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Test 610: International 350 Utility

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: March 26, 1957 to April 15, 1957
Manufacturer: INTERNATIONAL HARVESTER COMPANY,
CHICAGO 1, ILLINOIS
Manufacturer's rating: Not Rated

NEBRASKA TRACTOR TEST NO. 610

INTERNATIONAL 350 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 LOAD—TWO HOURS											
42.89	2000	3.064	14.00	0.500	178	44	57	29.015			
TEST D—RATED LOAD—ONE HOUR											
37.50	2001	2.738	13.70	0.511	168	44	56	29.005			
TEST E—VARYING LOAD—TWO HOURS (20 minute runs; last line average)											
37.31	2001	2.745	13.59	0.515	169	44	56			
1.60	2172	1.058	1.51	4.631	133	42	53			
19.49	2072	1.816	10.73	0.653	152	42	52			
41.92	1870	2.951	14.21	0.493	178	43	52			
9.92	2107	1.409	7.04	0.995	119	44	52			
28.64	2035	2.287	12.52	0.559	151	44	53			
23.15	2043	2.044	11.33	0.619	150	43	53	28.987			
TEST L—OPERATING MAXIMUM TORQUE											
% of rated rpm (engine)		100	95	90	85	80	75	70	65	60	55
% of rated-speed torque		100	105	107	116	119	120	121	120	118	115

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 med	Air wet bulb	Air dry bulb	
TEST H—RATED LOAD—TEN HOURS—3rd Gear											
31.15	2154	5.42	2001	3.80	2.502	12.45	0.563	152	36	42	28.671
TESTS F & G—100% MAXIMUM LOAD											
36.17	5862	2.31	1997	15.04	1st gear (part throttle)			155	32	37	28.635
39.45	3757	3.94	2002	5.75	2nd gear.....			168	47	50	28.780
40.42	2813	5.39	2002	4.34	3rd gear.....			166	37	45	29.075
40.02	2154	6.97	2000	3.37	4th gear.....			173	40	50	29.025
34.92	748	17.51	2000	0.23	5th gear.....			166	43	55	29.060
24.61	5835	1.58	2007	14.28	1st gear TA (prt thrtl)			147	30	33	28.635
37.64	5812	2.43	2004	13.94	2nd gear torc amplifier.			156	30	33	28.640
39.22	4136	3.56	2007	6.78	3rd gear torc amplifier.			166	36	43	29.125
40.26	3270	4.62	2001	5.22	4th gear torc amplifier.			173	38	48	29.060
38.11	1221	11.70	2000	1.32	5th gear torc amplifier.			157	40	50	29.015
TEST J—OPERATING MAXIMUM LOAD											
39.55	2823	5.25	2008	9.14	3rd gear.....			172	48	52	28.770
TEST K—OPERATING MAXIMUM LOAD											
28.93	2520	4.30	2003	14.14	3rd gear (part throttle)			146	38	42	29.285

TIRES, WHEELS AND WEIGHT

	Tests F, G, & H	Test J	Test K
Rear wheels			
Type	Pressed Steel	Pressed Steel	Pressed Steel
Liquid ballast	742 lb each	None	None
Added cast iron	828 lb each	None	None
Rear tires			
No. and size	Two 13-28	Two 13-28	Two 10-28
Ply	6	6	4
Air pressure	16 lb	14 lb	12 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 5.50-16	Two 5.50-16	Two 5.50-16
Ply	4	4	4
Air pressure	28 lb	28 lb	28 lb
Height of drawbar	18½ inches	19 inches	15 inches
Static weight			
Rear end	6080 lb	2940 lb	2800 lb
Front end	1540 lb	1540 lb	1510 lb
Total weight as tested with operator	7795 lb	4655 lb	4485 lb

FUEL, OIL, WATER and TIME Fuel Diesel Cetane No. ASTM 50 (rating taken from oil company's typical inspection data) **Weight per gallon** 7.005 lb **Oil** SAE 20-20W **To motor** 1.241 gal **Drained from motor** 0.960 gal **Water used** 0.255 gal **Total time motor was operated** 49½ hours.

CHASSIS TYPE Standard **Serial No.** 1983 **Tread** width rear 48" to 76" **front** 48" to 76" **Wheel base** 75" **Hydraulic control system** direct engine drive **Advertised speeds mph** first 2.6 second 4.0 third 5.4 fourth 6.9 fifth 16.7 **reverse** 3.2 (Using torque amplifier) first 1.8 second 2.7 third 3.6 fourth 4.6 fifth 11.3 **reverse** 2.2 **Belt pulley diam.** 11" **face** 7½" **rpm** 1082 **Belt speed** 3115 fpm **Belt flat Length** 72' **Width** 7" **Thickness** 0.216" **Maximum slip** 0.98% **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 pedals together **Power take-off** direct engine drive with independent clutch **Steering** hydraulically aided.

ENGINE Make Continental **Type** 4 cylinder vertical **Diesel** **Serial No.** D193-822 **Crankshaft** mounted lengthwise **Head** 1 **Lubrication** pressure **Bore and stroke** 3¾" x 4¾" **Rated rpm** 2000 **Compression ratio** 16.87 to 1 **Displacement** 193 cu. in. **Port diameter valves** Inlet 1.331" Exhaust 1.125" **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 edge filter and water trap, one second stage filter with replaceable pleated paper element, and one final stage replaceable sealed filter **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 a fuel pump setting selected by the manufacturer to develop approximately 44.1 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, K and L were made with the same setting.

HORSEPOWER SUMMARY

	Drawbar	Belt
1. Sea level (calculated) maximum horsepower (based on 60° F. and 29.92" Hg)	40.99	44.10
2. Observed maximum horsepower (tests F and B)	40.42	42.89
3. Seventy-five per cent of calculated maximum drawbar horsepower and eighty-five per cent of calculated maximum belt horsepower (ASAE and SAE ratings)	30.74	37.49

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. 610.

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 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.

