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Test 605: John Deere 720/730

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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 6, 1956 to November 12, 1956
Manufacturer: JOHN DEERE WATERLOO TRACTOR
WORKS OF DEERE MANUFACTURING CO.,
WATERLOO, IOWA
Manufacturer's rating: Not rated

NEBRASKA TRACTOR TEST NO. 605

JOHN DEERE 720 GASOLINE

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 | | | |
| TEST B—100% MAXIMUM LOAD—TWO HOURS | | | | | | | | | | |
| 57.77 | 1125 | 5.193 | 11.12 | 0.551 | 155 | 43 | 55 | 29.097 | | |
| TEST C—OPERATING MAXIMUM LOAD—ONE HOUR | | | | | | | | | | |
| 55.11 | 1125 | 4.514 | 12.21 | 0.502 | 155 | 42 | 54 | 29.103 | | |
| TEST D—RATED LOAD—ONE HOUR | | | | | | | | | | |
| 50.33 | 1125 | 4.171 | 12.07 | 0.508 | 154 | 41 | 53 | 29.100 | | |
| TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average) | | | | | | | | | | |
| 50.37 | 1125 | 4.175 | 12.06 | 0.508 | 154 | 41 | 53 | | | |
| 2.00 | 1240 | 1.664 | 1.20 | 5.100 | 144 | 41 | 52 | | | |
| 26.99 | 1203 | 2.863 | 9.43 | 0.650 | 150 | 42 | 53 | | | |
| 53.06 | 1038 | 4.326 | 12.27 | 0.500 | 156 | 42 | 53 | | | |
| 13.65 | 1216 | 2.163 | 6.31 | 0.971 | 148 | 40 | 50 | | | |
| 39.78 | 1185 | 3.514 | 11.32 | 0.541 | 150 | 40 | 52 | | | |
| 30.98 | 1168 | 3.117 | 9.94 | 0.617 | 150 | 41 | 52 | 29.118 | | |
| TEST L—OPERATING MAXIMUM TORQUE | | | | | | | | | | |
| % of rated rpm (engine) | 100 | 95 | 90 | 84 | 79 | 74 | 70 | 64 | 60 | 55 |
| % of rated-speed torque | 100 | 103 | 106 | 108 | 110 | 110 | 111 | 110 | 107 | 99 |

DRAWBAR HORSEPOWER TESTS

| 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 medi | Air wet bulb | Air dry bulb | |
| TEST H—RATED LOAD—TEN HOURS—4th Gear | | | | | | | | | | | |
| 40.37 | 3499 | 4.33 | 1125 | 3.97 | 3.693 | 10.93 | 0.561 | 153 | 41 | 48 | 29.075 |
| TEST F—100% MAXIMUM LOAD | | | | | | | | | | | |
| 53.41 | 4718 | 4.25 | 1125 | 5.70 | 4th gear | | | 154 | 29 | 35 | 29.395 |
| TEST G—OPERATING MAXIMUM LOAD | | | | | | | | | | | |
| 21.96 | 6647 | 1.24 | 1128 | 12.75 | 1st gear (part throttle) | | | 153 | 34 | 45 | 29.330 |
| 35.46 | 6600 | 2.01 | 1127 | 11.99 | 2nd gear (part throttle) | | | 154 | 37 | 45 | 29.350 |
| 48.28 | 5434 | 3.33 | 1125 | 7.55 | 3rd gear | | | 153 | 32 | 38 | 29.380 |
| 50.47 | 4433 | 4.27 | 1125 | 5.16 | 4th gear | | | 152 | 29 | 35 | 29.380 |
| 49.93 | 3340 | 5.61 | 1126 | 3.78 | 5th gear | | | 152 | 31 | 38 | 29.350 |
| 44.05 | 1469 | 11.24 | 1125 | 1.83 | 6th gear | | | 154 | 34 | 45 | 29.330 |
| TEST J—OPERATING MAXIMUM LOAD | | | | | | | | | | | |
| 47.93 | 4253 | 4.23 | 1125 | 6.09 | 4th gear | | | 151 | 44 | 51 | 28.865 |
| TEST K—OPERATING MAXIMUM LOAD | | | | | | | | | | | |
| 46.12 | 4275 | 4.05 | 1126 | 9.81 | 4th gear | | | 156 | 49 | 57 | 28.855 |

TIRES, WHEELS AND WEIGHT

| | Tests F, G, & H | Test J | Test K |
|--------------------------------------|-----------------|---------------|---------------|
| Rear wheels | | | |
| Type | Cast iron | Cast iron | Cast iron |
| Liquid ballast | 720 lb each | None | None |
| Added cast iron | None | None | None |
| Rear tires | | | |
| No. and size | Two 15.5-38 | Two 15.5-38 | Two 13.6-38 |
| Ply | 6 | 6 | 6 |
| Air pressure | 18 lb | 14 lb | 16 lb |
| Front wheels | | | |
| Type | Pressed steel | Pressed steel | Pressed steel |
| Liquid ballast | None | None | None |
| Added cast iron | None | None | None |
| Front tires | | | |
| No. and size | Two 6.00-16 | Two 6.00-16 | Two 6.00-16 |
| Ply | 6 | 6 | 6 |
| Air pressure | 36 lb | 36 lb | 36 lb |
| Height of drawbar | 17½ inches | 17½ inches | 18 inches |
| Static weight | | | |
| Rear end | 6870 lb | 5430 lb | 5374 lb |
| Front end | 1900 lb | 1900 lb | 1896 lb |
| Total weight as tested with operator | 8945 lb | 7505 lb | 7445 lb |

FUEL, OIL, WATER and TIME Fuel Gasoline Octane No. ASTM 81.6 Research 87.5 (rating taken from oil company's typical inspection data) Weight per gallon 6.130 lb Oil SAE 10W To motor 2.245 gal Drained from motor 1.811 gal Water used none Total time motor was operated 47 hours.

CHASSIS Type Tricycle Serial No. 7200000 Tread width rear 60" to 88" front 8 5/16" and 12 1/16" Wheel base 90 15/16" Hydraulic control system direct engine drive with throw out lever Advertised speeds mph first 1.5 second 2.25 third 3.5 fourth 4.5 fifth 5.75 sixth 11.5 reverse 3.5 Belt pulley diam. 12½" Face 7¾" rpm 1125 Belt speed 3790 fpm Belt flat Length 72' Width 7" Thickness 0.216" Maximum slip 0.80% Clutch double disc dry type operated by hand lever Seat upholstered seat cushioned by rubber in torsion Brakes internal expanding shoe operated by two foot pedals Equalized no Power take-off direct engine drive with independent clutch Steering aided by hydraulic power steering.

ENGINE Make John Deere Type 2 cylinder horizontal Serial No. 7200000 Crankshaft mounted cross-wise Head I Lubrication pressure Bore and stroke 6" x 6¾" Rated rpm 1125 Compression ratio 6.14 to 1 Displacement 360.5 cu. in. Port diameter valves inlet 2.000" exhaust 1.687" Governor variable speed centrifugal Carburetor size 1 11/16" Ignition system battery Starting system 12 volt (two-6 volt batteries) Air cleaner oil washed wire mesh Muffler was used Oil filter replaceable impregnated paper element Cooling medium temperature control thermostat.

REPAIRS AND ADJUSTMENTS No repairs or adjustments.

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, K & L were made with an operating setting of the carburetor (selected by the manufacturer) of 95.3% of maximum belt horsepower.

HORSEPOWER SUMMARY

| | Drawbar | Belt |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|
| 1. Sea level (calculated) maximum horsepower (based on 60° F and 29.92" Hg) | 53.05 | 59.12 |
| 2. Observed maximum horsepower (tests F and B) | 53.41 | 57.77 |
| 3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings) | 39.79 | 50.25 |

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 605.

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.

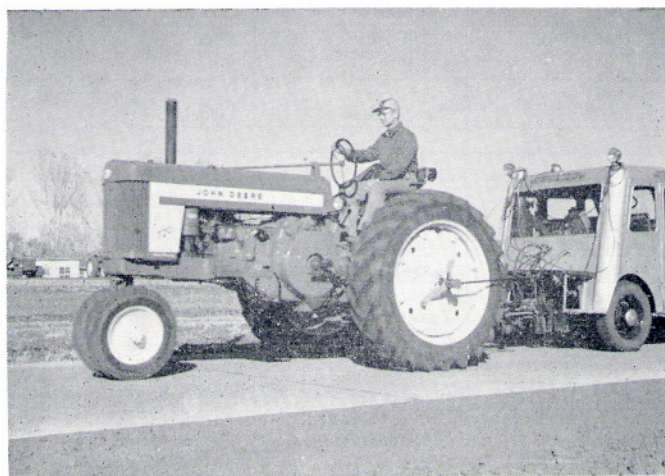
TEST H: Intended to test the ability of the tractor to run continuously for 10 hours at rated drawbar horsepower and to determine the fuel consumption during that time. Rated drawbar horsepower is 75% of 100% maximum drawbar horsepower (Test F), corrected to standard conditions.

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.



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.

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