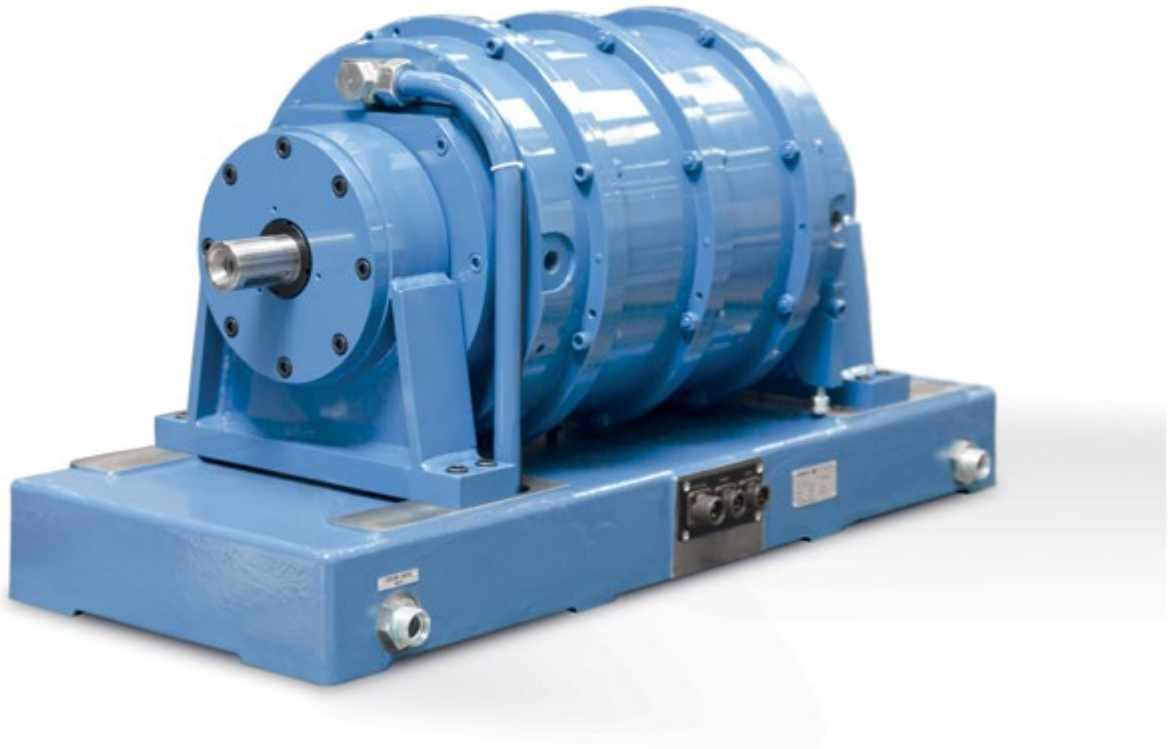
MAGTROL

WB-PB-TANDEM SERIES

EDDY-CURRENT & MAGNETIC POWDER DYNAMOMETERS

USER MANUAL

www.magtrol.com



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PURCHASE RECORD

To ensure continuity of information and to facilitate technical support, Magtrol invites you to note below some essential data about your equipment (model, serial number, date of purchase, etc.). The model number and serial number can be found on the identification plate (aluminum) or on the label (white or metallic) affixed to each unit. Please refer to these numbers when contacting a Magtrol representative about your equipment..

Model Number : _____

Serial Number : _____

Purchase Date : _____

Purchased From : _____

2nd English Edition | Revision A | May 2025

SAFETY PRECAUTIONS

WARNING

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 OR THE TORQUE MEASUREMENT DRIVE TRAIN.

ATTENTION

CAUTION: OPERATE THE DYNAMOMETER WB-PB-TANDEM SERIES WITH GREAT CAUTION! THE DYNAMOMETER MAY BE IRREVERSIBLY DAMAGED IF IMPACTED MECHANICALLY (FALL), CHEMICALLY (ACIDS) OR THERMALLY (HOT AIR, VAPOR).

1. Make sure that all Magtrol Dynamometer and electronic products are earth-grounded, to guarantee personal safety and proper operation.
2. Check line voltage before operating electronic equipment.
3. Make sure that all rotating parts (dynamometers, motors under test,...) are equipped with appropriate safety guards.

NOTICE

Detailed information regarding the safety guards or protective systems can be found *see section 2.8 - Protective systems*.

4. Always use couplings that matches the speed and braking torque of the system under tested.
5. Periodically check all connections and attachments.
6. Always wear protective glasses when working close to rotating elements.
7. Never wear a necktie or baggy clothes when standing close to rotating elements.
8. Never stand too close or bend over the rotating drive chain.
9. Electrically insulate the motor terminal block
10. Always connect the motor envelope to earth ground.
11. 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 BE PROPAGATE TO ALL CONNECTED INSTRUMENTS OR TO PERSONS IN CONTACT WITH THE DEVICES.

QUALIFIED PERSONNEL

Persons in charge of installing and operating the WB Series, PB Series or TANDEM Series Dynamometers must have read and understood this user manual, paying extra close attention to all safety-related information.

The WB, PB & TANDEM Dynamometer are high-precision products integrating the most recent measurement techniques. The dynamometer or system can give rise to residual dangers if used and manipulated in a non-compliant way by unqualified personnel.

These dyanometers must be handled by qualified personnel according to the technical requirements and the above-mentioned safety instructions. This is also true when using every dynamometer accessories.

RESIDUAL HAZARDS

Dynamometer performances are only one element in the test measurement chain. Safety is of equal importance. There are possible residual hazards when operating rotating test equipment and it is the responsibility of the designer, the manufacturer and the user to minimize these hazards.

In addition to general safety precautions, residual hazards are highlighted in this user manual by using safety symbols and sections (*see section - Conventions used in this manual*).

PROPER USE

The use of WB-PB-TANDEM Series Dynamometer is exclusively restricted to test measuring tasks and directly-related control and regulating tasks. Any further use shall be deemed to be improper.

For safe operation, the WB-PB-TANDEM Series Dynamometer and its accessories may only be used according to the data and specifications given in this User's Manual. Safe operation can be guaranteed only when the dynamometer is correctly transported, stored, installed, mounted and used.

MODIFICATIONS

The WB-PB-TANDEM Series Dynamometer and its accessories may not be modified without the express consent of Magtrol. Magtrol is not be liable for any consequential damages resulting from unauthorized modifications.

TABLE OF CONTENT

PREFACE

PURPOSE OF THIS MANUAL

This manual contains all the information required for the installation, setup, connection and general use of Magtrol's WB-PB-TANDEM Series Dynamometer. To achieve maximum capability and ensure proper use, please read this manual in its entirety before operating the unit. 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 test benches operators who are installing or using WB-PB-TANDEM Series Dynamometer in order to determine the torque and power of a motor in relation to its speed. The operator is assumed to have the necessary technical knowledge in electronics and mechanical engineering enabling him to install and operate these WB-PB-TANDEM Series Dynamometers without risk.

MANUAL ORGANIZATION

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

The structure of the manual is as follows:

Chapter 1: INTRODUCTION – Contains the technical data sheets for Magtrol's WB-PB-TANDEM Series Dynamometers, which describe the units, provide detailed technical characteristics and present a brief overview of their fields of application.

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

Chapter 3: TORQUE-SPEED-POWER CURVES - Torque-speed-power reference curve for each dynamometer model

Chapter 4: COOLING – Describes the necessary measures to take in order to guaranty an optimal dynamometer operating temperature.

Chapter 5: CONNECTIONS (ELECTRONIC DEVICES) – Provides information about the wiring between the dynamometers and the electronic control units, as well as tandem setups of dynamometers.

Chapter 6: OPERATING PRINCIPLES – Describes the physical phenomena on which the Eddycurrent (WB Series) and magnetic powder (PB Series) Dynamometer technology is based.

Chapter 7: CALIBRATION PROCESS – Provides recommended calibration schedules along with step-by-step instructions for the calibration procedure.

Chapter 8: MAINTENANCE, REPAIR & CALIBRATION – Provides information on preventive maintenance and repair operation.

Chapter 9: SERVICES INFORMATION - Information, process, contacts and addresses relative for repair and/or calibration.

SEMANTICS

In this manual, different terminologies may be used to speak about the «WB Series, PB Series or TANDEM Series Dynamometers». The primary purpose is to make this user manual useful and easy to read.

Below you will find different terminology used such as: «Dynamometer», «Brake», «Brake Dynamometer», «Dynamometer Brake», «Dyno»,... are all synonyms; «WB XXX Series» or «WB Series» are all abreviations for «WB Series Eddy-Current Dynamometer», etc.

The term «Series» stands for all the products of the series (e.g. XX 3XX Series refers to XX 300 ... XX 399).

CONVENTIONS USED IN THIS MANUAL

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

NOTICE

Indicates information considered important but not hazard related.

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

CAUTION

INDICATES A HAZARDOUS SITUATION THAT, IF NOT AVOIDED, COULD RESULT IN MINOR OR MODERATE INJURY.

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

WARNING

INDICATES A HAZARDOUS SITUATION THAT, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

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

DANGER

INDICATES A HAZARDOUS SITUATION THAT, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY. THE SIGNAL WORD «DANGER» IS TO BE LIMITED TO THE MOST EXTREME SITUATIONS.

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

The safety symbol may subsequently vary depending on the source of the hazard. Below are examples:

Various safety pictograms according to ISO 7010

1. INTRODUCTION

1.1 GENERAL INFORMATION

The WB, PB & TANDEM 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 Series** mounting of both dynamometer types for applications requiring measurements on a wide range of speeds.

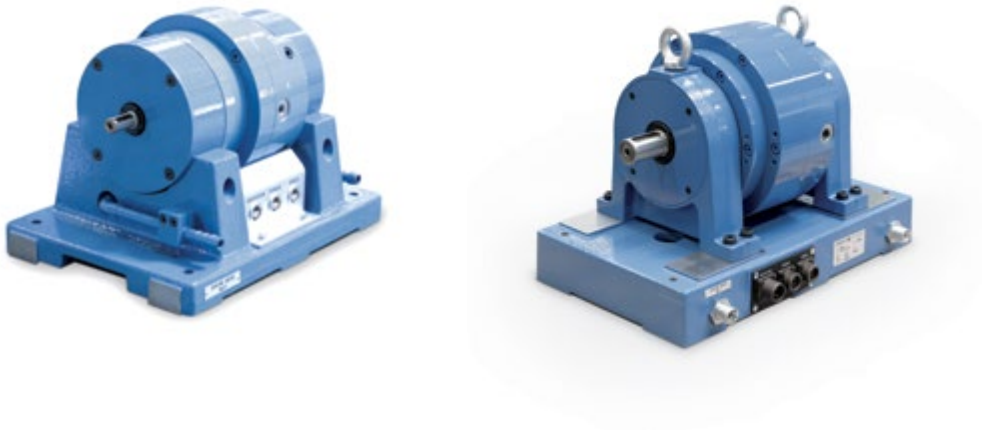


Fig.1-1 2WB/PB 43 & 2WB/PB 115 Dynamometers

Fig.1-2 4WB15 & 4PB15 TANDEM Dynamometer
(noticed the electromagnetic clutches inbetween)

1.2 DATASHEET · WB SERIES

WB SERIES
EDDY-CURRENT DYNAMOMETERS

MAGTROL offers 3 types of dynamometer brakes to absorb load: Hysteresis (**HD Series**), Eddy-Current (**WB Series**) and Magnetic Powder (**PB Series**). 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 standard models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

FEATURES

- 12 Standard Models with Maximum Torque: 400 mN·m ... 560 N·m (56.6 oz·in ... 413 lb·ft)
- Braking Power: 500 W ... 140 kW
- Stable Braking Torque, without Shock
- Low Moment of Inertia
- Low Residual Torque
- Operating Direction CW / CCW
- Braking Torque Measurement Integrated
- High Rotational Speed (≤ 80 000 rpm)
- Integrated Optical Speed Sensor
- Special designs available upon request

Fig. 1: 1 WB 115 | 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, providing high continuous power ratings (max. 140 kW). WB Series Dynamometers integrate a torque measuring system with an accuracy ratings of ± 0.3 % to ± 0.5 % full scale, depending on size and system configuration.

OPERATING PRINCIPLES

The WB Eddy-Current Dynamometers develop their full power at high rotation speeds. The WB Series is particularly intended for motors which rotate at high speeds, up to 80 000 rpm (up to 100 000 rpm with WB 23 / 27; see specific datasheet). The braking torque depends on the rotation speed.

APPLICATIONS

Mounted on test benches, the WB Series Eddy-Current Dynamometers allow performance and reliability testing on driving elements such as servomotors, micromotors for cameras, fans, drills, combustion engine, pumps, pneumatic equipment, hydraulic transmission systems, gas turbines, spindles, compressors and motors for domestic appliances.

OPTICAL SPEED SENSOR

Each WB Series Dynamometer is equipped with an optical speed sensor delivered as standard. WB 32 is equipped with a 4 PPR (Pulses Per Revolution) encoder, WB 43 and WB 65 HS are equipped with a 30 PPR encoder; WB 65, WB 115 & WB 15 are equipped with a 60 PPR encoder.

MODELS	WB 32	WB 43	WB 43 HS	WB 65	WB 65 HS	WB 115	WB 115 HS	WB 15	WB 15 HS
Encoder 4 PPR	x								
Encoder 30 PPR		x	x		x				
Encoder 60 PPR				x		x	x	x	x

DYNAMOMETER CONFIGURATIONS

The Dynamometers can be complemented by various electronic modules such as the DES Series (Power Supply), TSC Series (Torque & Speed Conditioner) and DSP 7010 (High Speed Programmable Dynamometer Controller).

Magtrol also offers In-Line Torque Transducers (TS 100 Series or TM 300 Series) or Torque Flange (TF 300 Series) for extremely accurate torque and speed measurement with high noise immunity. For a dynamic, high-precision system, the torque transducer can be mounted in line between the unit under test and the dynamometer, providing a torque accuracy of 0.1 %.

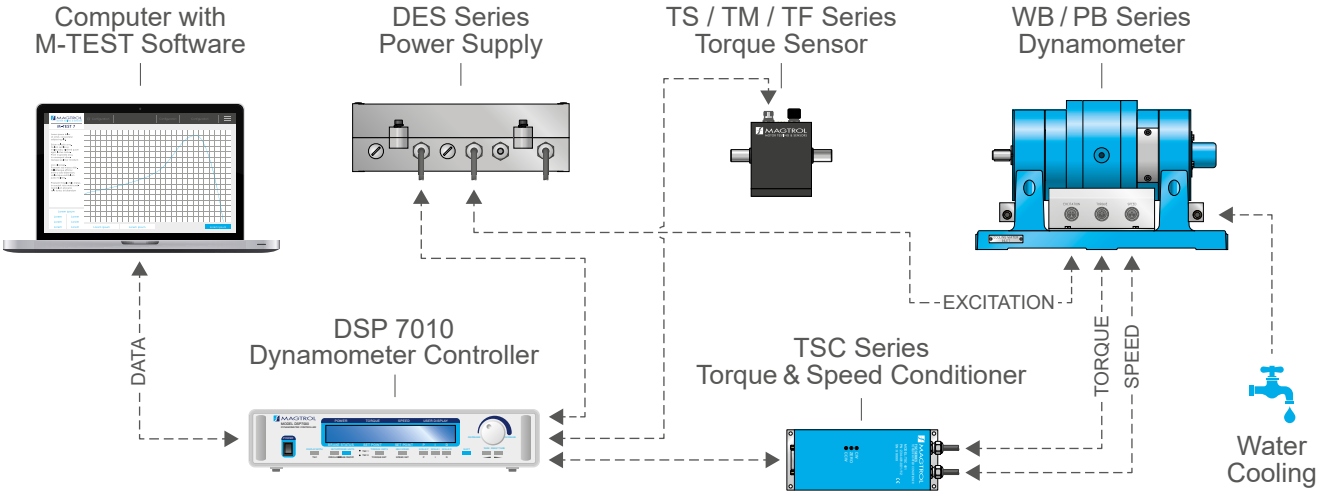


Fig. 2: Configuration of the WB Series Dynamometer with its accessories

SPECIFICATIONS

NOTE: For continuous operating (≥ 2 hours) at constant torque or power, please consider 20% reserve in both torque & power
NOTE: Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 4 decimal places.

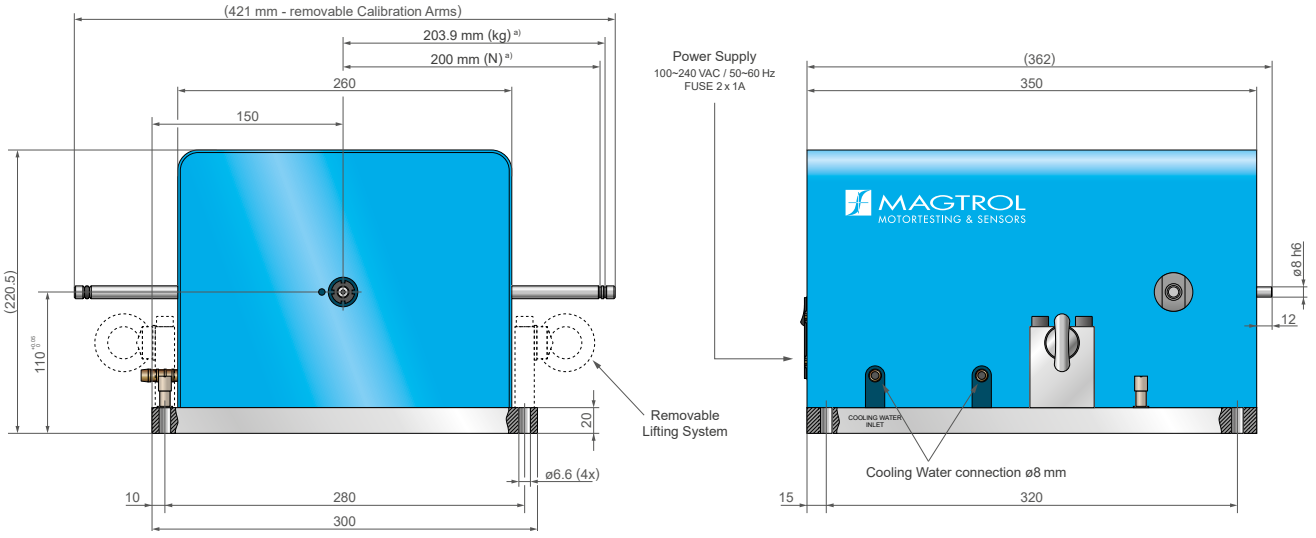
MODEL	RATED TORQUE		DRAG TORQUE DE-ENERGIZED		NOMINAL INPUT INERTIA		RATED POWER	RATED SPEED	MAX. SPEED		EXCITATION CURRENT
									STANDARD	HIGH-SPEED (HS version)	
	N·m	oz·in	mN·m	oz·in	kg·m²	lb·ft·s²	kW	rpm	rpm	rpm	A
1WB32 [f]	0.4	56.6	≤20 [e]	≤2.83	2.71×10^{-5}	1.19×10^{-5}	0.5	11950	80000	N/A	0.7 [a]
2WB32 [f]	0.8	113.3			5.03×10^{-5}	3.71×10^{-5}	1.0				1.4 [a]
1WB43	1.5	211.2	15	2.12	1.21×10^{-4}	8.92×10^{-5}	1.5	9550	50000	65000	1.0 [b]
2WB43	3.0	422.4	30	4.24	2.17×10^{-4}	1.60×10^{-4}	3.0				2.0 [b]

MODEL	RATED TORQUE		DRAG TORQUE DE-ENERGIZED		NOMINAL INPUT INERTIA		RATED POWER	RATED SPEED	MAX. SPEED		EXCITATION CURRENT
									STANDARD	HIGH-SPEED (HS version)	
	N·m	lb·ft	N·m	lb·in	kg·m²	lb·ft·s²	kW	rpm	rpm	rpm	A
1WB65	10	7.3	0.1	0.88	0.82×10^{-3}	6.04×10^{-4}	6	5730	30000	50000	2.5 [c]
2WB65	20	14.7	0.2	1.77	1.55×10^{-3}	1.14×10^{-3}	12				5.0 [c]
1WB115	50	36.8	0.5	4.43	1.27×10^{-2}	9.36×10^{-3}	15	2865	18000	22000	2.5 [c]
2WB115	100	73.7	1.0	8.85	2.57×10^{-2}	1.89×10^{-2}	30				5.0 [c]
1WB15	140	103.0	1.4	12.30	5.00×10^{-2}	3.68×10^{-2}	35	2390	7500	10000	4.0 [d]
2WB15	280	206.0	2.8	24.70	1.00×10^{-1}	7.37×10^{-2}	70				7.5 [d]
3WB15	420	309.0	4.2	37.10	1.50×10^{-1}	1.10×10^{-1}	105				10.0 [d]
4WB15	560	413.0	5.6	49.50	2.00×10^{-1}	1.47×10^{-1}	140				12.0 [d]

a) Voltage at 20 °C is 15 V
b) Voltage at 20 °C is 24 V
c) Voltage at 20 °C is 30 V
d) Voltage at 20 °C is 45 V
e) At 80000 rpm
f) This product will be available in summer 2025

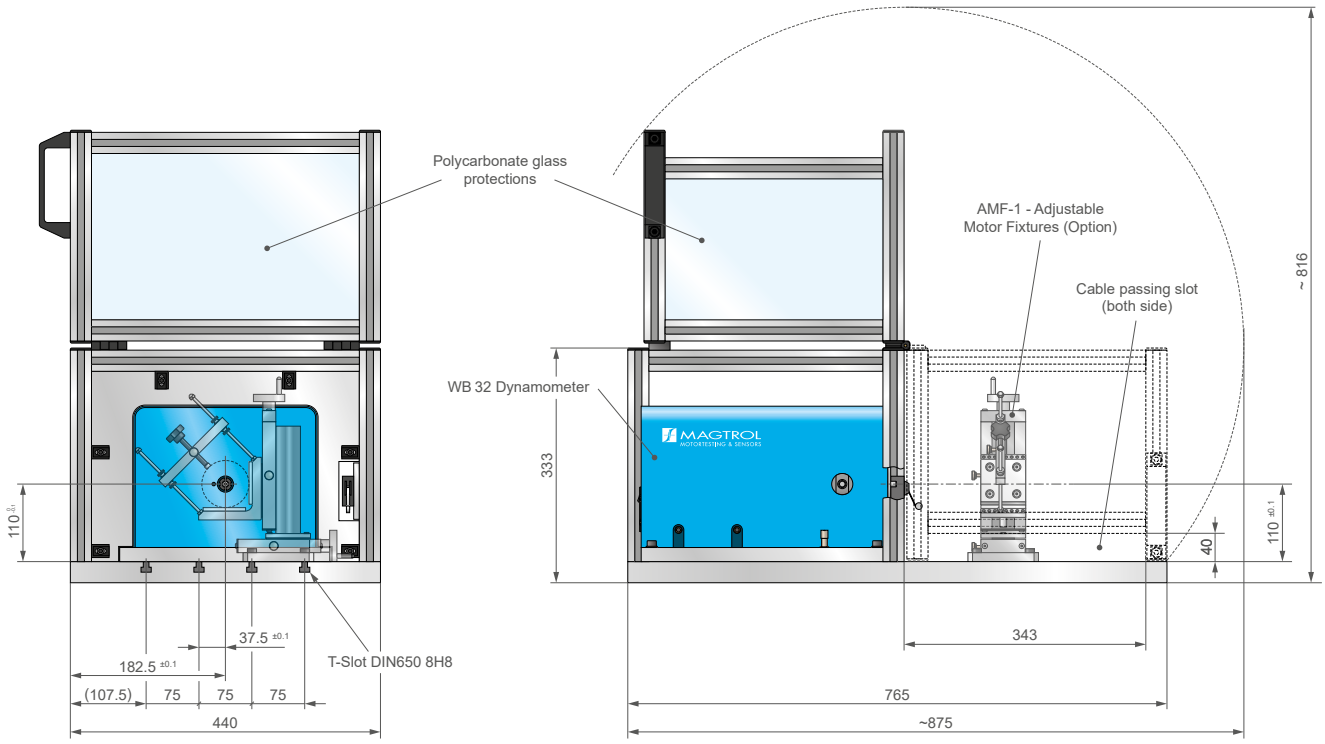
WB 32 DIMENSIONS

AVAILABLE IN SUMMER 2025.



CAUTION: All WB Series Dynamometers must be water cooled.
NOTE: All values are in metric units. Dimensions are in millimeters.

WB 32 WITH PROTECTION COVER

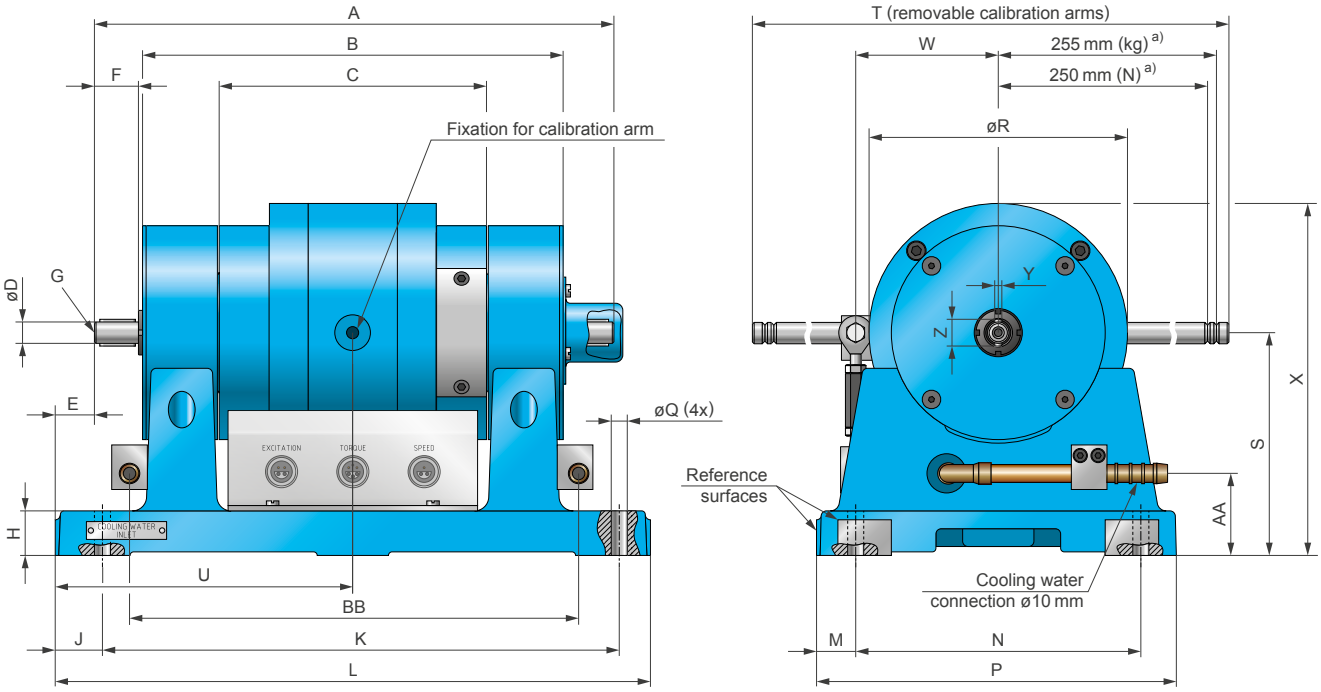


Magtrol offers a standard version integrating the dynamometer on a rigid base plate. The standard plate has 4 T-Slots to facilitate the attachment of other components and an ergonomic protective cover for the safety of the user.

As an option, the system can also be supplied with an AMF-1 Adjustable Motor Fixture. This allows test mounting and alignment of devices with diameters up to 100mm and 4.5kg.

Other designs and mounting systems are available on request. Please, contact our sales department for custom designs. Magtrol is at your service, and has a long experience in providing customized solutions.

WB 43 DIMENSIONS



CAUTION: All WB Series Dynamometers must be water cooled.
NOTE: Dimensions for the specific versions (HS, IS, ... see page 10) can slightly vary from the standard versions. For more information, please, contact our sales technicians for specific drawing.
NOTE: Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 4 decimal places.

MODEL	units	A	B	C	øD c)	E	F	G b)	H	J	K	L	M	N	P
1 WB 43	mm	240	186	100	12 h6	22	25	M4	25	22	240	284	22	160	202
	in	9.45	7.32	3.94	0.4724 0.4721	0.87	0.98		0.98	0.87	9.45	11.18	0.87	6.30	7.95
2 WB 43	mm	290	236	150	12 h6	22	25		25	22	290	334	22	160	202
	in	11.42	9.29	5.91	0.4724 0.4721	0.87	0.98		0.98	0.87	11.42	13.15	0.87	6.30	7.95

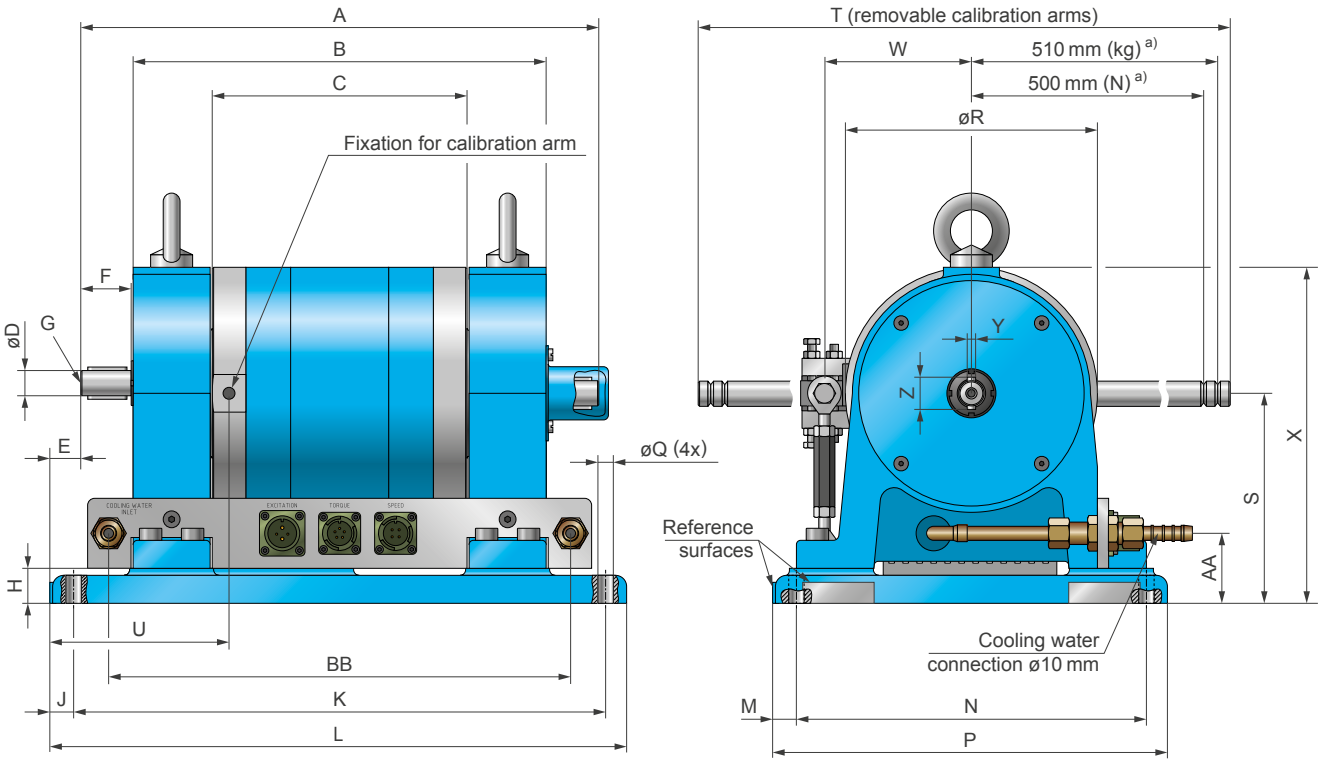
MODEL	units	øQ	øR	S	T	U	W	X	Y	Z	AA	BB	Weight
1 WB 43	mm	9	145	125 ±0.05	524	153	80	198	4 h9	15	46	202	~ 24 kg
	in	0.35	5.71	4.923 4.919	20.63	6.02	3.15	7.80	0.1574 0.1563	0.59	1.81	7.95	~ 52.9 lb
2 WB 43	mm	9	145	125 ±0.05	524	167	80	198	4 h9	15	46	252	~ 31 kg
	in	0.35	5.71	4.923 4.919	20.63	6.57	3.15	7.80	0.1574 0.1563	0.59	1.81	9.92	~ 68.4 lb

a) 255 mm for a calibration in N·m with weight in kg (use outer groove); 250 mm for calibration in N·m with weight in N (use inner groove)

b) Center according to DIN 332-D

c) Shaft of High Speed version (HS) is ø12 h6, smooth (without key) with a different length. For more information, please contact our sale service.

WB 65 DIMENSIONS



CAUTION: All WB Series Dynamometers must be water cooled.
NOTE: Dimensions for the specific versions (HS, IS, ... see page 10) can slightly vary from the standard versions. For more information, please, contact our sales technicians for specific drawing.
NOTE: Original dimensions are in metric units. Dimensions converted to English units have been rounded up to 4 decimal places.

MODEL	units	A	B	C	øD c)	E	F	G b)	H	J	K	L	M	N	P
1 WB 65	mm	300	225	112	18 h6	22	36	M5	25	17	310	342	17	250	282
	in	11.81	8.86	4.41	0.7086 0.7083	0.87	1.42		0.98	0.67	12.2	13.46	0.67	9.84	11.10
2 WB 65	mm	370	295	182	18 h6	22	36		25	17	380	412	17	250	282
	in	14.57	11.61	7.17	0.7086 0.7083	0.87	1.42		0.98	0.67	14.96	16.22	0.67	9.84	11.10

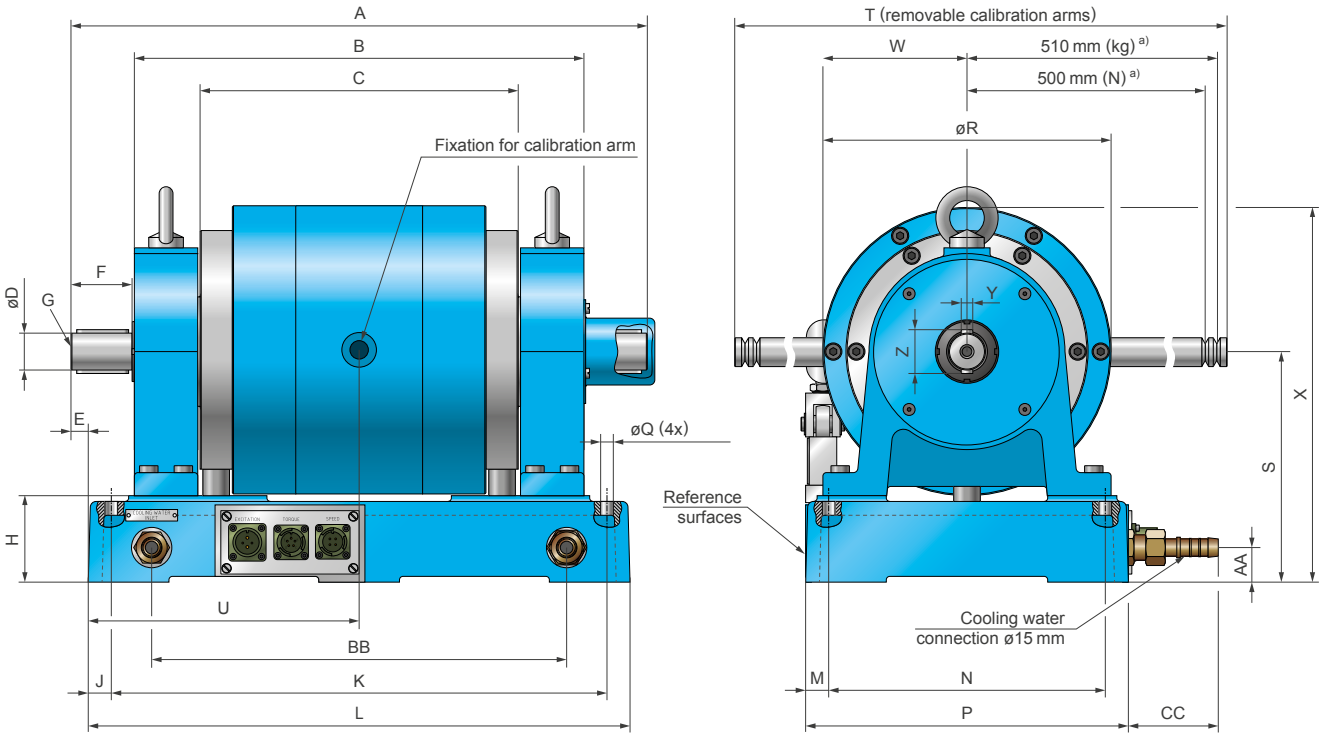
MODEL	units	øQ	øR	S	T	U	W	X	Y	Z	AA	BB	Weight
1 WB 65	mm	11	180	150 ±0.1	1034	128	105	240	6 h9	23	50	260	~ 55 kg
	in	0.43	7.09	5.909 5.902	40.71	5.04	4.13	9.45	0.2362 0.2351	0.91	1.97	10.24	~ 122 lb
2 WB 65	mm	11	180	150 ±0.1	1034	128	105	240	6 h9	23	50	330	~ 70 kg
	in	0.43	7.09	5.909 5.902	40.71	5.04	4.13	9.45	0.2362 0.2351	0.91	1.97	12.99	~ 155 lb

a) 510 mm for a calibration in N·m with weight in kg (use outer groove); 500 mm for a calibration in N·m with weight in N (use inner groove).

b) Center according to DIN 332-D

c) Shaft of High Speed version (HS) is ø12 h6, smooth (without key) with a different length. For more information, please contact our sale service.

WB 115 DIMENSIONS



CAUTION: All WB Series Dynamometers must be water cooled.
NOTE: Dimensions for the specific versions (HS, IS, ... see page 10) can slightly vary from the standard versions. For more information, please, contact our sales technicians for specific drawing.
NOTE: Original dimensions are in metric units. Dimensions converted to imperial units have been rounded up to 4 decimal places.

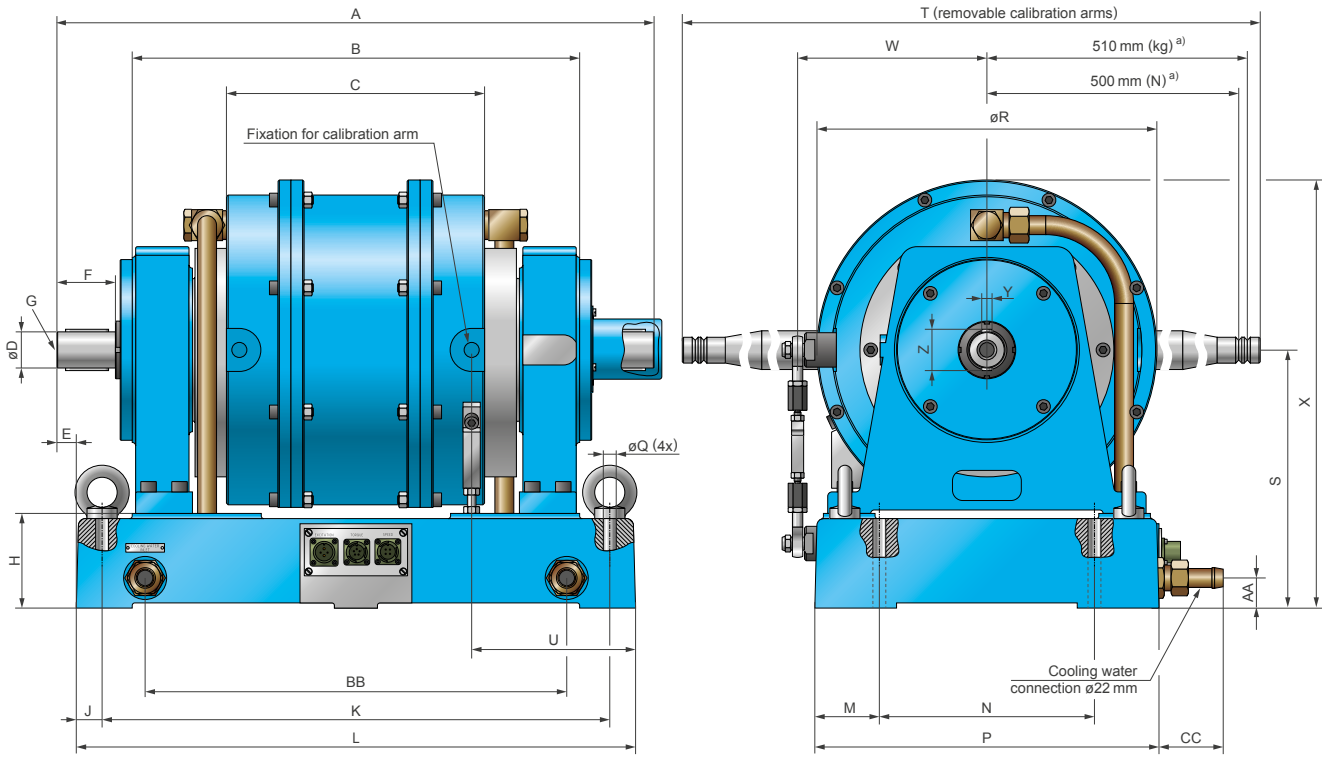
MODEL	units	A	B	C	øD	E	F	G b)	H	J	K	L	M	N	P
1 WB 115	mm	390	280	166	32 h6	-40	54	M8	75	20	430	470	40	200	280
	in	15.35	11.02	6.54	1.2598 1.2593	-1.57	2.13		2.95	0.79	16.93	18.50	1.57	7.87	11.02
2 WB 115	mm	500	390	276	32 h6	15	54		75	20	430	470	40	200	280
	in	19.69	15.35	10.87	1.2598 1.2593	0.59	2.13		2.95	0.79	16.93	18.50	1.57	7.87	11.02

MODEL	units	øQ	øR	S	T	U	W	X	Y	Z	AA	BB	CC	Weight
1 WB 115	mm	11	250	200 ±0.1	1038	197	125	325	10 h9	38	30	360	80	~ 80 kg
	in	0.43	9.84	7.878 7.870	40.87	7.76	4.92	12.80	0.3937 0.3932	1.50	1.18	14.17	3.15	~ 177 lb
2 WB 115	mm	11	250	200 ±0.1	1038	235	125	325	10 h9	38	30	360	80	~ 130 kg
	in	0.43	9.84	7.878 7.870	40.87	9.25	4.92	12.80	0.3937 0.3932	1.50	1.18	14.17	3.15	~ 287 lb

a) 510 mm for a calibration in N·m with weight in kg (use outer groove); 500 mm for a calibration in N·m with weight in N (use inner groove).

b) Center according to DIN 332-D

WB 15 DIMENSIONS



CAUTION: All WB Series Dynamometers must be water cooled.
NOTE: Dimensions for the specific versions (HS, IS, ... see page 10) can slightly vary from the standard versions. For more information, please, contact our sales technicians for specific drawing.
NOTE: Original dimensions are in metric units. Dimensions converted to imperial units have been rounded up to 4 decimal places.

MODEL	units	A	B	C	øD	E	F	G[b)]	H	J	K	L	M	N	P
1 WB 15	mm	544	370	150	42 g6	-53	68	M8	110	30	590	650	75	250	400
	in	21.42	14.57	5.91	1.6531 1.6526	-2.09	2.68		4.33	1.18	23.23	25.59	2.95	9.84	15.75
2 WB 15	mm	694	520	300	42 g6	22	68		110	30	590	650	75	250	400
	in	27.32	20.47	11.81	1.6531 1.6526	0.87	2.68		4.33	1.18	23.23	25.59	2.95	9.84	15.75
3 WB 15	mm	844	670	450	42 g6	-78	68		110	30	940	1000	75	250	400
	in	33.23	26.38	17.72	1.6531 1.6526	-3.07	2.68		4.33	1.18	37.01	39.37	2.95	9.84	15.75
4 WB 15	mm	994	820	600	42 g6	-3	68		110	30	940	1000	75	250	400
	in	39.13	32.28	23.62	1.6531 1.6526	-0.12	2.68		4.33	1.18	37.01	39.37	2.95	9.84	15.75

MODEL	units	øQ	øR	S	T	U	W	X	Y	Z	AA	BB	CC	Weight
1 WB 15	mm	15	395	300 ±0.2	1030	265	220	498	12	48	35	490	75	~ 185 kg
	in	0.59	15.55	11.819 11.803	40.55	10.43	8.66	19.61	0.47	1.89	1.38	19.29	2.95	~ 408 lb
2 WB 15	mm	15	395	300 ±0.2	1030	190	220	498	12	48	35	490	75	~ 290 kg
	in	0.59	15.55	11.819 11.803	40.55	7.48	8.66	19.61	0.47	1.89	1.38	19.29	2.95	~ 640 lb
3 WB 15	mm	15	395	300 ±0.2	1030	290	220	498	12	48	35	840	75	~ 385 kg
	in	0.59	15.55	11.819 11.803	40.55	11.42	8.66	19.61	0.47	1.89	1.38	33.07	2.95	~ 849 lb
4 WB 15	mm	15	395	300 ±0.2	1030	215	220	498	12	48	35	840	75	~ 520 kg
	in	0.59	15.55	11.819 11.803	40.55	8.46	8.66	19.61	0.47	1.89	1.38	33.07	2.95	~ 1147 lb

a) 510 mm for a calibration in N·m with weight in kg (use outer groove); 500 mm for a calibration in N·m with weight in N (use inner groove).

b) Center according to DIN 332-D

RELATED PRODUCTS

PB SERIES - POWDER DYNAMOMETER

Fig. 3: 1 PB 115 | Powder Dynamometer

The PB Series 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.

TANDEM SERIES - WB + PB DYNAMOMETER

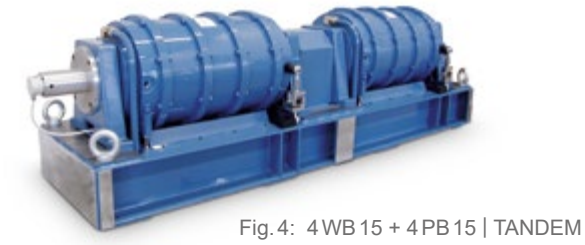


Fig. 4: 4 WB 15 + 4 PB 15 | TANDEM

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.

DUAL SERIES - DOUBLE WB DYNAMOMETER IN TANDEM SETUP

For application requiring higher power in a dedicated speed range, Magtrol offers some of the Eddy Current Dynamometer mounted in line on a common base. This would be for example the models 2 WB 65 + 2 WB 65 (rated torque 40 N·m, max speed 24 000 rpm, max power 24 kW) or 2 WB 115 + WB 115 (rated torque 200 N·m, max speed 15 000 rpm, max power 60 kW).

DYNAMOMETER OPTIONS

HIGH SPEED (HS)

For testing high-speed motors, Magtrol offers WB Series Eddy-Current Dynamometer with speed ranges up to 65 000 rpm (according to the version, see specification table).

For small or miniature motors, Magtrol models WB 23 / 27, WB 32 or Microdyne are available for speed up to 100 000 rpm (see specific data sheet).

INDUSTRIAL VERSION (IS)

WB Series Dynamometers are also available in an industrial version, which includes the base plate, but does not provide torque nor speed measurement.

MECHANICAL ROTOR BLOCKING DEVICE (MB)

As Eddy Current principle is proportional to speed and do not provide braking torque at 0 rpm, a mechanical rotor blocking device, which allows locked rotor testing, is available as an option for the WB Dynamometer.

VERTICAL MOUNTING (V)

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

NOTE: Dimensions of the specific versions can slightly vary from the standard versions. Please, contact our sales technicians for specific drawing.

ORDERING INFORMATION

ORDERING NUMBER	_	WB	_ _ _	-	_ _
1, 2, 3, 4 : Model number					
32 [a], **43, 65, 115, 15** : Model number					

HS: High speed version [b]
IS : Industrial version [b]
MB : Mechanical rotor bloking device [b]
V : Vertical mounting [b]

Example: 2 WB 43 Eddy-Current Dynamometer, high speed version would be ordered as **2WB43-HS**

1 WB 115 Eddy-Current Dynamometer, vertical mounting version would be ordered as **1WB115-V**

3 WB 65 Eddy-Current Dynamometer, industrial version would be ordered as **3WB65-IS**

a) Available in summer 2025
b) Not available for WB 32

1.3 DATASHEET · PB SERIES

PB SERIES
POWDER BRAKE DYNAMOMETERS

Magtrol offers 3 types of dynamometer brakes to absorb load: Hysteresis (**HD Series**), Eddy-Current (**WB Series**) and Magnetic Powder (**PB Series**). 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 standard models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

FEATURES

- 9 Models with Maximum Torque 5 N·m ... 1 200 N·m (3.69 lb·ft ... 885 lb·ft)
- Braking Power: 500 W ... 48 kW
- Stable Braking Torque
- Low Moment of Inertia
- Operation in Either Rotational Direction
- Braking Torque Measurement Integrated
- Integrated Optical Speed Sensor
- Special designs available upon request

Fig. 1: 1 PB 115 | Eddy-Current Dynamometer

DESCRIPTION

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. PB Series Powder Dynamometers integrate a torque measuring system with an accuracy ratings ±0.3 % ... ±0.5 % full scale, depending on size and system configuration.

APPLICATIONS

Mounted on test benches, the PB Series Powder Dynamometers allow performance and reliability testing on driving elements such as servomotors, geared motor, gearbox, windshield wiper motor, starter motor, fans, drills, hydraulic transmission systems and motors for domestic appliances.

POWDER DYNAMOMETER OPERATING PRINCIPLES

The PB Series - 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.

OPTICAL SPEED SENSOR

Each PB Series Dynamometer has an optical speed sensor delivered as standard. PB 43 has an optical speed sensor with a 30 PPR (Pulses Per Revolution); PB 65, PB 115 & PB 15 has an optical speed sensor with a 60 PPR.

For higher speed resolution in low speed applications, Magtrol offers a 600 PPR or 6 000 PPR encoder as an option.

DYNAMOMETER CONFIGURATIONS

The Dynamometers can be complemented by various electronic modules such as the DES Series (Power Supply), TSC Series (Torque & Speed Conditioner) and DSP 7010 (Programmable Dynamometer Controller).

Magtrol also offers In-Line Torque Transducers (TS 100 Series or TM 300 Series) or Torque Flange (TF 300 Series) for extremely accurate torque and speed measurement. For a dynamic, high-precision system, the torque transducer can be mounted in line between the unit under test and the dynamometer, providing a torque accuracy of 0.1 %.

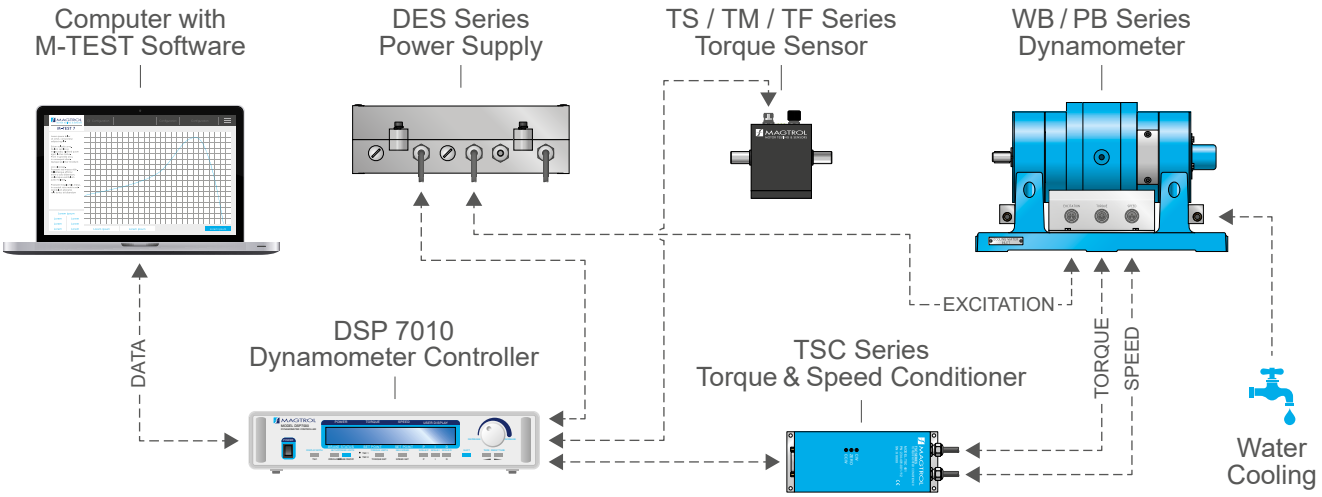


Fig. 2: Configuration of the PB Series Dynamometer with its accessories

SPECIFICATIONS

NOTE: For continuous operating (≥ 2 hours) at constant torque or power, please consider 20% reserve in both Torque & Power

MODEL	RATED TORQUE		DRAG TORQUE DE-ENERGIZED		NOMINAL INPUT INERTIA		RATED POWER	RATED SPEED [a]	MAX. SPEED	EXCITATION CURRENT
	N·m	lb·ft	N·m	lb·in	kg·m²	lb·ft·s²	kW	rpm	rpm	A
1 PB 43	5	3.69	0.1	0.88	1.41×10^{-4}	1.03×10^{-4}	0.5	955	4 000	1.0 [b]
2 PB 43	10	7.38	0.2	1.77	2.40×10^{-4}	1.77×10^{-4}	1.0			2.0 [b]
1 PB 65	25	18.40	0.5	4.42	0.92×10^{-3}	6.78×10^{-4}	1.5	570	3 000	2.5 [c]
2 PB 65	50	36.80	1.0	8.85	1.71×10^{-3}	1.26×10^{-3}	3.0			5.0 [c]
1 PB 115	100	73.70	2.0	17.70	1.24×10^{-2}	9.14×10^{-3}	5.0	480	3 000	2.5 [c]
2 PB 115	200	147.50	4.0	35.40	2.50×10^{-2}	1.84×10^{-2}	10.0			5.0 [c]
1 PB 15	300	221.00	6.0	53.10	5.40×10^{-2}	3.98×10^{-2}	12.0	382	2 000	4.0 [d]
2 PB 15	600	442.00	12.0	106.20	1.08×10^{-1}	7.96×10^{-2}	24.0			7.5 [d]
4 PB 15	1 200	885.00	24.0	212.41	2.16×10^{-1}	1.59×10^{-1}	48.0			12.0 [d]

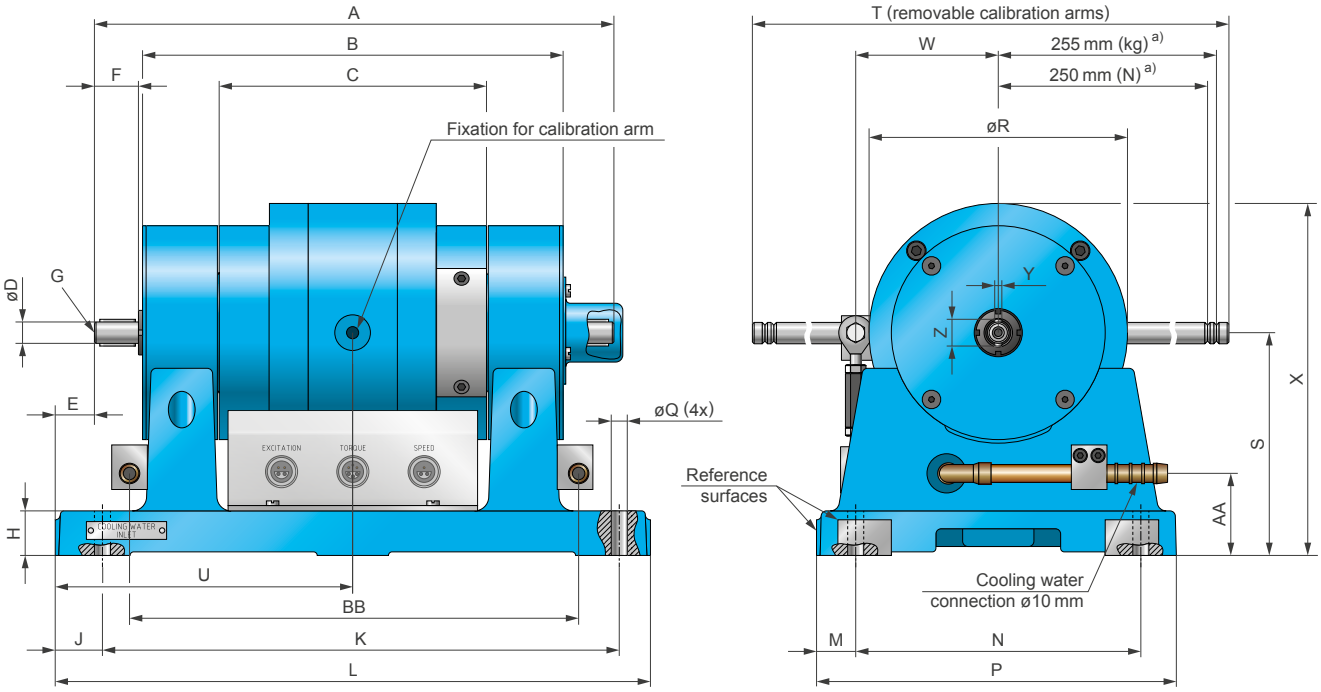
a) Depending on torsionnal stifness of the drive line, magnetic powder may generate a "slip-stick" effect (torsional vibration) at low speed (around 10 rpm)

b) Voltage @ 20 °C : 24 V

c) Voltage @ 20 °C : 30 V

d) Voltage @ 20 °C : 45 V

PB 43 DIMENSIONS



CAUTION: All PB Series Dynamometers must be water cooled.

NOTE: Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 4 decimal places.

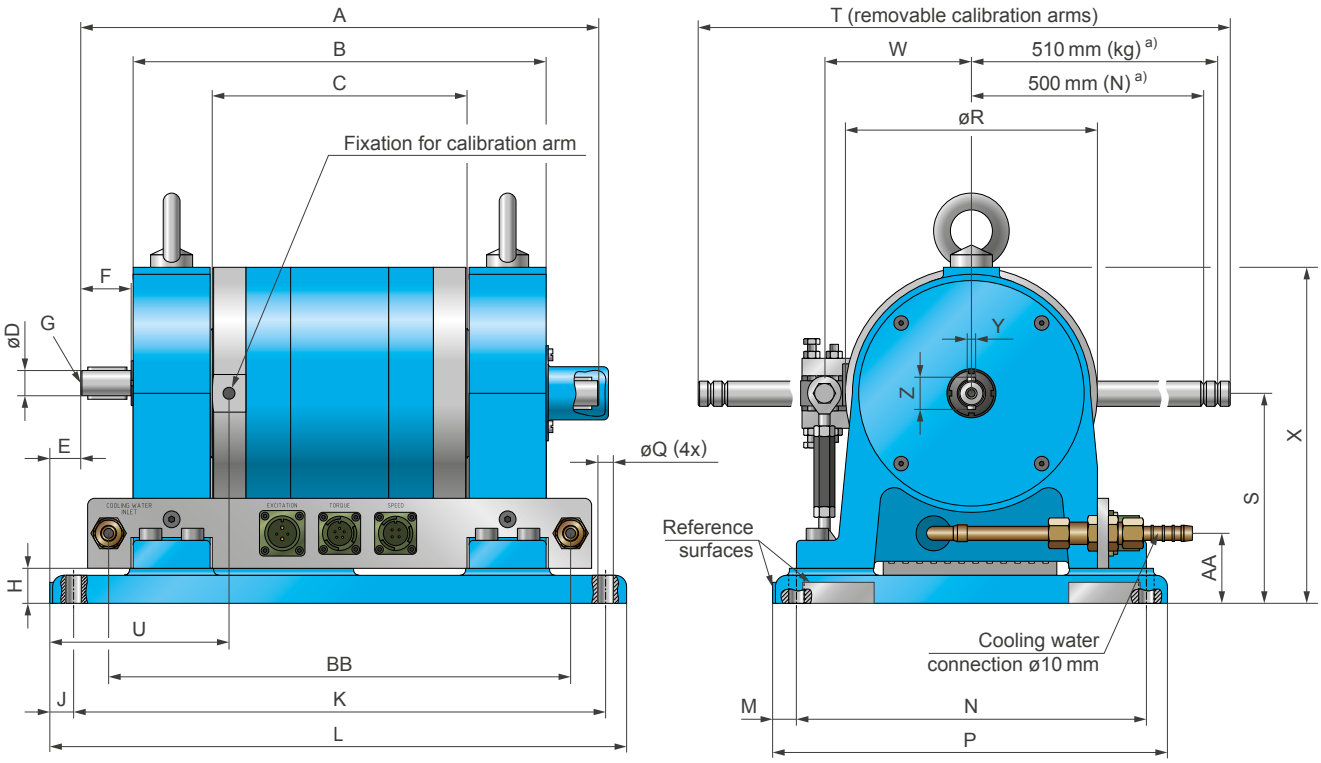
MODEL	units	A	B	C	øD	E	F	G b)	H	J	K	L	M	N	P
1 PB 43	mm	240	186	100	12 h6	22	25	M4	25	22	240	284	22	160	202
	in	9.45	7.32	3.94	0.4724 0.4721	0.87	0.98		0.98	0.87	9.45	11.18	0.87	6.30	7.95
2 PB 43	mm	290	236	150	12 h6	22	25		25	22	290	334	22	160	202
	in	11.42	9.29	5.91	0.4724 0.4721	0.87	0.98		0.98	0.87	11.42	13.15	0.87	6.30	7.95

MODEL	units	øQ	øR	S	T	U	W	X	Y	Z	AA	BB	Weight
1 PB 43	mm	9	145	125 ±0.05	524	153	80	198	4 h9	15	46	202	~ 24 kg
	in	0.35	5.71	4.923 4.919	20.63	6.02	3.15	7.80	0.1574 0.1563	0.59	1.81	7.95	~ 53 lb
2 PB 43	mm	9	145	125 ±0.05	524	167	80	198	4 h9	15	46	252	~ 31 kg
	in	0.35	5.71	4.923 4.919	20.63	6.57	3.15	7.80	0.1574 0.1563	0.59	1.81	9.92	~ 69 lb

a) 255 mm for a calibration in N·m with weight in kg (use outer groove);
250 mm for calibration in N·m with weight in N (use inner groove)

b) Center according to DIN 332-D

PB 65 DIMENSIONS



CAUTION: All PB Series Dynamometers must be water cooled.

NOTE: Original dimensions are in metric units. Dimensions converted to English units have been rounded up to 4 decimal places.

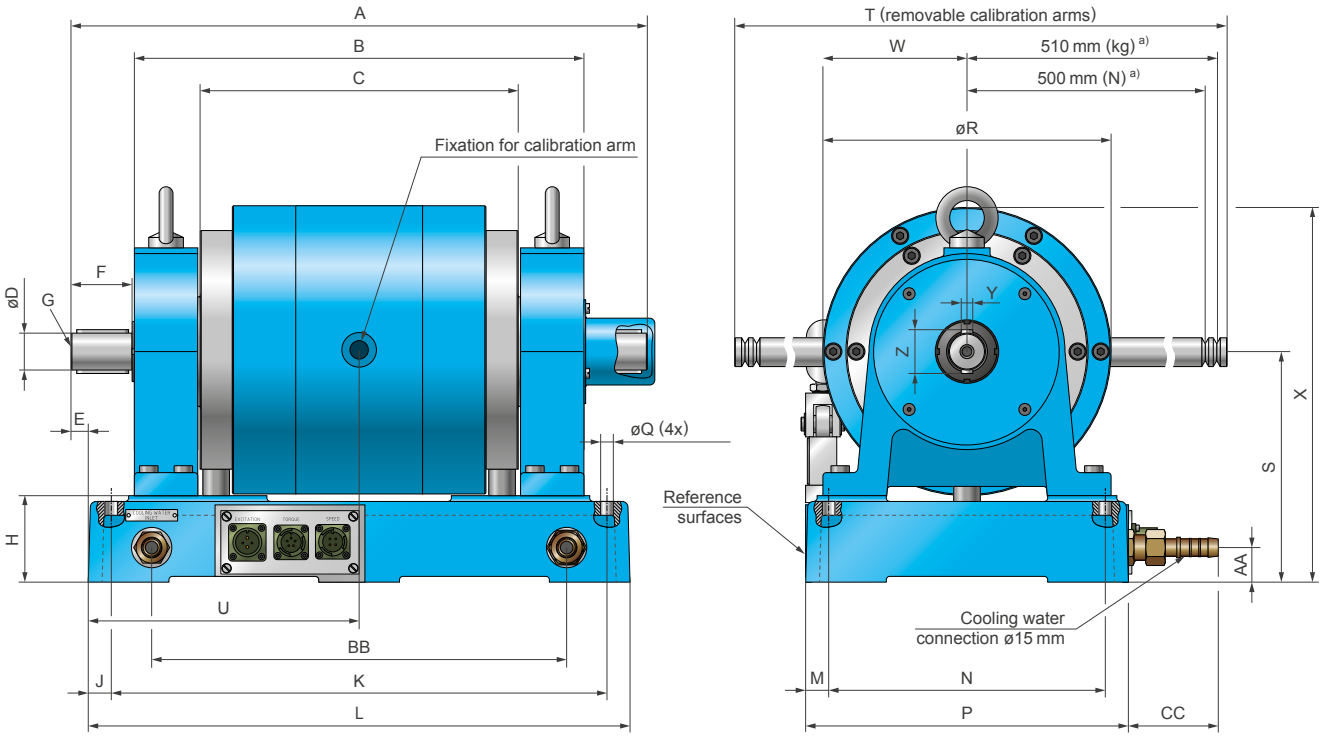
MODEL	units	A	B	C	øD	E	F	G b)	H	J	K	L	M	N	P
1 PB 65	mm	300	225	112	18 h6	22	36	M5	25	17	310	342	17	250	282
	in	11.81	8.86	4.41	0.7086 0.7083	0.87	1.42		0.98	0.67	12.2	13.46	0.67	9.84	11.10
2 PB 65	mm	370	295	182	18 h6	22	36		25	17	380	412	17	250	282
	in	14.57	11.61	7.17	0.7086 0.7083	0.87	1.42		0.98	0.67	14.96	16.22	0.67	9.84	11.10

MODEL	units	øQ	øR	S	T	U	W	X	Y	Z	AA	BB	Weight
1 PB 65	mm	11	180	$150^{\pm 0.1}$	1034	128	105	240	6 h9	23	50	260	~ 55 kg
	in	0.43	7.09	5.909 5.902	40.71	5.04	4.13	9.45	0.2362 0.2351	0.91	1.97	10.24	~ 122 lb
2 PB 65	mm	11	180	$150^{\pm 0.1}$	1034	128	105	240	6 h9	23	50	330	~ 70 kg
	in	0.43	7.09	5.909 5.902	40.71	5.04	4.13	9.45	0.2362 0.2351	0.91	1.97	12.99	~ 155 lb

a) 510 mm for a calibration in N·m with weight in kg (use outer groove); 500 mm for a calibration in N·m with weight in N (use inner groove).

b) Center according to DIN 332-D

PB 115 DIMENSIONS



CAUTION: All PB Series Dynamometers must be water cooled.

NOTE: Original dimensions are in metric units. Dimensions converted to imperial units have been rounded up to 4 decimal places.

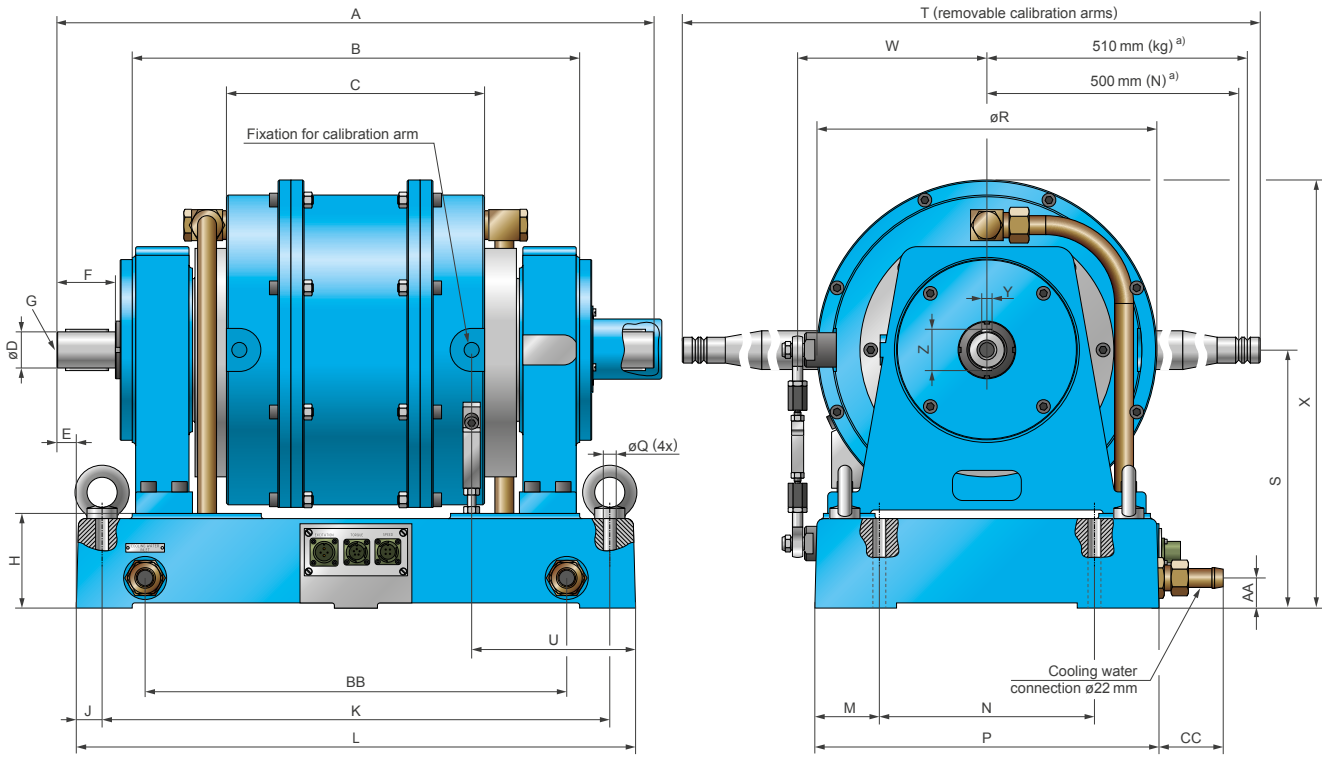
MODEL	units	A	B	C	øD	E	F	G b)	H	J	K	L	M	N	P
1 PB 115	mm	390	280	166	32 h6	-40	54	M8	75	20	430	470	40	200	280
	in	15.35	11.02	6.54	1.2598 1.2593	-1.57	2.13		2.95	0.79	16.93	18.50	1.57	7.87	11.02
2 PB 115	mm	500	390	276	32 h6	15	54		75	20	430	470	40	200	280
	in	19.69	15.35	10.87	1.2598 1.2593	0.59	2.13		2.95	0.79	16.93	18.50	1.57	7.87	11.02

MODEL	units	øQ	øR	S	T	U	W	X	Y	Z	AA	BB	CC	Weight
1 PB 115	mm	11	250	$200^{\pm 0.1}$	1038	197	125	325	10 h9	38	30	360	80	~ 80 kg
	in	0.43	9.84	7.878 7.870	40.87	7.76	4.92	12.80	0.3937 0.3932	1.50	1.18	14.17	3.15	~ 177 lb
2 PB 115	mm	11	250	$200^{\pm 0.1}$	1038	235	125	325	10 h9	38	30	360	80	~ 130 kg
	in	0.43	9.84	7.878 7.870	40.87	9.25	4.92	12.80	0.3937 0.3932	1.50	1.18	14.17	3.15	~ 287 lb

a) 510 mm for a calibration in N·m with weight in kg (use outer groove);
500 mm for a calibration in N·m with weight in N (use inner groove).

b) Center according to DIN 332-D

PB 15 DIMENSIONS



CAUTION: All PB Series Dynamometers must be water cooled.

NOTE: Original dimensions are in metric units. Dimensions converted to imperial units have been rounded up to 4 decimal places.

MODEL	units	A	B	C	øD	E	F	G b)	H	J	K	L	M	N	P
1 PB 15	mm	544	370	150	42 g6	-53	68	M8	110	30	590	650	75	250	400
	in	21.42	14.57	5.91	1.6531 1.6526	-2.09	2.68		4.33	1.18	23.23	25.59	2.95	9.84	15.75
2 PB 15	mm	694	520	300	42 g6	22	68		110	30	590	650	75	250	400
	in	27.32	20.47	11.81	1.6531 1.6526	0.87	2.68		4.33	1.18	23.23	25.59	2.95	9.84	15.75
4 PB 15	mm	994	820	600	42 g6	-3	68		110	30	940	1000	75	250	400
	in	39.13	32.28	23.62	1.6531 1.6526	-0.12	2.68		4.33	1.18	37.01	39.37	2.95	9.84	15.75

MODEL	units	øQ	øR	S	T	U	W	X	Y	Z	AA	BB	CC	Weight
1 PB 15	mm	15	395	300 ±0.2	1030	265	220	498	12 h9	48	35	490	75	~ 185 kg
	in	0.59	15.55	11.819 11.803	40.55	10.43	8.66	19.61	0.471 0.472	1.89	1.38	19.29	2.95	~ 408 lb
2 PB 15	mm	15	395	300 ±0.2	1030	190	220	498	12 h9	48	35	490	75	~ 290 kg
	in	0.59	15.55	11.819 11.803	40.55	7.48	8.66	19.61	0.471 0.472	1.89	1.38	19.29	2.95	~ 640 lb
4 PB 15	mm	15	395	300 ±0.2	1030	215	220	498	12 h9	48	35	840	75	~ 520 kg
	in	0.59	15.55	11.819 11.803	40.55	8.46	8.66	19.61	0.471 0.472	1.89	1.38	33.07	2.95	~ 1147 lb

a) 510 mm for a calibration in N·m with weight in kg (use outer groove);
500 mm for a calibration in N·m with weight in N (use inner groove).

b) Center according to DIN 332-D

RELATED PRODUCTS

WB SERIES - EDDY-CURRENT DYNAMOMETER

Fig. 3: 1 WB 43 | Eddy-Current Dynamometer

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).

TANDEM SERIES - WB + PB DYNAMOMETER

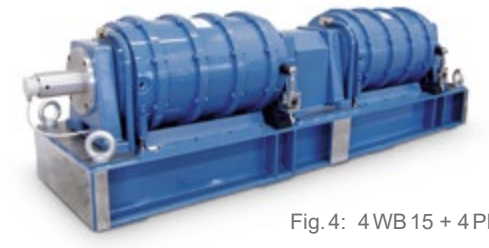


Fig. 4: 4 WB 15 + 4 PB 15 | TANDEM

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.

DUAL SERIES - DOUBLE WB DYNAMOMETER IN TANDEM SETUP

For application requiring higher power in a dedicated speed range, Magtrol offers some of the Eddy Current Dynamometer mounted in line on a common base. This would be for example the models 2 WB 65 + 2 WB 65 (rated torque 40 N·m, max speed 24 000 rpm, max power 24 kW) or 2 WB 115 + 2 WB 115 (rated torque 200 N·m, max speed 15 000 rpm, max power 60 kW).

DYNAMOMETER OPTIONS

SPEED ENCODER (DG)

PB Series Dynamometers, are equipped with a encoder (optical speed sensor) 30 PPR (PB 43) or 60 PPR (PB 65, PB 115 & PB 15) encoder.

On PB Dynamometers, a 600 PPR or 6 000 PPR encoder is available as an option for low speed applications.

INDUSTRIAL VERSION (IS)

PB Series Dynamometers are also available in an industrial version, which includes the base plate, but does not provide torque nor speed measurement.

NOTE: Dimensions of the specific versions can slightly vary from the standard versions. Please, contact our sales technicians for specific drawing.

ORDERING INFORMATION

ORDERING NUMBER	_	PB	_ _ _	-	_ _
1, 2, 4 : Model number					
43, 65, 115, 15 : Model number					
IS : Industrial version **DG-0600** : Speed Encoder 600 PPR [a] **DG-6000** : Speed Encoder 6000 PPR [a]					

a) PPR means Pulses Per Revolution

Examples:

2 PB 43 Powder Dynamometer, Industrial version would be ordered as: **2PB43-IS**

4 PB 115 Powder Dynamometer, with speed pickup 600 PPR would be ordered as: **4PB115-DG0600**

1 PB 65 Powder Dynamometer would be ordered as: **1PB65**

SYSTEM OPTIONS AND ACCESSORIES

DSP 7010 - DYNAMOMETER CONTROLLER

Magtrol's DSP 7010 High-Speed Programmable Dynamometer Controller employs state-of-the-art digital signal processing technology to provide superior motor testing capabilities. Designed for use with any Magtrol Hysteresis, Eddy-Current (WB Series) or Powder Brake (PB Series) Dynamometer, Magtrol In-Line Torque Transducer/Sensor (TS, TM, TF Series) or auxiliary instrument, the DSP 7010 can provide complete PC control via the USB or IEEE-488 interface. With up to 500 readings per second, the DSP 7010 is ideally suited for both the test lab and the production line.

Fig. 5: DSP 7010 | Programmable Dynamometer Controllers

TSC SERIES - TORQUE & SPEED CONDITIONER

The TSC Series is the Torque & Speed Conditioner used to connect Magtrol Eddy-Current (WB Series) or Powder (PB Series) Dynamometers to the DSP 7010 Controller. Powered by the DSP 7010, and based on a precision instrumentation amplifier, the unit amplifies and filters the torque signal. It also provides power supply and connections for the speed pickup sensor which is located in the dynamometer.

DES SERIES - POWER SUPPLIES

DES Series Power Supplies are specially designed for the full range of Magtrol's Eddy-current and Powder brake dynamometers with the design goal providing the best response time. The DES Series supplies are packaged in an industrial housing made of cast aluminum. This housing must be installed directly on the test bench, ideally on a thermal conductive surface.

Fig. 6: Custom Motor Test System with WB brake

MODEL 7500 - POWER ANALYZERS

The Magtrol MODEL 7500 Power Analyzer is an easy-to-use instrument ideal for numerous power measurement applications. From DC to 80 kHz AC, the MODEL 7500 Series measures volts, amps, watts, volt-amps, frequency, crest factor, Vpeak, Apeak and power factor in one convenient display. They may be used either as stand-alone instruments or in conjunction with any Magtrol Hysteresis, Eddy-Current or Powder Brake Dynamometer; any Magtrol Dynamometer Controller and M-TEST Software for more demanding motor test applications.

Fig. 7: MODEL 7500 | Power Analyzers

M-TEST - MOTOR TESTING SOFTWARE

Magtrol M-TEST is an advanced motor testing software (Windows® based) for data acquisition. Used with a Magtrol Programmable Dynamometer Controller (e.g. DSP 7010), M-TEST works with any Magtrol Dynamometer or In-Line Torque Transducer to help determine the performance characteristics of a motor under test. Up to 63 parameters are calculated and displayed utilizing M-TEST's feature-rich testing and graphing capabilities.

An integral component of any Magtrol Motor Test System, M-TEST performs ramp, curve, manual, pass/fail, coast and overload to trip tests in a manner best suited to the overall efficiency of the test rig. Written in LabVIEW™, M-TEST has the flexibility to test a variety of motors in a multitude of configurations. The data generated from this user-friendly program can be stored, displayed and printed in tabular or graphical formats, and is easily imported into a spreadsheet.

Magtrol can also make custom modifications to the software to meet additional motor testing requirements.

CMTS - CUSTOM MOTOR TEST SYSTEMS

MAGTROL provides motor testing components to turnkey solutions for all your motor testing needs. Typical test benches include: dynamometers, 4-Quadrant loading motors, tables, fixtures, control racks, power supplies, power analyzers, ohmmeters, temperature measurment and dedicated M-TEST software. Other sensors can be integrated upon request.

/ 03/2025

1.4 DATASHEET · TANDEM SERIES

TANDEM SERIES
IN-LINE DOUBLE DYNAMOMETERS

Magtrol offers 3 types of dynamometer brakes to absorb load: Hysteresis (**HD Series**), Eddy-Current (**WB Series**) and Magnetic Powder (**PB Series**). 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 standard models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

FEATURES

- 13 Models with Maximum Torque: 5 N·m ... 1 200 N·m (3.6 lb·ft... 885 lb·ft)
- Braking Power: 3 kW ... 140 kW
- Stable Braking Torque, without Shock
- Low Moment of Inertia
- Operating Direction CW / CCW
- Braking Torque Measurement Integrated
- Integrated Optical Speed Sensor
- Special designs available upon request

Fig. 1: 4 WB 15 + 4 PB 15 | TANDEM Dynamometer

DESCRIPTION

Eddy-current Brake Dynamometers (WB Series) provide increasing torque as the speed increases, reaching peak torque at rated speed. They are ideal for applications requiring high speeds and also when operating in the middle to high power range.

Powder Brake Dynamometers (PB Series) provide full torque at zero speed and are ideal for applications operating in the low to middle speed range or when operating in the middle to high torque range.

Tandem Dynamometers are based on the combination of Eddy-current Dynamometers (WB Series) and Powder Dynamometers (PB Series) mounted in line on a common base and connected by an electromagnetic clutch. Both dynamometers are cooled by a water circulation system, which passes inside the stator to dissipate heat generated by the braking power, allowing a power rating up to 140 kW.

Both WB and PB Dynamometers integrates a torque measurement system with accuracy ratings of ±0.3 % to ±0.5 % full scale, depending on size and system configuration.

APPLICATIONS

Mounted on test benches, TANDEM Dynamometers allow performance and reliability testing on driving elements such as electric motors, servomotors, geared motors, reduction gears, pneumatic equipment, hydraulic transmission systems and starter motors.

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 (Please refer to specific data sheet). An electromagnetic clutch will automatically switches off at the maximum speed of the PB Powder Dynamometer and automatically switches on at zero speed. Once the system is working over the PB Powder Dynamometer speed limit, the clutch cannot be switched on before the system being at 0 rpm (no longer rotating).

DUAL - DOUBLE WB DYNAMOMETER IN TANDEM

For application requiring higher power in a dedicated speed range, Magtrol offers some of the Eddy Current Dynamometer mounted in line on a common base. This would be for example the models 2 WB 65 + 2 WB 65 (rated torque 40 N·m, max speed 24 000 rpm, max power 24 kW) or 2 WB 115 + 2 WB 115 (rated torque 200 N·m, max speed 15 000 rpm, max power 60 kW).

OPTICAL SPEED SENSOR

Each TANDEM has an optical speed sensor delivered as standard. TANDEM 43 has an optical speed sensor with 30 PPR (Pulses Per Revolution); TANDEM 65, TANDEM 115 & TANDEM 15 has an optical speed sensor with a 60 PPR encoder.

TANDEM CONFIGURATIONS

The Dynamometers can be complemented by various electronic modules such as the DES Series (Power Supply), TSC 401 (Torque/Speed Conditioner) and DSP 7000 (High Speed Programmable Dynamometer Controller).

Magtrol also offers In-Line Torque Transducers (TS Series or TM Series) or Torque Flange (TF Series) for extremely accurate torque and speed measurement with high noise immunity. For a dynamic, high-precision system, the torque transducer can be mounted in line between the unit under test and the dynamometer, providing a torque accuracy of 0.1 %.

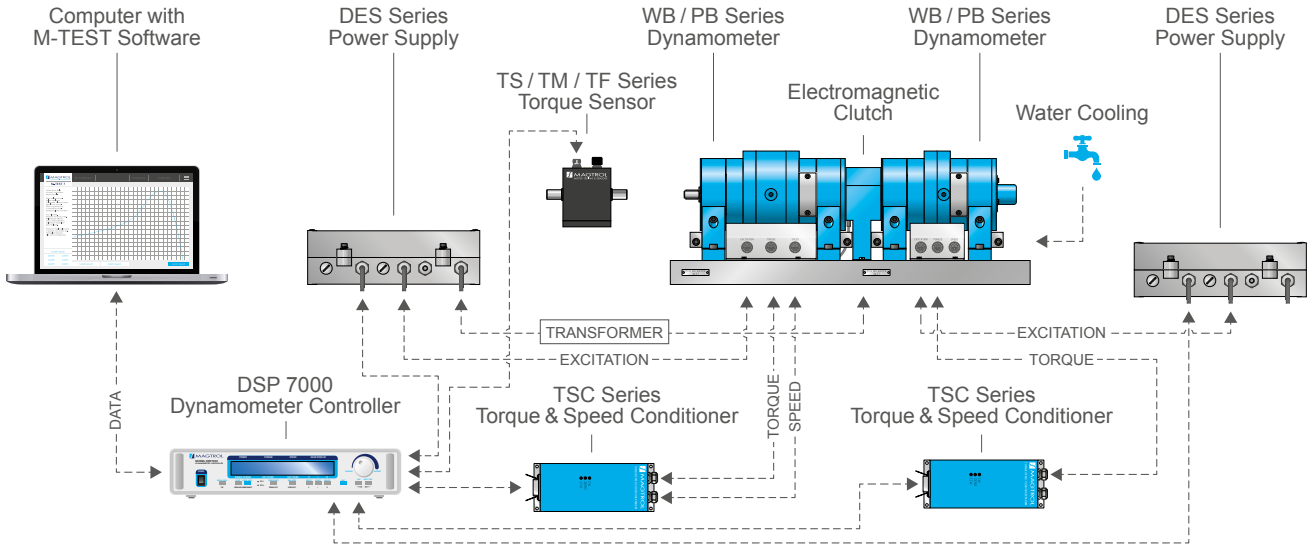


Fig. 2: Configuration of the TANDEM Series Dynamometer with its accessories

SPECIFICATIONS

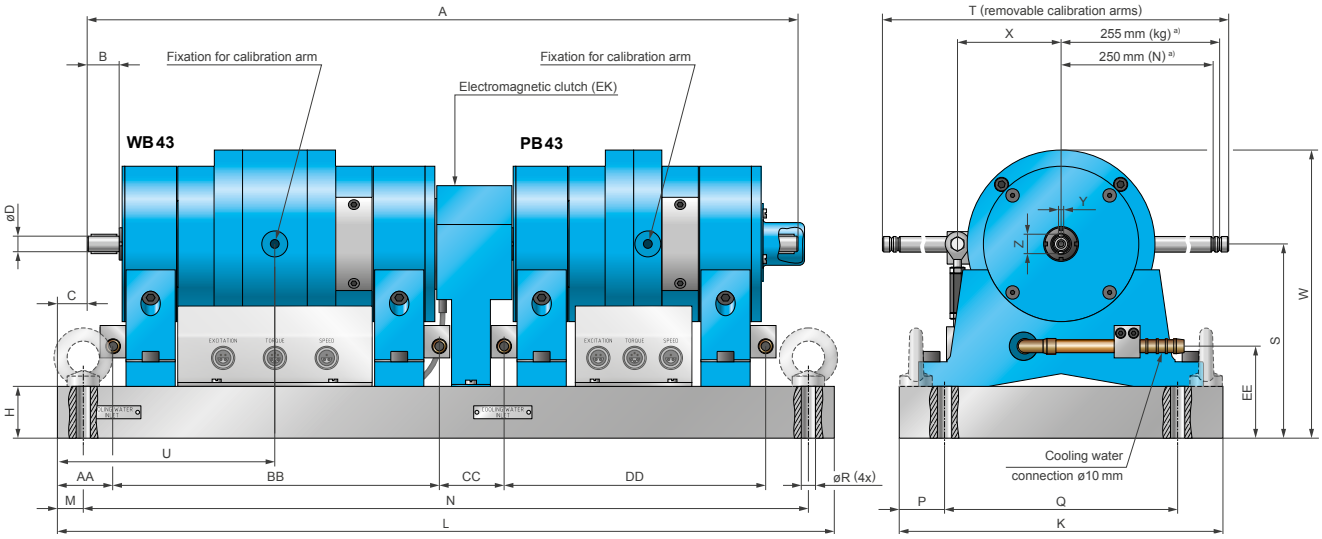
NOTE: For continuous operating (≥ 2 hours) at constant torque or power, please consider 20% reserve in both torque & power

NOTE: For excitation current, please refer to respective datasheets of the dynamometers.

MODEL	RATED TORQUE		DRAG TORQUE DE-ENERGIZED		NOMINAL INPUT INERTIA		RATED POWER	RATED SPEED	MAX. SPEED	MAX. EXCITED SPEED OF PB [a]
	N·m	lb·ft	N·m	lb·in	kg·m²	lb·ft·s²	kW	rpm	rpm	rpm
2WB43+1PB43	5	3.6	0.13	1.15	4.82×10^{-4}	3.56×10^{-4}	3	9550	25000	4000
2WB43+2PB43	10	7.3	0.23	2.03	5.81×10^{-4}	4.28×10^{-4}				
2WB65+1PB65	25	18.4	0.7	6.19	3.19×10^{-3}	2.35×10^{-3}	12	5730	18000	3000
2WB65+2PB65	50	36.8	1.2	10.62	3.98×10^{-3}	2.93×10^{-3}				
2WB115+1PB115	100	73.7	3.0	26.5	4.18×10^{-2}	3.08×10^{-2}	30	2865	15000	3000
2WB115+2PB115	200	147.5	5.0	44.2	5.44×10^{-2}	4.01×10^{-2}				
2WB115+2WB115	200	147.5	2.0	17.7	5.51×10^{-2}	4.07×10^{-2}	60			
2WB15+1PB15	300	221.0	8.8	77.0	1.77×10^{-1}	1.31×10^{-1}	70	2390	7500	2000
2WB15+2PB15	600	442.0	14.8	130.0	2.31×10^{-1}	1.70×10^{-1}				
2WB15+4PB15	1200	885.0	26.8	237.0	3.39×10^{-1}	2.50×10^{-1}				
4WB15+1PB15	300	221.0	11.6	102.0	2.77×10^{-1}	2.04×10^{-1}	140			
4WB15+2PB15	600	442.0	17.6	155.0	3.31×10^{-1}	2.44×10^{-1}				
4WB15+4PB15	1200	885.0	29.6	261.0	4.39×10^{-1}	3.23×10^{-1}				

a) Corresponds to the speed at which the clutch will be disconnected

TANDEM 43 DIMENSIONS



CAUTION: All TANDEM Series Dynamometers must be water cooled.

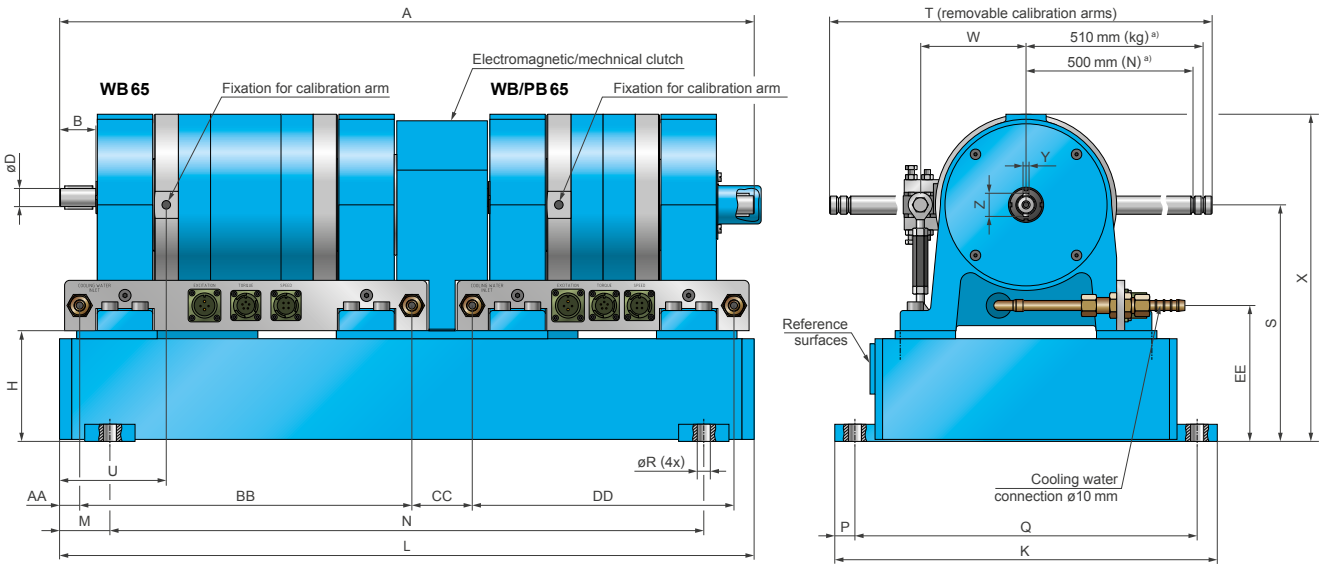
NOTE: Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 3 decimal places.

MODEL	units	A	øD	E	F	H	K	L	M	N	P	Q	øR	S
2 WB 43 + 1 PB 43	mm	542	12 h6	23	25	40	250	600	20	560	35	180	11	140 ±0.03
	in	21.34	0.4724 0.4721	0.91	0.98	1.57	9.85	23.62	0.79	22.05	1.38	7.09	0.43	5.513 5.511
2 WB 43 + 2 PB 43	mm	592	12 h6	23	25	40	250	650	20	610	35	180	11	140 ±0.03
	in	23.31	0.4724 0.4721	0.91	0.98	1.57	9.85	25.59	0.79	24.02	1.38	7.09	0.43	5.513 5.511

MODEL	units	T	U	W	X	Y	Z	AA	BB	CC	DD	EE	Weight
2 WB 43 + 1 PB 43	mm	524	168	222.5	80	4 h9	15	43	250	52	200	61	~ 55 kg
	in	20.63	6.61	8.76	3.15	0.1574 0.1563	0.59	1.69	7.87	2.05	7.87	2.40	~ 122 lb
2 WB 43 + 2 PB 43	mm	524	168	222.5	80	4 h9	15	43	250	52	250	61	~ 65 kg
	in	20.63	6.61	8.76	3.15	0.1574 0.1563	0.59	1.69	7.87	2.05	9.84	2.40	~ 144 lb

a) 255 mm for a calibration in N·m with weight in kg (use outer groove); 250 mm for calibration in N·m with weight in N (use inner groove)

TANDEM 65 DIMENSIONS



CAUTION: All TANDEM Series Dynamometers must be water cooled.

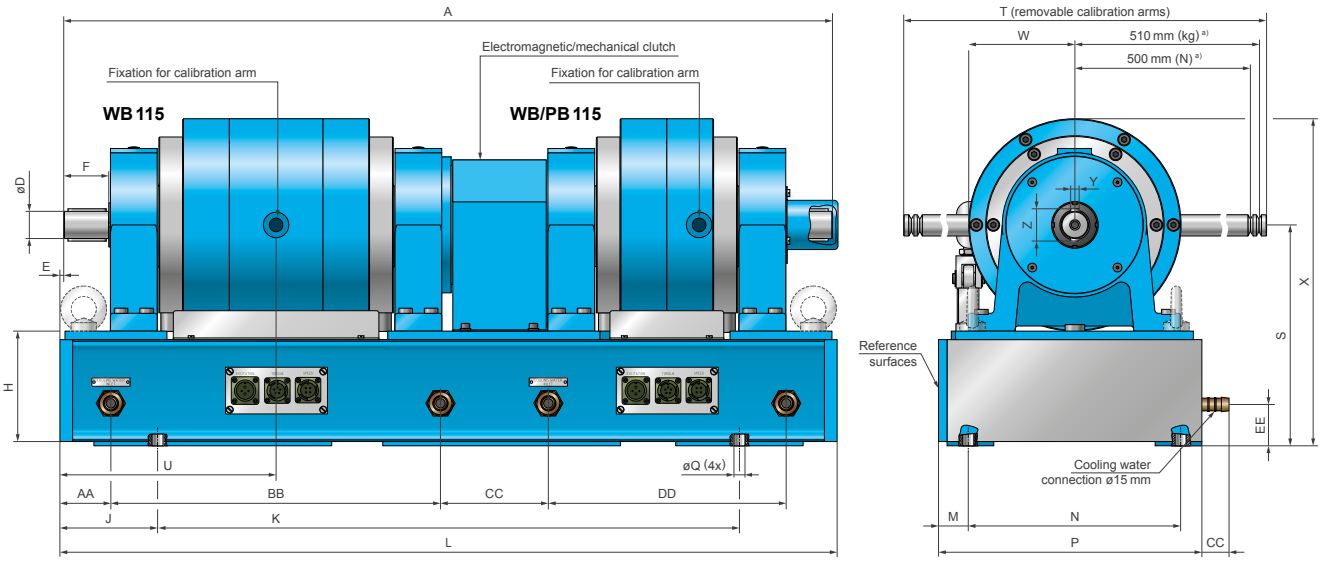
NOTE: Original dimensions are in metric units. Dimensions converted to English units have been rounded up to 3 decimal places.

MODEL	units	A	B	øD c)	H	K	L	M	N	P	Q	øR	S
2 WB 65 + 1 PB 65	mm	690	36	18 h6	110	380	690	50	590	20	340	13	235 ±0.02
	in	27.17	1.42	0.7086 0.7083	4.33	14.96	27.17	1.97	23.23	0.79	13.39	0.51	9.260 9.244
2 WB 65 + 2 PB 65	mm	760	36	18 h6	110	380	760	50	660	20	340	13	235 ±0.02
	in	29.92	1.42	0.7086 0.7083	4.33	14.96	29.92	1.97	25.98	0.79	13.39	0.51	9.260 9.244

MODEL	units	T	U	W	X	Y	Z	AA	BB	CC	DD	EE	Weight
2 WB 65 + 1 PB 65	mm	1034	106	105	325	6 h9	23	20	330	60	260	135	~ 135 kg
	in	40.71	4.174	4.13	12.8	0.2362 0.2351	0.91	0.79	12.99	2.36	10.24	5.31	~ 298 lb
2 WB 65 + 2 PB 65	mm	1034	106	105	325	6 h9	23	20	330	60	330	135	~ 150 kg
	in	40.71	4.174	4.13	12.8	0.2362 0.2351	0.91	0.79	12.99	2.36	12.99	5.31	~ 331 lb

a) 510 mm for a calibration in N·m with weight in kg (use outer groove); 500 mm for a calibration in N·m with weight in N (use inner groove).

TANDEM 115 DIMENSIONS



CAUTION: All TANDEM Series Dynamometers must be water cooled.

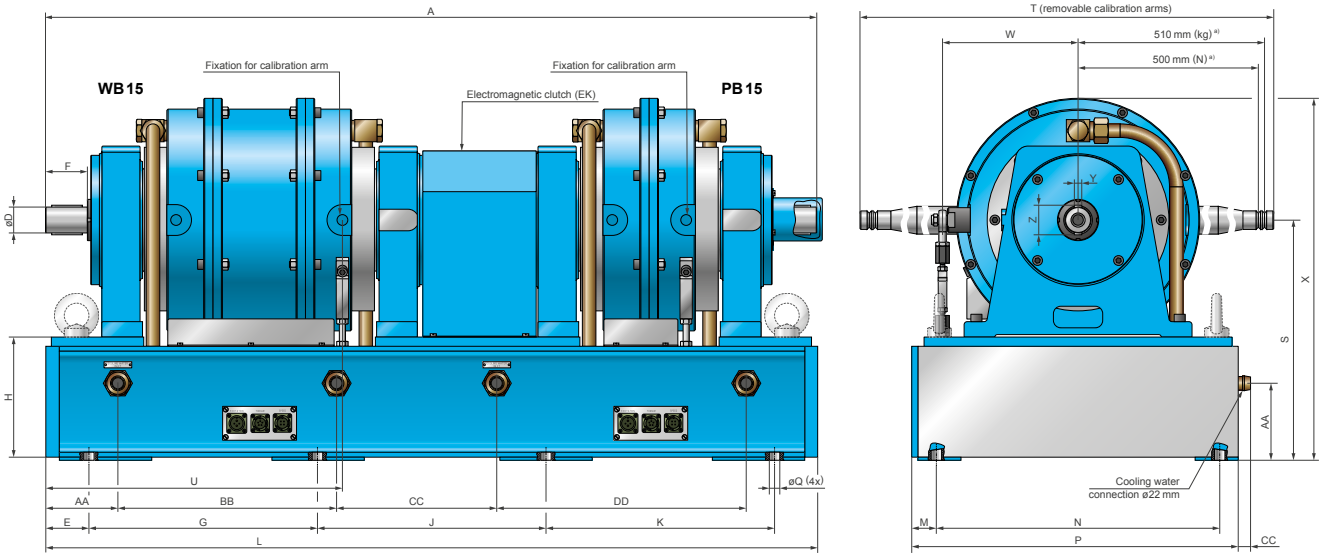
NOTE: Original dimensions are in metric units. Dimensions converted to imperial units have been rounded up to 4 decimal places.

MODEL	units	A	øD	E	F	H	J	K	L	M	N	P	øQ	S
2 WB 115 + 1 PB 115	mm	905	32 h6	4	54	135	115	685	915	35	250	310	13	$260^{\pm 0.1}$
	in	35.63	1.2598 1.2593	0.16	2.13	5.31	4.53	26.97	6.02	1.38	9.84	12.20	0.51	10.244 10.228
2 WB 115 + 2 PB 115	mm	1 015	32 h6	4	54	135	115	795	1 025	35	250	310	13	$260^{\pm 0.1}$
	in	39.96	1.2598 1.2593	0.16	2.13	5.31	4.53	31.30	40.35	1.38	9.84	12.20	0.51	10.244 10.228
2 WB 115 + 2 WB 115	mm	1 015	32 h6	4.5	53	135	115	795	1 025	35	250	310	13	$260^{\pm 0.1}$
	in	39.96	1.2598 1.2593	0.18	2.09	5.31	4.53	31.30	40.35	1.38	9.84	12.20	0.51	10.244 10.228

MODEL	units	T	U	W	X	Y	Z	AA	BB	CC	DD	EE	Weight
2 WB 115 + 1 PB 115	mm	1 038	254.5	125	385	10 h9	38	60	388	127	280	50	~ 214 kg
	in	40.87	10.02	4.92	15.15	0.3937 0.3932	1.50	2.36	15.28	5.00	11.02	1.97	~ 472 lb
2 WB 115 + 2 PB 115	mm	1 038	254.5	125	385	10 h9	38	60	388	127	390	50	~ 582 kg
	in	40.87	10.02	4.92	15.15	0.3937 0.3932	1.50	2.36	15.28	5.00	15.35	1.97	~ 264 lb
2 WB 115 + 2 WB 115	mm	1 038	254.5	125	385	10 h9	38	60	388	127	390	50	~ 582 kg
	in	40.87	10.02	4.92	15.15	0.3937 0.3932	1.50	2.36	15.28	5.00	15.35	1.97	~ 264 lb

a) 510 mm for a calibration in N·m with weight in kg (use outer groove); 500 mm for a calibration in N·m with weight in N (use inner groove).

TANDEM 15 DIMENSIONS



CAUTION: All TANDEM Series Dynamometers must be water cooled.

NOTE: Original dimensions are in metric units. Dimensions converted to imperial units have been rounded up to 3 decimal places.

MODEL	units	A	øD	E	F	G	H	J	K	L	M	N	P	øQ
2WB15+1PB15	mm	1252	42g6	70	68	371	200	371	371	1253	40	460	530	17
	in	49.29	1.6531 1.6526	2.76	2.68	14.61	7.87	14.61	14.61	49.33	1.57	18.11	20.87	0.67
2WB15+2PB15	mm	1402	42g6	70	68	371	200	421	471	1403	40	460	530	17
	in	55.20	1.6531 1.6526	2.76	2.68	14.61	7.87	16.57	18.54	55.24	1.57	18.11	20.87	0.67
2WB15+4PB15	mm	1702	42g6	70	68	521	200	521	521	1703	40	460	530	17
	in	67.01	1.6531 1.6526	2.76	2.68	20.51	7.87	20.51	20.51	67.05	1.57	18.11	20.87	0.67
4WB15+1PB15	mm	1552	42g6	70	68	521	200	421	471	1553	40	460	530	17
	in	61.10	1.6531 1.6526	2.76	2.68	20.51	7.87	16.57	18.54	61.14	1.57	18.11	20.87	0.67
4WB15+2PB15	mm	1702	42g6	70	68	521	200	521	521	1703	40	460	530	17
	in	67.01	1.6531 1.6526	2.76	2.68	20.51	7.87	20.51	20.51	67.5	1.57	18.11	20.87	0.67
4WB15+4PB15	mm	2002	42g6	70	68	590	200	683	590	2003	40	460	530	17
	in	78.82	1.6531 1.6526	2.76	2.68	23.23	7.87	26.89	23.23	78.86	1.57	18.11	20.87	0.67

MODEL	units	S	T	U	W	X	Y	Z	AA	BB	CC	DD	EE	Weight
2WB15+1PB15	mm	390±0.2	1030		225	588	12	48	117	355	260	405	125	~ 485 kg
	in	15.362 15.346	40.55		8.86	23.15	0.47	1.89	4.61	13.98	10.24	15.94	4.92	~ 1070 lb
2WB15+2PB15	mm	390±0.2	1030		225	588	12	48	117	355	260	555	125	~ 590 kg
	in	15.362 15.346	40.55		8.86	23.15	0.47	1.89	4.61	13.98	10.24	21.85	4.92	~ 1301 lb
2WB15+4PB15	mm	390±0.2	1030		225	588	12	48	117	355	260	855	125	~ 820 kg
	in	15.362 15.346	40.55		8.86	23.15	0.47	1.89	4.61	13.98	10.24	33.66	4.92	~ 1808 lb
4WB15+1PB15	mm	390±0.2	1030		225	588	12	48	117	655	260	405	125	~ 715 kg
	in	15.362 15.346	40.55		8.86	23.15	0.47	1.89	4.61	25.79	10.24	15.94	4.92	~ 1577 lb
4WB15+2PB15	mm	390±0.2	1030		225	588	12	48	117	655	260	555	125	~ 820 kg
	in	15.362 15.346	40.55		8.86	23.15	0.47	1.89	4.61	25.79	10.24	21.85	4.92	~ 1808 lb
4WB15+4PB15	mm	390±0.2	1030		225	588	12	48	117	655	260	855	125	~ 1050 kg
	in	15.362 15.346	40.55		8.86	23.15	0.47	1.89	4.61	25.79	10.24	33.66	4.92	~ 2315 lb

a) 510 mm for a calibration in N·m with weight in kg (use outer groove); 500 mm for a calibration in N·m with weight in N (use inner groove).

RELATED PRODUCTS

WB SERIES - EDDY-CURRENT DYNAMOMETER

Fig. 3: 1 WB 43 | Eddy-Current Dynamometer

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).

PB SERIES - POWDER DYNAMOMETER

Fig. 4: 1 PB 115 | Powder Dynamometer

The PB Series 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.

DYNAMOMETER OPTIONS

Tandem brakes consist of two brakes, each with its own specific options (see specific datasheet). Depending on the configuration of the tandem it is possible to add some options (e.g.Speed Encoder,...) Please, contact our sales technicians for technical information and specific dimensional drawing.

ORDERING INFORMATION

ORDERING NUMBER	_	WB	_ _ _	+	_	_ _	_ _ _
2, 4 : Model number							
43, 65, 115, 15 : Model number							
1, 2, 4 : Model number							
WB, PB : Type							
43, 65, 115, 15 : Model number							

Examples:

2 WB 43 & 1 PB 43 TANDEM Dynamometer would be ordered as **2WB43 + 1PB43**

2 WB 15 & 4 PB 15 TANDEM Dynamometer, would be ordered as **2WB15 + 4PB15**

2 WB 115 DUAL Dynamometer would be ordered as **2WB115 + 2WB115**

2. INSTALLATION / CONFIGURATION

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 & TANDEM 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 (*see section 2.1.1 to 2.1.4*).

NOTICE All dynamometers 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 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 (*see Fig.2-1*)

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).

NOTICE The overload protection screws and nuts (3) and (4) are adjusted at the factory (*see chapter 7 - CALIBRATION PROCESS*).

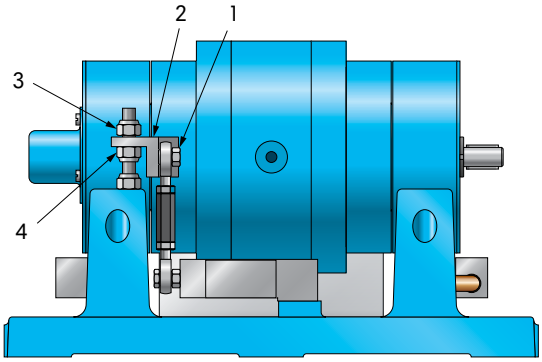


Fig.2-1 WB/PB 43 Load Cell Locking System

2.1.2 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 (*see Fig.2-2*) 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).

NOTICE The screws and nuts for overload protection (3) and (4) are adjusted at the factory (*see chapter 7 - CALIBRATION PROCESS*)

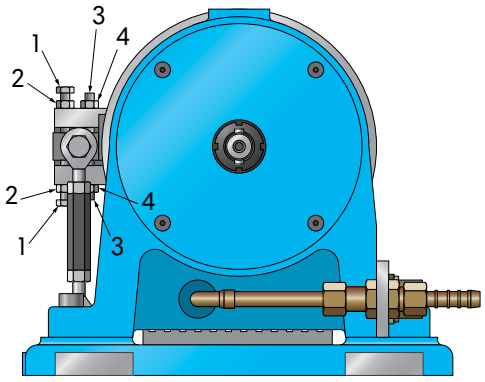


Fig.2-2 WB/PB 65 Load Cell Locking System

2.1.3 WB/PB 115 SERIES

WB/PB 115 Series Dynamometer 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 (*see Fig.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).

NOTICE The screws and nuts for overload protection (3) and (4) are adjusted in the factory (*see chapter 7 - CALIBRATION PROCESS*).

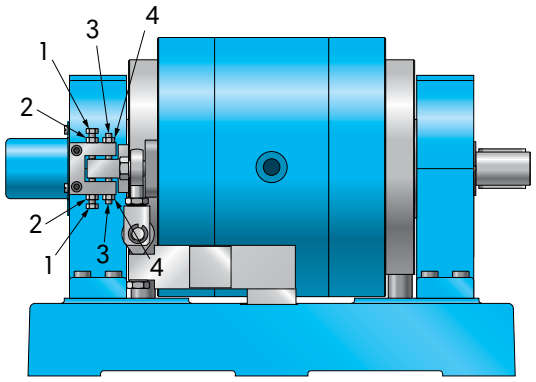


Fig.2-3 WB/PB 115 Load Cell Locking System

2.1.4 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 (*see Fig.2-4*) 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.

NOTICE The WB/PB 15 Dynamometers are not equipped with overload protection systems. The load cell (3) is strong enough to cope with any overload occurring during normal dynamometer use.

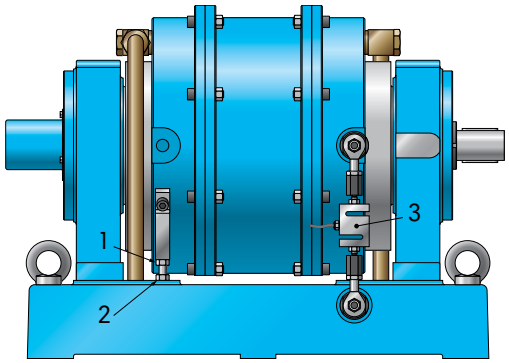


Fig.2-4 WB/PB 15 Load Cell Locking System

CAUTION 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.

NOTICE 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 to 1.4*) 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 Series) 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 (*see Fig.2-5*) below.

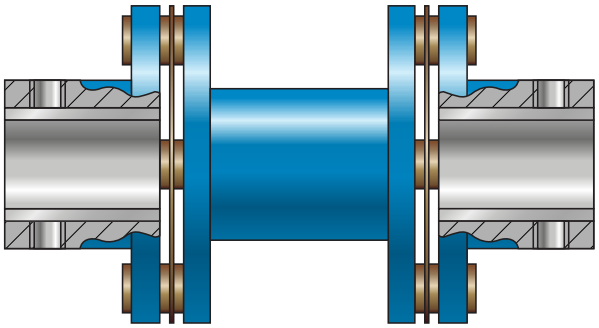


Fig.2-5 Couplings Using Key Clamping

By using this method, no slipping will damage the coupling or the dynamometer shaft. With small dynamometers such as the WB/PB 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.

NOTICE With more than 60 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 ... 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 to 1.4*) 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 FORCE

NOTICE 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:

MODEL	STANDARD VERSION		HIGH-SPEED VERSION (HS) [a]	
	F_{axial} max [N]	F_{radial} max [N]	F_{axial} max [N]	F_{radial} max [N]
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

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

For WB-HS Dynamometers (High Speed version), 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 (*SEE CHAPTER 7 - CALIBRATION PROCESS*).

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.

NOTICE The cooling tubes must have an inside diameter in accordance with the indications on the corresponding dynamometer data sheets (*see section 1.2 to 1.4*). 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 (*see chapter 4 - 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 DRIVE ELEMENT 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.

WARNING **THE ASSEMBLY AND INSTALLATION OF THE SYSTEMS MUST COMPLY WITH MACHINE SAFETY STANDARDS (ISO 12100 OR SIMILAR APPLICABLE STANDARDS).**

Below is an example of a protective system (*see Fig.2-6 to Fig.2-8*). All parts of the bench are accessible, but the covers prevent any risk to the user when closed.

Fig.2-6 Test bench with fixed and movable metal guard with safety switch.

Fig.2-7 Turnkey customized test bench with retractable guard.

Fig.2-8 Custom motor test system with control rack and full safety protection all around the test table.

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 TO 1.4)* CAN CAUSE IRREVERSIBLE DAMAGE.

3. TORQUE-SPEED-POWER CURVES

The diagrams on the following pages illustrate the performance of WB-PB-TANDEM and DUAL dynamometers by means of characteristic curves relating torque, speed and power. The curves are logarithmic; if you require any other type of diagram, please contact Magtrol technical support.

3.1 WB 43 CURVES

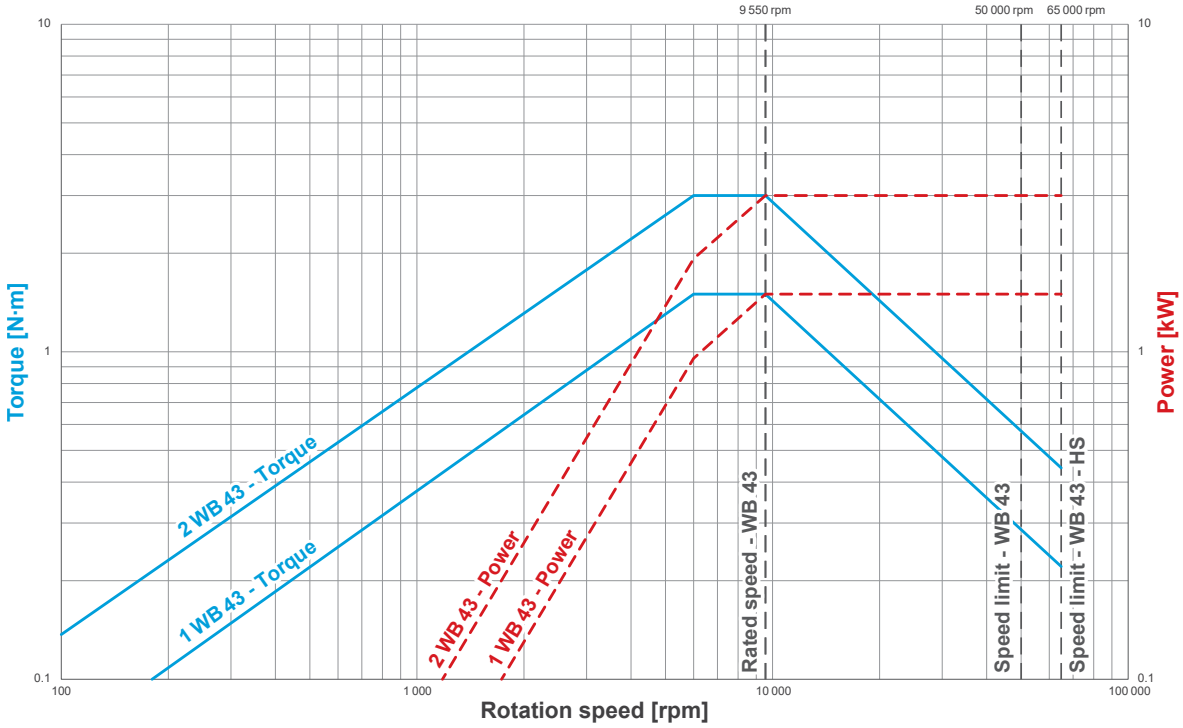


Fig.3-9 WB 43 - Ratings Curves

3.2 PB 43 & PB 65 CURVES

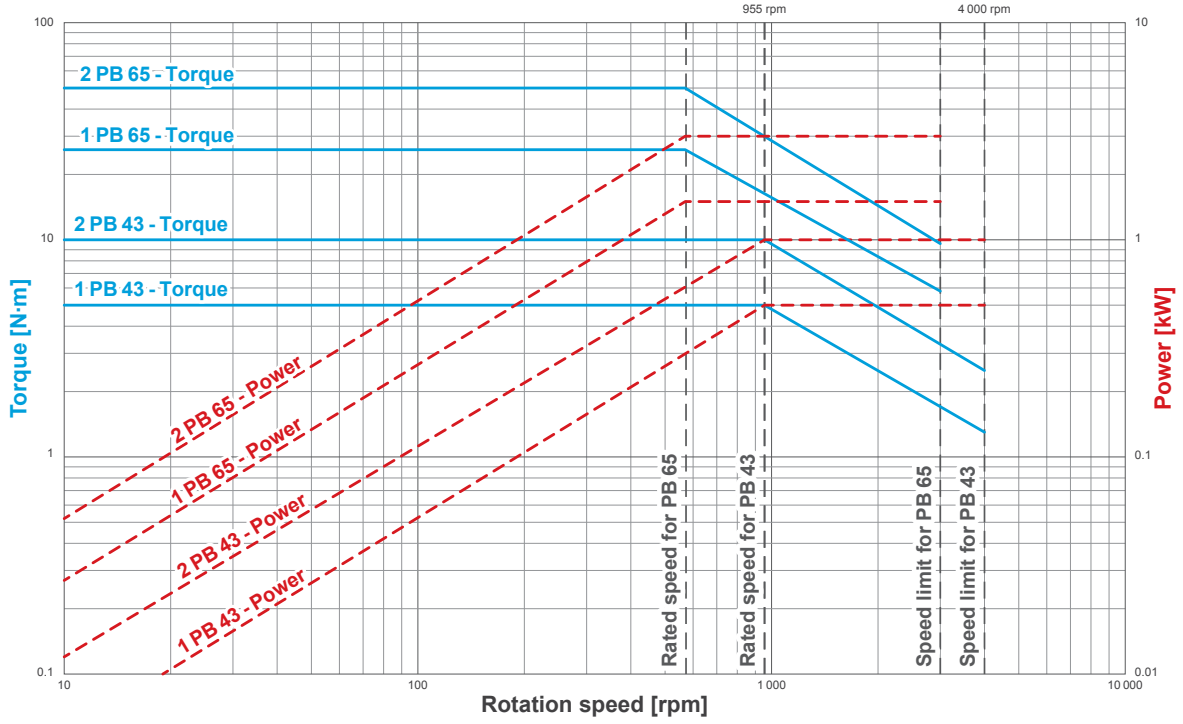


Fig.3-10 PB 43 & PB 65 - Ratings Curves

3.3 WB 65 & WB 115 CURVES

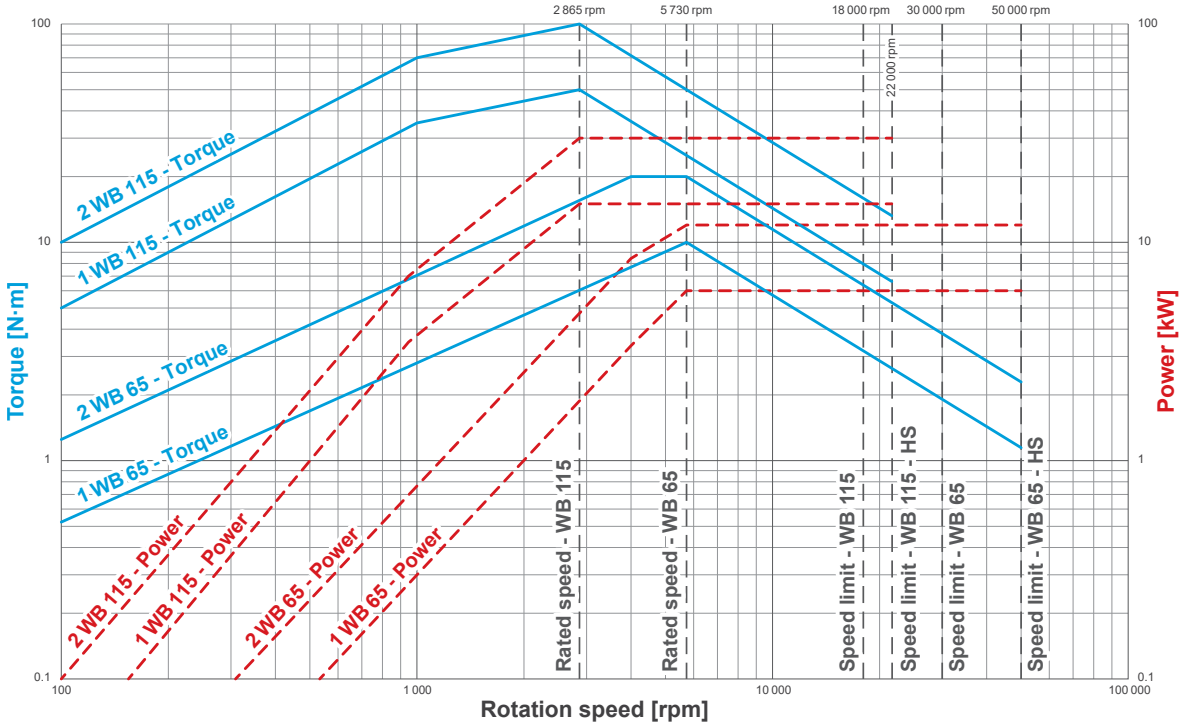


Fig.3-11 WB 65 & WB 115 - Ratings Curves

3.4 PB 115 CURVES

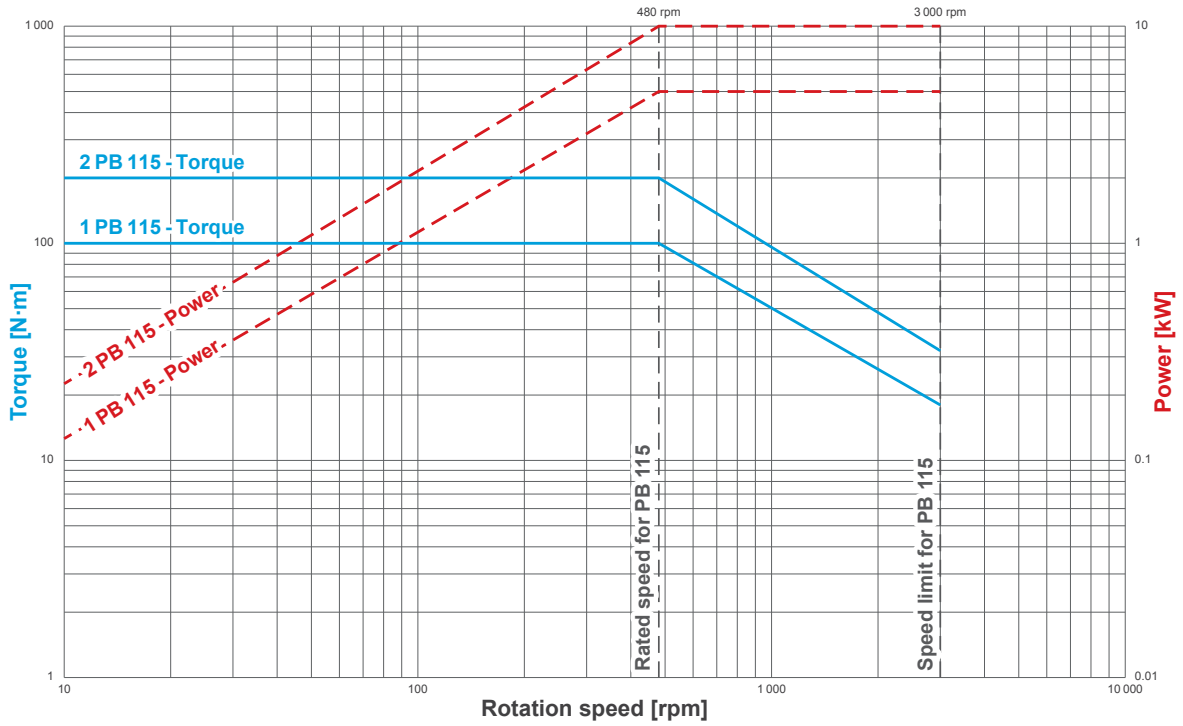


Fig.3-12 PB 115 - Ratings Curves

3.5 WB CURVES

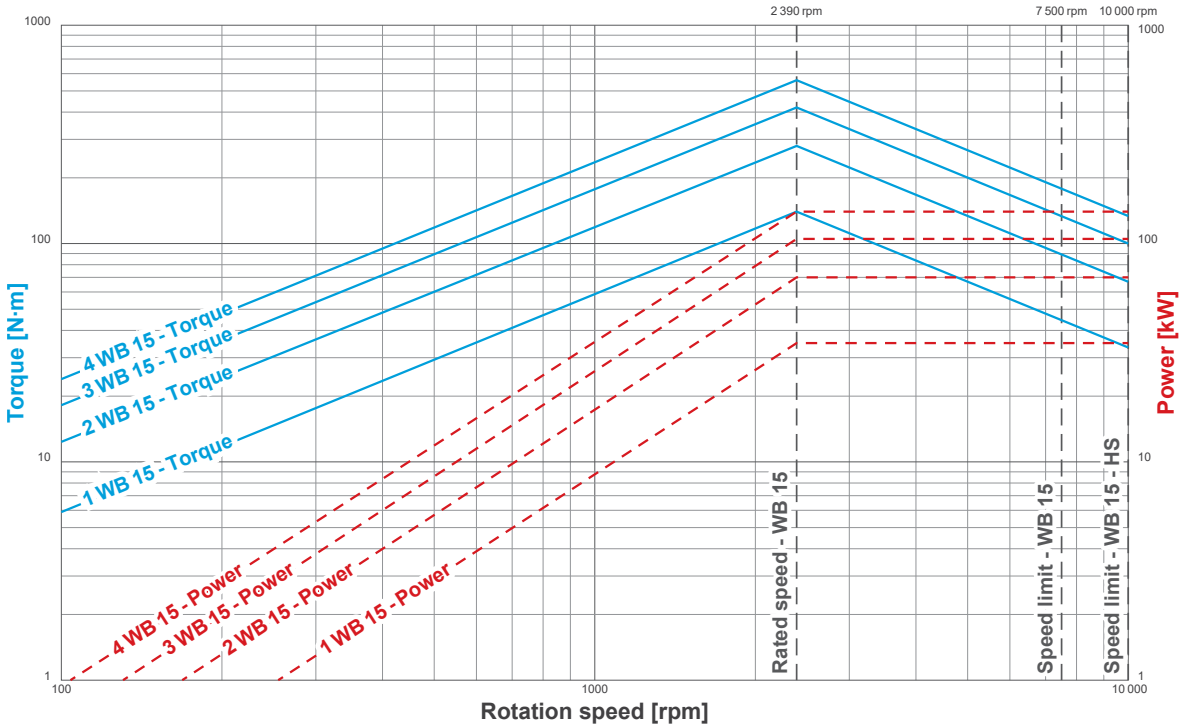


Fig.3-13 WB 15 - Ratings Curves

3.6 PB 15 CURVES

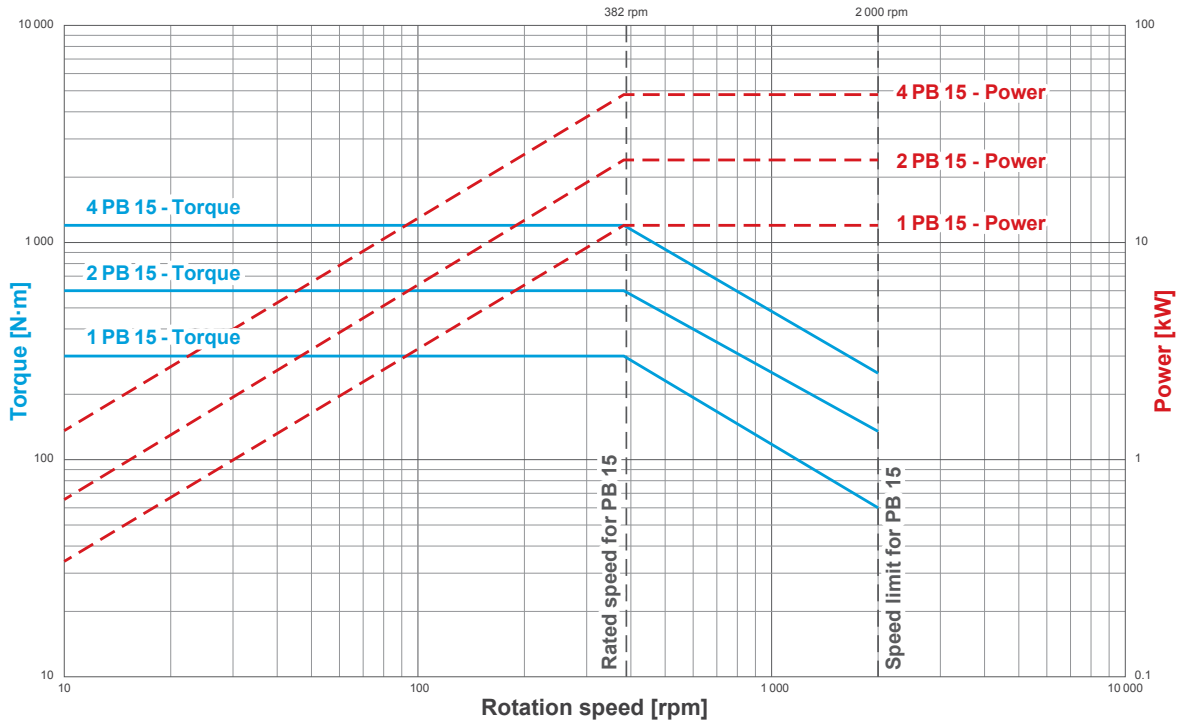


Fig.3-14 PB 15 - Ratings Curves

3.7 TANDEM 43 CURVES

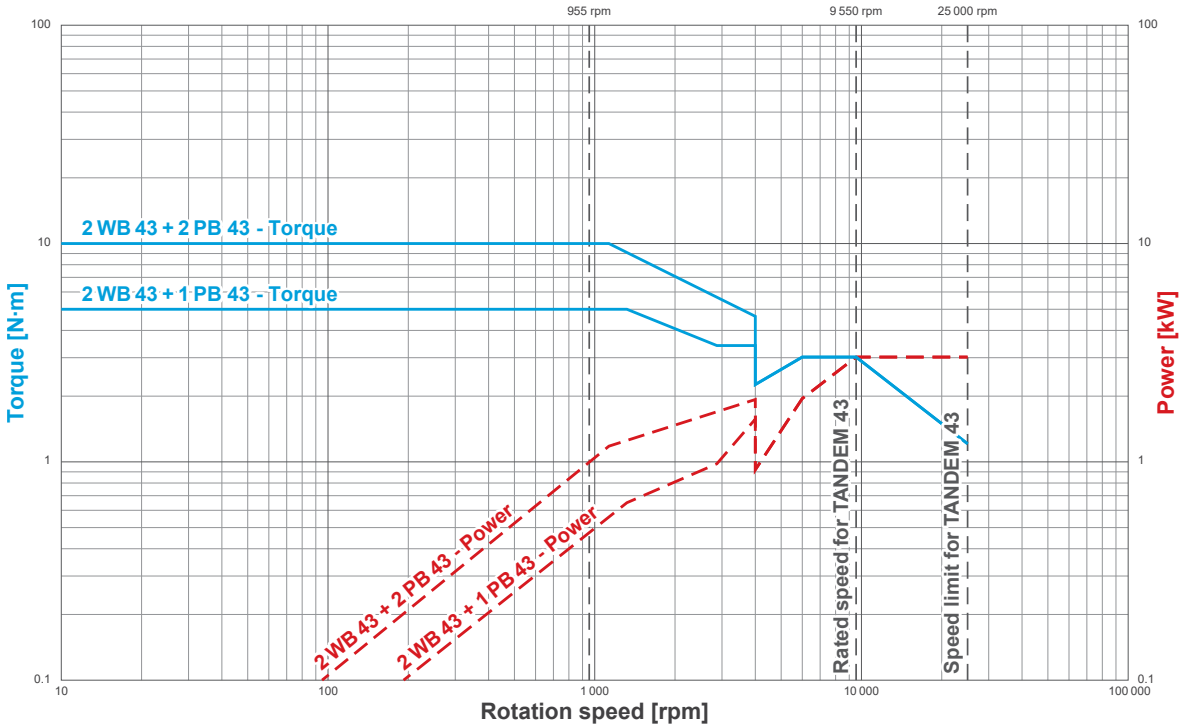


Fig.3-15 TANDEM 43 - Ratings Curves

3.8 TANDEM 65 CURVES

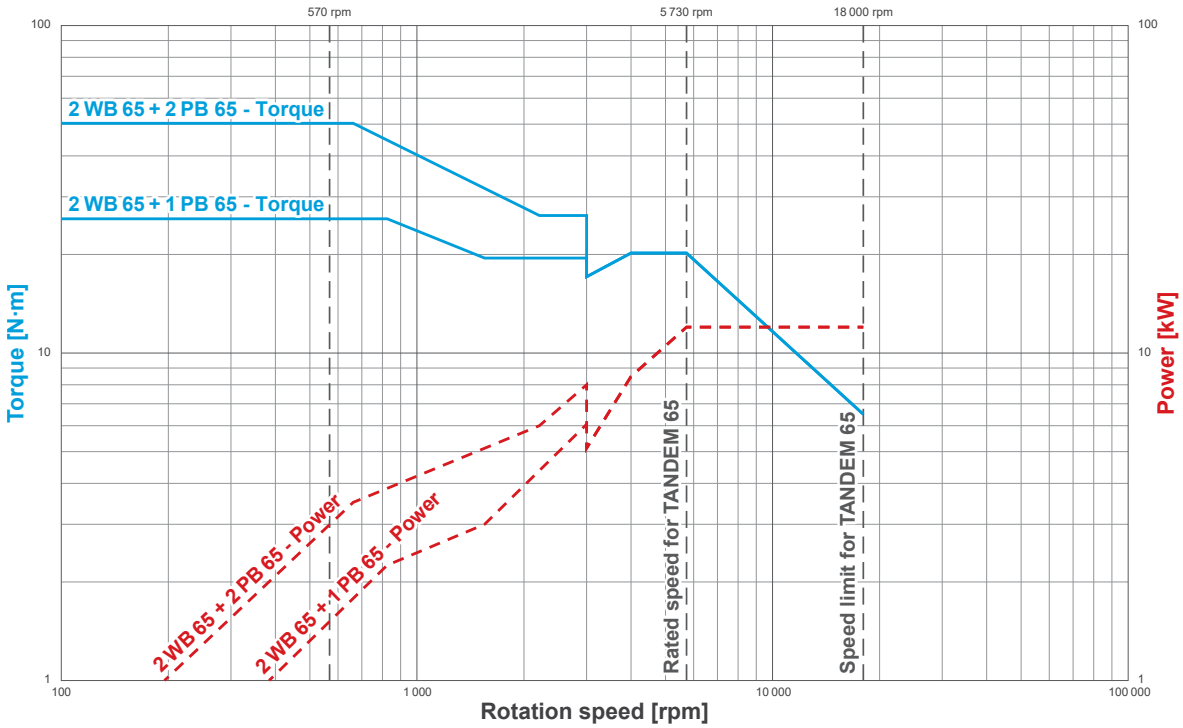


Fig.3-16 TANDEM 65 - Ratings Curves

3.9 TANDEM & DUAL 115 CURVES

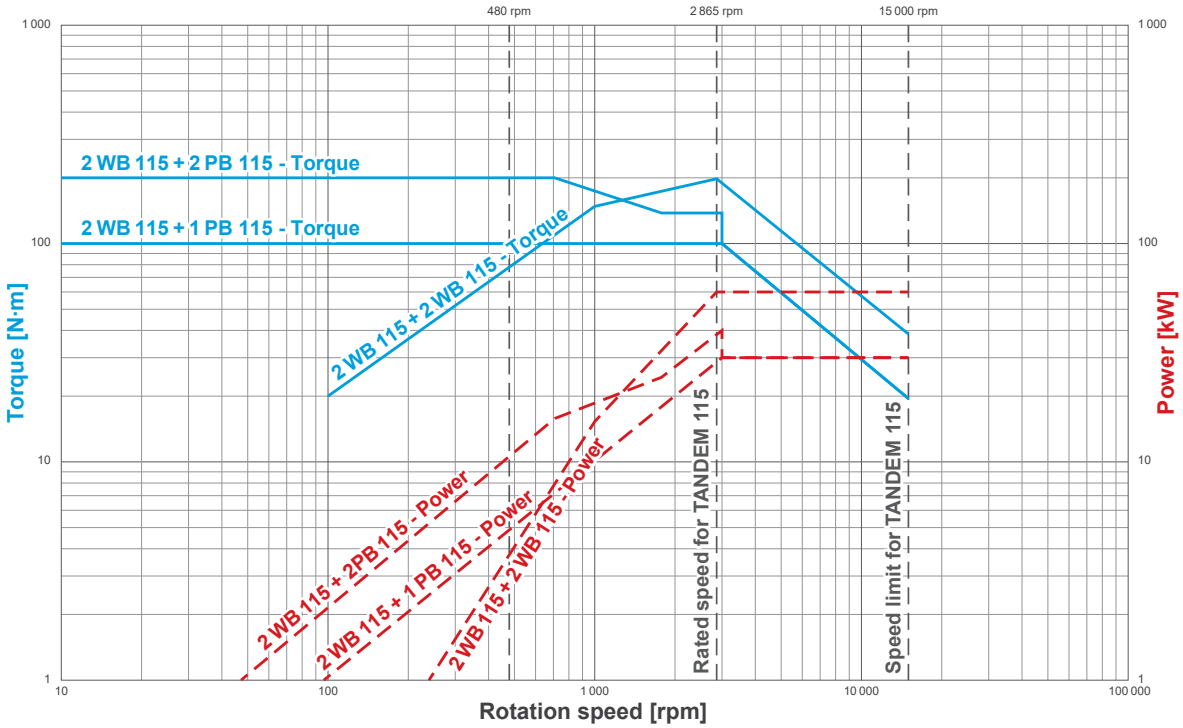


Fig.3-17 TANDEM & DUAL 115 - Ratings Curves

3.10 TANDEM 15 CURVES

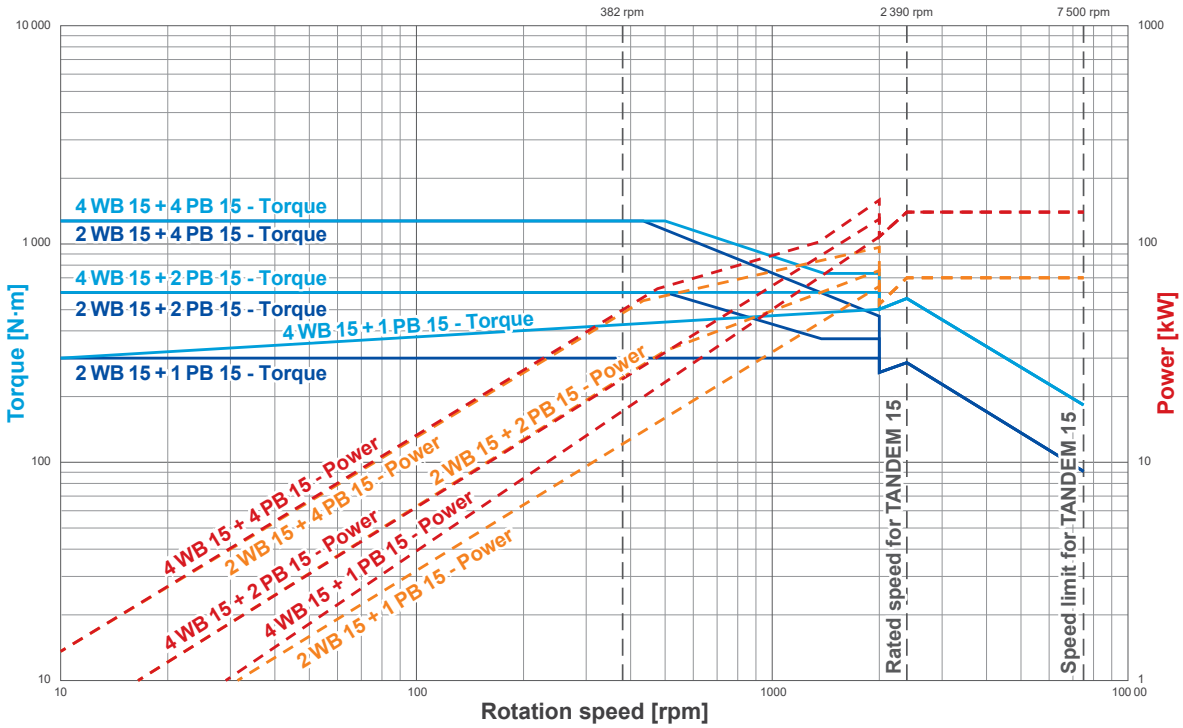


Fig.3-18 TANDEM 15 - Ratings Curves

4. COOLING

4.1 DYNAMOMETER COOLING

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

4.1.1 CONNECTIONS

CAUTION THE COOLING TUBES MUST HAVE AN INSIDE DIAMETER IN ACCORDANCE WITH THE INDICATIONS ON THE CORRESPONDING DYNAMOMETER DATA SHEETS *(SEE SECTION 1.2 TO 1.4)*. 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.

4.1.2 WATER FLOW AND PRESSURE

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

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

Fig.4-1 Calculate your water flow rate

NOTICE 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 0.5 ... 0.8 bar for models WB/PB 43 and 2 bar for models WB/PB 65, WB/PB 115 and WB/PB 15. Magtrol strongly recommends the installation of a pressure relief valve at the cooling inlet, to ensure correct pressure.

4.1.3 COOLING WATER CONSUMPTION

~ 30 l/kWh at Δt = 30 °C (Metric)
~ 8 gal/kWh at Δt = 86 °F (US)

Fig.4-2 Cooling water consumtion applicable for all WB, PB & TANDEM Dynamometers

4.1.4 TEMPERATURE SENSOR

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

4.2 OPEN-CIRCUIT COOLING SYSTEMS

Although open-circuit cooling is possible, Magtrol strongly advises against this configuration for environmental consideration. However, if you have a hydraulic configuration in your environment that could justify open-circuit cooling, please contact our Technical Department to find out about the options available.

In all cases, the cooling water must be clean and at a constant flow rate. Ecological aspects regarding water supply and treatment before discharge must be taken into consideration.

4.3 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.

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

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.

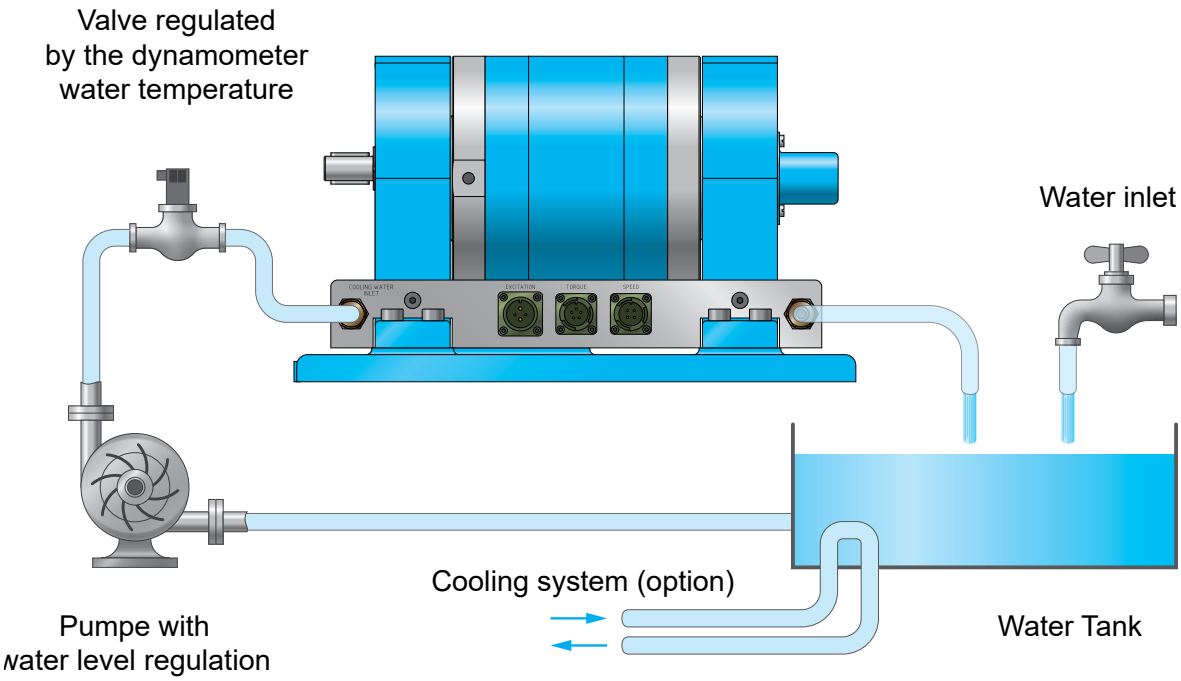


Fig.4-3 Closed-circuit Cooling Example

4.4 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.

4.4.1 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.

4.4.2 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

Fig.4-4 Water hardness table in German degrees [°dH]

°dH = German hardness degree = 10 mg CaO/liter
°fH = French hardness degree = 10 mg CaCO3/liter
°e = English hardness degree = 1 grain CaCO3/gallon
ppm = American hardness degree = 1 mg CaCO3/liter

1 °dH = 1.79 °fH = 1.25 °e = 17.9 ppm

Fig.4-5 Correspondence table

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.

4.4.3 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 µm. As a rule, the filter should remove approximately 98% of the substances above 250 µm of diameter.

4.4.4 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.

4.4.5 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.

4.4.6 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.

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.

4.5 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.

5. CONNECTIONS (ELECTRONIC DEVICES)

5.1 ELECTRONIC DEVICES COMMONLY USED IN COMBINATION

NOTICE For more system configuration options and detailed information about the following devices, please refer to the corresponding user manual (available online at www.magtrol.com).

5.1.1 DSP 7010 - DYNAMOMETER CONTROLLER

Magtrol's DSP 7010 Programmable Dynamometer Controller employs state-of-the-art Digital Signal Processing technology to provide superior testing capabilities. The DSP 7001 is designed to work with any Magtrol WB, PB or TANDEM Dynamometer and is also compatible with all TM Series (In-Line Torque Transducers) and TS Series (Torque Sensors). Any Magtrol Dynamometers can be used with any Magtrol Torque Sensors; both are controlled by the same unit.

Complete computer control of the test system can be attained via USB interface, (optionally GPIB IEEE-488), and Magtrol's M-TEST Software. This LabVIEW™-based program is equipped with ramp, curve and manual testing capabilities to help determine the performance characteristics of a motor under test, and also provides pass/fail testing for production line and inspection applications. The data generated can be easily saved, displayed, printed and exported.

5.1.2 TSC SERIES - TORQUE & SPEED CONDITIONER

The TSC Series is the Torque & Speed Conditioner used to connect Magtrol Eddy-Current (WB Series) or Powder (PB Series) Dynamometers to the DSP 7010 Controller. Powered by the DSP 7010, and based on a precision instrumentation amplifier, the unit amplifies and filters the torque signal. It also provides power supply and connections for the speed pickup sensor which is located in the dynamometer.

5.1.3 DES SERIES - POWER SUPPLIES

DES Series Power Supplies are specially designed for the full range of Magtrol's Eddy-current (WB Series)and Powder Brake (PB Series) Dynamometers with the design goal providing the best response time. The DES Series supplies are packaged in an industrial housing made of cast aluminum. This offers superior protection against radiated emissions in order to avoid any disruption of the surrounding electronics modules. This housing must be installed directly on the test bench, next to the brake, as close as possible.

The DES Series supplies can be controlled by digital signals and analog set point coming from peripheral electronics. For applications with TANDEM Series Dynanometers, the DES Series units also control the power supply of the electromagnetic clutch.

5.2 CONNECTION TO MAGTROL MOTOR TESTING ELECTRONICS

The connection and configuration of the Magtrol DES Series Power Supply, TSC Series Torque & Speed Conditioner and DSP7010 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.

5.2.1 MANUAL TEST CONFIGURATION

In a manual test configuration, all test parameters must be manually entered into the DSP7010 Dynamometer Controller. Data acquisition is then carried out manually.

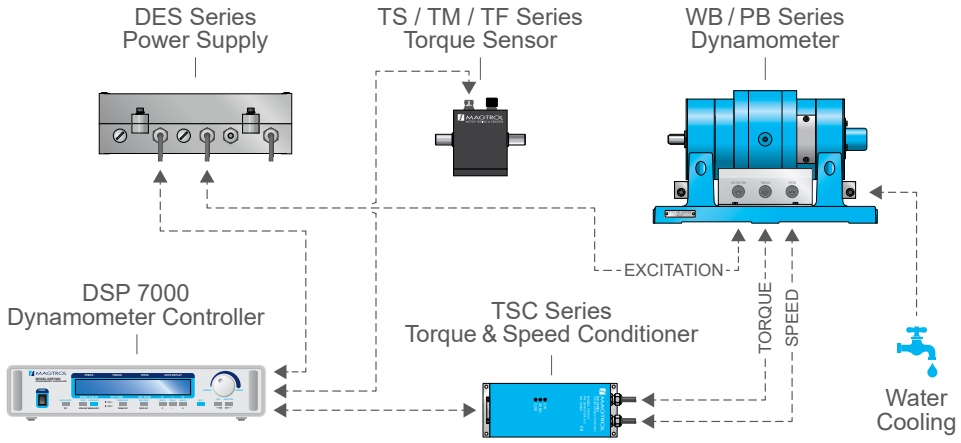


Fig.5-1 Manual Test Configuration with DSP7010

5.2.2 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 USB or GPIB IEEE-488 interface board and corresponding connection cable.

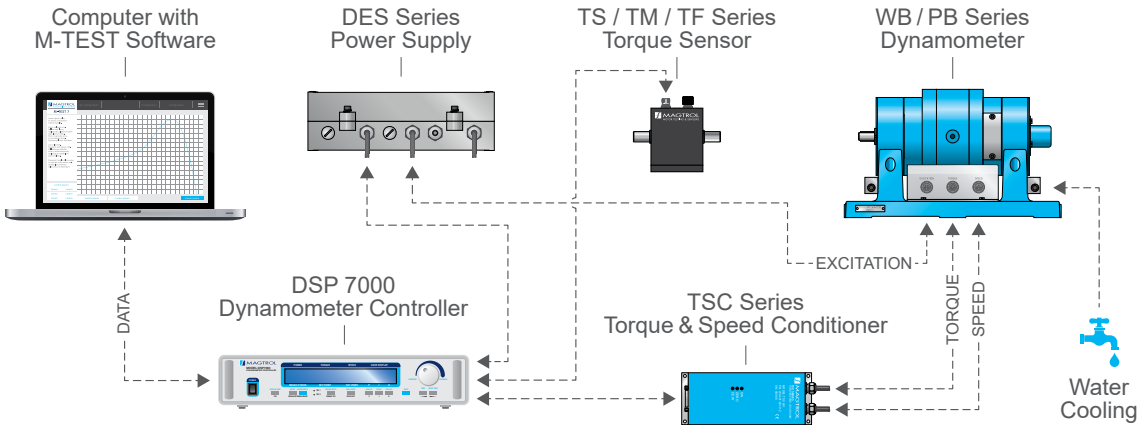


Fig.5-2 PC-Based Test Configuration with M-TEST Software

NOTICE

Magtrol's M-TEST Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with the Magtrol DSP7010 Controller, Magtrol M-TEST 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.

5.3 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.

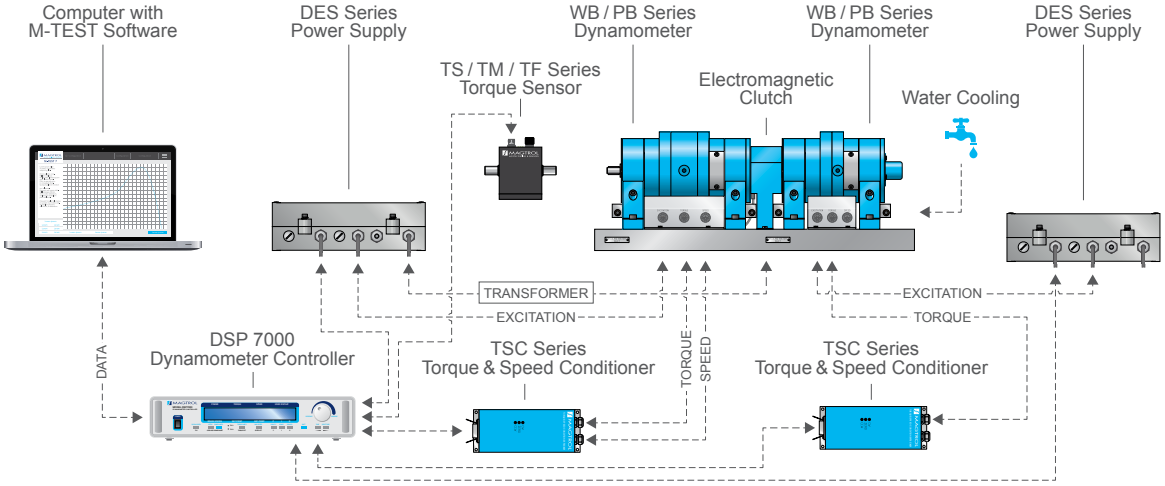


Fig.5-3 Tandem Configuration

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 *(see section 1.4 Datasheet · TANDEM series)* for speed and torque ratings of each tandem configuration.

NOTICE 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 is required *(see Fig.5-3)*.

5.3.1 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 7010 Controller is used *(see notice in section 5.3)*.

5.3.2 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.

Fig.5-4 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.

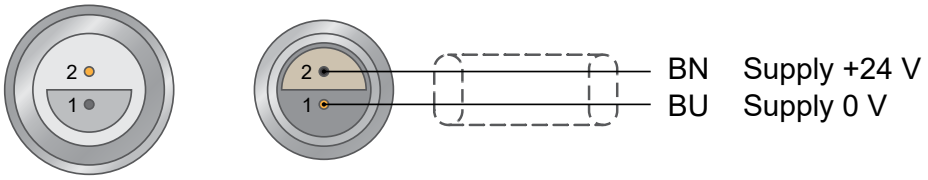


Fig.5-5 Control Signal Cable for WB/PB 43 TANDEM Dynamometer Clutches

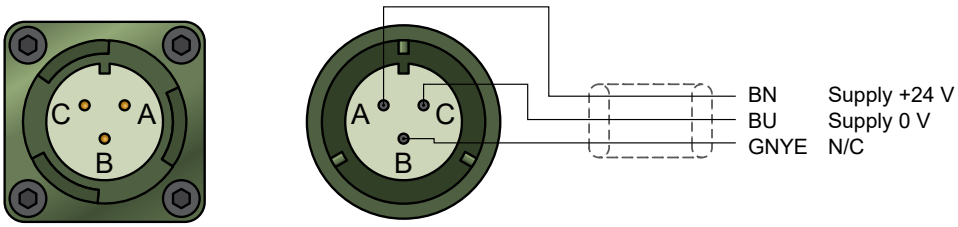


Fig.5-6 Control Signal Cable for WB/PB 65, 115 and 15 TANDEM Dynamometer Clutches

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

5.4 CONNECTION TO NON-MAGTROL ELECTRONIC CONTROL UNITS

CAUTION

USE ELECTRONIC CONTROL UNITS NOT SUPPLIED BY MAGTROL WITH EXTREME CAUTION.

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 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.

5.4.1 POWER AND THERMOSTAT CONNECTION

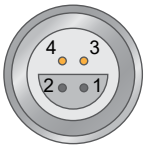
The PB Series Dynamometer torque depends exclusively on the excitation current, whereas the torque of a WB Series Dynamometer is determined by both the excitation current and its speed. Therefore, with WB Dynamometers, the excitation current must be reduced when its speed is being increased to hold a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

To keep operating temperatures at acceptable levels, it is important to run dynamometers within their power ratings. The braking power of the dynamometer must therefore be regularly checked by referring to the torque-speed-power rating curves (*see chapter 3 - TORQUE–SPEED–POWER CURVES*) of this manual or by using the following equation:

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

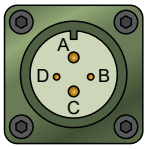
Fig.5-7 Braking power calculation

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.



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

Fig.5-8 Connector Pin Configuration for **WB/PB 43** Dynamometer Power and Temperature Measurement



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

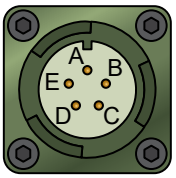
Fig.5-9 Connector Pin Configuration for **WB/PB 65, 115** and **15** Dynamometer Power and Temperature Measurement

5.4.2 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 -

Fig.5-10 Connector Pin Configuration for **WB/PB 43** Dynamometer Torque Signals



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

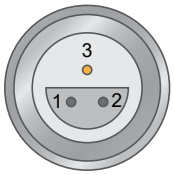
Fig.5-11 Connector Pin Configuration for **WB/PB 65, 115** and **15** Dynamometer Torque Signals

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

5.4.3 SPEED SIGNAL CONNECTION

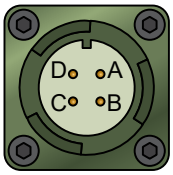
Speed measuring requires a 5 V supply. The square TTL type output signal frequency is proportional to the speed. According to the polar wheel mounted on the system, the pulse number (per revolution) will be 30, 60, 600 or 6000. For additional information on this item, refer to the dynamometer's corresponding data sheets (*see section 1.2 to 1.3*).

NOTICE 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 PPR (Pulses Per Revolution). This provides a higher resolution but limits the speed to 1 000 rpm.



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

Fig.5-12 Connector Pin Configuration for **WB/PB 43** Dynamometer Speed Signals



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

Fig.5-13 Connector Pin Configuration for **WB/PB 65, 115** and **15** Dynamometer Speed Signals

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

6. OPERATING PRINCIPLES

6.1 EDDY-CURRENT DYNAMOMETERS (WB SERIES)

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.

6.2 MAGNETIC POWDER DYNAMOMETERS (PB SERIES)

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.

6.3 WB SERIES VS. PB SERIES

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

Fundamentally, the difference between an Eddy-current dynamometer (WB Series) and a magnetic powder dynamometer (PB Series) 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.

7. CALIBRATION PROCESS

Every new Magtrol WB/PB Series Dynamometer is calibrated in our factories. Static calibration of the Zero and Torque is recommended from time to time, especially after having maintenance performed.

NOTICE Do not forget to unlock the dynamometer following transport (after it returns from overhaul) in accordance with *see section 2.1 - Locking the Dynamometer for Transport*.

7.1 BASIC CALIBRATION INFORMATION

Before the calibration, the motor or any other devices must be disconnected from the dynamometer; this allows the dynamometer shaft to rotate freely.

7.1.1 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 (*see Fig.7-1*).

The calibration is performed in N·m. Each calibration arm has two grooves: the outer grooves are used for calibration with weights in [kg], the inner grooves with weights in [N].

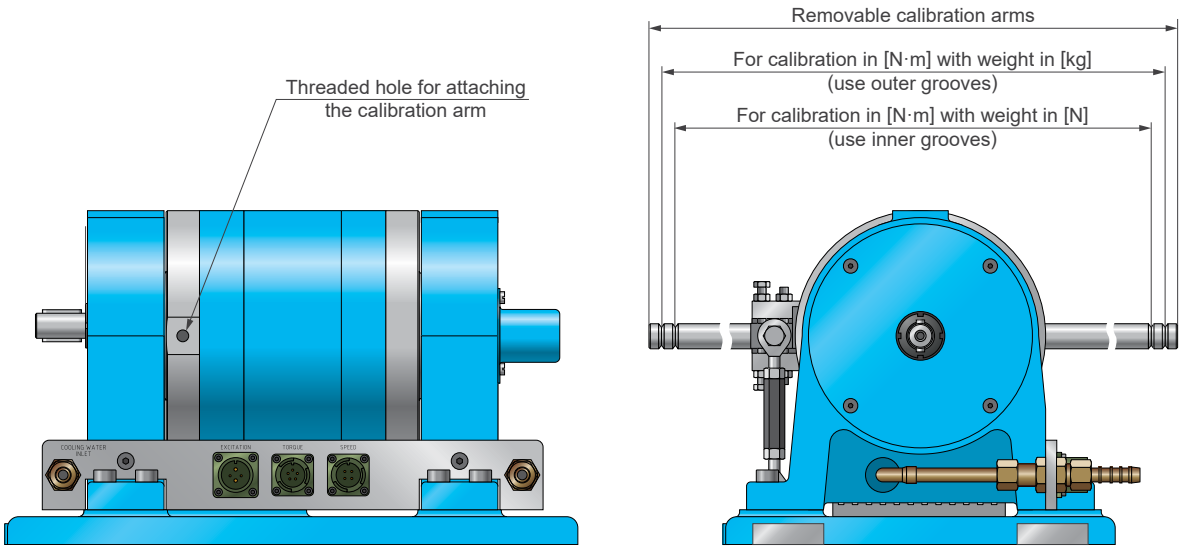


Fig.7-1 Calibration Arms mounted on WB/PB 65 (elements are not to scale)

CAUTION After calibration, do not forget to remove the calibration arms from the dynamometer.

7.1.2 CALIBRATION WEIGHT

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

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

MODEL	CALIBRATION WEIGHT *[kg]*	NOMINAL RATED TORQUE *[N·m]*
WB SERIES		
1 WB 43	0.6	1.5
2 WB 43	1.2	3.0
1 WB 65	2.0	10.0
2 WB 65	4.0	20.0
1 WB 115	10.0	50.0
2 WB 115	20.0	100.0
1 WB 15	28.0	140.0
2 WB 15	56.0	280.0
3 WB 15	84.0	420.0
4 WB 15	112.0	560.0
PB SERIES		
1 PB 43	2.0	5.0
2 PB 43	4.0	10.0
1 PB 65	5.0	25.0
2 PB 65	10.0	50.0
1 PB 115	20.0	100.0
2 PB 115	40.0	200.0
1 PB 15	60.0	300.0
2 PB 15	120.0	600.0
4 PB 15	240.0	1200.0

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

7.2 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 Series user manual** should be followed. Please refer to TSC User Manual: *Chapter 4 – CALIBRATION PROCESS*.

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

7.3 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. Disconnected the motor or any other devices, to allows the dynamometer shaft to rotate freely;
2. Mount the calibration arms;
3. Adjust the zero (0) on the electronic control unit;
4. Hang the calibration weight from one of the calibration arms;

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

5. Adjust the electronic control unit to obtain the reading of the nominal dynamometer torque;
6. 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 #3;
7. Remove the calibration arms;
8. Reconnect your motor and other devices.

7.4 CALIBRATION OF 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 *see section 7.4.1 through 7.4.3*

NOTICE WB/PB 15 Series Dynamometers do not have overload protection

7.4.1 WB/PB 43 SERIES

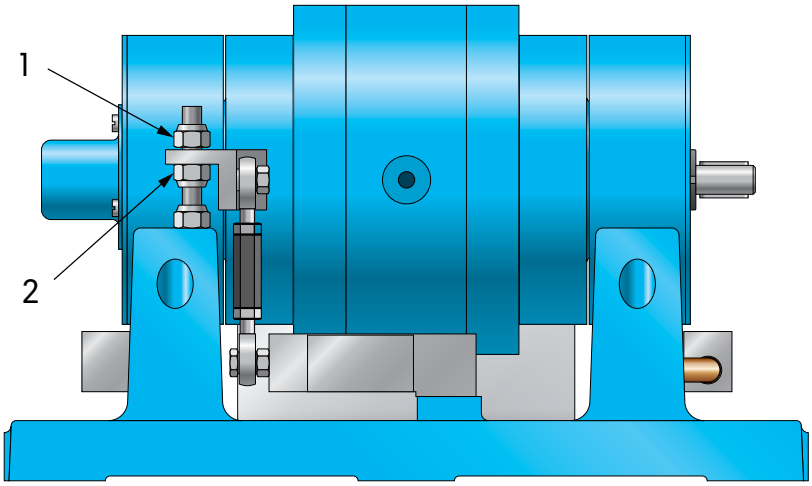


Fig.7-2 WB/PB 43 Overload Protection Calibration

1. Mount the calibration arms *see section 7.1.1 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.

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).

7.4.2 WB/PB 65 SERIES

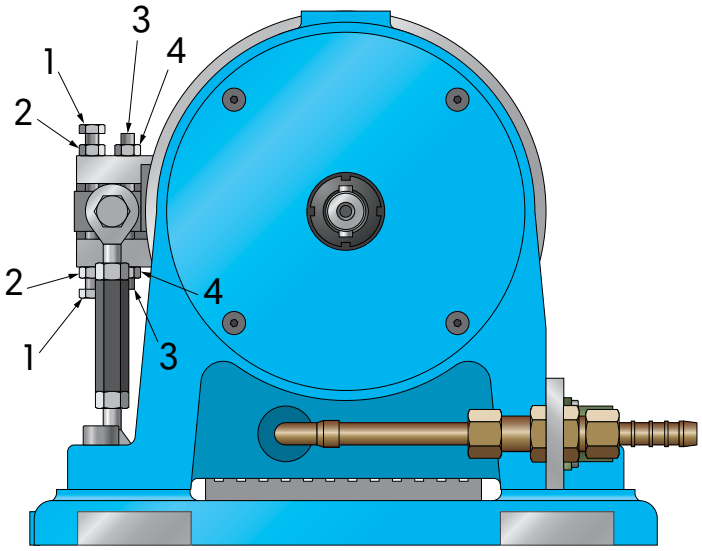


Fig.7-3 WB/PB 65 Overload Protection Calibration

1. Mount the calibration arms. *see section 7.1.1 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.

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).

7.4.3 WB/PB 115 SERIES

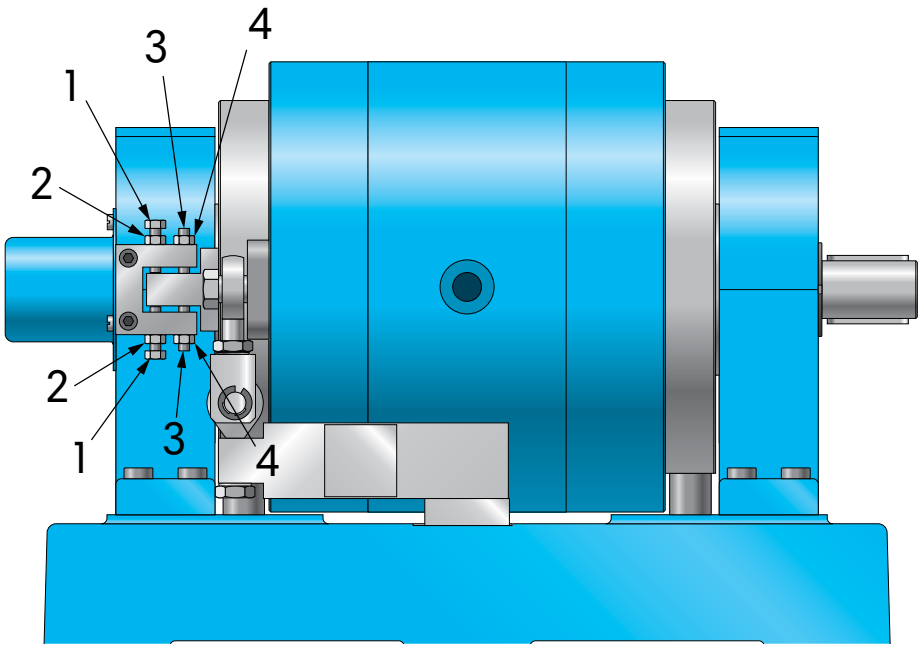


Fig.7-4 WB/PB 115 Overload Protection Calibration

1. Mount the calibration arms *see section 7.1.1 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.

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).

8. MAINTENANCE, REPAIR & CALIBRATION

8.1 MAINTENANCE

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. To use the brake at full speed, it must first be warmed up.

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.

CAUTION 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.

CAUTION THE USER MUST NOT ATTEMPT TO CHANGE OR REPAIR THE BEARINGS OR ANY OTHER COMPONENTS HIMSELF. FOR ALL MAINTENANCE OR REPAIR OPERATIONS, PLEASE RETURN THE DYNAMOMETER TO MAGTROL.

SIMILARLY, THE USER SHOULD NOT ATTEMPT TO CARRY OUT REVISIONS OR REPAIRS OF ANY KIND ON THE MECHANICAL OR ELECTRONIC COMPONENTS MAKING UP THE DYNAMOMETER. IF A PROBLEM IS SUSPECTED, MAGTROL SHOULD BE CONTACTED SO THAT ARRANGEMENTS CAN BE MADE TO PERFORM ANY REPAIRS IN THE FACTORY.

FAILURE TO COMPLY MAY RESULT IN SERIOUS DAMAGE TO THE TRANSDUCER OR MAY INVALIDATE THE WARRANTY.

NOTICE The WB-PB-TANDEM Dynamometer **housing is sealed**. If there is any evidence that the housing has been opened and unauthorized modifications have been attempted, **the warranty will be invalidated.**

8.2 REPAIR

In case of a defect, please see chapter *see chapter - SERVICES INFORMATION* of this manual. Whether you are directed to ship your equipment back to MAGTROL INC. in the United States or MAGTROL S.A. in Switzerland, it is very important to include the following information with your return shipment:

1. Model number, part number, serial number, order number and date of acquisition
2. Description of the defect and the conditions in which it appeared
3. Description of the test bench (drawing, photographs, sketches, etc.)
4. Description of the tested object (drawing, photographs, sketches, etc.)
5. Description of the test cycle

CAUTION MAINTENANCE MUST BE PERFORMED BY MAGTROL IN ORDER TO GUARANTEE FUTURE MEASURING ACCURACY.

To allow MAGTROL to complete the work in the best possible time, please follow the procedure below as well as the standard procedure for returing equipment to Magtrol *see chapter - SERVICES 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.

8.3 CALIBRATION

To ensure correct operation of the dynamometer and long-term measurement consistency, it is recommended to calibrate the dynamometer regularly. Magtrol strongly recommends at least **one calibration every 12 months**.

You can perform this operation yourself (*see chapter 7 - CALIBRATION PROCESS*) or return the dynamometer to Magtrol so that we can perform this operation for you **in our ISO 17025 accredited calibration laboratory**.

Returning the sensor directly to the Magtrol factory is both advantageous and economical. We can guarantee a dedicated calibration for the sensor performed by one of our specialists. In addition, any wear and tear requiring maintenance will be immediately taken care of by our after-sales service team.

SERVICES INFORMATION

RETURNING MAGTROL EQUIPMENT FOR REPAIR AND/OR CALIBRATION

When returning equipment to MAGTROL INC. (United States) or MAGTROL S.A. (Switzerland) for repair and/or calibration, a completed **Return Material Authorization (RMA) form is required.**

Please consult the «Services/Return and Calibration» section on our web site www.magtrol.com, in order to choose the most appropriate recipient for your needs.

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 S.A. in Switzerland.

RETURNING EQUIPMENT TO MAGTROL INC. (UNITED STATES)

1. Visit the «Services/Return and Calibration» section of Magtrol's web site www.magtrol.com to initiate an RMA procedure. Complete the RMA form online and submit.
2. An RMA number will be issued to you via e-mail. Include this number on all return documentation.
3. Ship your equipment to: **MAGTROL, INC.**
   70 Gardenville Parkway
   Buffalo, NY 14224 | USA
   Attn: Repair Department
4. 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.
5. 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.

CONTACT FOR AFTER SALES SERVICE AT MAGTROL INC.

After Sales, Repair & Calibration Services

phone +1 716 668 5555 ext. 115
e-mail service@magtrol.com

RETURNING EQUIPMENT TO MAGTROL S.A. (SWITZERLAND)

1. Visit the «Services/Return and Calibration» section of Magtrol's web site www.magtrol.com to initiate an RMA procedure; complete the RMA form online and submit.
2. After your request has been reviewed, you will receive an email containing an RMA number and dedicated return instructions including specifics about shipping details. The RMA number will be a Magtrol SA internal repair order (SR-xxxx) reference.

   Any **shipment sent without an RMA risks delays and possible rejection,** so please wait until you receive the email with the details you will need to properly return your equipment.

   Any **equipment returned for credit must be approved** prior to return and is subject to a re-stocking fee.

CONTACT FOR AFTER SALES SERVICE AT MAGTROL S.A.

After Sales, Repair & Calibration Services

phone +41 26 407 30 00
e-mail repair@magtrol.ch

REVISIONS TO THIS MANUAL

The contents of this manual are subject to change without prior notice. The latest updated versions of our manuals are available and downloadable at any time on Magtrol's website www.magtrol.com in the « SUPPORT » section.

To ensure that you have the latest version, compare the issue date (on the back of this manual) with the last updated document available on our website.

The table of revisions below lists the significant updates that have been made.

REVISION DATES

DATE	EDITION	CHANGES	SECTION(S)
May 2025	2nd Edition - rev. A	Updated all informations about the WB-PB-TANDEM Series; Global update regarding the continuous updates; Global reorganization and new design for the manual Withdrawal of WB 2.7 (obsolete)	All
Sept. 2015	1st Edition - rev. F	Page layout	3.1 / 3.1.2
Apr. 2015	1st Edition - rev. E	Remove WB 2.7 HS version Remove 1 WB 2.7 Dynamometer	1.2.1 1.2.1 / 2.10 / 6.1.2
May 2014	1st Edition - rev. D	Data sheets updated	1.2
Feb. 2014	1st Edition - rev. C	All references to DSP 6001 changed to DSP 7000	All
Apr. 2012	1st Edition - rev. B	Diagram (torque, power) for TANDEM WB 115 updated	1.2.4
Dec. 2009	1st Edition - rev. A	The maximum input pressure was changed.	3.1.2

www.magtrol.com

WB-PB-TANDEM Series | User Manual | 2nd English Edition - Rev. A | 05 / 2025

MAGTROL

MAGTROL INC
70 Gardenville Parkway
Buffalo, NY 14224 | USA
phone +1 716 668 55 55
fax +1 716 668 87 05
e-mail magtrol@magtrol.com

MAGTROL SA
Rte de Montena 77
1728 Rossens | Switzerland
phone +41 26 407 30 00
fax +41 26 407 30 01
e-mail magtrol@magtrol.ch

Subsidiaries
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Certification