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Test 533: International Model W-400

Nebraska Tractor Test Lab

University of Nebraska-Lincoln, tractortestlab@unl.edu

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Department of Agricultural Engineering
Dates of test: MARCH 28 to APRIL 8, 1955
Manufacturer: INTERNATIONAL HARVESTER
COMPANY, CHICAGO, ILLINOIS
Manufacturer's rating: Drawbar 45 Hp Belt 51 Hp
(Corrected to standard conditions)

INTERNATIONAL W-400

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										
51.94	1450	4.408	11.78	0.514	0.00	184	52	28.800		
TEST C—OPERATING MAXIMUM LOAD—ONE HOUR										
48.48	1450	3.964	12.23	0.495	0.00	192	70	28.800		
TEST D—RATED LOAD—ONE HOUR										
45.64	1452	3.866	11.81	0.513	0.00	194	76	28.780		
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)										
45.68	1452	3.866	11.82	0.512	...	193	77	.....	
1.34	1568	1.889	0.71	8.530	...	190	74	.....	
23.93	1517	2.870	8.34	0.726	...	179	76	.....	
45.44	1334	3.693	12.30	0.492	...	170	78	.....	
12.31	1556	2.503	4.92	1.231	...	194	76	.....	
35.16	1488	3.267	10.76	0.562	...	198	77	.....	
27.31	1486	3.015	9.06	0.668	...	187	76	28.765		
TORQUE (At Dynamometer)										
Eng rpm	1454	1374	1301	1223	1152	1072	999	918	842	770
Lb-ft	363.7	368.6	375.0	383.8	393.8	405.5	411.3	413.0	406.0	393.1
Dyn rpm	698	659	624	587	552	514	479	440	404	369

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 H—RATED LOAD—TEN HOURS—3rd GEAR											
35.73	2755	4.86	1450	4.30	3.602	9.92	0.610	0.00	196	50	29.096
TEST F—100% MAXIMUM LOAD											
45.84	3565	4.82	1449	5.09	..... 3rd Gear				162	56	28.840
TEST G—OPERATING MAXIMUM LOAD											
37.36	6361	2.20	1453	16.47	1st gear (Part Throttle)				166	60	28.870
43.57	4313	3.79	1447	6.28	2nd gear				171	60	28.870
43.72	3389	4.84	1449	4.69	3rd gear				173	60	28.870
43.51	2392	6.82	1451	3.40	4th gear				194	61	28.900
35.01	751	17.48	1451	0.41	5th gear				185	61	28.900
25.00	6294	1.49	1455	16.27	1st gear T. A. (Part Throttle)				180	60	28.870
38.89	6303	2.31	1452	15.53	2nd gear Torque Amplifier ..				168	60	28.870
42.28	5022	3.16	1449	7.81	3rd gear Torque Amplifier ..				169	61	28.870
42.90	3555	4.53	1449	4.89	4th gear Torque Amplifier ..				169	58	28.870
39.84	1283	11.64	1450	1.57	5th gear Torque Amplifier ..				194	61	28.900
TEST J—OPERATING MAXIMUM LOAD											
41.88	3404	4.61	1445	11.39	3rd gear				177	59	29.160
TEST K—OPERATING MAXIMUM LOAD											
34.42	3205	4.03	1450	14.50	3rd gear (Part Throttle)				160	64	29.210

TIRES, WHEELS AND WEIGHT

	Tests F, G & H	Test J	Test K
Rear wheels (Type)	Cast iron	Cast iron	Cast iron
Liquid ballast	1172 lb each	None	None
Added cast iron	700 lb each	None	None
Rear tires	Two 15-30	Two 15-30	Two 13-30
Ply	6	6	6
Air pressure	12 lb	12 lb	12 lb
Front wheels (Type)	Cast iron	Cast iron	Cast iron
Liquid ballast	None	None	None
Added cast iron	None	None	None
Front tires	Two 6.50-18	Two 6.50-18	Two 6.50-18
Ply	4	4	4
Air pressure	28 lb	28 lb	28 lb
Height of drawbar	19½ inches	22 inches	18 inches
Static weight			
Rear end	7486 lb	3743 lb	3601 lb
Front end	2424 lb	2410 lb	2382 lb
Weight with operator	10,085 lb	6328 lb	6158 lb

FUEL, OIL and TIME Gasoline Octane No. ASTM 80.8 Research 85.9 (rating taken from oil company's typical inspection data); weight per gallon 6.052 lb OIL SAE 20; to motor 2.016 gal; drained from motor 1.801 gal Total time motor was operated 45 hours.

CHASSIS Type Standard Serial No. 668-S Tread width rear 60¼" front 50¼" Wheel base 82" Hydraulic control system direct engine drive Advertised speeds mph first 2.42 second 3.72 third 4.67 fourth 6.49 fifth 16.15 reverse 3.22 Using torque amplifier (planetary underdrive) first 1.63 second 2.51 third 3.15 fourth 4.38 fifth 10.90 reverse 2.17 Belt pulley diam 11" face 7½"rpm 1450 Belt speed 2588 fpm Clutch single plate dry disc operated by foot pedal Seat upholstered seat on conical spring with shock absorber Brakes double disc brakes operated by two foot pedals Equalized by locking pedals together Power take-off direct engine drive with independent clutch.

ENGINE Make International Harvester Type 4 cylinder vertical Serial No. 138511 Crankshaft mounted lengthwise Head I Lubrication pressure Bore and stroke 4" x 5¼" Rated rpm 1450 Compression ratio 6.3 to 1 Displacement 264 cu. in. Port diameter valves inlet 1 19/32" exhaust 1 7/16" Governor variable speed centrifugal Carburetor size 1¼" Ignition system battery Starting system 6 volt battery Air cleaner oil washed wire mesh Muffler was used Oil filter replaceable treated paper element Cooling medium temperature control thermostat and radiator shutter.

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 were made with an operating setting of the carburetor (selected by the manufacturer) of 95.0% of maximum belt horsepower.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F and 29.92" HG)	47.38	53.54
2. Observed maximum horsepower (tests F and B)	45.84	51.94
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)	35.54	45.51

We, the undersigned, certify that this is a true and correct report of official tractor test No. 533.

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.

