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Test 690: Massey-Ferguson Model TO-35 (Diesel)

Nebraska Tractor Test Lab

University of Nebraska-Lincoln, tractortestlab@unl.edu

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NEBRASKA TRACTOR TEST 690 - MASSY-FERGUSON TO-35 DIESEL

The University of Nebraska Agricultural Experiment Station

W. V. Lambert, 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								
32.93	2000	2.249	0.479	14.64	194	58	76	29.003	
Standard Power Take-off Speed (540 rpm)—One Hour									
26.50	1501	1.698	0.449	15.61	193	54	74	29.033	
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS									
25.41	2059	1.836	0.506	13.84	173	54	75	.....
1.15	2089	1.263	7.696	0.91	150	53	71	.....
12.87	2086	1.421	0.774	9.06	165	55	76	.....
33.37	2003	2.264	0.476	14.74	191	56	76	.....
6.45	2090	1.288	1.400	5.01	151	53	70	.....
19.21	2075	1.584	0.578	12.13	167	54	72	.....
Av	16.41	2057	1.609	0.687	10.20	166	54	73	29.142

DRAWBAR PERFORMANCE

Hp	Draw- bar pull lbs	Speed miles per hr	Crank shaft speed rpm	% Slip of drive wheels	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temp. Degrees F Cool- ing med	Air wet bulb	Air dry bulb	Barometer inches of mercury
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—4th Gear											
30.49	2282	5.01	1984	6.44	2.313	0.532	13.18	157	40	45	29.243
75% of Pull at Maximum Power—Ten Hours—4th Gear											
24.00	1710	5.26	2058	5.29	1.957	0.572	12.26	162	38	41	29.235
50% of Pull at Maximum Power—Two Hours—4th Gear											
16.62	1148	5.43	2079	3.20	1.602	0.675	10.37	158	36	40	29.230
MAXIMUM POWER WITH BALLAST											
18.64	3877	1.80	2077	14.24	2nd Gear	.....	169	32	36		29.265
29.29	3338	3.29	1999	11.22	3rd Gear	.....	175	32	36		29.265
30.49	2283	5.01	2000	7.25	4th Gear	.....	172	32	36		29.265
30.55	1488	7.70	1999	4.78	5th Gear	.....	171	34	38		29.275
26.71	691	14.49	2003	2.22	6th Gear	.....	176	34	38		29.275
MAXIMUM POWER WITHOUT BALLAST											
30.08	2332	4.84	1995	10.58	4th Gear	.....	174	40	50		29.240
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear											
Pounds pull			2300	2500	2500	2500	2500	2500	2350		
Horsepower			30.5	30.0	26.7	23.3	20.0	15.7			
Miles per hour			5.0	4.5	4.0	3.5	3.0	2.5			

Department of Agricultural Engineering
 Dates of Test: April 3 to April 13, 1959
 Manufacturer: MASSEY-FERGUSON INC. DETROIT, MICHIGAN
 Manufacturer's Power Rating: Not Rated

FUEL, OIL and TIME Fuel No 2 Diesel Cetane No 51 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8418 Weight per gallon 7.009 lb Oil SAE 20-20W API service classification MS and DG To motor 1.754 gal Drained from motor 1.423 gal Transmission and final-drive lubricant SAE No 90 Type straight mineral transmission oil Total time motor was operated 51½ hours.

ENGINE Make Standard Motor 23-C Diesel Type 4 cylinder vertical Serial No SJ70122E Crankshaft mounted lengthwise Rated rpm 2000 Lubrication pressure Bore and stroke 3⁵/₁₆" x 4" Compression ratio 20.0 to 1 Displacement 137.8 cu in Cranking system 12 volts (2-6 volt batteries) Air cleaner Circulating oil bath Muffler was used Oil filter replaceable waste pack element Fuel filter one replaceable treated paper element and one replaceable waste pack element Cooling medium temperature control thermostat.

CHASSIS Type Standard Serial No SDM 183757 Tread width rear 48" to 76" front 48" to 80" Wheel base 72" 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 29" Vertical distance above roadway 26¼" Horizontal distance from center of rear wheel tread 0" to the right or left Hydraulic control system constant running-transmission driven Advertised speeds mph first 1.33 second 1.99 third 3.64 fourth 5.32 fifth 7.96 sixth 14.57 reverse 1.77 and 7.09 Belt pulley diam 9" face 6½" rpm 1356 Belt speed 1940 fpm Clutch dual dry disc operated by single foot pedal Brakes expanding double shoe operated by two independent foot pedals Power take-off 540 rpm at 1500 engine rpm Steering no power assistance Turning radius (on concrete surface with brake applied) right 108" left 108" (on concrete surface without brake) right 118" left 118" Turning space diameter (on concrete surface with brake applied) right 223" left 223" (on concrete surface without brake) right 241" left 241".

REPAIRS AND ADJUSTMENTS No repairs or adjustments.

REMARKS All test results were determined from observed data obtained in accordance with 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.

We, the undersigned, certify that this is a true and correct report of official Tractor Test No 690.

L. F. LARSEN
 Engineer-in-Charge

L. W. HURLBUT
 G. W. STEINBRUEGGE
 J. J. SULEK
 Board of Tractor
 Test Engineers

TIRES, BALLAST and WEIGHT		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 11-28;4;14	Two 11-28;4;12
Ballast	—Liquid	395 lb each	None
	—Cast iron	540 lb each	None
Front tires	—No, size, ply & psi	Two 6.00-16;4;28	Two 6.00-16;4;28
Ballast	—Liquid	60 lb each	None
	—Cast iron	110 lb each	None
Height of drawbar		20 inches	20½ inches
Static weight	—Rear	3900 lb	2030 lb
	—Front	1700 lb	1360 lb
Total weight with operator		5775 lb	3565 lb

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 transmissions, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree

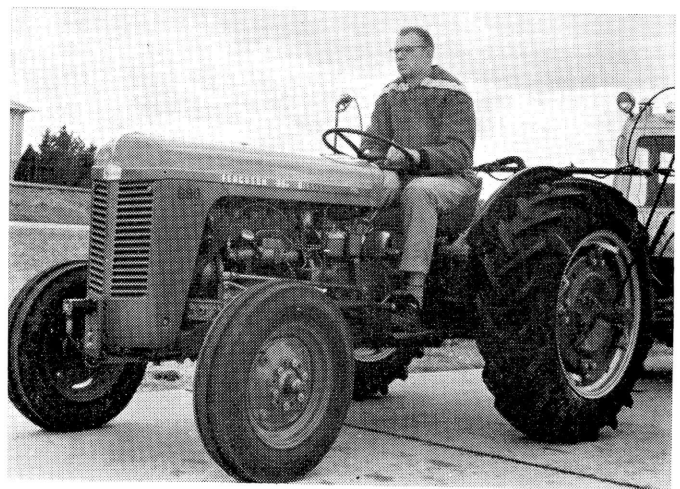
turns with a minimum radius of 50 feet. The drawbar pull is set at 3 different levels as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum 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.



Massey-Ferguson TO-35 Diesel