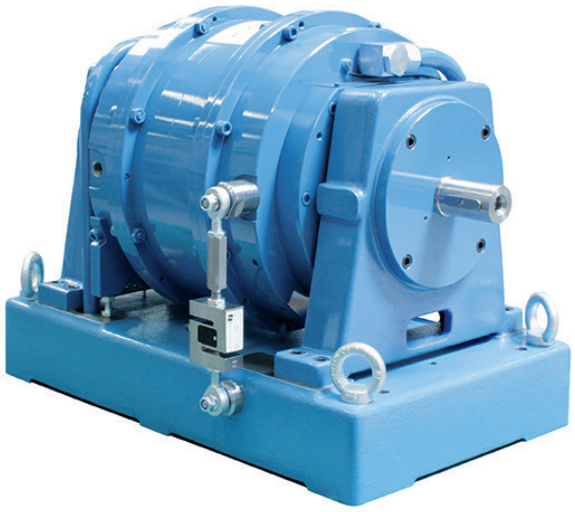
MAGTROL

WB and PB Series

Eddy-Current and Magnetic Powder Dynamometers



User's Manual

Purchase Record

Please record all model numbers and serial numbers of your Magtrol equipment, along with the general purchase information. The model number and serial number can be found on either a silver identification plate or white label affixed to each unit. Refer to these numbers whenever you communicate with a Magtrol representative about this equipment.

Model Number: _____

Serial Number: _____

Purchase Date: _____

Purchased From: _____

1st Edition - rev F – September 2015

MAGTROL

Safety Precautions

WARNING! IN ORDER TO MINIMIZE RISKS, IT IS OF UTMOST IMPORTANCE TO RESPECT THE CURRENT SAFETY STANDARDS WHEN PLANNING, CONFIGURING AND OPERATING THE MOTOR TEST SYSTEM.

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 operating electronic equipment.
3. Make sure that dynamometers and motors under test are equipped with appropriate safety guards.

Note: Detailed information regarding Motor Test Protective Systems can be found in *Section 2.8 – Protective Systems*.

4. Always select a coupling that matches the speed and braking torque of the tested system.
5. Wear protective glasses when working on a test bench.
6. Never wear a necktie or baggy clothes when standing close to the test bench.
7. Never stand too close to the running test bench or bend over a rotating shaft.
8. Electrically insulate the motor terminal block.
9. Always connect the motor envelope to earth ground.
10. Make sure that the safety circuitry of the motor control cannot be deactivated by accident.

WARNING! A DEFECT ON THE ELECTRICAL TRANSMISSION LINE CAN CAUSE A SHORT-CIRCUIT WHICH CAN PROPAGATE TO ALL CONNECTED INSTRUMENTS OR PERSONS IN CONTACT WITH THE APPARATUS.

Revisions To This Manual

The contents of this manual is subject to change without prior notice. Should revisions be necessary, updates to all Magtrol User's Manuals can be found at Magtrol's website 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

1st edition – rev. F - September 2015

TABLE OF REVISIONS

Date	Edition	Change	Section(s)
09/02/15	1st Edition - rev F	Page layout	3.1 / 3.1.2
04/21/15	1st Edition - rev E	Remove WB2.7 HS version	1.2.1
04/21/15	1st Edition - rev E	Remove the 1WB2.7 dynamometer	1.2.1 / 2.10 / 6.1.2
05/26/14	1st Edition - rev D	Data sheets updated	1.2
02/26/14	1st Edition - rev C	All references to DSP6001 changed to DSP7000	throughout manual
04/25/12	1st Edition - rev B	Diagram (torque, power) for Tandem WB 115 updated	1.2.4
12/21/09	1st Edition - rev A	The maximum input pressure was changed	3.1.2

Table of Contents

1. INTRODUCTION 1

1.1 GENERAL DESCRIPTION 1

1.2 DATA SHEETS 2

1.2.1 WB/PB 2.7 SERIES 2

1.2.2 WB/PB 43 SERIES 9

1.2.3 WB/PB 65 SERIES 17

1.2.4 WB/PB 115 SERIES 25

1.2.5 WB/PB 15 SERIES 33

2. INSTALLATION / MOUNTING 41

2.1 LOCKING THE DYNAMOMETER FOR TRANSPORT 41

2.1.1 WB/PB 2.7 SERIES 42

2.1.2 WB/PB 43 SERIES 43

2.1.3 WB/PB 65 SERIES 44

2.1.4 WB/PB 115 SERIES 45

2.1.5 WB/PB 15 SERIES 46

2.2 MOUNTING THE DYNAMOMETER TO THE TEST BENCH 47

2.2.1 ALIGNING THE DYNAMOMETERS ON THE TEST BENCH 47

2.2.2 VIBRATIONS INDUCED BY THE TEST BENCH 47

2.3 COUPLINGS 48

2.4 MEASURING RANGE 49

2.5 DRAG TORQUE 49

2.6 TOLERATED RADIAL AND AXIAL FORCES 49

2.7 CONNECTING THE COOLING SYSTEM 50

2.8 PROTECTIVE SYSTEMS 50

2.9 POWER/HEAT DISSIPATION 52

2.10 TORQUE–SPEED–POWER CURVES 52

3. COOLING 58

3.1 DYNAMOMETER COOLING 58

3.1.1 CONNECTIONS 58

3.1.2 WATER FLOW AND PRESSURE 58

3.1.3 COOLING WATER CONSUMPTION 58

3.1.4 TEMPERATURE SENSOR 58

3.2 OPEN-CIRCUIT COOLING SYSTEMS 59

3.2.1 EXAMPLE 59

3.3 CLOSED-CIRCUIT COOLING SYSTEMS 60

3.3.1 EXAMPLE 60

3.4 COOLING WATER ISSUES 61

3.4.1 IMPURITIES 61

3.4.2 HARDNESS 61

3.4.3 FILTERING 62

3.4.4 CONTROLLING THE WATER FLOW RATE 62

3.4.5 WATER INHIBITORS 62

3.4.6 CONDENSATION 63

3.5 COOLING CIRCUIT PURGING 63

4. CONNECTIONS / CONFIGURATION 64
4.1 CONNECTION TO MAGTROL MOTOR TESTING ELECTRONICS 64
4.1.1 MANUAL TEST CONFIGURATION 64
4.1.2 PC-BASED TEST CONFIGURATION 65
4.2 TANDEM DYNAMOMETER CONFIGURATION 66
4.2.1 ELECTROMAGNETIC CLUTCH 66
4.2.2 TRANSFORMER CONNECTION 67
4.3 CONNECTION TO NON-MAGTROL ELECTRONIC CONTROL UNITS 68
4.3.1 POWER AND THERMOSTAT CONNECTION 68
4.3.2 TORQUE SIGNAL CONNECTION 70
4.3.3 SPEED SIGNAL CONNECTION 71
5. OPERATING PRINCIPLES 72
5.1 EDDY-CURRENT DYNAMOMETERS (WB) 72
5.2 MAGNETIC POWDER DYNAMOMETERS (PB) 72
5.3 WB VS. PB 72
6. CALIBRATION 73
6.1 BASIC CALIBRATION INFORMATION 73
6.1.1 CALIBRATION ARMS 73
6.1.2 CALIBRATION WEIGHT 74
6.2 CALIBRATION WITH MAGTROL MOTOR TESTING ELECTRONICS 75
6.3 CALIBRATION USING NON-MAGTROL ELECTRONIC CONTROL UNITS 75
6.4 CALIBRATION OF OVERLOAD PROTECTION 75
6.4.1 WB/PB 43 SERIES 76
6.4.2 WB/PB 65 SERIES 77
6.4.3 WB/PB 115 SERIES 78
7. MAINTENANCE AND REPAIR 79
7.1 MAINTENANCE 79
7.2 REPAIR 79
7.3 SENDING EQUIPMENT TO MAGTROL FOR MAINTENANCE/REPAIR 79
SERVICE INFORMATION 80
RETURNING MAGTROL EQUIPMENT FOR REPAIR AND/OR CALIBRATION 80
RETURNING EQUIPMENT TO MAGTROL, INC. (UNITED STATES) 80
RETURNING EQUIPMENT TO MAGTROL SA (SWITZERLAND) 80

TABLE OF FIGURES

2. INSTALLATION / MOUNTING

Figure 2–1 WB/PB 2.7 Load Cell Locking System 42
Figure 2–2 WB/PB 43 Load Cell Locking System 43
Figure 2–3 WB/PB 65 Load Cell Locking System 44
Figure 2–4 WB/PB 115 Load Cell Locking System 45
Figure 2–5 WB/PB 15 Load Cell Locking System 46
Figure 2–6 Couplings Using Key Clamping 48
Figure 2–7 Example of Protective System 51
Figure 2–8 WB 2.7 Ratings Curve 52
Figure 2–9 PB 2.7 Ratings Curve 53
Figure 2–10 WB 43 Ratings Curve 53
Figure 2–11 PB 43 Ratings Curve 54
Figure 2–12 WB 65 Ratings Curve 54
Figure 2–13 PB 65 Ratings Curve 55
Figure 2–14 WB 115 Ratings Curve 55
Figure 2–15 PB 115 Ratings Curve 56
Figure 2–16 WB 15 Ratings Curve 56
Figure 2–17 PB 15 Ratings Curve 57

3. COOLING

Figure 3–1 Open-circuit Cooling Example 59
Figure 3–2 Closed-circuit Cooling Example 60

4. CONNECTIONS / CONFIGURATION

Figure 4–1 Manual Test Configuration 64
Figure 4–2 PC-Based Test Configuration with M-TEST Software 65
Figure 4–3 Tandem Configuration 66
Figure 4–4 Supply Cable Between 24 VDC Transformer and DES Power Supply 67
Figure 4–5 Control Signal Cable for WB/PB 2.7 and 43 Tandem Dynamometer Clutches 67
Figure 4–6 Control Signal Cable for WB/PB 65, 115 and 15 Tandem Dynamometer Clutches 67
Figure 4–7 Connector Pin Configuration for WB/PB 2.7 Dynamometer Power 69
Figure 4–8 Connector Pin Configuration for WB/PB 43 Dynamometer Power and Temperature Measurement 69
Figure 4–9 Connector Pin Configuration for WB/PB 65, 115 and 15 Dynamometer Power and Temperature Measurement 69
Figure 4–10 Connector Pin Configuration for WB/PB 2.7 and 43 Dynamometer Torque Signals 70
Figure 4–11 Connector Pin Configuration for WB/PB 65, 115 and 15 Dynamometer Torque Signals 70
Figure 4–12 Connector Pin Configuration for WB/PB 2.7 and 43 Dynamometer Speed Signals 71
Figure 4–13 Connector Pin Configuration for WB/PB 65, 115 and 15 Dynamometer Speed Signals 71

6. CALIBRATION

Figure 6–1 Calibration Arm Mounting 73
Figure 6–2 WB/PB 43 Overload Protection Calibration 76
Figure 6–3 WB/PB 65 Overload Protection Calibration 77
Figure 6–4 WB/PB 115 Overload Protection Calibration 78

Preface

PURPOSE OF THIS MANUAL

This manual contains information required for the installation and general use of Magtrol's WB Series and PB Series Dynamometers. To achieve maximum capability and ensure proper use, 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 bench test operators who are going to use a WB Eddy-current or PB Magnetic Powder Dynamometer in order to determine the torque and power of a motor in relation to its speed. It is assumed that the user has sufficient knowledge in mechanics and electronics to be able to install/operate these WB/PB Dynamometers without risk.

MANUAL ORGANIZATION

This section gives an overview of the structure of the manual and the information contained therein. 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 technical data sheets of all Magtrol WB/PB Series Dynamometers, which describe their technical characteristics and give a brief overview of their application fields.

Chapter 2: INSTALLATION / MOUNTING – Provides information needed for the mounting of the dynamometers, as well as limits and precautions to observe during operation.

Chapter 3: COOLING – Describes the necessary measures to take in order to guaranty an optimal dynamometer operating temperature.

Chapter 4: CONNECTION / CONFIGURATION – Provides information about the wiring between the dynamometers and the electronic control units, as well as tandem setups of dynamometers.

Chapter 5: OPERATING PRINCIPLES – Describes the physical phenomena on which the Eddy-current (WB) and magnetic powder (PB) dynamometer technology is based.

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

Chapter 7: MAINTENANCE AND REPAIR – Provides information on how to return a WB/PB series dynamometer to Magtrol for servicing, preventative maintenance or repair.

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 functioning of the product to be obtained.

CAUTION : THIS IS USED TO DRAW THE OPERATOR'S ATTENTION TO INFORMATION, DIRECTIVES, PROCEDURES, ETC. WHICH, IF IGNORED, MAY RESULT IN DAMAGE BEING CAUSED TO THE MATERIAL BEING USED. THE ASSOCIATED TEXT DESCRIBES THE NECESSARY PRECAUTIONS TO TAKE AND THE CONSEQUENCES THAT MAY ARISE IF THE 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 PARTIES MAY BE PUT AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

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1. Introduction

1.1 GENERAL DESCRIPTION

The WB and PB Dynamometers manufactured by Magtrol are used for testing all types of motors and rotational systems, and measuring their torque and power according to their speed. They have been specially designed for integration in a complete motor testing system.

The WB Series Dynamometers feature Eddy-current braking systems and are able to be operated at high speeds. However, as their braking torque is proportional to their speed, they cannot be used at low speeds.

The PB Series Dynamometers feature magnetic powder brakes and are therefore appropriate for low and medium-speed testing. Due to their design, they generate their maximum torque at standstill. However, their maximum speed is limited to avoid the magnetic powder being centrifuged.

To combine the advantages of both designs, Magtrol offers a tandem mounting of both dynamometer types for applications requiring measurements on a wide range of speeds.

1.2 DATA SHEETS

1.2.1 WB/PB 2.7 SERIES

WB/PB 2.7 Series Eddy-Current and Powder Dynamometers

FEATURES

- 9 Models with Maximum Torque from 300 mN·m to 2400 mN·m (42 oz·in to 340 oz·in)
- Braking Power: 20 W to 1 kW
- Stable Braking Torque, without Shock
- Low Moment of Inertia
- Low Residual Torque
- Operation in Either Rotational Direction
- Braking Torque Measurement Included
- Optional Speed Measurement
- Rated Torque Available From Zero Speed (Powder Dynamometers)
- Integrated Optical Speed Sensor

Model 4 WB-2.7-8K Eddy-Current Dynamometer

DESCRIPTION

Eddy-Current Brake Dynamometers (WB series) are ideal for applications requiring high speeds and also when operating in the middle to high power range. Eddy-Current Brakes provide increasing torque as the speed increases, reaching peak torque at rated speed. The dynamometers have low inertia as a result of small rotor diameter. Brake cooling is provided by a water circulation system, which passes inside the stator to dissipate heat generated by the braking power. The water cooling in the WB provides high continuous power ratings (max. 1 kW).

Powder Brake Dynamometers (PB series) are ideal for applications operating in the low to middle speed range or when operating in the middle to high torque range. Powder Brakes provide full torque at zero speed and are water-cooled, allowing for power ratings up to 600 W. Both WB and PB Dynamometers have accuracy ratings of ± 2% 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

Mounted on test benches, the WB/PB 2.7 Series Dynamometers allow performance and reliability testing on driving elements such as servomotors, micromotors for cameras, small fans, dental drills, geared motors, small reduction gears, pneumatic equipment, hydraulic transmission systems and motors for small domestic appliances.

MOTOR TESTING SYSTEMS

Magtrol's M-TEST 7 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol DSP7000 Programmable Dynamometer Controller, Magtrol M-TEST 7 Software provides the control of any Magtrol Eddy-Current or Powder Brake 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.

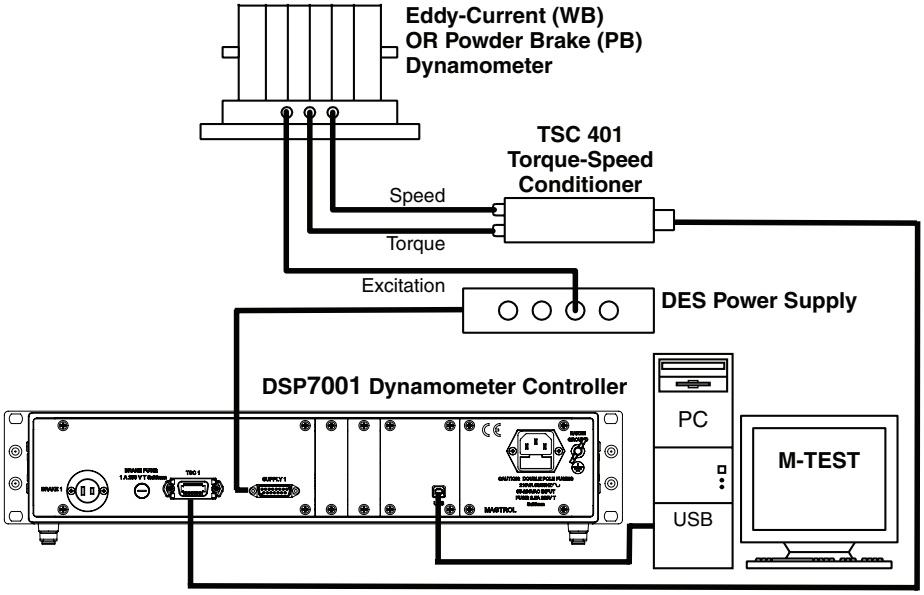
Written in LabVIEW™, M-TEST 7 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermocouples), controlling motor power and providing audio/visual indicators is relatively easy.

Magtrol's M-TEST 7 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.

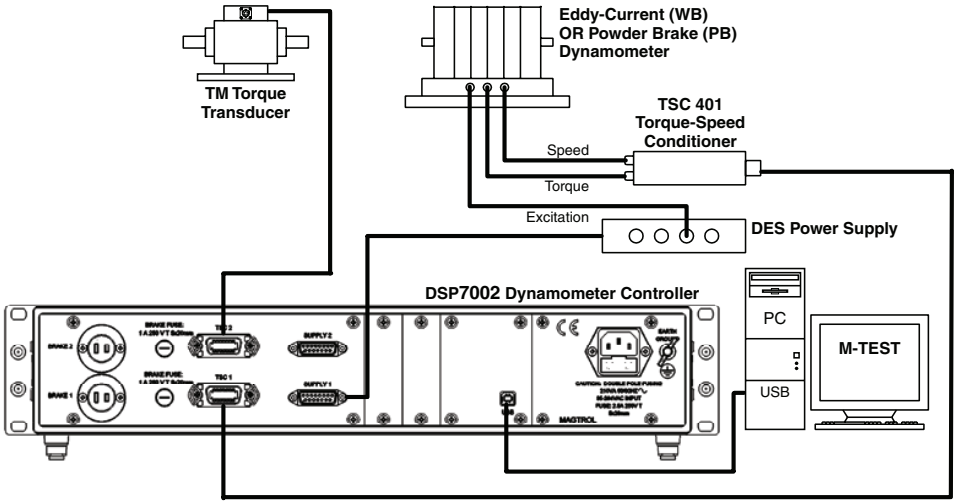
System Configurations WB/PB 2.7

SINGLE DYNAMOMETER CONFIGURATIONS

The Dynamometers can be complemented by various electronic modules such as the DES 410 Power Supply, TSC 401 Torque/ Speed Conditioner and DSP7000 High Speed Programmable Dynamometer Controller.



Magtrol also offers In-Line Torque Transducers for extremely accurate torque and speed measurement with high noise immunity. The transducers employ a unique non-contact differential transformer torque measuring technology which prevents the rotation of electronic components during operation, without the usage of sliprings. For a dynamic, high-precision system, the torque transducer can be mounted in line between the unit under test and the dynamometer.



Specifications WB 2.7

EDDY-CURRENT DYNAMOMETER OPERATING PRINCIPLES

The WB Eddy-Current Dynamometers develop their full power at high rotation speeds. The 2.7 Series is particularly intended for motors which rotate at high speeds, up to 50,000 rpm. The braking torque depends on the rotation speed.

WB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed standard version	Excitation Current*
	N·m	*oz·in*	*mN·m*	*oz·in*	*kg·m²*	*lb·ft·s²*	*W*	*rpm*	*rpm*	*A*
2 WB 2.7-8K	0.30	42.4	9	1.27	2.33×10^{-5}	1.71×10^{-5}	500	15,915	50,000	1.0
3 WB 2.7-8K	0.45	63.7	9	1.27	3.18×10^{-5}	2.34×10^{-5}	750	15,915	50,000	1.5
4 WB 2.7-8K	0.60	84.9	12	1.69	4.03 × 10-5	2.97×10^{-5}	1000	15,915	50,000	2.0

** Voltage at 20 °C is 15 volts.*

Optical Speed Sensor

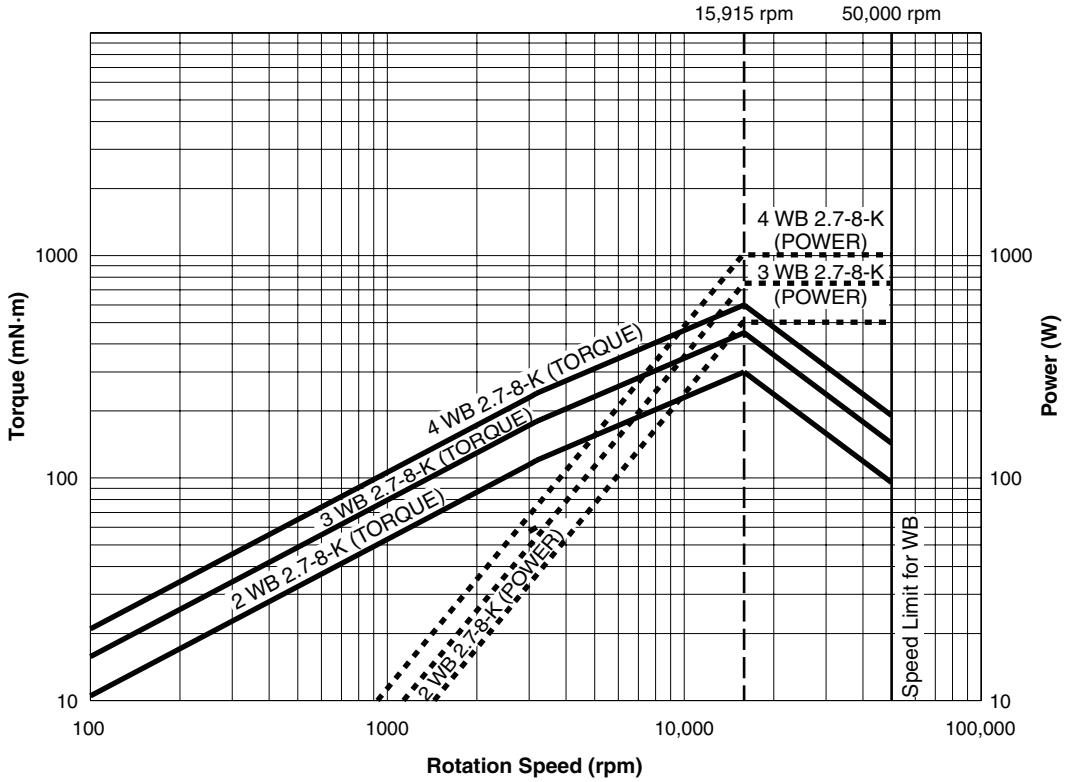
Each 2.7 Series WB Dynamometer has an optical speed sensor with a 30-bit pulse wheel delivered as standard.

Cooling Water Consumption

For all WB models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

WB TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 2.7 Series Eddy-Current Dynamometers.



Specifications PB 2.7

POWDER DYNAMOMETER OPERATING PRINCIPLES

The PB Powder Dynamometers contain, as their name suggests, a magnetic powder. The electrical current passing through the coil generates a magnetic field, which changes the property of the powder, thus producing a smooth braking torque through friction between rotor and stator. The Powder Dynamometers (PB) produce their rated torque at zero speed. The element to be tested can be loaded at standstill to determine the starting torque.

PB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*oz·in*	*mN·m*	*oz·in*	*kg·m²*	*lb·ft·s²*	*W*	*rpm*	*rpm*	*A*
1 PB 2.7-8	0.6	84	18	2.54	1.49×10^{-5}	1.09×10^{-5}	20	320	3000	0.5
2 PB 2.7-8	1.2	169	30	4.24	2.33×10^{-5}	1.71×10^{-5}	40	320	3000	1
4 PB 2.7-8	2.4	339	48	6.79	4.03×10^{-5}	2.97×10^{-5}	80	320	3000	2
1 PB 2.7-8K **	0.6	84	18	2.54	1.49×10^{-5}	1.09×10^{-5}	150	2390	10,000	0.5
2 PB 2.7-8K **	1.2	169	30	4.24	2.33×10^{-5}	1.71×10^{-5}	300	2390	10,000	1
4 PB 2.7-8K **	2.4	339	48	6.79	4.03×10^{-5}	2.97×10^{-5}	600	2390	10,000	2

* *Voltage at 20 °C is 24 volts.*

Optical Speed Sensor

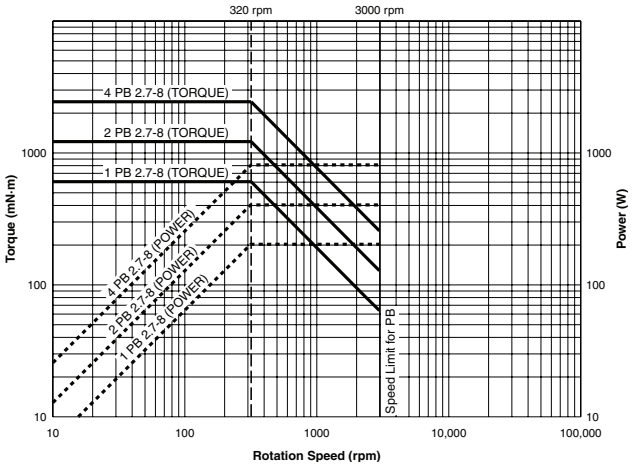
Each 2.7 Series PB Dynamometer has an optical speed sensor with a 30-bit pulse wheel delivered as standard.

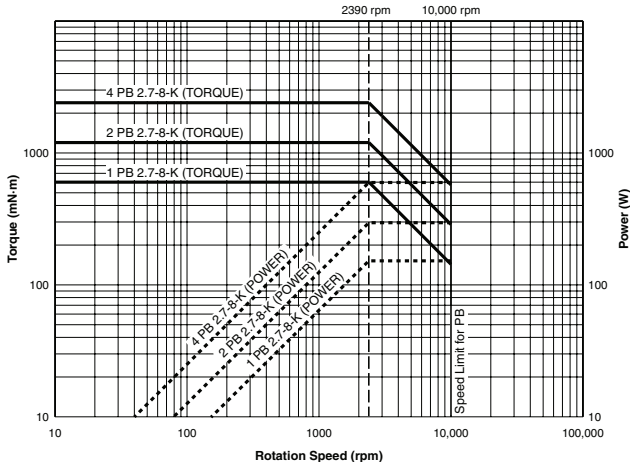
** Cooling Circuit

The 2.7 Series PB Dynamometers are available with (K) or without a cooling circuit. The cooling water consumption for all PB-8K models is: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

PB TORQUE–SPEED–POWER CURVES

The diagrams below shows the characteristic curves for the 2.7 Series Powder Dynamometers.

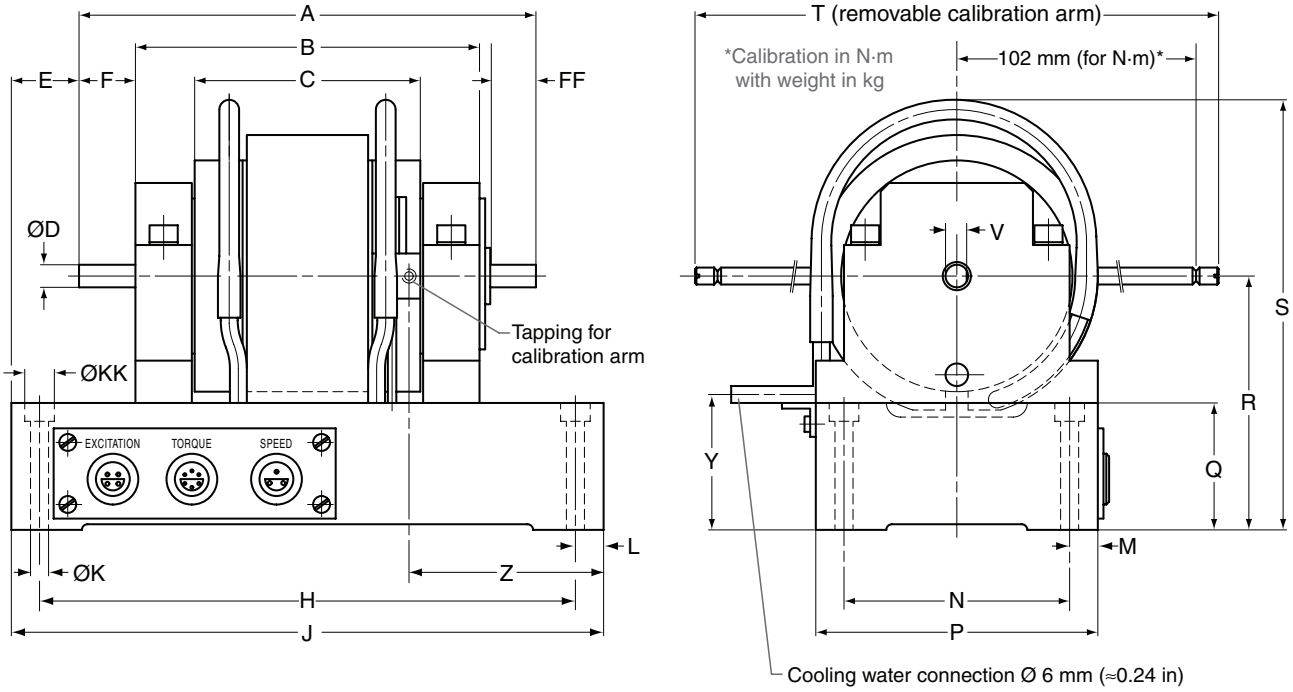




Dimensions

WB/PB 2.7

DYNAMOMETERS WITH COOLING CIRCUIT



NOTE:

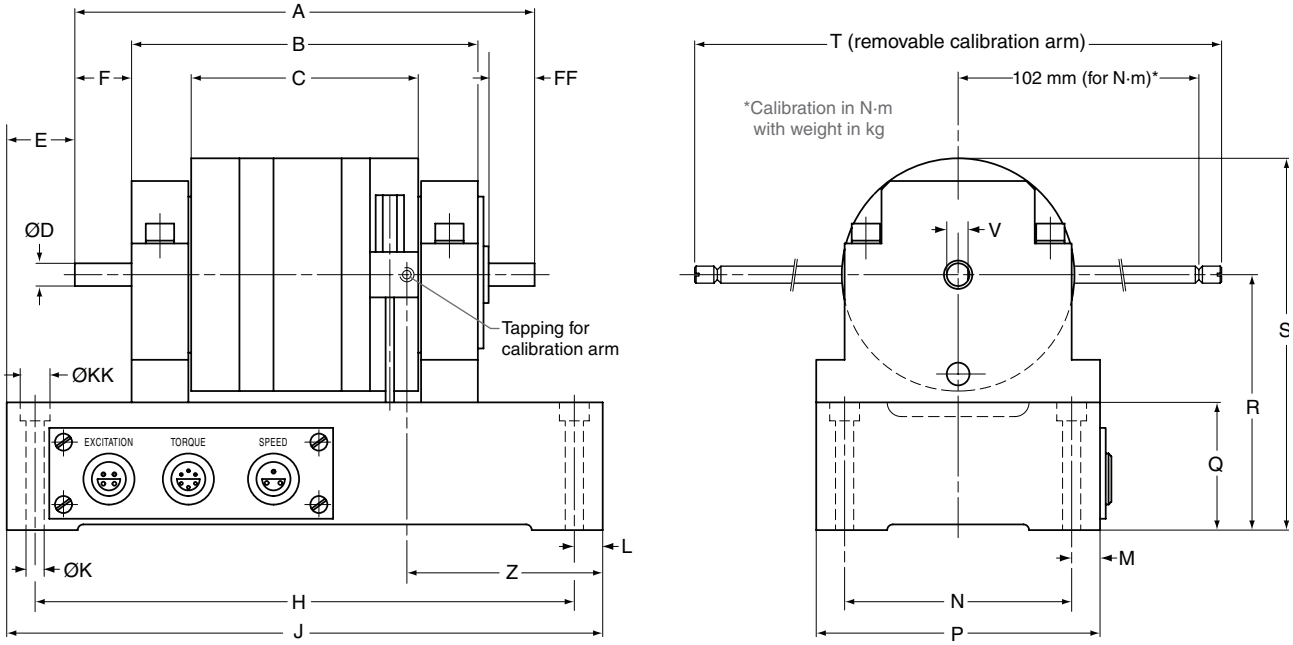
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 decimal places.

Model	units	A	B	C	D	E	F	H	J	K	L	M
1 PB 2.7-8-K	*mm*	138	98	56	Ø 8h5	36	20	190	210	Ø 6.4	10	10
	in	5.43	3.86	2.2	Ø 0.3148 0.3149	1.42	0.79	7.48	8.27	Ø 0.252	0.39	0.39
2 WB 2.7-8-K / 2 PB 2.7-8-K	*mm*	162	122	80	Ø 8h5	24	20	190	210	Ø 6.4	10	10
	in	6.38	4.8	3.15	Ø 0.3148 0.3149	0.94	0.79	7.48	8.27	Ø 0.252	0.39	0.39
3 WB 2.7-8-K	*mm*	186	146	104	Ø 8h5	12	20	190	210	Ø 6.4	10	10
	in	7.32	5.75	4.09	Ø 0.3148 0.3149	0.47	0.79	7.48	8.27	Ø 0.252	0.39	0.39
4 WB 2.7-8-K / 4 PB 2.7-8-K	mm	210	170	128	Ø 8h5	---	20	190	210	Ø 6.4	10	10
	in	8.27	6.69	5.04	Ø 0.3148 0.3149	---	0.79	7.48	8.27	Ø 0.252	0.39	0.39

Model	units	N	P	Q	R	S	T	V	Y	Z	FF	KK	Weight
1 PB 2.7-8-K	*mm*	80	100	45	90 ±0.1	152	220	7.6	48	81	16	Ø 10.5	4.2 kg
	in	3.15	3.94	1.77	3.547 3.539	5.98	8.66	0.299	1.89	3.19	0.63	Ø 0.413	9.26 lb
2 WB 2.7-8-K / 2 PB 2.7-8-K	*mm*	80	100	45	90 ±0.1	152	220	7.6	48	69	16	Ø 10.5	5.3 kg
	in	3.15	3.94	1.77	3.547 3.539	5.98	8.66	0.299	1.89	2.72	0.63	Ø 0.413	11.68 lb
3 WB 2.7-8-K	*mm*	80	100	45	90 ±0.1	152	220	7.6	48	57	16	Ø 10.5	6.4 kg
	in	3.15	3.94	1.77	3.547 3.539	5.98	8.66	0.299	1.89	2.24	0.63	Ø 0.413	14.11 lb
4 WB 2.7-8-K / 4 PB 2.7-8-K	*mm*	80	100	45	90 ±0.1	152	220	7.6	48	45	16	Ø 10.5	7.5 kg
	in	3.15	3.94	1.77	3.547 3.539	5.98	8.66	0.299	1.89	1.77	0.63	Ø 0.413	16.53 lb

Dimensions PB 2.7

DYNAMOMETERS WITHOUT COOLING CIRCUIT



NOTE:
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Model	units	A	B	C	D	E	F	H	J	K	L	M
1 PB 2.7-8	*mm*	138	98	56	Ø 8h5	36	20	190	210	Ø 6.4	10	10
	in	5.43	3.86	2.2	Ø 0.3148 0.3149	1.42	0.79	7.48	8.27	Ø 0.252	0.39	0.39
2 PB 2.7-8	*mm*	162	122	80	Ø 8h5	24	20	190	210	Ø 6.4	10	10
	in	6.38	4.8	3.15	Ø 0.3148 0.3149	0.94	0.79	7.48	8.27	Ø 0.252	0.39	0.39
4 PB 2.7-8	*mm*	210	170	128	Ø 8h5	---	20	190	210	Ø 6.4	10	10
	in	8.27	6.69	5.04	Ø 0.3148 0.3149	---	0.79	7.48	8.27	Ø 0.252	0.39	0.39

Model	units	N	P	Q	R	S	T	V	Z	FF	KK	Weight
1 PB 2.7-8	*mm*	80	100	45	90 ±0.1	131	220	7.6	81	16	Ø 10.5	3.8 kg
	in	3.15	3.94	1.77	3.547 3.539	5.16	8.66	0.299	2.72	0.63	Ø 0.413	8.38 lb
2 PB 2.7-8	*mm*	80	100	45	90 ±0.1	131	220	7.6	69	16	Ø 10.5	4.6 kg
	in	3.15	3.94	1.77	3.547 3.539	5.16	8.66	0.299	3.19	0.63	Ø 0.413	10.14 lb
4 PB 2.7-8	*mm*	80	100	45	90 ±0.1	131	220	7.6	45	16	Ø 10.5	6.2 kg
	in	3.15	3.94	1.77	3.547 3.539	5.16	8.66	0.299	2.72	0.63	Ø 0.413	13.67 lb

Ordering Information

WB/PB 2.7

DYNAMOMETER OPTIONS

Vertical Mounting (V)

Vertical Mounting is available on the Eddy-Current (WB) Dynamometer only. The vertical version has an adapted bearing fitting and its maximum speed is limited.

Mechanical Rotor Blocking Device (MB)

A mechanical rotor blocking device, which allows locked rotor testing, is available for the WB Dynamometer.

DYNAMOMETER MODELS

Eddy-Current	Powder with Cooling Circuit	Powder without Cooling Circuit
2 WB 2.7-8K	1 PB 2.7-8K	1 PB 2.7-8
3 WB 2.7-8K	2 PB 2.7-8K	2 PB 2.7-8
4 WB 2.7-8K	4 PB 2.7-8K	4 PB 2.7-8

ORDERING INFORMATION

If one of the listed options is desired, please follow the dynamometer model (see table above) with a dash and then the appropriate suffix (as noted in parenthesis). For example, a Model 1 WB 2.7-8K Eddy-Current Dynamometer with a maximum speed rating of 70,000 rpm is a 1 WB 2.7-8K-HS.

Example: 1 WB 2.7-8K - HS

Dynamometer Model — Option

SYSTEM OPTIONS AND ACCESSORIES

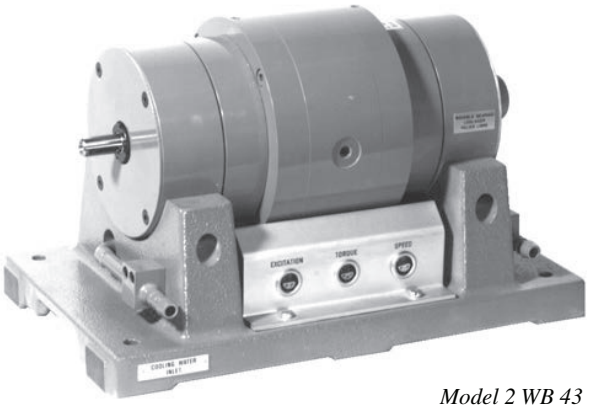
	DESCRIPTION	MODEL / PART #
ELECTRONICS	High Speed Programmable Dynamometer Controller	DSP7000
	Torque-Speed Conditioner (includes necessary cables)	TSC 401/111
	Power Supply (includes necessary cables)	DES 410/111
	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
SOFT-WARE	M-TEST 7 Motor Testing Software	M-TEST 7
	Temperature Testing Hardware	HW-TTEST
MISC	Couplings, Thermostatic Sluice, Pressure Sensitive Switch	On Request
	Water Cooling System for Brake	On Request
	Calibration Weights	On Request

1.2.2 WB/PB 43 SERIES

WB/PB 43 Series Eddy-Current and Powder Dynamometers

FEATURES

- 4 Models with Maximum Torque from 1.5 N·m to 10 N·m (1.1 lb·ft to 7.3 lb·ft)
- Braking Power: 0.5 kW to 3 kW
- Stable Braking Torque, without Shock
- Low Moment of Inertia
- Low Residual Torque
- Operation in Either Rotational Direction
- Braking Torque Measurement Included
- High Rotational Speed
- Rated Torque Available From Zero Speed (Powder Dynamometers)
- Integrated Optical Speed Sensor



Model 2 WB 43
Eddy-Current Dynamometer

DESCRIPTION

Eddy-Current Brake Dynamometers (WB series) are ideal for applications requiring high speeds and also when operating in the middle to high power range. Eddy-Current Brakes provide increasing torque as the speed increases, reaching peak torque at rated speed. The dynamometers have low inertia as a result of small rotor diameter. Brake cooling is provided by a water circulation system, which passes inside the stator to dissipate heat generated by the braking power. The water cooling in the WB provides high continuous power ratings (max. 3 kW).

Powder Brake Dynamometers (PB series) are ideal for applications operating in the low to middle speed range or when operating in the middle to high torque range. Powder Brakes provide full torque at zero speed and are water-cooled, allowing for power ratings up to 1 kW. Both WB and PB Dynamometers have accuracy ratings of ±0.3% 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

Mounted on test benches, WB/PB 43 Series Dynamometers allow performance and reliability testing on driving elements such as electric motors, combustion engines, hand-held drills, windshield wiper motors, servomotors, fans, geared motors, reduction gears, pneumatic equipment, hydraulic transmission systems and motors for domestic appliances.

MOTOR TESTING SYSTEMS

Magtrol's M-TEST 7 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol DSP7000 Programmable Dynamometer Controller, Magtrol M-TEST 7 Software provides the control of any Magtrol Eddy-Current or Powder Brake 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.

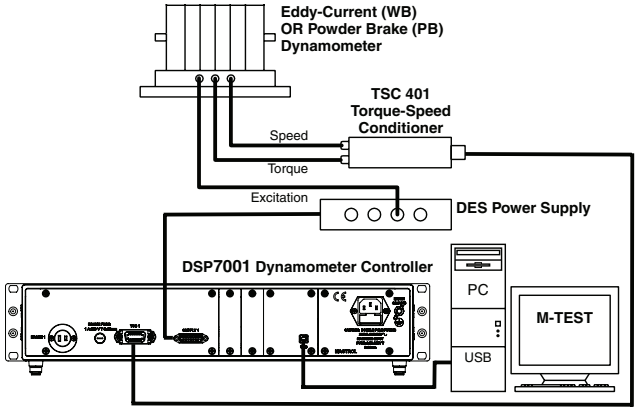
Written in LabVIEW™, M-TEST 7 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermocouples), controlling motor power and providing audio/visual indicators is relatively easy.

Magtrol's M-TEST 7 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.

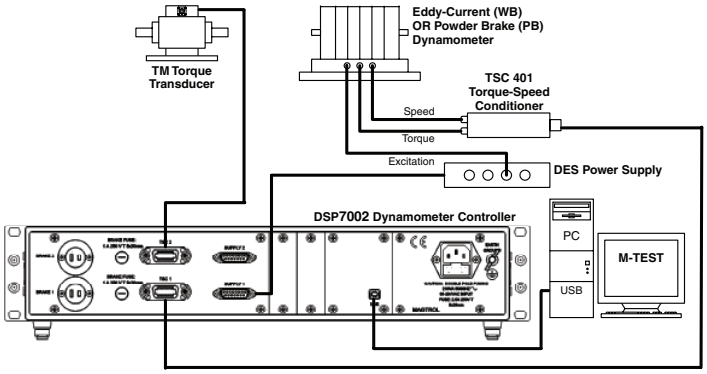
System Configurations

SINGLE DYNAMOMETER CONFIGURATIONS

The Dynamometers can be complemented by various electronic modules such as the DES 410 Power Supply, TSC 401 Torque/ Speed Conditioner and DSP7000 High Speed Programmable Dynamometer Controller.

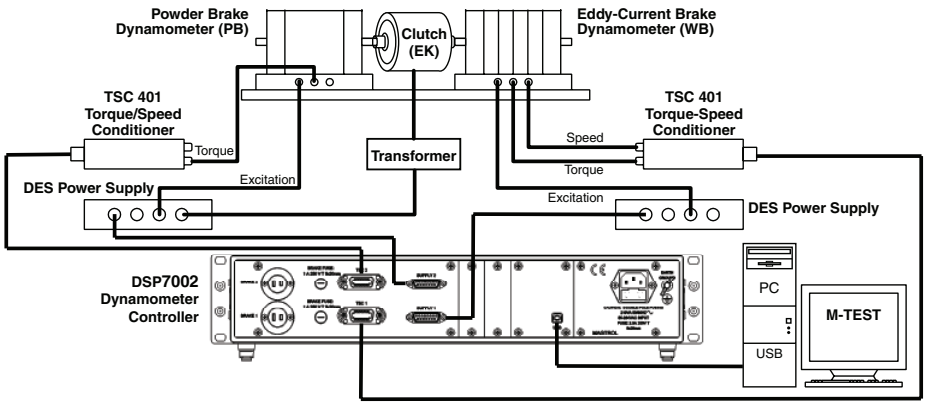


Magtrol also offers In-Line Torque Transducers, which employ a unique non-contact differential transformer torque measuring technology providing extremely accurate torque and speed measurement with superior electrical noise immunity. For a dynamic, high-precision system, the torque transducer can be mounted in line between the unit under test and the dynamometer.



TANDEM CONFIGURATION

Magtrol offers Eddy-Current and Powder Dynamometers mounted in tandem. In tandem, the unique features of each type of dynamometer brake are utilized, allowing the unit under test to be applied with nominal braking torque from zero speed to maximum rotation. The Tandem Dynamometers are available on a number of WB/PB combinations.



Specifications WB 43

EDDY-CURRENT DYNAMOMETER OPERATING PRINCIPLES

The WB Eddy-Current Dynamometers develop their full power at high rotation speeds. The 43 Series is particularly intended for motors which rotate at high speeds, up to 50,000 rpm. The braking torque depends on the rotation speed.

WB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed		Excitation Current*
									standard version	high-speed version (HS)	
	N·m	*lb·ft*	*mN·m*	*oz·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*rpm*	*A*
1 WB 43	1.5	1.1	15	2.12	1.21×10^{-4}	8.92×10^{-5}	1.5	9550	50,000	65,000	1
2 WB 43	3.0	2.2	30	4.24	2.17×10^{-4}	1.60×10^{-4}	3	9550	50,000	65,000	2

** Voltage at 20 °C is 24 volts.*

Optical Speed Sensor

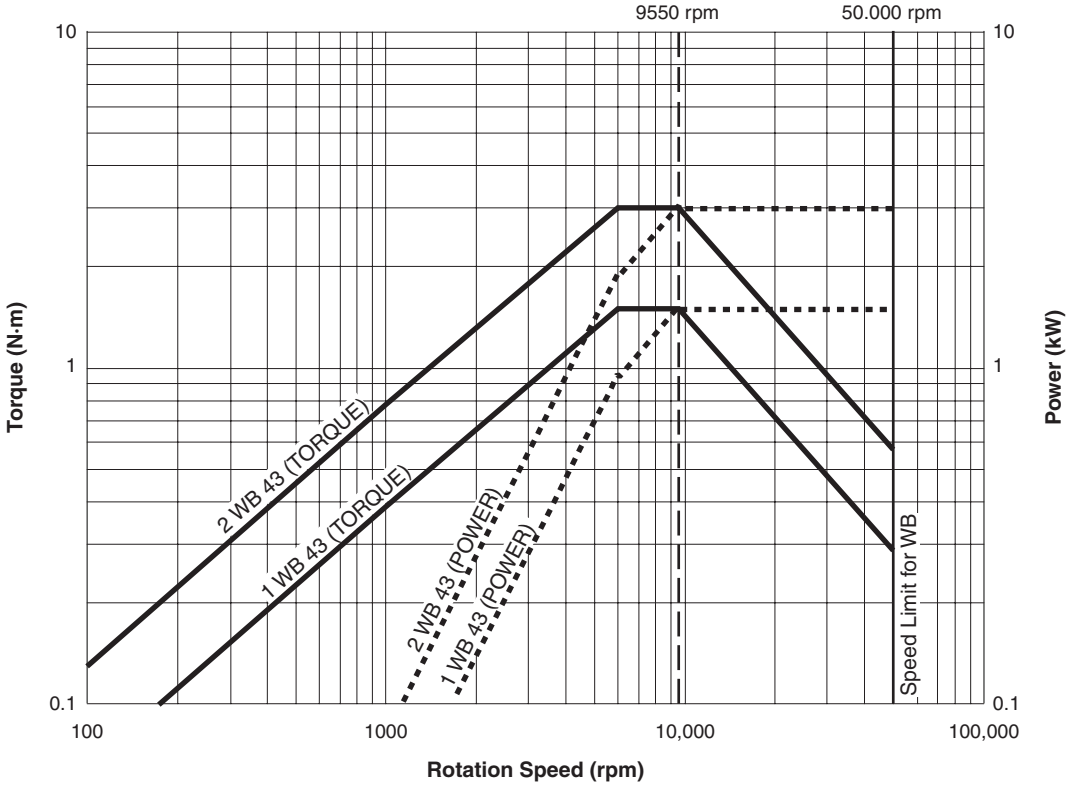
Each 43 Series WB Dynamometer has an optical speed sensor with a 30-bit pulse wheel delivered as standard.

Cooling Water Consumption

For all WB models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

WB TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 43 Series Eddy-Current Dynamometers.



Specifications PB 43

POWDER DYNAMOMETER OPERATING PRINCIPLES

The PB Powder Dynamometers contain, as their name suggests, a magnetic powder. The electrical current passing through the coil generates a magnetic field, which changes the property of the powder, thus producing a smooth braking torque through friction between rotor and stator. The Powder Dynamometers (PB) produce their rated torque at zero speed. The element to be tested can be loaded at standstill to determine the starting torque.

PB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*lb·ft*	*N·m*	*oz·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*A*
1 PB 43	5	3.6	0.1	14.1	1.41×10^{-4}	1.03×10^{-4}	0.5	955	4000	1
2 PB 43	10	7.3	0.2	28.3	2.40×10^{-4}	1.77×10^{-4}	1	955	4000	2

* *Voltage at 20 °C is 24 volts.*

Optical Speed Sensor

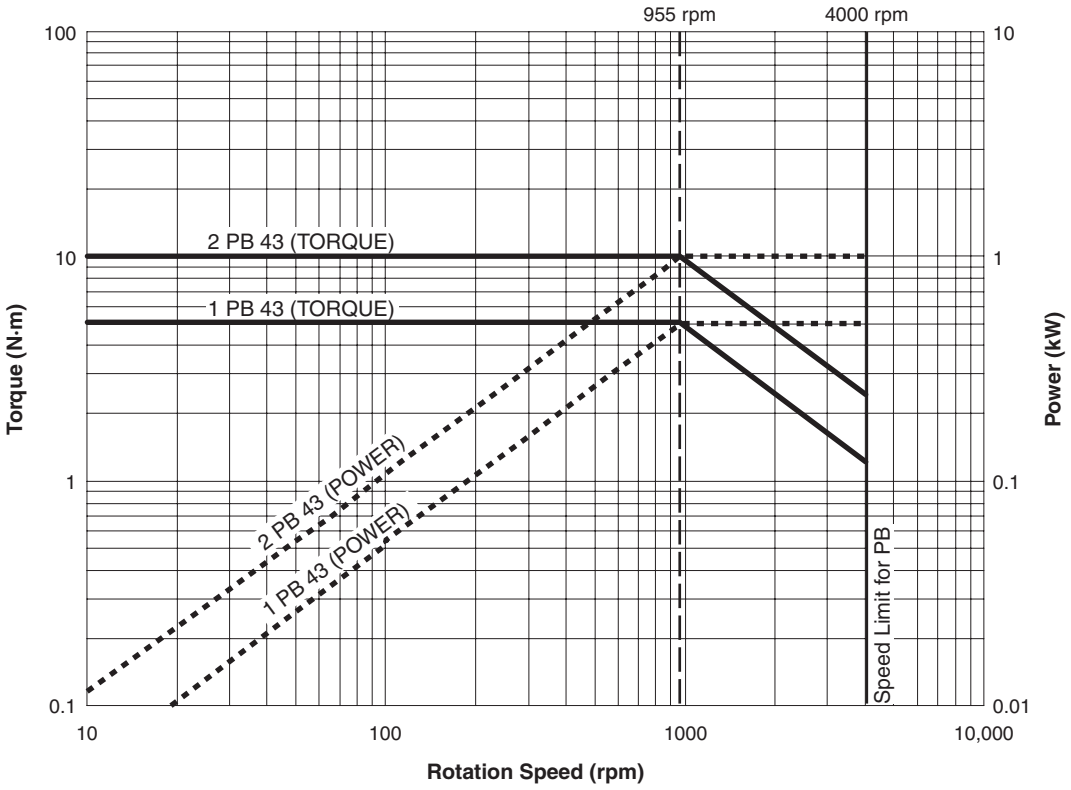
Each 43 Series PB Dynamometer has an optical speed sensor with a 30-bit pulse wheel delivered as standard. For better speed resolution in low speed applications, Magtrol offers a 600-bit or 6000-bit speed pickup (encoder) as an option.

Cooling Water Consumption

For all PB models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

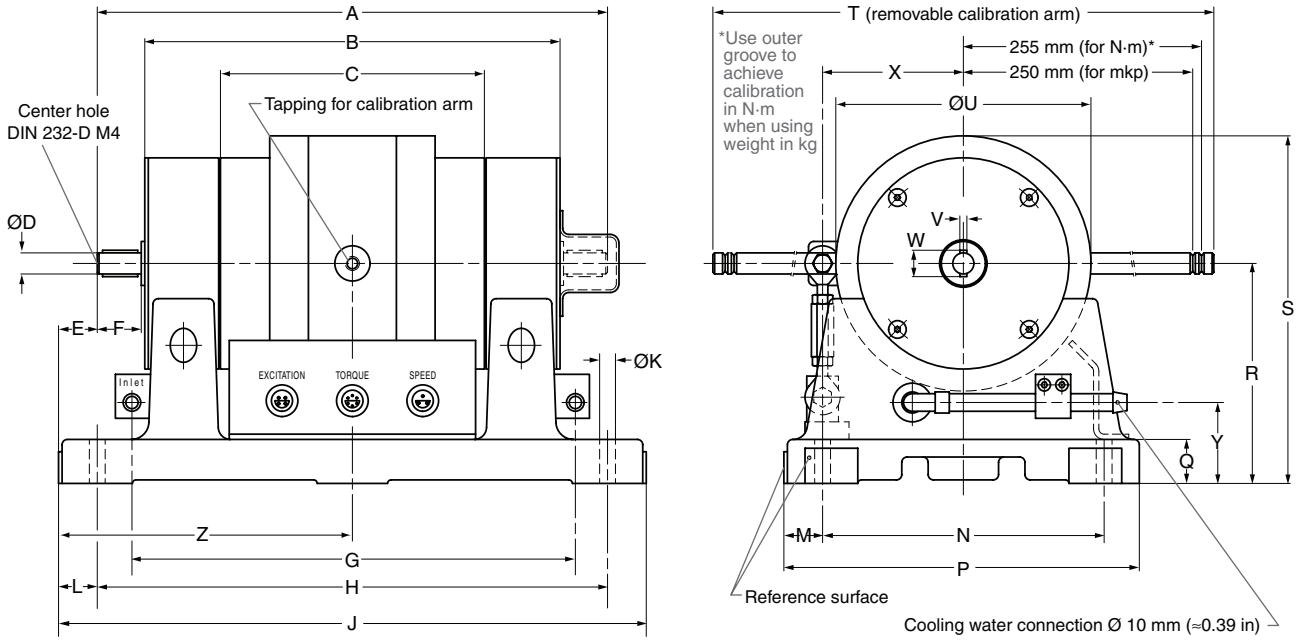
PB TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 43 Series Powder Dynamometers.



Specifications WB/PB 43

SINGLE DYNAMOMETER DIMENSIONS



NOTE:
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 decimal places.

Model	units	A	B	C	D	E	F	G	H	J	K	L	M	N
1 WB 43 / 1 PB 43	*mm*	240	186	100	Ø 12h6	22	25	202	240	284	Ø 9	22	22	160
	in	9.45	7.32	3.94	Ø 0.4724 0.4721	0.87	0.98	7.95	9.45	11.18	Ø 0.35	0.87	0.87	6.30
2 WB 43 / 2 PB 43	*mm*	290	236	150	Ø 12h6	22	25	252	290	334	Ø 9	22	22	160
	in	11.42	9.29	5.91	Ø 0.4724 0.4721	0.87	0.98	9.92	11.42	13.15	Ø 0.35	0.87	0.87	6.30

Model	units	P	Q	R	S	T	U	V	W	X	Y	Z	Weight
1 WB 43 / 1 PB 43	*mm*	202	25	125 ±0.05	198	524	Ø 145	4h9	15	80	46	153	24 kg
	in	7.95	0.98	4.923 4.919	7.80	20.63	Ø 5.71	0.1574 0.1563	0.59	3.15	1.81	6.02	52.91 lb
2 WB 43 / 2 PB 43	*mm*	202	25	125 ±0.05	198	524	Ø 145	4h9	15	80	46	167	31 kg
	in	7.95	0.98	4.923 4.919	7.80	20.63	Ø 5.71	0.1574 0.1563	0.59	3.15	1.81	6.57	68.34 lb

Shaft of high speed version (HS) is Ø 20-h6 mm, smooth (no key), with different length.
Drawing on request or available at www.magtrol/support/salesdrawings.htm

Tandem Specifications WB/PB 43

TANDEM OPERATING PRINCIPLES

Because the characteristics of the WB and PB dynamometers are complementary, Magtrol is able to offer them mounted in a tandem setup. Each dynamometer (WB and PB) can autonomously operate according to its own characteristics. An electromagnetic clutch is needed for this application which automatically switches off at the maximum speed of the PB Powder Dynamometer and automatically switches on at zero speed.

TANDEM DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*lb·ft*	*N·m*	*oz·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*A*
2 WB 43 + EK + 1 PB 43	5	3.6	0.13	18.4	4.82×10^{-4}	3.56×10^{-4}	3	9550	25,000	2
2 WB 43 + EK + 2 PB 43	10	7.3	0.23	32.5	5.81×10^{-4}	4.28×10^{-4}	3	9550	25,000	2

* *Voltage at 20 °C is 24 volts.*

Optical Speed Sensor

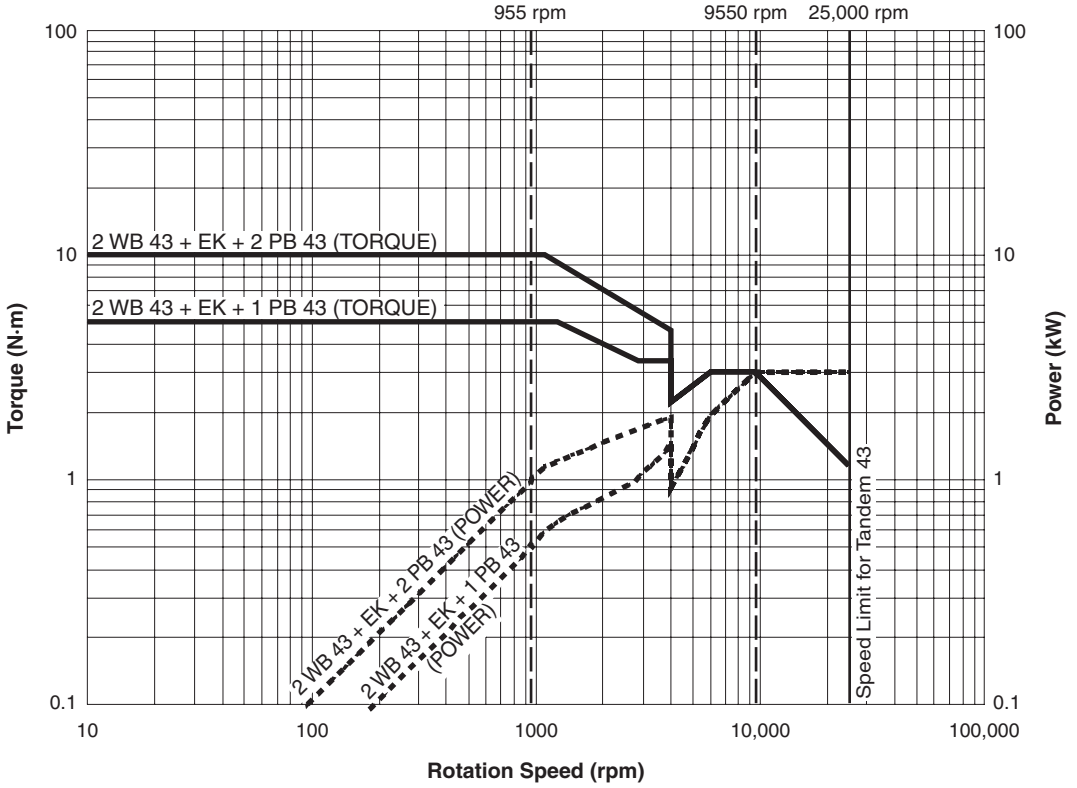
Each 43 Series Tandem Dynamometer has an optical speed sensor with a 30-bit pulse wheel delivered as standard.

Cooling Water Consumption

For all Tandem models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

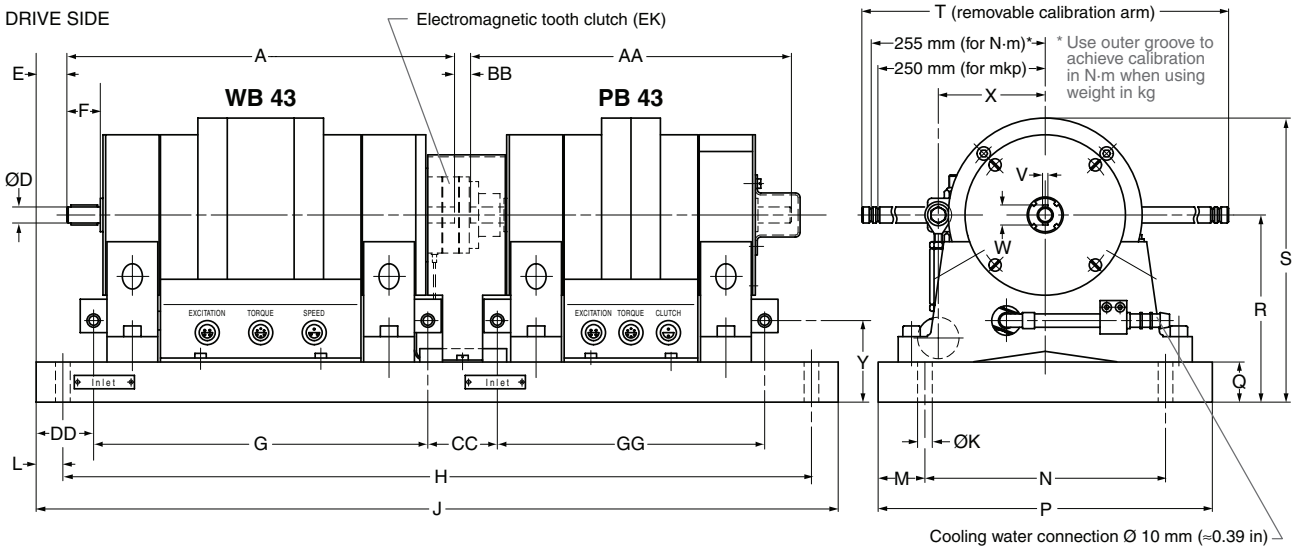
TANDEM TORQUE–SPEED–POWER CURVES

The diagrams below shows the characteristic curves for the 43 Series Tandem Dynamometers.



Tandem Specifications WB/PB 43

TANDEM DIMENSIONS



NOTE:
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 decimal places.

Model	units	A	D	E	F	G	H	J	K	L	M	N	P	Q
2 WB 43 + EK + 1 PB 43	*mm*	290	Ø 12h6	23	25	250	560	600	Ø 11	20	35	180	250	30
	in	9.45	Ø 0.4724 0.4721	0.91	0.98	7.87	22.05	23.62	Ø 0.43	0.79	1.38	7.09	9.84	1.18
2 WB 43 + EK + 2 PB 43	*mm*	290	Ø 12h6	23	25	250	610	650	Ø 11	20	35	180	250	30
	in	9.45	Ø 0.4724 0.4721	0.91	0.98	7.87	24.02	25.59	Ø 0.43	0.79	1.38	7.09	9.84	1.18

Model	units	R	S	T	V	W	X	Y	AA	BB	CC	DD	GG	Weight
2 WB 43 + EK + 1 PB 43	*mm*	140 ±0.03	213	524	4h9	15	80	61	240	12	52	43	200	≈55 kg
	in	5.513 5.511	8.39	20.63	0.1574 0.1563	0.59	3.15	2.40	9.45	0.47	2.05	1.69	7.87	121.25 lb
2 WB 43 + EK + 2 PB 43	*mm*	140 ±0.03	213	524	4h9	15	80	61	290	12	52	43	250	65 kg
	in	5.513 5.511	8.39	20.63	0.1574 0.1563	0.59	3.15	2.40	11.42	0.47	2.05	1.69	9.84	143.29 lb

Ordering Information

WB/PB 43

DYNAMOMETER OPTIONS

High Speed (HS)

For testing small/miniature high-speed motors, Magtrol offers a WB 43 Eddy-Current Dynamometer with speed ranges up to 65,000 rpm.

Industrial Version (IS)

Single WB and PB Dynamometers are also available in an industrial version which includes bearing supports, but does not provide a base plate, or torque and speed measurement.

Vertical Mounting (V)

Vertical Mounting is available on the Eddy-Current (WB) Dynamometer only. The vertical version has an adapted bearing fitting and its maximum speed is limited.

Speed Pickup (DG)

All models, including tandems, are equipped with a 30-bit optical speed sensor. On PB Dynamometers, a 600-bit or 6000-bit speed pickup (encoder) is available as an option for low speed applications.

Mechanical Rotor Blocking Device (MB)

A mechanical rotor blocking device, which allows locked rotor testing, is available for the WB Dynamometer.

DYNAMOMETER MODELS

Eddy-Current	Powder	Tandem
1 WB 43	1 PB 43	2 WB 43 + EK + 1 PB 43
2 WB 43	2 PB 43	2 WB 43 + EK + 2 PB 43

ORDERING INFORMATION

If one of the listed options is desired, please follow the dynamometer model (see table above) with a dash and then the appropriate suffix (as noted in parenthesis). For example, a Model 1 PB 43 Powder Dynamometer with an optional 600-bit speed pickup is a 1 PB 43 - DG - 600.

Example: 1 PB 43 - DG - 600

Dynamometer Model — Option

SYSTEM OPTIONS AND ACCESSORIES

	DESCRIPTION	MODEL / PART #
ELECTRONICS	High Speed Programmable Dynamometer Controller	DSP7000
	Torque-Speed Conditioner (includes necessary cables)	TSC 401/111
	Power Supply (includes necessary cables)	DES 410/111
	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
SOFT-WARE	M-TEST 7 Motor Testing Software	M-TEST 7
	Temperature Testing Hardware	HW-TTEST
MISC	Dynamometer Table (with grooved table top)	005449
	Transformer (24 VDC) for electromagnetic clutch of tandem dynamometers	234-311-920-011
	Couplings, Thermostatic Sluice, Pressure Sensitive Switch	On Request
	Water Cooling System for Brake	On Request
	Calibration Weights	On Request

1.2.3 WB/PB 65 SERIES

WB/PB 65 Series Eddy-Current and Powder Dynamometers

FEATURES

- 4 Models with Maximum Torque from 10 N·m to 50 N·m (7.3 lb·ft to 36 lb·ft)
- Braking Power: 1.5 kW to 12 kW
- Stable Braking Torque, without Shock
- Low Moment of Inertia
- Low Residual Torque
- Operation in Either Rotational Direction
- Braking Torque Measurement Included
- High Rotational Speed
- Rated Torque Available From Zero Speed (Powder Dynamometers)
- Integrated Optical Speed Sensor

Model 1 WB 65-HS Eddy-Current Dynamometer

DESCRIPTION

Eddy-Current Brake Dynamometers (WB series) are ideal for applications requiring high speeds and also when operating in the middle to high power range. Eddy-Current Brakes provide increasing torque as the speed increases, reaching peak torque at rated speed. The dynamometers have low inertia as a result of small rotor diameter. Brake cooling is provided by a water circulation system, which passes inside the stator to dissipate heat generated by the braking power. The water cooling in the WB provides high continuous power ratings (max. 12 kW).

Powder Brake Dynamometers (PB series) are ideal for applications operating in the low to middle speed range or when operating in the middle to high torque range. Powder Brakes provide full torque at zero speed and are water-cooled, allowing for power ratings up to 3 kW. Both WB and PB Dynamometers have accuracy ratings of ±0.3% 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

Mounted on test benches, WB/PB 65 Series Dynamometers allow performance and reliability testing on driving elements such as electric motors, combustion engines, hand-held power tools, windshield wiper motors, servomotors, fans, geared motors, reduction gears, pneumatic equipment, hydraulic transmission systems, motors for domestic appliances, starter motors, gas turbines and turbocompressors.

MOTOR TESTING SYSTEMS

Magtrol's M-TEST 7 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol DSP7000 Programmable Dynamometer Controller, Magtrol M-TEST 7 Software provides the control of any Magtrol Eddy-Current or Powder Brake 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.

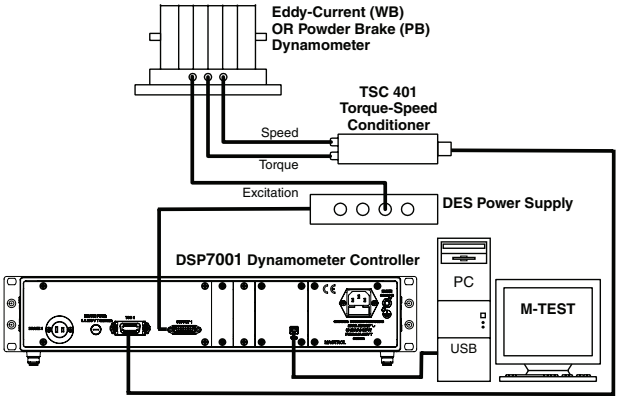
Written in LabVIEW™, M-TEST 7 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermocouples), controlling motor power and providing audio/visual indicators is relatively easy.

Magtrol's M-TEST 7 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.

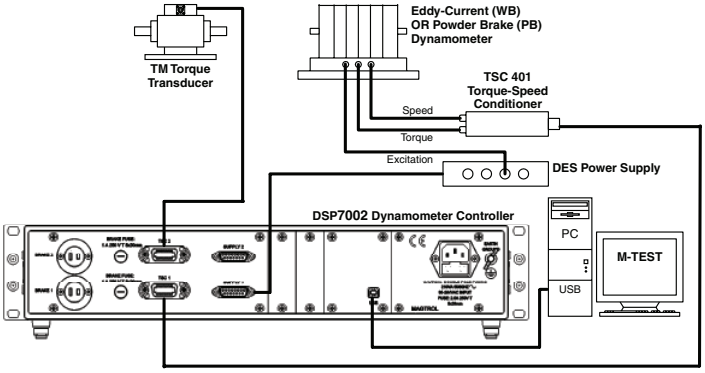
System Configurations WB/PB 65

SINGLE DYNAMOMETER CONFIGURATIONS

The Dynamometers can be complemented by various electronic modules such as the DES 411 Power Supply, TSC 401 Torque/ Speed Conditioner and DSP7000 High Speed Programmable Dynamometer Controller.

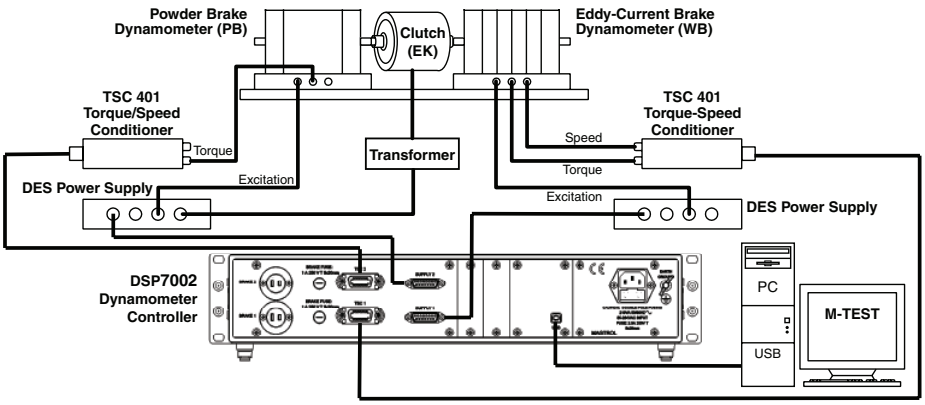


Magtrol also offers In-Line Torque Transducers, which employ a unique non-contact differential transformer torque measuring technology providing extremely accurate torque and speed measurement with superior electrical noise immunity. For a dynamic, high-precision system, the torque transducer can be mounted in line between the unit under test and the dynamometer.



TANDEM CONFIGURATION

Magtrol offers Eddy-Current and Powder Dynamometers mounted in tandem. In tandem, the unique features of each type of dynamometer brake are utilized, allowing the unit under test to be applied with nominal braking torque from zero speed to maximum rotation. The Tandem Dynamometers are available on a number of WB/PB combinations.



Specifications WB 65

EDDY-CURRENT DYNAMOMETER OPERATING PRINCIPLES

The WB Eddy-Current Dynamometers develop their full power at high rotation speeds. The 65 Series is particularly intended for motors which rotate at high speeds, up to 30,000 rpm. The braking torque depends on the rotation speed.

WB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed		Excitation Current*
									standard version	high-speed version (HS)	
	N·m	*lb·ft*	*N·m*	*lb·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*rpm*	*A*
1 WB 65	10	7.3	0.1	0.88	0.82×10^{-3}	6.04×10^{-4}	6	5730	30,000	50,000	2.5
2 WB 65	20	14.7	0.2	1.77	1.55×10^{-3}	1.14×10^{-3}	12	5730	30,000	50,000	5

** Voltage at 20 °C is 30 volts.*

Optical Speed Sensor

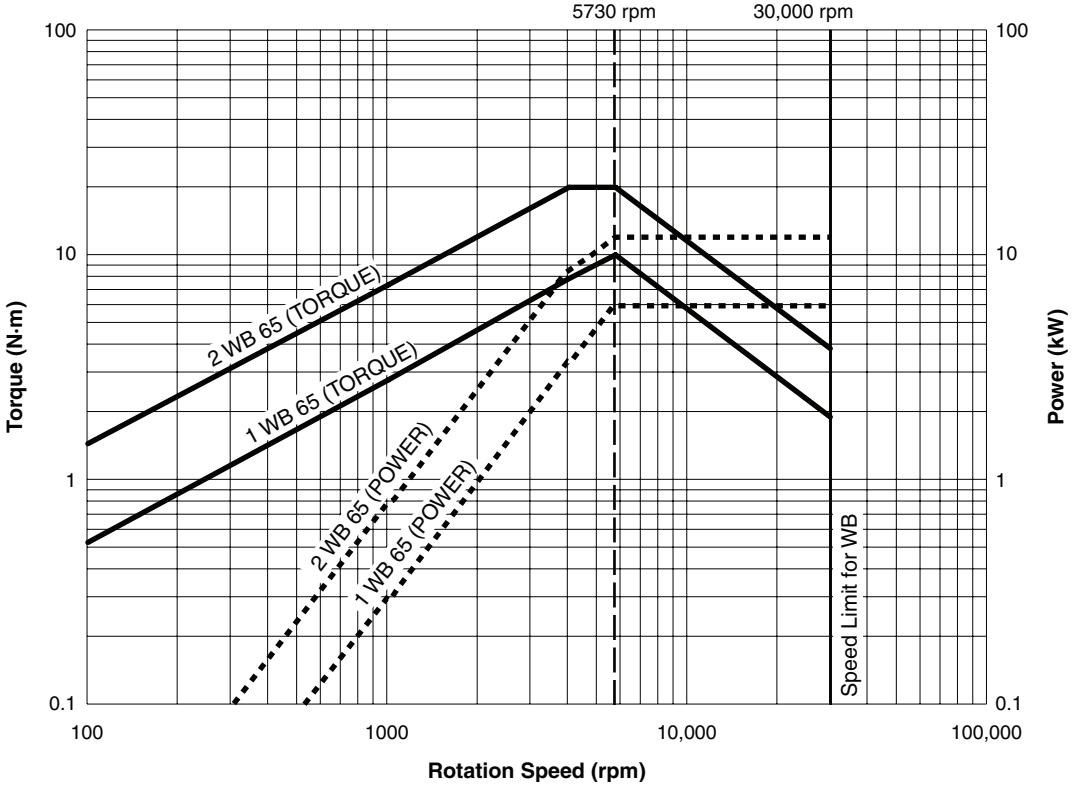
Each 65 Series WB Dynamometer has an optical speed sensor with a 60-bit pulse wheel delivered as standard.

Cooling Water Consumption

For all WB models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

WB TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 65 Series Eddy-Current Dynamometers.



Specifications PB 65

POWDER DYNAMOMETER OPERATING PRINCIPLES

The PB Powder Dynamometers contain, as their name suggests, a magnetic powder. The electrical current passing through the coil generates a magnetic field, which changes the property of the powder, thus producing a smooth braking torque through friction between rotor and stator. The Powder Dynamometers (PB) produce their rated torque at zero speed. The element to be tested can be loaded at standstill to determine the starting torque.

PB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*lb·ft*	*N·m*	*lb·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*A*
1 PB 65	25	18.4	0.5	4.42	0.92×10^{-3}	6.78×10^{-4}	1.5	570	3000	2.5
2 PB 65	50	36.8	1.0	8.85	1.71×10^{-3}	1.26×10^{-3}	3	570	3000	5

* *Voltage at 20 °C is 30 volts.*

Optical Speed Sensor

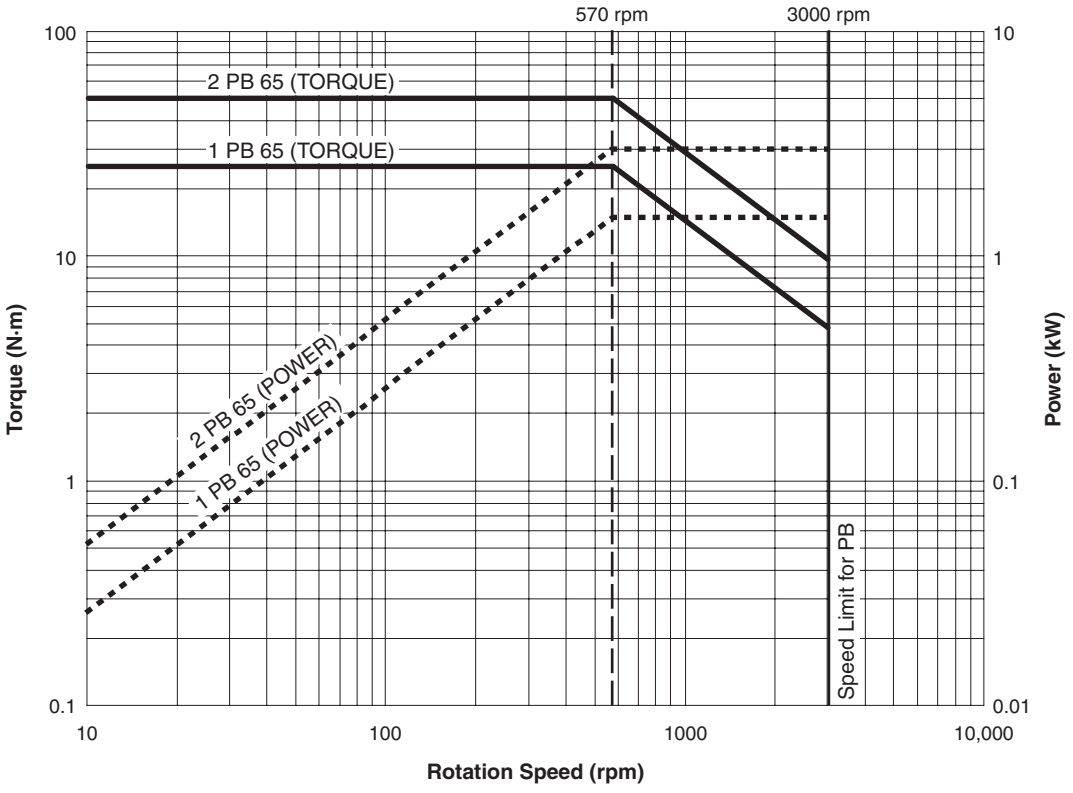
Each 65 Series PB Dynamometer has an optical speed sensor with a 60-bit pulse wheel delivered as standard. For better speed resolution in low speed applications, Magtrol offers a 600-bit or 6000-bit speed pickup (encoder) as an option.

Cooling Water Consumption

For all PB models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

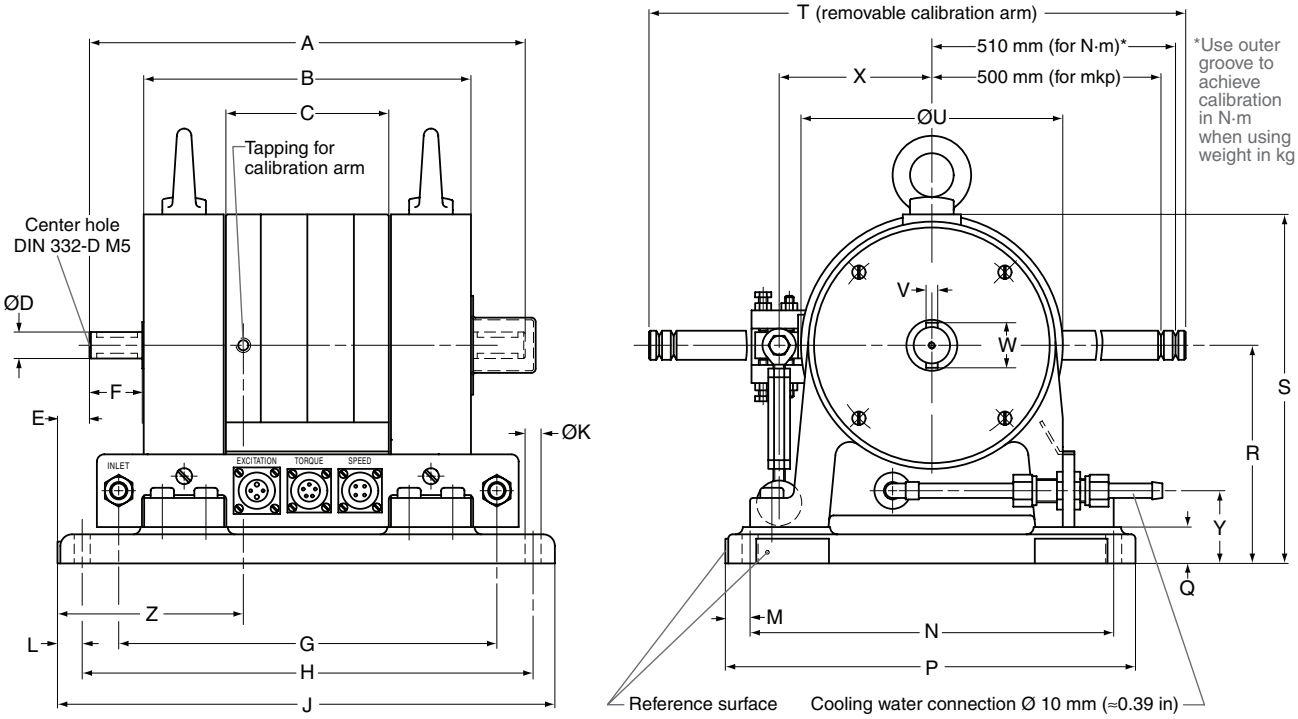
PB TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 65 Series Powder Dynamometers.



Specifications WB/PB 65

SINGLE DYNAMOMETER DIMENSIONS



NOTE:
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 decimal places.

Model	units	A	B	C	D	E	F	G	H	J	K	L	M	N
1 WB 65 / 1 PB 65	*mm*	300	225	112	Ø 18h6	22	36	260	310	342	Ø 11	17	17	250
	in	11.81	8.86	4.41	Ø 0.7086 0.7083	0.87	1.42	10.24	12.2	13.46	Ø 0.43	0.67	0.67	9.84
2 WB 65 / 2 PB 65	*mm*	370	295	182	Ø 18h6	22	36	330	380	412	Ø 11	17	17	250
	in	14.57	11.61	7.17	Ø 0.7086 0.7083	0.87	1.42	12.99	14.96	16.22	Ø 0.43	0.67	0.67	9.84

Model	units	P	Q	R	S	T	U	V	W	X	Y	Z	Weight
1 WB 65 / 1 PB 65	*mm*	282	25	150 ±0.1	240	1034	Ø 180	6h9	23	105	50	128	55 kg
	in	11.10	0.98	5.909 5.902	9.45	40.71	Ø 7.09	0.2362 0.2351	0.91	4.13	1.97	5.04	121.25 lb
2 WB 65 / 2 PB 65	*mm*	282	25	150 ±0.1	240	1034	Ø 180	6h9	23	105	50	128	70 kg
	in	11.10	0.98	5.909 5.902	9.45	40.71	Ø 7.09	0.2362 0.2351	0.91	4.13	1.97	5.04	154.32 lb

Shaft of high speed version (HS) is Ø 25-h6 mm, smooth (no key), with different length.
Drawing on request or available at www.magtrol/support/salesdrawings.htm

Tandem Specifications WB/PB 65

TANDEM OPERATING PRINCIPLES

Because the characteristics of the WB and PB Dynamometers are complementary, Magtrol is able to offer them mounted in a tandem setup. Each dynamometer (WB and PB) can autonomously operate according to its own characteristics. An electromagnetic clutch is needed for this application which automatically switches off at the maximum speed of the PB Powder Dynamometer and automatically switches on at zero speed.

TANDEM DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*lb·ft*	*N·m*	*lb·ft*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*A*
2 WB 65 + EK + 1 PB 65	25	18.4	0.7	6.19	3.19×10^{-3}	2.35×10^{-3}	12	5730	18,000	5
2 WB 65 + EK + 2 PB 65	50	36.8	1.2	10.62	3.98×10^{-3}	2.93×10^{-3}	12	5730	18,000	5

** Voltage at 20 °C is 30 volts.*

Optical Speed Sensor

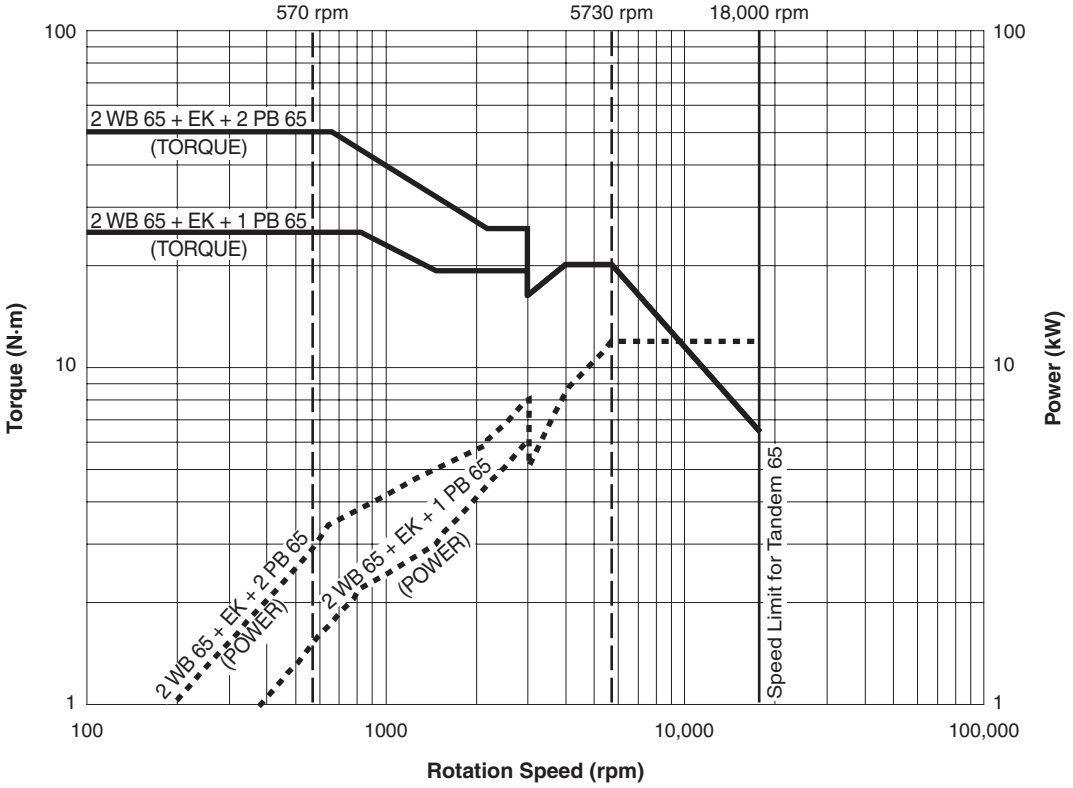
Each 65 Series Tandem Dynamometer has an optical speed sensor with a 60-bit pulse wheel delivered as standard.

Cooling Water Consumption

For all Tandem models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

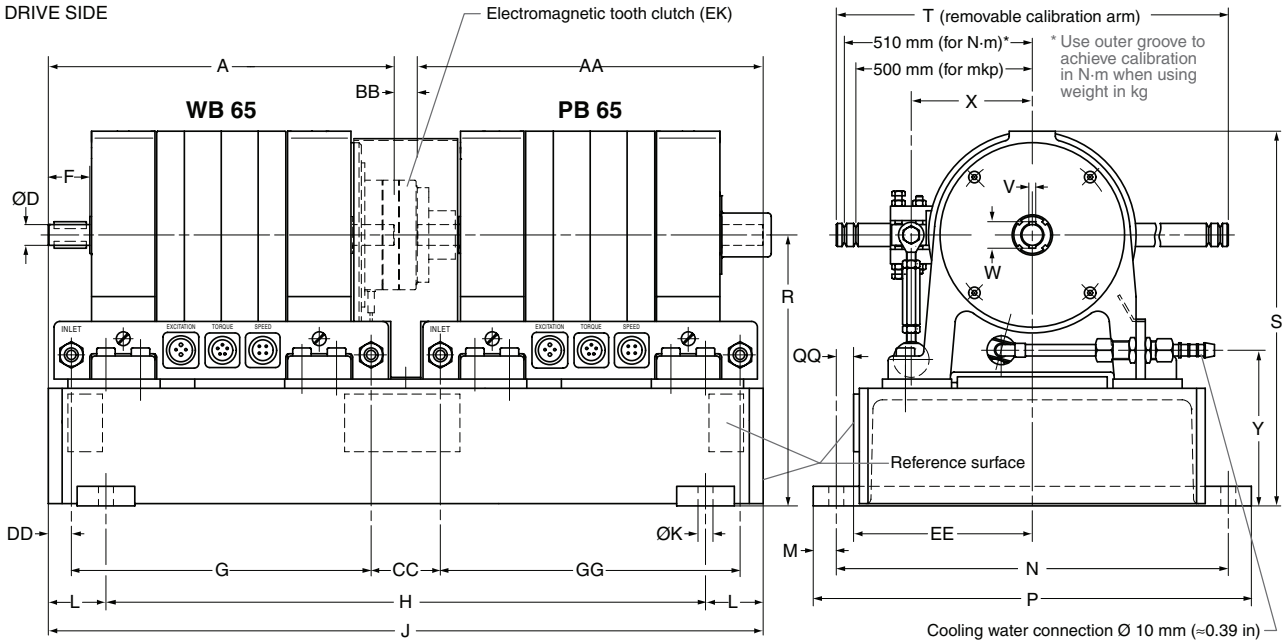
TANDEM TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 65 Series Tandem Dynamometers.



Tandem Specifications WB/PB 65

TANDEM DIMENSIONS



NOTE:
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 decimal places.

Model	units	A	D	F	G	H	J	K	L	M	N	P	R	S
2 WB 65 + EK + 1 PB 65	*mm*	370	Ø 18h6	36	330	590	690	Ø 13	50	20	340	380	235 ±0.02	325
	in	14.57	Ø 0.7086 0.7083	1.42	12.99	23.23	27.17	Ø 0.51	1.97	0.79	13.39	14.96	9.260 9.244	12.80
2 WB 65 + EK + 2 PB 65	*mm*	370	Ø 18h6	36	330	660	760	Ø 13	50	20	340	380	235 ±0.02	325
	in	14.57	Ø 0.7086 0.7083	1.42	12.99	25.98	29.92	Ø 0.51	1.97	0.79	13.39	14.96	9.260 9.244	12.80

Model	units	T	V	W	X	Y	AA	BB	CC	DD	EE	GG	QQ	Weight
2 WB 65 + EK + 1 PB 65	*mm*	1034	6h9	23	105	135	300	20	60	20	155 ±0.1	260	15	≈135 kg
	in	40.71	0.2362 0.2351	0.91	4.13	5.31	11.81	0.79	2.36	0.79	6.106 6.098	10.24	0.59	297.62 lb
2 WB 65 + EK + 2 PB 65	*mm*	1034	6h9	23	105	135	370	20	60	20	155 ±0.1	330	15	≈150 kg
	in	40.71	0.2362 0.2351	0.91	4.13	5.31	14.57	0.79	2.36	0.79	6.106 6.098	12.99	0.59	330.69 lb

Ordering Information WB/PB 65

DYNAMOMETER OPTIONS

High Speed (HS)

For testing small/miniature high-speed motors, Magtrol offers a WB 65 Eddy-Current Dynamometer with speed ranges up to 50,000 rpm.

Industrial Version (IS)

Single WB and PB Dynamometers are also available in an industrial version which includes bearing supports, but does not provide a base plate, or torque and speed measurement.

Vertical Mounting (V)

Vertical Mounting is available on the Eddy-Current (WB) Dynamometer only. The vertical version has an adapted bearing fitting and its maximum speed is limited.

Speed Pickup (DG)

All models, including tandems, are equipped with a 60-bit optical speed sensor. On PB Dynamometers, a 600-bit or 6000-bit speed pickup (encoder) is available as an option for low speed applications.

Mechanical Rotor Blocking Device (MB)

A mechanical rotor blocking device, which allows locked rotor testing, is available for the WB Dynamometer.

DYNAMOMETER MODELS

Eddy-Current	Powder	Tandem
1 WB 65	1 PB 65	2 WB 65 + EK + 1 PB 65
2 WB 65	2 PB 65	2 WB 65 + EK + 2 PB 65

ORDERING INFORMATION

If one of the listed options is desired, please follow the dynamometer model (see table above) with a dash and then the appropriate suffix (as noted in parenthesis). For example, a Model 1 PB 65 Powder Dynamometer with an optional 6000-bit speed pickup is a 1 PB 65 - DG - 6000.

Example: 1 PB 65 - DG - 6000

Dynamometer Model — Option

SYSTEM OPTIONS AND ACCESSORIES

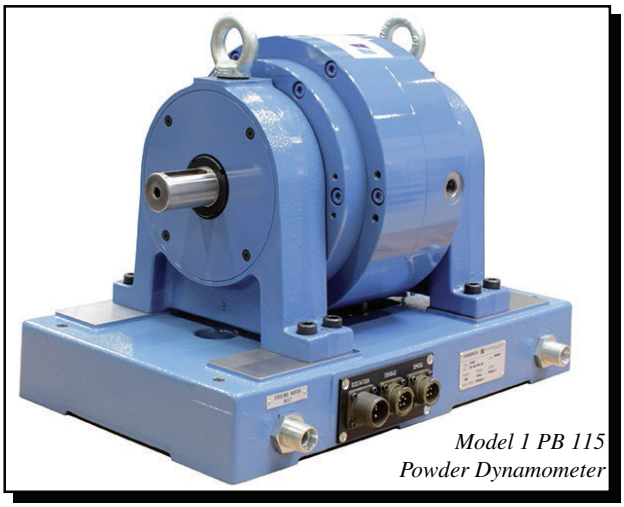
	DESCRIPTION	MODEL / PART #
ELECTRONICS	High Speed Programmable Dynamometer Controller	DSP7000
	Torque-Speed Conditioner (includes necessary cables)	TSC 401/121
	Power Supply (includes necessary cables)	DES 411/111
	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
SOFT-WARE	M-TEST 7 Motor Testing Software	M-TEST 7
	Temperature Testing Hardware	HW-TTEST
MISC	Dynamometer Table (with grooved table top)	005450
	Transformer (24 VDC) for electromagnetic clutch of tandem dynamometers	234-311-920-011
	Couplings, Thermostatic Sluice, Pressure Sensitive Switch	On Request
	Water Cooling System for Brake	On Request
	Calibration Weights	On Request

1.2.4 WB/PB 115 Series

WB/PB 115 Series Eddy-Current and Powder Dynamometers

FEATURES

- 4 Models with Maximum Torque from 50 N·m to 200 N·m (36 lb·ft to 147 lb·ft)
- Braking Power: 5 kW to 30 kW
- Stable Braking Torque, without Shock
- Low Moment of Inertia
- Low Residual Torque
- Operation in Either Rotational Direction
- Braking Torque Measurement Included
- High Rotational Speed
- Rated Torque Available From Zero Speed (Powder Dynamometers)
- Integrated Optical Speed Sensor



Model 1 PB 115 Powder Dynamometer

DESCRIPTION

Eddy-current Brake Dynamometers (WB series) are ideal for applications requiring high speeds and also when operating in the middle to high power range. Eddy-Current Brakes provide increasing torque as the speed increases, reaching peak torque at rated speed. The dynamometers have low inertia as a result of small rotor diameter. Brake cooling is provided by a water circulation system, which passes inside the stator to dissipate heat generated by the braking power. The water cooling in the WB provides high continuous power ratings (max. 30 kW).

Powder Brake Dynamometers (PB series) are ideal for applications operating in the low to middle speed range or when operating in the middle to high torque range. Powder Brakes provide full torque at zero speed and are water-cooled, allowing for power ratings up to 10 kW. Both WB and PB Dynamometers have accuracy ratings of ±0.3% 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

Mounted on test benches, WB/PB 115 Series Dynamometers allow performance and reliability testing on driving elements such as electric motors, combustion engines, hand-held drills, servomotors, fans, geared motors, reduction gears, pneumatic equipment, hydraulic transmission systems, starter motors, gas turbines and turbocompressors.

MOTOR TESTING SYSTEMS

Magtrol's M-TEST 7 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol DSP7000 Programmable Dynamometer Controller, Magtrol M-TEST 7 Software provides the control of any Magtrol Eddy-Current or Powder Brake 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.

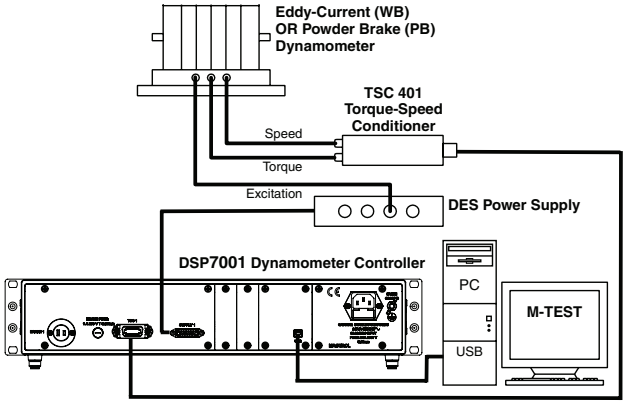
Written in LabVIEW™, M-TEST 7 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermocouples), controlling motor power and providing audio/visual indicators is relatively easy.

Magtrol's M-TEST 7 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.

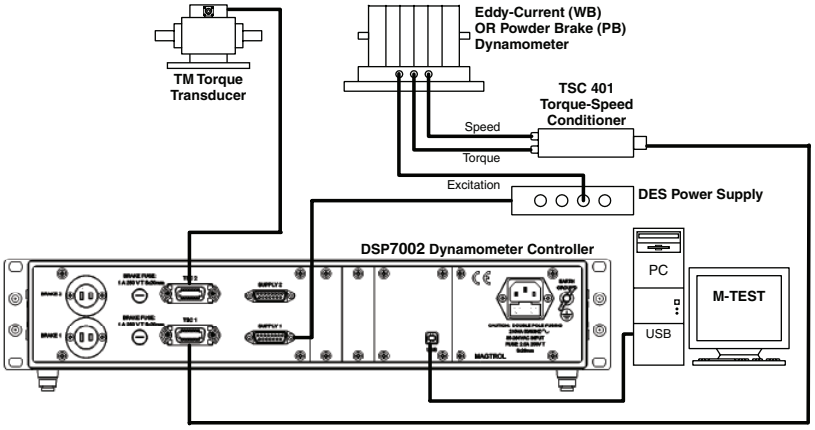
System Configurations WB/PB 115

SINGLE DYNAMOMETER CONFIGURATIONS

The Dynamometers can be complemented by various electronic modules such as the DES 411 Power Supply, TSC 401 Torque/ Speed Conditioner and DSP7001 High Speed Programmable Dynamometer Controller.

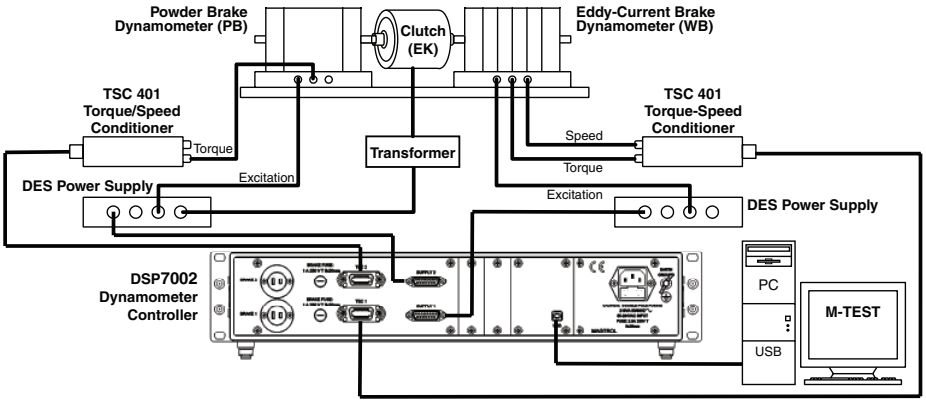


Magtrol also offers In-Line Torque Transducers, which employ a unique non-contact differential transformer torque measuring technology providing extremely accurate torque and speed measurement with superior electrical noise immunity. For a dynamic, high-precision system, the torque transducer can be mounted in line between the unit under test and the dynamometer.



TANDEM CONFIGURATION

Magtrol offers Eddy-Current and Powder Dynamometers mounted in tandem. In tandem, the unique features of each type of dynamometer brake are utilized, allowing the unit under test to be applied with nominal braking torque from zero speed to maximum rotation. The Tandem Dynamometers are available on a number of WB/PB combinations.



Specifications WB 115

EDDY-CURRENT DYNAMOMETER OPERATING PRINCIPLES

The WB Eddy-Current Dynamometers develop their full power at high rotation speeds. The 115 Series is particularly intended for motors which rotate at high speeds, up to 22,000 rpm. The braking torque depends on the rotation speed.

WB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed		Excitation Current*
									standard version	high-speed version (HS)	
	N·m	*lb·ft*	*N·m*	*lb·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*rpm*	*A*
1 WB 115	50	36.8	0.5	4.43	1.27×10^{-2}	9.36×10^{-3}	15	2865	18,000	22,000	2.5
2 WB 115	100	73.7	1.0	8.85	2.57×10^{-2}	1.89×10^{-2}	30	2865	18,000	22,000	5

** Voltage at 20 °C is 30 volts.*

Optical Speed Sensor

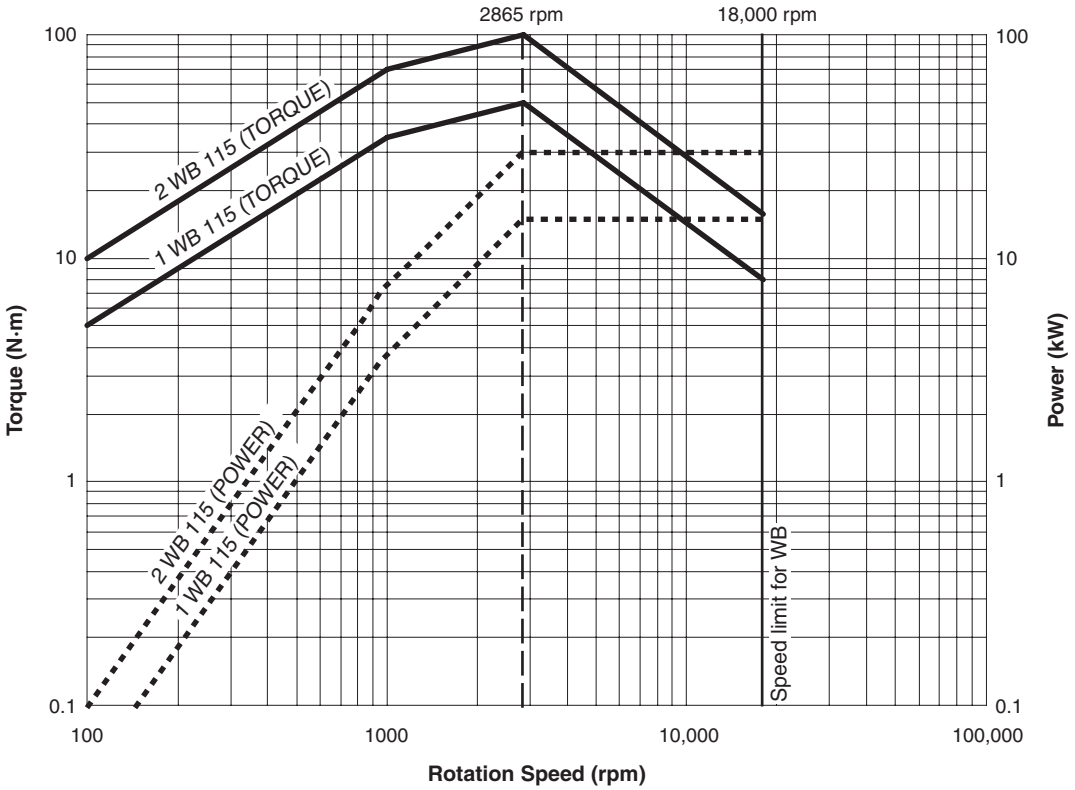
Each 115 Series WB Dynamometer has an optical speed sensor with a 60-bit pulse wheel delivered as standard.

Cooling Water Consumption

For all WB models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

WB TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 115 Series Eddy-Current Dynamometers.



Specifications PB 115

POWDER DYNAMOMETER OPERATING PRINCIPLES

The PB Powder Dynamometers contain, as their name suggests, a magnetic powder. The electrical current passing through the coil generates a magnetic field, which changes the property of the powder, thus producing a smooth braking torque through friction between rotor and stator. The Powder Dynamometers (PB) produce their rated torque at zero speed. The element to be tested can be loaded at standstill to determine the starting torque.

PB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*lb·ft*	*N·m*	*lb·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*A*
1 PB 115	100	73.7	2	17.7	1.24×10^{-2}	9.14×10^{-3}	5	480	3000	2.5
2 PB 115	200	147.5	4	35.4	2.50×10^{-2}	1.84×10^{-2}	10	480	3000	5

* *Voltage at 20 °C is 30 volts.*

Optical Speed Sensor

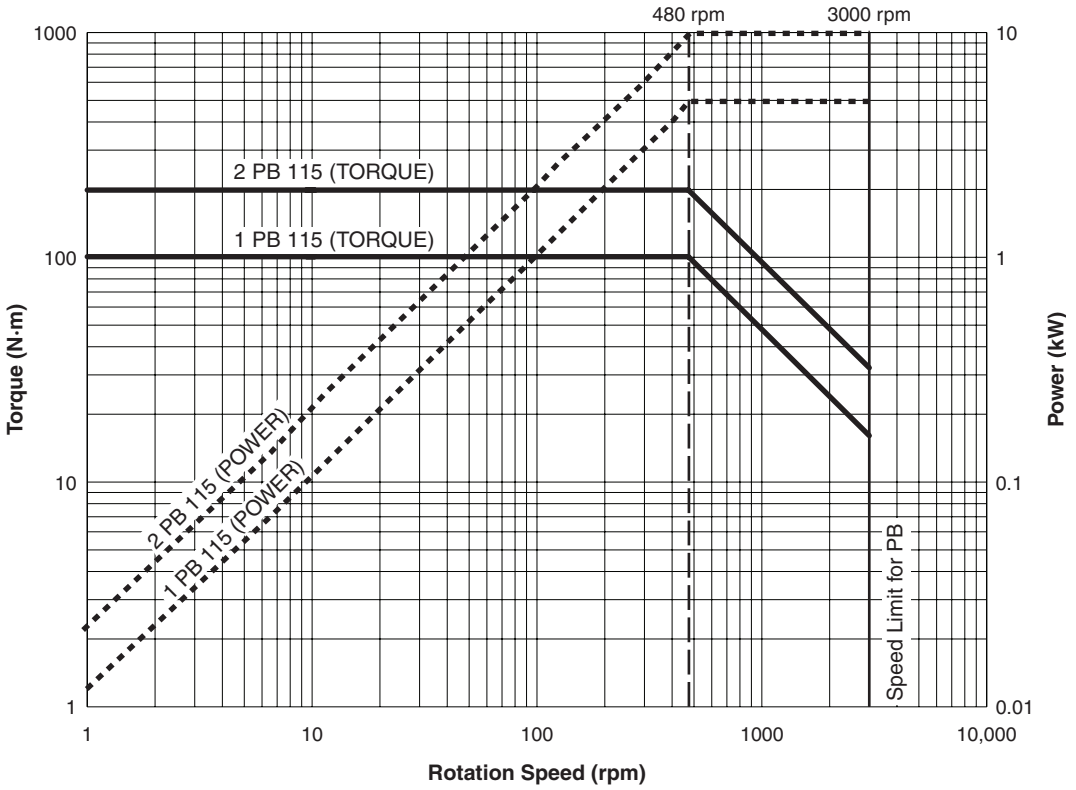
Each 115 Series PB Dynamometer has an optical speed sensor with a 60-bit pulse wheel delivered as standard. For better speed resolution in low speed applications, Magtrol offers a 600-bit or 6000-bit speed pickup (encoder) as an option.

Cooling Water Consumption

For all PB models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

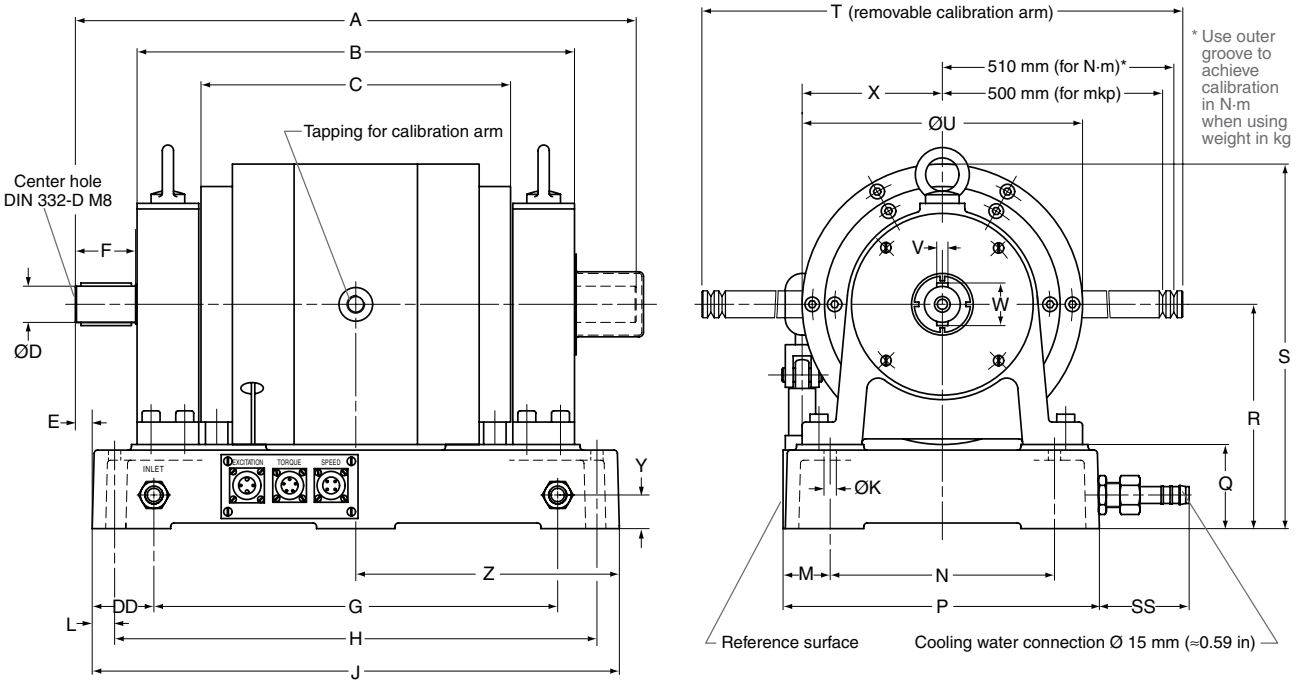
PB TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 115 Series Powder Dynamometers.



Specifications WB/PB 115

SINGLE DYNAMOMETER DIMENSIONS



NOTE:

Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 decimal places.

Model	units	A	B	C	D	E	F	G	H	J	K	L	M	N	P
1 WB 115 / 1 PB 115	*mm*	390	280	166	Ø 32h6	-40	54	360	430	470	Ø 11	20	40	200	280
	in	15.35	11.02	6.54	Ø 1.2598 1.2593	-1.57	2.13	14.17	16.93	18.50	Ø 0.43	0.79	1.57	7.87	11.02
2 WB 115 / 2 PB 115	*mm*	500	390	276	Ø 32h6	15	54	360	430	470	Ø 11	20	40	200	280
	in	19.69	15.35	10.87	Ø 1.2598 1.2593	0.59	2.13	14.17	16.93	18.50	Ø 0.43	0.79	1.57	7.87	11.02

Model	units	Q	R	S	T	U	V	W	X	Y	Z	DD	SS	Weight
1 WB 115 / 1 PB 115	*mm*	75	200 ±0.1	325	1038	Ø 250	10h9	38	125	30	197	55	80	80 kg
	in	2.95	7.878 7.870	12.80	40.87	Ø 9.84	0.3937 0.3932	1.50	4.92	1.18	7.76	2.17	3.15	176.37 lb
2 WB 115 / 2 PB 115	*mm*	75	200 ±0.1	325	1038	Ø 250	10h9	38	125	30	235	55	80	130 kg
	in	2.95	7.878 7.870	12.80	40.87	Ø 9.84	0.3937 0.3932	1.50	4.92	1.18	9.25	2.17	3.15	286.60 lb

Tandem Specifications WB/PB 115

TANDEM OPERATING PRINCIPLES

Because the characteristics of the WB and PB dynamometers are complementary, Magtrol is able to offer them mounted in a tandem setup. Each dynamometer (WB and PB) can autonomously operate according to its own characteristics. An electromagnetic clutch is needed for this application which automatically switches off at the maximum speed of the PB Powder Dynamometer and automatically switches on at zero speed.

TANDEM DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*lb·ft*	*N·m*	*lb·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*A*
2 WB 115 + EK + 1 PB 115	100	73.7	3	26.5	4.18×10^{-2}	3.08×10^{-2}	30	2865	15,000	5
2 WB 115 + EK + 2 PB 115	200	147.5	5	44.2	5.44×10^{-2}	4.01×10^{-2}	30	2865	15,000	5
2 WB 115 + MK + 2 WB 115	200	147.5	2	17.7	5.51×10^{-2}	4.07×10^{-2}	60	2865	15,000	5

** Voltage at 20 °C is 30 volts.*

Optical Speed Sensor

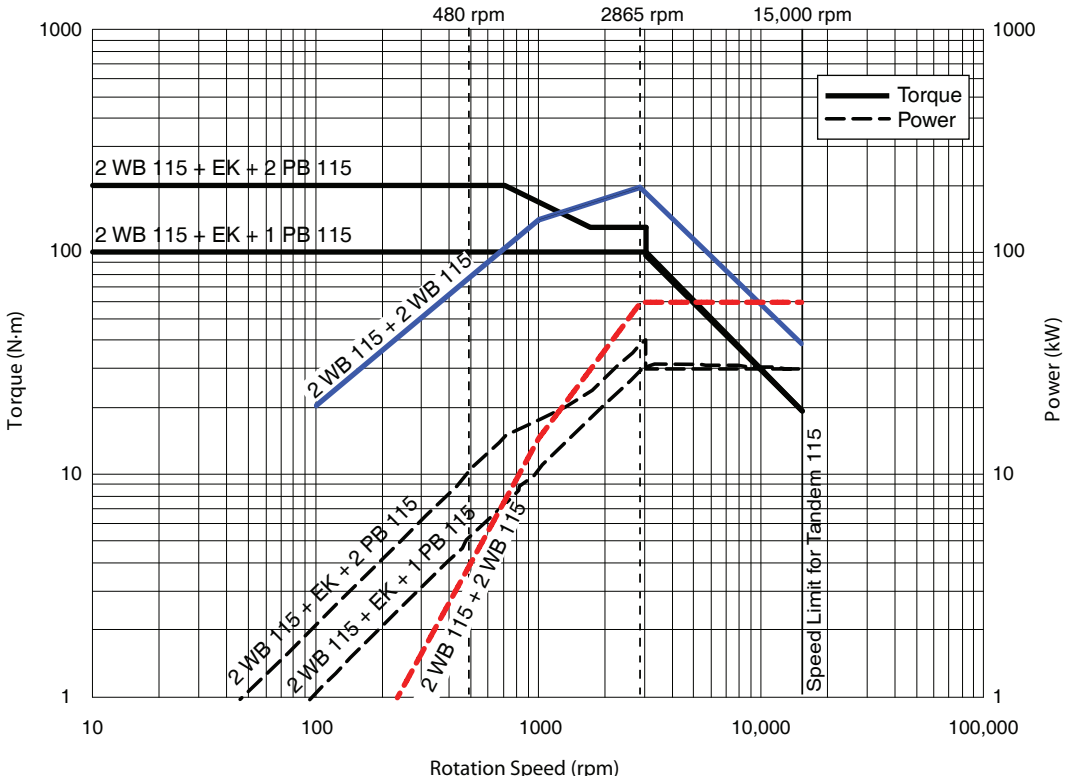
Each 115 Series Tandem Dynamometer has an optical speed sensor with a 60-bit pulse wheel delivered as standard.

Cooling Water Consumption

For all Tandem models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

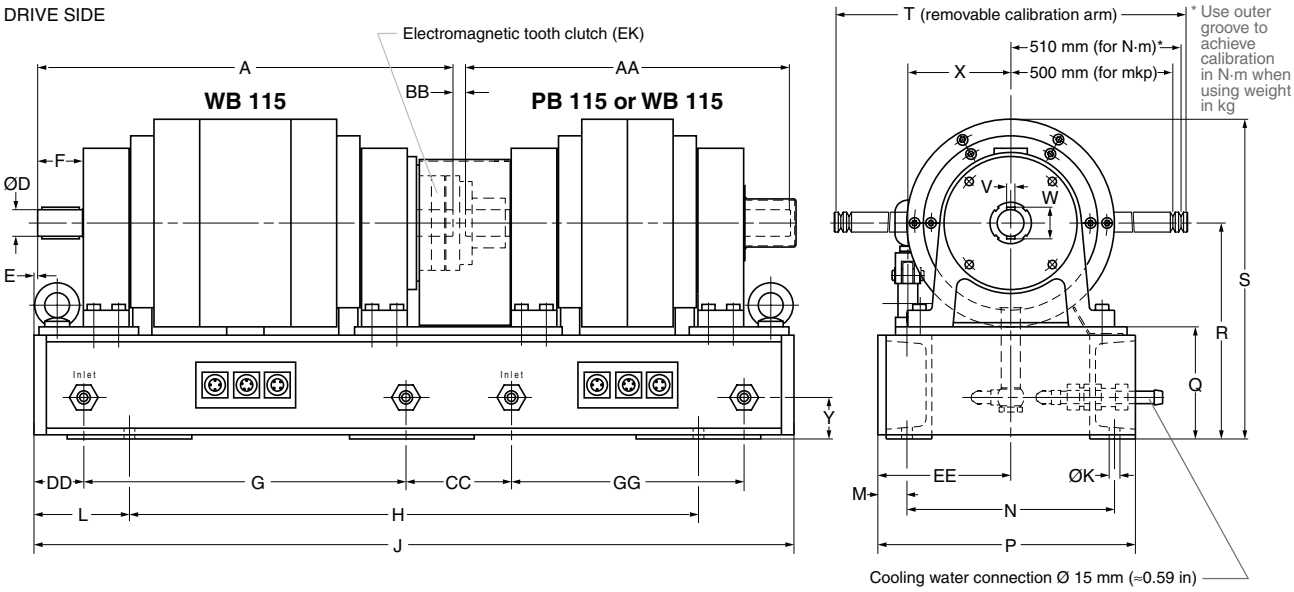
TANDEM TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 115 Series Tandem Dynamometers.



Tandem Specifications WB/PB 115

TANDEM DIMENSIONS



NOTE:
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 decimal places.

Model	units	A	D	E	F	G	H	J	K	L	M	N	P	Q	R
2 WB 115 + EK + 1 PB 115	*mm*	500	Ø 32h6	4	54	388	685	915	Ø 13	115	35	250	310	135	260 ±0.2
	in	19.69	Ø 1.2598 1.2593	0.16	2.13	15.28	26.97	36.02	Ø 0.51	4.53	1.38	9.84	12.20	5.31	10.244 10.228
2 WB 115 + EK + 2 PB 115	*mm*	500	Ø 32h6	4	54	388	795	1025	Ø 13	115	35	250	310	135	260 ±0.2
	in	19.69	Ø 1.2598 1.2593	0.16	2.13	15.28	31.30	40.35	Ø 0.51	4.53	1.38	9.84	12.20	5.31	10.244 10.228
2 WB 115 + MK + 2 WB 115	*mm*	500	Ø 32h6	4.5	53	388	795	1025	Ø 13	115	35	250	310	135	260±0.2
	in	19.69	Ø 1.2598 1.2593	0.18	2.09	15.28	31.30	40.35	Ø 0.51	4.53	1.38	9.84	12.20	5.31	10.244 10.228

Model	units	S	T	V	W	X	Y	AA	BB	CC	DD	EE	GG	Weight
2 WB 115 + EK + 1 PB 115	*mm*	385	1038	10	38	125	50	390	15	127	60	160 ±0.1	280	214 kg
	in	15.15	40.87	0.39	1.50	4.92	1.97	15.35	0.59	5.00	2.36	6.303 6.295	11.02	471.79 lb
2 WB 115 + EK + 2 PB 115	*mm*	385	1038	10	38	125	50	500	15	127	60	160 ±0.1	390	264 kg
	in	15.15	40.87	0.39	1.50	4.92	1.97	19.69	0.59	5.00	2.36	6.303 6.295	15.35	582.02 lb
2 WB 115 + MK + 2 WB 115	*mm*	385	1038	10	38	125	50	500	15	127	60	160±0.1	390	264 kg
	in	15.15	40.87	0.39	1.50	4.92	1.97	19.69	0.59	5.00	2.36	6.303 6.295	15.35	582.02 lb

Ordering Information WB/PB 115

DYNAMOMETER OPTIONS

Industrial Version (IS)

Single WB and PB Dynamometers are also available in an industrial version which includes bearing supports, but does not provide a base plate, or torque and speed measurement.

Vertical Mounting (V)

Vertical Mounting is available on the Eddy-Current (WB) Dynamometer only. The vertical version has an adapted bearing fitting and its maximum speed is limited.

Speed Pickup (DG)

All models, including tandems, are equipped with a 60-bit optical speed sensor. On PB Dynamometers, a 600-bit or 6000-bit speed pickup (encoder) is available as an option for low speed applications.

Mechanical Rotor Blocking Device (MB)

A mechanical rotor blocking device, which allows locked rotor testing, is available for the WB Dynamometer.

DYNAMOMETER MODELS

Brake 1	Powder	Tandem
1 WB 115	1 PB 115	2 WB 115 + EK + 1 PB 115
2 WB 115	2 PB 115	2 WB 115 + EK + 2 PB 115
		2 WB 115 + MK + 2 WB 115

ORDERING INFORMATION

If one of the listed options is desired, please follow the dynamometer model (see table above) with a dash and then the appropriate suffix (as noted in parenthesis). For example, a Model 1 PB 115 Powder Dynamometer with an optional 600-bit speed pickup is a 1 PB 115 - DG - 600.

Example: 1 PB 115 - DG - 600

Dynamometer Model — Option

SYSTEM OPTIONS AND ACCESSORIES

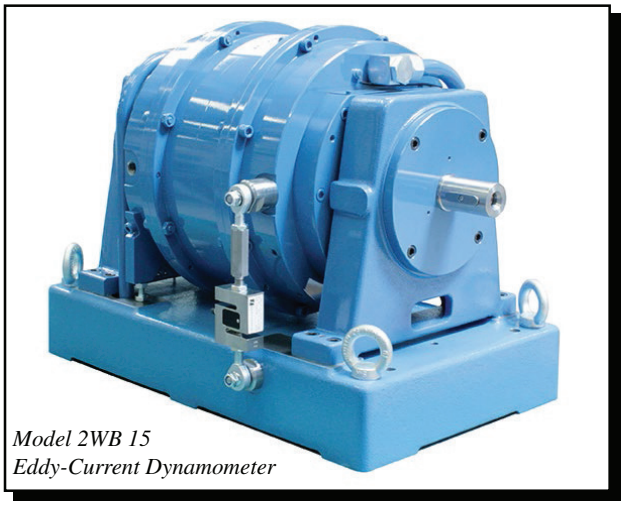
	DESCRIPTION	MODEL / PART #
ELECTRONICS	High Speed Programmable Dynamometer Controller	DSP7000
	Torque-Speed Conditioner (includes necessary cables)	TSC 401/121
	Power Supply (includes necessary cables)	DES 411/111
	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
SOFT-WARE	M-TEST 7 Motor Testing Software	M-TEST 7
	Temperature Testing Hardware	HW-TTEST
MISC	Dynamometer Table (with grooved table top)	005034
	Transformer (24 VDC) for electromagnetic clutch of tandem dynamometers	234-311-920-011
	Couplings, Thermostatic Sluice, Pressure Sensitive Switch	On Request
	Water Cooling System for Brake	On Request
	Calibration Weights	On Request

1.2.5 WB/PB 15 Series

WB/PB 15 Series Eddy-Current and Powder Dynamometers

FEATURES

- 7 Models with Maximum Torque from 140 N·m to 1200 N·m (103 lb·ft to 885 lb·ft)
- Braking Power: 12 kW to 140 kW
- Stable Braking Torque, without Shock
- Low Moment of Inertia
- Low Residual Torque
- Operation in Either Rotational Direction
- Braking Torque Measurement Included
- High Rotational Speed
- Rated Torque Available From Zero Speed (Powder Dynamometers)
- Integrated Optical Speed Sensor



Model 2WB 15
Eddy-Current Dynamometer

DESCRIPTION

Eddy-Current Brake Dynamometers (WB series) are ideal for applications requiring high speeds and also when operating in the middle to high power range. Eddy-Current Brakes provide increasing torque as the speed increases, reaching peak torque at rated speed. The dynamometers have low inertia as a result of small rotor diameter. Brake cooling is provided by a water circulation system, which passes inside the stator to dissipate heat generated by the braking power. The water cooling in the WB provides high continuous power ratings (max. 140 kW).

Powder Brake Dynamometers (PB series) are ideal for applications operating in the low to middle speed range or when operating in the middle to high torque range. Powder Brakes provide full torque at zero speed and are water-cooled, allowing for power ratings up to 48 kW. Both WB and PB Dynamometers have accuracy ratings of ±0.3% 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

Mounted on test benches, WB/PB 15 Series Dynamometers allow performance and reliability testing on driving elements such as electric motors, combustion engines, servomotors, geared motors, reduction gears, pneumatic equipment, hydraulic transmission systems, starter motors, electromagnetic clutches, gas turbines and turbocompressors.

MOTOR TESTING SYSTEMS

Magtrol's M-TEST 7 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol DSP7000 Programmable Dynamometer Controller, Magtrol M-TEST 7 Software provides the control of any Magtrol Eddy-Current or Powder Brake 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.

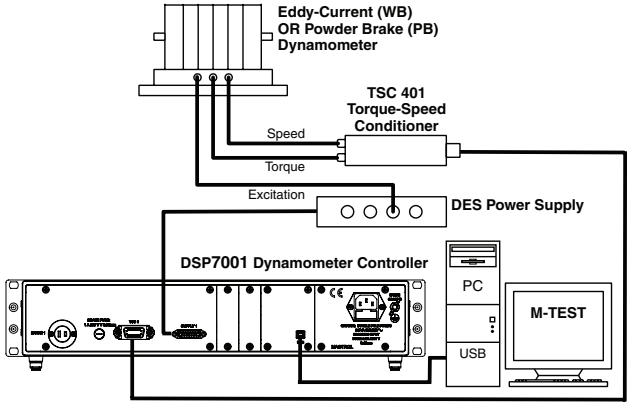
Written in LabVIEW™, M-TEST 7 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermocouples), controlling motor power and providing audio/visual indicators is relatively easy.

Magtrol's M-TEST 7 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.

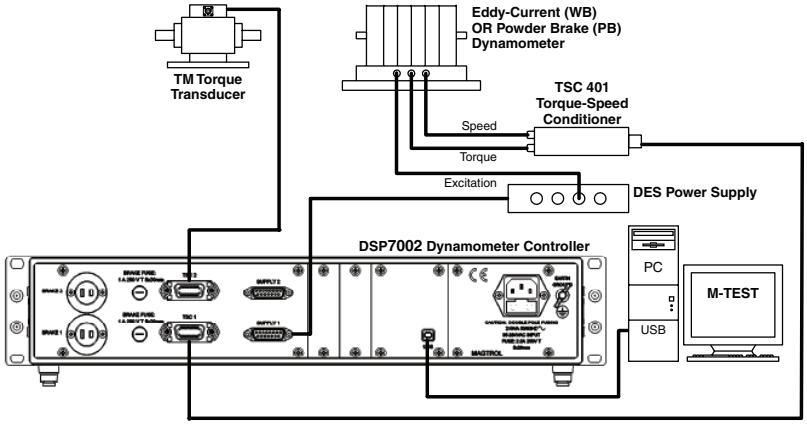
System Configurations WB/PB 15

SINGLE DYNAMOMETER CONFIGURATIONS

The Dynamometers can be complemented by various electronic modules such as the DES 411 Power Supply, TSC 401 Torque/ Speed Conditioner and DSP7000 High Speed Programmable Dynamometer Controller.

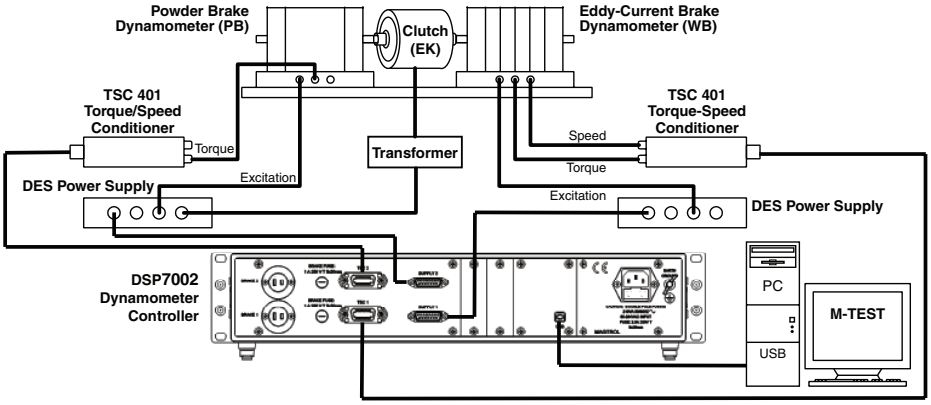


Magtrol also offers In-Line Torque Transducers, which employ a unique non-contact differential transformer torque measuring technology providing extremely accurate torque and speed measurement with superior electrical noise immunity. For a dynamic, high-precision system, the torque transducer can be mounted in line between the unit under test and the dynamometer.



TANDEM CONFIGURATION

Magtrol offers Eddy-Current and Powder Dynamometers mounted in tandem. In tandem, the unique features of each type of dynamometer brake are utilized, allowing the unit under test to be applied with nominal braking torque from zero speed to maximum rotation. The Tandem Dynamometers are available on a number of WB/PB combinations.



Specifications WB 15

EDDY-CURRENT DYNAMOMETER OPERATING PRINCIPLES

The WB Eddy-Current Dynamometers develop their full power at high rotation speeds. The 15 Series is particularly intended for motors which rotate at high speeds, up to 7500 rpm. The braking torque depends on the rotation speed.

WB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*lb·ft*	*N·m*	*lb·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*A*
1 WB 15	140	103	1.4	12.3	5.00×10^{-2}	3.68×10^{-2}	35	2390	7500	4
2 WB 15	280	206	2.8	24.7	1.00×10^{-1}	7.37×10^{-2}	70	2390	7500	7.5
3 WB 15	420	309	4.2	37.1	1.50×10^{-1}	1.10×10^{-1}	105	2390	7500	10
4 WB 15	560	413	5.6	49.5	2.00×10^{-1}	1.47×10^{-1}	140	2390	7500	12

** Voltage at 20 °C is 45 volts.*

Optical Speed Sensor

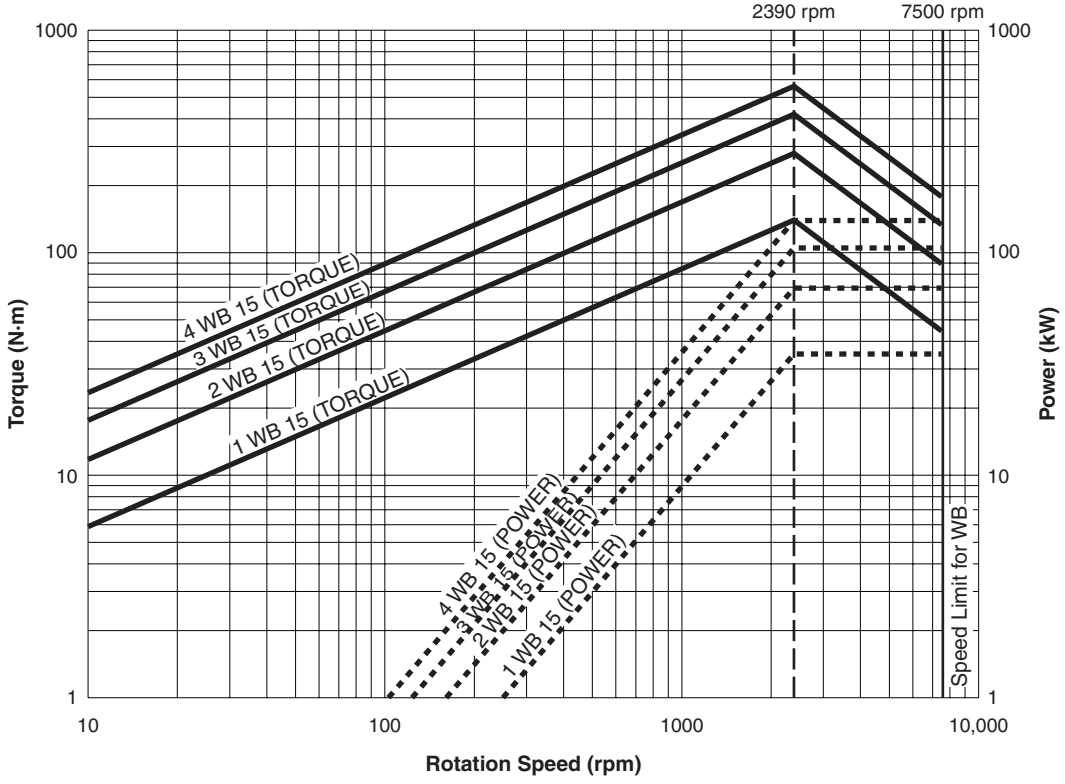
Each 15 Series WB Dynamometer has an optical speed sensor with a 60-bit pulse wheel delivered as standard.

Cooling Water Consumption

For all WB models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

WB TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 15 Series Eddy-Current Dynamometers.



Specifications PB 15

POWDER DYNAMOMETER OPERATING PRINCIPLES

The PB Powder Dynamometers contain, as their name suggests, a magnetic powder. The electrical current passing through the coil generates a magnetic field, which changes the property of the powder, thus producing a smooth braking torque through friction between rotor and stator. The Powder Dynamometers (PB) produce their rated torque at zero speed. The element to be tested can be loaded at standstill to determine the starting torque.

PB DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*lb·ft*	*N·m*	*lb·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*A*
1 PB 15	300	221	6	53	5.40×10^{-2}	3.98×10^{-2}	12	382	2000	4
2 PB 15	600	442	12	106	1.08×10^{-1}	7.96×10^{-2}	24	382	2000	7.5
4 PB 15	1200	885	24	212	2.16×10^{-1}	1.59×10^{-1}	48	382	2000	12

* *Voltage at 20 °C is 45 volts.*

Optical Speed Sensor

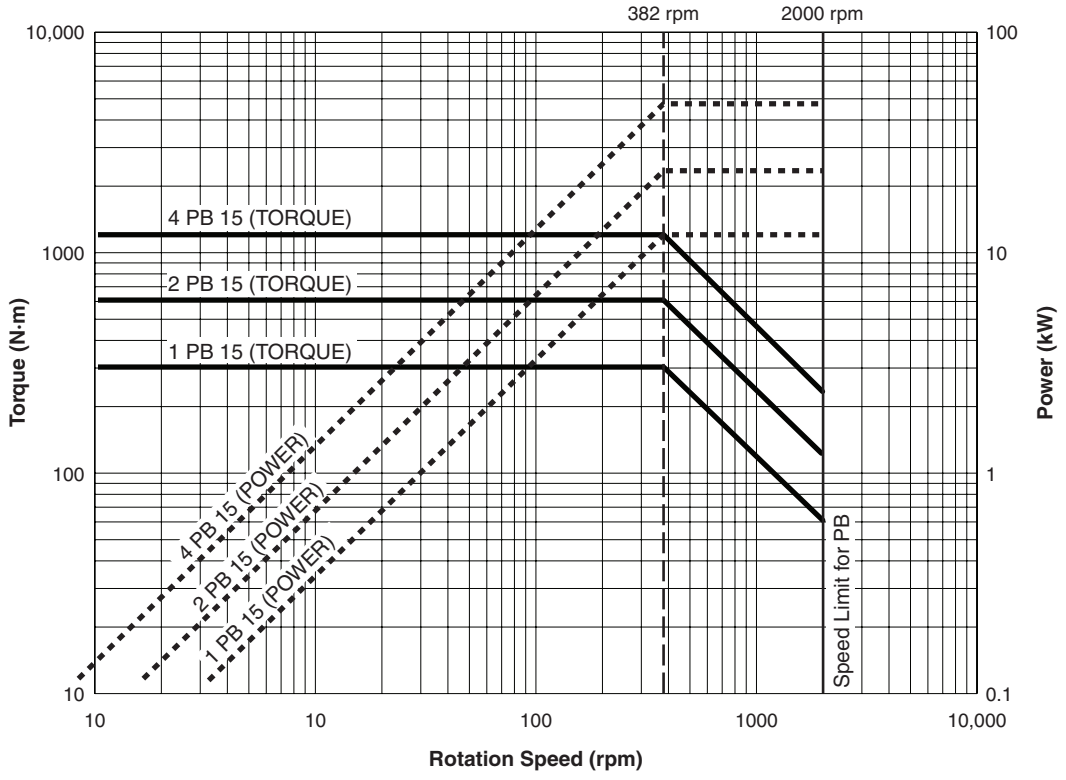
Each 15 Series PB Dynamometer has an optical speed sensor with a 60-bit pulse wheel delivered as standard. For better speed resolution in low speed applications, Magtrol offers a 600-bit or 6000-bit speed pickup (encoder) as an option.

Cooling Water Consumption

For all PB models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

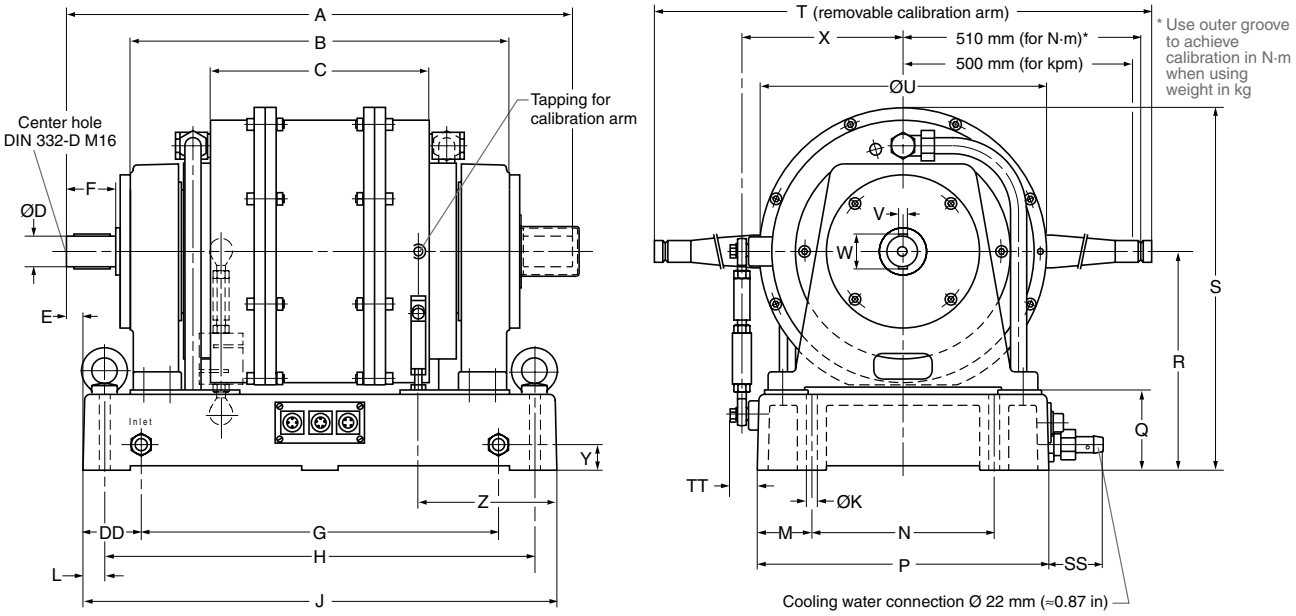
PB TORQUE–SPEED–POWER CURVES

The diagram below shows the characteristic curves for the 15 Series Powder Dynamometers.



Specifications WB/PB 15

SINGLE DYNAMOMETER DIMENSIONS



NOTE:
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 decimal places.

Model	units	A	B	C	D	E	F	G	H	J	K	L	M	N	P
1 WB 15 / 1 PB 15	*mm*	544	370	150	Ø 42g6	-53	68	490	590	650	Ø 15	30	75	250	400
	in	21.42	14.57	5.91	Ø 1.6531 1.6526	-2.09	2.68	19.29	23.23	25.59	Ø 0.59	1.18	2.95	9.84	15.75
2 WB 15 / 2 PB 15	*mm*	694	520	300	Ø 42g6	22	68	490	590	650	Ø 15	30	75	250	400
	in	27.32	20.47	11.81	Ø 1.6531 1.6526	0.87	2.68	19.29	23.23	25.59	Ø 0.59	1.18	2.95	9.84	15.75
3 WB 15	*mm*	844	670	450	Ø 42g6	-78	68	840	940	1000	Ø 15	30	75	250	400
	in	33.23	26.38	17.72	Ø 1.6531 1.6526	-3.07	2.68	33.07	37.01	39.37	Ø 0.59	1.18	2.95	9.84	15.75
4 WB 15 / 4 PB 15	*mm*	994	820	600	Ø 42g6	-3	68	840	940	1000	Ø 15	30	75	250	400
	in	39.13	32.28	23.62	Ø 1.6531 1.6526	-0.12	2.68	33.07	37.01	39.37	Ø 0.59	1.18	2.95	9.84	15.75

Model	units	Q	R	S	T	U	V	W	X	Y	Z	DD	SS	TT	Weight
1 WB 15 / 1 PB 15	*mm*	110	300 ±0.2	498	1030	Ø 395	12	48	220	35	265	80	75	37	185 kg
	in	4.33	11.819 11.803	19.61	40.55	Ø 15.55	0.47	1.89	8.66	1.38	10.43	3.15	2.95	1.46	407.86 lb
2 WB 15 / 2 PB 15	*mm*	110	300 ±0.2	498	1030	Ø 395	12	48	220	35	190	80	75	37	290 kg
	in	4.33	11.819 11.803	19.61	40.55	Ø 15.55	0.47	1.89	8.66	1.38	7.48	3.15	2.95	1.46	639.34 lb
3 WB 15	*mm*	110	300 ±0.2	498	1030	Ø 395	12	48	220	35	290	80	75	37	385 kg
	in	4.33	11.819 11.803	19.61	40.55	Ø 15.55	0.47	1.89	8.66	1.38	11.42	3.15	2.95	1.46	848.78 lb
4 WB 15 / 4 PB 15	*mm*	110	300 ±0.2	498	1030	Ø 395	12	48	220	35	215	80	75	37	520 kg
	in	4.33	11.819 11.803	19.61	40.55	Ø 15.55	0.47	1.89	8.66	1.38	8.46	3.15	2.95	1.46	1146.40 lb

Tandem Specifications WB/PB 15

TANDEM OPERATING PRINCIPLES

Because the characteristics of the WB and PB dynamometers are complementary, Magtrol is able to offer them mounted in a tandem setup. Each dynamometer (WB and PB) can autonomously operate according to its own characteristics. An electromagnetic clutch is needed for this application which automatically switches off at the maximum speed of the PB Powder Dynamometer and automatically switches on at zero speed.

TANDEM DYNAMOMETER RATINGS

Model	Rated Torque		Drag Torque De-energized		Nominal Input Inertia		Rated Power	Rated Speed	Max. Speed	Excitation Current*
	N·m	*lb·ft*	*N·m*	*lb·in*	*kg·m²*	*lb·ft·s²*	*kW*	*rpm*	*rpm*	*A*
2 WB 15 + EK + 1 PB 15	300	221	8.8	77	1.77×10^{-1}	1.31×10^{-1}	70	2390	7500	7.5
2 WB 15 + EK + 2 PB 15	600	442	14.8	130	2.31×10^{-1}	1.70×10^{-1}	70	2390	7500	7.5
2 WB 15 + EK + 4 PB 15	1200	885	26.8	237	3.39×10^{-1}	2.50×10^{-1}	70	2390	7500	12
4 WB 15 + EK + 1 PB 15	300	221	11.6	102	2.77×10^{-1}	2.04×10^{-1}	140	2390	7500	12
4 WB 15 + EK + 2 PB 15	600	442	17.6	155	3.31×10^{-1}	2.44×10^{-1}	140	2390	7500	12
4 WB 15 + EK + 4 PB 15	1200	885	29.6	261	4.39×10^{-1}	3.23×10^{-1}	140	2390	7500	12

** Voltage at 20 °C is 45 volts.*

Optical Speed Sensor

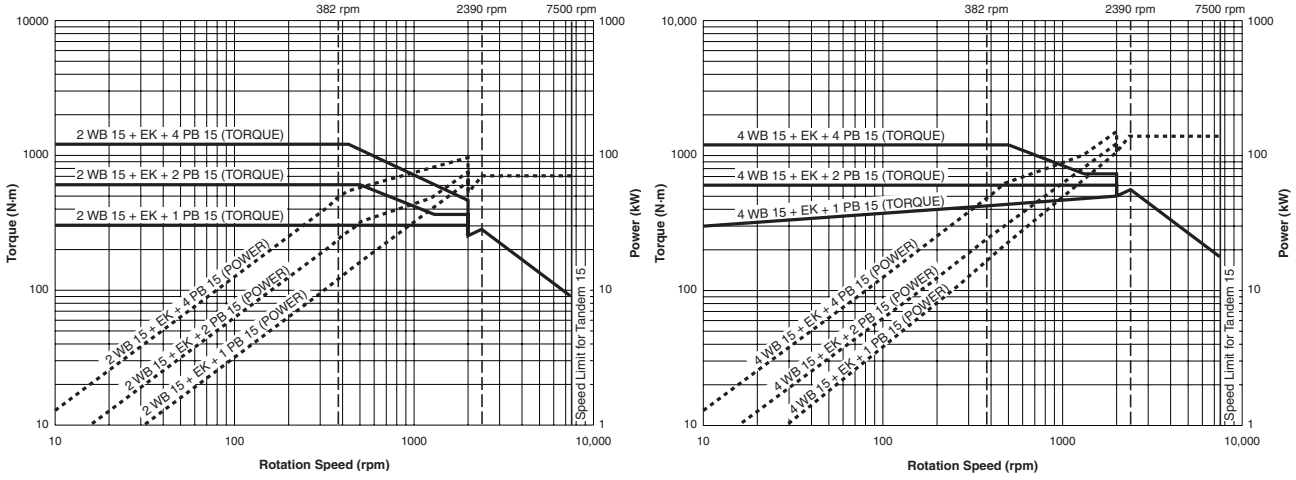
Each 15 Series Tandem Dynamometer has an optical speed sensor with a 60-bit pulse wheel delivered as standard.

Cooling Water Consumption

For all Tandem models: ≈ 30 l/kWh at Δt = 30 °C (Metric)
≈ 8 gal/kWh at Δt = 86 °F (US)

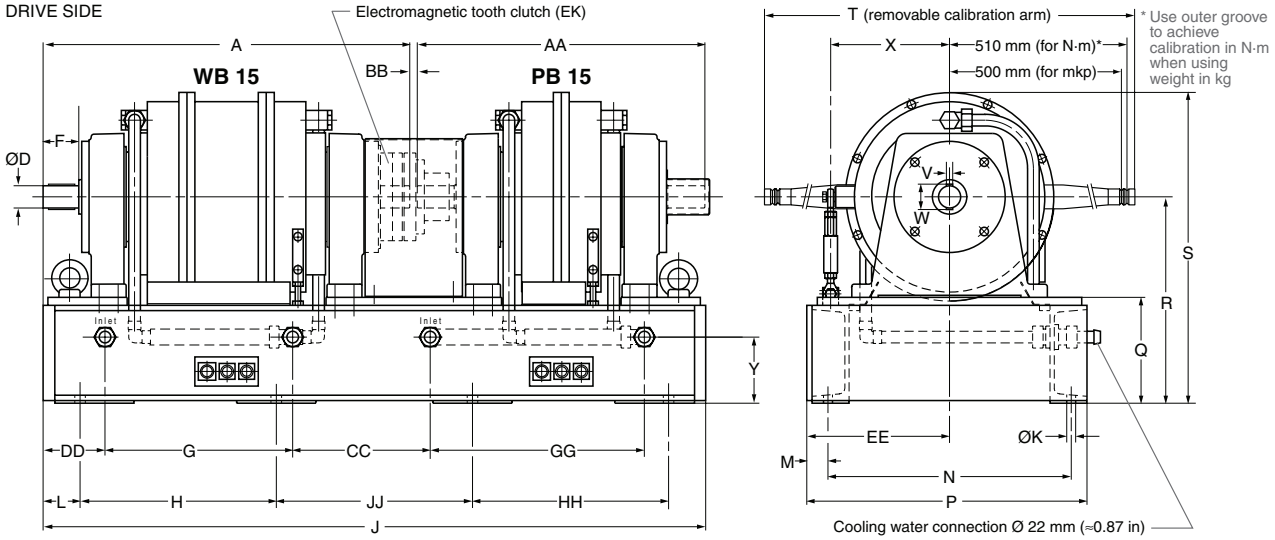
TANDEM TORQUE–SPEED–POWER CURVES

The diagrams below show the characteristic curves for the 15 Series Tandem Dynamometers.



Tandem Specifications WB/PB 15

TANDEM DIMENSIONS



NOTE:
Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 decimal places.

Model	units	A	D	F	G	H	J	K	L	M	N	P	Q	R	S
2 WB 15 + EK + 1 PB 15	*mm*	694	Ø 42g6	68	355	371	1253	Ø 17	70	40	460	530	200	390 ±0.2	588
	in	27.32	Ø 1.6531 1.6526	2.68	13.98	14.61	49.33	Ø 0.67	2.76	1.57	18.11	20.87	7.87	15.362 15.346	23.15
2 WB 15 + EK + 2 PB 15	*mm*	694	Ø 42g6	68	355	371	1403	Ø 17	70	40	460	530	200	390 ±0.2	588
	in	27.32	Ø 1.6531 1.6526	2.68	13.98	14.61	55.24	Ø 0.67	2.76	1.57	18.11	20.87	7.87	15.362 15.346	23.15
2 WB 15 + EK + 4 PB 15	*mm*	694	Ø 42g6	68	355	521	1703	Ø 17	70	40	460	530	200	390 ±0.2	588
	in	27.32	Ø 1.6531 1.6526	2.68	13.98	20.51	67.05	Ø 0.67	2.76	1.57	18.11	20.87	7.87	15.362 15.346	23.15
4 WB 15 + EK + 1 PB 15	*mm*	994	Ø 42g6	68	655	521	1553	Ø 17	70	40	460	530	200	390 ±0.2	588
	in	39.13	Ø 1.6531 1.6526	2.68	25.79	20.51	61.14	Ø 0.67	2.76	1.57	18.11	20.87	7.87	15.362 15.346	23.15
4 WB 15 + EK + 2 PB 15	*mm*	994	Ø 42g6	68	655	521	1703	Ø 17	70	40	460	530	200	390 ±0.2	588
	in	39.13	Ø 1.6531 1.6526	2.68	25.79	20.51	67.05	Ø 0.67	2.76	1.57	18.11	20.87	7.87	15.362 15.346	23.15
4 WB 15 + EK + 4 PB 15	*mm*	994	Ø 42g6	68	655	590	2003	Ø 17	70	40	460	530	200	390 ±0.2	588
	in	39.13	Ø 1.6531 1.6526	2.68	25.79	23.23	78.86	Ø 0.67	2.76	1.57	18.11	20.87	7.87	15.362 15.346	23.15

Model	units	T	V	W	X	Y	AA	BB	CC	DD	EE	GG	HH	JJ	Weight
2 WB 15 + EK + 1 PB 15	*mm*	1030	12	48	225	125	544	14	260	117	270 ±0.1	405	371	371	485 kg
	in	40.55	0.47	1.89	8.86	4.92	21.42	0.55	10.24	4.61	10.634 10.626	15.94	14.61	14.61	1069.24 lb
2 WB 15 + EK + 2 PB 15	*mm*	1030	12	48	225	125	694	14	260	117	270 ±0.1	555	471	421	590 kg
	in	40.55	0.47	1.89	8.86	4.92	27.32	0.55	10.24	4.61	10.634 10.626	21.85	18.54	16.57	1300.73 lb
2 WB 15 + EK + 4 PB 15	*mm*	1030	12	48	225	125	994	14	260	117	270 ±0.1	855	521	521	820 kg
	in	40.55	0.47	1.89	8.86	4.92	39.13	0.55	10.24	4.61	10.634 10.626	33.66	20.51	20.51	1807.79 lb
4 WB 15 + EK + 1 PB 15	*mm*	1030	12	48	225	125	544	14	260	117	270 ±0.1	405	471	421	715 kg
	in	40.55	0.47	1.89	8.86	4.92	21.42	0.55	10.24	4.61	10.634 10.626	15.94	18.54	16.57	1576.31 lb
4 WB 15 + EK + 2 PB 15	*mm*	1030	12	48	225	125	694	14	260	117	270 ±0.1	555	521	521	820 kg
	in	40.55	0.47	1.89	8.86	4.92	27.32	0.55	10.24	4.61	10.634 10.626	21.85	20.51	20.51	1807.79 lb
4 WB 15 + EK + 4 PB 15	*mm*	1030	12	48	225	125	994	14	260	117	270 ±0.1	855	590	683	1050 kg
	in	40.55	0.47	1.89	8.86	4.92	39.13	0.55	10.24	4.61	10.634 10.626	33.66	23.23	26.89	2314.85 lb

Ordering Information

WB/PB 15

DYNAMOMETER OPTIONS

Industrial Version (IS)

Single WB and PB Dynamometers are also available in an industrial version which includes bearing supports, but does not provide a base plate, or torque and speed measurement.

Vertical Mounting (V)

Vertical Mounting is available on the Eddy-Current (WB) Dynamometer only. The vertical version has an adapted bearing fitting and its maximum speed is limited.

Speed Pickup (DG)

All models, including tandems, are equipped with a 60-bit optical speed sensor. On PB Dynamometers, a 600-bit or 6000-bit speed pickup (encoder) is available as an option for low speed applications.

Mechanical Rotor Blocking Device (MB)

A mechanical rotor blocking device, which allows locked rotor testing, is available for the WB Dynamometer.

DYNAMOMETER MODELS

Eddy-Current	Powder	Tandem
1 WB 15	1 PB 15	2 WB 15 + EK + 1 PB 15
2 WB 15	2 PB 15	2 WB 15 + EK + 2 PB 15
3 WB 15	4 PB 15	2 WB 15 + EK + 4 PB 15
4 WB 15		4 WB 15 + EK + 1 PB 15
		4 WB 15 + EK + 2 PB 15
		4 WB 15 + EK + 4 PB 15

ORDERING INFORMATION

If one of the listed options is desired, please follow the dynamometer model (see table above) with a dash and then the appropriate suffix (as noted in parenthesis). For example, a Model 1 PB 15 Powder Dynamometer with an optional 6000-bit speed pickup is a 1 PB 15 - DG - 6000.

Example: 1 PB 15 - DG - 6000

Dynamometer Model — Option

SYSTEM OPTIONS AND ACCESSORIES

	DESCRIPTION	MODEL / PART #
ELECTRONICS	High Speed Programmable Dynamometer Controller	DSP7000
	Torque-Speed Conditioner (includes necessary cables)	TSC 401/121
	Power Supply (includes necessary cables)	DES 411/121
	High Speed Single-Phase Power Analyzer	6510*e*
	High Speed Three-Phase Power Analyzer	6530
SOFT-WARE	M-TEST 7 Motor Testing Software	M-TEST 7
	Temperature Testing Hardware	HW-TTEST
MISC	Dynamometer Table for (with grooved table top) 1 & 2 WB/PB 15 Series Dynamometers	005476
	Water Cooling Kit for DES 411/121 Power Supply (for 2, 3 and 4 WB or 2 and 4 PB 15)	234-311-900-011
	Transformer (24 VDC) for electromagnetic clutch of tandem dynamometers	234-311-920-011
	Couplings, Thermostatic Sluice, Pressure Sensitive Switch	On Request
	Water Cooling System for Brake	On Request
	Calibration Weights	On Request

2. Installation / Mounting

The dynamometer lifespan (before overhauling) may vary from a few months to a few decades, depending on the application, but equally depending on the way it has been mounted. By mounting the dynamometer as described in the following sections, the operating life as well as the measuring precision of the unit may be increased considerably.

2.1 LOCKING THE DYNAMOMETER FOR TRANSPORT

Dynamometers are equipped with a load cell for measuring the torque generated by the tested system on the brake. The load measuring cell is a precision instrument which must be protected from shocks during transport in order to guaranty the measurement repeatability. Therefore, all Magtrol WB/PB Dynamometers are fitted with a locking system in order to protect the load cell during transport.

The dynamometer can only be used after removing that model's specific locking device. The unlocking procedure is described for each dynamometer model in *sections 2.1.1 though 2.1.5*.

Note: All dynamometers, except the WB/PB 2.7 Series, have to be mounted on the test bench **prior to** the removal of the load cell protection device. This prevents damage to the load cell transducer during dynamometer installation.

CAUTION: TO PREVENT DAMAGE TO THE LOAD CELL, THE DYNAMOMETER MUST BE LOCKED BEFORE MOVING OR SHIPPING.

2.1.1 WB/PB 2.7 Series

Before mounting any WB/PB 2.7 Series Dynamometer to the test bench, the load cell must first be unlocked. The shipping/restraining pin of the locking system is found on the lower part of the brake. Proceed as follows and refer to *figure 2–1* to unlock the dynamometer:

1. Loosen the fixing screw ①.
2. Remove the shipping/restraining pin ②, and re-insert it with the thinner part inside.
3. Tighten the screw ①.

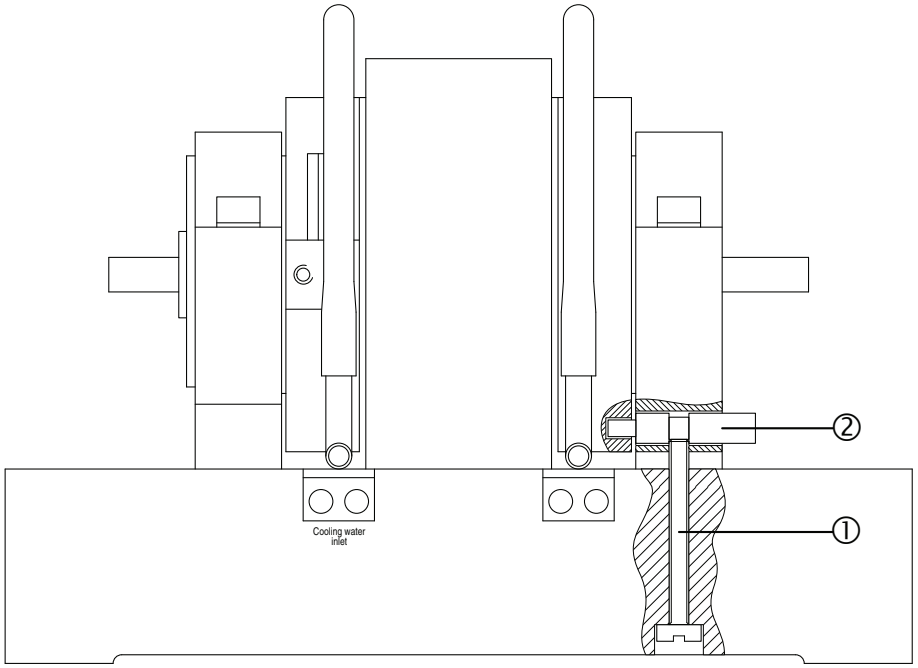


Figure 2–1 WB/PB 2.7 Load Cell Locking System

2.1.2 WB/PB 43 Series

WB/PB 43 Series Dynamometers are fitted with a connecting screw between the stator assembly and the load cell. After installing the dynamometer on a test bench, fasten the connecting screw to get the load cell operational. Proceed as follows and refer to *figure 2–2*:

CAUTION: WHILE TIGHTENING THE SCREW ①, KEEP THE WRENCH PARALLEL TO THE VERTICAL CONNECTING ROD TO AVOID LOAD CELL OVERLOAD.

1. Insert the hexagon cap screw ① supplied with the dynamometer into the rod end ②.
2. Fasten the screw ①.

Note: The overload protection screws and nuts ③ and ④ are adjusted at the factory (refer to *Chapter 6 – Calibration* for possible adjustments).

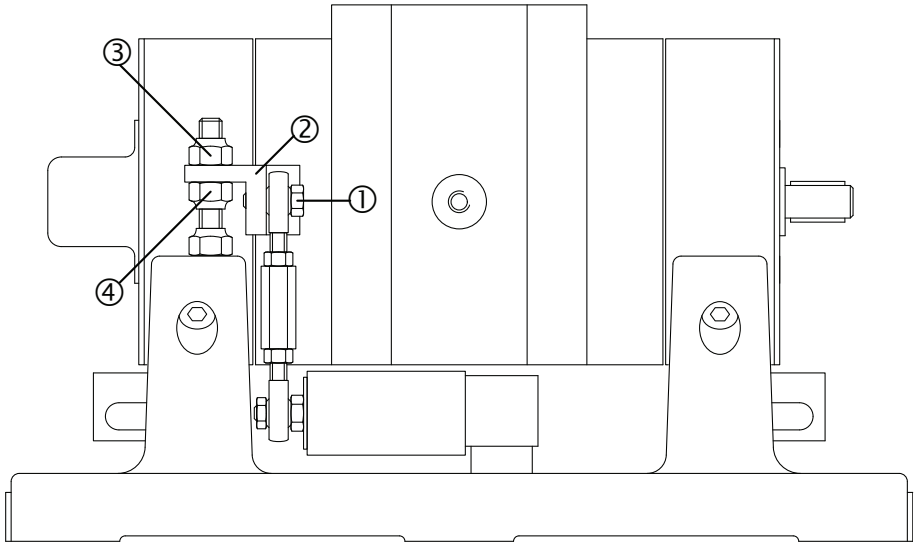


Figure 2–2 WB/PB 43 Load Cell Locking System

2.1.3 WB/PB 65 Series

WB/PB 65 Series Dynamometers are fitted with a mechanical stator assembly locking device protecting the load cell during transport. After installing the dynamometer on the test bench, proceed as follows and refer to *figure 2–3* to unlock the system:

1. Loosen the two nuts ②.
2. Unscrew the two screws ① with three turns.
3. Tighten the two nuts ②.

Note: The screws and nuts for overload protection ③ and ④ are adjusted at the factory (refer to *Chapter 6 – Calibration* for possible adjustments).

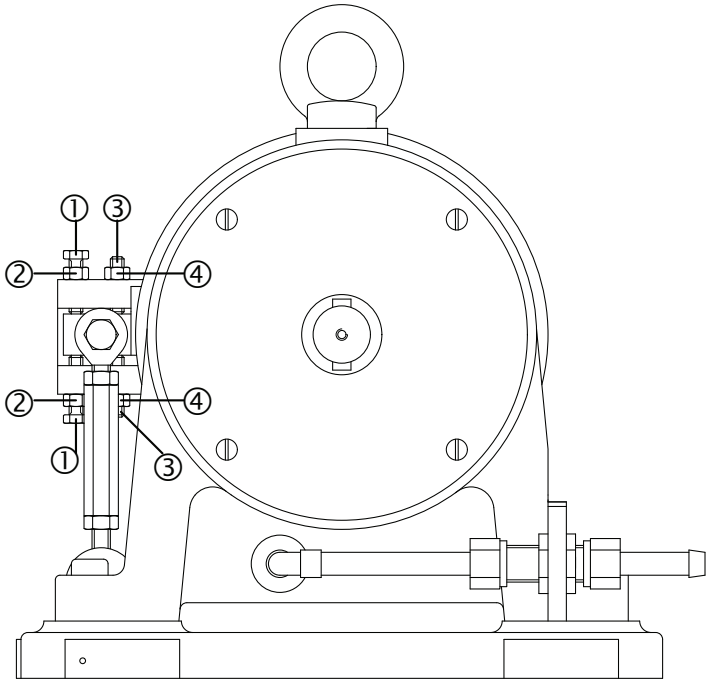


Figure 2–3 WB/PB 65 Load Cell Locking System

2.1.4 WB/PB 115 Series

WB/PB 115 Series Dynamometers are fitted with a mechanical stator assembly locking device protecting the load cell during transport. After installing the dynamometer on the test bench, proceed as follows and refer to *figure 2–4* to unlock the system:

1. Loosen the two nuts ②.
2. Unscrew the two screws ① with three turns.
3. Tighten the two nuts ②.

Note: The screws and nuts for overload protection ③ and ④ are adjusted in the factory (refer to *Chapter 6 – Calibration* for possible adjustments).

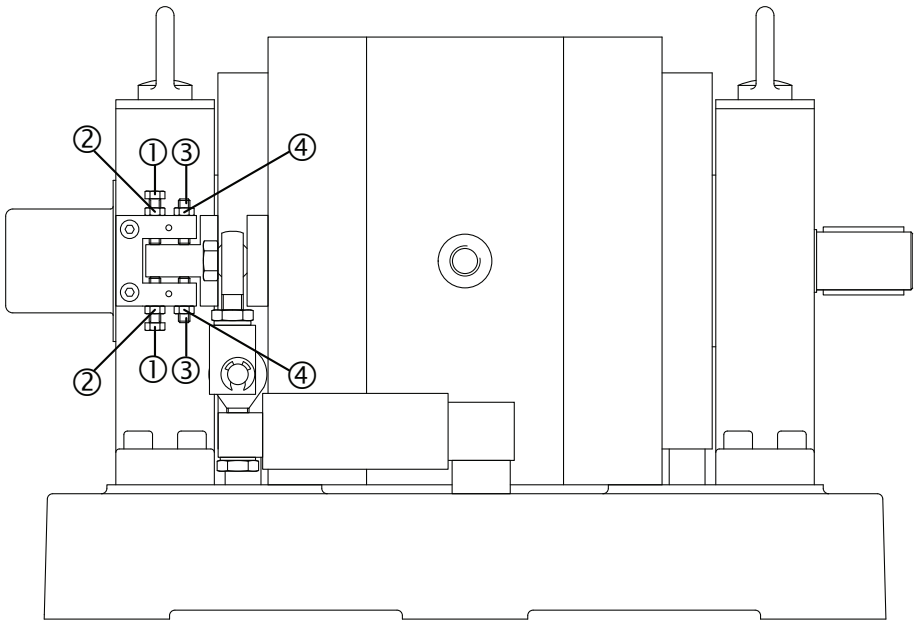


Figure 2–4 WB/PB 115 Load Cell Locking System

2.1.5 WB/PB 15 Series

WB/PB 15 Series Dynamometers are fitted with a mechanical stator assembly locking device protecting the load cell during transport. After installing the dynamometer on the test bench, proceed as follows and refer to *figure 2–5* to unlock the system:

1, Screw the nuts ① on each side of the dynamometer with three turns.

2, Unscrew the nuts ② on each side of the dynamometer until they touch the nuts ①. A minimum clearance of 0.4 mm between the nuts ① and the dynamometer locking device is requested.

Note: The WB/PB 15 Series Dynamometers are not fitted with overload protection systems. The load cell ③ is strong enough to cope with any overload occurring during normal dynamometer use.

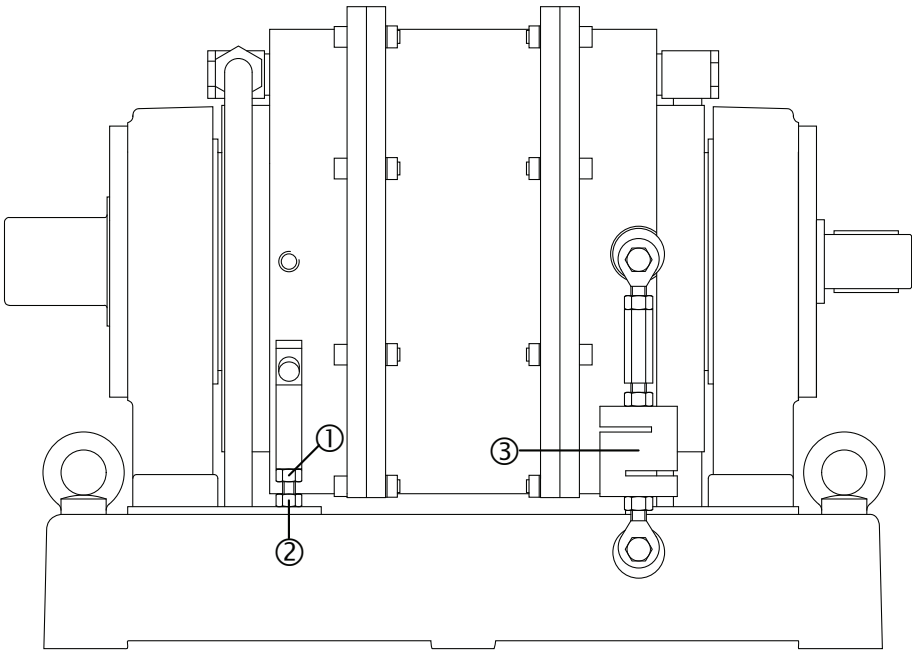


Figure 2–5 WB/PB 15 Load Cell Locking System

WARNING: WHEN THE DYNAMOMETER IS LOCKED DURING TRANSPORT, THE LOAD CELL SHOULD NOT BE UNDER MECHANICAL STRESS (COMPRESSION OR TRACTION).

2.2 MOUNTING THE DYNAMOMETER TO THE TEST BENCH

The dynamometer should be placed on a stable horizontal base plate—preferably constructed of cast iron, steel or aluminum—in order to eliminate vibrations to the greatest extend possible. Flatness defects should not exceed 0.05 mm. In addition, the dynamometer frame must withstand the torque transmitted by the dynamometer without deformation.

Note: Magtrol offers standard and custom dynamometer tables specially designed to support the entire range of Magtrol dynamometers.

The dynamometer is mounted onto the bench by means of four screws. The size of these screws depends on the dynamometer model. Tandem dynamometers require stronger screws than single dynamometers. Refer to the data sheet of the corresponding dynamometer (*see Section 1.2*) for additional information on the screw type and size.

2.2.1 ALIGNING THE DYNAMOMETERS ON THE TEST BENCH

The proper alignment of the dynamometer with the motor under test is very important. The higher the speed of the test, the more care must be taken when performing the alignment. The maximum tolerated misalignment depends on the selected coupling.

With high-speed Eddy-current dynamometers (WB-HS), 0.01 mm may be tolerated. With magnetic powder dynamometers (PB) operating at lower maximum speeds, a misalignment of up to 0.1 mm is acceptable.

2.2.2 VIBRATIONS INDUCED BY THE TEST BENCH

Vibrations generate premature wear of the bearings. Since modifying the motor under test in order to prevent any vibration is not feasible, measures will have to be taken to forestall any damage to the dynamometer.

In order to evaluate motors producing vibrations (for instance, combustion engines), the motors must be mounted on a heavyweight base plate equipped with vibration mounts. By doing this, the vibrations transmitted from the motor to the dynamometer will be reduced considerably.

Height differences due to varying motor loading must be taken into account. The vibration mounts should not be compressed, creating a misalignment between the motor and the dynamometer. This would affect the measurement results and damage the dynamometer.

CAUTION: OPERATING AT THE RESONANCE FREQUENCY OF THE MEASURING CHAIN WILL SEVERELY DAMAGE THE DYNAMOMETER.

2.3 COUPLINGS

The dynamometer couplings used with the motor under test is an important factor to take into consideration. In fact, a coupling which is not correctly specified for the application will lead to measuring errors and premature wear of the dynamometer.

Given the fact that the dynamometer is a precision measuring device, high quality couplings should be used. Couplings with insufficient torsion stiffness will generate unwanted sinusoidal signals on the original measuring signal.

The coupling must be dynamically balanced (Q1 for WB Series Dynamometers and Q2.5 for PB Series Dynamometers). This balancing must compensate for maximum tolerated misalignment between the motor under test and the dynamometer. For all Magtrol WB/PB Series Dynamometers, it is advisable to employ a twin (dual disc) coupling clamped onto the shaft keys (as shown in the figure below).

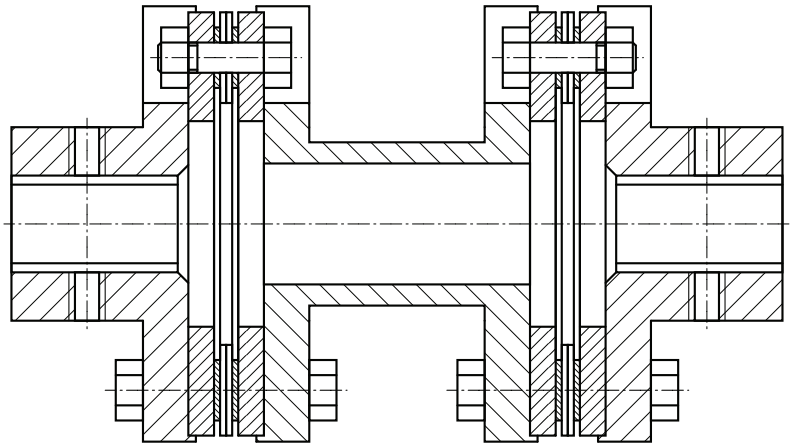


Figure 2–6 Couplings Using Key Clamping

By using this method, no slipping will damage the coupling or the dynamometer shaft. With small dynamometers such as the WB/PB 2.7 and 43 Series Dynamometers, mounting takes place by tightening onto a smooth shaft, or using a self-centering coupling with two tightening screws.

Couplings must dampen axial and radial vibration and isolate the dynamometer from vibrations generated by the tested unit, particularly in case of gas engines. With high-speed Eddy-current (WB-HS) Dynamometers, consult your Magtrol representative for the best suited coupling for your specific application.

Note: With more than 50 years of experience in the field of motor testing, Magtrol is your best partner to determine the best suited dynamometer for any given application.

2.4 MEASURING RANGE

As with most transducers, dynamometers should be operated in the upper part of their measuring range, between 10% and 100% of their rating.

2.5 DRAG TORQUE

Magtrol dynamometers are characterized by a low drag torque: approximately 1% of the rated torque for WB Series Dynamometers and approximately 2% for PB Series Dynamometers. Refer to the corresponding data sheets (*see Section 1.2*) for the maximum drag torque values of each model.

Drag torque (which is measured by the dynamometer) is generated by friction originating from the bearings, the contact between the powder and the rotor unit in magnetic powder brakes, as well as all other mechanical contacts.

2.6 TOLERATED RADIAL AND AXIAL FORCES

Note: Any radial or axial force exercised on a dynamometer causes premature wear of the bearings, as well as an increase of the drag torque.

The following table shows the maximum axial and radial forces the WB/PB Series Dynamometer can support without being damaged:

Series	Standard version		High-speed version (HS)*	
	F_{axial} max *[N]*	F_{radial} max *[N]*	F_{axial} max *[N]*	F_{radial} max *[N]*
WB/PB 2.7	20	5	4	2.5
WB/PB 43	40	30	8	15
WB/PB 65	200	60	40	30
WB/PB 115	300	200	60	100
WB/PB 15	N/A	N/A	N/A	N/A

** Only Eddy-current (WB) Dynamometers have, as an option, a high-speed version.*

For WB-HS Dynamometers, the limit is lower in order to protect the high-performance bearings. Magtrol offers, for the same reason, a specially adapted high-speed coupling.

By applying a radial or axial force on the dynamometer, the bearings are subjected to different stresses. This hinders them from rotating freely and generates torque on the measuring line.

The side load of the measuring line is detected by the dynamometer cell. This is not an offset but a real torque, normally measured. Thus, the zero on the electronics must not be set when the dynamometer is mechanically coupled.

By slightly moving the dynamometer stator backwards and forwards when the motor is stopped, the side load disappears. If uncoupling the dynamometer makes the drag torque disappear, either the coupling will have to be changed or it will have to be realigned with the motor.

CAUTION: THE DYNAMOMETER MUST BE UNCOUPLED PRIOR TO CALIBRATION. (REFER TO *CHAPTER 6 – CALIBRATION* FOR MORE DETAILS.)

2.7 CONNECTING THE COOLING SYSTEM

Proper cooling of the dynamometer is essential to ensure a long operating life and accurate measuring results. All Magtrol WB/PB Series Dynamometers* are water-cooled to guaranty the best possible heat dissipation.

** PB 2.7 Series Dynamometers are available with (K) or without a cooling circuit.*

Note: The cooling tubes must have an inside diameter in accordance with the indications on the corresponding dynamometer data sheets (*see Section 1.2*). They must be fitted to the dynamometer using a metal ring. Also, check for correct water flow direction.

The cooling water input is marked "COOLING WATER INLET" on the dynamometer housing. The other nipple is used for the water outlet. Check for correct connections.

For more information on the dynamometer's cooling system, refer to *Chapter 3 – Cooling*.

2.8 PROTECTIVE SYSTEMS

WARNING! ALL ROTATING PARTS MUST BE FITTED WITH A PROTECTIVE SYSTEM TO ENSURE THAT THE USER, AS WELL AS ALL OTHER SURROUNDING PEOPLE AND OBJECTS, WILL NOT BE INJURED OR DAMAGED AS A RESULT OF THE MOTOR UNDER TEST BECOMING BLOCKED, A TORQUE OVERLOAD, OR ANY OTHER POTENTIAL PROBLEM.

The following precautions concerning protective equipment of the drive train must be observed:

- Protective elements must prevent access to moving parts (during test).
- Protective elements must cover all parts which can cause crushing or cutting, and protect against projections of parts having become loose.
- Avoid attaching protective elements to rotating parts.
- Keep protective elements at a sufficient distance away from rotating parts.

Figure 2–7 shows a good example of a protective system. All parts of the bench are accessible, but the covers prevent any risk to the user when closed.

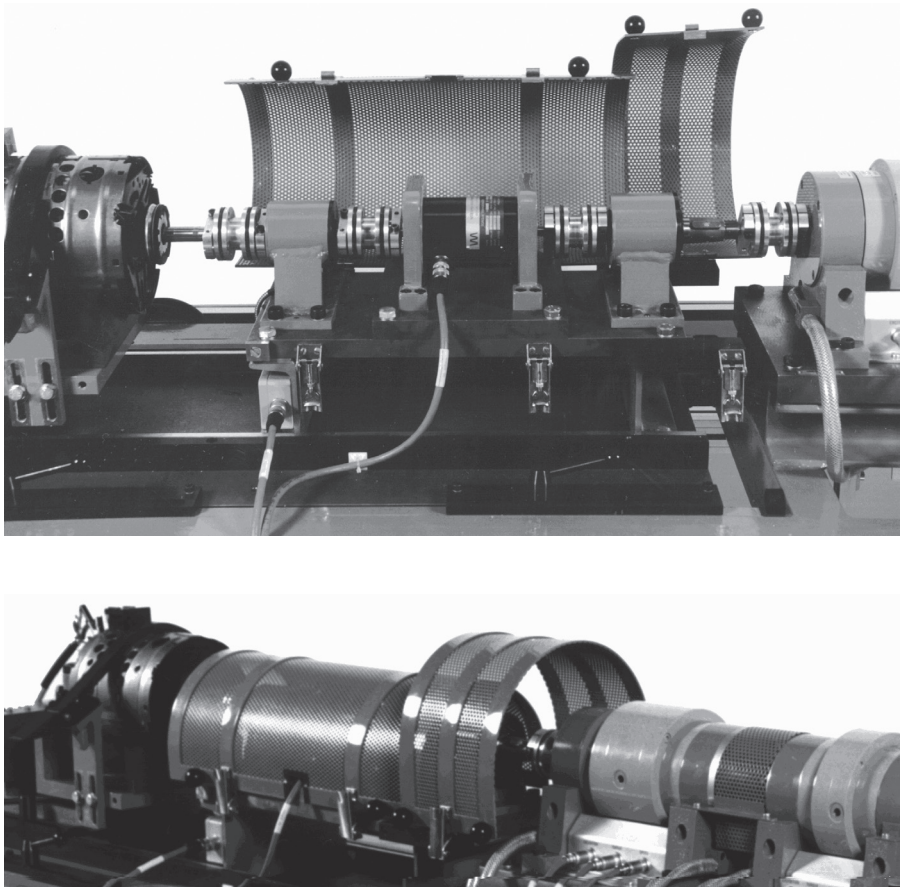


Figure 2–7 Example of Protective System

2.9 POWER/HEAT DISSIPATION

All Magtrol WB/PB Series Dynamometers are instruments which absorb energy. They convert the kinetic energy of the coupled rotating systems into heat.

The quantity of heat which can be dissipated by the dynamometers is not infinite. Additionally, the dynamometers cannot resist excessive temperatures without damage. The most frequent consequence of a too important energy supply is a premature deterioration of the excitation coils of the stator, possibly inducing serious damages to the dynamometer and even to its immediate environment.

An excessive supply of energy over a long period can induce damages, which may remain undetected if no detailed examination is performed. This can lead to a premature degradation of the bearing lubricant, or to defects of the insulation of coils generating the magnetic field.

Converesely, dynamometers should never be loaded at full speed when cold. If a motor must be tested cold, warm up the dynamometer with a different motor first.

CAUTION: IT IS IMPORTANT TO FAMILIARIZE YOURSELF WITH THE DYNAMOMETER'S RATINGS. RUNNING THE SYSTEM OUTSIDE OF THE LIMITS SPECIFIED IN THE DATA SHEETS (SEE SECTION 1.2) CAN CAUSE IRREVERSIBLE DAMAGE.

2.10 TORQUE–SPEED–POWER CURVES

The diagrams on the following pages illustrate the characteristic curves for the WB/PB Series Dynamometers.

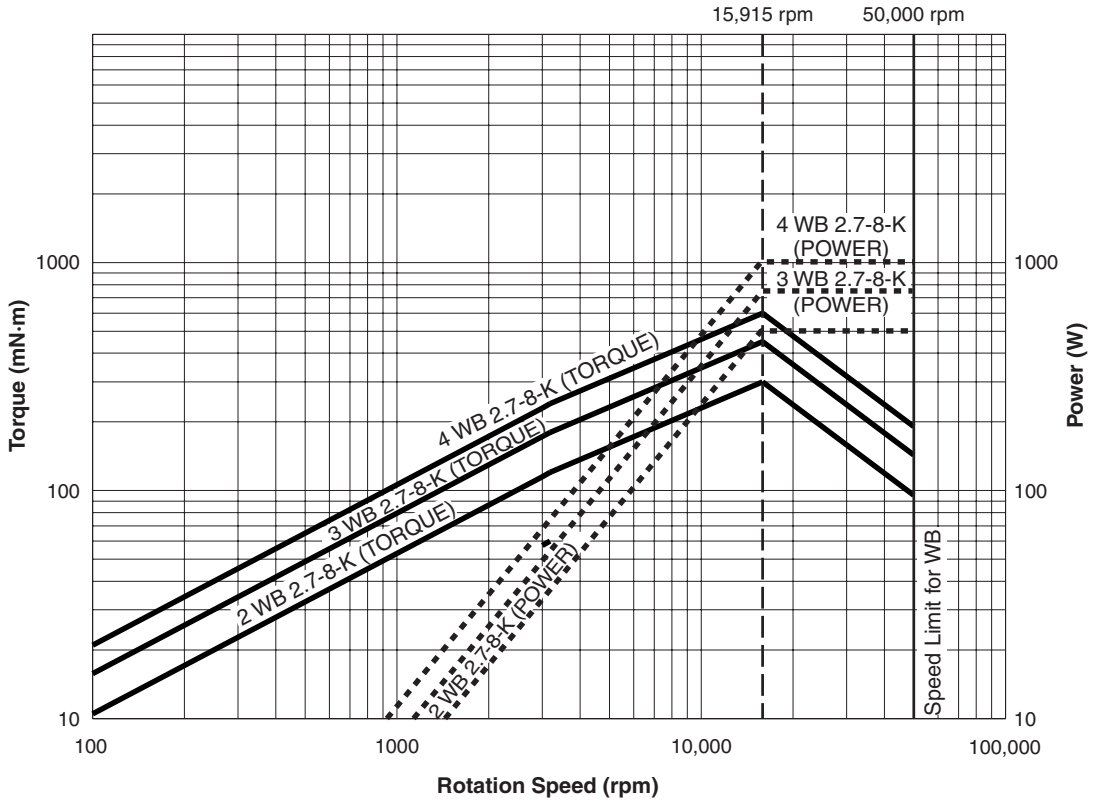


Figure 2–8 WB 2.7 Ratings Curve

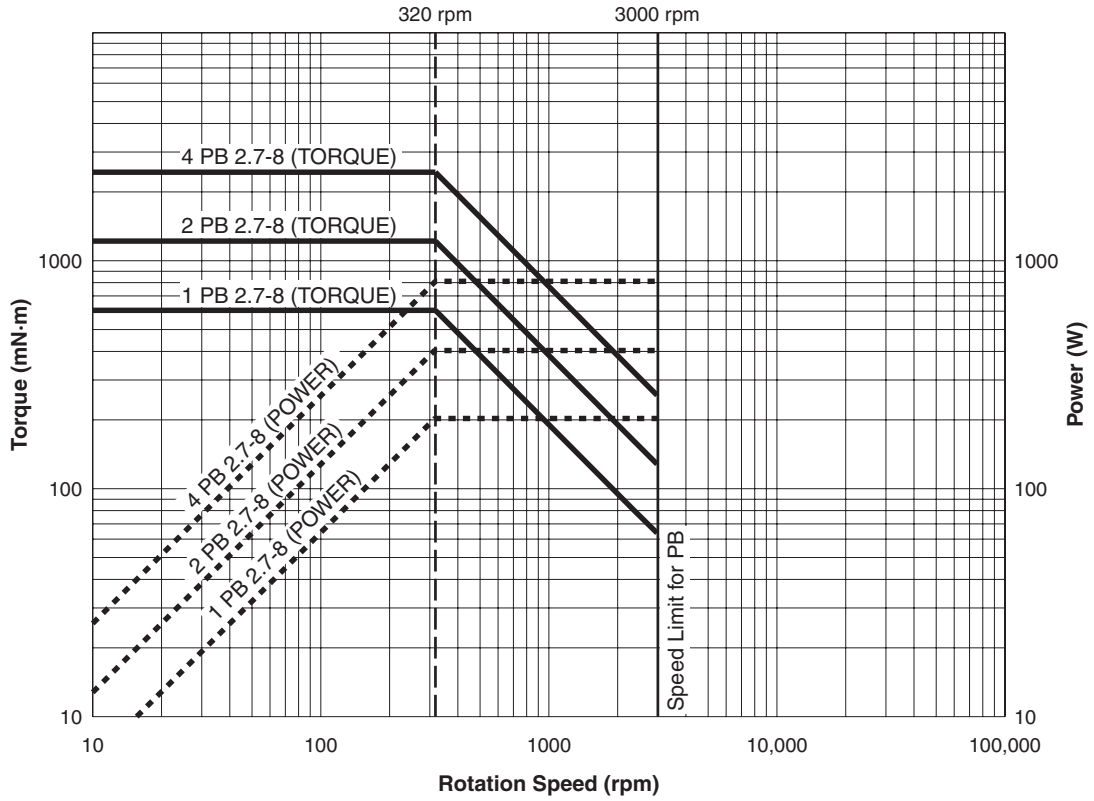


Figure 2–9 PB 2.7 Ratings Curve

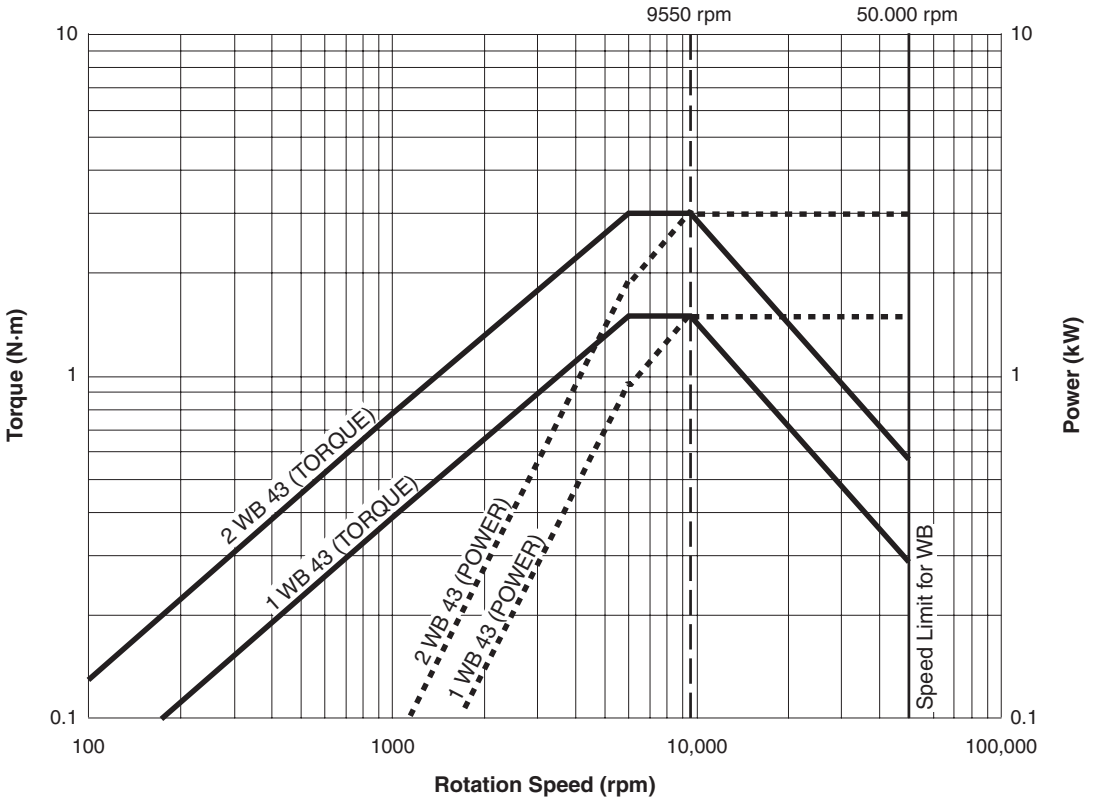


Figure 2–10 WB 43 Ratings Curve

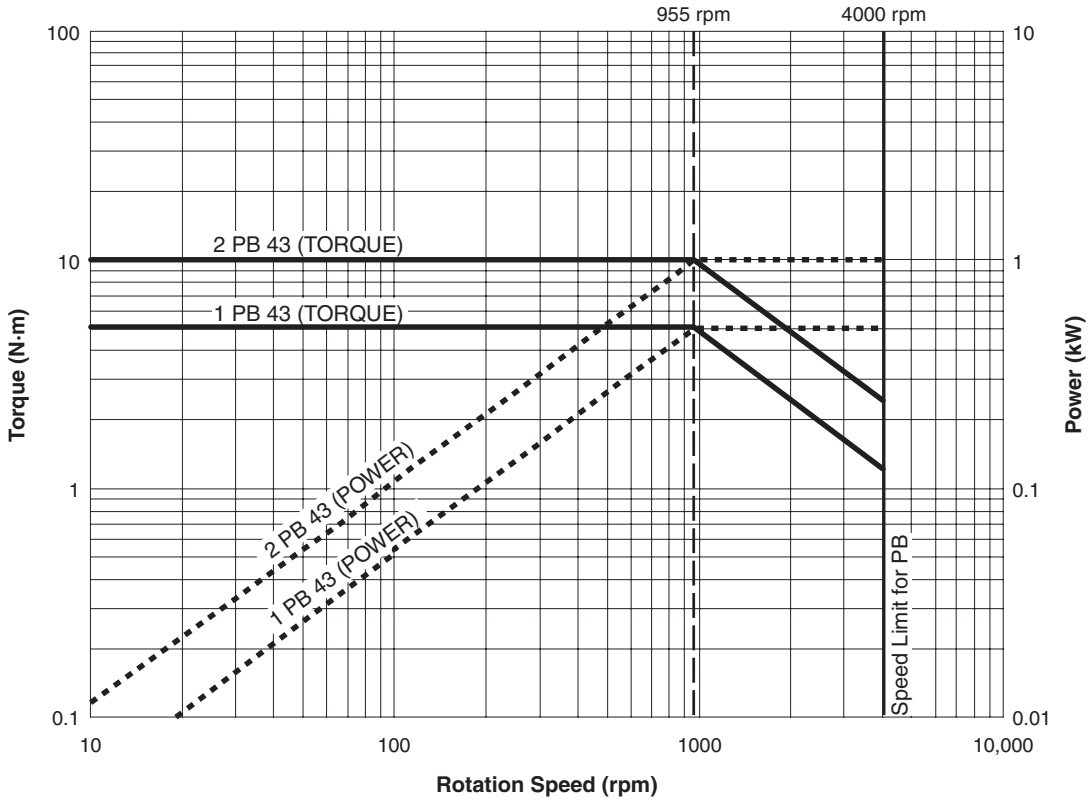


Figure 2–11 PB 43 Ratings Curve

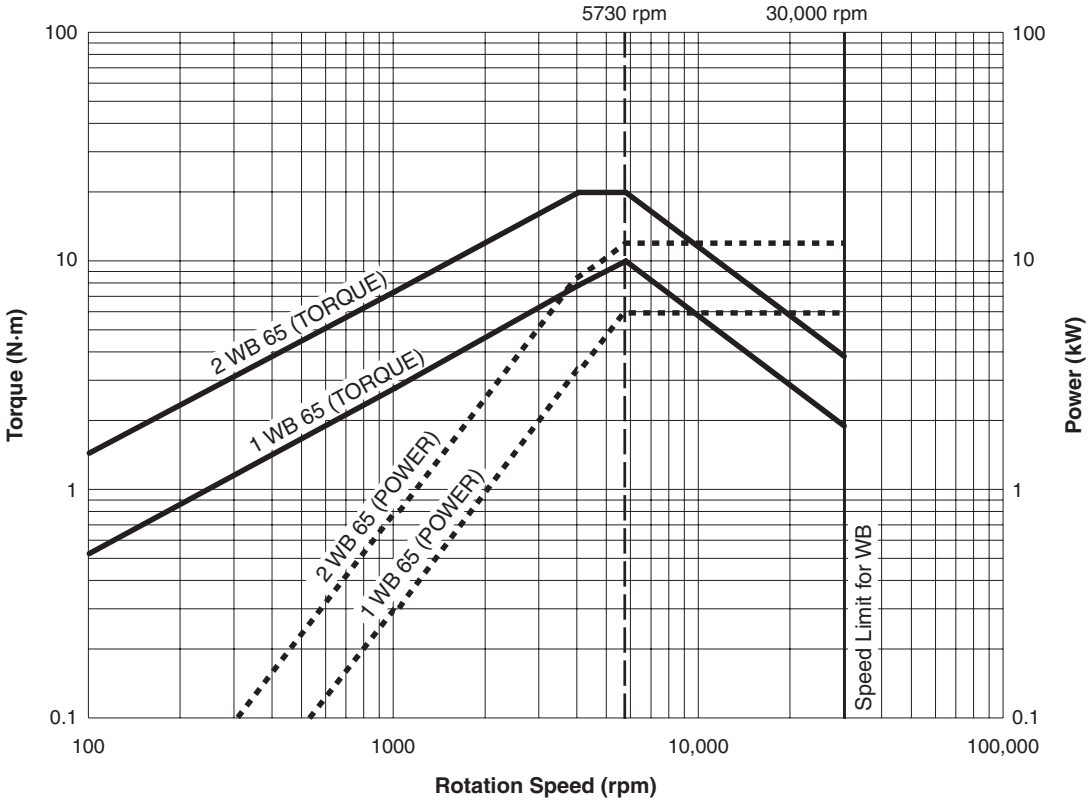


Figure 2–12 WB 65 Ratings Curve

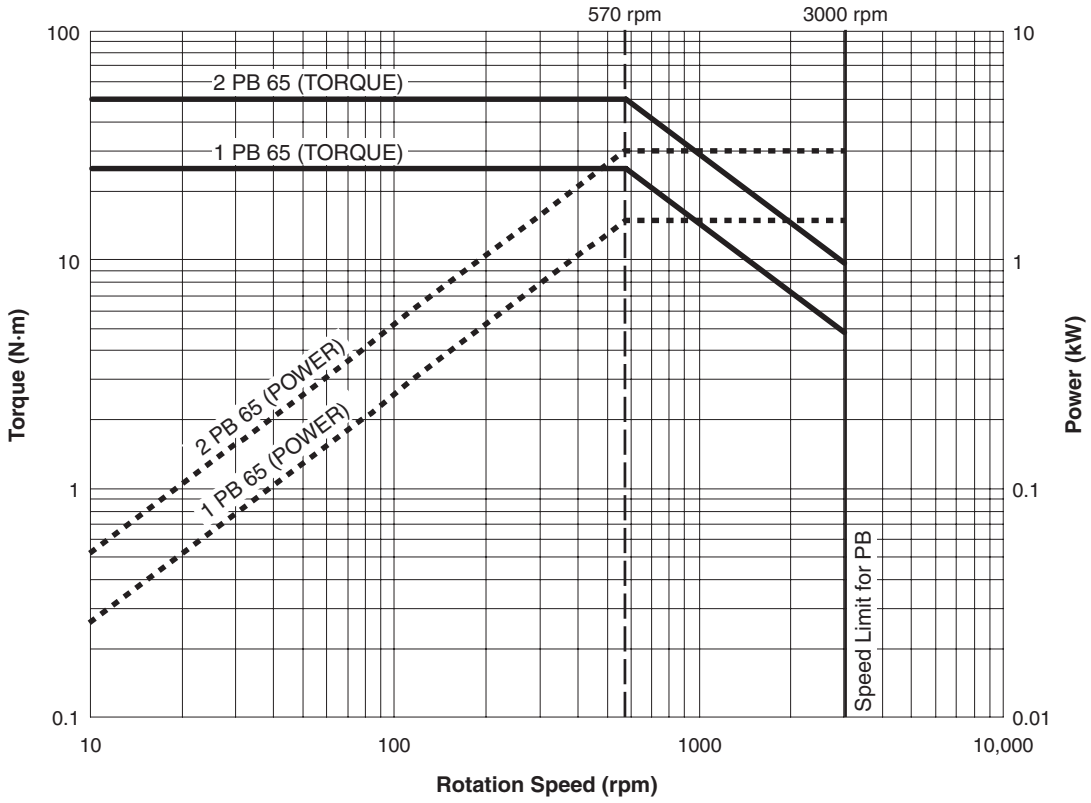


Figure 2–13 PB 65 Ratings Curve

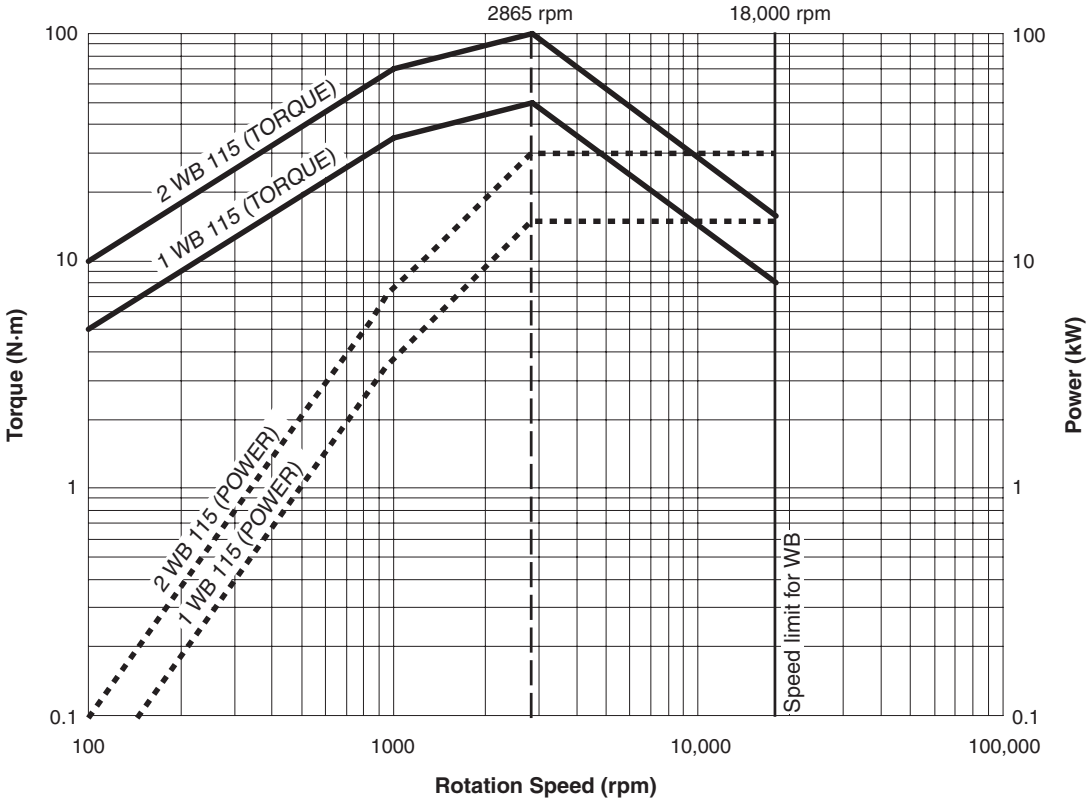


Figure 2–14 WB 115 Ratings Curve

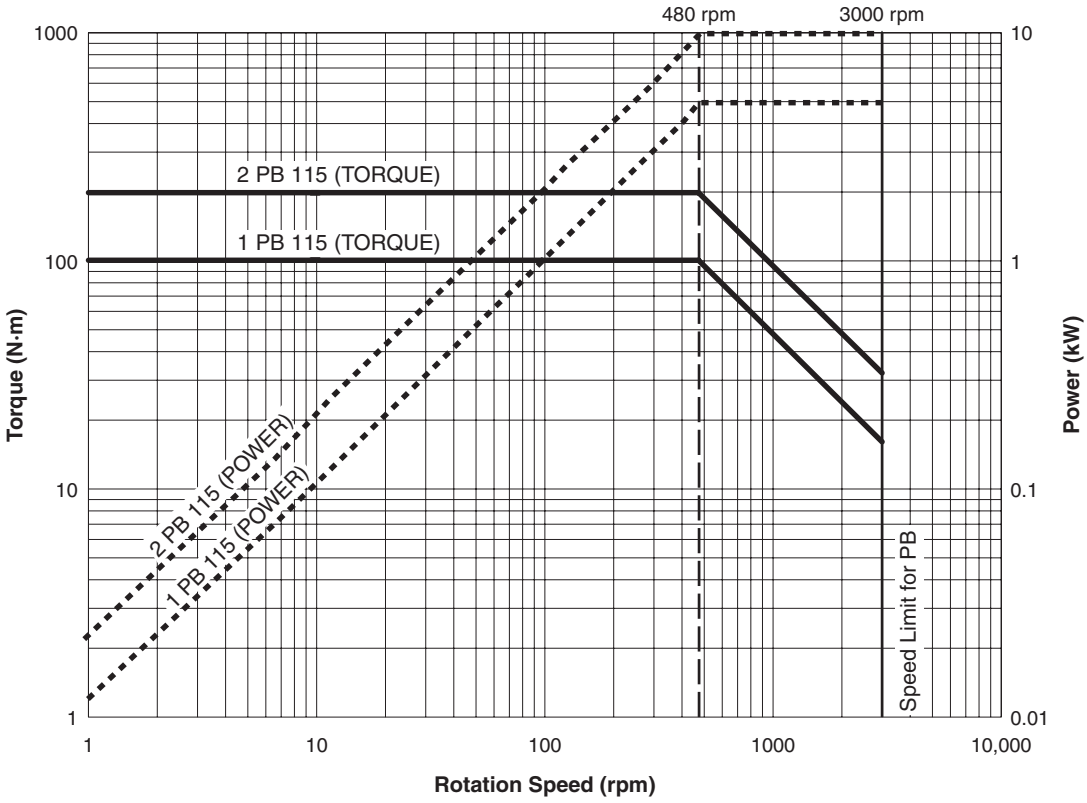


Figure 2–15 PB 115 Ratings Curve

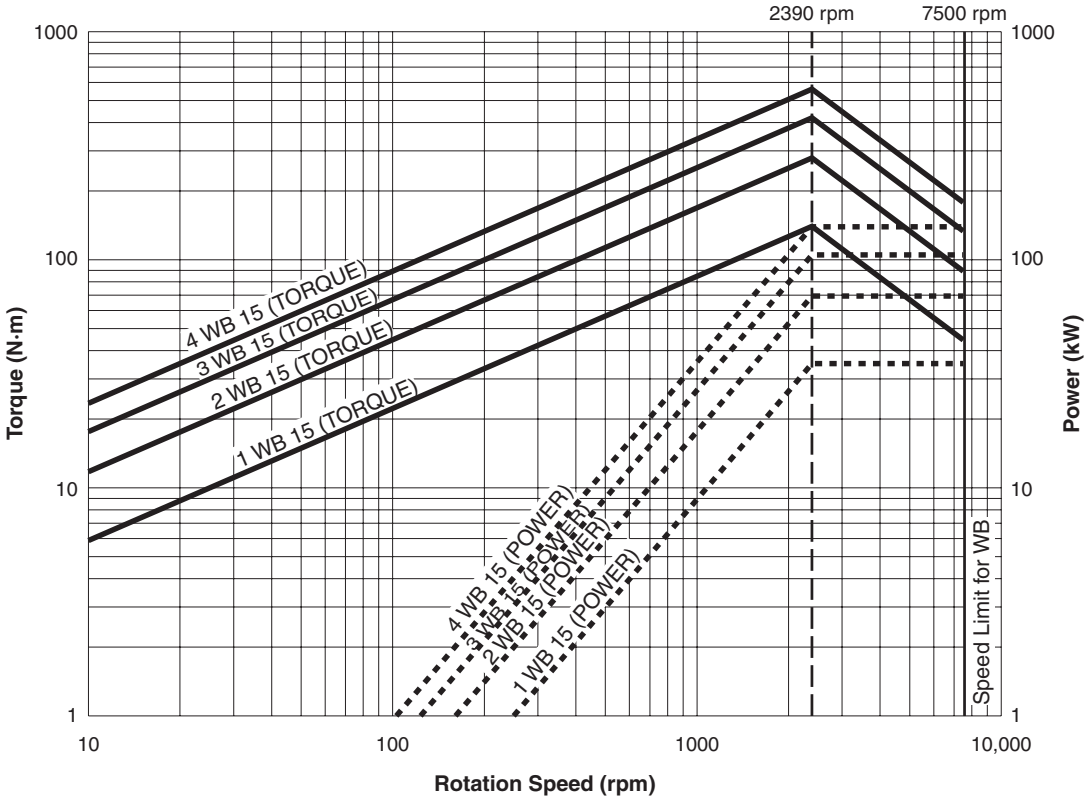


Figure 2–16 WB 15 Ratings Curve

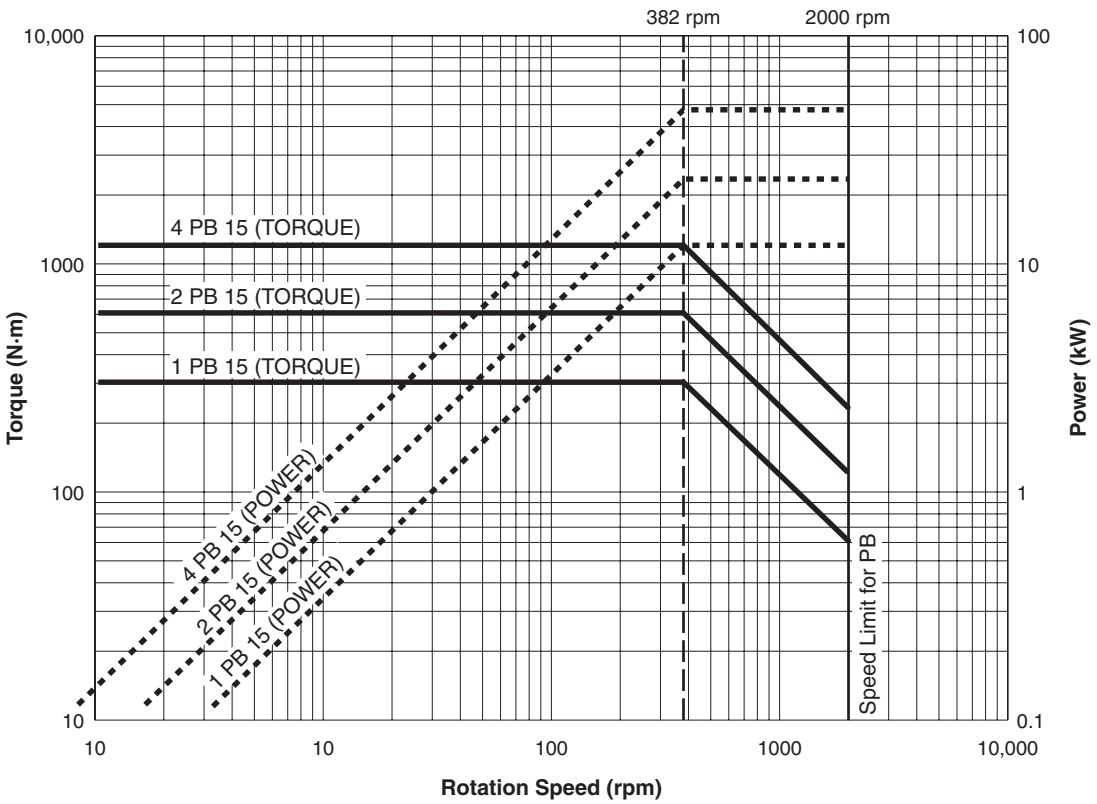


Figure 2–17 PB 15 Ratings Curve

3. Cooling

3.1 DYNAMOMETER COOLING

Proper cooling of the dynamometer is essential to ensure a long operating life and accurate measuring results. All Magtrol WB/PB Series Dynamometers* are water-cooled to guaranty the best possible heat dissipation.

Note: PB 2.7 Series Dynamometers are available with a cooling circuit (K) or without a cooling circuit.

3.1.1 CONNECTIONS

WARNING: THE COOLING TUBES MUST HAVE AN INSIDE DIAMETER IN ACCORDANCE WITH THE INDICATIONS ON THE CORRESPONDING DYNAMOMETER DATA SHEETS (*SEE SECTION 1.2*). THEY MUST BE FITTED TO THE DYNAMOMETER USING A METAL RING. ALSO, CHECK FOR CORRECT WATER FLOW DIRECTION.

The cooling water input is marked "COOLING WATER INLET" on the dynamometer housing. The other nipple is used for the water outlet. Check for correct connections.

3.1.2 WATER FLOW AND PRESSURE

The required cooling water flow rate can be worked out by means of the following formula:

$$\text{Flow rate [l/h]} = \frac{\text{Braking Power [kW]} \cdot 860\ [\text{l}\cdot^\circ\text{C/kWh}]}{\text{Outlet Water Temperature [°C]} - \text{Inlet Water Temperature [°C]}}$$

Note: 1 kWh = 860 kcal = 3600 kJ

The dynamometer cooling system has been designed for an open outflow and freely flowing water without back-pressure. The maximum input pressure must not exceed 2 bars for models WB/PB 15, WB/PB 115 and WB/PB 65. The maximum input pressure must not exceed 0.5-0.8 bars for models WB/PB 2.7 and WB/PB 43. A pressure valve can be added to the cooling system of the brake upon request.

3.1.3 COOLING WATER CONSUMPTION

≈ 30 l/kWh at Δt = 30 °C (Metric)

≈ 8 gal/kWh at Δt = 86 °F (US)

3.1.4 Temperature Sensor

The dynamometer is fitted with a sensor measuring the outlet water temperature. This sensor generates an alarm in case of overheating.

3.2 OPEN-CIRCUIT COOLING SYSTEMS

In an open-circuit cooling system, the necessary water comes directly from the main water distribution system (faucet), passes through the dynamometer, and is then disposed of (down a drain). The advantage of this type of system is its low installation cost. This solution is acceptable if there are no restrictions on water supply and if the available water is clean.

3.2.1 Example

The simplest example of an open-circuit cooling system is a clean water supply and flow rate regulation by means of a tap. The dynamometer water outlet should be equipped with a thermometer and the flow rate must be adjusted in order to maintain the outlet water temperature between 40 °C and 50 °C (resp. 100 °F to 120 °F).

CAUTION: THE TAP SHOULD ALWAYS REMAIN OPEN AND RUNNING WHEN THE DYNAMOMETER IS IN USE.

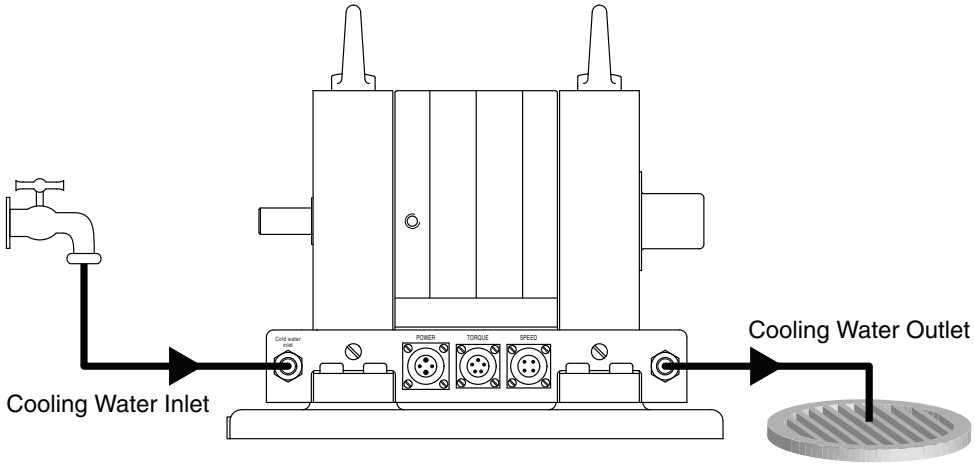


Figure 3–1 Open-circuit Cooling Example

3.3 CLOSED-CIRCUIT COOLING SYSTEMS

The closed-circuit cooling system uses water-to-air or water-to-water heat exchangers, or a chiller. This system is used when the water supply is restricted or when the water cannot be used for cooling without prior treatment/filtering.

Note: It is recommended to use water specific additives to avoid proliferation of living organisms, and to protect against corrosion and mineral deposits.

3.3.1 EXAMPLE

A closed-circuit cooling system simply requires a water tank in which the heat exchange will take place. The ideal operating temperature of the dynamometer is maintained by a temperature-regulated valve on the dynamometer cooling water outlet.

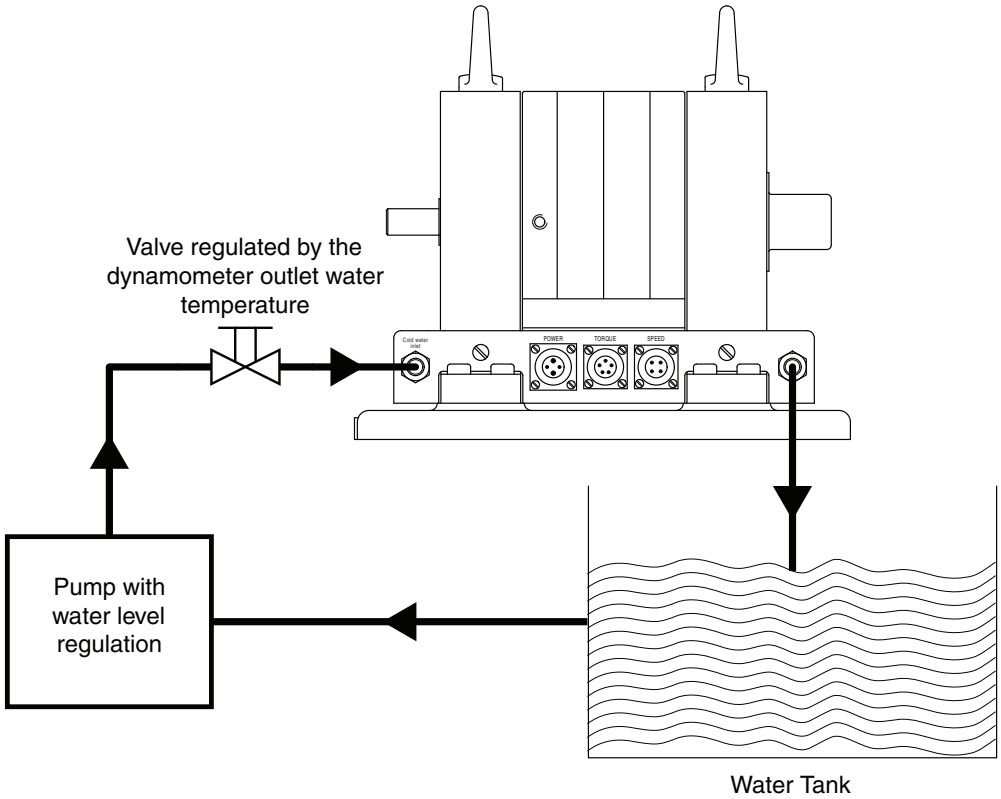


Figure 3–2 Closed-circuit Cooling Example

3.4 COOLING WATER ISSUES

Despite the fact that water is necessary for cooling, it represents a risk. Rust, corrosion, erosion and scale deposits have a negative effect on the functioning of the dynamometer.

3.4.1 IMPURITIES

As a matter of fact, running water may contain dust; mud; calcium or magnesium carbonates; calcium or magnesium sulfates; silicates; iron; carbons; sulfides or algae; and other fungi.

If the cooling water is not analyzed and treated, scale may become deposited on the inside surface of the tubing, reducing the heat transfer and the water flow rate. A 0.5 mm thick scale deposit reduces the cooling system tubing diameter by 30%. A 1 mm thick scale deposit reduces the heat transfer by about 10% which, in turn, increases the dynamometer temperature.

The higher water temperature increases the speed of scale depositing. Also, the warmer the water, the faster the corrosion and erosion. A water temperature increase of 10 °C (50 °F) multiplies the corrosion effect by a factor of two or even four.

3.4.2 HARDNESS

The following table indicates the water hardness in German degrees [°dH]. The total hardness is defined as the sum of the temporary and the permanent hardness. The temporary hardness can be removed by boiling the water, which only takes the calcium and magnesium carbonates and bicarbonates into account. The permanent hardness is caused by the presence of calcium and magnesium sulfates in the water and cannot be removed by boiling. Soft water has a hardness between 3 and 6 °dH, whereas hard water may have a hardness of more than 16 °dH.

	Open-circuit Cooling	Closed-circuit Cooling
pH value	6 – 8	6 – 8
Total hardness	< 20 °dH	< 15 °dH
Temporary hardness	< 10 °dH	< 6 °dH
Permanent hardness	< 10 °dH	< 9 °dH
Free carbon dioxide (CO_2)	< 10 mg/l	< 3 mg/l
Organic substances	< 10 mg/l	< 10 mg/l
Algae and fungal attacks	not acceptable	
Sand and mud	0 mg/l	0 mg/l
Sulfates (SO_4^{2-})	< 50 mg/l	< 50 mg/l
Chlorides (Cl-)	< 30 mg/l	< 30 mg/l
Solute iron (Fe_2+ and Fe_3+)	< 1 mg/l	< 1 mg/l
Phosphates (PO_4^{3-})	0 mg/l	0 mg/l
Total salt content (NaCl)	< 3000 mg/l	< 3000 mg/l
Manganese (Mn)	< 0,1 mg/l	< 0,1 mg/l

°dH	= German hardness degree	= 10 mg CaO/liter
°THfr	= French hardness degree	= 10 mg $CaCO_3$/liter
°eH	= English hardness degree	= 1 grain $CaCO_3$/gallon
°THus	= American hardness degree	= 1 mg $CaCO_3$/liter (ppm)

1 °dH = 1.79 °THfr = 1.25 °eH = 17.9 °THus

CAUTION: NEVER USE DEMINERALIZED WATER FOR THE COOLING OF DYNAMOMETERS AS THIS WATER IS AGGRESSIVE AND LEADS TO CORROSION DUE TO A HIGH CONTENT OF FREE CARBON DIOXIDE.

3.4.3 FILTERING

In order to avoid clogging of the cooling system due to sand, mud, rust or other substances, the installation of a filter at the water inlet is recommended.

Solid substances conveyed by the cooling water should not exceed 250 microns. As a rule, the filter should remove approximately 98% of the substances above 250 microns of diameter.

3.4.4 CONTROLLING THE WATER FLOW RATE

An excessive deposit of minerals may be avoided by limiting consumption to the absolute minimum necessary for the dynamometer braking power dissipation. This may be performed by installing a thermostatic valve on the water outlet and by adjusting it just below the cutoff temperature of the dynamometer safety thermostat (approximate setting ~50 °C or 120 °F). This valve must constantly guaranty a flow rate in order to get enough water flowing to the dynamometer safety thermostat.

3.4.5 WATER INHIBITORS

In order to prevent scale from forming in closed-circuit cooling circuit systems, it is sometimes necessary to use water inhibitors which must be effective against rust, corrosion and mineral deposits.

The use of strong alkaline substances or certain acids may be risky and dangerous during manipulations. These substances can attack the different metals of the dynamometer, and may even be toxic to the operator.

- **Chromates:** should not be used as they cannot avoid mineral deposits and do not protect aluminum. Furthermore, they are acid-based, dangerous and toxic.
- **Borates:** should not be used as they cannot prevent deposits from forming.
- **Phosphates:** should not be used as they will cause algae growth.
- **Chlorides**, **nitrates** and **sulfates:** should not be used as they will cause corrosion.

If the available water proves to be of questionable quality, the user should contact the local authorities to be informed about an adequate form of water treatment. Special attention should be paid to water found in industrial areas where contained polluting substances may represent a source of potential dangers for the dynamometer cooling system. Furthermore, water inhibitors improperly used can have a negative impact on the environment.

3.4.6 CONDENSATION

CAUTION: WHEN THE DYNAMOMETER IS AT A STANDSTILL, THE COOLING WATER MUST BE TURNED OFF. THIS REDUCES THE LEVEL OF SCALE DEPOSITS AND, EVEN MORE IMPORTANT, AVOIDS CONDENSATION.

As a general rule, condensation occurs in the dynamometer when the outlet temperature of the cooling water is lower than the ambient temperature in the room. When using a PB Series Magnetic Powder Dynamometer, the condensation oxidizes the powder which leads to a decrease of the braking torque. This happens very quickly and forces the user to send the dynamometer back to Magtrol for replacement of the magnetic powder. On WB Series Eddy-current Dynamometers, the condensation generates rust on the internal components which rapidly reduces the operating life of the dynamometer.

3.5 COOLING CIRCUIT PURGING

Prior to storing the dynamometer for a long period of time, the water remaining in the cooling circuit must be blown out with (preferably lubricated) compressed air.

4. Connections / Configuration

4.1 CONNECTION TO MAGTROL MOTOR TESTING ELECTRONICS

The connection and configuration of the Magtrol DES Power Supply, TSC Torque/Speed Conditioner and DSP Dynamometer Controller are described in the corresponding User's Manuals for each unit. These manuals can be found on Magtrol's User Manual CD-ROM (delivered with your dynamometer) and can also be accessed at Magtrol's Web site: *www.magtrol.com*. Refer to these documents for additional information on connecting the WB/PB Series Dynamometer to Magtrol motor testing electronics.

4.1.1 MANUAL TEST CONFIGURATION

In a manual test configuration, all test parameters must be manually entered into the DSP Dynamometer Controller. Data acquisition is then carried out manually.

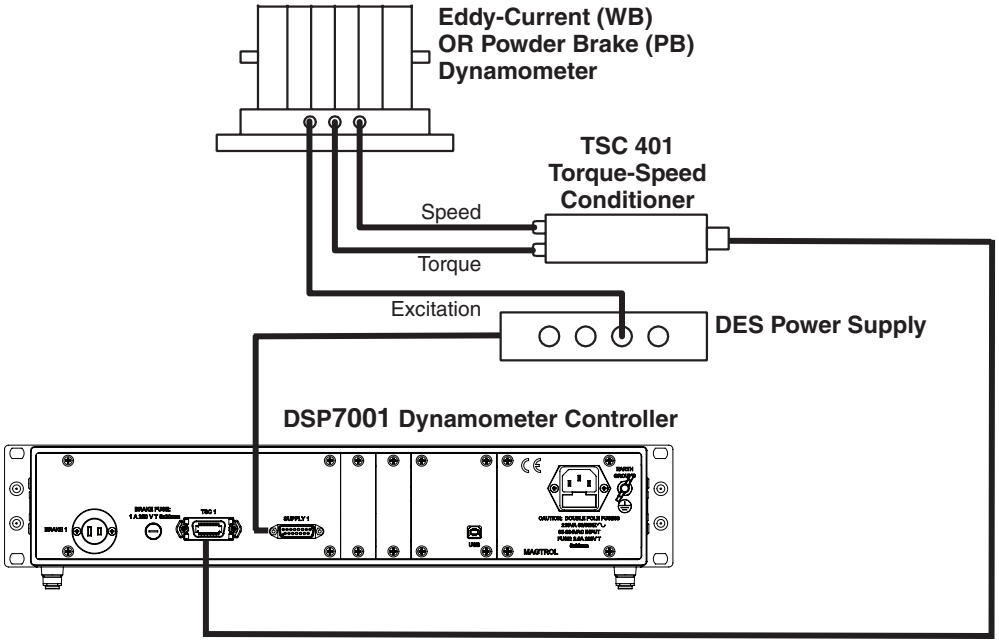


Figure 4–1 Manual Test Configuration

4.1.2 PC-BASED TEST CONFIGURATION

For enhanced motor testing capabilities and full data acquisition, Magtrol offers a complete system which includes a DSP High-Speed Programmable Dynamometer Controller and M-TEST Motor Testing Software. Communication between the DSP Controller and PC running the M-TEST Software is carried out by a GPIB or RS-232 interface board and corresponding connection cable.

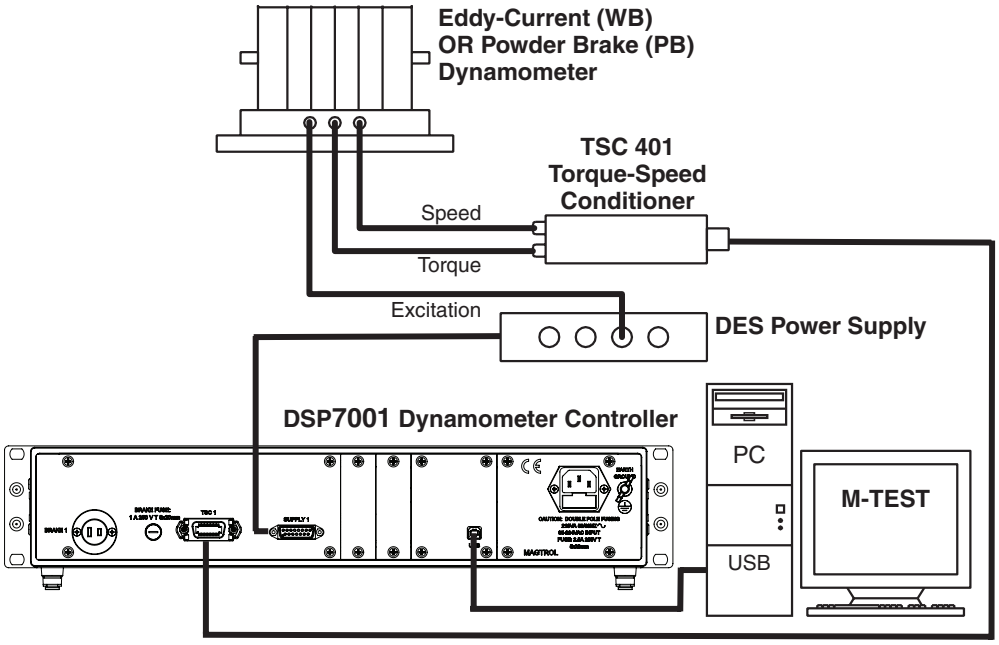


Figure 4–2 PC-Based Test Configuration with M-TEST Software

Note: Magtrol's M-TEST Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with the Magtrol DSP7000 Controller, Magtrol M-TEST 5.0 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. This complete system is the ideal solution for performing complete test cycles on all types of rotating systems. Please contact Magtrol for additional information on this type of configuration.

4.2 TANDEM DYNAMOMETER CONFIGURATION

The tandem configuration combines the advantages of both the WB Eddy-current and PB magnetic powder dynamometers by coupling them in series.

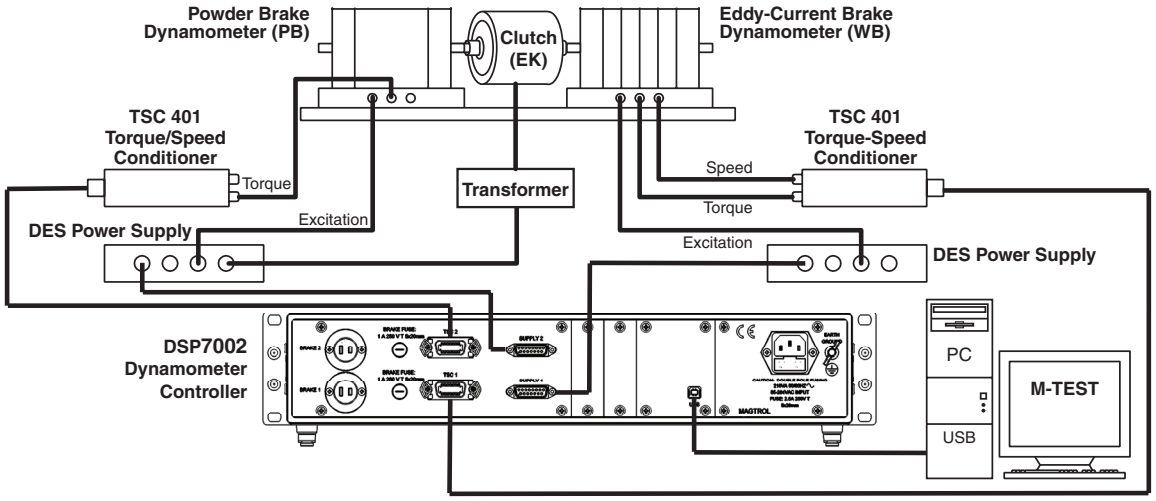


Figure 4–3 Tandem Configuration

In tandem, the unique features of each type of dynamometer brake are utilized, allowing nominal braking torque to be applied to the unit under test from zero speed to maximum rotation. Each dynamometer (WB and PB) can also autonomously operate according to its own characteristics. Tandem Dynamometers are available on a number of PB/WB combinations. Refer to the corresponding data sheets in *Section 1.2* for speed and torque ratings of each tandem configuration.

Note: The parametrization of the tandem dynamometers is quite complicated. In order to get the maximum torque and to be able to use the system at its fullest capacity, a complete Magtrol measuring chain (as illustrated in *Figure 4–3*) is required.

4.2.1 ELECTROMAGNETIC CLUTCH

To couple both dynamometers together in a tandem configuration, a toothed electromagnetic clutch is required. This clutch is delivered as standard with all Magtrol tandem dynamometers.

When the speed of the PB Dynamometer is at zero, the electromagnetic clutch is engaged. Conversely, the clutch disengages when the PB Dynamometer has reached its maximum speed. This function is automatic when a Magtrol DSP Controller is used. (See *Note* in *Section 4.2*.)

4.2.2 TRANSFORMER CONNECTION

A transformer converts the power supplied by the DES into a 24 V DC current, in order to energize the electromagnetic clutch. The connecting cable between the DES Power Supply and the transformer is already connected to the transformer terminals 1 (brown lead) and 2 (blue lead). The yellow/green lead is to be connected to the GND. Refer to the corresponding section of the DES Power Supply User's Manual for more information.

Figure 4–4 Supply Cable Between 24 V DC Transformer and DES Power Supply

Connect the electrical cable to terminal 3 (brown lead) and 4 (blue lead) of the transformer to link the electromagnetic clutch to the transformer. The polarity is unimportant as the clutch can run either with +24 V DC or -24 V DC.

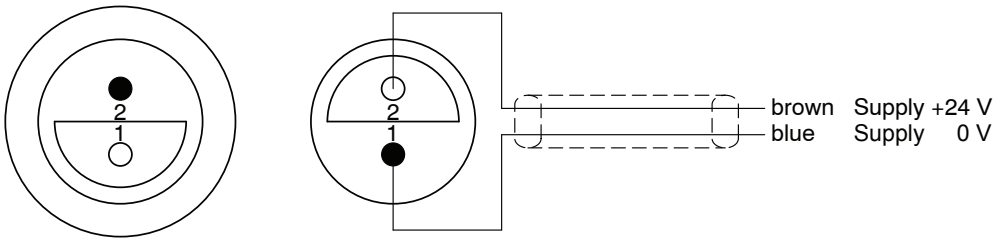


Figure 4–5 Control Signal Cable for WB/PB 2.7 and 43 Tandem Dynamometer Clutches

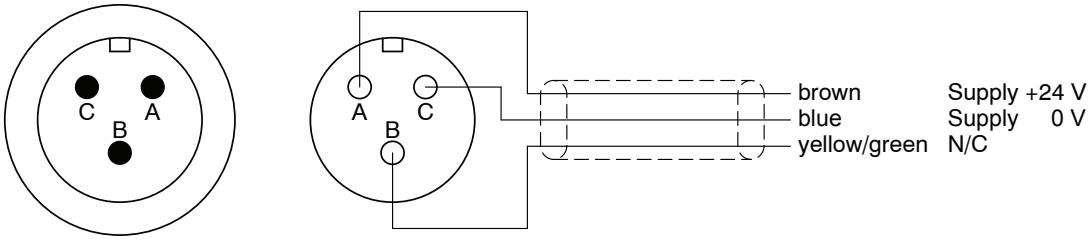


Figure 4–6 Control Signal Cable for WB/PB 65, 115 and 15 Tandem Dynamometer Clutches

Note: The electromagnetic clutch has no common ground connection with the transformer.

4.3 CONNECTION TO NON-MAGTROL ELECTRONIC CONTROL UNITS

CAUTION: USE EXTREME CAUTION WHEN USING ELECTRONIC CONTROL UNITS NOT PROVIDED BY MAGTROL.
MAGTROL MOTOR TESTING ELECTRONICS ARE FITTED WITH SAFETY DEVICES SUCH AS FUSES, CURRENT LIMITERS, THERMOSTATS, ETC. PREVENTING THE DYNAMOMETERS FROM OPERATING OUTSIDE OF THEIR LIMITS.

Magtrol WB/PB Dynamometers are fitted with two types of connectors. The WB/PB 2.7 and 43 Series Dynamometers are fitted with LEMO type connectors and WB/PB 65, 115 and 15 Series Dynamometers use MS type connectors. Additionally, the available options vary from one dynamometer to the other. Therefore, two or three different pin configurations are shown for each connection.

4.3.1 POWER AND THERMOSTAT CONNECTION

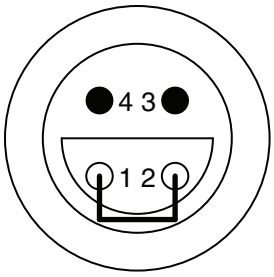
The PB Series Dynamometer torque depends exclusively on the excitation current, whereas the torque of a WB Series Dynamometer is determined by both the excitation current and its speed. Therefore, with WB Dynamometers, the excitation current must be reduced when its speed is being increased to hold a constant torque.

To keep operating temperatures at acceptable levels, it is important to run dynamometers within their power ratings. The breaking power of the dynamometer must therefore be regularly checked by referring to the torque-speed-power rating curves shown in *Section 2.10* of this manual or by using the following equation:

$$\text{Breaking Power [kW]} = \frac{\text{Breaking Torque [N·m]} \times \text{n [rpm]}}{9550}$$

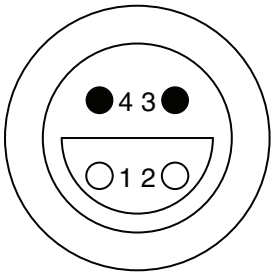
The thermostat is a normally closed contact which opens when a temperature limit of approximately 50 °C (120 °F) is reached. When this limit is reached, the excitation must be stopped.

Note: Unlike all other Magtrol WB/PB Dynamometers, the WB/PB 2.7 Series Dynamometers are not fitted with a thermostat. This function is defeated by a short between terminal 1 and 2.



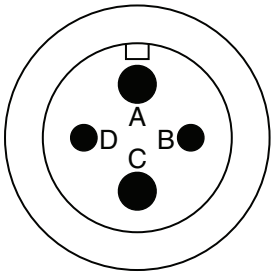
1. N/C
2. N/C
3. Supply +
4. Supply –

Figure 4–7 Connector Pin Configuration for WB/PB 2.7 Dynamometer Power



1. Temperature A
2. Temperature B
3. Supply +
4. Supply –

Figure 4–8 Connector Pin Configuration for WB/PB 43 Dynamometer Power and Temperature Measurement

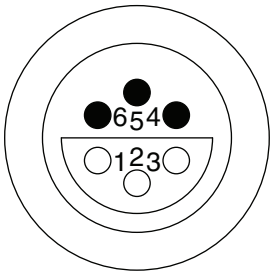


A. Supply +
B. Temperature B
C. Supply –
D. Temperature A

Figure 4–9 Connector Pin Configuration for WB/PB 65, 115 and 15 Dynamometer Power and Temperature Measurement

4.3.2 TORQUE SIGNAL CONNECTION

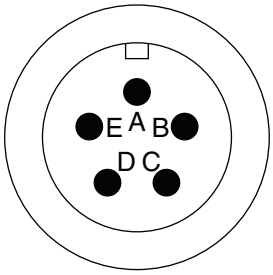
The torque signal is supplied by a load cell fitted with a bridge strain gauge.



1. Signal +
2. N/C
3. Signal –
4. Supply +
5. N/C
6. Supply –

Figure 4–10 Connector Pin Configuration for WB/PB 2.7 and 43 Dynamometer Torque Signals

Note: The use of shielded cable is mandatory. Connect cable shielding to the connector housing.



A Signal +
B. Signal –
C. Supply +
D. Supply –
E. Shield

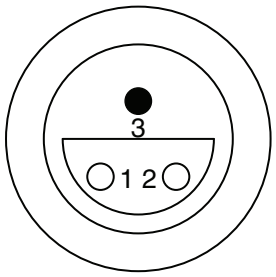
Figure 4–11 Connector Pin Configuration for WB/PB 65, 115 and 15 Dynamometer Torque Signals

Note: The use of shielded cable is mandatory. Connect cable shielding to the connector housing.

4.3.3 Speed Signal Connection

Speed measuring requires a 5 V supply. The square TTL type output signal frequency is proportional to the speed. According to the polar wheel mounted on the system, the pulse number (per revolution) will be 30, 60, 600 or 6000. For additional information on this item, refer to the dynamometer's corresponding data sheet in *Section 1.2*.

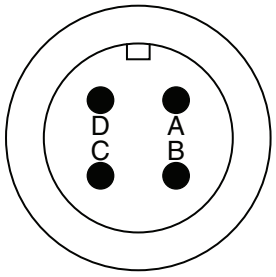
Note: The use of a 600-bit encoder limits the speed of the system to 10,000 rpm. If the testing application requires, Magtrol can offer a speed sensor providing 6,000 impulses per revolution. This provides a higher resolution but limits the speed to 1000 rpm.



1. Supply +5 V
2. Supply 0 V
3. Signal TTL

Figure 4–12 Connector Pin Configuration for WB/PB 2.7 and 43 Dynamometer Speed Signals

Note: The use of shielded cable is mandatory. Connect cable shielding to the connector housing.



A Supply 0 V
B. Signal TTL
C. Shield / Grounding
D. Supply +5 V

Figure 4–13 Connector Pin Configuration for WB/PB 65, 115 and 15 Dynamometer Speed Signals

Note: The use of shielded cable is mandatory. Connect cable shielding to the connector housing.

5. Operating Principles

5.1 EDDY-CURRENT DYNAMOMETERS (WB)

Magtrol Eddy-current Dynamometers carry the designation of "WB" which stands for "Wirbelstrom-Bremse" in German (Wirbelstrom = Eddy-current, bremse = brake). Eddy-currents are circular currents induced in conductors crossing a magnetic field. These currents generate electromagnetic forces acting against the movement of the rotor.

In the WB Eddy-current Dynamometer, the moving part is a toothed cylindrical rotor. The magnetic field is created by coils powered by a DC current source. The magnetic flux flows through the rotor teeth—not the air gap—creating magnetized and non-magnetized areas within the stator. During rotation, the rotor teeth generate Eddy currents in the stator which create a braking force. The kinetic heat generated in this process is absorbed by the stator cooling circuit.

The braking torque depends upon the rotational speed and increases with increasing speed. At a standstill, the torque is zero. To be able to measure a starting torque with this dynamometer, it is necessary to block both the stator and the rotor. In this case, the dynamometer ceases to rotate and the tested motor's torque is integrally transmitted to the dynamometer measuring cell.

5.2 MAGNETIC POWDER DYNAMOMETERS (PB)

Magtrol magnetic powder dynamometers carry the designation of "PB" which stands for "Pulverbremse" in German (Pulver = powder).

In the PB Magnetic Powder Dynamometer, the magnetic field generated by a DC current passing through the coils magnetizes the ferromagnetic powder. This powder is located in the gap between the toothed rotor and the stator of the brake. Due to the action of the magnetic field, some columns build up which generate friction between the rotor teeth and the stator surface.

By varying the coil current, the braking torque can be varied continuously.

5.3 WB VS. PB

Mechanically, PB and WB dynamometers are quite similar and only differ by their size and the shape of the rotor teeth.

Fundamentally, the difference between an Eddy-current and a magnetic powder dynamometer lies in the fact that the maximum braking torque of the later is already available at standstill. On the other hand, the friction generated in magnetic powder brakes limits the speed of the dynamometer at lower levels to prevent premature wear and powder dispersion into the bearings due to centrifugal forces.

6. Calibration

Every new Magtrol WB/PB Series Dynamometer is factory calibrated. Static calibration of the zero and torque is recommended from time to time, especially after having maintenance performed.

Note: Do not forget to unlock the dynamometer following transport (after it returns from overhaul) in accordance with *Section 2.1 – Locking the Dynamometer for Transport.*

6.1 BASIC CALIBRATION INFORMATION

Prior to calibration, the motor must be separated from the dynamometer so that the dynamometer shaft can rotate freely.

6.1.1 CALIBRATION ARMS

Two calibration arms are delivered with each Magtrol WB/PB Series Dynamometer. These arms are inserted into the threaded holes found on each side of the stator. S*ee Figure 6–1 Calibration Arm Mounting*.

Each calibration arm has two grooves: the outer groove allows for calibration in N·m, the inner in mkp.

Note: Mkp is an obsolete unit of torque measurement. Magtrol recommends calibration in N·m (by using the outer groove) and calibration weight in kg. Refer to *Section 6.1.2 – Calibration Weight*.

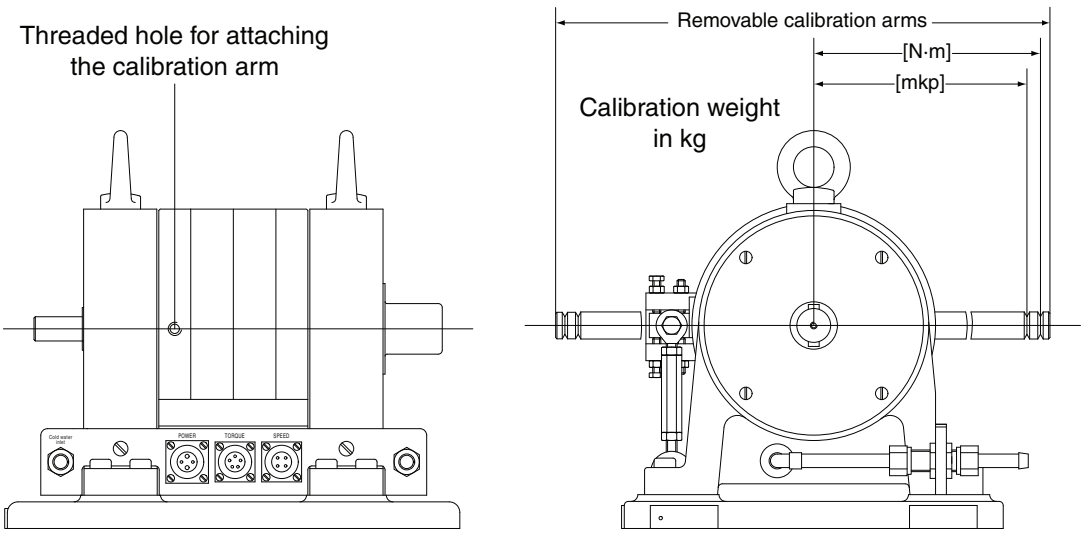


Figure 6–1 Calibration Arm Mounting

CAUTION: AFTER CALIBRATION, DO NOT FORGET TO REMOVE THE CALIBRATION ARMS FROM THE DYNAMOMETER.

6.1.2 CALIBRATION WEIGHT

The calibration weight is determined by dynamometer model, according to the table below.

Note: Use outer groove to achieve calibration in N·m when using weight in kg.

Model	Calibration Weight *[kg]*	Nominal Rated Torque *[N·m]*
2 WB 2.7-8 K	0.30	0.30
3 WB 2.7-8 K	0.45	0.45
4 WB 2.7-8 K	0.60	0.60
1 PB 2.7-8 K	0.60	0.60
2 PB 2.7-8 K	1.20	1.20
4 PB 2.7-8 K	2.40	2.40
1 WB 43	0.6	1.5
2 WB 43	1.2	3
1 PB 43	2	5
2 PB 43	4	10
1 WB 65	2	10
2 WB 65	4	20
1 PB 65	5	25
2 PB 65	10	50
1 WB 115	10	50
2 WB 115	20	100
1 PB 115	20	100
2 PB 115	40	200
1 WB 15	28	140
2 WB 15	56	280
3 WB 15	84	420
4 WB 15	112	560
1 PB 15	60	300
2 PB 15	120	600
4 PB 15	240	1200

Note: A calibration weight adapted specifically for the dynamometer can be ordered directly from Magtrol.

6.2 CALIBRATION WITH MAGTROL MOTOR TESTING ELECTRONICS

When standard Magtrol motor testing electronics are used in the test bench (Magtrol DSP Controller and TSC Torque/Speed Conditioner), the calibration procedure as described in the TSC 401 Instruction Manual should be followed. Refer to *Section 3 – Calibration* for dynamometer calibration.

Note: The User's Manuals for all Magtrol products can be accessed/ downloaded from Magtrol's web site: www.magtrol.com.

6.3 CALIBRATION USING NON-MAGTROL ELECTRONIC CONTROL UNITS

When a Magtrol TSC Torque/Speed Conditioner and DSP Controller are not used in the test bench, the calibration must be carried out by using the following procedure:

1. Mount the calibration arms.
2. Adjust the zero (0) on the electronic control unit. The dynamometer shaft must rotate freely (the motor must be disconnected).
3. Hang the calibration weight from one of the calibration arms.

Note: Use outer groove to achieve calibration in N·m when using weight in kg.

4. Adjust the electronic control unit to obtain the reading of the nominal dynamometer torque.
5. Move the calibration weight to the opposite calibration arm. The reading on the electronic unit should be the same (difference <1%). If this is not the case, remove the weights and return to step #2.
6. Remove the calibration arms.

6.4 CALIBRATION OF OVERLOAD PROTECTION

Note: WB/PB 15 Series Dynamometers do not have overload protection.

Calibration of the overload protection for WB/PB 43, 65 and 115 Series Dynamometers is performed at the factory. However, it may be necessary to periodically check or confirm the protection of the measuring cell by following the procedures outlined in *Sections 6.4.1 through 6.4.3*.

Note: This does not apply to WB/PB 2.7 Series Dynamometers as the overload stop is fixed and requires no setting.

CAUTION: FOR OVERLOAD CALIBRATION OF WB/PB 43, 65 AND 115 SERIES DYNAMOMETERS, READINGS OF 150% OF THE NOMINAL TORQUE ARE ONLY POSSIBLE IF THE MEASURING SYSTEM OPERATES WITHOUT SATURATION. WITH A COMPLETE DSP-CONTROLLED MAGTROL SYSTEM (WB/PB DYNAMOMETER, DSP DYNAMOMETER CONTROLLER, DES POWER SUPPLY AND TSC TORQUE/SPEED CONDITIONER), THE TSC UNIT MUST BE CONNECTED TO THE TSC2 INPUT OF THE DSP UNIT (AS THE TSC1 INPUT CANNOT MEASURE A VALUE OF MORE THAN 130% OF THE NOMINAL TORQUE).

6.4.1 WB/PB 43 SERIES

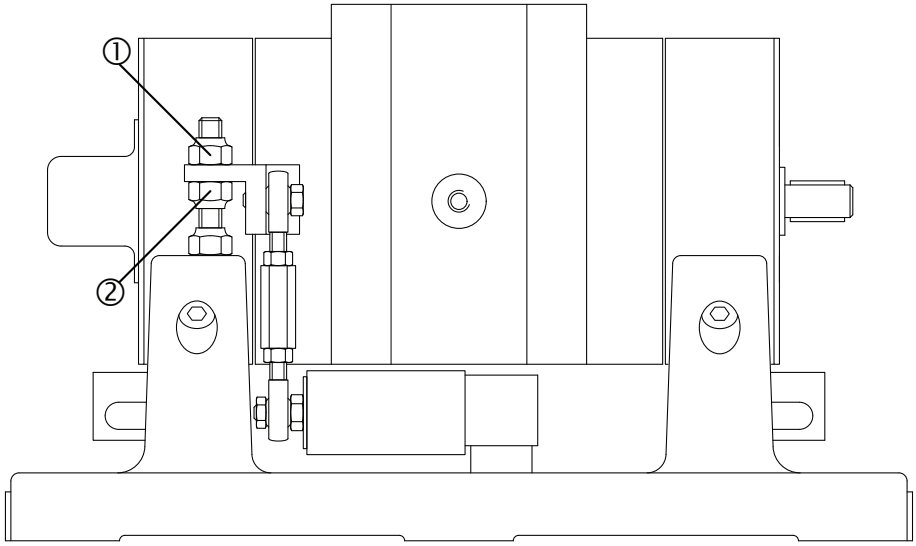


Figure 6–2 WB/PB 43 Overload Protection Calibration

1. Mount the calibration arms. (See *Section 6.1.1 – Calibration Arms.*)
2. Place 100% of the calibration weight on the arm on the connector side.
3. Adjust the screw ① to decrease the torque slightly.
4. Place 200% of the calibration weight on the arm on the connector side.
5. Adjust the screw ① so that the display indicates 150% of the nominal torque.
6. Move the 100% calibration weight onto the opposite arm.
7. Adjust the screw ② to decrease the torque slightly.
8. Place 200% of the calibration weight on the arm.
9. Adjust the screw ② so that the display indicates 150% of the nominal torque.
10. Remove the calibration weight and arms.

6.4.2 WB/PB 65 Series

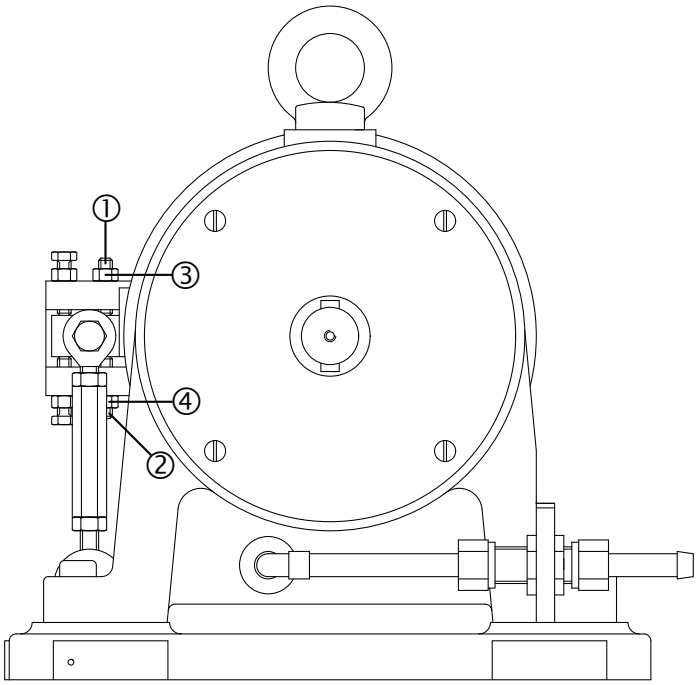


Figure 6–3 WB/PB 65 Overload Protection Calibration

1. Mount the calibration arms. (See *Section 6.1.1 – Calibration Arms*.)
2. Place 100% of the calibration weight on the arm on the connector side.
3. Loosen the nut ③ and adjust the screw ① to decrease the torque slightly.
4. Place 200% of the calibration weight on the arm on the connector side.
5. Adjust the screw ① so that the display indicates 150% of the nominal torque.
6. Tighten the nut ③.
7. Move the 100% calibration weight onto the opposite arm.
8. Loosen the nut ④ and adjust the screw ② to decrease the torque slightly.
9. Place 200% of the calibration weight on the arm.
10. Adjust the screw ② so that the display indicates 150% of the nominal torque.
11. Tighten the nut ④.
12. Remove the calibration weight and arms.

6.4.3 WB/PB 115 Series

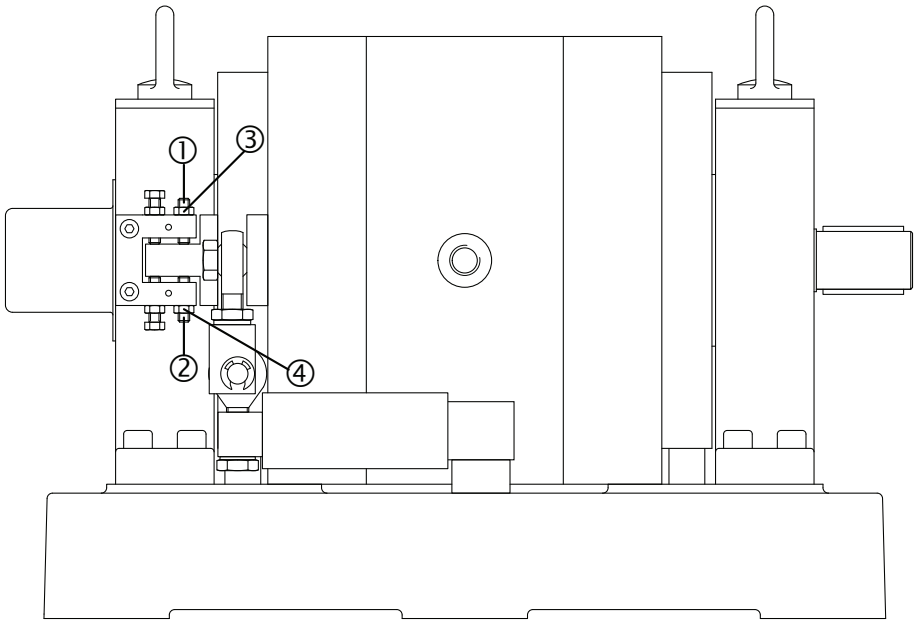


Figure 6–4 WB/PB 115 Overload Protection Calibration

1. Mount the calibration arms. (See *Section 6.1.1 – Calibration Arms*.)
2. Place 100% of the calibration weight on the arm on the connector side.
3. Loosen the nut ③ and adjust the screw ① to decrease the torque slightly.
4. Place 200% of the calibration weight on the arm on the connector side.
5. Adjust the screw ① so that the display indicates 150% of the nominal torque.
6. Tighten the nut ③.
7. Move the 100% calibration weight onto the opposite arm.
8. Loosen the nut ④ and adjust the screw ② to decrease the torque slightly.
9. Place 200% of the calibration weight on the arm.
10. Adjust the screw ② so that the display indicates 150% of the nominal torque.
11. Tighten the nut ④.
12. Remove the calibration weight and arms.

7. Maintenance and Repair

7.1 MAINTENANCE

Just like any rotating equipment, Magtrol dynamometers require periodic maintenance. It is recommended that maintenance be performed every 5000 hours of normal operation. This corresponds to the theoretical life of the bearings and the time after which Magtrol recommends their replacement. (Bearings should be replaced as soon as they start showing signs of wear.) Higher wear occurs when the dynamometer is operated outside its optimal working conditions. This is especially true when the dynamometer is operated at excessive rotational speeds, which results in the generation of axial and radial forces on the bearings.

Various indicators alert the user as to when maintenance is required:

- The dynamometer can no longer reach its nominal torque (particularly true with magnetic powder dynamometers)
- The water tubing is clogged causing a temperature rise
- The residual torque is out of specification.

When the bearings generate noises, it indicates that maintenance is overdue. At this stage, measurements have already been distorted and the entire dynamometer unit is subject to vibrations, reducing its operating life.

7.2 REPAIR

In case of a defect, please refer to both the *Warranty* and *Service Information* located at the back of this manual. Whether you are directed to ship your equipment back to Magtrol, Inc. in the United States or Magtrol SA in Switzerland, it is very important to include the following information with your return shipment:

- Model number, part number, serial number, order number and date of purchase
- Description of the defect and the conditions in which it appeared
- Description of the test bench (drawing, photographs, sketches, etc.)
- Description of the tested object (drawing, photographs, sketches, etc.)
- Description of the test cycle

7.3 SENDING EQUIPMENT TO MAGTROL FOR MAINTENANCE/REPAIR

CAUTION: MAINTENANCE MUST BE PERFORMED BY MAGTROL IN ORDER TO GUARANTY FUTURE MEASURING ACCURACY. TO ALLOW MAGTROL TO COMPLETE THE WORK IN THE BEST POSSIBLE TIME, FOLLOW THE PROCEDURE OUTLINED BELOW AS WELL AS THE PROCEDURE OUTLINED IN THE REAR OF THIS MANUAL UNDER *SERVICE INFORMATION*.

1. Do not dismantle the dynamometer (so that Magtrol can test it prior to performing maintenance).
2. Lock the dynamometer for transport (see *Section 2.1 – Locking the Dynamometer for Transport*).
3. Carefully pack the dynamometer.
4. The Magtrol DES Power Supply and TSC Torque/Speed Conditioner that is used with the dynamometer should also be returned at this time for calibration.

Service Information

RETURNING MAGTROL EQUIPMENT FOR REPAIR AND/OR CALIBRATION

Before returning equipment to Magtrol for repair and/or calibration, please visit Magtrol's Web site at http://www.magtrol.com/support/rma.htm to begin the Return Material Authorization (RMA) process. Depending on where the equipment is located and which unit(s) will be returned, you will be directed to either ship your equipment back to Magtrol, Inc. in the United States or Magtrol SA in Switzerland.

Returning Equipment to Magtrol, Inc. (United States)

When returning equipment to Magtrol, Inc.'s factory in the United States for repair and/or calibration, a completed Return Material Authorization (RMA) form is required.

1. Visit Magtrol's Web site at http://www.magtrol.com/support/rma.htm to begin the RMA process.
2. Complete the RMA form online and submit.
3. An RMA number will be issued to you via e-mail. Include this number on all return documentation.
4. Ship your equipment to:
   MAGTROL, INC.
   70 Gardenville Parkway
   Buffalo, NY 14224
   Attn: Repair Department
5. After Magtrol's Repair Department receives and analyzes your equipment, a quotation listing all the necessary parts and labor costs, if any, will be faxed or e-mailed to you.
6. After receiving your repair estimate, provide Magtrol with a P.O. number as soon as possible. A purchase order confirming the cost quoted is required before your equipment can be returned.

Returning Equipment to Magtrol SA (Switzerland)

If you are directed to ship your equipment to Switzerland, no RMA form/number is required. Just send your equipment directly to Magtrol SA in Switzerland and follow these shipment instructions:

1. Ship your equipment to:
   MAGTROL SA
   After Sales Service
   Route de Montena 77
   1728 Rossens / Fribourg
   Switzerland
   VAT No: 485 572
2. Please use our forwarder : TNT • 1-800-558-5555 • Account No 154033
   Only ship ECONOMIC way (3 days max. within Europe)
3. Include the following documents with your equipment:
   - Delivery note with Magtrol SA's address (as listed above)
   - Three pro forma invoices with:
     - Your VAT number
     - Description of returned goods
     - Noticed failures
     - Value - for customs purposes only
     - Origin of the goods (in general, Switzerland)
4. A cost estimate for repair will be sent to you as soon as the goods have been analyzed. If the repair charges do not exceed 25% the price of a new unit, the repair or calibration will be completed without requiring prior customer authorization.

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