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Test 756: Minneapolis-Moline M-5 (Gasoline)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 756 - MINNEAPOLIS - MOLINE M-5 GASOLINE

The University of Nebraska Agricultural Experiment Station

E. F. Frolik, Dean and Acting Director, Lincoln, Nebraska

POWER TAKE-OFF PERFORMANCE

Hp	Crank shaft speed rpm	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temp Cool- ing med	Degrees F Air wet bulb	Air dry bulb	Barometer inches of mercury
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours								
61.01	1500	5.327	0.545	11.45	178	68	78	29.060
Standard Power Take-off Speed (540 rpm)—One Hour								
57.45	1365	4.890	0.531	11.75	184	71	83	29.080
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
53.42	1545	4.959	0.579	10.77	181	74	88	.....
0.00	1673	2.083	.....	.....	151	73	88	.....
27.40	1584	3.401	0.774	8.06	172	74	91	.....
60.11	1500	5.281	0.548	11.38	188	74	92	.....
14.41	1665	2.814	1.218	5.12	166	75	92	.....
41.47	1598	4.180	0.629	9.92	168	75	93	.....
Av 32.80	1594	3.786	0.720	8.66	171	74	91	29.082

DRAWBAR PERFORMANCE

Hp	Draw- bar pull lbs	Speed miles per hr	Crank shaft speed rpm	Slip of drivers %	Fuel Consumption Gal per hr	Lb per hp hr	Hp-hr per gal	Temperature Cooling medium	Degrees F Air wet bulb	Air dry bulb	Barometer inches of mercury
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—2nd Gear											
52.51	4331	4.55	1498	6.41	5.536	0.658	9.49	186	79	93	28.830
75% of Pull at Maximum Power—Ten Hours—2nd Gear											
42.68	3264	4.90	1585	4.65	4.635	0.677	9.21	186	76	91	28.778
50% of Pull at Maximum Power—Two Hours—2nd Gear											
29.14	2173	5.03	1608	3.72	3.845	0.823	7.58	160	59	66	29.130
MAXIMUM POWER WITH BALLAST											
47.43	6365	2.79	1496	11.89	1st Gear.....	.....	.....	186	69	75	28.820
53.07	4376	4.55	1500	6.41	2nd Gear.....	.....	.....	178	72	80	28.880
54.36	3557	5.73	1499	5.20	3rd Gear.....	.....	.....	170	61	70	29.070
52.50	2772	7.10	1497	3.90	4th Gear.....	.....	.....	170	76	89	28.820
41.17	6693	2.31	1586	14.62	2nd Gear Ampli-Torc.	.....	.....	180	69	75	28.820
48.39	6591	2.75	1499	13.22	3rd Gear Ampli-Torc.	.....	.....	188	71	78	28.820
49.39	5221	3.55	1499	8.86	4th Gear Ampli-Torc.	.....	.....	188	74	85	28.820
42.85	1779	9.03	1505	2.41	5th Gear Ampli-Torc.	.....	.....	175	76	89	28.820
MAXIMUM POWER WITHOUT BALLAST											
51.20	4401	4.36	1502	11.31	2nd Gear.....	.....	.....	165	65	78	29.010
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—2nd Gear											
Pounds pull			4400		4350	4700	4800		4650		4150
Horsepower			53.1		47.6	45.1	39.7		33.5		25.5
Miles per hour			4.6		4.1	3.6	3.1		2.7		2.3

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 15.5-38;6;18	Two 15.5-38;6;14
Ballast	—Liquid	550 lb each	None
	—Cast iron	840 lb each	None
Front tires	—No, size, ply & psi	Two 6.00-16;6;24	Two 6.00-16;6;24
Ballast	—Liquid	None	None
	—Cast iron	35 lb each	None
Height of drawbar		16 inches	17 inches
Static weight	—Rear	7320 lb	4540 lb
	—Front	2120 lb	2050 lb
Total weight with operator		9615 lb	6765 lb

Department of Agricultural Engineering

Dates of Test: August 31 to September 10, 1960

Manufacturer: MINNEAPOLIS-MOLINE COMPANY,

HOPKINS, MINNESOTA

Manufacturer's Power Rating: Not Rated

FUEL, OIL and TIME Fuel regular gasoline Octane No Motor 84 Research 92 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.7492 Weight per gallon 6.237 lb Oil SAE 10W-30 API service classification MS, DM To motor 2.194 gal Drained from motor 2.048 gal Transmission and final-drive lubricant SAE 80 Type multi-purpose gear lube Total time engine was operated 43½ hours.

ENGINE Make Minneapolis-Moline Gasoline Type 4 cylinder vertical Serial No 16900672 Crankshaft mounted lengthwise Rated rpm 1500 Bore and stroke 4½" x 5" Compression ratio 6.5 to 1 Displacement 336 cu in Carburetor size 1¼" Ignition system battery Cranking system 12 volt electric Lubrication pressure Air cleaner oil washed wire screen Oil filter replaceable paper element Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type standard Serial No 17100742 Tread width rear 60" to 88" front 52" to 76" Wheel base 101½" Center of gravity (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 31.5" Vertical distance above roadway 34.4" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission fixed ratio operator controlled partial range power shifting Advertised speeds mph first 3.14 second 4.80 third 5.95 fourth 7.31 fifth 17.37 reverse 4.80 (using Ampli-torc) first 1.65 second 2.52 third 3.13 fourth 3.84 fifth 9.12 reverse 2.52 Clutch single plate dry disc operated by foot pedal Brakes double disc operated by two foot pedals Steering power assisted Turning radius (on concrete surface with brake applied) right 144" left 142" (on concrete surface without brake) right 158" left 155" Turning Space diameter (on concrete surface with brake applied) right 300" left 296" (on concrete surface without brake) right 330" left 322" Belt pulley 993 rpm at 1366 engine rpm diam 12" face 7" Belt speed 3120 fpm Power take-off 540 rpm at 1366 engine rpm.

REPAIRS and ADJUSTMENTS It was necessary to readjust the high idle speed during the drawbar runs.

REMARKS All test results were determined from observed data obtained in accordance with the SAE and ASAE test code.

First gear Ampli-torc drive was not run as it was necessary to limit the pull in second gear direct drive to avoid excessive wheel slippage. Fifth gear direct drive was not run as it exceeded 15 mph.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 756.

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

GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories can be disconnected only when it is convenient for the operator to do so in practice. Additional weight can be added as ballast if the manufacturer regularly supplies it for sale. The static tire loads and the inflation pressures must conform to recommendations in the Tire Standards published by the Society of Automotive Engineers.

PREPARATION FOR PERFORMANCE RUNS

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operators manual. The fuel used and the maintenance operations must also conform to the published information delivered with the tractor. The tractor is then limbered-up for 12 hours on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

The tractor is equipped with approximately the amount of added ballast that is used during maximum drawbar tests. The tire tread-bar height must be at least 65% of new tread height prior to the maximum power run.

BELT OR POWER TAKE-OFF PERFORMANCE

Maximum Power and Fuel Consumption. The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever is set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the belt pulley or the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power. The corresponding fuel consumption is measured.

Varying Power and Fuel Consumption. Six different horsepower levels are used to show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85% of the dynamometer torque at maximum power; minimum dynamometer torque, $\frac{1}{2}$ the 85% torque; maximum power; $\frac{1}{4}$ and $\frac{3}{4}$ of the 85% torque. Since a tractor is generally subjected to varying loads the average of the results in this test serve well for predicting the fuel consumption of a tractor in general usage.

DRAWBAR PERFORMANCE

All engine adjustments are the same as those used in the belt or power take-off tests. If the manufacturer specifies a different rated crankshaft speed for drawbar operations, then the position of the manually operated governor control is changed to provide the high-idle speed specified by the manufacturer in the operating instructions.

Varying Power and Fuel Consumption With Ballast. The varying power runs are made to show the effect of speed-control devices (engine governor, automatic transmissions, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree

turns with a minimum radius of 50 feet. The drawbar pull is set at 3 different levels as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum power; and (3) 50% of the pull at maximum power. Prior to 1958, fuel consumption data (10 hour test) were shown only for the pull obtained at maximum power for tractors having torque converters and at 75% of the pull obtained at maximum power for gear-type tractors.

Maximum Power with Ballast. Maximum power is measured on straight level sections of the test course. Data are shown for not more than 12 different gears or travel speeds. Some gears or travel speeds may be omitted because of high slippage of the traction members or because the travel speed may exceed the safe-limit for the test course. The maximum safe speed for the Nebraska Test Course has been set at 15 miles per hour. The slippage limits have been set at 15% and 7% for pneumatic tires and steel tracks or lugs, respectively. Higher slippage gives widely varying results.

Maximum Power Without Ballast. All added ballast is removed from the tractor. The maximum drawbar power of the tractor is determined by the same procedure used for getting maximum power with ballast. The gear (or travel speed) is the same as that used in the 10-hour test.

Varying Power and Travel Speed with Ballast. Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions; (1) maximum pull is obtained, (2) the maximum slippage limit is reached, or (3) some other operating limit is reached.

For additional information about the **Nebraska Tractor Tests** write to the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska.



Minneapolis-Moline M-5 Gasoline