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8-16-1956

Test 586: International TD-9

Nebraska Tractor Test Lab

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The Experiment Station
University of Nebraska College of Agriculture
W. V. Lambert, Director, Lincoln, Nebraska

Department of Agricultural Engineering
Dates of test: August 16, 1956 to August 21, 1956
Manufacturer: INTERNATIONAL HARVESTER COMPANY, MELROSE PARK, ILLINOIS
Manufacturer's rating: 54.5 maximum drawbar horsepower and 62.0 maximum belt horsepower (corrected to standard conditions)

NEBRASKA TRACTOR TEST NO. 586

INTERNATIONAL TD-9

BELT HORSEPOWER TESTS

BEST TORQUE-POWER TESTS											
Hp	Crank shaft speed rpm	Fuel Consumption			Temp. Deg. F.			Barometer inches of mercury			
		Gal per hr	Hp-hr per gal	Lb per hp-hr	Cooling medium	Air wet bulb	Air dry bulb				
TESTS B & C—100% MAXIMUM LOAD—TWO HOURS											
62.69	1550	4.311	14.54	0.483	187	55	59	29.070			
TEST D—RATED LOAD—ONE HOUR											
55.00	1550	3.798	14.48	0.485	188	53	56	29.078			
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)											
54.76	1550	3.799	14.41	0.488	189	53	57			
1.45	1642	1.383	1.05	6.703	164	53	56			
28.47	1603	2.553	11.15	0.630	179	52	55			
63.59	1506	4.256	14.94	0.470	188	53	56			
14.54	1632	1.912	7.605	0.924	172	53	56			
+2.01	1579	3.129	13.43	0.523	186	54	57			
34.14	1585	2.839	12.03	0.584	179	53	56	29.088			
TEST L—OPERATING MAXIMUM TORQUE											
% of rated rpm (engine)		100	95	90	85	80	75	69	65	60	55
% of rated-speed torque		100	105	105	106	108	113	112	112	110	107

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											
42.67	6676	2.40	1551	3.17	3.638	11.73	0.599	198	77	91	28.707
TESTS F & G—100% MAXIMUM LOAD											
49.86	11720	1.60	1551	8.63	1st	Gear		195	65	78	28.810
52.79	8404	2.36	1550	4.76	2nd	Gear		184	69	76	28.755
50.59	5721	3.32	1551	2.63	3rd	Gear		194	72	79	28.740
48.85	4278	4.28	1550	1.74	4th	Gear		199	73	81	28.740
44.92	2864	5.88	1547	0.86	5th	Gear		186	74	82	28.735

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 20 To motor 2.661 gal Drained from motor 2.214 gal Water used none Total time motor was operated 42 hours.

CHASSIS TYPE Tracklayer Serial No. TD91-61220 Tread width 60" Wheel base 63" Measured length of track 214½" Cleats integral with shoes Cleats per track 33 Size of cleats 18" x 2 7/64" Advertised speeds mph first 1.7 second 2.5 third 3.4 fourth 4.3 fifth 5.9 reverse 1.9 Belt pulley diam 11" Face 8½" rpm 878 Belt speed 2528 fpm Belt flat Length 75' Width 8" Thickness 0.216" Maximum slip 0.87% Clutch single plate over center operated by hand lever Seat upholstered Brakes contracting bands operated by two foot pedals which can be locked Steering two hand levers controlling multiple disc clutches Drawbar height 13¾".

ENGINE Make International Type 4 cylinder vertical Diesel Serial No. TD91-M1705 Crankshaft mounted lengthwise Head I Lubrication pressure Bore and stroke 4½" x 5½" Rated rpm 1550 Compression ratio 15.64 to 1 Displacement 350 cu. in. Port diameter valves inlet 1 21/32" exhaust 1 15/32" Governor variable speed centrifugal Carburetor size ¾" (for starting only) Ignition system 12 volt battery (for starting only) Starting system 12 volt Air cleaner oil bath wire packed Muffler was used Oil filter one replaceable radial fin paper element Fuel filter replaceable radial fin paper element in both auxiliary and final filters Cooling medium temperature control thermostat and shutter.

TOTAL WEIGHT AS TESTED (with operator) 12830 lbs.

REPAIRS AND ADJUSTMENTS During test F and G fan belt was tightened. During test H the fuel filter was replaced with a new one.

REMARKS All test results were determined from observed data and without allowances, additions or deductions. Tests B and F were made with fuel pump set by manufacturer to develop approximately 55 corrected maximum drawbar horsepower and data from these tests were used in determining the horsepower to be developed in tests D and H, respectively. Tests C, D, E, G, H, and L were made with the same setting.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60°F and 29.92" Hg)	55.77	64.46
2. Observed maximum horsepower (tests F and B)	52.79	62.69
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	41.83	54.79

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 586.

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.

