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Test 863: Minneapolis-Moline U302 (LPG)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 863 - MINNEAPOLIS - MOLINE U302 LPG

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

POWER TAKE-OFF PERFORMANCE

Hp	Crank- shaft 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									
55.69	1900	5.812	0.444	9.58	170	55	75	28.890	
Standard Power Take-off Speed (540) rpm—One Hour									
48.32	1525	4.774	0.420	10.12	173	57	78	28.870	
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
49.61	1991	5.125	0.439	9.68	169	59	82	.....
0.00	2104	1.609	.....	.....	158	59	82	.....
25.31	2031	3.296	0.554	7.68	167	59	81	.....
55.11	1902	5.696	0.439	9.68	173	59	82	.....
12.88	2068	2.400	0.792	5.37	162	60	83	.....
37.36	1997	4.249	0.483	8.79	169	60	84	.....
Av	30.05	2015	3.729	0.527	8.06	166	59	82	28.850

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—Second Gear											
48.41	3492	5.20	1895	4.66	5.647	0.496	8.57	169	48	56	28.818
75% of Pull at Maximum Power—Ten Hours—Second Gear											
39.19	2651	5.54	1998	3.70	4.882	0.529	8.03	167	49	55	28.588
50% of Pull at Maximum Power—Two Hours—Second Gear											
26.77	1739	5.77	2051	2.24	3.735	0.593	7.17	164	45	50	28.820

MAXIMUM POWER WITH BALLAST

34.23	7515	1.71	2013	14.49	1st Gear	Ampli-Torc	170	58	66	28.770
46.09	6733	2.57	1901	10.76	2nd Gear	Ampli-Torc	169	58	67	28.770
47.99	5499	3.27	1906	8.90	1st Gear	.....	166	52	64	28.750
47.88	5055	3.55	1904	7.48	3rd Gear	Ampli-Torc	166	52	64	28.770
48.10	4379	4.12	1904	6.16	4th Gear	Ampli-Torc	169	52	64	28.800
49.50	3558	5.22	1904	4.79	2nd Gear	.....	168	49	58	28.820
48.33	2574	7.04	1901	3.53	3rd Gear	.....	165	52	65	28.770
48.02	2223	8.10	1904	3.10	4th Gear	.....	167	52	65	28.770
46.24	1706	10.16	1905	2.38	5th Gear	Ampli-Torc	169	52	65	28.760

MAXIMUM POWER WITHOUT BALLAST

45.52	3514	4.86	1903	12.46	2nd Gear	168	52	56	28.760
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VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST Second Gear

Pounds pull	3558	3601	3791	3856	3832	3715
Horsepower	49.50	44.72	42.23	37.43	31.68	25.54
Crankshaft speed, rpm	1904	1702	1529	1334	1136	942
Miles per hour	5.22	4.66	4.18	3.64	3.10	2.58
Slip of drivers, %	4.79	4.79	5.07	5.35	5.35	5.07

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
	—Liquid	770 lb each	None
	Cast iron	1100 lb each	None
Front tires	—No, size, ply & psi	Two 6.00-16; 4; 32	Two 6.00-16; 4; 32
	—Liquid	None	None
	Cast iron	None	None
Height of drawbar		13½ inches	15 inches
Static weight	—Rear	7300 lb	3560 lb
	Front	1910 lb	1900 lb
Total weight with operator		9385 lb	5635 lb

Department of Agricultural Engineering

Dates of Test: April 13 to April 24, 1964

Manufacturer: MINNEAPOLIS-MOLINE, INC.,
HOPKINS, MINNESOTA

Manufacturer's Power Rating: 47 Drawbar
Horsepower and 53 PTO Horsepower at 29.00
inches of mercury and 85° F.

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 1.482 gal
Drained from motor 1.189 gal Transmission and
final-drive lubricant SAE 80 Type multipurpose
lubricant Total time engine was operated 39
hours.

ENGINE Make Minneapolis-Moline LPG
Type 4 cylinder vertical Serial No 27900011
Crankshaft mounted lengthwise Rated rpm 1900
Bore and stroke 3¾ x 5" Compression ratio 9.80
to 1 Displacement 221.1 cu in Carburetor size
1¼" Ignition system battery Cranking system
12 volt electric Lubrication pressure Air cleaner
dry type with replaceable paper element Oil filter
replaceable paper element Fuel filter screen
Muffler was used Cooling medium temperature
control thermostat.

CHASSIS Type Standard Serial No 27600016
Tread width rear 56" to 88" front 52" to 76"
Wheel base 94½" Center of gravity (without
operator or ballast, with minimum tread, with
fuel tank filled and tractor serviced for operation)
Horizontal distance forward from centerline
of rear wheels 32.53" Vertical distance above
roadway 34.62" Horizontal distance from center
of rear wheel tread 0" to the right/left Hydraulic
control system direct engine drive Transmission
selective gear fixed ratio with partial range
operator controlled power shifting Advertised
speeds mph first 3.5 second 5.3 third 7.1 fourth
8.1 fifth 19.4 reverse 5.3 (using Ampli-Torc drive)
first 1.8 second 2.8 third 3.7 fourth 4.1 fifth 10.2
reverse 2.8 Clutch single plate dry disc operated
by foot pedal Brakes double disc operated by
two foot pedals which can be locked Steering
hydraulic with power assist Turning radius (on
concrete surface with brake applied) right 140"
left 133½" (on concrete surface without brake)
right 156" left 141" Turning space diameter (on
concrete surface with brake applied) right 288"
left 275" (on concrete surface without brake)
right 320" left 290" Belt pulley 1470 rpm at 1550
engine rpm diam 8¾" face 6½" Power take-off
540 rpm at 1525 engine rpm Belt speed 3220
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 863.

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 U302 LPG