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Test 663: Nuffield Universal Three

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 15, 1958 to August 20, 1958
Manufacturer: MORRIS MOTORS, LTD.,
BIRMINGHAM, ENGLAND
Manufacturer's rating: Not Rated

NEBRASKA TRACTOR TEST NO. 663

NUFFIELD UNIVERSAL THREE

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption			Temp. Deg. F.			Barometer inches of mercury
		Gal per hr	Hp-hr per gal	Lb per hp-hr	Cooling medium	Air wet bulb	Air dry bulb	
TESTS B & C—100%MAXIMUM POWER—TWO HOURS								
34.21	2001	2.425	14.11	0.498	171	66	72	28.890
TEST D—RATED POWER—ONE HOUR								
30.53	2134	2.107	14.49	0.485	171	66	71	28.890
TEST E—VARYING POWER—TWO HOURS (20 minute runs; last line average)								
30.56	2133	2.129	14.35	0.490	172	66	72
3.27	2240	0.862	3.79	1.853	162	67	74
15.74	2190	1.344	11.71	0.600	173	66	73
34.53	2001	2.467	14.00	0.502	171	67	76
8.03	2230	1.046	7.68	0.915	173	67	75
23.19	2153	1.690	13.72	0.512	171	68	78
19.22	2158	1.590	12.09	0.581	170	67	74	28.890

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lbs	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption			Temp. Deg. F.			Barometer inches of mercury
					Gal per hr	Hp-hr per gal	Lb per hp-hr	Cool- ing med	Air wet bulb	Air dry bulb	
TEST H—RATED POWER—TEN HOURS—3rd Gear											
25.02	2088	4.49	2115	3.83	1.897	13.19	0.533	162	75	87	28.801
TESTS F & G—OPERATING MAXIMUM POWER											
25.51	5572	1.72	2001	13.85	1st Gear (part throttle)			166	69	79	28.850
30.16	3921	2.88	2000	8.36	2nd Gear			174	69	79	28.850
31.00	2784	4.18	2002	5.62	3rd Gear			169	69	79	28.850
29.82	1780	6.28	1999	3.51	4th Gear			166	72	85	28.860
26.36	661	14.95	2000	0.95	5th Gear			168	70	87	28.840
TEST J—OPERATING MAXIMUM POWER											
29.81	2729	4.10	1994	7.99	3rd Gear			176	78	88	28.790
TEST K—SPEED-PULL CHARACTERISTIC											
Pounds Pull		2088	2784	2850	3000	3100	3100	3100	3100	3000	
Horsepower		25.02	31.00	28.1	26.4	24.0	20.7	20.7	20.7	16.8	
Miles Per Hour		4.49	4.18	3.7	3.3	2.9	2.5	2.5	2.5	2.1	

FUEL, OIL, WATER and TIME Fuel Diesel Cetane No. ASTM 52 (rating taken from oil company's typical inspection data) Weight per gallon 7.030 lb Oil SAE 20-20W To motor 2.003 gal Drained from motor 1.822 gal Water used 0.066 gal Total time motor was operated 37 hours.

CHASSIS Type Standard Serial No. 3DL-771-2771 Tread width rear 52" to 80" front 53" to 71½" Wheel base 73" Hydraulic control system driven by P.T.O. shaft Advertised speeds mph first 1.96 second 3.07 third 4.35 fourth 6.4 fifth 14.9 reverse 3.42 Belt pulley diam. 10¼" face 6½" rpm 1643 Belt speed 4510 fpm Belt flat Length 71' Width 6" Thickness 0.215" Maximum slip 0.53% Clutch single plate dry disc operated by foot pedal Seat pressed steel with cover pad and rubber puck suspension Brakes internal expanding shoe operated by two foot pedals on right hand side of tractor Equalized by foot action Power take-off conventional type.

ENGINE Make Morris Motors Ltd., (England) Type 3 cylinder vertical Diesel Serial No. 2720 Crankshaft mounted Lengthwise Head I Lubrication pressure Bore and stroke 3.74" x 4.724" Rated rpm 2000 Compression ratio 16.5 to 1 Displacement 155.6 cu. in. Valves port diameter Inlet 1.45" Exhaust 1.29" Governor pneumatic Starting system 12 volt battery Air cleaner oil washed wire mesh Muffler was used Oil filter replaceable micronic paper element Fuel filter replaceable laminated paper element Cooling medium temperature control thermostat and shutters.

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 fuel pump set to develop approximately 35 observed 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.

TIRES, WHEELS AND WEIGHT

	Tests F, G, H & K	Test J
Rear wheels		
Type	Pressed steel	Pressed steel
Liquid ballast	498 lb each	None
Added cast iron	935 lb each	None
Rear tires		
No. and size	Two 13-24	Two 13-24
Ply	6	6
Air pressure	18 lb	18 lb
Front wheels		
Type	Pressed steel	Pressed steel
Liquid ballast	67 lb each	None
Added cast iron	135 lb each	None
Front tires		
No. and size	Two 6.00-16	Two 6.00-16
Ply	6	6
Air pressure	24 lb	24 lb
Height of drawbar	20 inches	20½ inches
Static weight		
Rear end	5940 lb	3074 lb
Front end	1970 lb	1566 lb
Total weight as tested with operator	8085 lb	4815 lb

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60°F and 29.92" Hg)	32.73	35.83
2. Observed maximum horsepower (Tests F and B)	31.00	34.21
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	24.55	30.46

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 663.

L. F. LARSEN
Engineer-in-Charge

L. W. HURLBUT, Chairman
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 manual throttle control lever is set so that 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 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 manual throttle control lever is set the same as for tests B and C allowing the governor to control engine speed at part throttle. Load is applied until 85% of maximum corrected horsepower found in test B is obtained.

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.

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. When rubber tires are used, all tests are made on the concrete test course. The same tires, wheels and weights are used for all tests except J. All crawler type tractors are tested on an earthen test course which is maintained by grading, sprinkling and rolling so that it remains very nearly the same for each test.

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 the 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 manual throttle control lever is set so that 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 15%. 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 horsepower the manual throttle control lever is set the same as in tests F and G allowing the governor to maintain engine speed at part throttle. 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: This is intended to show the pull, horsepower, and travel speed of the tractor at rated horsepower (taken from test H); maximum horsepower (taken from test G); and at least four other conditions obtained by reducing travel speed in 10% increments by overload.

