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Test 926: Minneapolis-Moline M670 Diesel (Also M670 Super Diesel and G750 Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 926 - MINNEAPOLIS-MOLINE M670 DIESEL

(ALSO MINNEAPOLIS-MOLINE M670 SUPER DIESEL)

(ALSO MINNEAPOLIS-MOLINE G750 DIESEL)

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									
71.01	1601	5.041	0.491	14.09	185	61	75	29.022	
Standard Power Take-off Speed (540 rpm)—One Hour									
62.51	1366	4.292	0.475	14.56	189	61	75	29.007	
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
62.66	1661	4.227	0.467	14.82	172	61	75	.....
0.00	1746	1.058	.....	.....	138	60	72	.....
32.22	1710	2.566	0.551	12.56	163	59	72	.....
71.58	1600	5.059	0.489	14.15	185	61	74	.....
16.36	1736	1.786	0.756	9.160	153	60	72	.....
47.61	1683	3.308	0.481	14.39	168	59	72	.....
Av	38.41	1689	3.001	0.541	12.80	163	60	73	29.003

DRAWBAR PERFORMANCE

Hp	Draw- bar pull lbs	Speed miles per hr	Crank- shaft speed rpm	Slip of drivers %	Fuel Consumption		Temp Degrees F					Barom- eter inches of Mercury
					Gal per hr	Lb per hp-hr	Hp-hr per gal	Cool- ing med	Air wet bulb	Air dry bulb		
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST												
Maximum Available Power—Two Hours—6th Gear (2nd DD)												
64.08	5205	4.62	1597	5.71	5.074	0.548	12.63	182	34	38	29.240	
75% of Pull at Maximum Power—Ten Hours—6th Gear (2nd DD)												
50.46	3883	4.87	1661	4.37	4.064	0.557	12.42	178	40	44	29.184	
50% of Pull at Maximum Power—Two Hours—6th Gear (2nd DD)												
34.86	2581	5.06	1702	2.95	3.161	0.628	11.03	175	24	25	29.155	
MAXIMUM POWER WITH BALLAST												
57.62	9731	2.22	1617	14.77	2nd Gear (2nd AT)		180	50	53	29.090		
61.00	7950	2.88	1596	10.15	3rd Gear (1st DD)		180	51	54	29.090		
59.83	7180	3.13	1597	8.92	4th Gear (3rd AT)		180	53	56	29.090		
61.13	5878	3.90	1602	6.97	5th Gear (4th AT)		180	55	60	29.030		
62.04	5039	4.62	1599	5.78	6th Gear (2nd DD)		180	52	61	29.030		
61.88	3696	6.28	1600	3.99	7th Gear (3rd DD)		182	52	61	29.085		
60.62	2933	7.75	1604	3.10	8th Gear (4th DD)		180	52	61	29.080		
57.90	2396	9.06	1596	2.43	9th Gear (5th AT)		180	53	61	29.070		
MAXIMUM POWER WITHOUT BALLAST												
60.64	5228	4.35	1600	13.40	6th Gear (2nd DD)		180	39	45	29.000		
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—6th Gear (2nd DD)												
Pounds pull				5039	5182	5147	5268	5022	4606			
Horsepower				62.04	57.19	50.83	45.43	36.92	28.45			
Crankshaft speed, rpm				1599	1436	1287	1124	955	799			
Miles per hour				4.62	4.14	3.70	3.23	2.76	2.32			
Slip of drivers, %				5.78	5.99	6.13	6.27	5.71	5.71			

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 18.4-34; 6; 16	Two 18.4-34; 6; 16
	—Liquid	1068 lb each	None
	—Cast iron	1280 lb each	None
Front tires	—No, size, ply & psi	Two 6.00-16; 6; 48	Two 6.00-16; 6; 48
	—Liquid	None	None
	—Cast iron	118 lb each	None
Height of drawbar		19½ inches	21½ inches
Static weight	—Rear	9875 lb	5180 lb
	—Front	2455 lb	2220 lb
Total weight with operator		12505 lb	7575 lb

Department of Agricultural Engineering

Dates of Test: NOVEMBER 4 TO NOVEMBER 10, 1965

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

FUEL, OIL and TIME Fuel No 2 diesel Cetane No 57.0 (rating taken from oil company's typical inspection data) **Specific gravity** converted to 60°/60° 0.8312 **Weight per gallon** 6.920 lb **Oil SAE 30 API service classification** DS **To motor** 2.185 gal **Drained from motor** 1.949 gal **Transmission and final-drive lubricant** SAE 80 multi-purpose **Total time engine was operated** 41 hours.

ENGINE Make Minneapolis-Moline Diesel Type 4 cylinder vertical **Serial No** 29600599 **Crankshaft mounted lengthwise** **Rated rpm** 1600 **Bore and stroke** 4½" x 5" **Compression ratio** 14.3 to 1 **Displacement** 336 cu in **Cranking system** 12 volt electric **Lubrication** pressure **Air cleaner** dry type with replaceable paper element **Oil filter** replaceable pleated paper element **Fuel filter** two parallel flow filters with replaceable pleated paper cartridges **Muffler** was used **Cooling medium temperature control** thermostat.

CHASSIS Type standard **Serial No** 30000441 **Tread width** rear 60" to 98" 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 centerline of rear wheels 30.6" Vertical distance above roadway 34.5" 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 powershifting **Advertised speeds mph** first 1.6 second 2.5 third 3.1 fourth 3.3 fifth 4.1 sixth 4.7 seventh 6.3 eighth 7.7 ninth 9.0 tenth 17.2 reverse 2.5 and 4.7 **Clutch** single plate dry disc operated by foot pedal **Brakes** double disc operated by two foot pedals which can be locked **Steering** mechanical with power assist **Turning radius** (on concrete surface with brake applied) right 145" left 143" (on concrete surface without brake) right 159" left 156" **Turning space diameter** (on concrete surface with brake applied) right 302" left 298" (on concrete surface without brake) right 332" left 325" **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 gear was not run as it was necessary to limit the pull in second gear to avoid excessive wheel slippage. Tenth 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 926.

L. F. LARSEN

Engineer-in-Charge

G. W. STEINBRUEGGE, Chairman

J. J. SULEK

D. E. LANE

Board of Tractor Test Engineers

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

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, $\frac{1}{2}$ of 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 M670 Diesel