8-28-1953

Test 502: Willys Farm Jeep

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 28 to September 4, 1953
Manufacturer: WILLYS MOTORS INC., TOLEDO, OHIO
Manufacturer's rating: Not rated.

NEBRASKA TRACTOR TEST NO. 502

WILLYS FARM JEEP

FUEL, OIL and TIME Gasoline Octane No. ASTM 76 Research 82 (rating taken from oil company's typical inspection data); weight per gallon 6.120 lb **OIL** SAE 20; to motor 1.001 gal; drained from motor 0.914 gal **Total time motor was operated** 42½ hours.

CHASSIS TYPE Standard 4 wheel drive **Serial No.** 453GC2-10083 **Tread width** rear 48¼" front 48¼" **Wheel Base** 80 3/32" **Hydraulic control system** Direct engine drive **Advertised speeds mph** first 4.6 second 8.2 third 11.2 fourth 12.9 fifth 20.2 sixth 31.3 reverse 3.4 and 8.2 **Belt pulley** diam 8" face 8" rpm 1714 **Belt speed** 3599 fpm **Clutch** Single plate dry disc operated by foot pedal **Seat** Upholstered automotive type seat **Brakes** Hydraulic with internal expanding shoes for all four wheels. Emergency brake can be locked **Equalized** yes, on four wheels **Power take-off** Standard type.

ENGINE Make Willys Motors Inc. **Type** 4 cylinder vertical **Serial No.** 4J29621 **Crankshaft mounted** lengthwise **Head** F **Lubrication** pressure **Bore and Stroke** 3⅛" x 4⅜" **Rated rpm** 2400 and 2000 **Compression ratio** 6.9 to 1 **Displacement** 134.2 cu. in. **Port Diameter Valves** Inlet 1.840" Exhaust 1 9/32" **Governor** variable speed centrifugal **Carburetor Size** 1¼" **Ignition System** coil and distributor **Starting System** 6 volt battery **Air Cleaner** oil washed wire mesh **Muffler** was used **Oil Filter** replaceable cartridge **Cooling medium temperature control** Thermostat.

REPAIRS AND ADJUSTMENTS: Hand throttle control wire interfered with governor control during Test E. This was corrected by bending.

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 the same setting.

Oil dripped from transfer case during belt test.

BELT HORSEPOWER TESTS

Hp	Crank shaft speed rpm	Fuel Consumption: Gal per hr	Fuel Consumption: Hp-hr per gal	Fuel Consumption: Lb per hp-hour	Water used gal per hr	Temp Deg F: Cooling med	Temp Deg F: Air	Barometer inches of mercury
TESTS B & C—100% MAXIMUM LOAD—TWO HOURS								
35.23	2401	3.391	10.39	0.589	0.00	196	80	28.887
TEST D—RATED LOAD—ONE HOUR								
31.61	2399	3.180	9.94	0.616	0.00	188	77	28.905
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)								
31.61	2400	3.186	9.92	0.617	...	187	77	.....
0.69	2529	1.270	0.54	11.261	...	150	76	.....
16.47	2491	2.216	7.43	0.823	...	163	76	.....
32.83	2156	3.304	9.94	0.616	...	193	86	.....
8.40	2538	1.706	4.92	1.243	...	156	80	.....
23.99	2426	2.662	9.01	0.679	...	176	83	.....
19.00	2423	2.391	7.95	0.770	0.00	171	79	28.905

TORQUE (At Dynamometer)										
Eng. RPM	2373	2268	2121	1958	1804	1650	1484	1326	1183	1043
Lb. Ft.	151.8	157.2	160.2	160.7	159.2	158.7	158.6	157.2	155.7	151.8

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
TESTS F & G—100% MAXIMUM LOAD											
25.40	2317	4.11	2000	8.32	.....	Not Recorded	.....		201	96	28.870
27.08	1304	7.79	2002	3.94	.....	Not Recorded	.....		167	79	29.040
26.83	943	10.67	2005	2.34	.....	Not Recorded	.....		192	95	28.870
26.63	812	12.30	2005	2.25	.....	Not Recorded	.....		159	76	29.040
TEST H—RATED LOAD—TEN HOURS—1st Gear											
20.69	1843	4.21	1997	5.97	2.420	8.55	0.716	0.00	188	91	28.712
TEST J—OPERATING MAXIMUM LOAD—1st Gear											
22.61	2267	3.74	2009	16.71	.....	Not Recorded	.....		178	77	28.980

TIRES, WHEELS AND WEIGHT

	Tests F, G, & H	Test J
Rear wheels		
Type	Pressed steel	Pressed steel
Liquid ballast	None	None
Added cast iron	None	None
Rear tires		
No. and size	Two 7.00-15	Two 7.00-15
Ply	4	4
Air pressure	20 lb	16 lb
Front wheels		
Type	Pressed steel	Pressed steel
Liquid ballast	None	None
Added cast iron	755 lb each	None
Front tires		
No. and size	Two 7.00-15	Two 7.00-15
Ply	4	4
Air pressure	20 lb	20 lb
Height of drawbar	13½ inches	13 inches
Static weight		
Rear end	1440 lb	1320 lb
Front end	1854 lb	1219 lb
Total weight as tested with operator	3469 lb	2714 lb

HORSEPOWER SUMMARY

	Draw-bar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F and 29.92" HG)	27.22	37.19
2. Observed maximum horsepower (tests F & B)	25.40	35.23
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)	20.42	31.61

We, the undersigned, certify that this is a true and correct report of official tractor test No. 502.

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, 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.