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Test 494: Ford NAA

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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: May 22 to June 1, 1953.
Manufacturer: FORD MOTOR COMPANY, DEARBORN, MICHIGAN.
Manufacturer's rating: Not Rated.

NEBRASKA TRACTOR TEST NO. 494

FORD NAA

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption			Water used gal per hour	Temp Deg F		Barometer inches of mercury		
		Gal per hour	Hp-hr per gal	Lb per hp-hour		Cooling med	Air			
TEST B—100% MAXIMUM LOAD—TWO HOURS										
* 31.14	2000	2.867	10.86	0.564	0.00	190	66	28.910		
TEST C—OPERATING MAXIMUM LOAD—ONE HOUR										
30.15	2000	2.683	11.24	0.545	0.00	183	64	28.923		
TEST D—RATED LOAD—ONE HOUR										
27.61	2000	2.616	10.55	0.581	0.00	181	66	28.950		
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)										
27.50	1994	2.600	10.58	0.579	...	189	74	.....	
1.65	2108	1.165	1.42	4.327	...	157	75	.....	
14.17	2053	1.836	7.72	0.794	...	168	76	.....	
28.76	1918	2.595	11.08	0.553	...	195	76	.....	
7.27	2099	1.435	5.07	1.209	...	160	76	.....	
20.72	2001	2.189	9.47	0.647	...	178	77	.....	
16.68	2029	1.970	8.47	0.724	0.00	174	76	28.975		
TORQUE (At Dynamometer)										
Eng RPM	1997	1873	1754	1623	1501	1370	1256	1124	994	862
Lb.-ft.	173.6	177.6	181.8	184.5	186.4	186.6	188.5	191.3	190.8	185.5

DRAWBAR HORSEPOWER TESTS

Hp	Draw bar pull lb	Speed miles per hr	Crank shaft speed rpm	Slip of drive wheels %	Fuel Consumption			Water used gal per hour	Temp Deg F		Barometer inches of mercury
					Gal per hour	Hp-hr per gal	Lb per hp-hr		Cooling med	Air	
TEST F—100% MAXIMUM LOAD—2nd Gear											
25.30	2632	3.60	1748	8.34	.....	Not Recorded	.....	202	84	28.870
TEST G—OPERATING MAXIMUM LOAD											
22.96	3232	2.66	1747	12.88	.....	Not Recorded	.....	194	80	28.890
23.97	2476	3.63	1749	7.77	.....	Not Recorded	.....	196	86	28.870
24.76	1811	5.13	1746	5.20	.....	Not Recorded	.....	194	84	28.860
23.49	796	11.06	1752	2.27	.....	Not Recorded	.....	192	85	28.860
TEST H—RATED LOAD—TEN HOURS—2nd Gear											
20.21	2055	3.69	1752	6.46	2.004	10.08	0.608	0.00	186	85	28.630
TEST J—OPERATING MAXIMUM LOAD—2nd Gear											
17.14	1915	3.36	1747	16.14	.....	Not Recorded	.....	184	85	28.835

TIRES, WHEELS and WEIGHT

	Tests F, G, & H	Test J
Rear wheels Type	Pressed steel	Pressed steel
Liquid ballast	None	None
Added cast iron	774 lb each	None
Rear tires No. and size	Two 10-28	Two 10-28
Ply	4	4
Air pressure	12 lb	12 lb
Front wheels Type	Pressed steel	Pressed steel
Liquid ballast	None	None
Added cast iron	None	None
Front tires No. and size	Two 5.50-16	Two 5.50-16
Ply	4	4
Air pressure	28 lbs	28 lbs
Height of drawbar	23 inches	24½ inches
Static weight Rear end	3154 lb	1606 lb
Front end	1063 lb	1060 lb
Total weight as tested with operator	4392 lb	2841 lb

FUEL, OIL and TIME Gasoline octane No ASTM 76 Research 82 (rating taken from oil company's typical inspection data); weight per gallon 6.127 lb Oil SAE 20; to motor 1.231 gal; drained from motor 0.935 gal Total time motor was operated 55 hours.

CHASSIS Type Standard Serial No NAA 37790 Tread width rear 48" to 76" front 48" to 80" Wheel Base 73.88" Hydraulic control system direct engine drive Advertised speeds mph first 3.13 second 4.02 third 5.54 fourth 11.55 reverse 3.64 Belt Pulley diam 9" face 6" rpm 1358 Belt speed 3200 fpm Clutch single plate clutch operated by foot pedal Seat pressed steel Brakes internal expanding shoes operated by two foot pedals located on right hand side of tractor Equalized by foot action only Power take-off standard type.

ENGINE Make Ford Type 4 cylinder vertical Serial No NAA 37790 Crankshaft mounted lengthwise Head I Lubrication Pressure Bore and Stroke 3.4375" x 3.60" Rated rpm belt 2000 drawbar 1750 Compression ratio 6.6 to 1 Displacement 134 cu in Port Diameter Valves Inlet 1.46" Exhaust 1.26" Governor variable speed centrifugal fly ball Carburetor size ¾" 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 During Test H a loss in power occurred; by loosening the gas tank cap the power returned.

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, & J were made with an operating setting of the carburetor (selected by the manufacturer) of 96.6% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Draw-bar	Belt
1. Sea level (calculated) maximum horsepower (based on 60°F and 29.92" HG)	26.82	32.41
2. Observed maximum horsepower (tests F & B)	25.30	31.14
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)	20.12	27.55

We, the undersigned, certify that this is a true and correct report of official tractor test No. 494.

L. F. LARSEN
Engineer in Charge

C. W. SMITH
L. W. HURLBUT
F. D. YUNG
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, $\frac{1}{2}$ 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.

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.

