ASSOCIATED TESTING LABORATORIES

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September 13, 1995
Page 1

Mr. Wilson Bezerra
ACS Corporation
232 Union Blvd.
Totowa, NJ 07512

Subject: Associated Testing Laboratories Report No. T33083-001

Dear Mr. Bezerra:

Enclosed please find Revision 1 of the above-referenced test report. For your information, the following changes were made:

Page 1: In first paragraph, the test completion date was corrected to read September 8, 1995.

Changed to show Revision 1 and current date.

Please destroy the original page now in your possession and substitute the enclosed.

We are sorry for any inconvenience this may have caused you.

Very truly yours,

ASSOCIATED TESTING LABORATORIES

Thomas J. Dowd
Laboratory Manager

TJD/ljs
Attachment: Revision 1

LABORATORY TEST RESULTS

* EXPERIMENTAL *

Summary :

The Stepper Bike and a conventional bike were tested by Associated Testing Laboratories under identical conditions. Two types of tests were performed:

Test #1-

The first test measured, in inches, the distance the bicycle traveled. This is commonly referred to as "displacement." The test consisted of measuring the distance the bike would travel placing the pedals at different positions. For example, the pedal began at "12 o'clock" and was rotated in one (1) hour intervals coming to rest at "6 o' clock." Each pedal increment is calculated in inches traveled. In a complete revolution, test results revealed the conventional bike lagged behind, traveling only 386 inches, compared to 629 inches by the Stepper Bike! And, because pumping up and down is more efficient motion than circling round and round, in the time that it takes to complete one pedal revolution on a conventional bike, a cyclist can achieve more than 3 pedal strokes on the stepper. As a result, the stepper cyclist can travel a greater distance with equal pedaling effort.

Test #2-

The second test measured the amount of force being transmitted to the rear wheel when engaging pedal movement. Graph illustration shows the conventional bike's distribution of force as severely arching with each 180 degree pedal rotation. This accounts for the "dead zones," those areas in the pedal motion when no force is being transmitted.

By contrast, the Stepper Bike's smooth pumping action displayed an almost uniform, wave-like distribution of force. Technical data supports that the Stepper Bike is much more efficient with 90% force

being transmitted to the rear wheel, while the conventional bike falls behind with only 63%, concluding that the Stepper Bike travels a much greater distance with an equal amount of force! There was only a slight discrepancy between predicted (theoretical) and actual (experimental) displacement measurements, possibly resulting from clutch slippage.

A remarkable feature of the Stepper Bike's propulsion mechanism is that it is so far advanced, it has the ability to be adjusted to accommodate any degree of desired force. That means it can be re-tooled to decrease displacement (distance traveled), but increase torque. So, for example, going up a hill is made much easier, and traveling over rough terrain requires much less effort! This fulfills a broad spectrum of consumer needs.

In conclusion, these tests verify predicted results and confirm the overwhelming advantages of the Stepper Bike System.

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Mr. Wilson Bezerra
ACS Corporation
232 Union Blvd.
Totowa, NJ 07512

Reference: ACS Corporation Purchase Order No. ATL072495
Associated Testing Laboratories Job No. T-33083

Subject: Perform physical testing on one (1) standard bicycle and one (1) stepper bicycle

Dear Mr. Bezerra:

This is to certify that the subject bicycles were subjected to the following tests in accordance with Associated Testing Laboratories Quotation No. 2629. The tests were completed on September 8, 1995 and consisted of the following.

KINEMATICS

Standard Bicycle
One (1) drive pedal was moved through the arc from top to bottom positions in increments of 30 degrees. The forward motion of the rear wheel was measured with the drive chain installed on the front sprocket (52 cog gear) and the rear wheel smallest sprocket (11 cog gear) and largest sprocket (24 cog gear).

Stepper Bicycle
One (1) drive pedal was moved from the uppermost position to the lowest position in equally spaced increments shown in Figure 1. The forward motion of the rear wheel was measured for each position with the drive chain installed in the following combinations of drive sprocket and rear wheel sprocket:

Front Sprocket		Rear Wheel Sprocket
Large 52 teeth chain ring	to	Small 11 cog gear Large 24 cog gear
Smaller gear		Small 11 cog gear Large 24 cog gear

KINEMATICS (continued)

TEST DATA

Standard Bicycle

Pedal Position (degrees)	Distances Traveled - Rear Wheel (inches)* Smallest Sprocket (11 cogs)	Largest Sprocket (24 cogs)
0 - 30	28.2500	10.5625
30 - 60	34.5000	14.5625
60 - 90	32.0625	15.3750
90 - 120	33.9375	12.6250
120 - 150	32.3125	18.5625
150 - 180	32.5625	10.6250
	193.6 x 2 = 387.22	82.375 x 2 = 164.58

Stepper Bicycle

Pedal Position (See Figure 1)	Distances Traveled - Rear Wheel (inches)* Smallest Sprocket (11 cogs) L**	S**	Largest Sprocket (24 cogs) L**	S**
1 - 2	20.5000	31.5625	16.2500	14.5000
2 - 3	42.2500	33.0000	17.2500	14.7500
3 - 4	37.6875	34.3125	20.3125	17.5625
4 - 5	38.0625	36.7500	16.6875	15.6875
5 - 6	40.0625	37.3125	17.6875	16.4375
6 - 7	60.7500	58.0000	30.6250	26.7500
	239.30 x 2 = 478.60	230.93 x 2 = 461.86	118.79 x 2 = 237.58	105.67 x 2 = 211.34

* Measured to nearest 1/16 inch shown as decimal equivalent
** L = Large front sprocket - (52 cogs)
S = Small front sprocket

FORCE TRANSMISSION

A 50-pound weight was attached to the pedal of the standard bicycle and stepper bicycle, and for each position of the pedal described above, the resultant force was measured at the rear wheel. The measured force for the stepper and standard bicycles was measured with the drive chain installed on the 52 cog front drive sprocket and for each combination of rear wheel sprockets as follows:

Gear 1 . . . . . 11 cogs
Gear 2 . . . . . 12 cogs
Gear 3 . . . . . 14 cogs
Gear 4 . . . . . 16 cogs
Gear 5 . . . . . 18 cogs
Gear 6 . . . . . 21 cogs
Gear 7 . . . . . 24 cogs

FORCE TRANSMISSION (continued)

A typical force transmission test setup may be seen in Figures 2, 3 and 4.

TEST DATA

Standard Bicycle
Force Measurements

Gear No.	Pedal Position (degrees)	Measured Force (lbs)
1	0	0.0314
1	30	2.5190
1	60	3.8420
1	90	4.9050
1	120	3.1880
1	150	2.1100
1	180	0.3464
2	0	0.0078
2	30	2.6970
2	60	4.6370
2	90	5.6530
2	120	4.6290
2	150	3.2280
2	180	0
3	0	0.0078
3	30	2.7160
3	60	5.5740
3	90	5.9370
3	120	5.9270
3	150	3.1880
3	180	0
4	0	0
4	30	4.4010
4	60	6.9290
4	90	7.8340
4	120	6.7400
4	150	4.2120
4	180	0

FORCE TRANSMISSION (continued)

TEST DATA (continued)

Standard Bicycle
Force Measurements

Gear No.	Pedal Position (degrees)	Measured Force (lbs)
5	0	0
5	30	3.9600
5	60	7.9130
5	90	8.3540
5	120	7.2990
5	150	6.1100
5	180	0.0157
6	0	0
6	30	4.6690
6	60	9.1330
6	90	10.0390
6	120	7.1100
6	150	6.5430
6	180	0.0078
7	0	0
7	30	5.5590
7	60	10.3140
7	90	11.1650
7	120	10.8340
7	150	5.6450
7	180	0.0157

Stepper Bicycle
Force Measurements

Gear No.	Pedal Position (See Figure 1)	Measured Force (lbs)
1	1	2.7480
1	2	3.0230
1	3	2.8420
1	4	3.1880
1	5	3.4010
1	6	3.1730
1	7	2.5870

FORCE TRANSMISSION (continued)

TEST DATA (continued)

Stepper Bicycle
Force Measurements

Gear No.	Pedal Position (See Figure 1)	Measured Force (lbs)
2	1	2.7550
2	2	3.2510
2	3	3.3460
2	4	3.3770
2	5	3.5190
2	6	3.1180
2	7	2.1250
3	1	3.3700
3	2	3.7870
3	3	4.0550
3	4	4.0780
3	5	3.9290
3	6	3.8810
3	7	3.7320
4	1	3.5740
4	2	4.3770
4	3	4.7480
4	4	4.5590
4	5	4.7000
4	6	4.5190
4	7	3.5430
5	1	4.4170
5	2	4.8340
5	3	5.1100
5	4	5.1490
5	5	4.7950
5	6	4.5660
5	7	4.2360
6	1	4.9290
6	2	5.5900
6	3	5.5590
6	4	5.8180
6	5	5.8580
6	6	5.5110
6	7	4.8500

FORCE TRANSMISSION (continued)

TEST DATA (continued)

Stepper Bicycle
Force Measurements

Gear No.	Pedal Position (See Figure 1)	Measured Force (lbs)
7	1	6.0230
7	2	6.1880
7	3	6.6530
7	4	6.8180
7	5	7.0700
7	6	6.6530
7	7	5.6290

The test data shown above may be seen graphically in Figures 5 through 18.

TEST RESULTS

There was no malfunctioning of the bicycles during the performance of the kinematics and force transmission test. No damage was observed. The distance traveled and individual force measurements may be seen in the test data section of this report.

The following equipment was used to conduct the tests:

Equipment	Manufacturer	Model	Calibration Date	Calibration Due Date
Multimeter	Hewlett-Packard	3478A	8/02/95	11/01/95
Power Supply	Hewlett-Packard	6291A	3/03/95	9/02/95
Load Cell	Artech	20210-250	6/19/95	6/18/96
Caliper	Kenon	4A001	7/18/95	1/17/96
50 lb. Weight	Fairbanks	N/A	1/10/95	1/10/96

We thank you for the opportunity to be of service to you. If you have any questions, please do not hesitate to contact us.

Very truly yours,

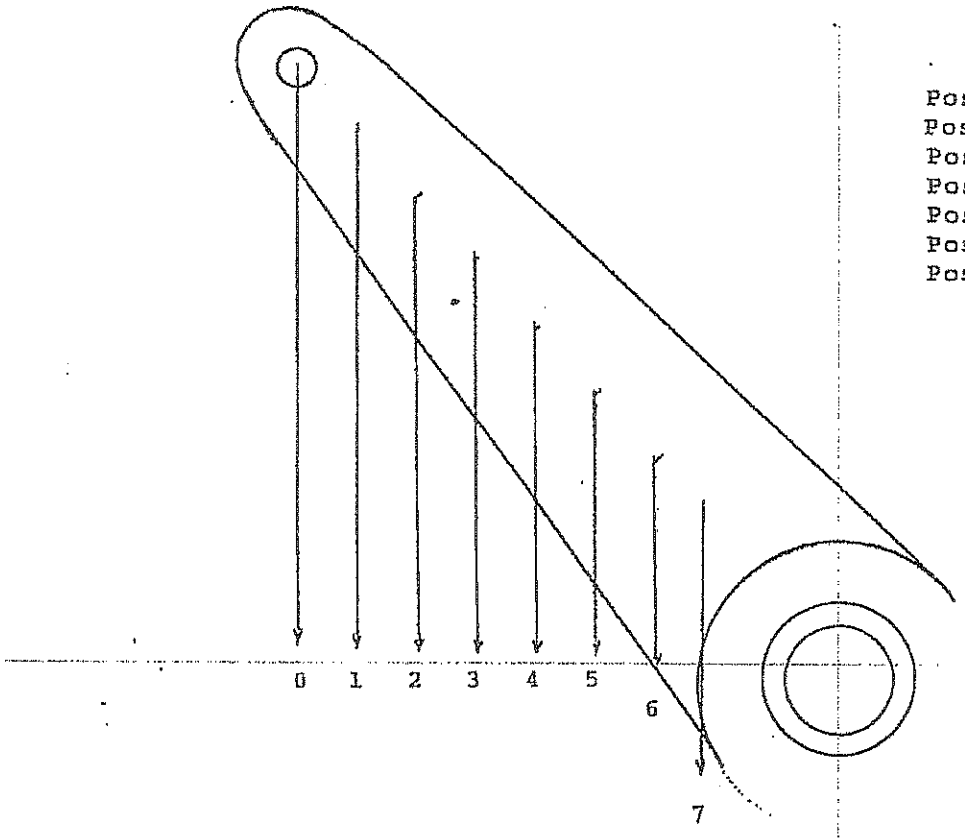
ASSOCIATED TESTING LABORATORIES

Thomas J. Dowd
Laboratory Manager

TJD/ljs
Attachments: Figures 1 through 18

Verified:

George J. Murphy
Director of Operations



Position 1 . . . . Fully Up
Position 2 . . . . 2.604
Position 3 . . . . 5.208
Position 4 . . . . 7.812
Position 5 . . . .10.416
Position 6 . . . .13.020
Position 7 . . . .15.624
(Fully Down)

Figure 1

Stepper Bicycle Measurements
Positions (inches)

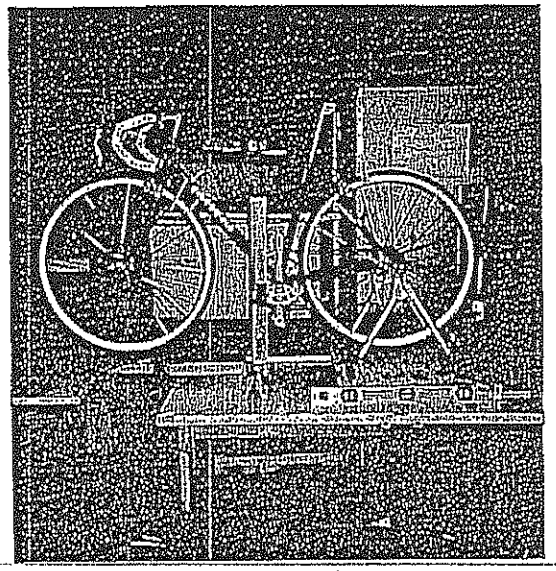


Figure 2

Standard Bicycle Test Setup
Force Transmission Test

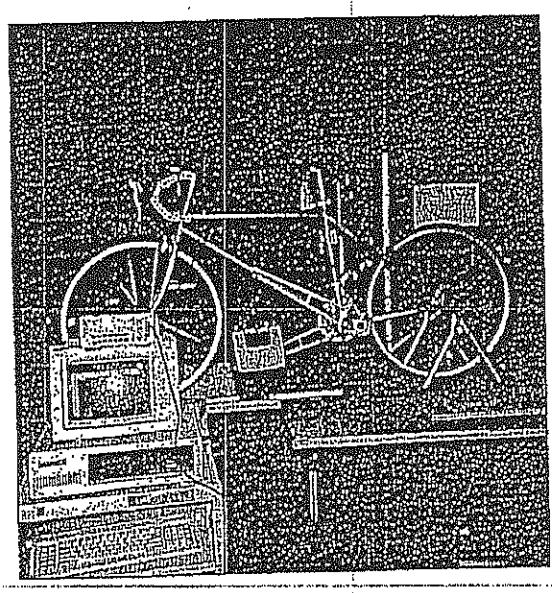


Figure 3

Stepper Bicycle Test Setup
Force Transmission Test

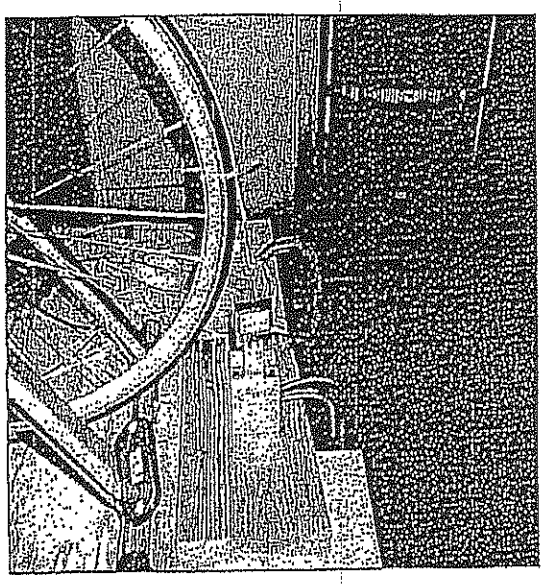


Figure 4

Force Transmission Test Setup
Showing Load Cell

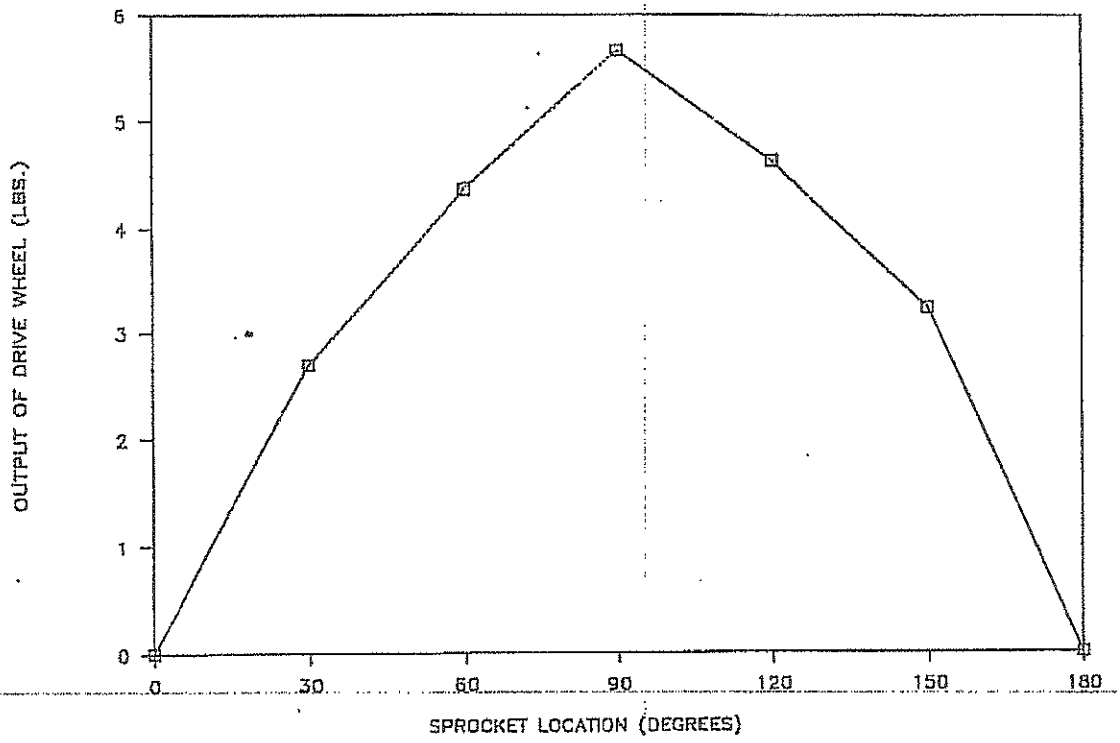


Figure 6

Force Transmission Test
Univega-Superstrada (Gear 2)

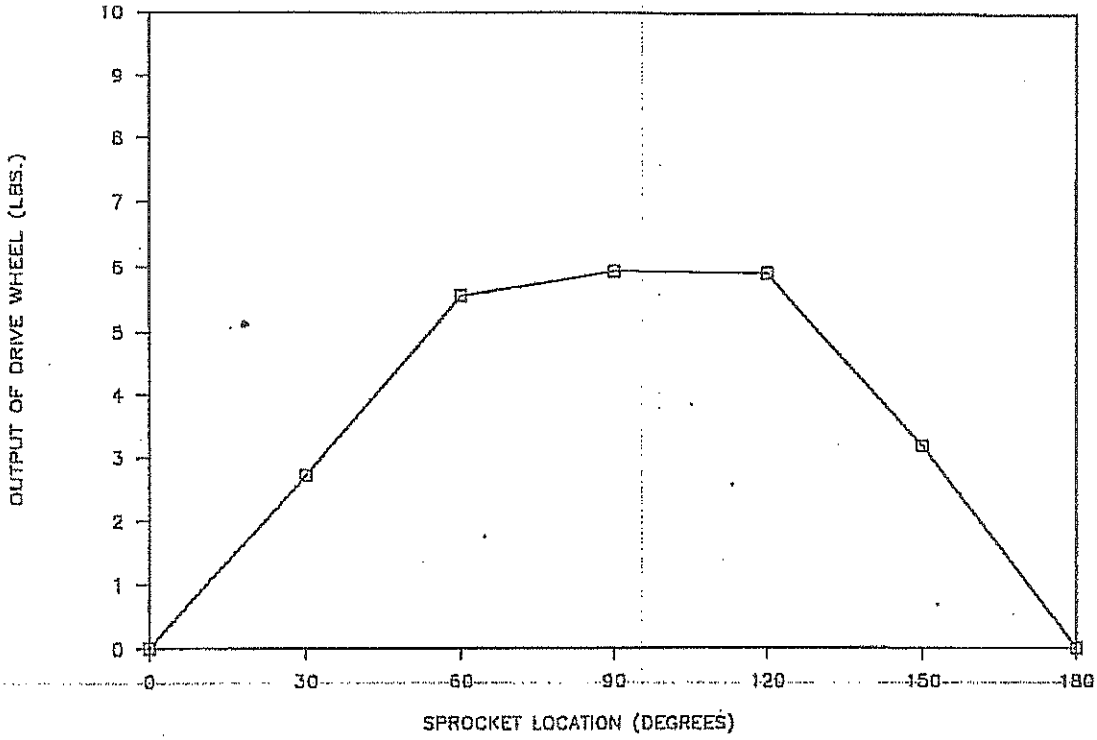


Figure 7

Force Transmission Test
Univega-Superstrada (Gear 3)

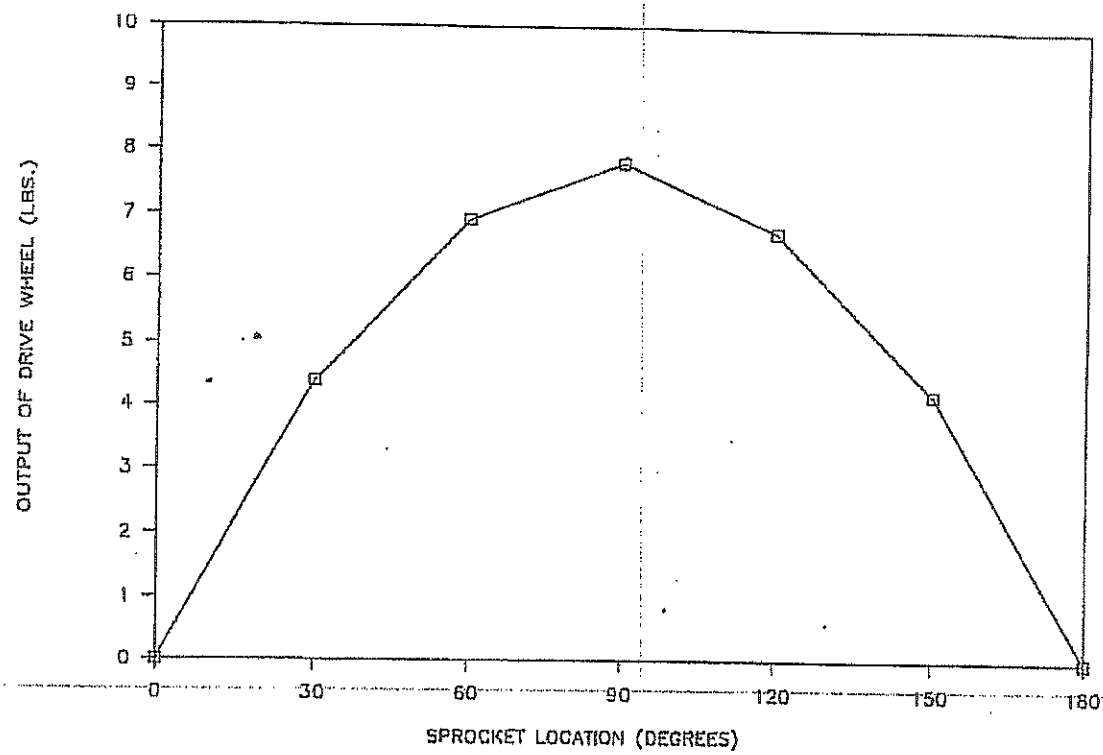


Figure 8

Force Transmission Test
Univega-Superstrada (Gear 4)

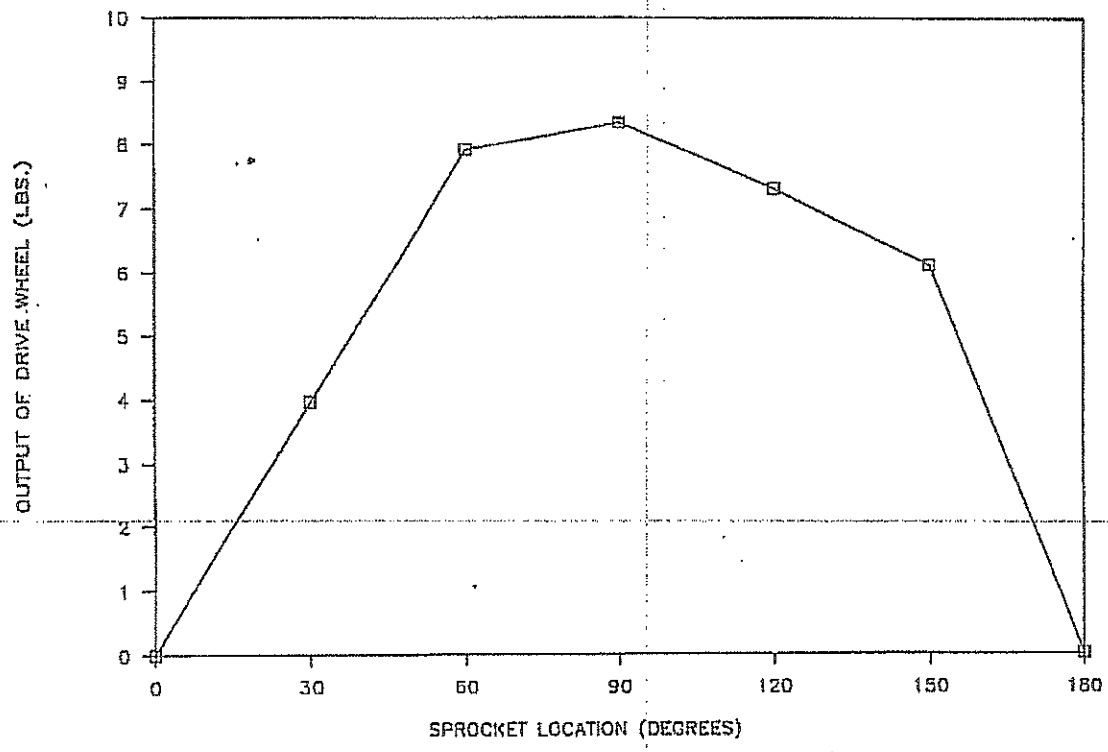


Figure 9

Force Transmission Test
Univega-Superstrada (Gear 5)

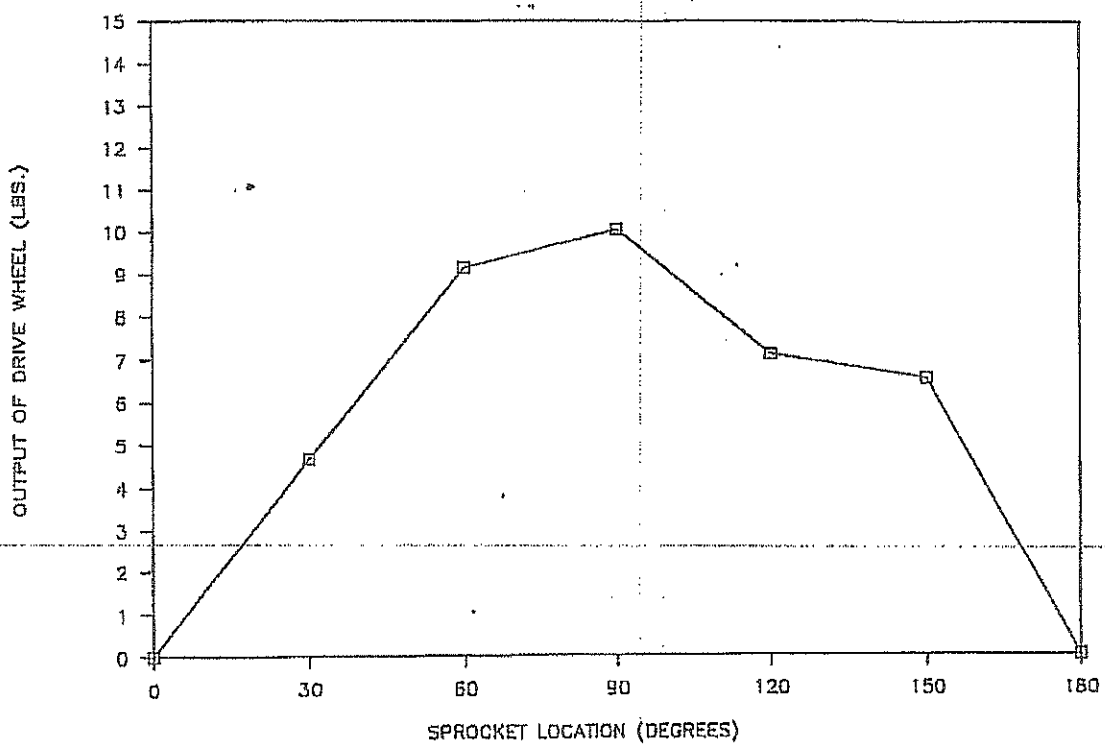


Figure 10

Force Transmission Test
Univega-Superstrada (Gear 6)

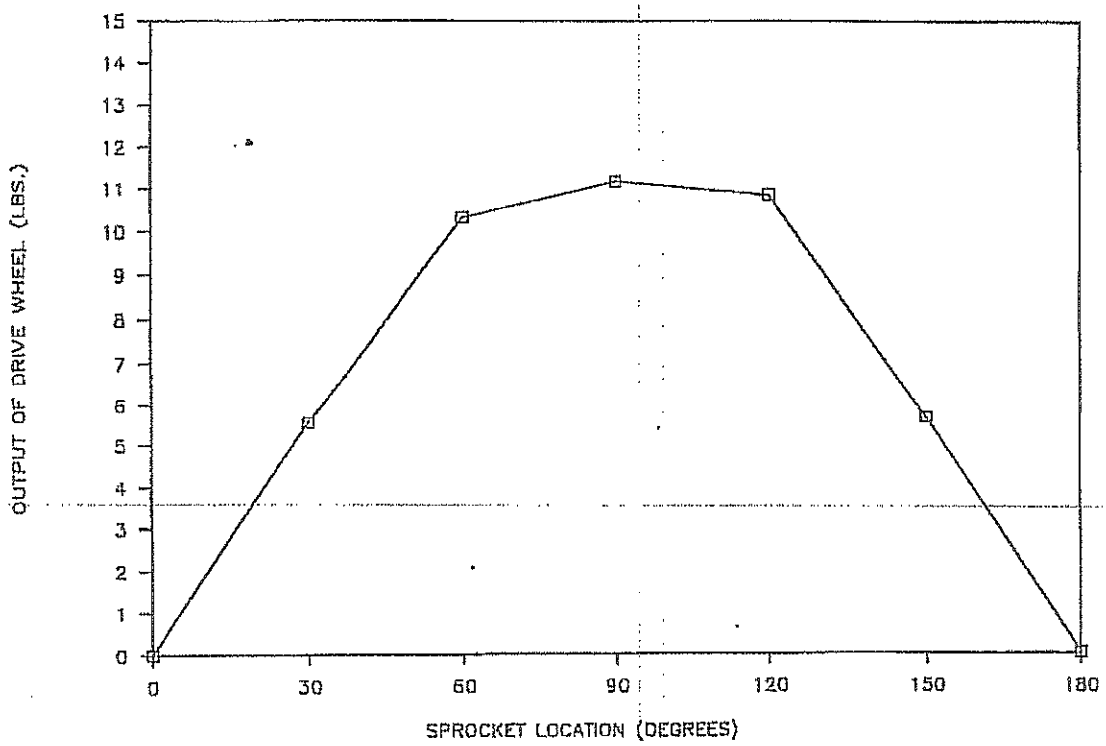


Figure 11

Force Transmission Test
Univega-Superstrada (Gear 7)

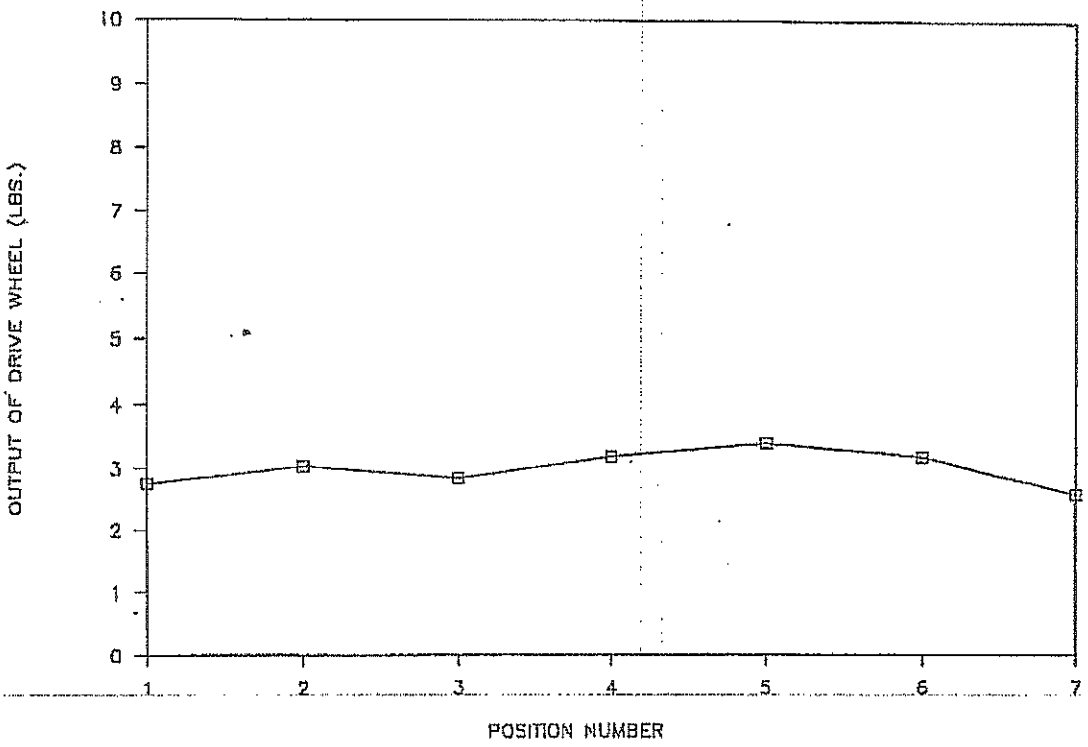


Figure 12

Force Transmission Test
Stepper Bike (Gear 1)

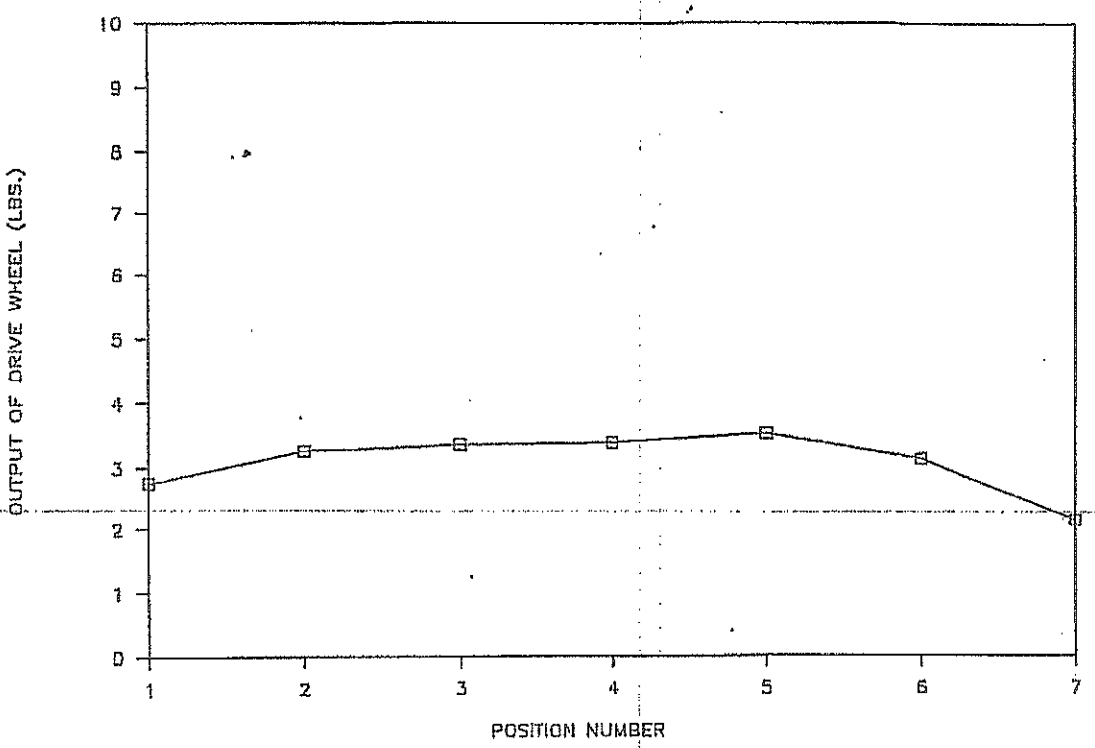


Figure 13

Force Transmission Test
Stepper Bike (Gear 2)

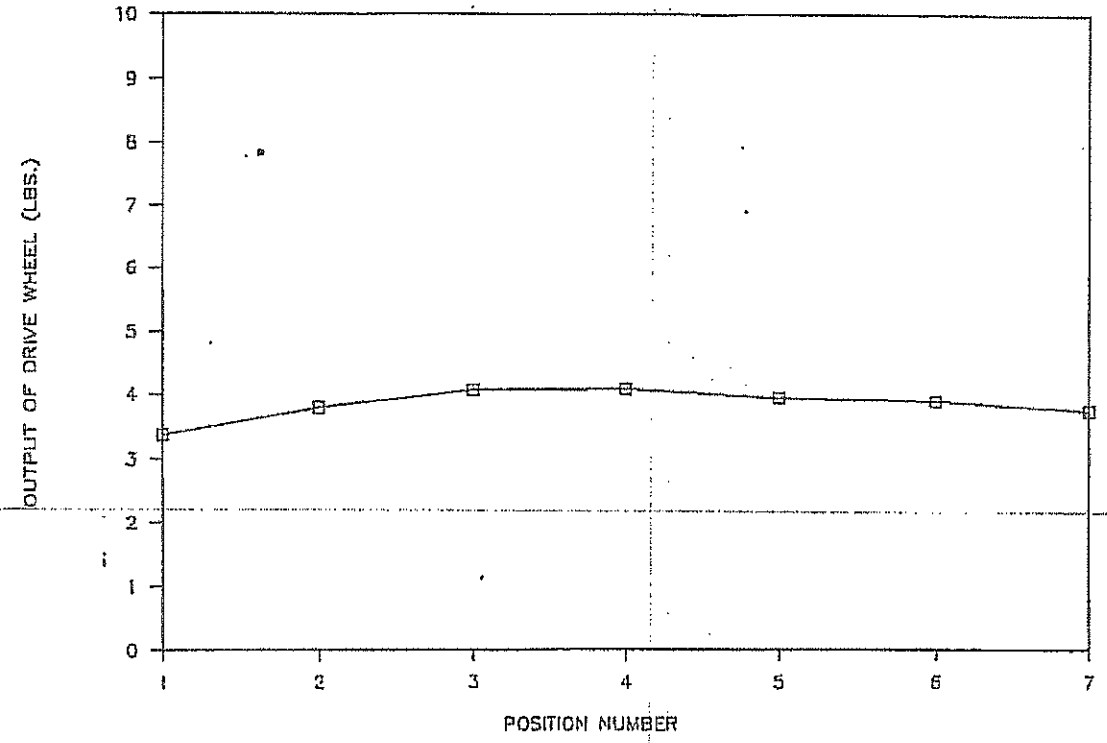


Figure 14

Force Transmission Test
Stepper Bike (Gear 3)

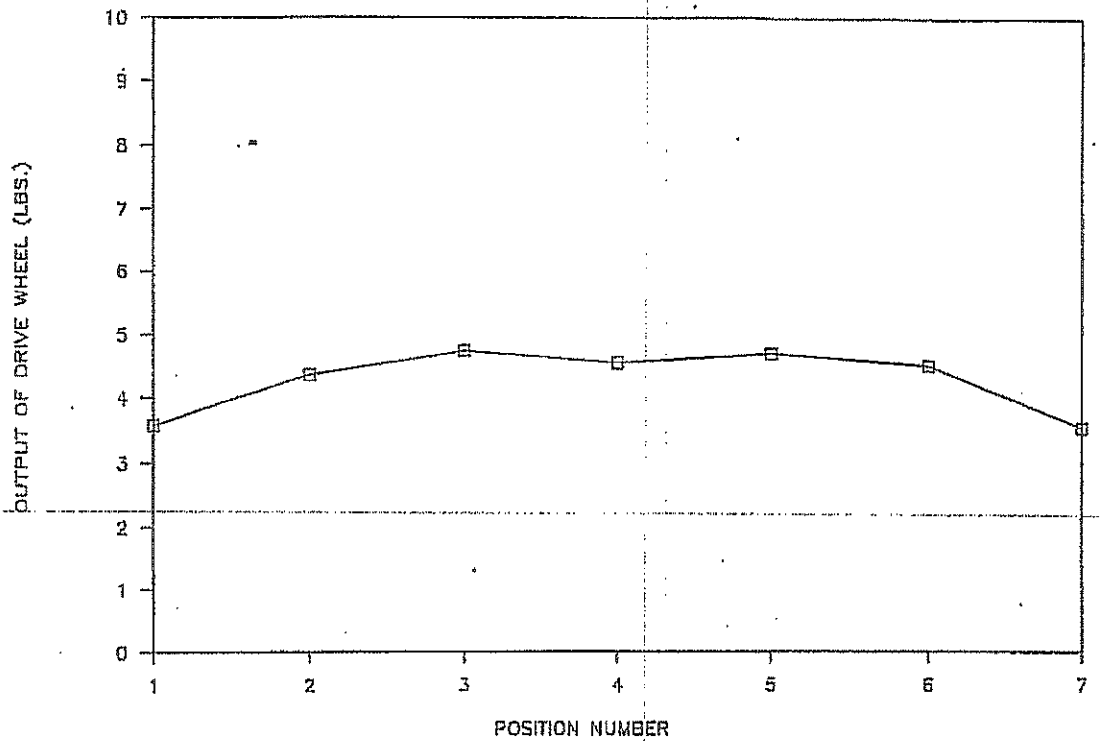


Figure 15

Force Transmission Test
Stepper Bike (Gear 4)

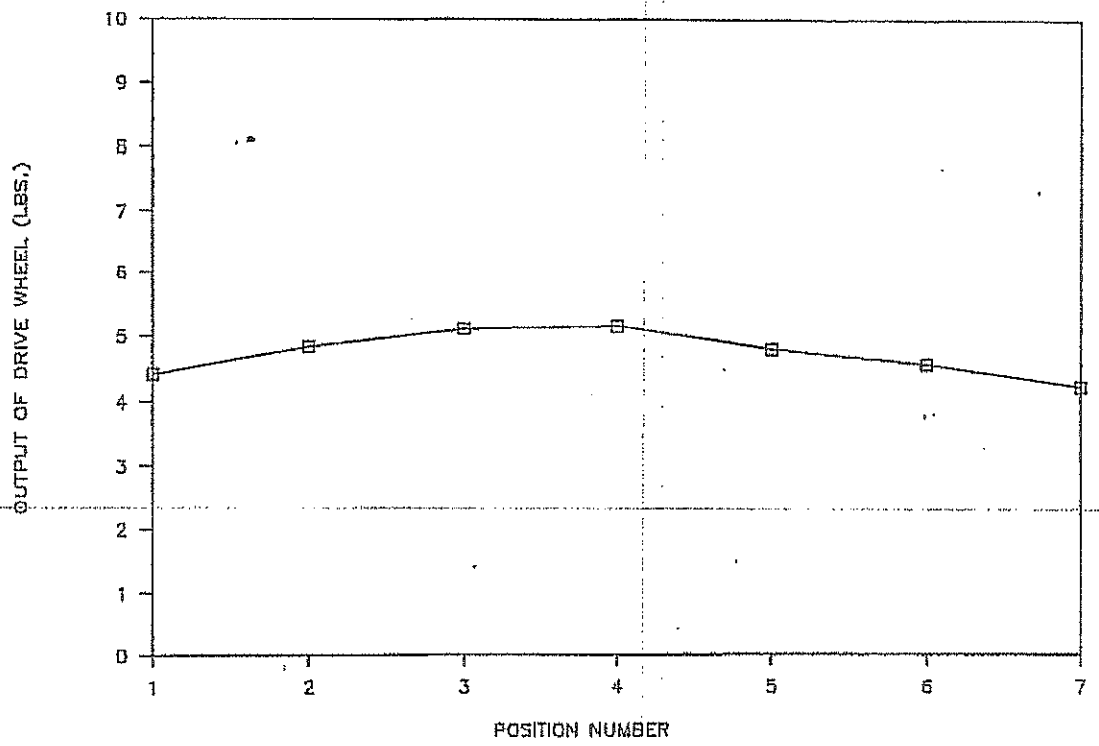


Figure 16

Force Transmission Test
Stepper Bike (Gear 5)

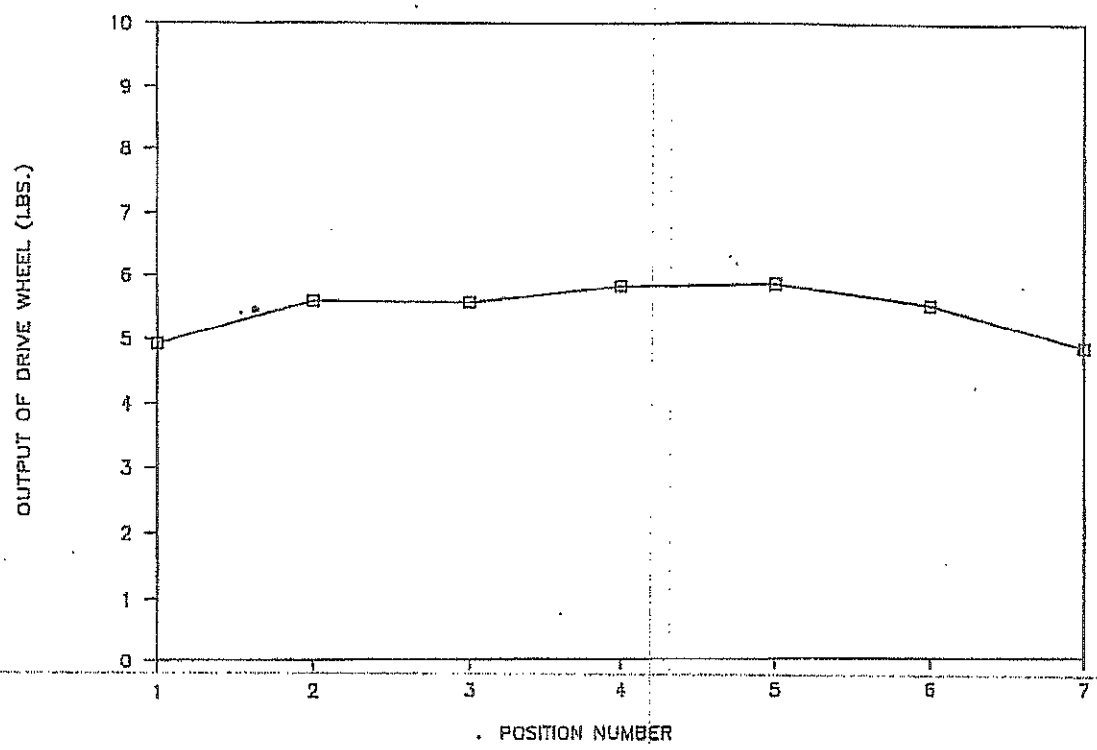


Figure 17

Force Transmission Test
Stepper Bike (Gear 6)

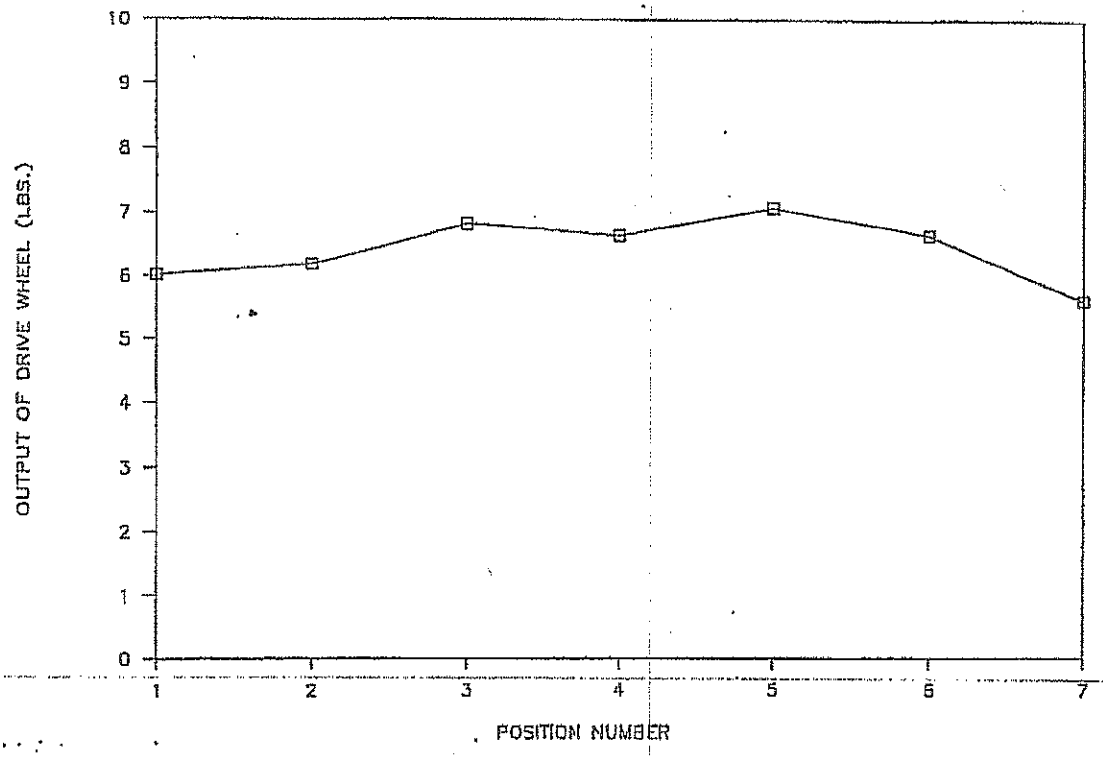


Figure 18

Force Transmission Test
Stepper Bike (Gear 7)

ASSOCIATED TESTING LABORATORIES

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LEAD PAGE

TODAY'S DATE: 9/13/95

COMPANY NAME: ACS Corporation

COMPANY TELEFAX NUMBER: 942-2977

ATTENTION: Mr. Wilson Pezerra

ORIGINATOR: Mr. T. Dowd

NUMBER OF PAGES (INCLUDING LEAD PAGE): 3

ADDITIONAL COMMENTS:

IF THERE ARE QUESTIONS REGARDING THIS TRANSMITTAL, PLEASE CALL:
(201) 628-1363