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## Test 835: Minneapolis-Moline G705 (Diesel)

Nebraska Tractor Test Lab

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# NEBRASKA TRACTOR TEST 835 - MINNEAPOLIS-MOLINE G705 DIESEL

(ALSO MASSEY-FERGUSON MF97 DIESEL)

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								
101.01	1600	7.409	0.506	13.63	184	56	75	28.790
Standard Power Take-off Speed (540 rpm)—One Hour								
81.47	1200	5.741	0.486	14.19	183	56	75	28.835
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
89.54	1669	6.202	0.478	14.44	171	56	76	.....
0.00	1773	1.744	.....	.....	141	55	73	.....
46.28	1724	3.723	0.555	12.43	167	55	73	.....
101.53	1600	7.446	0.506	13.64	184	55	75	.....
23.42	1746	2.692	0.793	8.70	155	55	73	.....
68.37	1699	4.819	0.486	14.19	173	55	74	.....
Av 54.86	1702	4.438	0.558	12.36	165	55	74	28.893

## DRAWBAR PERFORMANCE

Hp	Draw- bar pull lbs	Speed miles per hr	Crank- shaft speed rpm	Slip of drivers %	Fuel Consumption			Temp Degrees F			Barometer 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—3rd Gear											
90.80	6899	4.94	1598	5.98	7.350	0.558	12.35	176	46	58	29.070
75% of Pull at Maximum Power—Ten Hours—3rd Gear											
73.50	5258	5.24	1671	4.25	5.818	0.546	12.63	178	45	53	28.987
50% of Pull at Maximum Power—Two Hours—3rd Gear											
50.94	3537	5.40	1700	2.53	4.370	0.592	11.66	175	48	52	28.983
MAXIMUM POWER WITH BALLAST											
84.19	11345	2.78	1632	14.35	1st Gear .....			175	41	50	29.165
92.45	8313	4.17	1603	7.32	2nd Gear .....			178	43	54	29.120
93.01	7066	4.94	1602	6.27	3rd Gear .....			178	41	50	29.155
92.85	4804	7.25	1601	4.18	4th Gear .....			178	43	54	29.120
MAXIMUM POWER WITHOUT BALLAST											
67.17	5218	4.83	1682	14.74	3rd Gear .....			183	38	41	29.225
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—3rd Gear											
Pounds pull			7066	7370	7698	7779	7640	7349			
Horsepower			93.01	87.17	80.60	70.95	59.62	47.77			
Crankshaft speed rpm			1602	1444	1282	1117	955	793			
Miles per hour			4.94	4.44	3.93	3.42	2.93	2.44			
Slip of drivers %			6.27	6.54	6.67	6.54	6.54	6.67			

## 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	1530 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	None	None
	Cast iron	None	None
Height of drawbar		16½ inches	19½ inches
Static weight	—Rear	12340 lb	5280 lb
	Front	2595 lb	2700 lb
Total weight with operator		15110 lb	8155 lb

Department of Agricultural Engineering

Dates of Test: April 19 to April 30, 1963

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

Manufacturer's Power Rating: Not rated

**FUEL, OIL and TIME** Fuel No 2 Diesel Cetane No 56.7 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8285 Weight per gallon 6.898 lb Oil SAE 20-20W API service classification MS, DM To motor 3.642 gal Drained from motor 2.613 gal Transmission and final-drive lubricant SAE 90 Type EP Total time engine was operated 41½ hours.

**ENGINE** Make Minneapolis-Moline Diesel Type 6 cylinder vertical Serial No 23700186 Crankshaft mounted lengthwise Rated rpm 1600 Bore and stroke 4½" x 5" Compression ratio 14.8 to 1 Displacement 504 cu in in Cranking system 12 volt electric (three 12 volt batteries) Lubrication pressure Air cleaner oil washed wire screen Oil filter two replaceable pleated paper elements Fuel filter primary filter with replaceable cotton element and secondary filter with replaceable paper element Muffler was used Cooling medium temperature control two thermostats.

**CHASSIS** Type standard Serial No 23900101 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 835.

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 Diesel