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Test 673: International 400 Utility (Diesel)

Nebraska Tractor Test Lab

University of Nebraska-Lincoln, tractortestlab@unl.edu

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Department of Agricultural Engineering
Dates of test: October 2, 1958 to October 9, 1958
Manufacturer: INTERNATIONAL HARVESTER COMPANY, CHICAGO, ILLINOIS
Manufacturer's rating: Not Rated

INTERNATIONAL 460 UTILITY DIESEL

BELT HORSEPOWER 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	
TESTS B & C—100% MAXIMUM POWER—TWO HOURS								
50.01	1800	3.642	13.73	0.512	192	58	70	28.813
TEST D—RATED POWER—ONE HOUR								
44.58	* 1838	3.211	13.88	0.506	176	57	71	28.790
TEST E—VARYING POWER—TWO HOURS (20 minute runs; last line average)								
44.58	1838	3.205	13.91	0.505	178	59	73
1.15	1938	1.105	1.04	6.757	140	57	70
23.10	1894	2.061	11.21	0.627	156	57	70
50.14	1803	3.653	13.73	0.512	189	58	71
11.69	1913	1.515	7.72	0.911	148	56	67
34.14	1869	2.629	12.99	0.541	160	56	68
27.47	1876	2.361	11.63	0.604	162	57	70	28.780

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	Cooling med	Air wet bulb	Air dry bulb	
TEST H—RATED POWER—TEN HOURS—3rd Gear											
36.44	2440	5.60	1846	3.02	2.944	12.38	0.568	167	65	71	28.555
TESTS F & G—100% MAXIMUM POWER											
28.66	6408	1.68	1801	14.29	1st Gear (prt thrtl)			153	53	60	28.7-0
45.10	4348	3.89	1802	6.90	2nd Gear			182	66	72	28.600
45.52	3192	5.35	1796	4.86	3rd Gear			194	66	72	28.600
45.12	2184	7.75	1801	2.92	4th Gear			180	69	81	28.545
42.01	901	17.48	1794	0.25	5th Gear			178	69	81	28.545
19.55	6437	1.14	1800	13.81	1st Gear TA (prt thrtl)			150	53	63	28.770
40.96	6241	2.46	1799	12.62	2nd Gear Torq. Amp.			158	53	60	28.740
43.40	4638	3.51	1800	7.63	3rd Gear Torq. Amp.			203	69	81	28.545
44.10	3250	5.09	1790	4.86	4th Gear Torq. Amp.			184	66	72	28.600
44.17	1414	11.71	1799	1.22	5th Gear Torq. Amp.			167	69	81	28.545
TEST J—OPERATING MAXIMUM POWER											
42.11	3083	5.12	1795	10.83	3rd Gear			172	53	67	28.850
TEST K—SPEED-PULL CHARACTERISTIC											
Pounds Pull		2440	3192	3300	3250	3150	3000	2800			
Horsepower		36.44	45.52	42.2	37.3	31.1	25.6	20.2			
Miles Per Hour		5.60	5.35	4.8	4.3	3.7	3.2	2.7			

FUEL, OIL, WATER and TIME Fuel Diesel Cetane No. ASTM 50.8 (rating taken from oil company's typical inspection data) Weight per gallon 7.030 lb Oil SAE 10W-30 To motor 1.993 gal Drained from motor 1.771 gal Water used 0.744 gal Total time motor was operated 42½ hours.

CHASSIS Type standard Serial No. 695 S Tread width rear 48" to 76" front 48" and 76" Wheel base 78.7" Hydraulic control system direct engine drive Advertised speeds mph first 1.8 second 3.9 third 5.3 fourth 7.5 fifth 16.5 reverse 2.3 (Using Torque Amplifier) first 1.2 second 2.6 third 3.6 fourth 5.0 fifth 11.1 reverse 1.5 Belt pulley diam. 11" Face 7½" rpm 1078 Belt speed 3104 fpm Belt flat Length 71" Width 6" Thickness 0.215" Maximum slip 0.84% Clutch single plate dry disc operated by foot pedal Seat upholstered seat with back rest Brakes double disc brakes operated by two foot pedals Equalized by locking together Power take-off direct engine drive with independent clutch Steering aided by hydraulic power steering.

ENGINE Make International Diesel Type 6 cylinder vertical Serial No. D236 941 Crankshaft mounted lengthwise Head I Lubrication pressure Bore and stroke 3½" x 3½" Rated rpm 1800 Compression ratio 17.6 to 1 Displacement 236 Cu. in. Valves port diameter Inlet 1½" Exhaust 1" Governor variable speed centrifugal Starting system 12 volt battery Air cleaner oil washed wire screen Muffler was used Oil filter replaceable treated paper element Fuel filter one first stage metal screen and water trap, one primary filter with replaceable pleated paper element, and one final stage replaceable pleated 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 fuel pump set to develop approximately 52 corrected 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 and K were made with the same setting. Radiator temperature indicator became inoperative during drawbar testing.

TIRES, WHEELS AND WEIGHT

Tests F, G, H & K			Test J	
Rear wheels	Pressed Steel		Pressed Steel	
Type	Liquid ballast		None	
	Added cast iron		None	
Rear tires	Two 14.9-28		Two 14.9-28	
No. and size	6		6	
Ply	16 lb		14 lb	
Air pressure				
Front wheels	Pressed Steel		Pressed Steel	
Type	None		None	
	Added cast iron		None	
Front tires	Two 6.00-16		Two 6.00-16	
No. and size	6		6	
Ply	44 lb		36 lb	
Air pressure				
Height of drawbar	21 inches		22½ inches	
Static weight				
Rear end	6115 lb		3105 lb	
Front end	2290 lb		1975 lb	
Total weight as tested with operator	8580 lb		5255 lb	

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F and 29.92" Hg)	48.16	52.43
2. Observed maximum horsepower (tests F and B)	45.52	50.01
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	36.12	44.57

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 673.

L. F. LARSEN
Engineer-in-Charge

L. W. HURLBUT, Chairman
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 manual throttle control lever is set so that 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 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 manual throttle control lever is set the same as for tests B and C allowing the governor to control engine speed at part throttle. Load is applied until 85% of maximum corrected horsepower found in test B is obtained.

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.

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. When rubber tires are used, all tests are made on the concrete test course. The same tires, wheels and weights are used for all tests except J. All crawler type tractors are tested on an earthen test course which is maintained by grading, sprinkling and rolling so that it remains very nearly the same for each test.

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 the 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 manual throttle control lever is set so that 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 15%. 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 horsepower the manual throttle control lever is set the same as in tests F and G allowing the governor to maintain engine speed at part throttle. 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: This is intended to show the pull, horsepower, and travel speed of the tractor at rated horsepower (taken from test H); maximum horsepower (taken from test G); and at least four other conditions obtained by reducing travel speed in 10% increments by **overload**.

