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Test 836: Minneapolis-Moline G705 (LPG)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 836 - MINNEAPOLIS-MOLINE G705 LPG

(ALSO MASSEY-FERGUSON MF97 LPG)

The University of Nebraska Agricultural Experiment Station
E. F. Frolik, Dean; H. H. Kramer, Director, Lincoln, Nebraska

POWER TAKE-OFF PERFORMANCE

* Hp	Crankshaft speed rpm	Fuel Consumption		Hp-hr per gal	Temperature Degrees F			Barometer inches of Mercury
		Gal per hr	Lb per hp-hr		Cooling medium	Air wet bulb	Air dry bulb	

MAXIMUM POWER AND FUEL CONSUMPTION

Rated Engine Speed—Two Hours								
101.05	1600	11.522	0.485	8.77	178	59	75	28.977
Standard Power Take-off Speed (540 rpm)—One Hour								
82.12	1200	9.033	0.467	9.09	182	59	75	28.955

VARYING POWER AND FUEL CONSUMPTION—TWO HOURS

90.17	1681	9.854	0.464	9.15	180	59	75	.....
0.00	1834	3.325	.....	.....	166	59	73	.....
47.29	1762	6.791	0.610	6.96	180	59	74	.....
101.46	1601	11.541	0.483	8.79	184	60	75	.....
24.25	1807	5.111	0.896	4.74	175	59	73	.....
69.11	1716	8.273	0.509	8.35	183	59	75	.....
Av 55.38	1733	7.482	0.574	7.40	178	59	74	28.943

DRAWBAR PERFORMANCE

Hp	Drawbar pull lbs	Speed miles per hr	Crankshaft speed rpm	Slip of drivers %	Fuel Consumption		Hp-hr per gal	Temp Degrees F			Barometer inches of Mercury
					Gal per hr	Lb per hp-hr		Cooling med	Air wet bulb	Air dry bulb	

VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST

Maximum Available Power—Two Hours—3rd Gear											
90.08	6845	4.94	1600	6.31	11.412	0.538	7.89	181	55	65	28.933
75% of Pull at Maximum Power—Ten Hours—3rd Gear											
74.83	5245	5.35	1706	4.63	9.465	0.538	7.91	178	53	58	28.742
50% of Pull at Maximum Power—Two Hours—3rd Gear											
51.18	3467	5.54	1742	3.41	7.588	0.630	6.74	169	40	45	29.273

MAXIMUM POWER WITH BALLAST

83.94	11432	2.75	1626	14.76	1st Gear	.....	176	58	65	28.955
90.89	8117	4.20	1605	6.87	2nd Gear	.....	179	58	65	28.955
91.98	6954	4.96	1599	5.68	3rd Gear	.....	178	57	63	28.990
92.27	4756	7.28	1601	3.97	4th Gear	.....	179	58	65	28.955

MAXIMUM POWER WITHOUT BALLAST

66.30	5019	4.95	1722	14.62	3rd Gear	180	45	56	29.220
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VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—3rd Gear

Pounds pull	6954	7209	7434	7588	7606	7674	7375
Horsepower	91.98	85.81	78.71	69.56	59.12	50.11	39.20
Crankshaft speed rpm	1599	1444	1287	1117	947	796	646
Miles per hour	4.96	4.46	3.97	3.44	2.91	2.45	1.99
Slip of drivers %	5.68	6.01	6.28	6.54	6.54	6.54	6.41

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 23.1-26; 8; 16	Two 23.1-26; 8; 16
Ballast	—Liquid	1540 lb each	None
	Cast iron	2000 lb each	None
Front tires	—No, size, ply & psi	Two 7.50-18; 4; 24	Two 7.50-18; 4; 24
Ballast	—Liquid	None	None
	Cast iron	None	None
Height of drawbar		16½ inches	19½ inches
Static weight	—Rear	12290 lb	5210 lb
	Front	2510 lb	2600 lb
Total weight with operator		14975 lb	7985 lb

Department of Agricultural Engineering

Dates of Test: April 24 to May 1, 1963

Manufacturer: MINNEAPOLIS-MOLINE, INC.,
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 20-20W API service classification MM To motor 2.946 gal Drained from motor 2.510 gal Transmission and final-drive lubricant SAE 90 Type EP Total time engine was operated 39 hours.

ENGINE Make Minneapolis-Moline LPG Type 6 cylinder vertical Serial No 23600211 Crankshaft mounted lengthwise Rated rpm 1600 Bore and stroke 4½" x 5" Compression ratio 8.0 to 1 Displacement 504 cu in Carburetor size 1½" Ignition system battery Cranking system 12 volt electric (two 12-volt batteries) Lubrication pressure Air cleaner oil washed wire screen Oil filter two replaceable paper elements Fuel filter cotton element Muffler was used Cooling medium temperature control two thermostats.

CHASSIS Type standard Serial No 23800117 Tread width rear 72¼" front 54¼" Wheel base 96 3/16" 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 32.8" Vertical distance above roadway 35" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio Advertised speeds mph first 3.3 second 4.7 third 5.5 fourth 7.9 fifth 18.3 reverse 2.56 Clutch double disc over center operated by hand lever Brakes double disc operated by two foot pedals Steering mechanical with power assist Turning radius (on concrete surface with brake applied) right 196" left 196" (on concrete surface without brake) right 229" left 229" Turning space diameter (on concrete surface with brake applied) right 408" left 408" (on concrete surface without brake) right 474" left 474" Belt pulley 741 rpm at 1300 engine rpm diam 16" face 7" Power take-off 540 rpm at 1200 engine rpm Belt speed 3110 fpm.

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.

Fifth gear was not run as it exceeded 15 mph.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 836.

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 trans-

mission, 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 G705 LPG