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Test 710: Caterpillar Model D-7 (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST NO. 710 - CATERPILLAR D-7 DIESEL

The University of Nebraska Agricultural Experiment Station

W. V. Lambert, Director, Lincoln, Nebraska

DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank shaft speed rpm	% Slip of drive wheels	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—2nd Gear											
109.79	18959	2.17	1199	2.60	8.252	0.527	13.30	167	62	73	29.060
75% of Pull at Maximum Power—Ten Hours—2nd Gear											
91.40	14888	2.30	1251	1.19	7.405	0.568	12.34	164	65	76	28.970
50% of Pull at Maximum Power—Two Hours—2nd Gear											
60.59	9632	2.36	1274	0.69	5.329	0.617	11.37	162	62	70	29.063
MAXIMUM POWER WITH BALLAST											
107.70	28274	1.43	1203	6.60	1st Gear			164	63	73	29.010
114.60	19594	2.19	1203	2.28	2nd Gear			166	63	77	29.050
115.07	13615	3.17	1201	1.11	3rd Gear			167	63	76	29.040
108.83	8954	4.56	1200	0.73	4th Gear			167	63	74	29.020
104.85	6602	5.96	1206	0.83	5th Gear			167	63	74	29.020
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—2nd Gear											
Pounds pull			19600	21150	22250	22400	22550	21700			20650
Horsepower			114.6	112.8	100.9	95.6	90.2	75.2			60.6
Miles per hour			2.2	2.0	1.7	1.6	1.5	1.3			1.1

Department of Agricultural Engineering

Dates of Test: August 3 to August 11, 1959

Manufacturer: CATERPILLAR TRACTOR COMPANY, PEORIA, ILLINOIS

Manufacturer's Power Rating: 112 drawbar horsepower (corrected to standard conditions)

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 30 API service classification DS To motor 5.518 gal Drained from motor 4.980 gal Transmission and final-drive lubricant SAE No 90 Type straight mineral oil Total time motor was operated 38½ hours.

ENGINE Make Caterpillar Diesel Type 4 cylinder vertical with turbocharger Serial No 17A12730 Crankshaft mounted lengthwise Rated rpm 1200 Lubrication pressure Bore and stroke 5¼" x 8" Compression ratio 15.7 to 1 Displacement 831 cu in Air cleaner dry type replaceable paper element Muffler not used Oil filter two replaceable paper elements Fuel filter one primary screen filter and one secondary replaceable paper element Cooling medium temperature control thermostat.

STARTING ENGINE Make Caterpillar Type 2 cylinder vertical Mounted left side of diesel engine Mfg rating 25 H.P. at 2700 rpm Bore and stroke 3½" x 4" Ignition system magneto Air cleaner oil washed wire mesh Starting system 12 volt electric.

CHASSIS Type tracklayer Serial No 17A12730 Tread width 74" Wheel base 94½" Drawbar height 18" Measured length of track 24.7 ft Cleats integral with shoes Cleats per track 37 Size of cleats 20" x 2½" 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 49" Vertical distance above roadway 30" Horizontal distance from center of rear wheel tread 0.3" to the left Cable control system direct engine drive Advertised speeds mph first 1.5 second 2.2 third 3.2 fourth 4.6 fifth 5.9 reverse first 1.8 second 2.6 third 3.8 fourth 5.4 Clutch oil type two plates over center operated by hand lever Brakes contracting bands operated by two foot pedals one of which can be locked Steering hand levers controlling multiple disc clutch with hydraulic booster Turning space diameter (with brake applied) right 231" left 231".

Total weight with operator 32,035 pounds including crankcase guards 510 lbs, track roller guards 550 lbs, front pull hook 48 lbs, push plate 985 lbs, electrical system 175 lbs, and cable control system 1890 lbs.

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.

We, the undersigned, certify that this is a true and correct report of official Tractor Test No 710.

L. F. LARSEN

Engineer-in-Charge

L. W. HURLBUT
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 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.



Caterpillar D-7 Diesel