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Test 862: Minneapolis-Moline U302 (Gasoline)

Nebraska Tractor Test Lab
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NEBRASKA TRACTOR TEST 862 - MINNEAPOLIS - MOLINE U302 GASOLINE

The University of Nebraska Agricultural Experiment Station
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POWER TAKE-OFF PERFORMANCE

	Hp	Crank-shaft speed rpm	Fuel Consumption Gal per hr	Fuel Consumption Lb per hp-hr	Hp-hr per gal	Temperature Degrees F Cooling medium	Temperature Degrees F Air wet bulb	Temperature Degrees F Air dry bulb	Barometer inches of Mercury
MAXIMUM POWER AND FUEL CONSUMPTION									
Rated Engine Speed—Two Hours									
	55.82	1900	4.890	0.541	11.42	168	53	75	29.060
Standard Power Take-off Speed (540) rpm—One Hour									
	48.51	1525	4.200	0.535	11.55	171	54	75	29.055
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
	49.80	1994	4.408	0.547	11.30	163	53	75	.....
	0.00	2063	1.690	.....	.....	158	53	74	.....
	25.15	2013	3.020	0.742	8.33	164	54	76	.....
	55.83	1900	4.899	0.542	11.40	171	54	75	.....
	12.76	2042	2.335	1.131	5.46	160	53	75	.....
	37.69	2011	3.700	0.607	10.19	166	53	74	.....
Av	**30.21**	**2004**	**3.342**	**0.684**	**9.04**	**164**	**53**	**75**	**29.057**

DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank-shaft speed rpm	Slip of drivers %	Fuel Consumption Gal per hr	Fuel Consumption Lb per hp-hr	Hp-hr per gal	Temp Degrees F Cool-ing med	Temp Degrees F Air wet bulb	Temp Degrees F Air dry bulb	Barom-eter inches of Mercury
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—Second Gear											
46.89	3369	5.22	1901	4.54	4.770	0.629	9.83	163	59	62	28.640
75% of Pull at Maximum Power—Ten Hours—Second Gear											
38.37	2620	5.49	1977	3.41	4.014	0.646	9.56	164	46	57	28.869
50% of Pull at Maximum Power—Two Hours—Second Gear											
26.16	1752	5.60	2001	2.77	3.410	0.805	7.67	162	53	57	28.690
MAXIMUM POWER WITH BALLAST											
33.26	7417	1.68	1995	14.83	1st	Gear Ampli-Torc		160	55	61	28.780
46.42	6848	2.54	1902	11.56	2nd	Gear Ampli-Torc		164	50	64	28.965
47.05	5360	3.29	1902	8.03	1st	Gear		165	49	62	28.950
47.17	4964	3.56	1902	7.11	3rd	Gear Ampli-Torc		165	49	62	28.950
47.34	4314	4.11	1904	6.05	4th	Gear Ampli-Torc		165	49	62	28.950
48.91	3522	5.21	1905	4.89	2nd	Gear		165	49	63	28.965
49.00	2610	7.04	1896	3.21	3rd	Gear		163	43	54	29.040
48.32	2234	8.11	1903	2.77	4th	Gear		164	43	54	29.040
45.13	1671	10.13	1895	2.12	5th	Gear Ampli-Torc		167	42	52	29.040
MAXIMUM POWER WITHOUT BALLAST											
44.31	3495	4.75	1900	14.56	2nd	Gear		158	52	55	28.870

VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST
Second Gear

Pounds pull	3522	3657	3705	3869	3912	3928	3706
Horsepower	48.91	45.38	41.18	37.39	32.21	26.92	20.26
Crankshaft speed rpm	1905	1704	1529	1333	1136	947	751
Miles per hour	5.21	4.65	4.17	3.62	3.09	2.57	2.05
Slip of drivers, %	4.89	5.10	5.37	5.51	5.64	5.64	5.37

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	783 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
Ballast	—Liquid	None	None
	Cast iron	None	None
Height of drawbar		13½ inches	15 inches
Static weight	—Rear	7235 lb	3470 lb
	Front	1835 lb	1830 lb
Total weight with operator		9245 lb	5475 lb

Department of Agricultural Engineering

Dates of Test: April 10 to April 24, 1964

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

Manufacturer's Power Rating: 47 Drawbar Horsepower and 54 PTO Horsepower at 29.00 inches of mercury and 85° F.

FUEL, OIL and TIME: Fuel Regular gasoline **Octane No Motor** 83.6 **Research** 93.0 (rating taken from oil company's typical inspection data) **Specific gravity converted to 60°/60°** 0.7423 **Weight per gallon** 6.179 lb. **Oil** SAE 10W-30 **API service classification** MS, DM **To motor** 1.565 gal **Drained from motor** 1.231 gal **Transmission and final-drive lubricant** SAE 80 Type multi-purpose lubricant **Total time engine was operated** 481½ hours.

ENGINE: Make Minneapolis-Moline **Type** 4 cylinder vertical **Serial No** 27900036 **Crankshaft mounted** lengthwise **Rated rpm** 1900 **Bore and stroke** 3¾" x 5" **Compression ratio** 7.60 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 in sediment bowl **Muffler** was used **Cooling medium temperature control** thermostat.

CHASSIS: Type standard **Serial No** 27600017 **Tread width rear** 56" to 88" **front** 52" to 76" **Wheel base** 94$^{3}/_{16}$" **Center of gravity** (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from centerline of rear wheels 32.26" Vertical distance above roadway 34.72" 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 8⅜" face 6½" **Belt speed** 3220 fpm **Power take-off** 540 rpm at 1525 engine rpm.

REPAIRS and ADJUSTMENTS Four bolts (rear wheel to hub) failed during drawbar runs.

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 862.

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 corrseponding 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, ½ the 85% torque; maximum power, ¼ and ¾ 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 transmission, 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) maxmium 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.**

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