



MAGNETIC BRAKE SYSTEMS
A DIVISION OF TECHNICAL FILM SYSTEMS, INC.

DYNAMOMETER DATA SHEET

(Version 1.0)

MODELS:

DI3M-3.75T-FM DI3M-3.75T-BM

Max continuous power dissipation:	3.3 HP (2.46 kW)
Max 30 second power dissipation:	4.52 HP (3.37 kW)
Max continuous brake torque:	540 in-oz. (381 N-cm)
Max brake speed:	12,000 RPM



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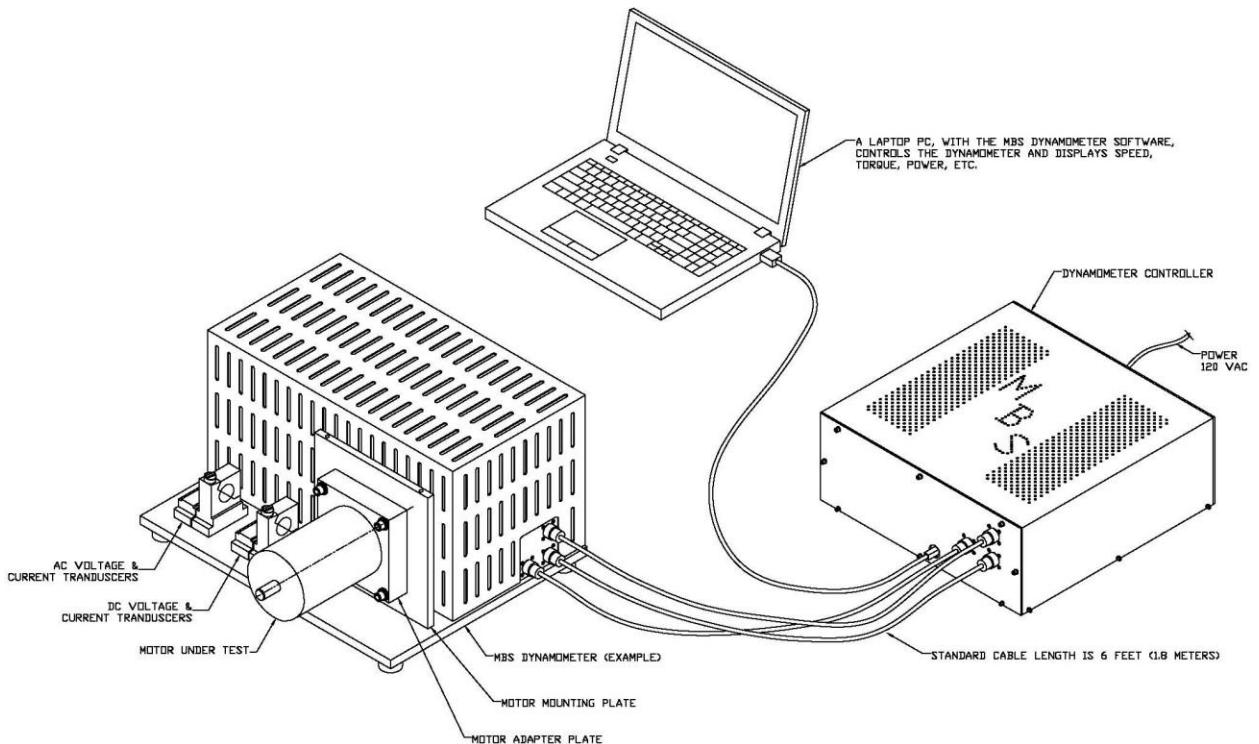
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1. OVERVIEW

This data sheet is a reference for the performance specifications of the dynamometer models listed on the cover page.

The MBS dynamometers may be used to test just about any type of motor (i.e. electric, hydraulic, pneumatic, reciprocating). Types of testing include: endurance testing, speed versus torque curves, measure stall torque, efficiency, temperature rise, performance verification, etc. MBS dynamometers are sold as complete systems (shown in image below) that include: the dynamometer, controller, computer with software, calibration weight, manual and all cables. Our systems do not require annual fees, licenses or permits. The software is user friendly, is very configurable (i.e. changing units, display scale limits, data acquisition rate, etc.) and has some safety precautions build in to prevent damage to the motor under test and/or the system (i.e. brake temperature sensor, setting current limit, setting power limit, trigger input signals).



Dynamometers, or more specifically the size of the brakes for the dynamometers, are selected based on the required power dissipation and required torque.

The nomenclature of the dynamometer part number is described at the end of this document. The power dissipation rating for this system is located on the bottom of the cover page. This data sheet may also be used to determine the best configuration for a system.



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The DI3M-3.75T-FM is a direct drive system where one of the brakes may be un-coupled to test smaller motors; the load cell measures the motor torque.

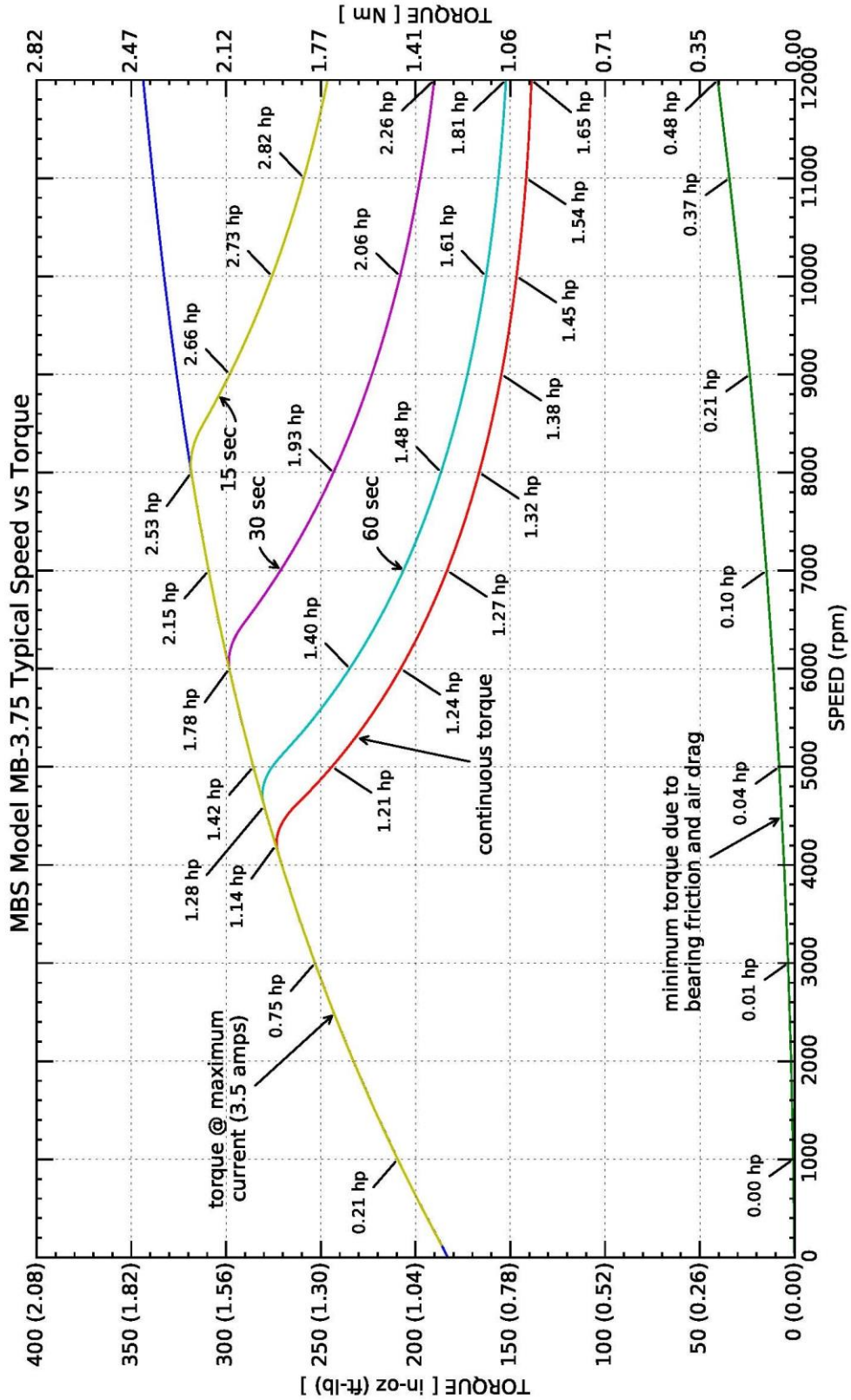
Dynamometers, or more specifically the brakes for the dynamometers, are sized based on the required power dissipation and required torque. The benefit of this dynamometer as an inline system is the ability to test much higher speeds than an off the shelf transmission can handle.

The torque, speed, voltage and current ranges (and types; i.e. DC, AC) need to be specified when purchasing a dynamometer in order to select the limits for the instrumentation. The following performance specifications for load cells, transducers, etc. are based on vendor specifications.



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2. SPEED vs. TORQUE CURVE – FOR ONE MB-3.75 BRAKE





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3. TORQUE & SPEED OUTPUT TO MOTOR

Motor_Spd (RPM)	Motor Torque (in-oz.)	Power (HP)	Pulley Ratio (motor/brake)	Qty. Brakes	Brake Torque (in-oz./qty.)	Brake_Spd (RPM)	Time (sec)
0	180	0	Direct drive	1	180	0	cont.
0	360	0	Direct drive	2	360	0	cont.
4,500	270	1.2	Direct drive	1	270	4,500	cont.
4,500	540	2.4	Direct drive	2	540	4,500	cont.
6,000	420	2.5	Direct drive	2	420	6,000	cont.
6,000	600	3.5	Direct drive	2	600	6,000	30
12,000	140	1.6	Direct drive	1	140	12,000	cont.
12,000	280	3.2	Direct drive	2	280	12,000	cont.

Table 1: Torque, Speed and Power (English Units)

Motor_Spd (RPM)	Motor Torque (N-cm)	Power (Watts)	Pulley Ratio (motor/brake)	Qty. Brakes	Brake Torque (N-cm/qty.)	Brake_Spd (RPM)	Time (sec)
0	130	0	Direct drive	1	130	0	cont.
0	260	0	Direct drive	2	260	0	cont.
4,500	191	895	Direct drive	1	191	4,500	cont.
4,500	382	1,790	Direct drive	2	382	4,500	cont.
6,000	297	1,865	Direct drive	1	297	5,500	cont.
6,000	424	2,611	Direct drive	2	424	5,500	30
12,000	99	1,193	Direct drive	1	99	12,000	cont.
12,000	198	2,387	Direct drive	2	198	12,000	cont.

Table 2: Torque, Speed and Power (SI Units)

The tables are based on the performance graph for the MBZ-3.75 Brake, shown in Figure 1. The 3.75 model brake has been known to operate up to 15,000 RPM but no data is available above 12,000 RPM.

4. LOAD CELL (DI3M-2.4T-FM, Measure Motor Torque)

Max Rated Load on Load Cell	211 oz. (6-Kg.)
Load Cell Arm	3.0 inches (7.62 cm)
Max Rated Torque to L.C	635 in-oz. (448 N-cm)
Max Brake Torque	600 in-oz. (424 N-cm)
Non-Linearity	0.02% of Rated Load (R.L.)
Hysteresis	0.02% of R.L.
Non-Repeatability	0.02% of R.L.
Zero Balance	±1% of R.L.
Compensated Temperature Range	14°F to 104°F
Safe Temperature Range	14°F to 140°F
Temperature Effect on Output	0.002% of Load/°F
Temperature Effect on Zero	0.002% of Load/°F
Safe Overload	150% of R.L.*

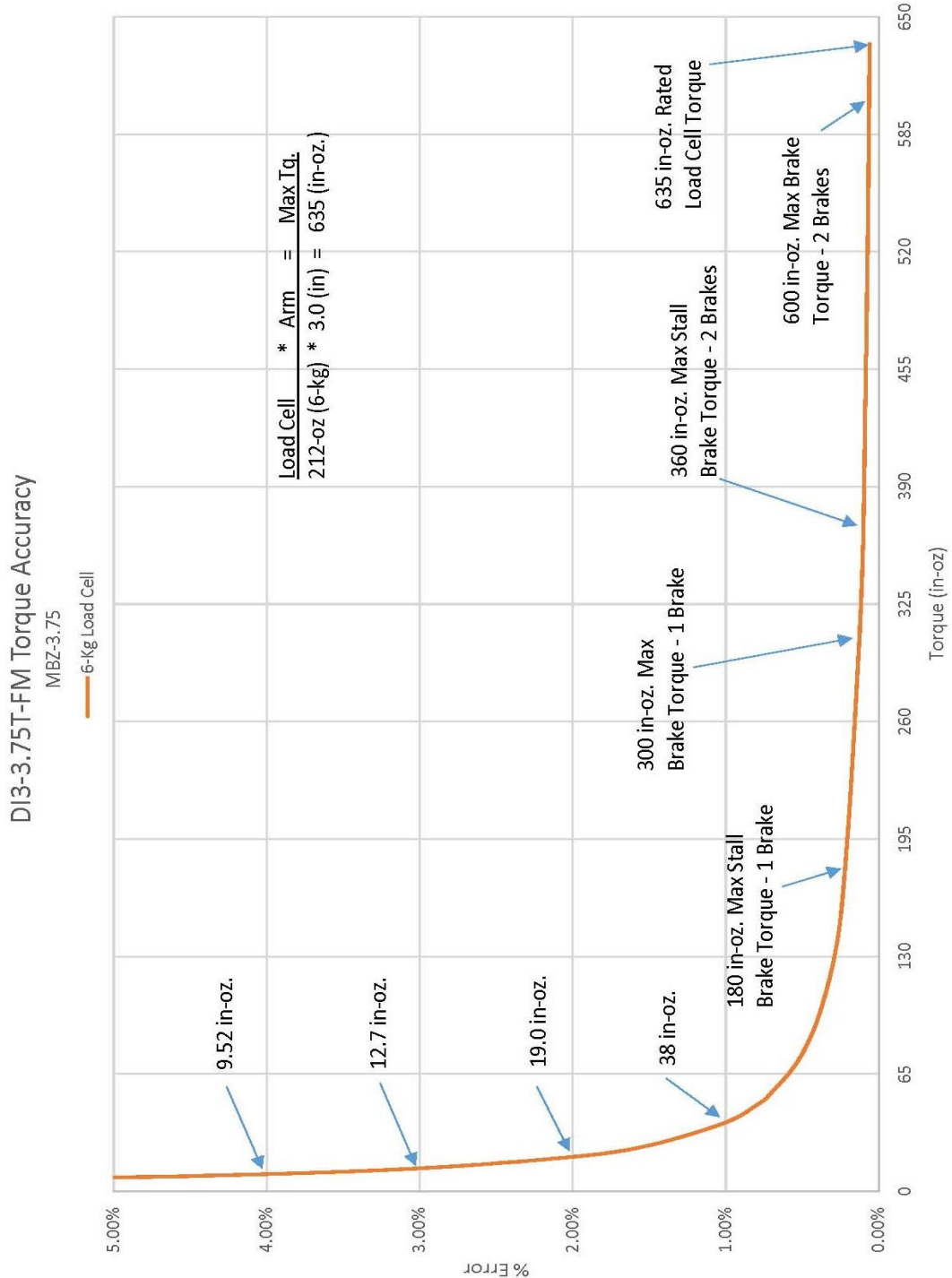
* Hard stops are in place to help prevent damage from over-load.



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4.1 Load Cell Accuracy Plot (in-oz.)

The Torque Error plot shows the percentage error as a function of measured torque. These plots show the range that a load cell will accurately measure. The maximum torque to the motor is based on the maximum torque from the brake. The error plot is based on published data from the load cell vendor.



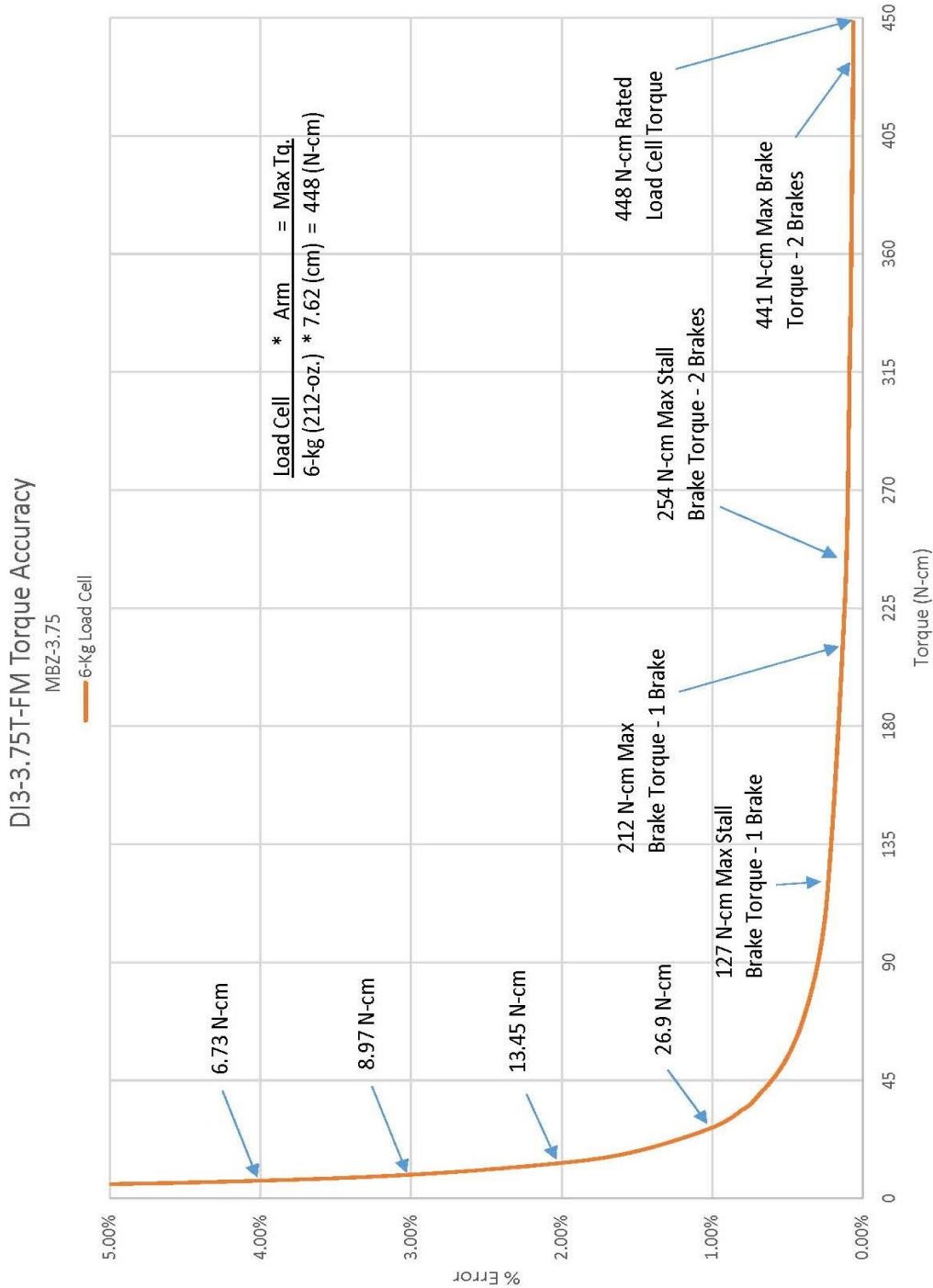


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4.2 Load Cell Accuracy Plot (N-cm)

The Torque Error plot shows the percentage error as a function of measured torque. These plots show the range that a load cell will accurately measure. The maximum torque to the motor is based on maximum torque from the brake. The error plot is based on published data from the load cell vendor.





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5. SPEED MEASUREMENT

A standard brake has five magnets (alternative quantity are optional) which trigger a hall effect sensor. The speed is averaged over one revolution of the brake. A 48-MHZ clock is used to measure the time between magnets.

Parameter	Conditions	Min.	Typ.	Max.	Units
Clock Error	~25°C		±30		PPM
	-10°C to 60°C		±50		PPM
	-40°C to 85°C		±100		PPM
Brake Speed	5 magnets	12		180*	KPM
	30 magnets	2		30*	KPM

* Theoretical speed; actual maximum speed is limited to the speed of the brake.

6. DATA SAMPLING

Sampling is the frequency of measuring and recording data; this rate is adjustable by the operator.

Parameter	Conditions	Min.	Typ.	Max.	Units
Sampling Rate	2.3 GHz Proc.	20	50	-	ms

i.e. 50 ms = 20 samples (or readings) per second.

7. LAPTOP COMPUTER

Parameter	Conditions	Min.	Typ.	Max.	Units
Processor		2.3			GHz
Memory		8			GB
Display	LED LCD		15.6		inches

8. POWER REQUIREMENTS

The MBS Dynamometer requires two 115 or 230 VAC power outlets: one for the laptop computer and one for the controller. The brakes in the dynamometer structure receive power from the controller.

Item	Voltage	Type	Current (amps)	Freq. (Hz)	# Plugs
Controller	115/230	VAC	1.1/0.6	50/60	1
Laptop	110-240	VAC	1.2	50/60	1
Dynamometer	24	VDC	6.0	-	none



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9. DC VOLTAGE TRANSDUCERS

9.1 Input

Range 0 VDC to: 1, 5, 10, 50, 150, 200 up to 600 VDC
Overload 2x voltage range selected
Frequency Range DC only

9.2 Output

Basic Accuracy 1.0%
Linearity 10% to 100% F.S.
Thermal Drift 500 PPM/°C
Response Time 250 ms

9.3 Environmental and Physical Characteristics

Operating Temperature 0°C to +50°C
Insulation Category CAT II
Vibration Tested to IEC 60068-2-6, 1995
Pollution Degree 2
Altitude 2000-meter max.
Insulation Voltage 2500 VDC
MTBF Greater than 100K hours
Relative Humidity 5% to 95%, non-condensing
Weight 0.5 lbs.

10. AC VOLTAGE TRANSDUCERS – SINGLE PHASE

10.1 Input

Range 0 VAC to: 50, 150, 250, 500, 600 VAC
Overload 2x voltage range selected
Frequency Range 20 Hz to 5 kHz

10.2 Output

Basic Accuracy 0.5%
Linearity 10% to 100% F.S.
Calibration True RMS sensing
Thermal Drift 500 PPM/°C
Response Time 250 ms

10.3 Environmental and Physical Characteristics

Operating Temperature 0°C to +60°C
Insulation Category CAT II
Vibration Tested to IEC 60068-2-6, 1995
Pollution Degree 2
Altitude 2000-meter max.
Insulation Voltage 2500 VDC
MTBF Greater than 100K hours
Relative Humidity 5% to 95%, non-condensing
Weight 0.5 lbs.



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11. DC CURRENT TRANSDUCERS (Split Core)

11.1 Input

Range 0 ADC to: 2, 5, 10, 20, 30, 50, 75, 100
..... up to 600 ADC
Overload 4x current range selected
Frequency Range DC only

11.2 Output

Basic Accuracy 1.0%
Linearity 10% to 100% F.S.
Thermal Drift 500 PPM/C
Response Time 250 ms

11.3 Environmental and Physical Characteristics

Operating Temperature 0°C to +50°C
Insulation Category CAT II
Vibration Tested to IEC 60068-2-6, 1995
Pollution Degree 2
Altitude 2000-meter max.
Insulation Voltage 2500 VDC
MTBF Greater than 100K hours
Relative Humidity 5% to 95%, non-condensing
Weight 0.5 lbs.

12. AC CURRENT TRANSDUCERS – SINGLE PHASE (Split Core)

12.1 Input

Range 0 AAC to: 5, 10, 15, 20, 25, 30, 40, 50
..... up to 600 AAC
Overload 4x current range selected
Frequency Range 20 Hz to 5 kHz

12.2 Output

Basic Accuracy 0.5%
Linearity 10% to 100% F.S.
Calibration True RMS sensing
Thermal Drift 500 PPM/C
Response Time 250 ms

12.3 Environmental and Physical Characteristics

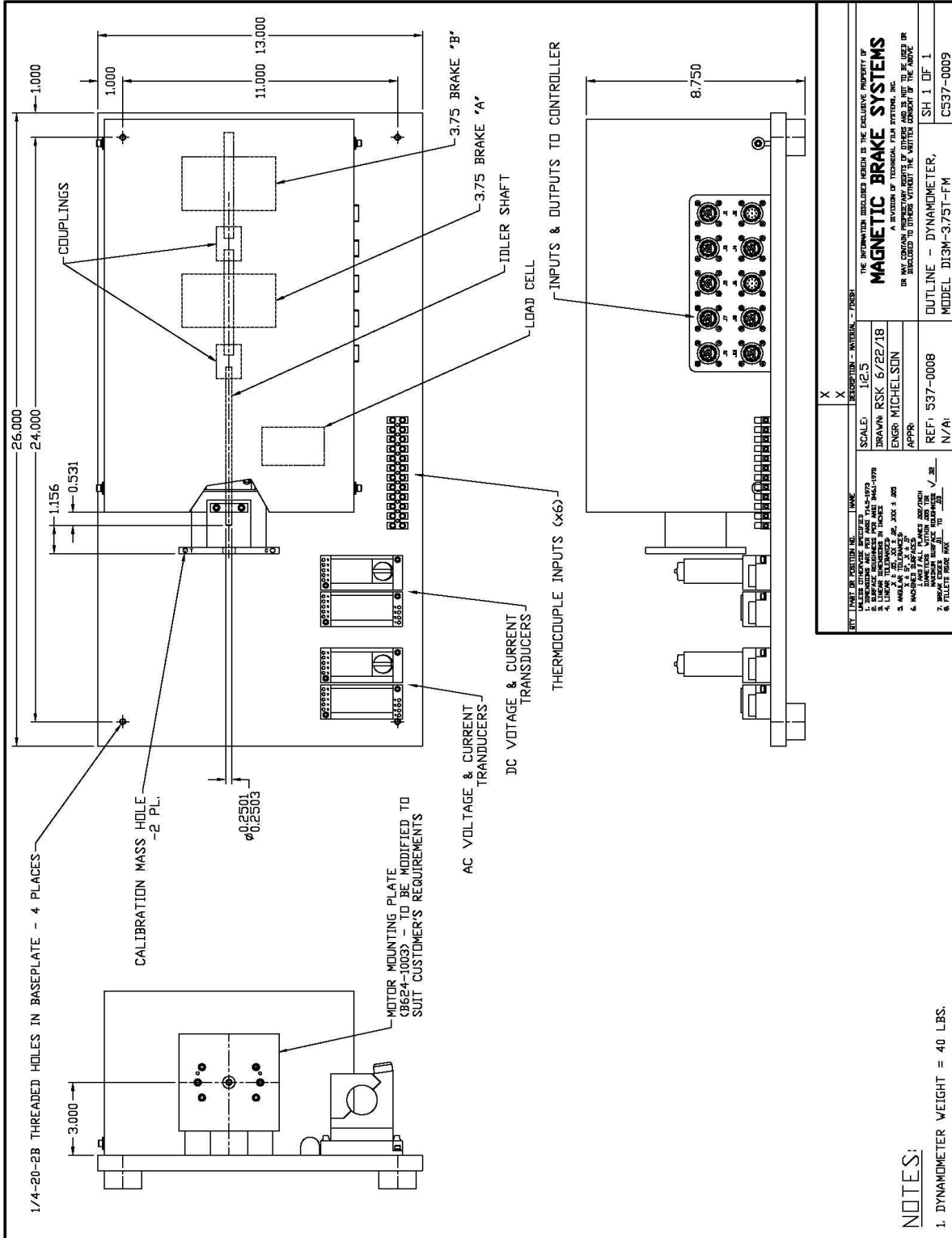
Operating Temperature 0°C to +60°C
Insulation Category CAT II
Vibration Tested to IEC 60068-2-6, 1995
Pollution Degree 2
Altitude 2000-meter max.
Insulation Voltage 2500 VDC
MTBF Greater than 100K hours
Relative Humidity 5% to 95%, non-condensing
Weight 0.5 lbs.



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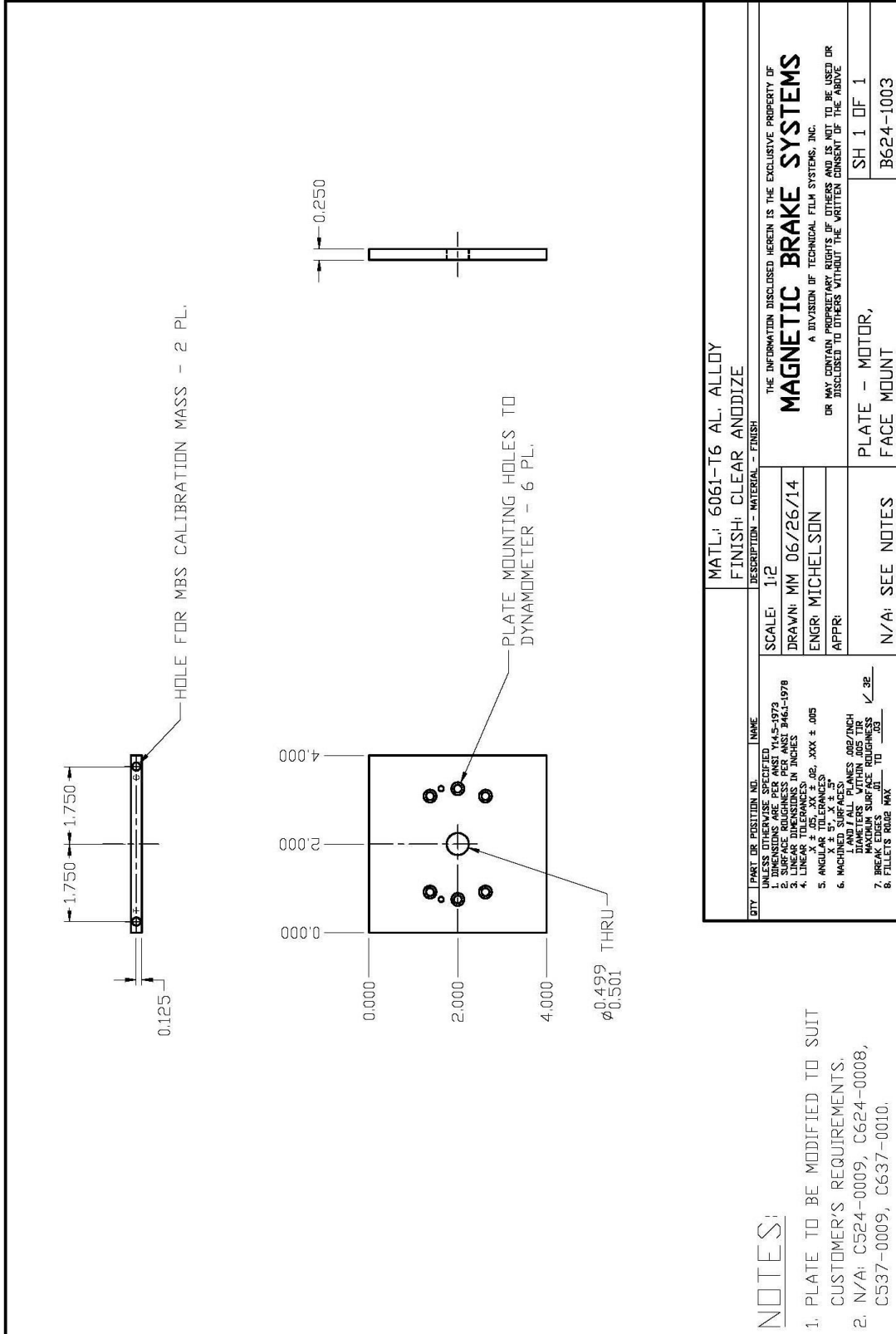
13. DYNAMOMETER LAYOUT – DB3M-3.7T-FM, LOAD CELL ON MOTOR





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14. MOTOR MOUNTING PLATE – DI3M



NOTES:

1. PLATE TO BE MODIFIED TO SUIT CUSTOMER'S REQUIREMENTS.
2. N/A: C524-0009, C624-0008, C537-0009, C637-0010.

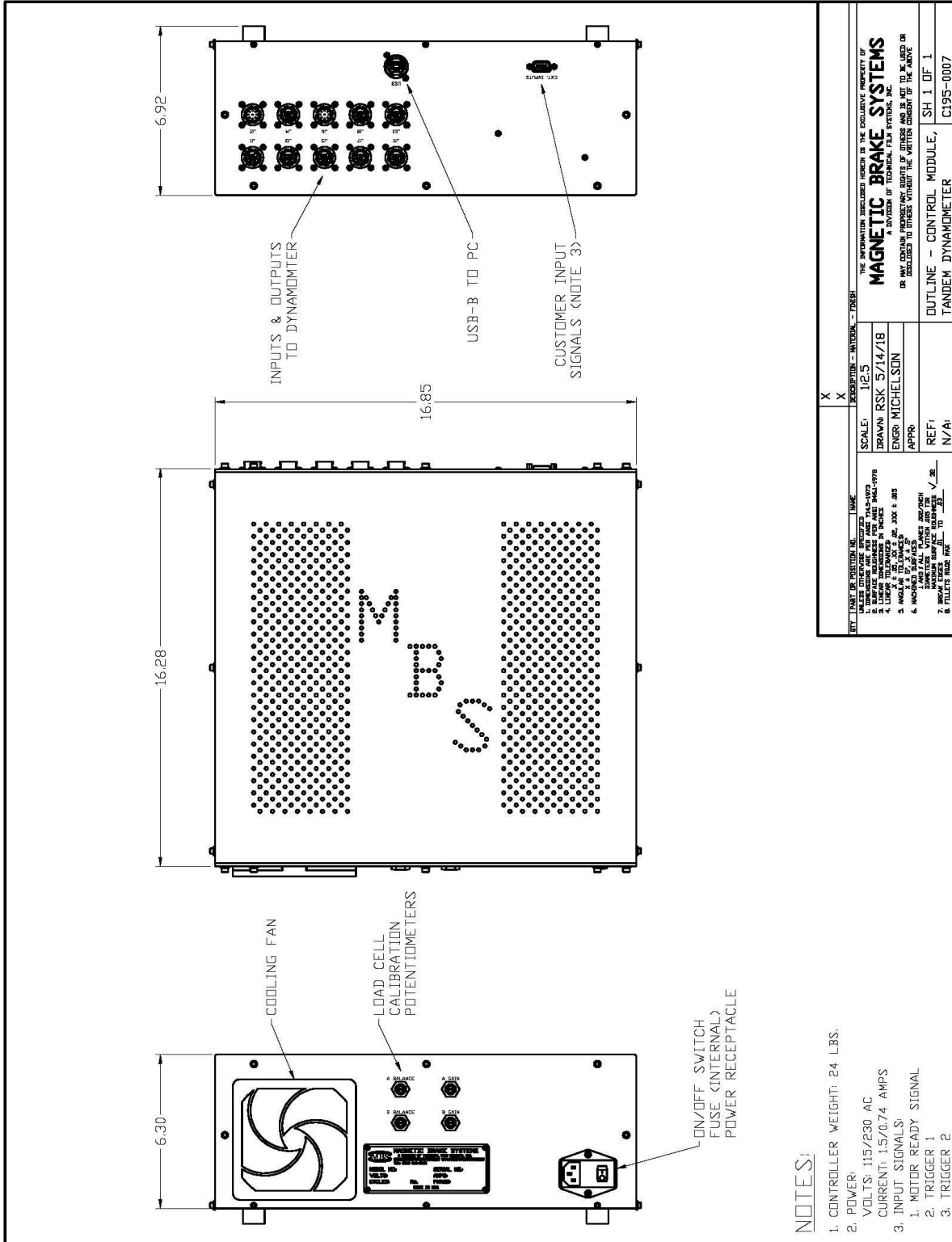
DESCRIPTION - MATERIAL - FINISH MATL: 6061-T6 AL. ALLOY FINISH: CLEAR ANODIZE	
SCALE: 1:2 DRAWN: MM 06/26/14 ENGR: MICHELSON APPR:	THE INFORMATION DISCLOSED HEREIN IS THE EXCLUSIVE PROPERTY OF MAGNETIC BRAKE SYSTEMS A DIVISION OF TECHNICAL FILM SYSTEMS, INC. OR MAY CONTAIN PROPRIETARY RIGHTS OF OTHERS AND IS NOT TO BE USED OR DISCLOSED TO OTHERS WITHOUT THE WRITTEN CONSENT OF THE ABOVE
QTY PART OR POSITION NO. NAME <small>UNLESS OTHERWISE SPECIFIED: 1. DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED 2. SURFACE FINISH PER ANSI B46.1-1978 3. LINEAR DIMENSIONS IN INCHES 4. LINEAR TOLERANCES: .01, .02, .03, .04, .05 5. ANGULAR TOLERANCES: 6. HATCHED ARE 5° UNLESS NOTED 7. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE NOTED 8. BREAK EDGES MAX TO 3B 9. FILLETS R9 UNLESS OTHERWISE NOTED</small>	SH 1 OF 1 B624-1003
N/A: SEE NOTES PLATE - MOTOR, FACE MOUNT	



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15. DYNAMOMETER CONTROLLER



NOTES:

1. CONTROLLER WEIGHT: 24 LBS.
2. POWER:
VOLTS: 115/230 AC
CURRENT: 1.5/0.74 AMPS
3. INPUT SIGNALS:
1. MOTOR READY SIGNAL
2. TRIGGER 1
3. TRIGGER 2

REV. 1	DATE	DESCRIPTION	BY	CHK
1	05/14/18	REVISED TO ADD USB-B TO PC PORT	ENGR. MICHELSON	
2	05/14/18	REVISED TO ADD CUSTOMER INPUT SIGNALS	ENGR. MICHELSON	
3	05/14/18	REVISED TO ADD MOTOR READY SIGNAL	ENGR. MICHELSON	
4	05/14/18	REVISED TO ADD TRIGGER 1 AND TRIGGER 2	ENGR. MICHELSON	
5	05/14/18	REVISED TO ADD COOLING FAN	ENGR. MICHELSON	
6	05/14/18	REVISED TO ADD LOAD CELL CALIBRATION POTENTIOMETERS	ENGR. MICHELSON	
7	05/14/18	REVISED TO ADD ON/OFF SWITCH FUSE (INTERNAL) POWER RECEPTACLE	ENGR. MICHELSON	
8	05/14/18	REVISED TO ADD MBS LOGO	ENGR. MICHELSON	

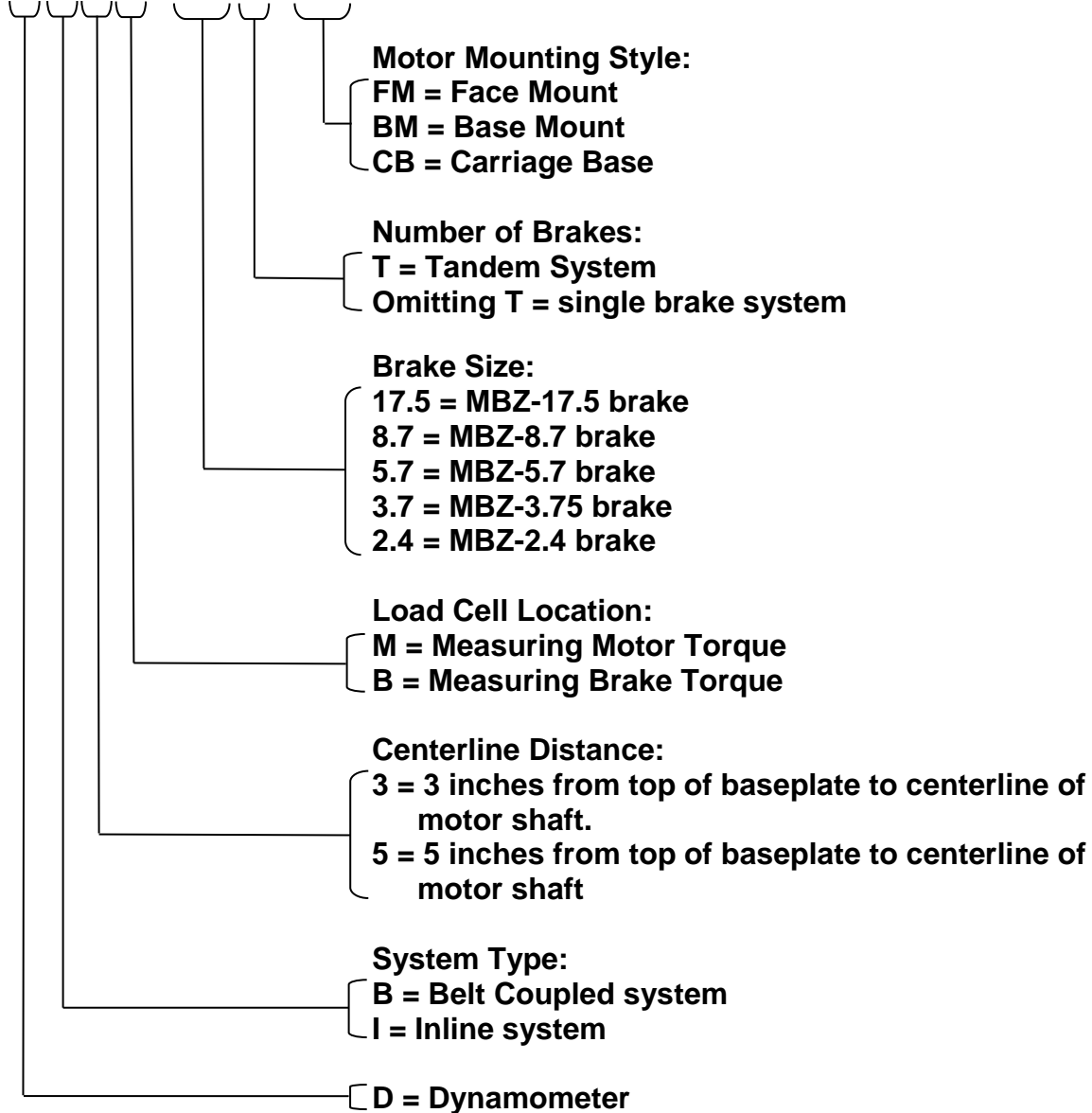
SCALE:	1:1
DRAWN:	RSK 5/14/18
ENGR.:	MICHELSON
APPR.:	
REF.:	N/A
DUTLINE - CONTROL MODULE,	SH 1 OF 1
TANDEM DYNAMOMETER	C19S-0007



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16. NOMENCLATURE OF DYNAMOMETER PART NUMBER

DB5M-8.7T-FM



The load cell(s) size(s) and type(s) of voltage & Current transducers are to be specified individually.