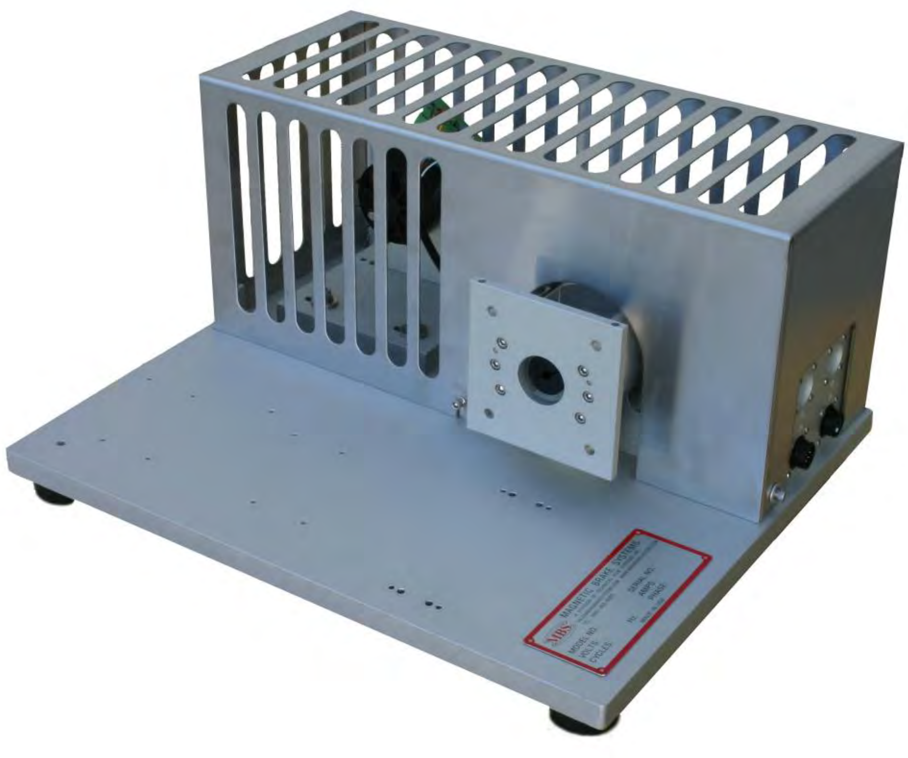
MAGNETIC BRAKE SYSTEMS

A DIVISION OF TECHNICAL FILM SYSTEMS, INC.

DYNAMOMETER DATA SHEET

(Version 1.0)



MODELS:

DB3B-2.4-FM	**DB3M-2.4-FM**
DB3B-2.4-BM	**DB3M-2.4-BM**

Max continuous power dissipation:	1 HP (746 watts)
Max continuous brake torque:	67 in-oz. (47 N-cm)
Max brake speed:	15,000 RPM

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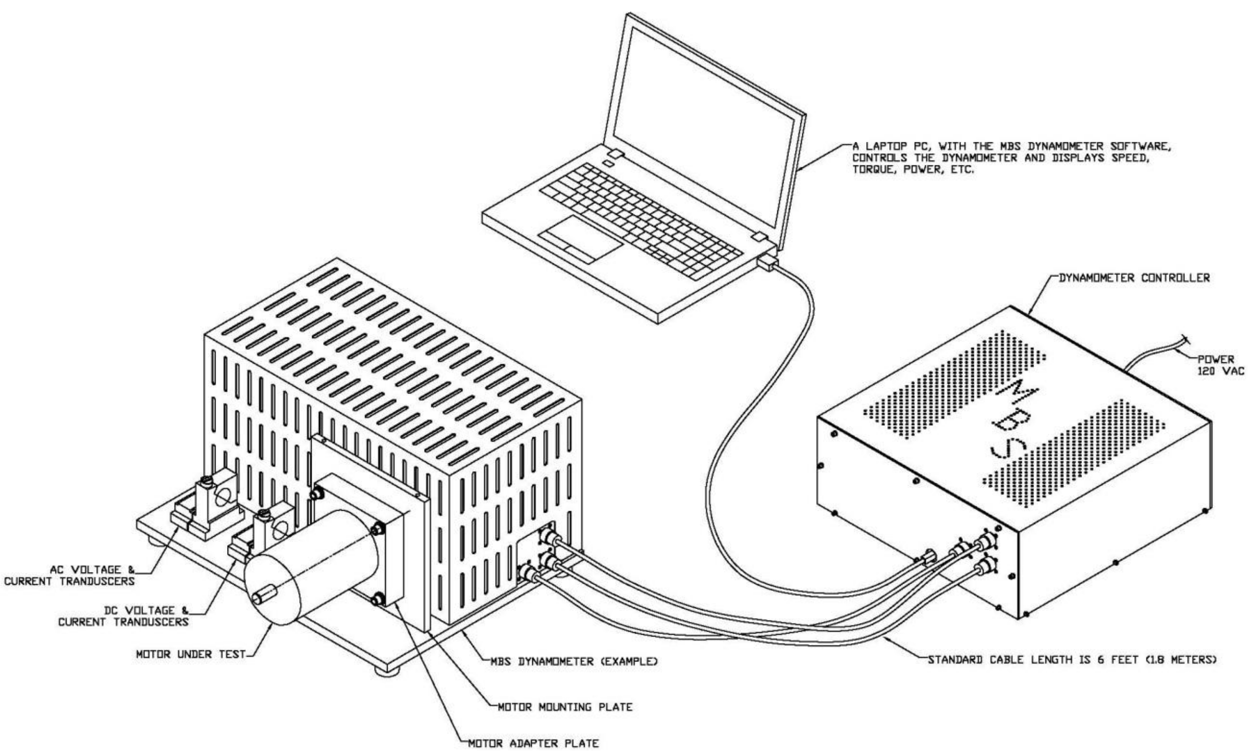
TABLE OF CONTENTS

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).



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.

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

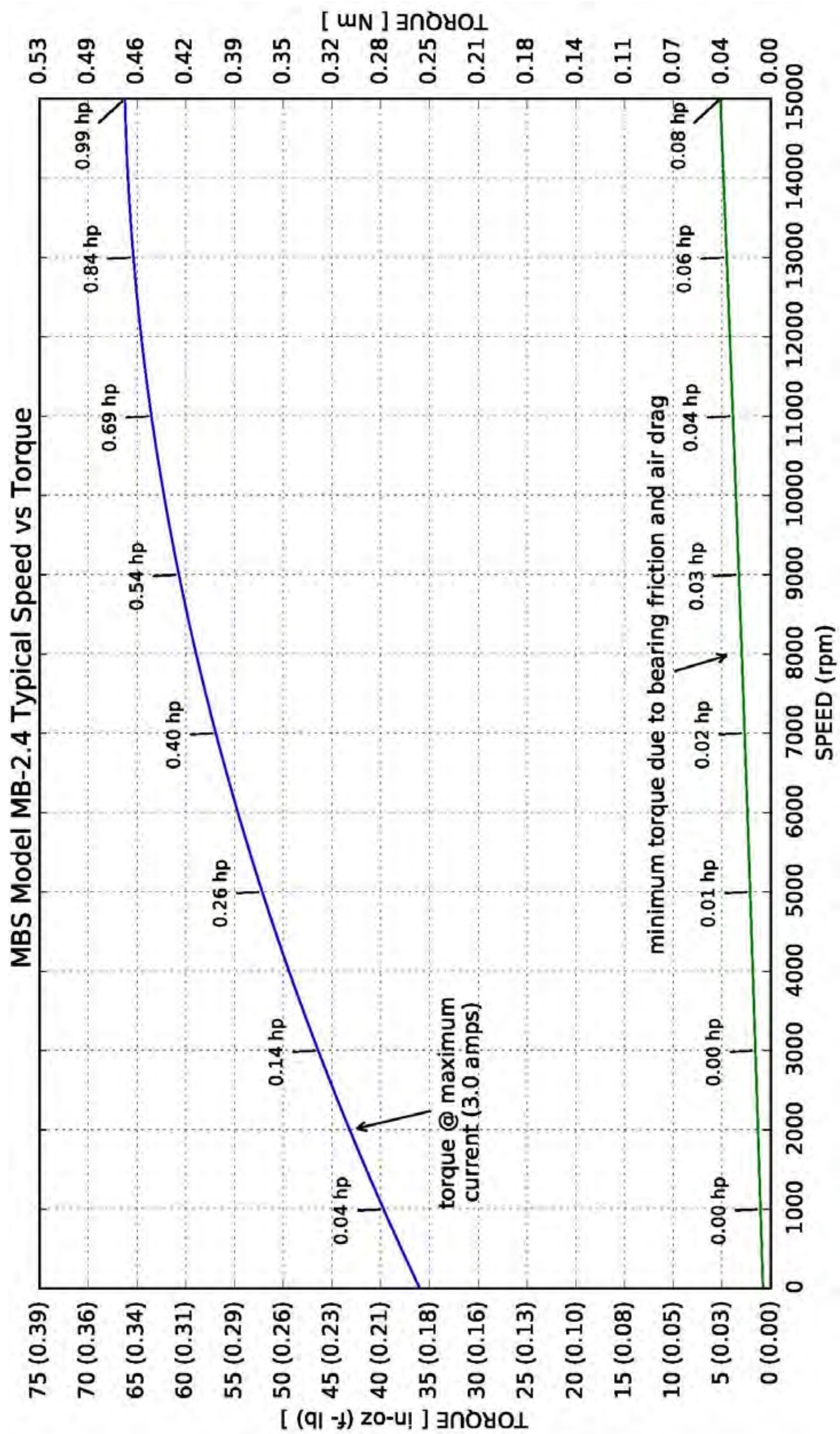
A belt coupled system will provide a much broader range of torque supplied to the motor under test, which makes a dynamometer more cost effective and diverse than a direct drive system.

The location of the load cell is optional but must be decided prior to purchasing a dynamometer. Placing the load cell so that it measures the torque of the motor (i.e., Model DB3M-2.4-FM) may provide the most accurate torque readings; however, the range of torque that the system can measure is limited to the maximum load of the load cell and the accuracy at low loads; this can be seen in Section 3, Torque and Speed Output to Motor and Section 5, Load Cell Accuracy Plots.

Alternatively, placing the load cell so that it measures the torque of the brake (i.e., Model DB3B-2.4-FM) allows a much broader range of load torque to the motor; however, now the load cell will not measure belt friction, bearing friction and any other minor losses. Bearing friction is usually negligible and a properly aligned belt may have an efficiency as high as 98%. When measuring the brake torque, the air drag from the brake is not measured; however, the dynamometer software compensates for the air drag.

The motor torque, speed, voltage and current ranges (and types; i.e., DC, AC, AC-3ph) 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.

2. SPEED vs. TORQUE CURVE – MB-2.4 BRAKE



3. TORQUE & SPEED OUTPUT TO MOTOR

Possible speed/torque combinations based on different pulley ratios:

3.1 Pulley Ratio's (English Units)

Motor_Spd (RPM)	Motor Torque (in-oz.)	Power (HP)	Pulley Ratio (motor/brake)	Brake Torque (in-oz.)	Brake_Spd (RPM)	Time (sec)
0	144	0	4:1	36	0	cont.
2,125	240	0.5	4:1	60	8,500	cont.
3,750	268	1.0	4:1	67	15,000	cont.

Table 1: Speed, Torque & Power (English Units) 1:4 ratio

Motor_Spd (RPM)	Motor Torque (in-oz.)	Power (HP)	Pulley Ratio (motor/brake)	Brake Torque (in-oz.)	Brake_Spd (RPM)	Time (sec)
0	36	0	1:1	36	0	cont.
8,500	60	0.5	1:1	60	8,500	cont.
15,000*	67	1.0	1:1	67	15,000	cont.

Table 2: Speed, Torque & Power (English Units) 1:1 ratio

Motor_Spd (RPM)	Motor Torque (in-oz.)	Power (HP)	Pulley Ratio (motor/brake)	Brake Torque (in-oz.)	Brake_Spd (RPM)	Time (sec)
0	9	0	1:4	36	0	cont.
25,000*	12.38	0.31	1:4.28	53	5,841	cont.
25,000*	13.75	0.34	1:4	55	6,250	cont.

Table 3: Speed, Torque & Power (English Units) 4:1 ratio

3.2 Pulley Ratio's (SI Units)

Motor_Spd (RPM)	Motor Torque (Ncm)	Power (watts)	Pulley Ratio (motor/brake)	Brake Torque (Ncm)	Brake_Spd (RPM)	Time (sec)
0	102	0	4:1	25.4	0	cont.
2,125	169	373	4:1	42.4	8,500	cont.
3,750	189	746	4:1	47.3	15,000	cont.

Table 4: Speed, Torque & Power (SI Units) 4:1 Pulley Ratio

Motor_Spd (RPM)	Motor Torque (Ncm)	Power (watts)	Pulley Ratio (motor/brake)	Brake Torque (Ncm)	Brake_Spd (RPM)	Time (sec)
0	25.4	0	1:1	25.4	0	cont.
8,500	42.4	373	1:1	42.4	8,500	cont.
15,000*	47.3	746	1:1	47.3	15,000	cont.

Table 5: Speed, Torque & Power (SI Units) 1:1 Pulley Ratio

Motor_Spd (RPM)	Motor Torque (Ncm)	Power (watts)	Pulley Ratio (motor/brake)	Brake Torque (Ncm)	Brake_Spd (RPM)	Time (sec)
0	6.36	0	1:4	25.4	0	cont.
25,000*	8.74	224	1:4.28	35.0	5,833	cont.
25,000*	9.71	224	1:4	38.8	6,250	cont.

Table 6: Speed, Torque & Power (SI Units) 1:4 Pulley Ratio

The table is based on the performance graph for the MB-2.4 Brake, shown in Section 2.
* Maximum speed is limited to the physical speed limits of the pulleys and belt.

4. LOAD CELLS (Option 1: DB3B-2.4-FM, Measure Brake Torque)

Load Cell Load Rating .... 212 oz. (6 kg)
Arm Length .... 1.5 inches (3.81 cm)
Max Rated torque to Load Cell .... 318 in-oz. (224 Ncm)
Max Brake Torque .... 67 in-oz. (47.3 Ncm)
Max Torque to Load Cell .... 67 in-oz. (47.3 Ncm)
Non-Linearity .... 0.1% of Rated Output (R.O.)
Hysteresis …………………….. .... 0.1% of R.O.
Non-Repeatability ……………... .... 0.05% of R.O.
Zero Balance .... ±1% mV/V
Compensated Temperature Range .... 14°F to 104°F
Safe Temperature Range ………….................... 14°F to 140°F
Temperature Effect on Output …............................ 0.01% of Load/°F
Temperature Effect on Zero ……….......................... 0.01% of Load/°F
Safe Overload .... 200% of R.O.*

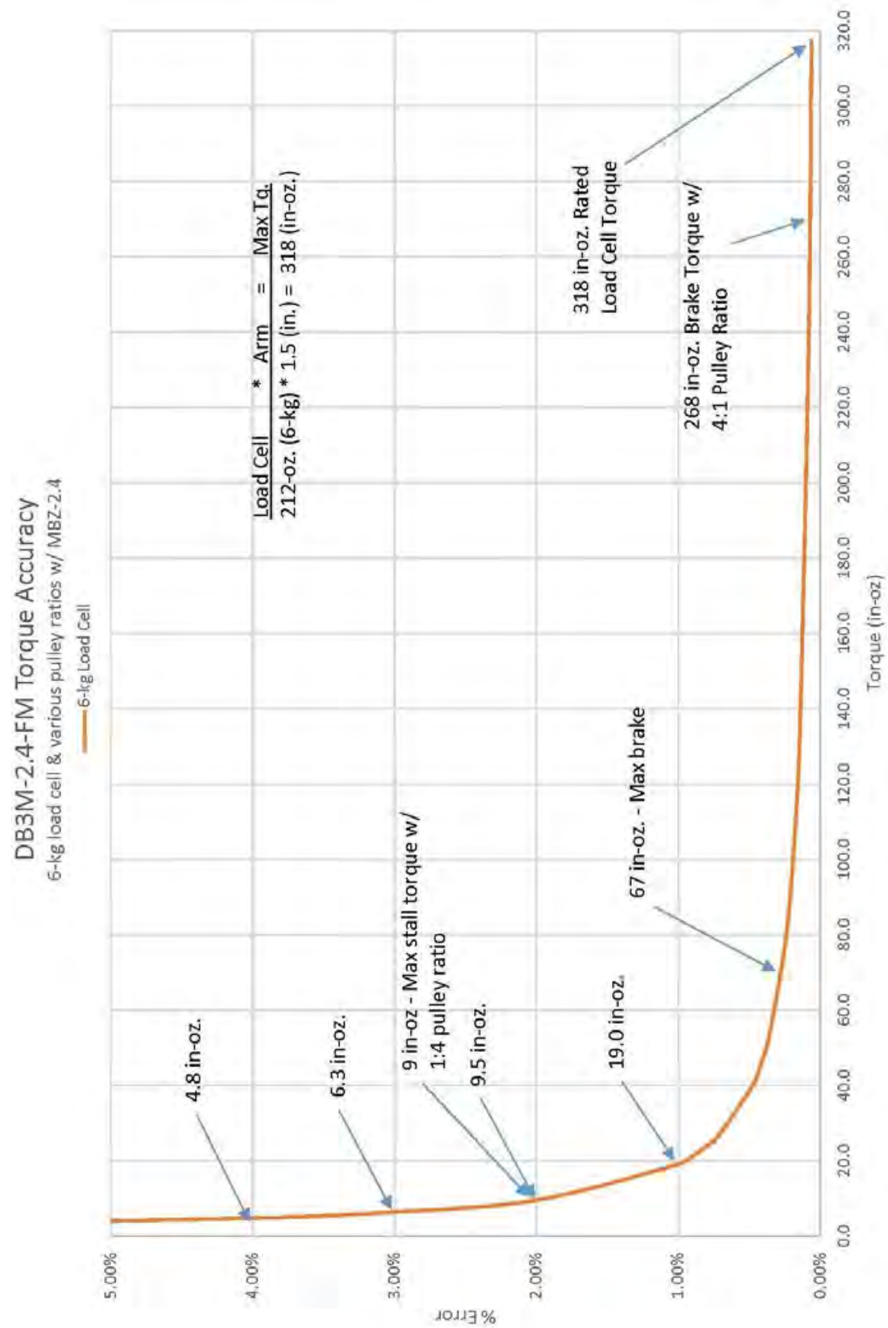
5. LOAD CELLS (Option 2: DB3M-2.4-FM, Measure Motor Torque)

Load Cell Load Rating .... 212 oz. (6 kg)
Arm Length .... 1.5 inches (3.81 cm)
Max Rated torque to Load Cell .... 318 in-oz. (224 Ncm)
Max Brake Torque .... 67 in-oz. (47.3 Ncm)
Max Torque to Load Cell (4:1 ratio .... 268 in-oz. (189 Ncm)
Non-Linearity …………………... .... 0.1% of Rated Output (R.O.)
Hysteresis …………………….. .... 0.1% of R.O.
Non-Repeatability ……………... .... 0.05% of R.O.
Zero Balance ………………..... .... ±1% mV/V
Compensated Temperature Range .... 14°F to 104°F
Safe Temperature Range .... 14°F to 140°F
Temperature Effect on Output .... 0.01% of Load/°F
Temperature Effect on Zero .... 0.01% of Load/°F
Safe Overload .... 200% of R.O.*

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

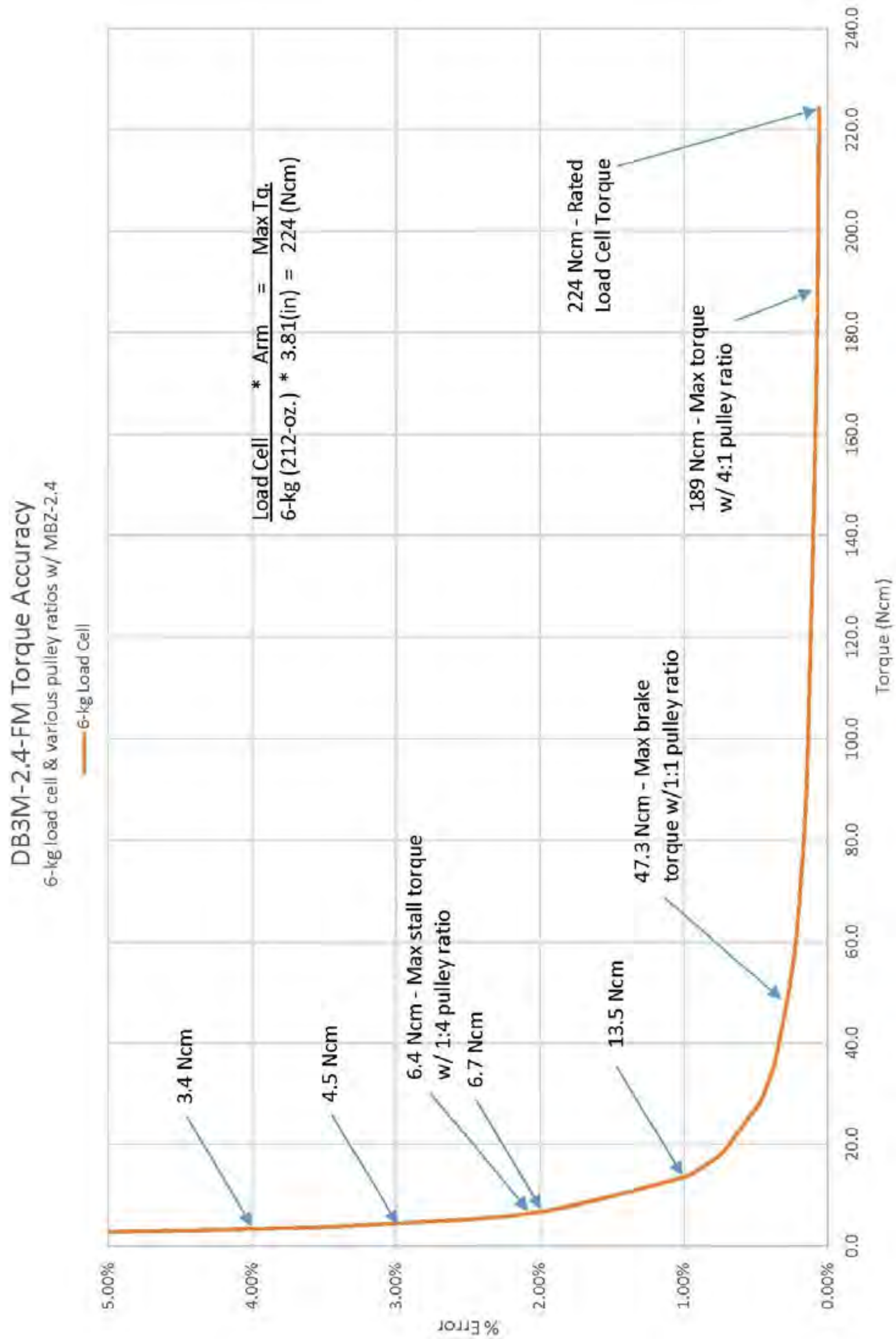
5.1 Load Cell Accuracy Plot (in-oz.)

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



5.2 Load Cell Accuracy Plot (Ncm)

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



6. 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.

7. 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.

8. LAPTOP COMPUTER

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

9. 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

10. DC VOLTAGE TRANSDUCERS

10.1 Input

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

10.2 Output

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

10.3 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.

11. AC VOLTAGE TRANSDUCERS – SINGLE PHASE

11.1 Input

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

11.2 Output

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

11.3 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.

12. DC CURRENT TRANSDUCERS (Split Core)

12.1 Input

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

12.2 Output

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

12.3 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.

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

13.1 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

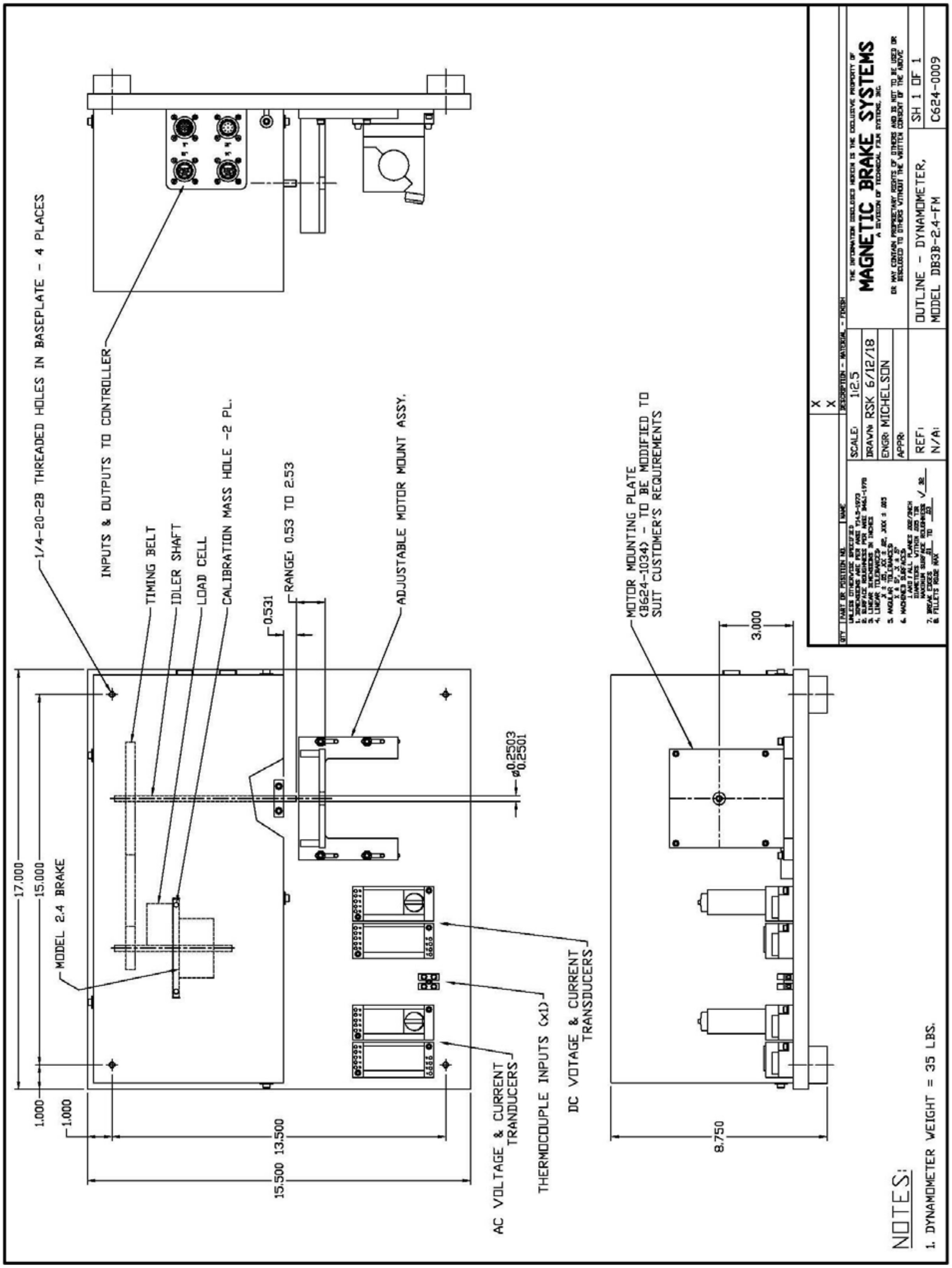
13.2 Output

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

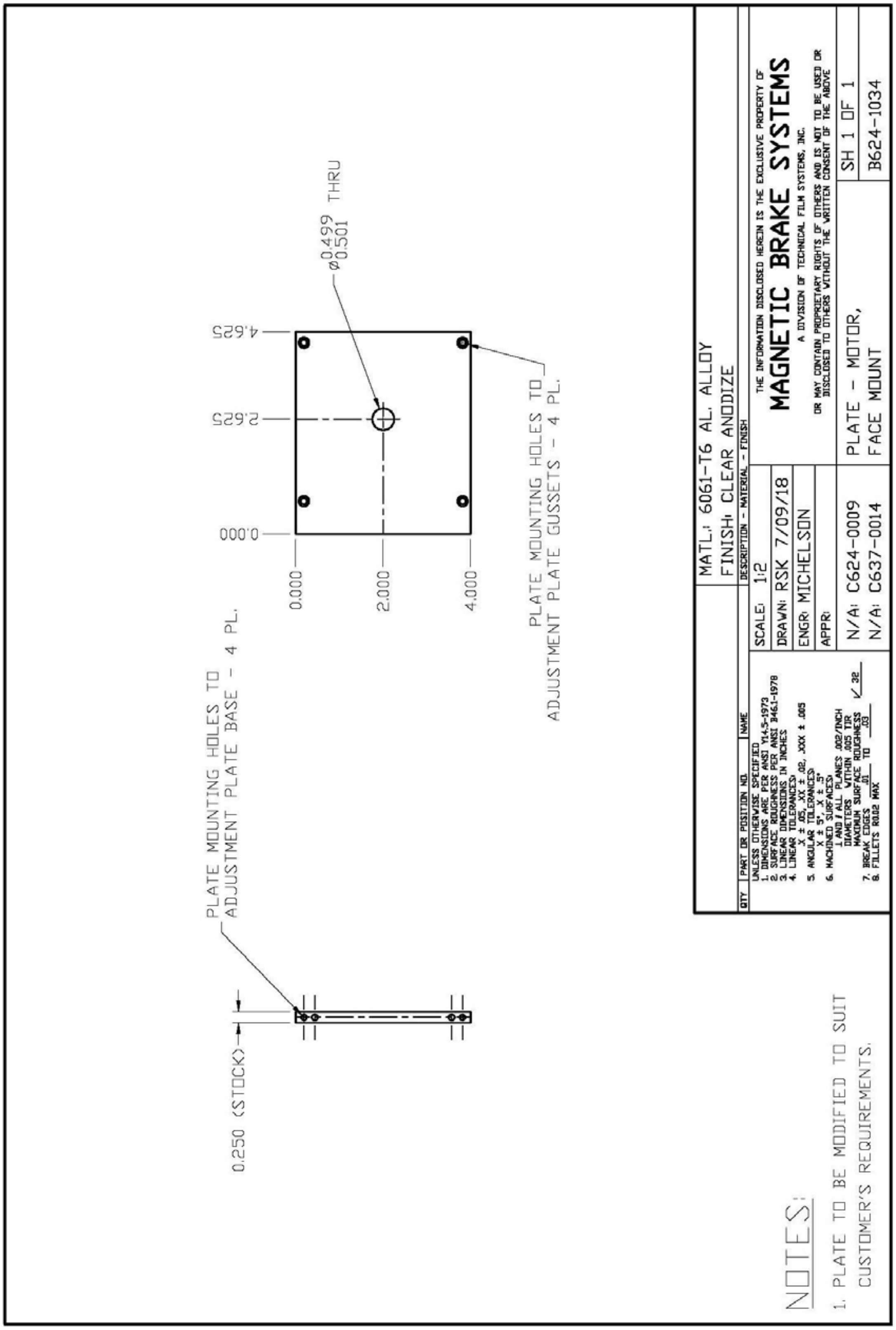
13.3 Environmental and Physical Characteristics

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.

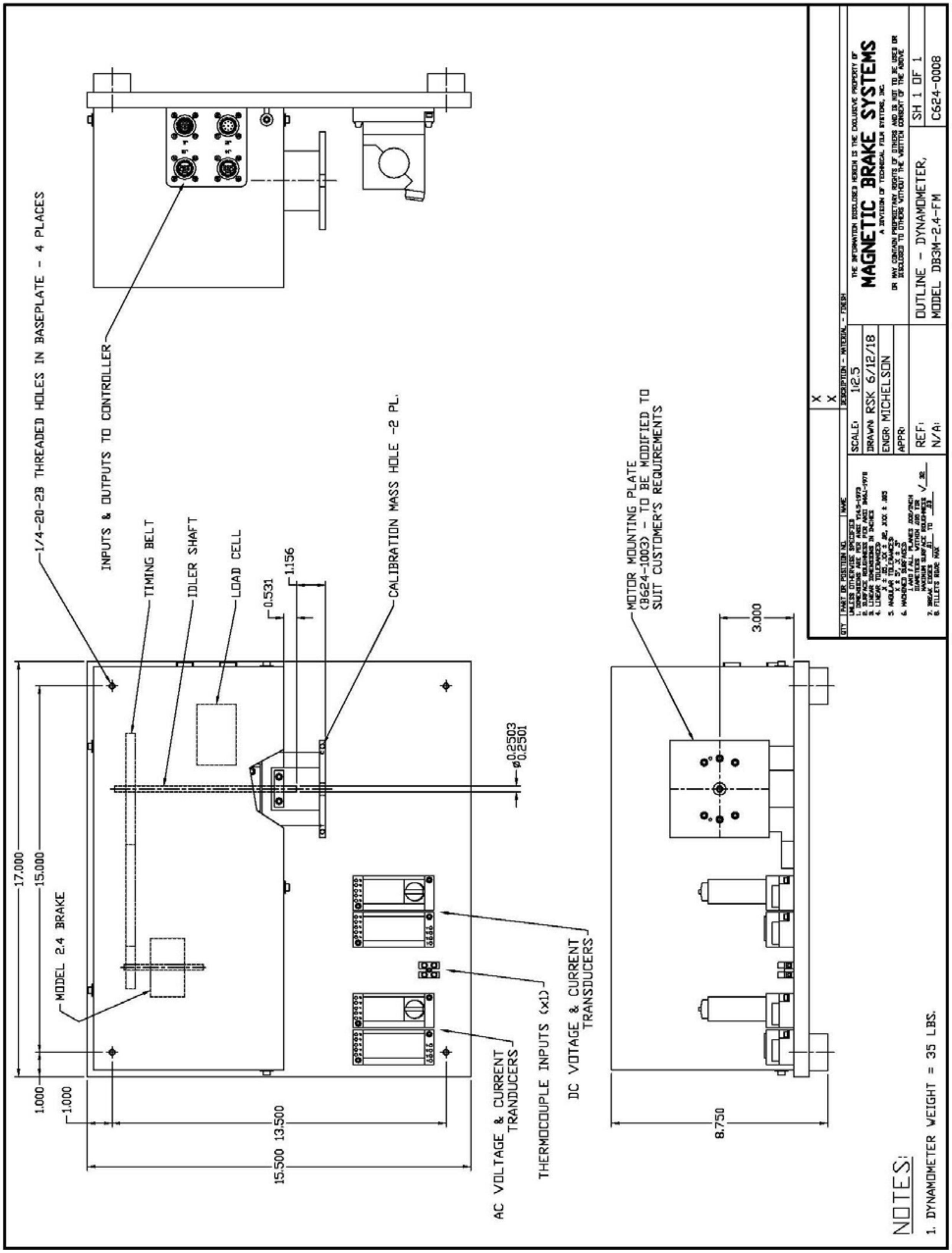
14. DYNAMOMETER LAYOUT – DB3B-2.4-FM, LOAD CELL ON BRAKE



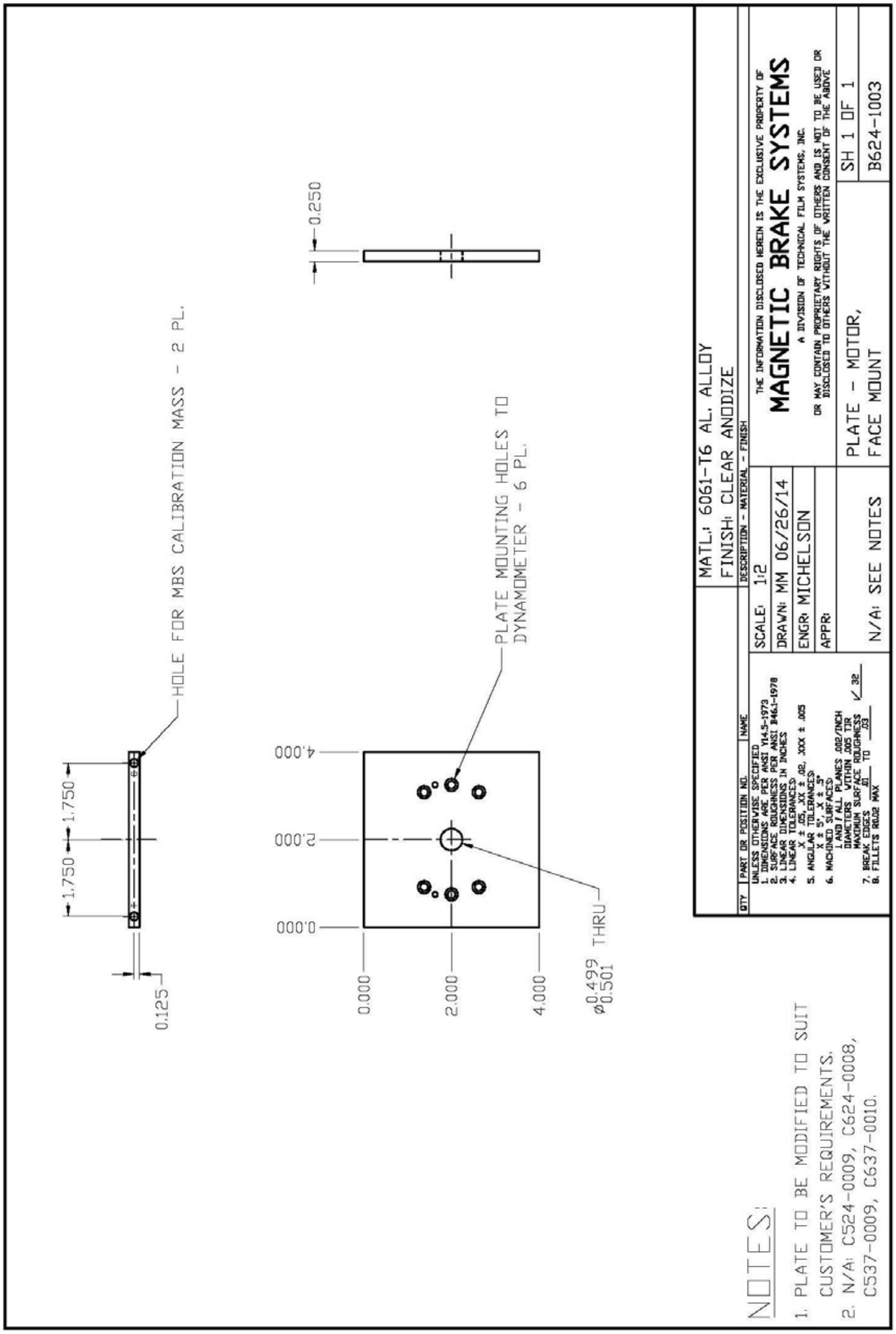
15. MOTOR MOUNTING PLATE – DB3B



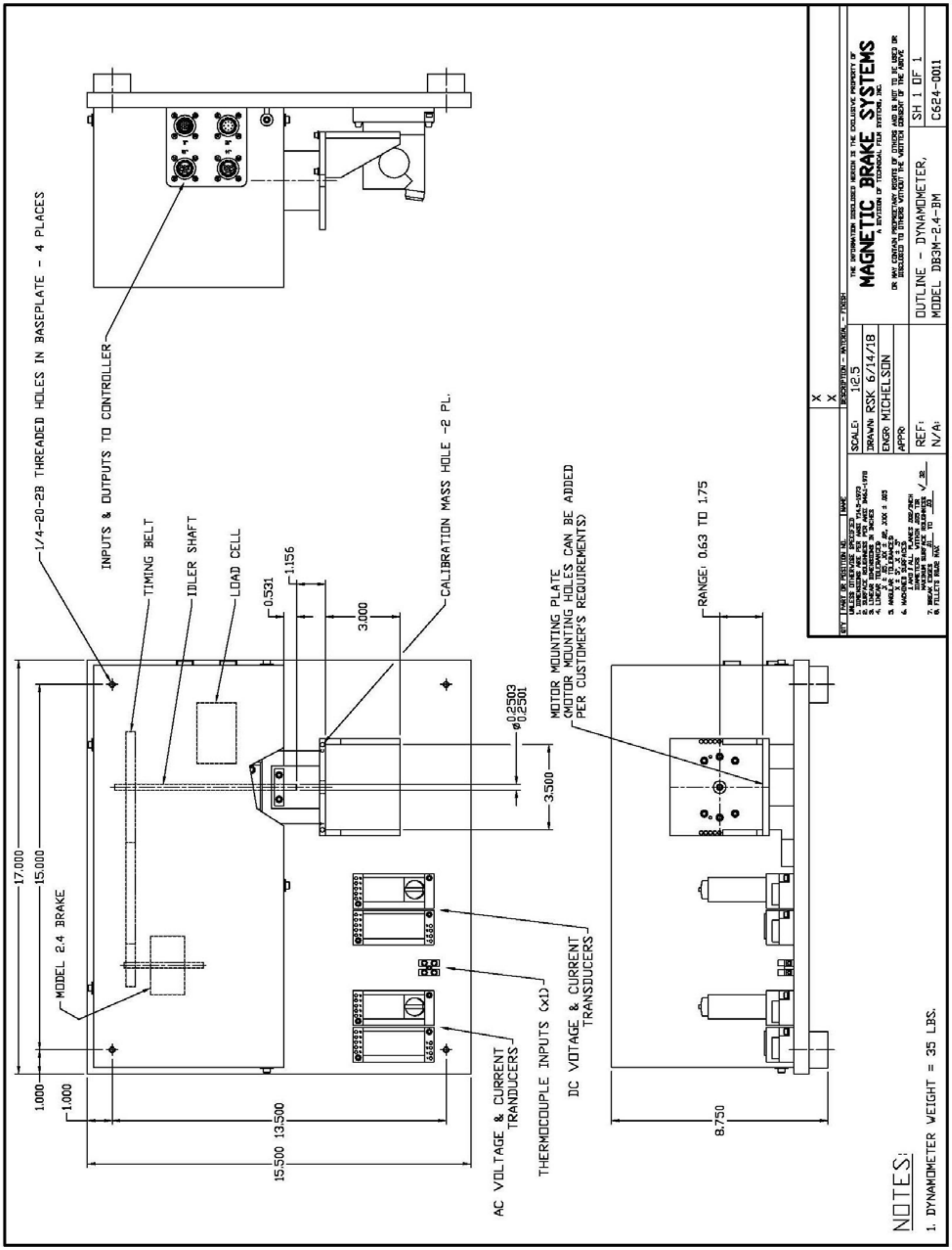
16. DYNAMOMETER LAYOUT – DB3M-2.4-FM, LOAD CELL ON MOTOR (OPTION 1)



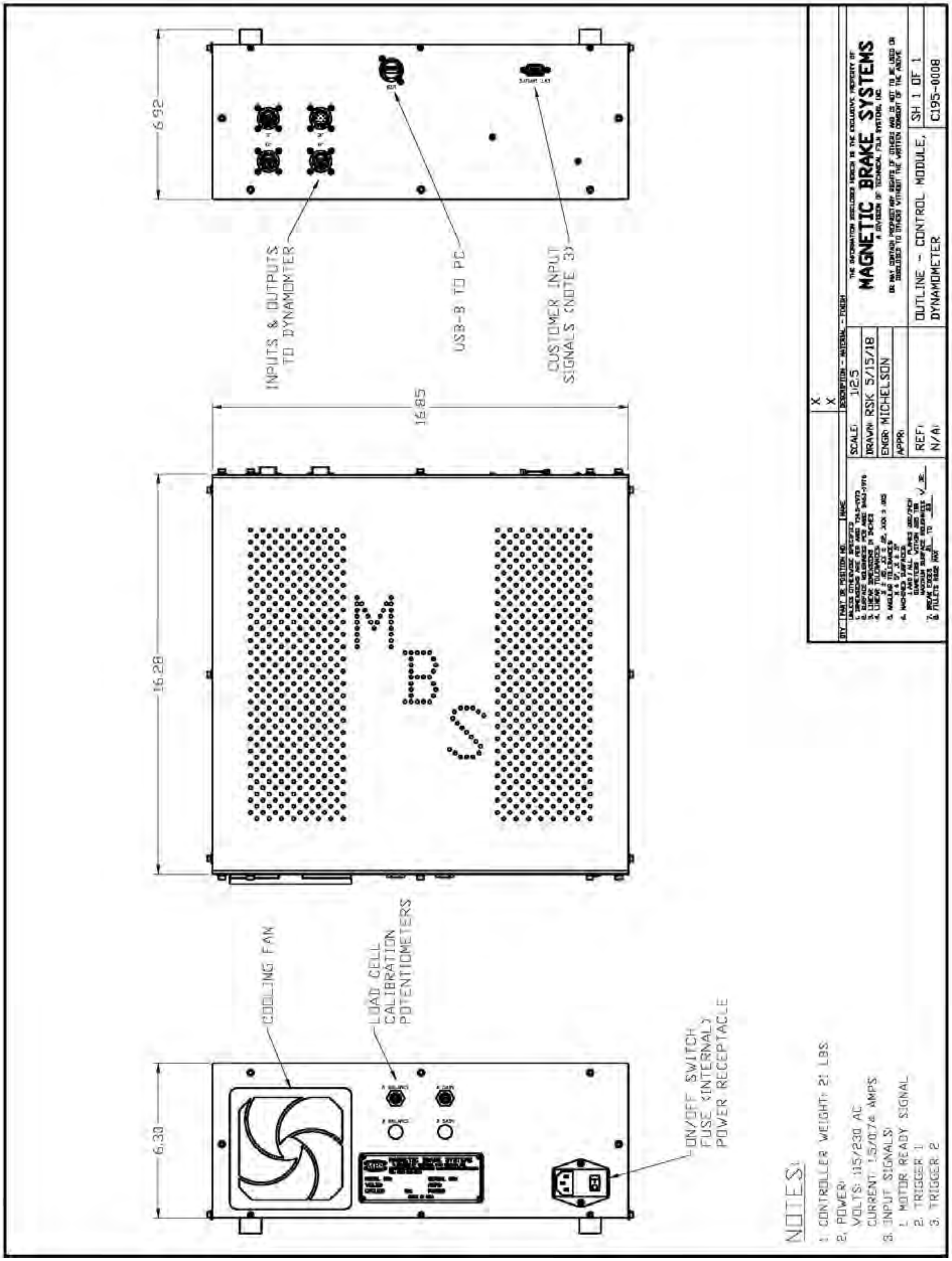
17. MOTOR MOUNTING PLATE – DB3M



18. DYNAMOMETER LAYOUT – DB3M-2.4-BM, LOAD CELL ON MOTOR (OPTION 2)



19. CONTROLLER LAYOUT



20. NOMENCLATURE OF DYNAMOMETER PART NUMBER

DB5M-8.7T-FM

Motor Mounting Style:
FM = Face Mount
BM = Base Mount
CB = Carriage Base

Number of Brakes:
T = Tandem System
Omitting T = single brake system

Brake Size:
17.5 = MBZ-17.5 brake
8.7 = MBZ-8.7 brake
5.7 = MBZ-5.7 brake
3.7 = MBZ-3.75 brake
2.4 = MBZ-2.4 brake

Load Cell Location:
M = Measuring Motor Torque
B = Measuring Brake Torque

Centerline Distance:
3 = 3 inches from top of baseplate to centerline of motor shaft.
5 = 5 inches from top of baseplate to centerline of motor shaft

System Type:
B = Belt Coupled system
I = Inline system

D = Dynamometer

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