tapped. The use of helix thread inserts is a good idea if you are going to interchange fixtures often.

Note: For an additional charge, Magtrol can perform base plate modifications.

The following diagram illustrates examples of possible shaft misalignment.

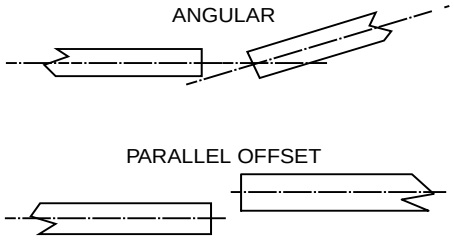


Figure 4–23 Examples of Possible Shaft Misalignment

The use of high quality double flexure couplings is recommended to help correct any misalignment problems. This type of coupling—two flexing elements separated by a solid link—inherently tolerates greater parallel offset. If you would like more specific coupling recommendations, contact Magtrol Technical Assistance. For precise misalignment tolerances, consult your coupling manufacturer.

4.1.5 WINDAGE

Windage is proportional to the square of speed and magnifies rapidly above rated speed. The air friction is tangential to the surface and impinges upon the stationary field assembly. This acts as viscous drag and becomes part of the motor load and torque reading. However, there is a small amount of air dissipated as pumping loss. Since this appears as a load on the motor, not measured by the dynamometer, it becomes a source of error.

Windage effects on accuracy tests have been conducted on all Magtrol dynamometers. The percentage of torque loss due to windage ranges between 0.025% and 0.20% of full scale at maximum rated rpm.

Windage is proportional to the square of speed and magnifies rapidly above rated speed. Conversely, at one half of the rated speed, the effect becomes immeasurably small.

4.1.6 FRICTION

Friction of the shaft bearings is a measurable load, but some friction can exist in the carrier bearing. When correctly loaded and lubricated, the friction is insignificant. The value may be quantitatively established by the following procedure.

1. Remove all attachments to the dynamometer shaft.
2. Advance the torque control slightly, to obtain a small torque load.
3. Apply a small amount of torque (by hand) in one direction of rotation.
4. Carefully release the shaft, allow several seconds, and record the torque reading, if any.
5. Then, carefully re-apply torque in the opposite direction.
6. Slowly release the shaft as above, and compare the two readings.

The difference should be less than 1% of full scale. During actual motor testing there is usually enough system vibration to "settle" negating frictional effects. If excessive drag is present, mechanical realignment may be required, dependent upon dynamometer size. Certain mechanical factors need to be determined before corrective action proceeds. Please contact Magtrol Technical Assistance.

4.1.7 VIBRATION

All rotating dynamometer assemblies are precision balanced, however, the dynamometer shaft is cantilevered. This may cause vulnerability to radial forces.

At high speeds, some vibration and noise are inevitable but not necessarily harmful. However, excessive resonant vibrations, caused by bent shafts, poor alignment and out of balance couplings will produce excessive data errors and are a safety hazard.

WARNING! SHAFT COUPLINGS OPERATING AT SPEEDS ABOVE THEIR DESIGN LIMITS ARE EXTREMELY HAZARDOUS. MANY COUPLINGS CONTAIN SOMEWHAT LOOSELY SUPPORTED FLEXURE ELEMENTS. WHEN OVERDRIVEN, EXCESSIVE CENTRIFUGAL FORCE MAY DISPLACE THEM OUT OF AXIAL ALIGNMENT. AS THIS HAPPENS, THEY IMMEDIATELY BEGIN TO ABSORB ENERGY RESULTING IN SEVERE VIBRATION AND DESTRUCTION OF THE COUPLING.

4.1.8 COGGING

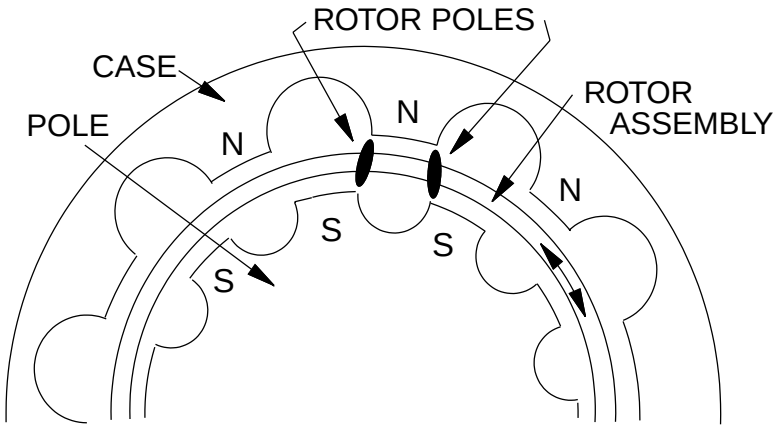


Figure 4–24 Hysteresis Brake Cross-Section

This cross-section shows (by one tooth) the magnetic relationship of the hysteresis brake elements. If the dynamometer shaft is at rest with torque applied, and if the torque control is then reduced to zero, a magnetic salient pole will be temporarily imposed on the rotor of the brake.

If the shaft is then rotated slowly, the magnetic poles on the rotor will attempt to align with the adjacent case-pole tooth form. This is often referred to as "cogging". The action is sinusoidal—first it tries to resist rotation and then, as the rotor passes through the tooth form, it subsequently supports rotation. At a few hundred rpm, these forces integrate resulting in an effective torque of nearly zero.

To avoid magnetic cogging, before the shaft comes to rest, reduce the torque control to zero.

To remove cogging, once established, reapply current on the dynamometer. Then, decrease the current to zero while simultaneously rotating the dynamometer shaft.

4.1.9 EDDY CURRENTS

There is some eddy current generation within the brake rotor. These magnetically induced currents cause an increase in brake torque proportional to speed.

The larger the hysteresis brake, the higher the rotor surface velocity. Additionally, as brakes become larger the rotor cross-sectional area increases. Each of these factors increase eddy current generation. The combination results in speed-related torque increase, exhibiting a more pronounced effect on larger dynamometers.

With the HD-800 through 815 models, the eddy-current torque component adds approximately 10%/1000 rpm to a static, fixed current, torque value. On the smaller dynamometer sizes, 2% to 4%/1000 rpm is typical.

4.1.10 TEMPERATURE RISE

Temperature rise has a more complex effect on hysteresis brake load torque and is difficult to quantify. As the temperature of the brake increases, differential expansions cause dimensional changes that tend to increase torque. Conversely, electrical resistance in the rotor increases with temperature, resulting in decreased eddy current generation and torque, all in a variable frame.

Where current and speed remain fixed, there may be a gradual torque increase over a period of a few moments. This will generally settle 0.5% to 2% of the starting torque value, per 1000 rpm of applied speed. The smaller of the two estimates is applicable to the smaller dynamometer sizes.

If highly accurate long-term torque stability is required, consider the Magtrol DSP6001 Dynamometer Controller. This is a computer-controlled closed loop system capable of maintaining either constant torque or speed.

5. Operating Principles

5.1 SPEED

Inside the dynamometer enclosure is an optical speed transducer. A high-speed optical switch, consisting of an Infrared (IR) LED and IR receiver, senses the passage of light through a slotted disk that is attached to the end of the dynamometer shaft. Light passing through a slot in the disk causes the speed output signal to go to a logic low (near 0 VDC). As a solid section passes in front of the IR receiver, the output signal switches to a logic high (near 5 VDC). Rotation of the disk results in the optical switch generating a pulse frequency of 60 bits per shaft revolution. For schematic, see *Section B.2 – Speed Sensor Board* in Appendix B.

5.2 TORQUE

Torsional force from the hysteresis brake assembly is measured by a load cell. The load cell consists of a flexing beam with four strain gauges. The strain gauges are in a bridge configuration, producing an analog signal proportional to torque.

The load cell schematic in Appendix B shows voltage levels and connection identifications. The mechanical diagram below illustrates how the assembly clamps onto the rear support member of the brake.

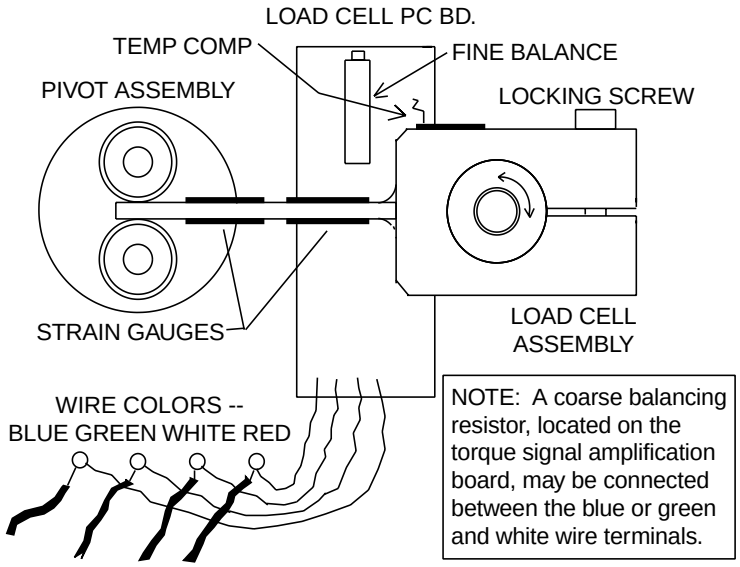


Figure 5–1 Mechanical Layout of a Load Cell

5.3 TORQUE SIGNAL AMPLIFICATION

A printed circuit board mounted on the dynamometer rear panel, identified as part number 234-401-101-xxx, contains the torque signal amplifiers IC1, IC2 and IC3, load cell excitation supply consisting of voltage reference DZ1, amplifier IC4 and Transistors Q1-Q4.

Voltage reference DZ1 is a precision voltage source, and along with IC4 and Q1–Q4, provides +5.00 and -5.00 volts DC excitation to the load cell bridge. Transistors Q1–Q4 are NPN and PNP transistors, serving as series pass elements to boost the current output drive capability to over 30 mA. Bipolar bridge excitation is used to improve the noise immunity of the low millivolt range bridge output signal. See *B.1 – Torque Amplification Signal* in Appendix B.

Amplifier IC1 is a precision, differential input instrumentation amplifier providing amplification necessary to calibrate the torque signal. IC2 and IC3 provide additional amplification and scaling, along with the counterclockwise calibration (CCW CAL) control.

The torque signal is calibrated by adjusting the rear panel trim potentiometers P1 and P2, labeled "CW CAL" and "CCW CAL". Torque signal zero is adjusted by using the rear panel trim potentiometer P3, labeled "ZERO", when no torque is applied.

The load cell on all dynamometers except the HD-106, produce an output signal of 15 mV at full torque. The HD-106 output is 7.5 mV full scale. Amplifiers IC1-IC3 calibrate this so the output in millivolts equals the dynamometer full scale torque.

The torque signal zero may be affected thermally and may need periodic readjustment. Therefore, the "ZERO" adjustment can be readjusted as needed.

The clockwise calibration (CW CAL) adjustments should not typically need readjustment. In the event that a "CW CAL" adjustment is needed, a precision calibration beam and weight must be used. The calibration beam may be purchased from Magtrol.

Note: Use only an insulated screwdriver or a plastic trim pot adjustment tool when adjusting the "CW CAL," "CCW CAL" or "ZERO" trim potentiometers.

For example, the HD-400-6 Dynamometer lists the full scale torque at 40.0 oz·in. Therefore, the amplifier gain will be set to produce 0.400 VDC output, when the load cell input is ≅0.011 VDC.

5.4 DECIMAL POINT CONTROL

Two solder links on the circuit board indicate to the digital readout instrument where the decimal point belongs. The chart below shows how this is accomplished by jumping the appropriate link on the board. Digital output "XXX" represents the result of the analog output (in millivolts) with the decimal point properly located.

Digital Output	SL13	SL12
X.XX	Closed	Open
XX.X	Open	Closed
XXX.	Closed	Closed

5.5 DAMPER CYLINDER

Hysteresis brakes, machined from (solid bar) magnetic material, represent a heavy mass. The load cell behaves somewhat like a spring. A mass, supported by a spring, will resonate at the system's natural frequency. For this reason, the dynamometer brake assembly must be dampened to filter out torque data and to avoid stress and fatigue. The damper cylinder arm, attached to the brake, connects to a piston within the hydraulic cylinder. When the load cell shipping/ restraining bolt was removed (see *Section 3.1 – Removal of the Load Cell Shipping/Restraining Bolt*), the brake/load cell assembly was centered and the damper became functional.

5.6 BRAKE CONTROL POWER

Any Magtrol Dynamometer Controller is universal in that it must operate all dynamometers. Due to the higher level of current required by Magtrol's larger dynamometers, a booster power amplifier is used to increase the control current. These supplies, contained within the dynamometer enclosures, are in operation when the cooling fans are on.

5.6.1 HD-800/815 AND ED-815

A booster power amplifier is used with the HD-800, 805, 810, 815 and ED-815 dynamometers to increase control current by a factor of 2 and 4, respectively. The schematic in *Section B.4 – HD-800-815 Brake Control Supply* details the HD-800, 805, 810 and 815 brake power amplifier.

5.6.2 HD-825

An HD-825 uses a 5241 power amplifier to increase the control current. For the schematic, see *Section B.5 – HD-825 Brake Control Supply*.

6. Calibration

All Magtrol instruments are calibrated prior to shipment. There is a calibration label on each unit as shown in the following figure.

Figure 6–1 Calibration Label

This label tells the user when the next calibration is required, although Magtrol does recommend that calibration be completed after the dynamometer, readout instrumentation and power supply are set up for the first time.

6.1 CALIBRATION PREPARATION

Before beginning the calibration procedure (see *Section 6.2 – Calibration Procedure*), the following items must be checked.

- Be sure all equipment is set for the correct power-line input voltage as specified on the original order.
- Ensure correct earth grounds on equipment.
- For instructions and operational details on how to set an open loop current, refer to your power supply manual.
- Turn on the controller or readout and power supply and allow 20 minutes for warm-up, longer if the equipment is below room temperature.

6.2 CALIBRATION PROCEDURE

The pin location on the torque beam precisely fixes the distance, in either metric or English units. Therefore, the force (weight) required will be equal to the torque value divided by the distance on the beam.

The calibration procedure is as follows:

1. Select a calibration weight heavy enough to apply a torque close to the full scale rating.

Note: Precision weights are needed in order to complete the calibration procedure.

2. Install the calibration beam on the dynamometer shaft as shown in the following diagram, Do not hang the weight until instructed to do so in step 6.

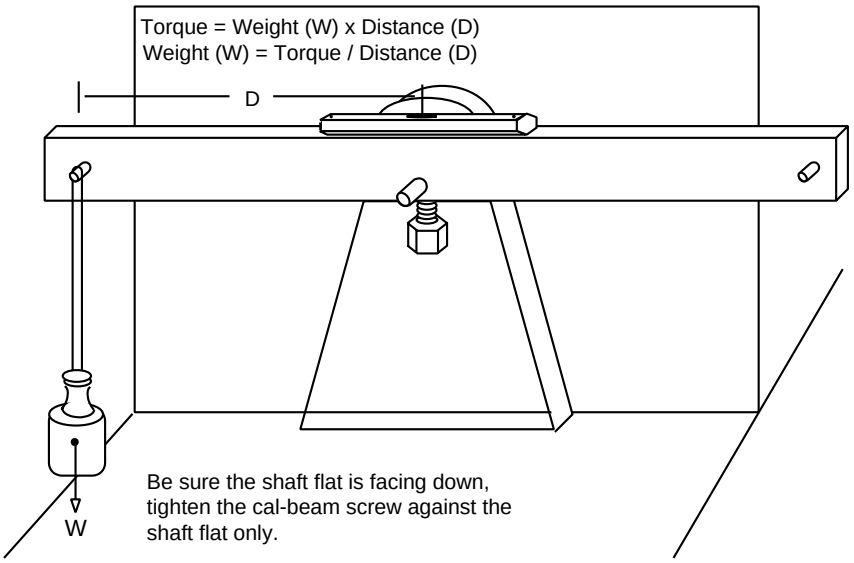


Figure 6–2 Calibration Beam on Dynamometer

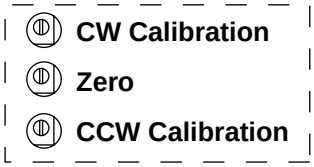


Figure 6–3 Calibration Potentiometers

3. Using lightweight (but strong) line, form a loop and attach it to the weight. Do not use a wire hook. Hooks will generally apply the force slightly off the center line of the pin.
4. Apply full current to the dynamometer brake.
5. With the beam perfectly horizontal, adjust the ZERO trim point so that the torque reading is zero ± 1 least significant dynamometer torque digit.
6. Hang the weight from the clockwise (CW CAL) pin and level the calibration beam. The weight times the distance calculation should be equal to, or near, the full scale of the dynamometer.
7. Adjust the CW CAL trim pot so that the torque reading equals the weight times the distance.
8. Transfer the weight to the counterclockwise (CCW CAL) pin and level the calibration beam.
9. Adjust the CCW cal trim pot so that the torque reading equals the weight times the distance.
10. Remove the weight from the calibration beam.
11. Reduce the current to zero while pumping the calibration beam CW/CCW. This will ensure that there are no salient poles left on the rotor.
12. Remove the calibration beam.

The dynamometer is calibrated and ready for motor testing.

Magtrol load cells are temperature compensated and designed for stability. It is a good idea to calibrate, frequently at first, maintaining a record (see *Appendix A – Calibration Record*) until you have established a history. If there appears to be excessive drift, contact Magtrol Technical Assistance.

7. Optional Features

7.1 SPEED ENCODER

All Magtrol dynamometers come standard with a 60-bit speed encoder, best suited for high-speed systems. For low speed motors, with maximum speeds of less than 200 rpm, Magtrol offers several additional encoder options, which include:

- 600-bit single encoder
- 6000-bit single encoder
- 60/600-bit dual encoder
- 60/6000-bit dual encoder

With the single higher resolution encoder option, five wires from the 600 or 6000-bit encoder run internally to the torque amplification board. All five of the wires from the encoder are then passed directly to the back panel connector.

14-PIN CONNECTOR	SPEED ENCODER
pin 11	index pulse
pin 10	TACH_A
pin 2	TACH_B
pin 7	+5 VDC
pin 8	+5 VDC COM

With the dual encoder option, the dynamometer comes equipped with a standard 60-bit encoder and an additional 600 or 6000-bit encoder. The user can select which encoder to use via a back panel switch. (*See Figure 2–1 Rear Panel*). Five wires from the 600/6000-bit encoder run the torque amplification board. Three of the wires from the encoder are then passed directly to the back panel connector (14-pin connector, pin 11 = index pulse, pin 2 = TACH_B, pin 8 = +5VDC COM.). Two of the wires route to a double pole double throw switch. The switch selects which encoder will be powered up and routes the appropriate Tach_A signal to the 14-pin connector (14-pin connector, pin 10 = TACH_A, pin 7 = +5VDC).

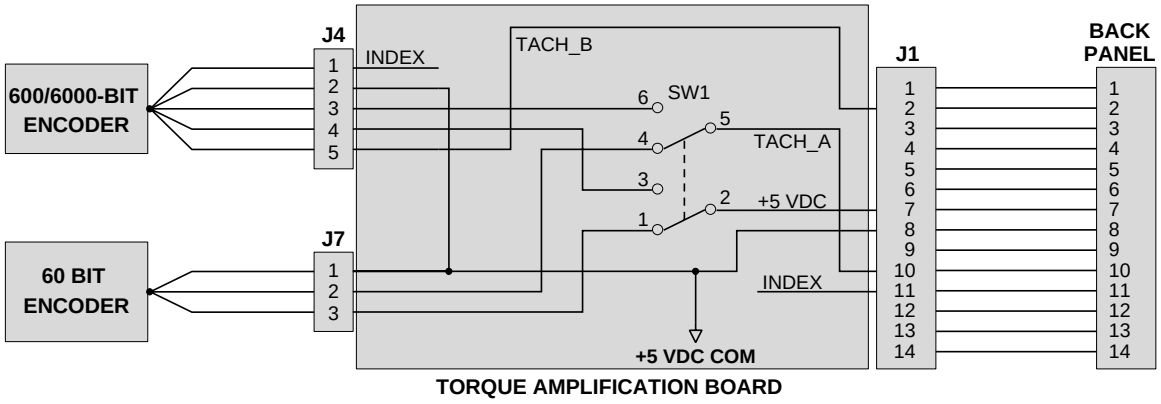


Figure 7–1 Speed Encoder Schematic

The user may use the 60 bit encoder for high speed systems and the 600/6000-bit encoder for lower speed applications. Additionally the TACH_A and TACH_B signals can be quadrature decoded to give even higher resolutions and direction of rotation.

7.2 ANALOG OUTPUTS

With the analog output option, the dynamometer is modified such that the last stage amplifier circuit on the Torque Amplification Board provides ± 5 VDC full scale. The torque signal from the board is removed from pins 13 and 14 of the 14-pin connector and rerouted to an isolated BNC connector on the back of the dynamometer.

8. Troubleshooting

8.1 TORQUE READOUT PROBLEMS

8.1.1 NEW DYNAMOMETER

If the dynamometer is new (never operated before) and the torque reading is near full scale and constant, the probable cause is failure to remove the shipping restraining bolt. This applies to all dynamometers with model numbers from 106 to 715. For further instruction refer to *Section 3.1 – Removal of the Load Cell/Shipping Restraining Bolt*.

8.1.2 ZERO BALANCE

Zero balance is usually attained by the ZERO control potentiometer on the rear panel of the dynamometer. Refer to *Section 6.2 – Calibration Procedure*. If you cannot obtain a zero torque reading with zero applied torque, you will need to first make sure that your load cell is functional. To verify that the strain gauge is stable under stress, complete the following steps.

1. Install the calibration beam.
2. Set the power supply for full current.
3. Install a weight on the beam (either side) sufficient to apply close to 100% of full-scale rated torque. If the reading is stable, switch the weight to the other side of the beam.
4. Steady the weight and the beam to be sure they are motionless.

Note: The torque reading may show activity, but hold steady within three or four dynamometer torque digits.

8.1.2.1 Steady Torque Reading

If the torque reading is active and steady, you will need to reestablish the zero load cell balance.

1. Adjust the zero control on the rear panel for an approximate mechanical center. This is a 20 turn control, so rotate it clockwise more than 20 turns and then counterclockwise for 10 turns.
2. Disconnect the dynamometer line cord from the line power source.
3. Turn off the digital readout device or dynamometer controller.
4. Lower the rear panel.

Note: It is a good idea to clamp the rear panel to the dynamometer base plate. This will decrease the possibility of pulling on the fragile interconnection lead wires.

5. Remove resistor R20 from the torque amplification circuit board.
6. Turn on the digital readout instrument.
7. While observing (or recording) the torque reading, start with a 100 K to 200 K resistor and temporarily connect it in the R20 position on the circuit board.
8. Temporarily jumper solder link SL14. If the reading becomes larger, remove the jumper and bridge solder link SL 17. If the reading becomes smaller, remove the jumper and bridge solder link SL 14.

9. Select resistors until two adjacent resistance values, within 1% or 2% of each other, cause the reading to swing through zero. Do not use any resistance below 10K.
10. Once the correct resistance value has been established, a high quality 50 ppm/°C, 1% or better, precision resistor (RN60C or RN65C) must be obtained. Permanently solder it onto the board in the R20 position.
11. The ZERO control potentiometer, which was previously set to a mechanical center, should now trim out any remaining imbalance.

Note: If something has caused the original balance to shift to such an extent that the rear panel ZERO balancing control is out of range, it is probable that more difficulties lie ahead. Whereas a new load cell might offer the best solution, these instructions may get the dynamometer operational.

8.1.2.2 Erratic Torque Reading

If the torque reading is erratic, then the problem could be a defective load cell or electronic component in the dynamometer or readout device. It will be necessary to establish specifically what is defective. At this time contact Magtrol Technical Assistance.

8.1.3 FULL SCALE TORQUE

If the dynamometer cannot obtain full torque and will not support the beam and weight at full scale, a resistance or current check may be used to help locate the problem.

8.1.3.1 Resistance Check

1. Disconnect the 2-pin connector and the dynamometer line cord.
2. Measure the resistance across the 2-pin male plug at the dynamometer.
3. Check the reading to the table below.

Dynamometer Model	Res. Ohms
HD-106	153
HD-100	180
HD-400	80
HD-500	120
HD-510	75
HD-505	60
HD-700	80
HD-705	40
HD-710	80
HD-715	40
HD-800	20
HD-810	20
HD-805	10
HD-815	10
HD-825	5
ED-715	40
ED-815	13
HSD-610M	96
HSD-710	80

If the reading is within ±10% of the value specified in the table, proceed to *Section 8.1.3.2 – Current Check* . If the reading is not within the values specified, contact Magtrol Technical Assistance.

Note: The resistance check is only accurate for Magtrol HD-100, -400, -500 and -700 Series and ED-715 Dynamometers

8.1.3.2 Current Check

1. Insert an ammeter between the power supply and dynamometer brake.
2. Adjust the power supply voltage until the ammeter reading is equal to the value in the following table.

Dynamometer Model	F.S. Current (A)
HD-106	0.157
HD-100	0.135
HD-400	0.300
HD-500	0.200
HD-510	0.298
HD-505	0.400
HD-700	0.339
HD-705	0.339
HD-710	0.678
HD-715	0.678
HD-800	1.200
HD-810	1.200
HD-805	2.400
HD-815	2.400
HD-825	4.800
ED-715	0.700
ED-815	0.700
HSD-610M	0.250
HSD-710	0.339

3. Attach the appropriate weight for full-scale torque and verify whether the brake holds the load. If it does not hold the load with proper current flowing in the brake, the power supply is not the problem. The dynamometer is probably at fault and you will need to contact Magtrol Technical Assistance for further help.

Note: The current check is accurate for all Magtrol Dynamometers.

8.1.4 MECHANICAL (ROTATIONAL) ALIGNMENT

Refer to the drawing and the instructions below if the dynamometer will apply torque but the torque reading will not calibrate full scale, even though the zero balance is within tolerance. See *Figure 5–1 Mechanical Layout of a Load Cell*.

1. Disconnect all inputs and outputs on the dynamometer rear panel.
2. Disconnect the dynamometer line cord from the line power source if applicable.
3. Carefully remove the rear panel.

Note: It is a good idea to clamp the rear panel to the dynamometer base plate.

4. Remove the socket-head cap screw retaining the pulse disk to the shaft.
5. Remove the pulse disk.
6. Loosen, but do not remove, the load cell clamping screw.
7. Carefully grasp the brake assembly and slowly rotate the assembly in both directions. Please note several degrees of free-swing, restrained by the damper cylinder in both directions.

Note: Do not force this assembly!

The objective is to reposition the load cell in such a manner to re-establish the center of allowable rotation, restricted by the damper assembly. Devise a shim of sufficient thickness, that when inserted between the top of the damper cylinder and the damper arm, the arm will be parallel to the top of the cylinder.

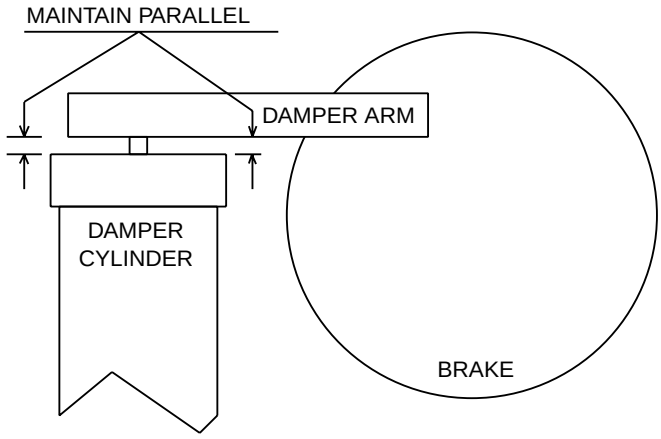


Figure 8–1 Damper Connection

The above diagram shows the location of these elements, however, you will only be able to view them from the top.

8. While pressing down on the damper arm, thus positioning the entire assembly, tighten the load cell clamping screw. Be sure the load cell assembly has not moved axially and is seated against the sleeve resting up against the inner race of the carrier bearing.
9. Remove the shim.
10. Reinstall the pulse disk, reassemble the enclosure and then recalibrate.

8.2 SPEED READOUT PROBLEMS

If there is an erratic speed reading, or no speed reading at all, remove the rear panel of the dynamometer and inspect the pulse disk. It must be tight on the rotor shaft and the shaft must rotate freely. Also, make sure that the disk is not bent or distorted. If the disk is damaged, contact Magtrol Technical Assistance for a replacement disk.

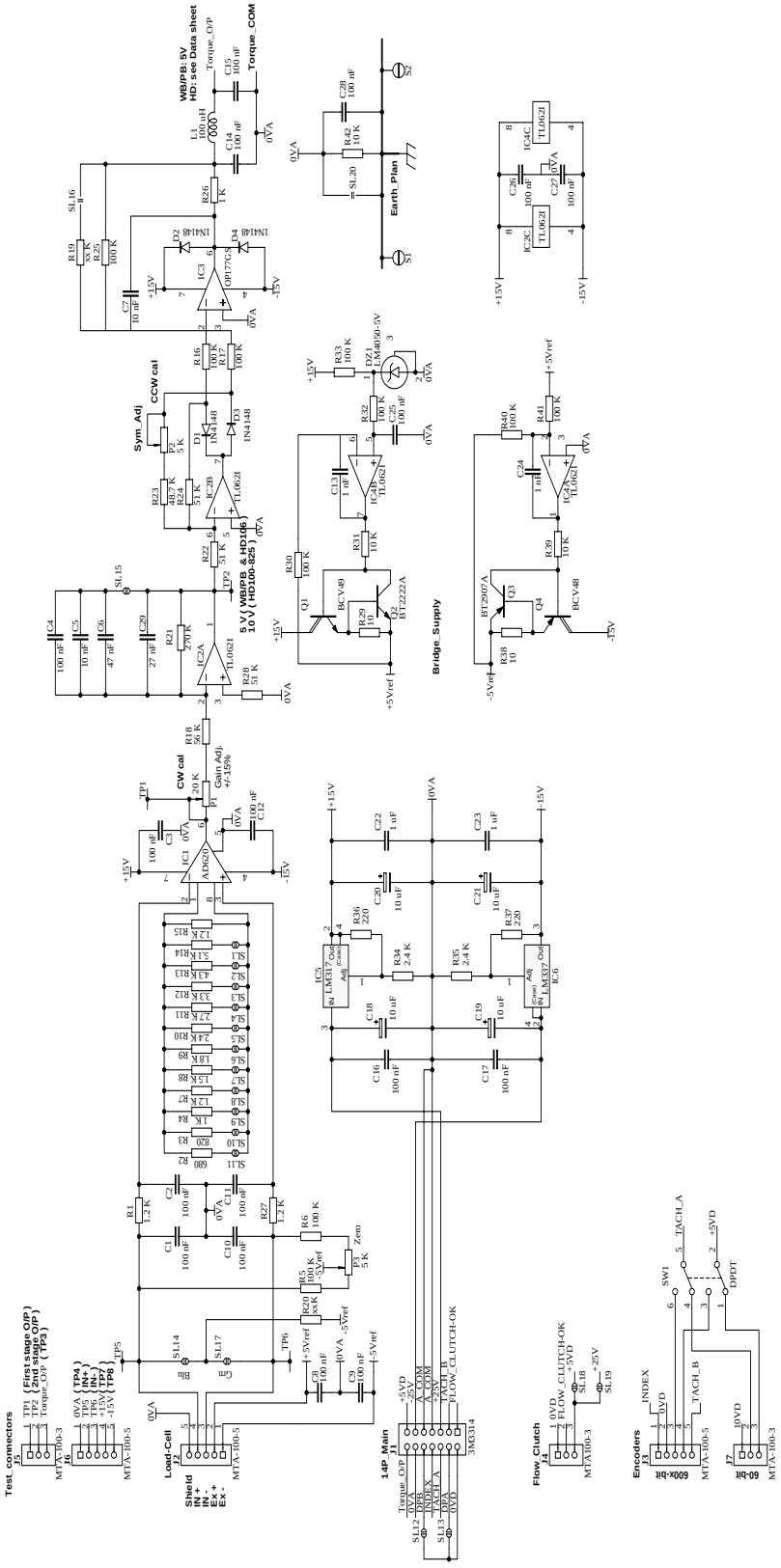
If the pulse disk appears normal, then connect an oscilloscope with the probes across pins 8 and 10 of the dynamometer 14-pin "D" connector—pin 8 is common or ground. As the disk rotates, the pulse voltage should switch between a low of about 0.4 VDC (or less) and a high of about 5 VDC. If this signal is incorrect, the problem is on the encoder optical pickup board. The encoder optical pickup is replaceable as an assembly from the Magtrol Technical Assistance Department. If this signal is correct, examine your digital readout instrument for the problem.

Appendix A: Calibration Record

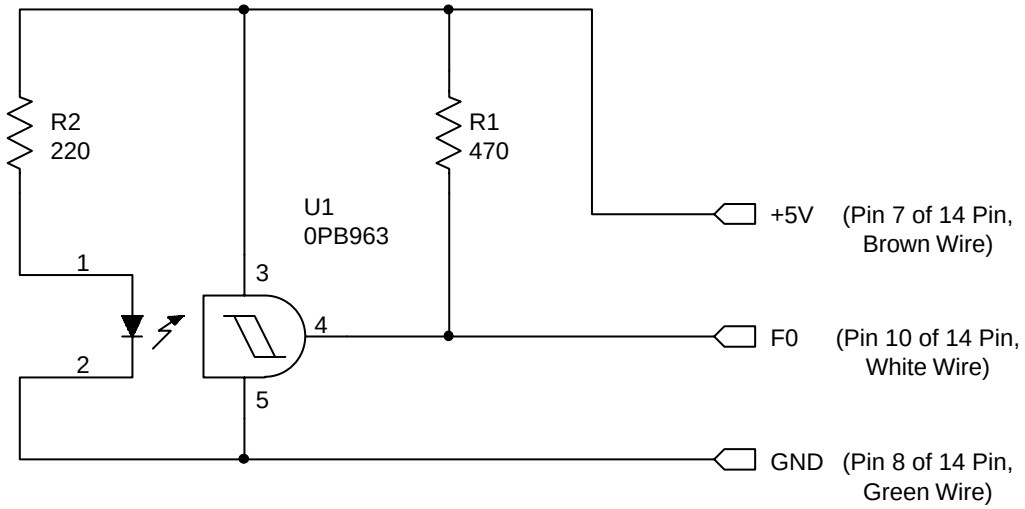
DATE	DYNAMOMETER MODEL/SERIAL #	APPLIED TORQUE	INDICATED TORQUE	ERROR	TESTER

Appendix B: Schematics

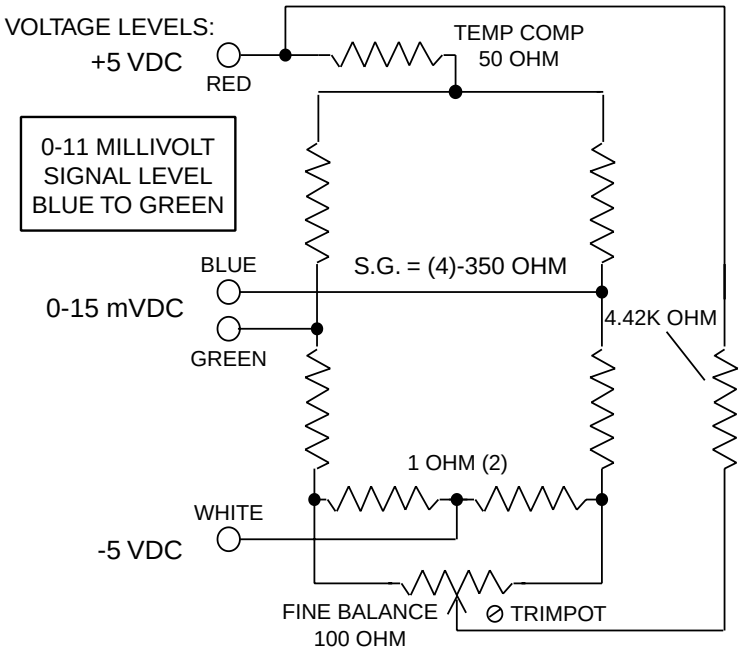
B.1 TORQUE AMPLIFICATION BOARD



B.2 SPEED SENSOR BOARD

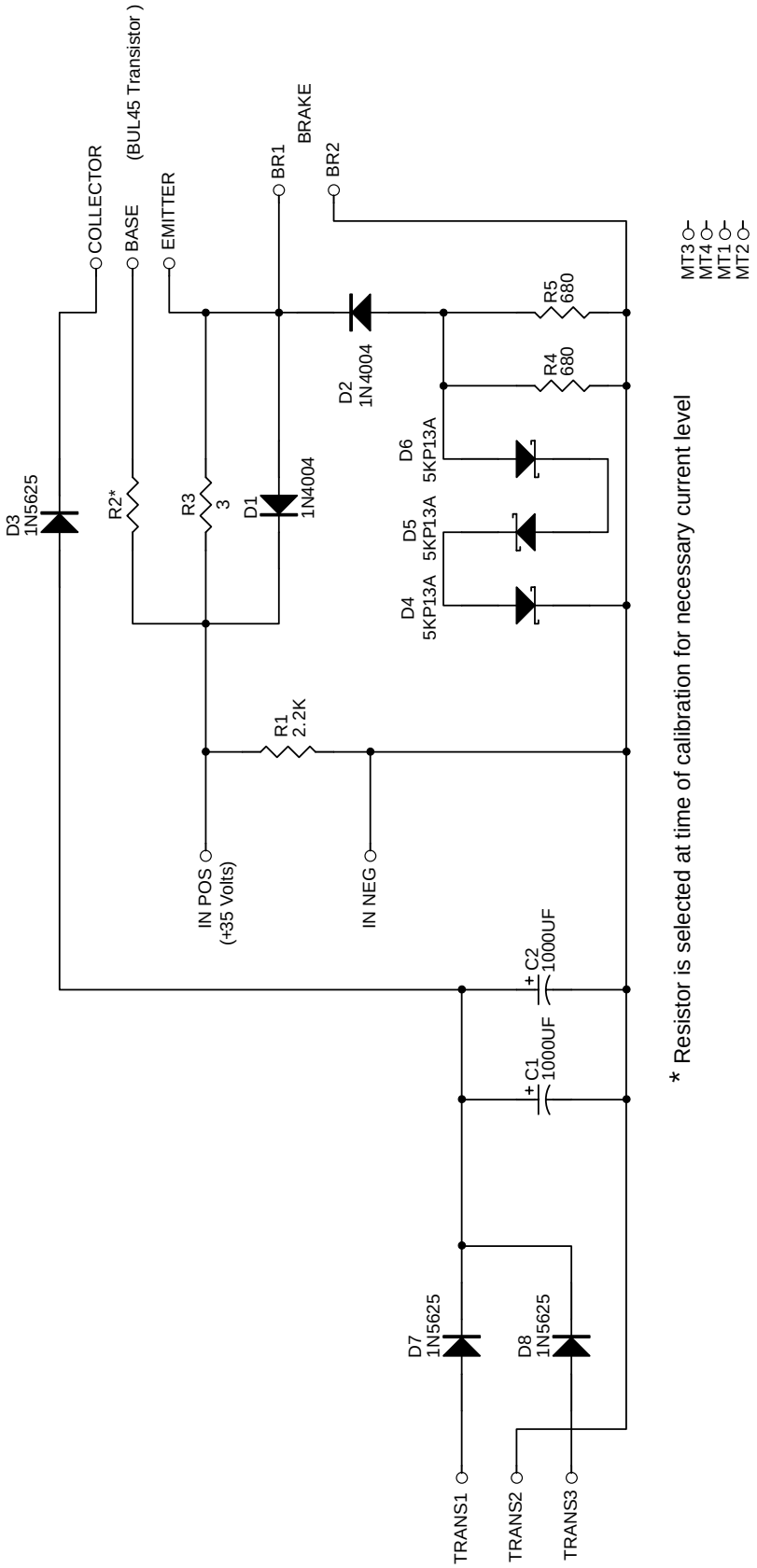


B.3 LOAD CELL SCHEMATIC

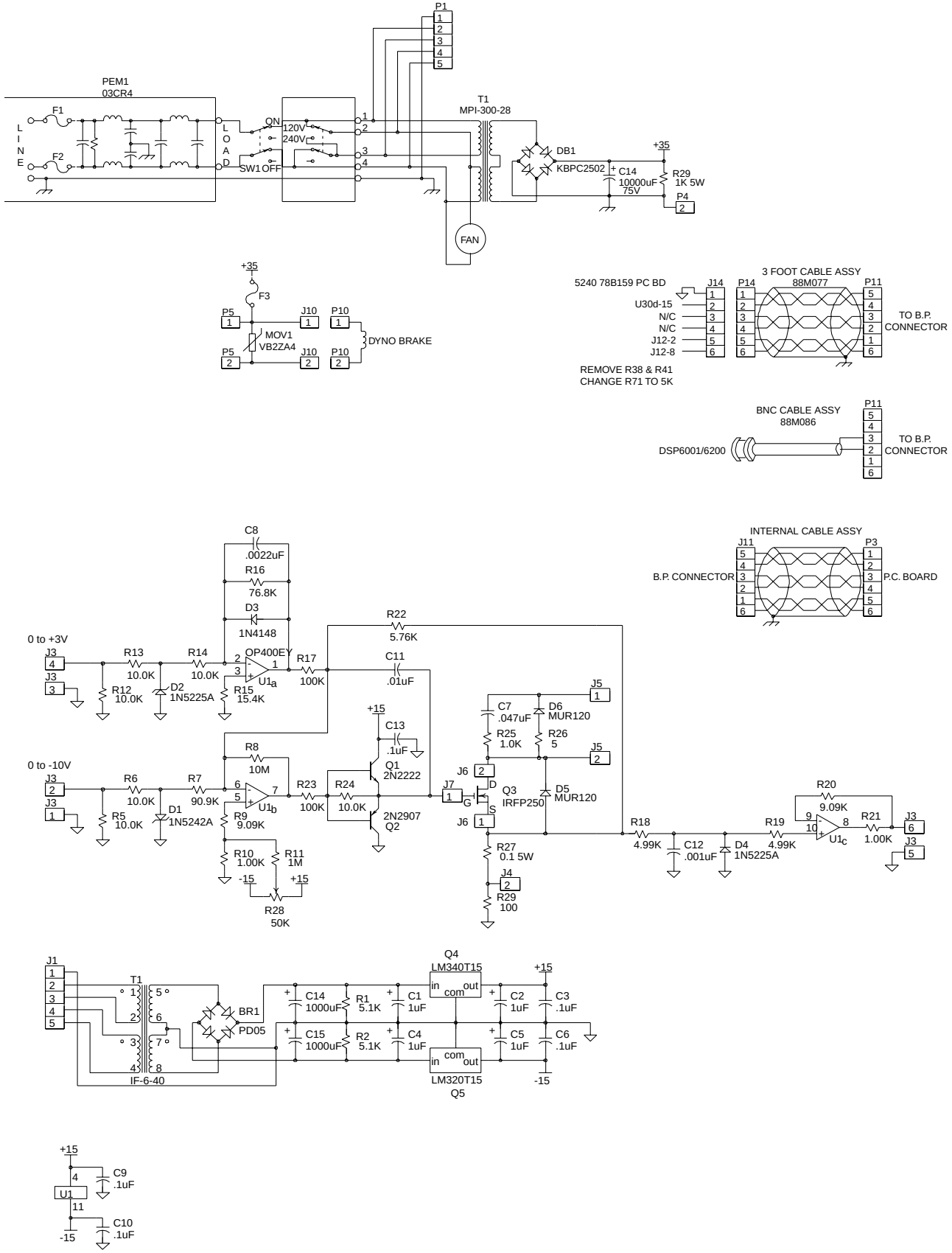


APPENDICES

B.4 HD-800–815 BRAKE CONTROL SUPPLY



B.5 HD-825 BRAKE CONTROL SUPPLY



Index

T

U

V

W

Z

Magtrol Limited Warranty

Magtrol, Inc. warrants its products to be free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment. Software is warranted to operate in accordance with its programmed instructions on appropriate Magtrol instruments. This warranty extends only to the original purchaser and shall not apply to fuses, computer media, or any other product which, in Magtrol's sole opinion, has been subject to misuse, alteration, abuse or abnormal conditions of operation or shipping.

Magtrol's obligation under this warranty is limited to repair or replacement of a product which is returned to the factory within the warranty period and is determined, upon examination by Magtrol, to be defective. If Magtrol determines that the defect or malfunction has been caused by misuse, alteration, abuse or abnormal conditions of operation or shipping, Magtrol will repair the product and bill the purchaser for the reasonable cost of repair. If the product is not covered by this warranty, Magtrol will, if requested by purchaser, submit an estimate of the repair costs before work is started.

To obtain repair service under this warranty, purchaser must forward the product (transportation prepaid) and a description of the malfunction to the factory. The instrument shall be repaired at the factory and returned to purchaser, transportation prepaid. **MAGTROL ASSUMES NO RISK FOR IN-TRANSIT DAMAGE.**

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MAGTROL INC
70 Gardenville Parkway
Buffalo, New York 14224 USA
Phone: +1 716 668 5555
Fax: +1 716 668 8705
E-mail: magtrol@magtrol.com

MAGTROL SA
Route de Moncor 4B
1701 Fribourg, Switzerland
Phone: +41 (0)26 407 3000
Fax: +41 (0)26 407 3001
E-mail: magtrol@magtrol.ch

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