MAGNETIC BRAKE SYSTEMS

A DIVISION OF TECHNICAL FILM SYSTEMS, INC.

DYNAMOMETER DATA SHEET

(Version 1.0)

MODELS:

DI5B-8.7-BM DI5M-8.7-BM

DI5B-8.7-FM DI5M-8.7-FM

Max continuous power dissipation:	6.6 HP (4.9 kW)
Max power for 30 seconds:	15 HP (11.2 kW)
Max continuous brake torque:	212 in-lbs. (24 N-m) @ 1,000 RPM
Max Brake Torque:	250 in-lbs. (28.2 N-m)
Max brake speed:	6,000 RPM

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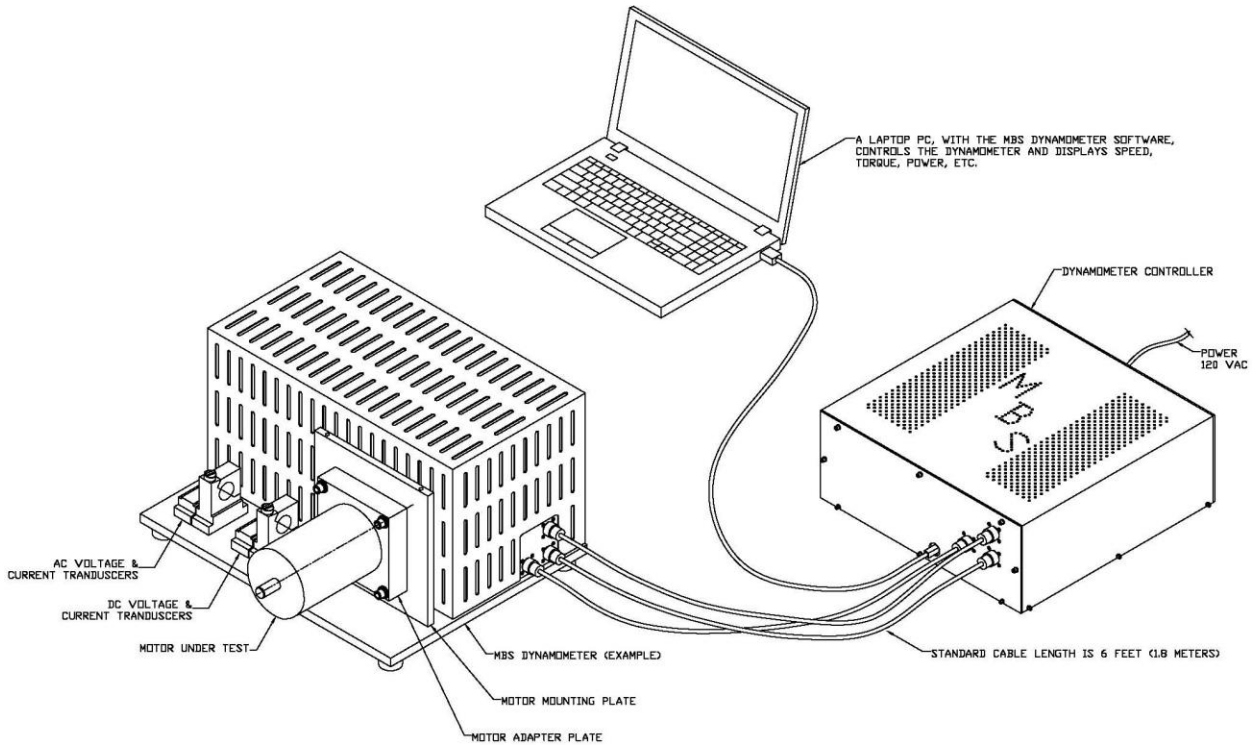
1. OVERVIEW

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).



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.

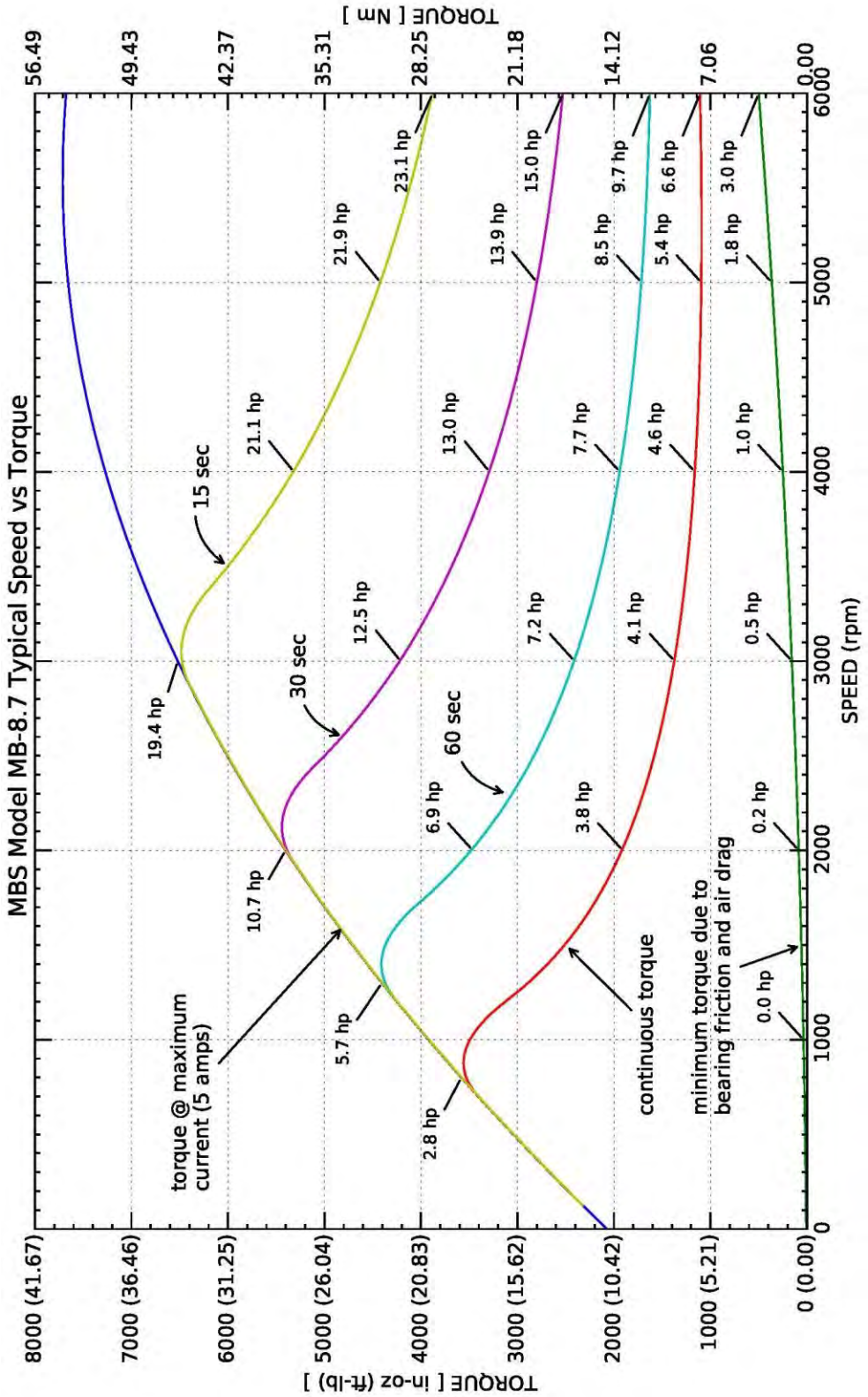
A belt coupled system will provide a much broader range of torque supplied to the motor under test, which makes a dynamometer more cost effective and diverse than a direct drive system.

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 DI5M-8.7-BM) 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 5, Load Cell Accuracy Plots.

Alternatively, placing the load cell so that it measures the torque of the brake (i.e. Model DI5B-8.7-FM) omits measuring rogue torque loads to the motor (i.e. bumping power cables during test); however, now the load cell will not measure bearing friction (which is usually negligible) and any other minor losses. 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-8.7 BRAKE



3. MOTOR TORQUE & SPEED

Brake Torque (in-lbs.)	Brake_Spd (RPM)	Power (HP)	Time (sec)	Pulley Ratio (motor/brake)	Motor Torque (in-lbs.)	Motor_Spd (RPM)
125	0	0	cont.	Direct drive	125	0
219	1,000	3.5	cont.	Direct drive	219	1,000
87.5	3,600	5.0	cont.	Direct drive	87.5	3,600
237	3,600	13.5	30	Direct drive	237	3,600
69	6,000	6.6	cont.	Direct drive	69	6,000
158	6,000	15	30	Direct drive	158	6,000

Table 1: Torque, Speed and Power

The table is based on the performance graph for the MBZ-8.7 Brake, shown in Section 2.

4. LOAD CELL (Option 1: DI5B-8.7-FM, Measure Brake Torque)

Max Brake Torque..... 250 in-lbs. (28.3 Nm) *
Max Torque to L.C..... 265 in-lbs. (30 Nm)
Non-Linearity ..... 0.02% of Rated Output (R.O.)
Hysteresis ..... 0.02% of R.O.
Non-Repeatability..... 0.02% of R.O.
Zero Balance ..... ±1% of R.O.
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.O.*

5. LOAD CELL (Option 2: DI5M-8.7-FM, Measure Motor Torque)

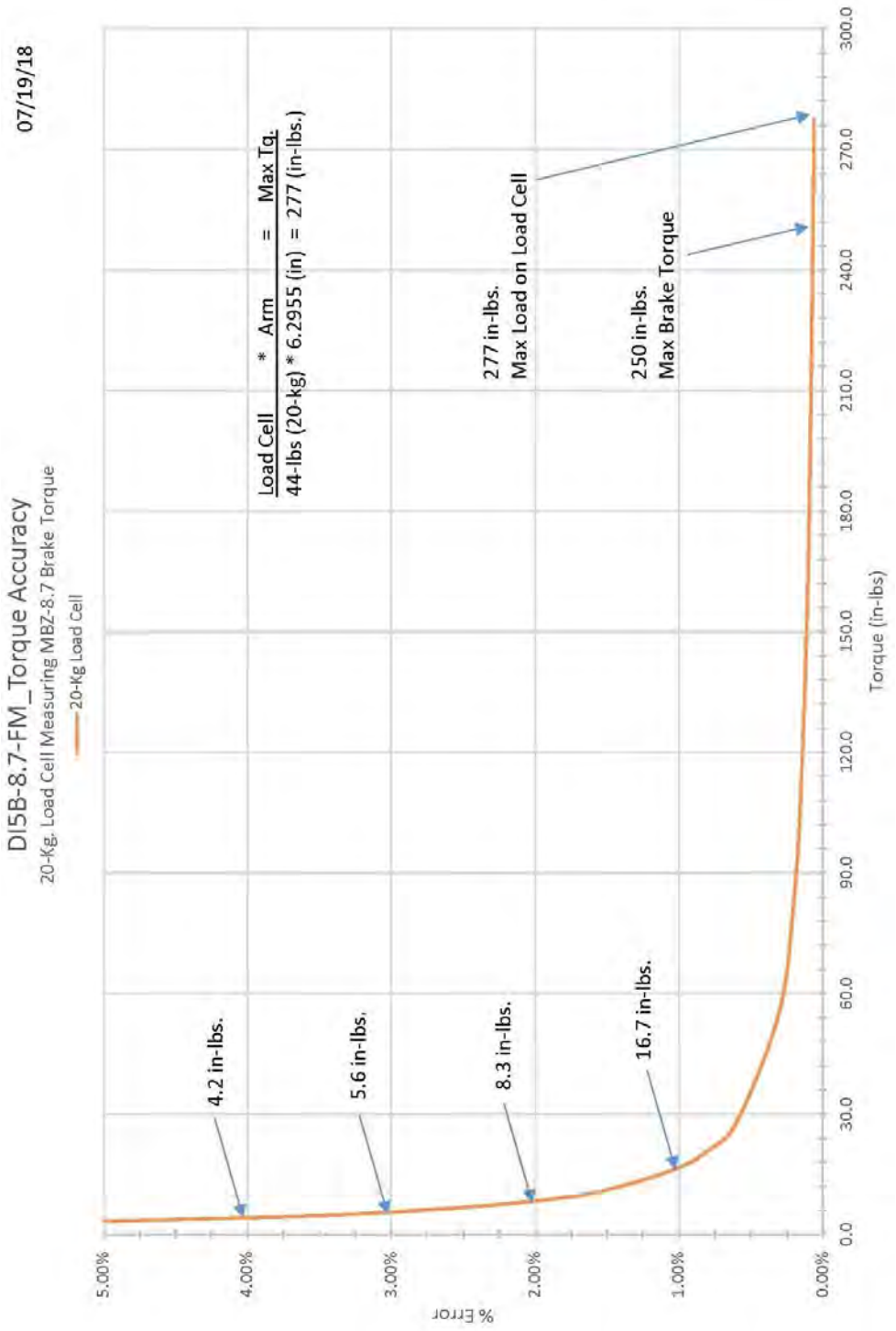
Max Brake Torque..... 250 in-lbs. (28 Nm) *
Max Torque to L.C..... 265 in-lbs. (30 Nm)
Non-Linearity ..... 0.02% of R.O.
Hysteresis ..... 0.02% of R.O.
Non-Repeatability ..... 0.02% of R.O.
Zero Balance ..... ±1% of R.O.
Compensated Temperature Range ..... 14°F to 104°F
Safe Temperature Range ..... 14°F 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.O.**

* 250 in-lbs. is the standard maximum brake torque; if this value is changed, the load cell may also need to be changed.

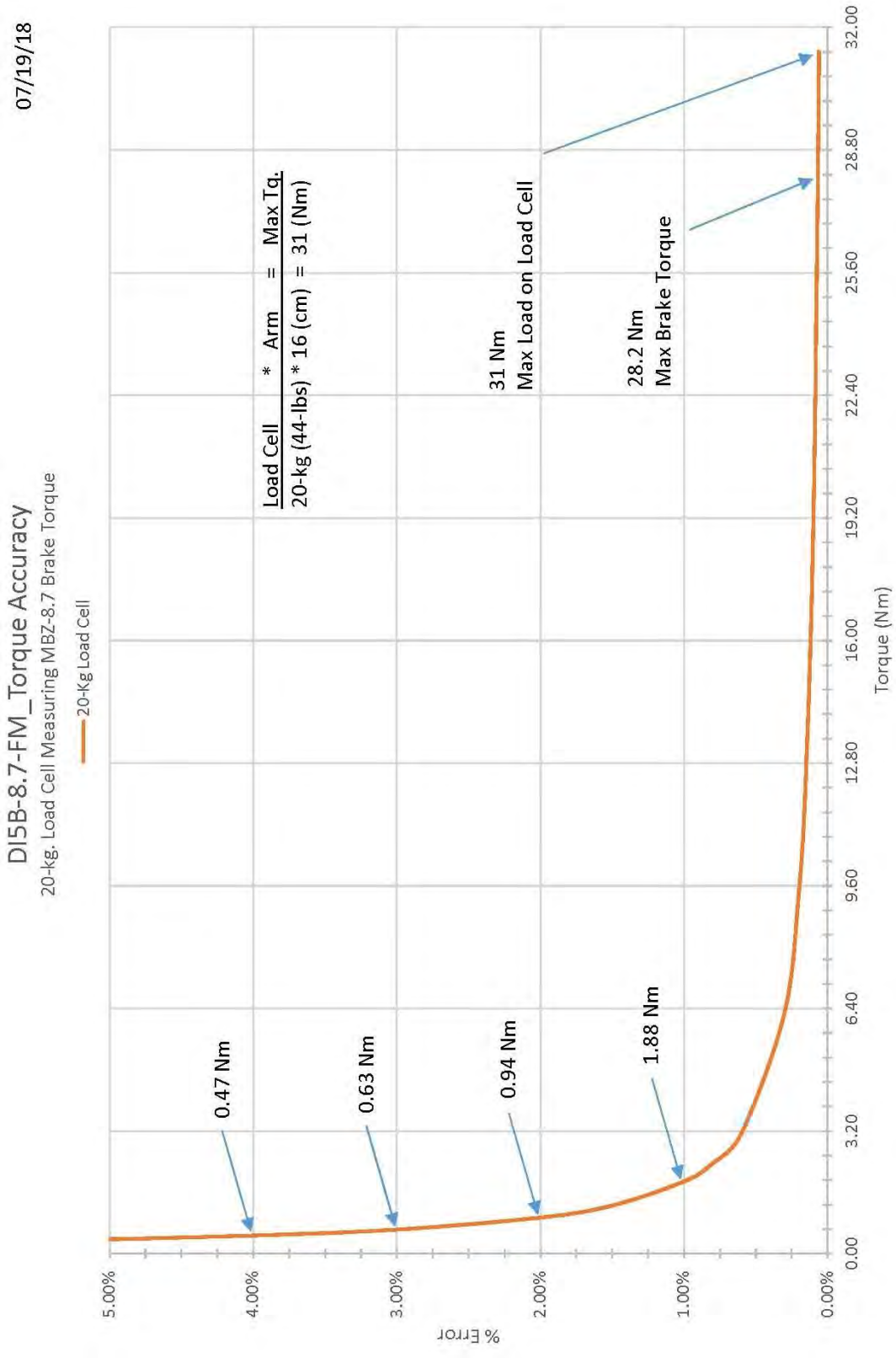
** Hard stops are in place to help prevent damage from over-load.

5.1 Load Cell Accuracy Plot (in-lbs.) – DI5B-8.7-FM

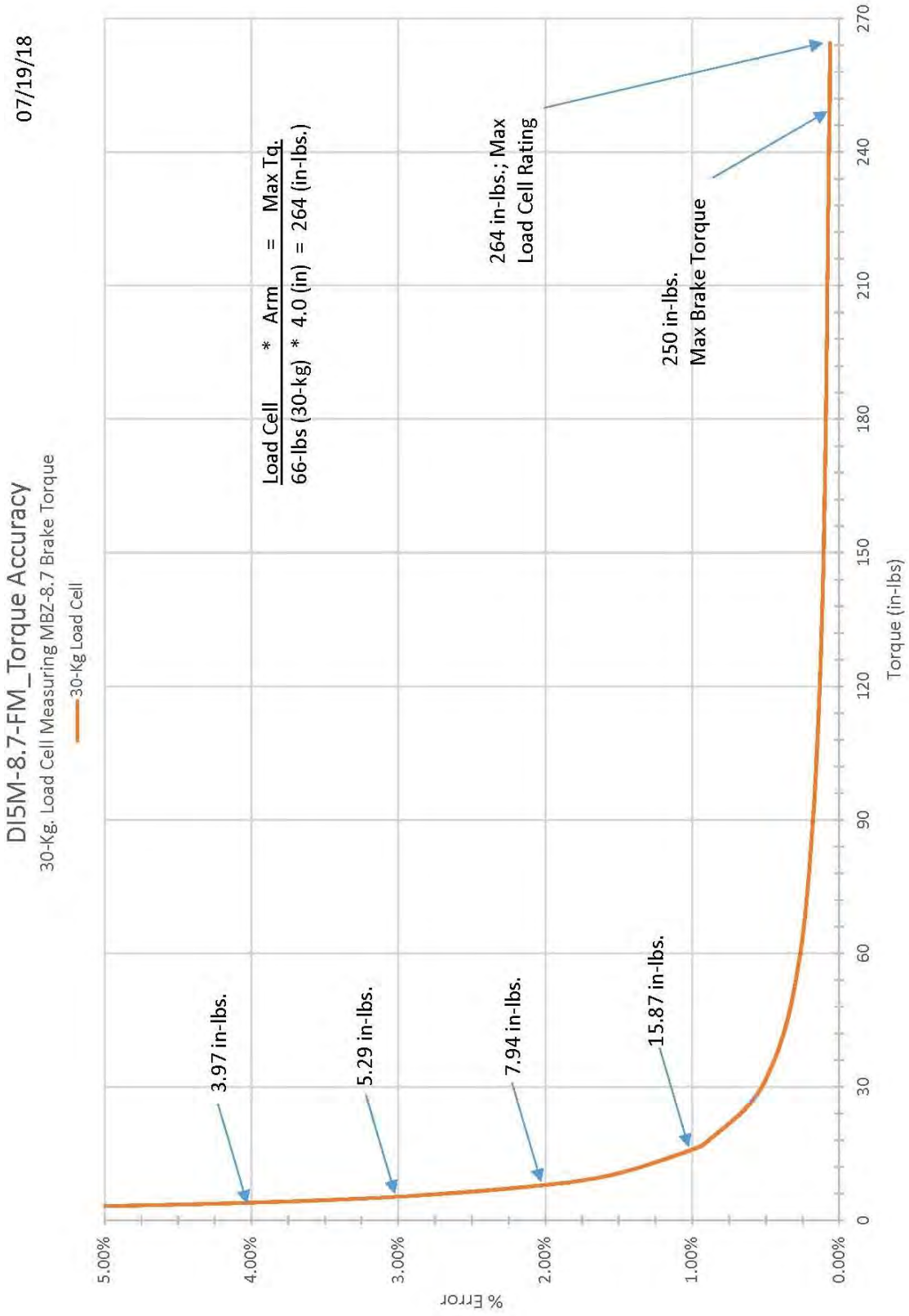
The Torque Error plot shows the percentage error as a function of measured torque. These plots show the range that a load cell will accurately measure. The maximum torque to the motor is based on the maximum torque from the brake. The error plot is based on published data from the load cell vendor.



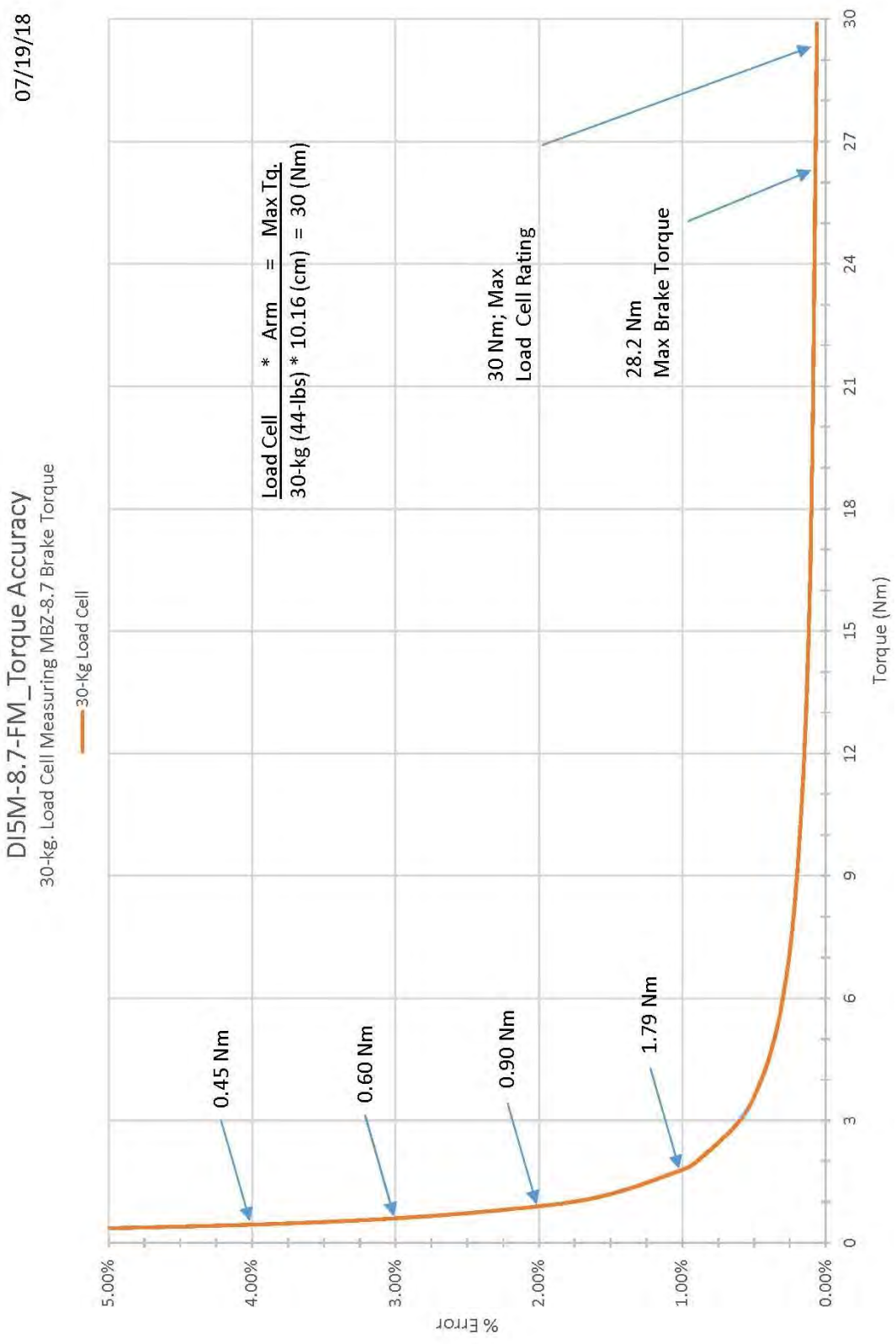
5.2 Load Cell Accuracy Plot (Nm) – DI5B-8.7-FM



5.3 Load Cell Accuracy Plot (in-lbs.) – DI5M-8.7-FM



5.4 Load Cell Accuracy Plot (Nm) – DI5M-8.7-FM



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. AC VOLTAGE TRANSDUCERS – THREE PHASE

12.1 Input

Range	0 VAC to: 50, 150, 250, 500, 600 VAC
Overload	2x voltage 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.

12.4 Applications

Harmonic voltages
Chopped waveform drivers
Quickly varying voltage supplies
Phase fired controlled devices

13. DC CURRENT TRANSDUCERS (Split Core)

13.1 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

13.2 Output

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

13.3 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.

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

14.1 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

14.2 Output

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

14.3 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.

15. AC CURRENT TRANSDUCERS – THREE PHASE (Low Current)

15.1 Input

Range	0 AAC to: 0.5, 5, 10, 15, 16, 20, 25 AAC
Overload	4x current range selected
Frequency Range	20 Hz to 5 kHz

15.2 Output

Basic Accuracy	0.5%
Linearity	10% to 100% F.S.
Calibration	True RMS sensing
Thermal Drift	500 PPM/°C
Response Time	250 ms max., 0 - 90%

15.3 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.

16. AC CURRENT TRANSDUCERS – THREE PHASE (High Current)

16.1 Input

Range	0 to: 150, 200, 250, 400, 500, 600, 800, 1000 AAC
Overload (per range selected)	600, 750, 800, 1000, 1200, 1200, 1500, 1500 AAC
Frequency Range	47 to 63 Hz

16.2 Output

Current Signal	4 to 20 mA-DC (Full Scale)
Accuracy	(Over the temp. range) ±0.5% F.S. max (±100 mA)

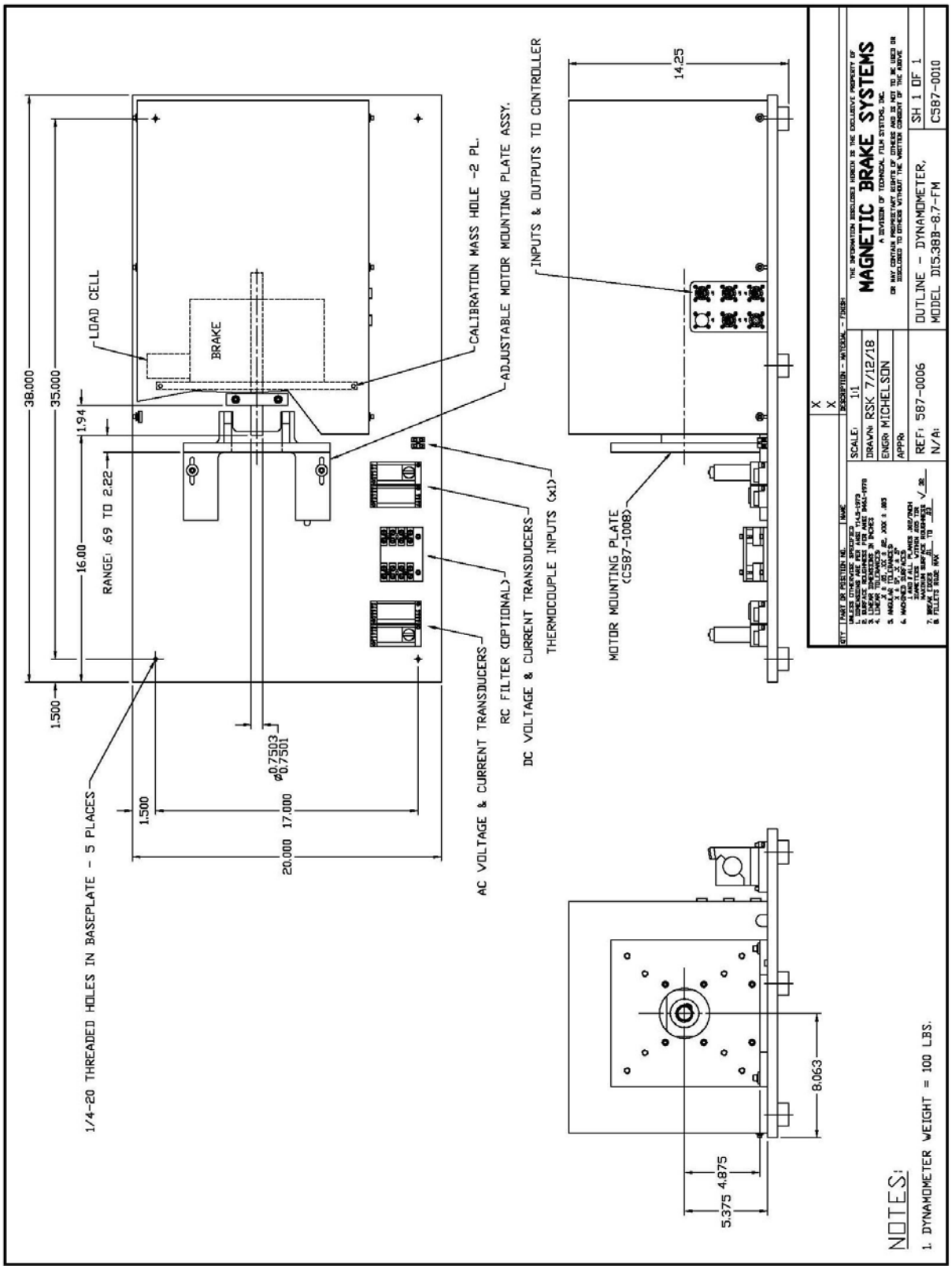
(Specified accuracy includes the combined worst-case effects of 4mA Offset, Temperature, Hysteresis, Supply Swings and Current Cable Positioning.)

Ripple	0.2% max (40 uA-AC)
Response Time (10 to 90%)	300 ms
Load Resistance (RL)	250 Ohms Nominal (0-300 Ohms Range)
Crest Factors	0 to 5
Current Signal @ Overload	23 mA-DC typical
Output Protection	Reverse Polarity Protection

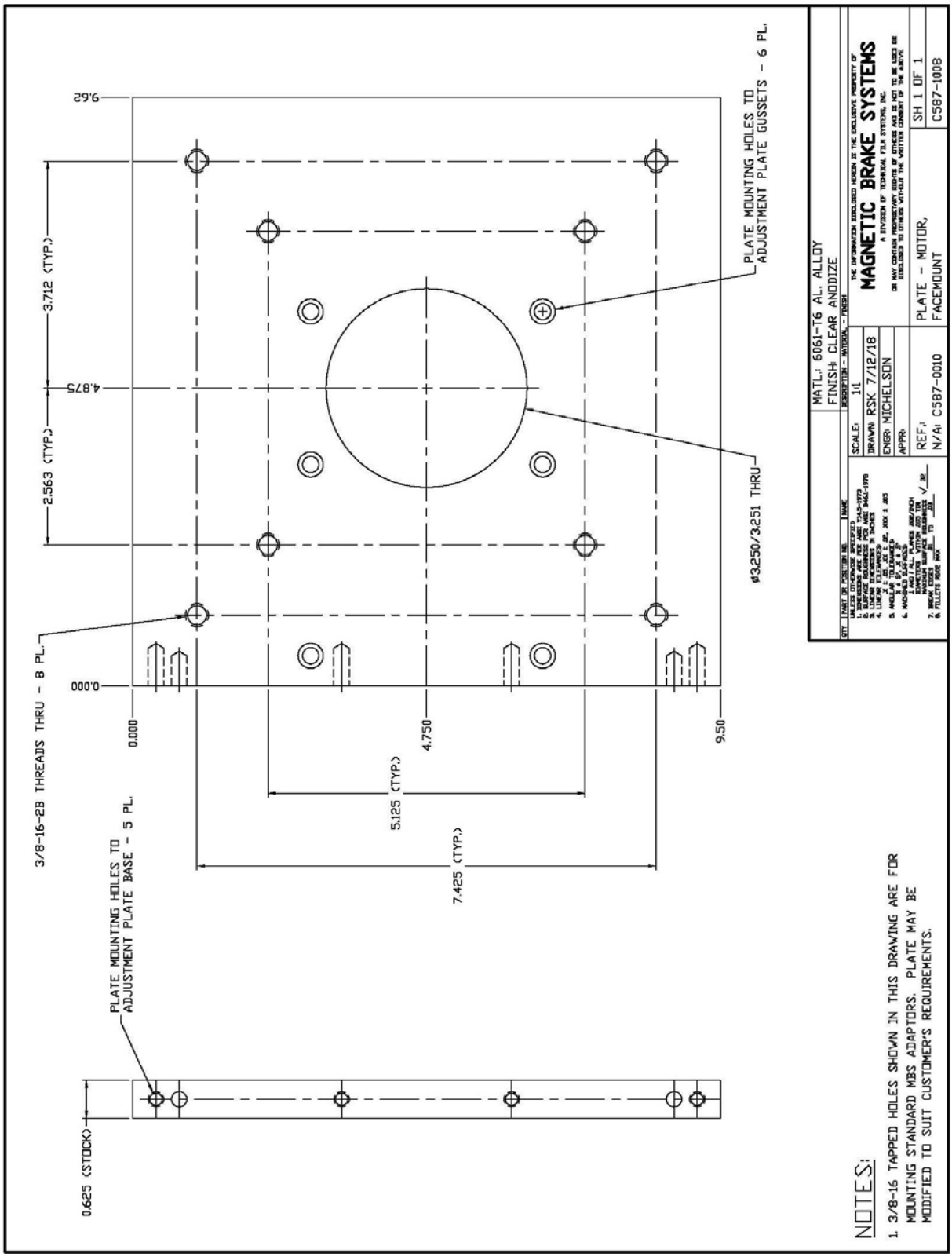
16.3 Environmental and Physical Characteristics

Operating Temperature Range	-40°C to +85°C
Conducted Susceptibility	DO-160E Section 20 (1.5 Ma @ 10KHz to 75 Ma @ 500 kHz to 400 MHz
Transient Burst (EN 50155)	±2KV Open CKT test voltage supply leads
Electrostatic Discharge (ESD)	DO-160E Section 25 Category A
Humidity (Operating)	0% to 100% R.H.
Moisture Resistance	MIL-STD-202 Method 106
Random Vibration (Operating)	MIL-STD-810F, Proc.1, Cat.12, WO=0.095G2/Hz, Time1 hr., Overall Level 12.G-RMS
Shock	50g 11m-sec. half sine pulse
Isolation	Input to output 5KV RMS 60 Hz/1min.
Insulation Resistance	500 M-Ohms @ 100 VDC
Case Material	Brass
Finish	Fuse tin plate per ASTM-B-545
Weight	4 lbs. Max

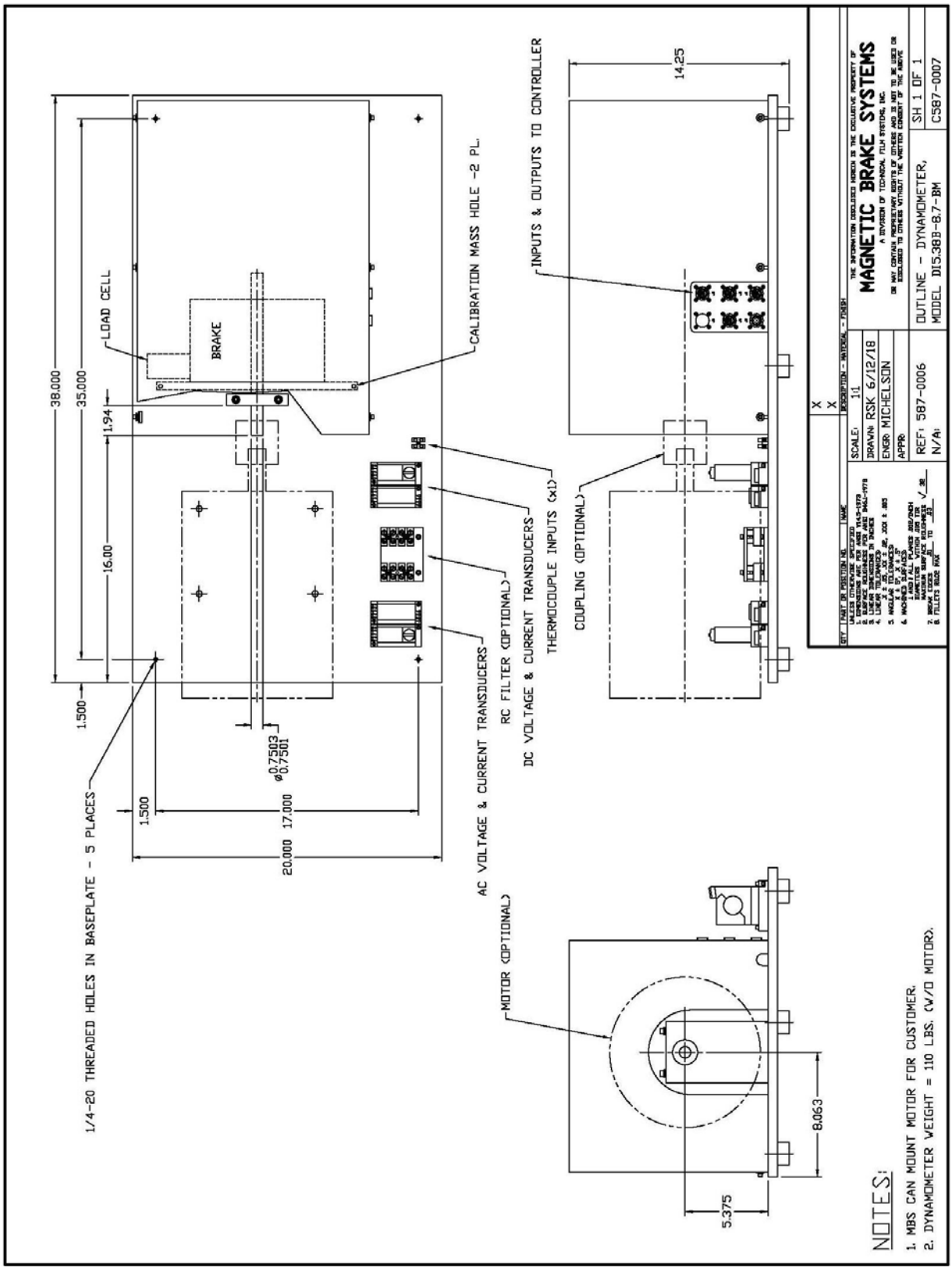
17. DYNAMOMETER LAYOUT – DI5B-8.7-FM, L.C. ON BRAKE (OPTION 1)



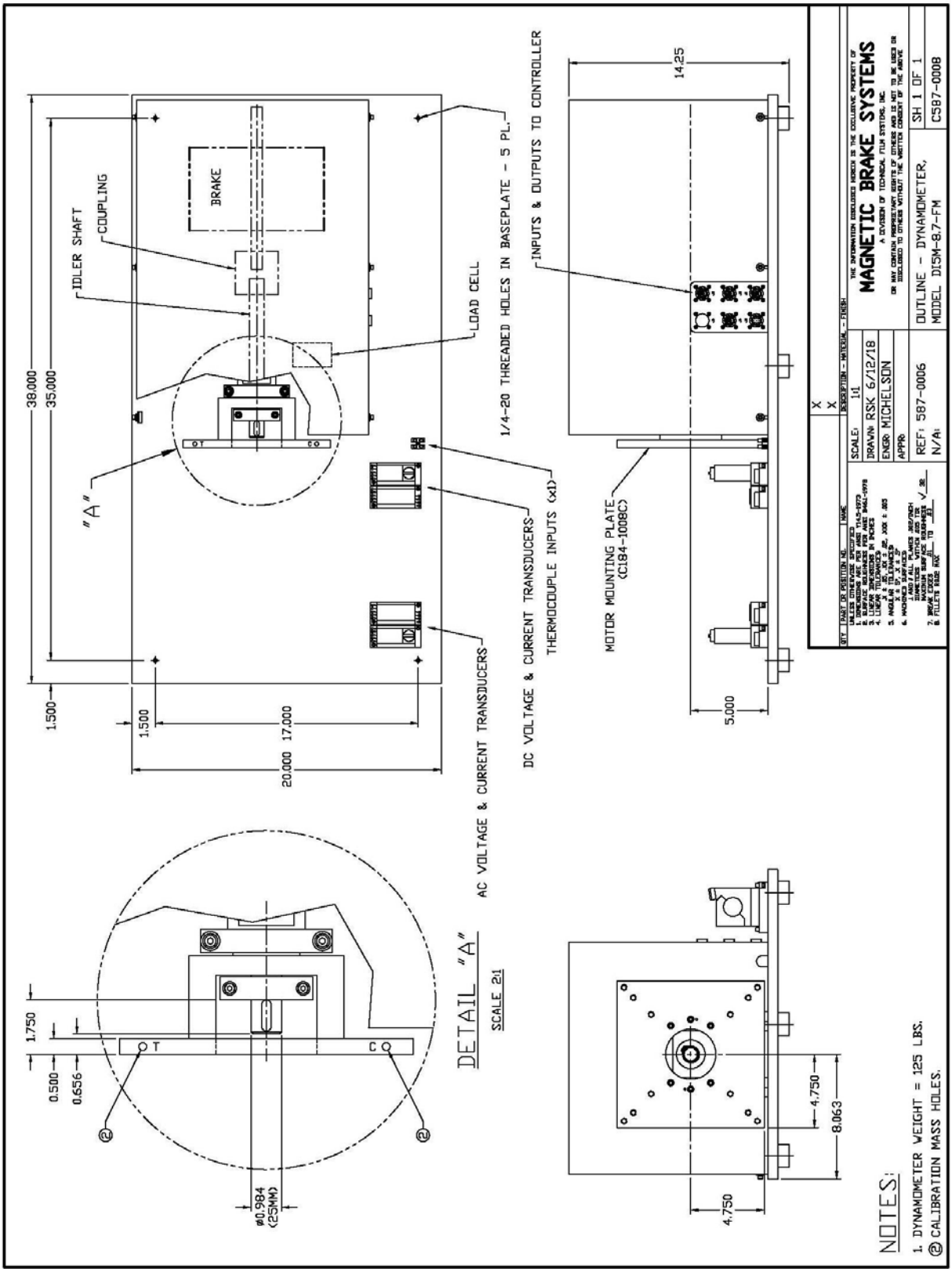
18. MOTOR MOUNTING PLATE – DI5B



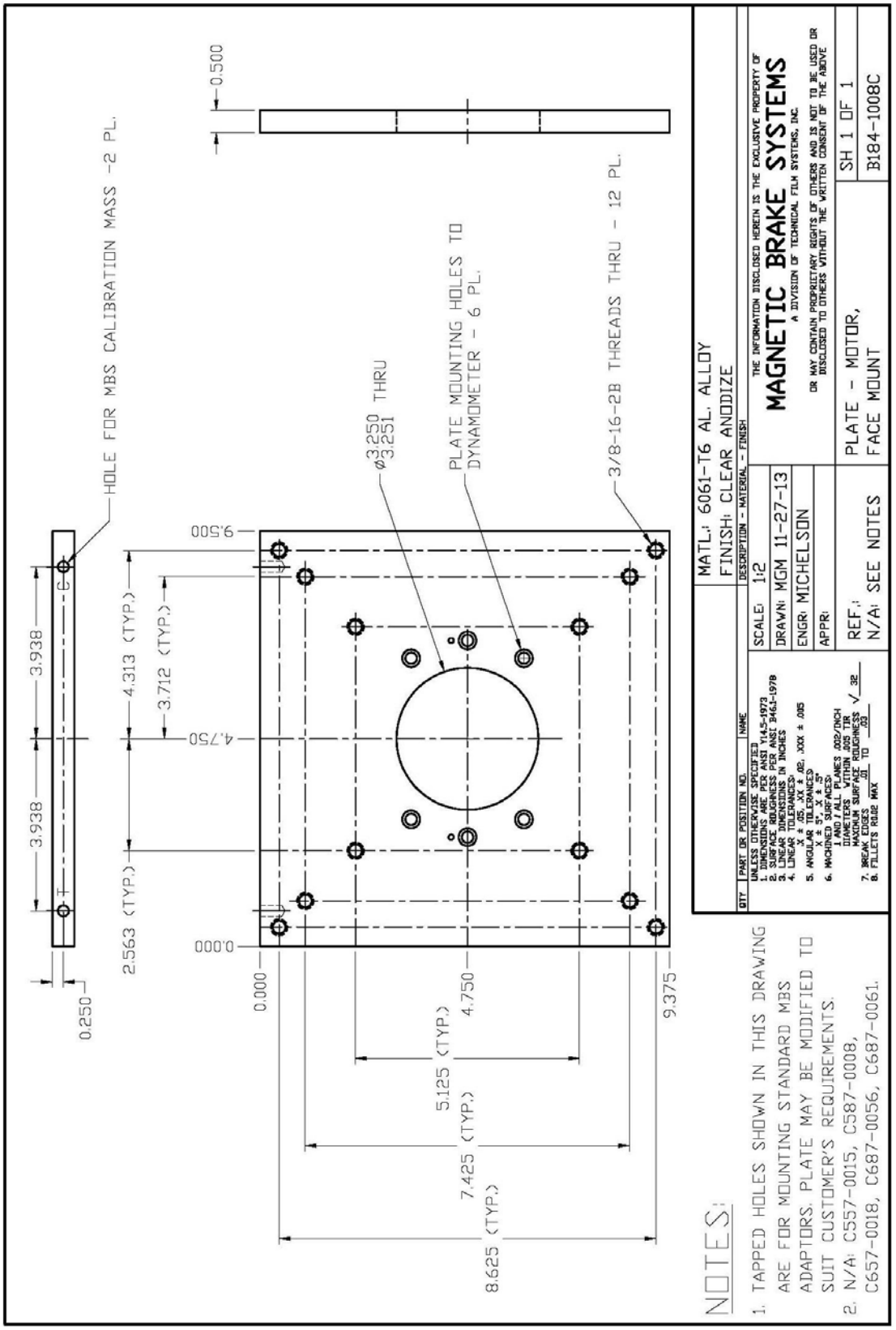
19. DYNAMOMETER LAYOUT – DI5B-8.7-BM, L.C. ON BRAKE (OPTION 2)



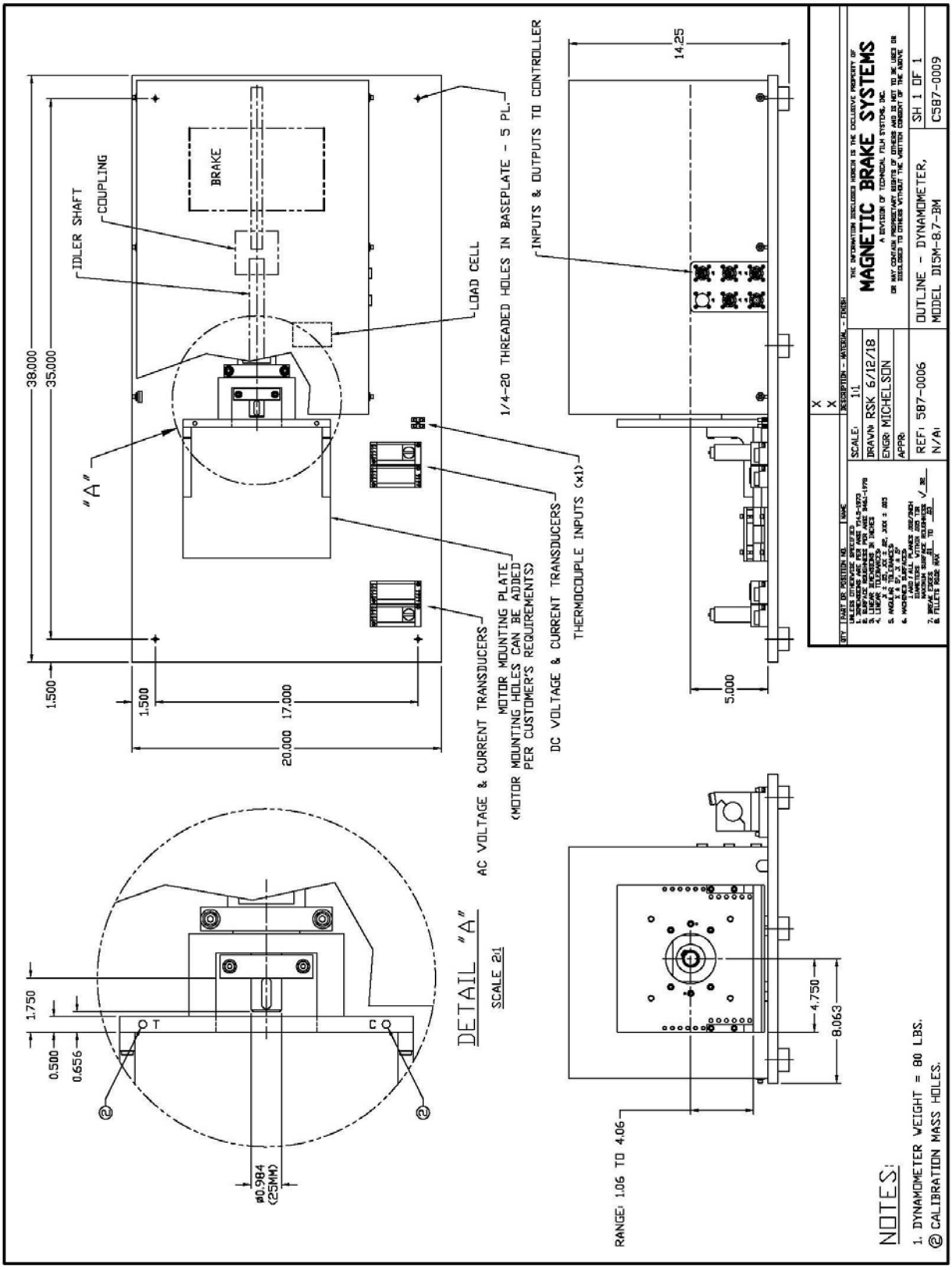
20. DYNAMOMETER LAYOUT – DI5M-8.7-FM, L.C. ON MOTOR (OPTION 1)



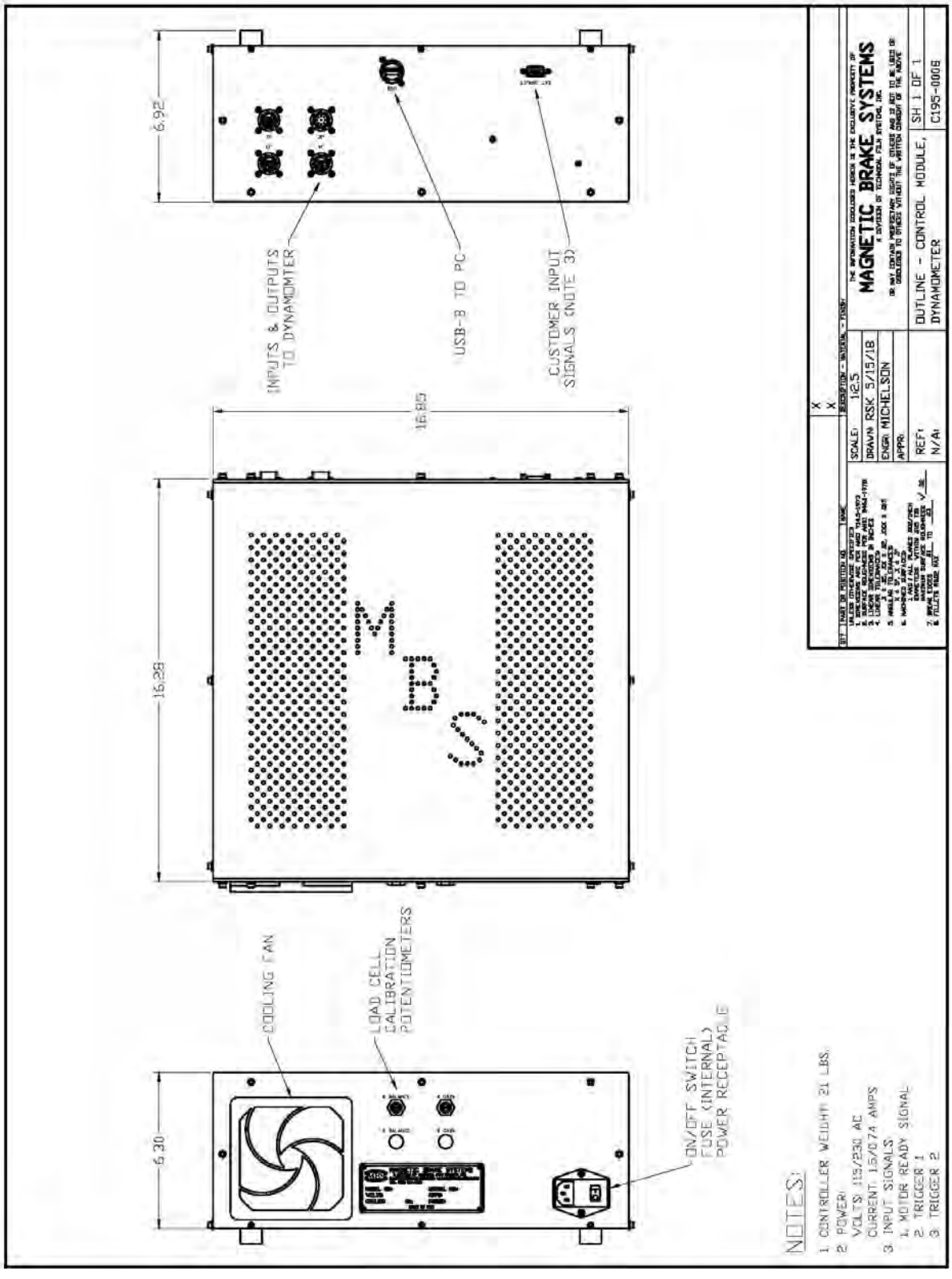
21. MOTOR MOUNTING PLATE – DI5M



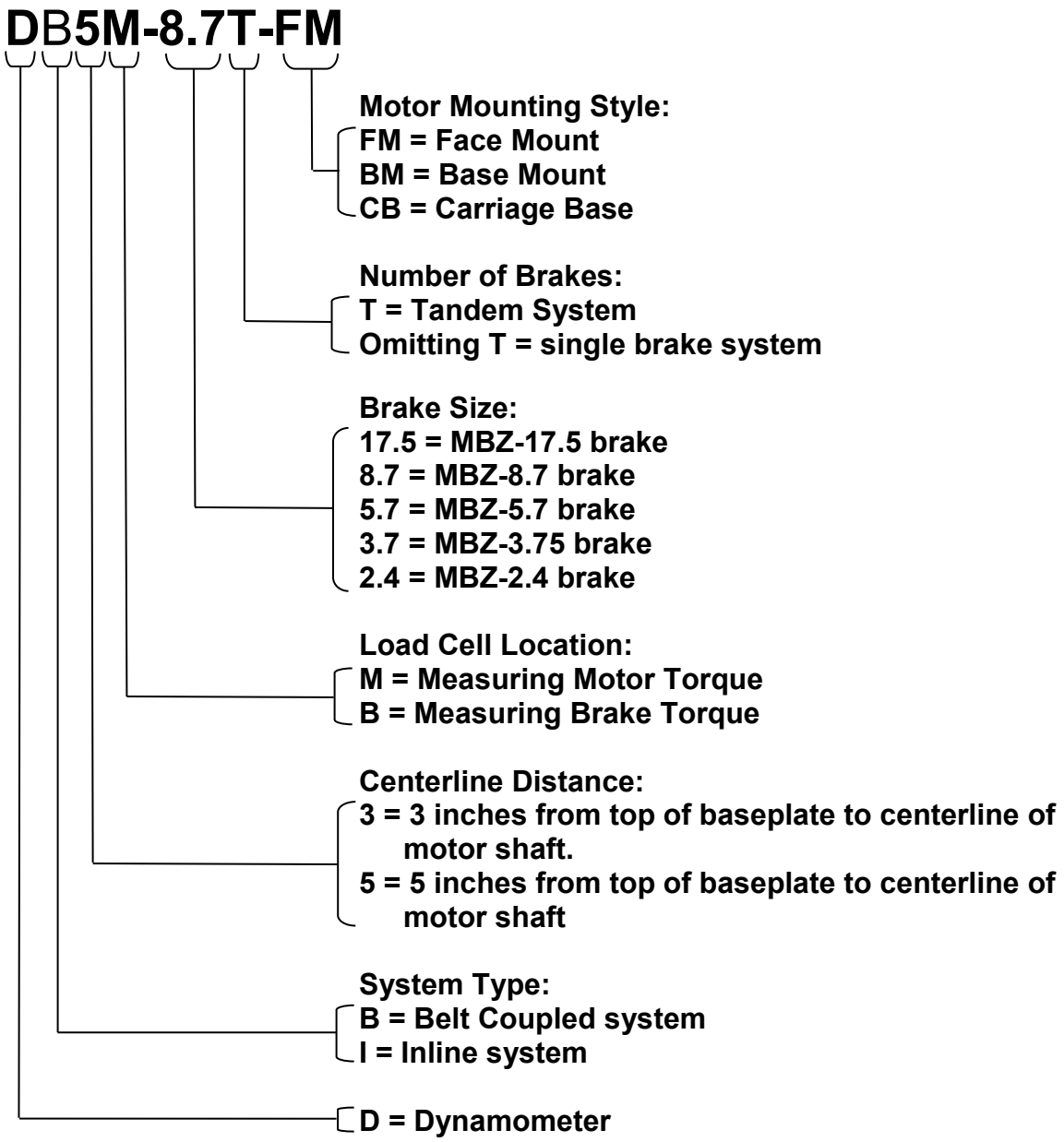
22. DYNAMOMETER LAYOUT – DI5M-8.7-BM, L.C. ON MOTOR (OPTION 2)



23. DYNAMOMETER CONTROLLER



24. NOMENCLATURE OF DYNAMOMETER PART NUMBER



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