11-1955

Test 569: Ford 960

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: November 7 to November 15, 1955
Manufacturer: FORD MOTOR COMPANY, BIRMINGHAM, MICHIGAN
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 569

FORD 960

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption: Gal per hour	Fuel Consumption: Hp-hr per gal	Fuel Consumption: Lb per hp-hour	Water used gal per hour	Temp Deg F: Cooling med	Temp Deg F: Air	Barometer inches of mercury
TEST B—100% MAXIMUM LOAD—TWO HOURS								
46.27	2200	4.102	11.28	0.540	0.00	180	45	29.180
TEST C—OPERATING MAXIMUM LOAD—ONE HOUR								
44.11	2200	3.731	11.82	0.515	0.00	183	50	29.170
TEST D——RATED LOAD—ONE HOUR								
39.86	2200	3.543	11.25	0.542	0.00	169	52	29.170
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)								
39.55	2200	3.520	11.24	0.542	...	171	52	.....
1.70	2247	1.398	1.22	5.012	...	147	55	.....
20.45	2255	2.275	8.99	0.678	...	162	56	.....
41.88	2082	3.525	11.88	0.513	...	182	58	.....
10.29	2261	1.758	5.85	1.041	...	155	56	.....
30.55	2246	2.925	10.44	0.583	...	167	55	.....
24.07	2215	2.567	9.38	0.650	0.00	164	55	29.100

TORQUE (At Dynamometer)										
Eng rpm	2194	2069	1952	1795	1662	1535	1412	1255	1147	1021
Lb-ft	281.8	287.0	294.0	298.4	301.0	305.0	305.4	305.4	303.6	297.5
Dyn rpm	810	764	720	663	613	566	521	463	424	376

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lb	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption: Gal per hour	Fuel Consumption: Hp-hr per gal	Fuel Consumption: Lb per hp-hr	Water used gal per hour	Temp Deg F: Cooling med	Temp Deg F: Air	Barometer inches of mercury
TEST H—RATED LOAD—TEN HOURS—3rd Gear											
30.67	2564	4.49	2000	6.32	2.980	10.29	0.592	0.00	167	47	28.468
TEST F—100% MAXIMUM LOAD											
38.40	3250	4.43	2005	7.66	3rd gear				170	55	28.150
TEST G—OPERATING MAXIMUM LOAD											
23.50	4669	1.89	1996	16.65	1st gear (part throttle)				162	57	28.090
35.38	4153	3.19	1999	11.41	2nd gear				167	54	28.100
36.65	3087	4.45	2003	7.17	3rd gear				167	55	28.150
35.02	2086	6.30	2004	5.01	4th gear				162	56	28.090
31.56	1027	11.53	2009	2.45	5th gear				164	58	28.090
TEST J—OPERATING MAXIMUM LOAD											
25.37	2340	4.07	2001	16.41	3rd gear (part throttle)				153	36	28.720

TIRES, WHEELS AND WEIGHT

	Tests F, G & H	Test J
Rear wheels		
Type	Pressed steel	Pressed steel
Liquid ballast	400 lb each	None
Added cast iron	865 lb each	None
Rear tires		
No. and size	Two 12-28	Two 12-28
Ply	4	4
Air pressure	14 lb	12 lb
Front wheels		
Type	Pressed steel	Pressed steel
Liquid ballast	60 lb each	None
Added cast iron	100 lb each	None
Front tires		
No. and size	Two 6.00-16	Two 6.00-16
Ply	4	4
Air pressure	28 lb	28 lb
Height of drawbar	23 inches	24 inches
Static weight		
Rear end	4860 lb	2331 lb
Front end	1440 lb	1120 lb
Total weight as tested with operator	6475 lb	3626 lb

FUEL, OIL and TIME Gasoline Octane No. ASTM 80.1 Research 85.7 (rating taken from oil company's typical inspection data) **Weight per gallon** 6.093 lb **OIL** SAE 10 **To motor** 1.255 gal **Drained from motor** 0.999 gal **Total time motor was operated** 44 hours.

CHASSIS Type Tricycle **Serial No.** 56214 **Tread width** rear 56" to 76" front 8.3" to 16.3" **Wheel base** 85.3" **Hydraulic control system** direct engine drive **Advertised speeds mph** first 2.22 second 3.52 third 4.72 fourth 6.48 fifth 11.75 reverse 3.80 **Belt pulley** diam 9" face 6½" **rpm** 1279 **Belt speed** 3015 fpm **Clutch** dual dry disc clutch operated by single foot pedal **Seat** pressed steel cushioned by rubber in torsion **Brakes** internal expanding shoes operated by two foot pedals located on right hand side of tractor **Equalized** by foot action only **Power take-off** constant running controlled by secondary clutch.

ENGINE Make FORD **Type** 4 cylinder vertical **Serial No.** 56214 **Crankshaft mounted** lengthwise **Head** I **Lubrication** pressure **Bore and stroke** 3.90" x 3.60" **Rated rpm** belt 2200 drawbar 2000 **Compression ratio** 6.75 to 1 **Displacement** 172 cu. in. **Port diameter valves** inlet 1.46" exhaust 1.26" **Governor** variable speed centrifugal fly ball **Carburetor size** 1" **Ignition system** battery **Starting system** 6 volt battery **Air cleaner** oil washed wire mesh **Muffler** was used **Oil filter** full flow with replaceable paper element **Cooling medium temperature control** thermostat.

REPAIRS AND ADJUSTMENTS Rapid variation in engine speed occurred during "No load" in test "E." Following test "E" the governor 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 carburetor set for 100% maximum belt 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 J were made with an operating setting of the carburetor (selected by the manufacturer) of 95.8% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F. and 29.92" Hg)	40.62	46.76
2. Observed maximum horsepower (tests F and B)	38.40	46.27
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (formerly ASAE and SAE ratings)	30.47	39.75

We, the undersigned, certify that this is a true and correct report of official tractor test No. 569.

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 held 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 held 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.

Torque, lb-ft at dynamometer, is obtained with wide open throttle and sufficient load is applied to give several readings.

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. All tests are made on the same 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.