

Team B9 Test plan #2

3-12-2020

Test manager: Ian Legge

Test co manager: Kevin Hendersen

The goal of this test is to determine the efficiency of a gear set on the Lego motor test stand. Data points are underlined, variables are **bolded and underlined**.

**Gear Efficiency:**

1. Set up previously programmed mindstorm to rotate the ~22mm dia. drum to move the weight 254 mm (10in).
2. Attach the motor to the test machine (figure 1.).
4. Use built-in rotation sensor in mindstorm to measure the time it takes to rotate the drum to move the mass 254 mm). Repeat test 10 times and record time for each run.
5. Detach motor from test apparatus, insert gear system and replace on apparatus.
6. Use a slow-motion camera to calculate time it takes to move the weight 254mm upward. Repeat test 10 times and record time for each run.

Team Signatures:

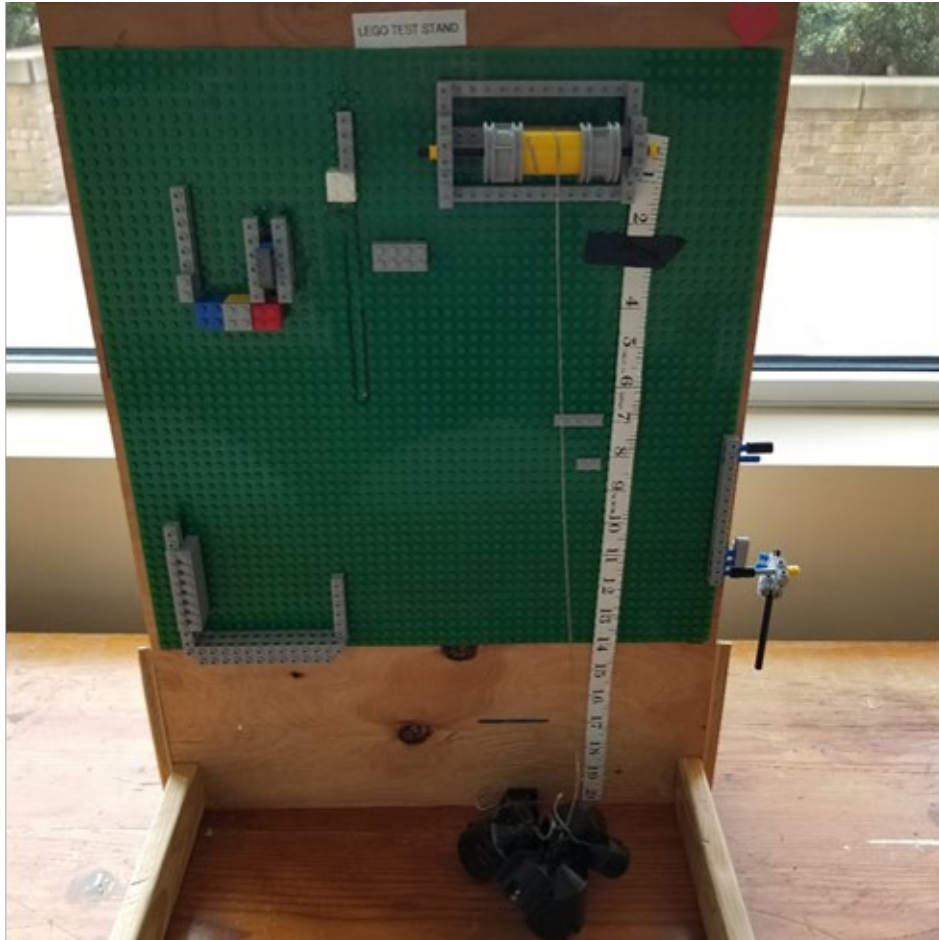


Figure 1. Lego motor test stand.

*Data on the next page...*

	Run Number	time 0	time end	del T	velocity (m/s)	$\omega$ (rpm)	$\omega$ (rev/s)	torque (Nm)	power (w)
No Gear Ratio	1	0	<b>1.7</b>	1.7	0.1500	129.3358	2.1556	0.796268096	10.78466947
	2	0	<b>1.73</b>	1.73	0.1474	127.0930	2.1182	0.796268096	10.59765208
	3	0	<b>1.74</b>	1.74	0.1466	126.3626	2.1060	0.796268096	10.53674603
	4	0	<b>1.75</b>	1.75	0.1457	125.6405	2.0940	0.796268096	10.47653606
	5	0	<b>1.75</b>	1.75	0.1457	125.6405	2.0940	0.796268096	10.47653606

1:2.18 Gear Ratio	1	0	<b>0.95</b>	0.95	0.2684	231.4431	3.8574	0.796268096	19.29888221
	2	0	<b>0.98</b>	0.98	0.2602	224.3581	3.7393	0.796268096	18.7081001
	3	0	<b>0.98</b>	0.98	0.2602	224.3581	3.7393	0.796268096	18.7081001
	4	0	<b>0.98</b>	0.98	0.2602	224.3581	3.7393	0.796268096	18.7081001
	5	0	<b>0.98</b>	0.98	0.2602	224.3581	3.7393	0.796268096	18.7081001

\*Bold Values Are Measured\*

Drum dia.(m)	0.02215	Average RPM w/o Gear Assembly	126.8
lifting distance(m)	0.255	Theoretical RPM with Gear Assembly	277.4
gravity (m/s <sup>2</sup> )	9.81	Average RPM with Gear Assembly	225.8
Drum cer.(m)	0.0696		
Drum roations:	3.665	Average Power w/o Gear Assembly	10.6
Mass (kg)	0.5	Theoretical Power with Gear Assembly	23.1
		Average Power with Gear Assembly	18.8
Ideal Motor Torque (N-m)	0.3		
Force Needed (N)	4.13	Efficiency	Power 0.813877
Torque Needed (N-m)	0.04573975		Speed 0.813877
Ideal Gear Ratio (1: )	2.1875		