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## Test 559: Nuffield Universal Model PM-4

Nebraska Tractor Test Lab

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The Experiment Station  
University of Nebraska College of Agriculture  
W. V. Lambert, Director, Lincoln, Nebraska

Department of Agricultural Engineering  
Dates of test: August 29 to September 8, 1955  
Manufacturer: MORRIS MOTORS LTD., BIRMINGHAM, ENGLAND  
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 559

NUFFIELD UNIVERSAL PM-4

**BELT HORSEPOWER TESTS**

Hp	Crank shaft speed rpm	Fuel Consumption			Water used gal per hour	Temp Deg F		Barometer inches of mercury		
		Gal per hour	Hp-hr per gal	Lb per hp-hour		Cooling med	Air			
TESTS B AND C—100% MAXIMUM LOAD—TWO HOURS										
38.40	2000	3.910	9.82	0.624	0.00	179	72	29.103		
TEST D—RATED LOAD—ONE HOUR										
34.07	2001	3.604	9.45	0.648	0.00	176	72	29.110		
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)										
34.13	2004	3.594	9.50	0.645	...	177	74	.....		
2.68	2062	1.758	1.52	4.019	...	150	74	.....		
17.09	2009	2.531	6.75	0.908	...	163	78	.....		
37.38	1797	3.682	10.15	0.604	...	191	80	.....		
8.72	2043	2.061	4.23	1.448	...	160	80	.....		
25.74	2013	3.065	8.40	7.296	...	177	83	.....		
20.96	1988	2.782	7.53	0.813	0.00	169	78	29.145		
TORQUE (At Dynamometer)										
Eng rpm	2000	1850	1700	1550	1400	1250	1100	950	800	650
Lb-ft	167.0	179.0	191.5	202.5	212.2	219.6	223.8	226.0	226.0	220.0
Dyn rpm	1192	1102	1012	930	835	745	708	569	480	390

**DRAWBAR HORSEPOWER TESTS**

Hp	Draw bar pull lb	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption			Water used gal per hour	Temp Deg F		Barometer inches of mercury
					Gal per hour	Hp-hr per gal	Lb per hp-hr		Cooling med	Air	
TEST H—RATED LOAD—TEN HOURS—3rd Gear											
27.79	2097	4.97	2001	3.97	3.308	8.40	0.729	0.00	171	76	28.956
TESTS F & G—100% MAXIMUM LOAD											
27.01	5216	1.94	1996	16.64	1st gear				180	83	28.900
34.12	3789	3.38	2003	8.70	2nd gear				191	86	28.920
34.34	2623	4.91	2000	5.11	3rd gear				185	81	28.890
33.15	1677	7.41	2005	3.14	4th gear				177	73	28.910
31.20	658	17.78	2007	0.94	5th gear				187	86	28.920
TEST J—OPERATING MAXIMUM LOAD											
33.66	2618	4.82	1997	8.21	3rd gear				182	82	28.760
TEST K—OPERATING MAXIMUM LOAD											
32.64	2623	4.67	2003	10.30	3rd gear				194	85	28.760

**TIRES, WHEELS AND WEIGHT**

	Tests F, G & H	Test J	Test K
<b>Rear wheels</b>			
Type	Pressed steel	Pressed steel	Pressed steel
Liquid ballast	642 lb each	None	None
Added cast iron	375 lb each	None	None
<b>Rear tires</b>			
No. and size	Two 14-30	Two 14-30	Two 11-36
Ply	6	6	6
Air pressure	12 lb	12 lb	12 lb
<b>Front wheels</b>			
Type	Pressed steel	Pressed steel	Pressed steel
Liquid ballast	None	None	None
Added cast iron	165 lb each	None	None
<b>Front tires</b>			
No. and size	Two 7.50-18	Two 7.50-18	Two 6.00-16
Ply	6	6	6
Air pressure	28 lb	28 lb	28 lb
<b>Height of drawbar</b>	18½ inches	19 inches	20 inches
<b>Static weight</b>			
Rear end	5666 lb	3533 lb	3393 lb
Front end	1924 lb	1599 lb	1544 lb
<b>Weight with operator</b>	7765 lb	5307 lb	5112 lb

**FUEL, OIL and TIME** Gasoline Octane No. ASTM 80.3 Research 85.9 (rating taken from oil company's typical inspection data) weight per gallon 6.127 lb Oil SAE 40 to motor 1.721 drained from motor 1.567 gal Total time motor was operated 46½ hours.

**CHASSIS** Type Standard Serial No. N178310 Tread width rear 53" to 88" front 52¼" to 71¼" Wheel base 78" Hydraulic control system driven by P.T.O. shaft Advertised speeds mph first 2.26 second 3.6 third 5.05 fourth 7.45 fifth 17.3 reverse 3.96 Belt pulley diam 10¼" face 6½" rpm 1642 Belt speed 4510 fpm Clutch single plate dry disc clutch operated by foot pedal Seat pressed steel with cover pad and rubber puck suspension Brakes internal expanding shoe operated by two foot pedals and a hand lever Equalized by locking two brakes together Power take-off conventional type.

**ENGINE** Make Morris Motors Ltd., (England) Type 4 cylinder vertical Serial No. ETD 120388 Crankshaft mounted lengthwise Head "L" Lubrication pressure Bore and stroke 3.937" x 4.724" Rated rpm 2000 Compression ratio 6 to 1 Displacement 230 cu. in. Port diameter valves inlet 1½" exhaust 1½" Governor variable speed centrifugal Carburetor size 30 mm Ignition system battery Starting system 12 volt battery Air cleaner oil washed wire mesh Muffler was used Oil filter replaceable micronic paper element Cooling medium temperature control thermostat.

**REPAIRS AND ADJUSTMENTS** No repairs or adjustments.

**REMARKS** All test results were determined from observed data and without allowances, additions or deductions. Tests B and F were made with carburetor set for 100% maximum belt horsepower and data from these tests were used in determining the horsepower to be developed in tests D and H, respectively. Tests C, D, E, G, H, J & K were made with the same setting of the carburetor (selected by the manufacturer).

**HORSEPOWER SUMMARY**

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F and 29.92" Hg)	36.28	39.93
2. Observed maximum horsepower (tests F and B)	34.34	38.40
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (formerly ASAE and SAE ratings)	27.21	33.94

We, the undersigned, certify that this is a true and correct report of official tractor test No. 559.

L. F. LARSEN  
Engineer-In-Charge

L. W. Hurlbut  
G. W. Steinbruegge  
J. J. Sulek  
Board of Tractor  
Test Engineers

## EXPLANATION OF TEST REPORT

**TEST A:** The manufacturer's representative operates the tractor for a minimum of 12 hours using light to heavy drawbar loads in each gear.

This serves as a period for limber up, general observation and adjustments. Adjustments that are permissible include valve tappet clearance, breaker point gap, spark plug gaps, clutch and others of a similar nature. No new parts or accessories can be installed without having mention made of it in the report.

No data are recorded during this preliminary run except the time that the engine is operated.

### BELT HORSEPOWER TESTS

**TEST B:** The throttle valve is held wide open and the belt load on the dynamometer is adjusted so that the engine is at the rated speed recommended by the manufacturer. Carburetor, ignition timing and manifold adjustments are all set for maximum engine power.

This test is designed to determine maximum belt horsepower of the tractor at rated speed and to measure fuel consumption at the maximum power on the belt.

**TEST C:** For tractors with carburetors the best fuel economy does not always occur when the engine develops maximum power at rated speed. Test C is intended to allow the manufacturer's representative to select a more economical fuel setting even though there is a slight loss of power. *This more practical carburetor setting is used in all later tests except test F.* The throttle valve is held wide open and load adjusted to give rated rpm. Tests B and C are the same for diesel tractors, which have an altogether different fuel system.

**TEST D:** The throttle control lever is set so that the governor will maintain rated engine speed when rated load is applied. Rated load is 85% of 100% maximum, as obtained in test B, corrected to standard conditions.

This rating is somewhat less than the maximum belt horsepower in order that the operator may have a certain amount of reserve.

### TEST E:

**Varying load** serves to show the range of engine speeds when the engine is controlled by the governor during the following varied loads, of 20 minutes each: rated load, no load,  $\frac{1}{2}$  rated load, maximum load at wide open throttle valve,  $\frac{1}{4}$  and  $\frac{3}{4}$  rated load.

The average result of this test shows the average power and fuel consumption. Since the average tractor is subjected to varying loads, these data serve well in predicting fuel consumption and efficiency of a tractor in general use.

**Torque, lb-ft at dynamometer,** is obtained with wide open throttle and sufficient load is applied to give several readings.

### DRAWBAR HORSEPOWER TESTS

In all drawbar tests the pull exerted by the tractor is transmitted by a hydraulic pressure cylinder to a recording instrument in the test car. All tests are made on the same dirt test course which is maintained by grading, sprinkling and rolling

so that it remains very nearly the same throughout the season. The same tires, wheels and weights are used for all tests except J and K.

**TEST F:** A drawbar test, the results of which are used to determine the rated drawbar horsepower in test H. The carburetor is set to develop maximum power as in test B. The rated gear recommended by manufacturer as plow gear is used in this test. The drawbar load is adjusted to give rated engine speed.

**TEST G:** Maximum drawbar horsepower is determined in each gear when the carburetor is set for fuel economy as in test C. The throttle valve is held wide open and the load is applied so that the engine runs at rated engine speed.

When operating in low gear it is not uncommon for the tractor to develop less drawbar horsepower than in rated gear because of excessive wheel slippage. When excessive wheel slippage occurs the load is reduced until slippage approaches 16%. When the load is reduced it is necessary to operate the tractor engine at part throttle and control engine speed by governor action.

**TEST H:** Intended to test the ability of the tractor to run continuously for 10 hours at rated drawbar horsepower and to determine the fuel consumption during that time. Rated drawbar horsepower is 75% of 100% maximum drawbar horsepower (Test F), corrected to standard conditions.

When operating at rated load the throttle control lever is set to maintain rated engine speed. This rating is less than maximum drawbar horsepower in order that the operator may have a certain amount of reserve.

**TEST J:** The tractor is operated in rated gear with all added weight removed. This test shows the effect of the removal of added weight on the performance of the tractor when compared with test G.

Removal of wheel weights generally increases wheel slippage and decreases drawbar horsepower.

**TEST K:** Similar to test J except that the smallest tires and lightest wheels offered by the manufacturer are used.

