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Test 584: Caterpillar D-9

Nebraska Tractor Test Lab

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Department of Agricultural Engineering

Dates of test: July 31, 1956 to August 4, 1956

Manufacturer: CATERPILLAR TRACTOR COMPANY, PEORIA, ILLINOIS

Manufacturer's rating: 230 maximum drawbar horsepower (corrected to standard conditions)

NEBRASKA TRACTOR TEST NO. 584

CATERPILLAR D-9

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lbs	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption			Temp. Deg. F.			Barometer inches of mercury
					Gal per hr	Hp-hr per gal	Lb per hp-hr	Cool- ing med	Air wet bulb	Air dry bulb	
TEST H—RATED LOAD—TEN HOURS—2nd Gear											
206.84	36521	2.12	1239	1.44	15.293	13.53	0.520	179	75	94	28.810
TEST F & G—100% MAXIMUM LOAD											
242.02	56724	1.60	1241	5.66	1st	Gear.....		170	73	91	28.865
252.33	44817	2.11	1240	2.54	2nd	Gear.....		168	78	95	28.870
252.20	31899	2.96	1240	1.15	3rd	Gear.....		171	77	93	28.810
247.16	23607	3.93	1241	0.78	4th	Gear.....		174	78	90	28.810
237.30	17777	5.01	1241	0.59	5th	Gear.....		174	78	90	28.820
210.65	11351	6.96	1241	0.59	6th	Gear.....		172	78	90	28.800

FUEL, OIL, WATER and TIME Fuel Diesel Cetane No. 50 (rating taken from oil company's typical inspection data) Weight per gallon 7.028 lb Oil SAE 30 To motor 9.648 gal Drained from motor 7.619 gal Water used none Total time motor was operated 32 hours.

CHASSIS TYPE Tracklayer Serial No. 18A915 Tread width 90" Wheel base 129 3/4" Measured length of track 387" Cleats integral with shoes Cleat per track 43 Size of cleats 27" x 2 11/16" Advertised speeds mph first 1.7 second 2.2 third 3.0 fourth 3.9 fifth 5.0 sixth 7.0 Reverse first 1.7 second 2.2 third 3.0 fourth 3.9 fifth 5.0 sixth 7.0 Clutch oil type 4 plates over center operated by hand lever with hydraulic booster Seat upholstered and adjustable Brakes air cooled contracting bands operated by two foot pedals which can be locked with hydraulic booster Steering hand levers controlling multiple disc clutches with hydraulic booster Drawbar height 21".

ENGINE Make Caterpillar Type 6 cylinder vertical diesel with turbocharger Serial No. 18A915 Crankshaft mounted lengthwise Head I Lubrication pressure Bore and stroke 6 1/4" x 8" Rated rpm 1240 Compression ratio 15.5 to 1 Displacement 1473 cu. in. Port diameter valves inlet 2.281" exhaust 2.125" Governor variable speed centrifugal Air cleaner oil bath wire screen with precleaner Muffler not used Oil filter replaceable paper element Fuel filter two replaceable paper elements 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 3 3/8" x 4" Ignition system magneto Air cleaner oil wash wire mesh Starting system 6 volt electric.

TOTAL WEIGHT AS TESTED (with operator) 66,025 pounds.

REPAIRS AND ADJUSTMENTS During test A the engine temperature gauge was replaced.

REMARKS All test results were determined from observed data and without allowances, additions or deductions. Test F was made with fuel pump setting, selected by the manufacturer to develop approximately 270 corrected maximum drawbar horsepower and data from this test were used in determining the horsepower to be developed in test H. No belt tests were made on this tractor due to the limited capacity of the dynamometer.

HORSEPOWER SUMMARY

	Drawbar
1. Sea level (calculated) maximum horsepower (based on 60°F and 29.92" Hg)	270.17
2. Observed maximum horsepower (test F)	252.33
3. Seventy-five per cent of calculated maximum drawbar horsepower (ASAE and SAE ratings)	202.63

We, the undersigned certify that this is a true and correct report of official Tractor Test No. 584.

L. F. LARSEN
Engineer-in-Charge

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

EXPLANATION OF TEST REPORT

TEST A: The manufacturer's representative operates the tractor for a minimum of 12 hours using light to heavy drawbar loads in each gear.

This serves as a period for limber up, general observation and adjustments. Adjustments that are permissible include valve tappet clearance, breaker point gap, spark plug gaps, clutch and others of a similar nature. No new parts or accessories can be installed without having mention made of it in the report.

No data are recorded during this preliminary run except the time that the engine is operated.

BELT HORSEPOWER TESTS

TEST B: The throttle valve is wide open and the belt load on the dynamometer is adjusted so that the engine is at the rated speed recommended by the manufacturer. Carburetor, ignition timing and manifold adjustments are all set for maximum engine power.

This test is designed to determine maximum belt horsepower of the tractor at rated speed and to measure fuel consumption at the maximum power on the belt.

TEST C: For tractors with carburetors the best fuel economy does not always occur when the engine develops maximum power at rated speed. Test C is intended to allow the manufacturer's representative to select a more economical fuel setting even though there is a slight loss of power. *This more practical carburetor setting is used in all later tests except test F.* The throttle valve is wide open and load adjusted to give rated rpm. Tests B and C are the same for diesel tractors which have an altogether different fuel system.

TEST D: The throttle control lever is set so that the governor will maintain rated engine speed when rated load is applied. Rated load is 85% of 100% maximum, as obtained in test B, corrected to standard conditions.

This rating is somewhat less than the maximum belt horsepower in order that the operator may have a certain amount of reserve.

TEST E:

Varying load serves to show the range of engine speeds when the engine is controlled by the governor during the following varied loads, of 20 minutes each; rated load, no load, $\frac{1}{2}$ rated load, maximum load at wide open throttle valve, $\frac{1}{4}$ and $\frac{3}{4}$ rated load.

The average result of this test shows the average power and fuel consumption. Since the average tractor is subjected to varying loads, these data serve well in predicting fuel consumption and efficiency of a tractor in general use.

TEST L: This torque test is run with wide open throttle. Loads are applied to reduce engine speed in approximately ten 5% increments. Rated speed equals 100%. The corresponding dynamometer torque is recorded as a per cent of torque at rated speed.

DRAWBAR HORSEPOWER TESTS

In all drawbar tests the pull exerted by the tractor is transmitted by a hydraulic pressure cylinder to a recording instru-

ment in the test car. When rubber tires are used, all tests are made on the concrete test course. All crawler type tractors are tested on a dirt test course which is maintained by grading, sprinkling and rolling so that it remains very nearly the same throughout the season. The same tires, wheels and weights are used for all tests except J and K.

TEST F: A drawbar test, the results of which are used to determine the rated drawbar horsepower in test H. The carburetor is set to develop maximum power as in test B. The rated gear recommended by manufacturer as plow gear is used in this test. The drawbar load is adjusted to give rated engine speed.

TEST G: Maximum drawbar horsepower is determined in each gear when the carburetor is set for fuel economy as in test C. The throttle valve is held wide open and the load is applied so that the engine runs at rated engine speed.

When operating in low gear it is not uncommon for the tractor to develop less drawbar horsepower than in rated gear because of excessive wheel slippage. When excessive wheel slippage occurs the load is reduced until slippage approaches 16%. When the load is reduced it is necessary to operate the tractor engine at part throttle and control engine speed by governor action.

TEST H: Intended to test the ability of the tractor to run continuously for 10 hours at rated drawbar horsepower and to determine the fuel consumption during that time. Rated drawbar horsepower is 75% of 100% maximum drawbar horsepower (Test F), corrected to standard conditions.

When operating at rated load the throttle control lever is set to maintain rated engine speed. This rating is less than maximum drawbar horsepower in order that the operator may have a certain amount of reserve.

TEST J: The tractor is operated in rated gear with all added weight removed. This test shows the effect of the removal of added weight on the performance of the tractor when compared with test G.

Removal of wheel weights generally increases wheel slippage and decreases drawbar horsepower.

TEST K: Similar to test J except that the smallest tires and lightest wheels offered by the manufacturer are used.

