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Test 582: Caterpiller D-7

Nebraska Tractor Test Lab
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University of Nebraska College of Agriculture
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Department of Agricultural Engineering
Dates of test: July 23, 1956 to August 6, 1956
Manufacturer: CATERPILLAR TRACTOR COMPANY, PEORIA, ILLINOIS
Manufacturer's rating: 102 maximum drawbar horsepower (corrected to standard conditions)

NEBRASKA TRACTOR TEST NO. 582

CATERPILLAR D-7

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** 5.552 gal **Drained from motor** 3.796 gal **Water used** none **Total time motor was operated** 56 hours.

CHASSIS TYPE Tracklayer **Serial No.** 17A3337 **Tread width** 74" **Wheel base** 94⅜" **Measured length of track** 296" **Cleats** integral with shoes **Cleats per track** 37 **Size of cleats** 20" x 2⅜" **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 **Belt pulley diam** 17⅞" **Face** 15" **rpm** 831 **Belt speed** 3834 fpm **Belt** flat **Length** 49' **Width** 14" **Thickness** 0.248" **Maximum slip** 1.06% **Clutch** oil type two plates over center operated by hand lever **Seat** upholstered **Brakes** contracting bands operated by two foot pedals one of which can be locked **Steering** hand levers controlling multiple disc clutch with hydraulic booster **Drawbar height** 18".

ENGINE **Make** Caterpillar Diesel **Type** 4 cylinder vertical **Serial No.** 17A3337 **Crankshaft mounted** lengthwise **Head** I **Lubrication** pressure **Bore and stroke** 5¾" x 8" **Rated rpm** 1200 **Compression ratio** 15.7 to 1 **Displacement** 831 cu. in. **Port diameter valves** inlet 2.093" exhaust 1.940" **Governor** variable speed centrifugal **Air cleaner** oil washed wire mesh with precleaner **Muffler** not used **Oil filter** replaceable paper element **Fuel filter** one replaceable paper element **Cooling medium temperature control** thermostat.

STARTING ENGINE **Make** Caterpillar **Type** 2 cylinder vertical **Mounted** left side diesel engine **Mfg rating** 25 H.P. at 2700 rpm **Bore and stroke** 3⅜" x 4" **Ignition system** magneto **Air cleaner** oil washed wire mesh **Starting system** 6 volt electric.

TOTAL WEIGHT AS TESTED (with operator) 30460 lbs.

REPAIRS AND ADJUSTMENTS Adjusted tracks by loosening during drawbar tests.

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 108 corrected maximum drawbar horsepower and data from this test were used in determining the horsepower to be developed in tests D and H respectively. Tests B, C, D, E, G, H, & L were made with the same setting.

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption: Gal per hr	Fuel Consumption: Hp-hr per gal	Fuel Consumption: Lb per hp-hr	Temp. Deg. F.: Cooling medium	Temp. Deg. F.: Air wet bulb	Temp. Deg. F.: Air dry bulb	Barometer inches of mercury
TEST B & C—MAXIMUM LOAD—TWO HOURS								
121.70	1200	9.747	12.49	0.563	187	76	86	28.858
TEST D—RATED LOAD—ONE HOUR								
110.40	1200	7.173	15.39	0.457	169	75	84	28.840
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)								
110.76	1200	7.163	15.46	0.454	167	75	84	.....
2.79	1288	2.109	1.32	5.312	151	76	86	.....
57.83	1255	4.316	13.40	0.524	155	75	83	.....
122.19	1160	9.207	13.27	0.530	173	73	79	.....
29.41	1273	3.159	9.31	0.755	152	73	78	.....
85.23	1236	5.519	15.44	0.455	154	74	80	.....
68.04	1235	5.245	12.97	0.542	158	74	82	28.853

TEST L—OPERATING MAXIMUM TORQUE

% of rated rpm (engine)	100	95	90	85	80	75	69	65	60	55
% of rated-speed torque	100	102	103	105	106	108	108	107	108	108

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lbs	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption: Gal per hr	Fuel Consumption: Hp-hr per gal	Fuel Consumption: Lb per hp-hr	Temp. Deg. F.: Cooling med	Temp. Deg. F.: Air wet bulb	Temp. Deg. F.: Air dry bulb	Barometer inches of mercury
TEST H—RATED LOAD—TEN HOURS—2nd Gear											
83.28	14173	2.20	1201	1.04	6.853	12.15	0.578	176	70	89	28.838
TEST F & G—100% MAXIMUM LOAD											
101.81	26289	1.45	1206	5.31	1st Gear.....			166	71	81	28.863
103.65	17834	2.18	1199	2.08	2nd Gear.....			166	69	75	28.880
100.67	11912	3.17	1201	0.67	3rd Gear.....			169	73	87	28.860
91.96	7575	4.55	1200	0.34	4th Gear.....			176	72	87	28.860
83.34	5291	5.91	1199	0.40	5th Gear.....			178	72	89	28.865

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated maximum horsepower (based on 60°F and 29.92" Hg)	108.92	129.29
2. Observed maximum horsepower (tests F and B)	103.65	121.70
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	81.69	109.90

We, the undersigned certify that this is a true and correct report of official Tractor Test No. 582.

L. F. LARSEN
Engineer-in-Charge

L. W. HURLBUT
G. W. STEINBRUEGGE
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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 permissable 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 econonmy 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, ½ rated load, maximum load at wide open throttle valve, ¼ and ¾ 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 instrument 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 lighest wheels offered by the manufacturer are used.