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Test 757: Minneapolis-Moline M-5 (LPG)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 757 - MINNEAPOLIS - MOLINE M-5 LPG

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								
61.26*	1500	6.808	0.472	9.00	182	70	82	28.823
Standard Power Take-off Speed (540 rpm)—One Hour								
57.34	1365	6.162	0.457	9.31	184	71	84	28.835
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
55.27	1591	6.007	0.462	9.20	182	72	90	.....
0.00	1767	2.393	....	....	148	73	90	.....
28.45	1638	4.341	0.649	6.55	170	74	91	.....
60.64	1499	6.833	0.479	8.87	191	74	92	.....
14.56	1676	3.332	0.973	4.37	157	74	93	.....
41.69	1601	5.308	0.541	7.85	179	74	94	.....
Av 33.44	1629	4.702	0.598	7.11	171	73	92	28.833

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											
54.47	4458	4.58	1500	6.94	6.759	0.527	8.06	186	81	92	28.810
75% of Pull at Maximum Power—Ten Hours—2nd Gear											
43.84	3265	5.04	1613	4.87	5.924	0.574	7.40	175	70	73	28.921
50% of Pull at Maximum Power—Two Hours—2nd Gear											
30.56	2257	5.08	1602	3.46	4.812	0.669	6.35	171	81	93	28.783
MAXIMUM POWER WITH BALLAST											
49.90	6802	2.75	1495	14.46	1st Gear.....			176	68	74	28.830
54.00	4448	4.55	1497	7.49	2nd Gear.....			177	70	78	28.830
54.05	3485	5.82	1500	5.14	3rd Gear.....			165	66	69	29.000
53.98	2820	7.18	1503	5.21	4th Gear.....			178	72	80	28.820
49.03	6599	2.79	1498	13.32	3rd Gear Ampli-Torc.			176	68	74	28.820
53.28	5605	3.56	1500	9.42	4th Gear Ampli-Torc.			176	68	74	28.820
51.76	2152	9.02	1498	3.46	5th Gear Ampli-Torc.			176	74	83	28.820
MAXIMUM POWER WITHOUT BALLAST											
52.58	4442	4.44	1500	9.96	2nd Gear.....			164	64	78	28.990
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—2nd Gear											
Pounds pull	4450	4550	4650	4750	4700	4700	4600				
Horsepower	54.0	49.7	45.9	40.5	33.8	28.8	22.1				
Miles per hour	4.6	4.1	3.7	3.2	2.7	2.3	1.8				

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 commercial propane Specific gravity converted to 60°/60° 0.5103 Weight per gallon 4.25 lb Oil SAE 10W-30 API service classification MS, DM To motor 2.387 gal Drained from motor 2.097 gal Transmission and final-drive lubricant SAE 80 Type multi-purpose gear lube Total time engine was operated 40½ hours.

ENGINE Make Minneapolis-Moline LPG Type 4 cylinder vertical Serial No 16900704 Crankshaft mounted lengthwise Rated rpm 1500 Bore and stroke 4½" x 5" Compression ratio 7.9 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 Fuel filter screen Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type standard Serial No 17100746 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 wheel 31.6" Vertical distance above roadway 34.7" 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 No repairs or adjustments.

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

First and second gear Ampli-torc were not run because of the high slippage in first gear direct and third gear Ampli-torc drive. Fifth gear direct drive was not run because it exceeded 15 mph.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 757.

L. F. LARSEN
Engineer-in-Charge

L. W. HURLBUT, Chairman
G. W. STEINBRUEGGE
J. J. SULEK
Board of Tractor
Test Engineers

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	615 lb each	None
	—Cast iron	735 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	4620 lb
	—Front	2180 lb	2110 lb
Total weight with operator		9675 lb	6905 lb

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 LPG