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Test 967: International Farmall 656 Hydrostatic (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 967

INTERNATIONAL FARMALL 656 HYDROSTATIC DIESEL

POWER TAKE-OFF PERFORMANCE

Hp	Crank-shaft speed rpm	Fuel Consumption		Temperature Degrees F				
		Gal per hr	Lb per hp-hr	Hp-hr per gal	Cooling medium	Air wet bulb	Air dry bulb	Barometer inches of Mercury
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours								
66.06	2300	5.411	0.569	12.21	195	57	76	28.860
Standard Power Take-off Speed (540 rpm)—One Hour								
62.18	1989	4.973	0.555	12.50	199	57	75	28.890
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
58.75	2407	4.815	0.569	12.20	182	58	76	.....
0.00	2535	2.075	.....	.....	173	57	75	.....
30.17	2473	3.341	0.769	9.03	176	58	76	.....
66.40	2301	5.372	0.562	12.36	190	58	76	.....
15.28	2504	2.701	1.227	5.66	174	58	76	.....
44.70	2442	4.033	0.626	11.08	180	58	76	.....
Av 35.88	2444	3.723	0.720	9.64	179	58	76	28.890

DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank-shaft speed rpm	Slip of drivers %	Fuel Consumption		Temp Degrees F				Barometer inches of Mercury
					Gal per hr	Lb per hp-hr	Hp-hr per gal	Cooling med	Air wet bulb	Air dry bulb	
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—Speed Setting 4.0 MPH—Lo Range											
50.50	4681	4.05	2291	6.23	5.380	0.740	9.39	177	29	31	28.805
75% of Pull at Maximum Power—Ten Hours—Speed Setting 4.0 MPH—Lo Range											
42.75	3633	4.41	2395	4.56	4.717	0.766	9.05	177	38	44	28.389
50% of Pull at Maximum Power—Two Hours—Speed Setting 4.0 MPH—Lo Range											
30.22	2470	4.59	2461	3.17	3.935	0.904	7.68	138	33	34	28.780

MAXIMUM POWER WITH BALLAST

49.61	7558	2.46	2303	11.41	The infinitely variable drive control was set to give the travel speeds shown as selected by the manufacturer	Lo Range	183	32	38	29.180
51.03	7112	2.69	2304	9.76		Lo Range	171	27	29	29.365
51.48	5986	3.23	2304	7.78		Lo Range	172	27	29	29.360
52.12	5150	3.80	2305	6.46		Lo Range	180	32	37	29.360
51.57	4788	4.04	2303	6.06		Lo Range	178	29	33	29.340
50.76	4263	4.46	2300	5.17		Lo Range	176	29	33	29.340
50.17	3826	4.92	2299	4.68		Lo Range	176	29	33	29.340
49.63	3415	5.45	2304	4.19		Lo Range	177	30	33	29.330
50.85	3197	5.96	2297	4.05		Hi Range	173	30	33	29.330
50.98	2924	6.54	2295	3.70		Hi Range	176	33	35	29.310
50.95	2458	7.77	2304	2.98		Hi Range	176	33	35	29.310
42.97	1106	14.57	2300	1.22		Hi Range	178	33	37	29.260

MAXIMUM PULL WITHOUT BALLAST

47.49	5914	3.01	2369	14.75	Speed Setting 3.01 MPH	Lo Range	183	34	36	29.070
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VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST Speed Setting 4.0 MPH—Lo Range

Pounds pull	4788	5317	5813	5856	5953	5654
Horsepower	51.57	50.61	47.38	41.70	35.97	28.73
Crankshaft speed rpm	2303	2075	1834	1601	1374	1140
Miles per hour	4.04	3.57	3.06	2.67	2.27	1.91
Slip of drivers %	6.06	6.73	7.52	7.65	8.04	7.26

TIRES, BALLAST AND WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 14.9-38; 6; 18	Two 14.9-38; 6; 14
Ballast	—Liquid	785 lb each	None
	Cast iron	420 lb each	None
Front tire	—No, size, ply & psi	Two 6.00-16; 6; 48	Two 6.00-16; 6; 40
Ballast	—Liquid	None	None
	Cast iron	60 lb each	None
Height of drawbar		23 inches	24 inches
Static weight with operator—Rear		7720 lb	5310 lb
Front		2290 lb	2170 lb
Total		10010 lb	7480 lb

Department of Agricultural Engineering

Dates of Test: October 31 to November 29, 1967

Manufacturer: INTERNATIONAL HARVESTER COMPANY, CHICAGO, ILLINOIS

FUEL, OIL and TIME Fuel No 2 Diesel Cetane No 54.7 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8336 Weight per gallon 6.941 lb Oil SAE 30 API service classification DS To motor 2.348 gal Drained from motor 1.592 gal Transmission and final-drive lubricant IH Hy-Tran Fluid Total time engine was operated 70 hours.

ENGINE Make International Diesel Type 6 cylinder vertical Serial No 79111 Crankshaft mounted lengthwise Rated rpm 2300 Bore and stroke 3¹¹/₁₆" x 4.390" Compression ratio 17.6 to 1 Displacement 281.3 cu in Cranking system 12 volt electric (two 6-volt batteries) Lubrication pressure Air cleaner dry type with replaceable paper element with automatic dust unloader Oil filter replaceable paper element Oil cooler engine coolant heat exchanger for crankcase oil and radiator for transmission and hydraulic oil Fuel filter primary filter with replaceable cotton element and final filter with replaceable paper element Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type tricycle Serial No 29156 Tread width rear 54" to 96" front 8" to 16" Wheel base 96.3" Center of gravity (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 29.6" Vertical distance above roadway 35.5" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission infinitely variable hydrostatic using a variable displacement hydraulic pump and motor Sliding gears give high and low ranges Advertised speeds, mph forward 0-7³/₄ low range 0-21 high range Reverse 0-3¹/₂ low range 0-9¹/₂ high range Drive Clutch none—hydrostatic drive pressure can be controlled by foot pedal Brakes double disc operated by two foot pedals which can be locked together Steering hydraulic with power assist Turning radius (on concrete surface with brake applied) right 109" left 109" (on concrete surface without brake) right 114" left 114" Turning space diameter (on concrete surface with brake applied) right 218" left 218" (on concrete surface without brake) right 233" left 233" Belt pulley 1210 rpm at 2300 engine rpm diam 11" face 7¹/₂" Belt speed 3485 fpm Power take-off 543 rpm at 2000 engine rpm.

REPAIRS and ADJUSTMENTS No repairs or adjustments.

REMARKS All test results were determined from observed data obtained in accordance with the SAE and ASAE test code.

The slower travel speeds were not run because maximum drawbar pull was limited by the stability formula. Travel speeds above 15 mph were not run.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 967.

L. F. LARSEN

Engineer in Charge

G. W. STEINBRUEGGE

J. J. SULEK

D. E. LANE

Board of Tractor Test Engineers

The University of Nebraska Agricultural Experiment Station
E. F. Frolik, Dean; H. W. Ottoson, Director; Lincoln, Nebraska

EXPLANATION OF TEST REPORT

GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories can be disconnected only when it is convenient for the operator to do so in practice. Additional weight can be added as ballast if the manufacturer regularly supplies it for sale. The static tire loads and the inflation pressures must conform to recommendations in the Tire Standards published by the Society of Automotive Engineers.

PREPARATION FOR PERFORMANCE RUNS

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operators manual. The fuel used and the maintenance operations must also conform to the published information delivered with the tractor. The tractor is then limbered-up for 12 hours on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

The tractor is equipped with approximately the amount of added ballast that is used during maximum drawbar tests. The tire tread-bar height must be at least 65% of new tread height prior to the maximum power run.

BELT OR POWER TAKE-OFF PERFORMANCE

Maximum Power and Fuel Consumption. The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever is set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the belt pulley or the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power. The corresponding fuel consumption is measured.

Varying Power and Fuel Consumption. Six different horsepower levels are used to show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85% of the dynamometer torque at maximum power; minimum dynamometer torque, $\frac{1}{2}$ of the 85% torque; maximum power, $\frac{1}{4}$ and $\frac{3}{4}$ of the 85% torque. Since a tractor is generally subjected to varying loads the average of the results in this test serve well for predicting the fuel consumption of a tractor in general usage.

DRAWBAR PERFORMANCE

All engine adjustments are the same as those used in the belt or power take-off tests. If the manufacturer specifies a different rated crankshaft speed for drawbar operations, then the position of the manually operated governor control is changed to provide the high-idle speed specified by the manufacturer in the operating instructions.

Varying Power and Fuel Consumption With Ballast. The varying power runs are made to show the effect of

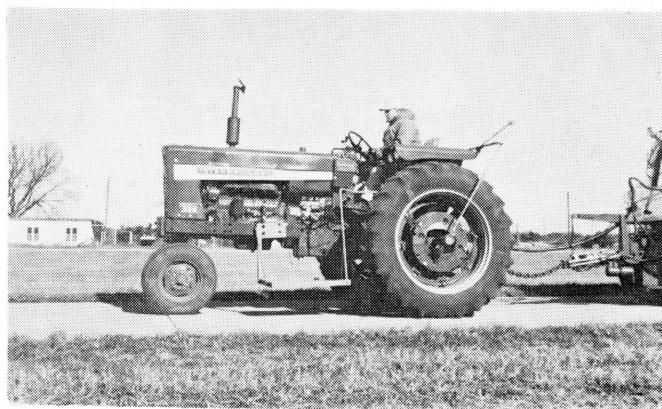
speed-control devices (engine, governor, automatic transmission, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree turns with a minimum radius of 50 feet. The drawbar pull is set at 3 different levels as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum power; and (3) 50% of the pull at maximum power. Prior to 1958, fuel consumption data (10 hour test) were shown only for the pull obtained at maximum power for tractors having torque converters and at 75% of the pull obtained at maximum power for gear-type tractors.

Maximum Power with Ballast. Maximum power is measured on straight level sections of the test course. Data are shown for not more than 12 different gears or travel speeds. Some gears or travel speeds may be omitted because of high slippage of the traction members or because the travel speed may exceed the safe-limit for the test course. The maximum safe speed for the Nebraska Test Course has been set at 15 miles per hour. The slippage limits have been set at 15% and 7% for pneumatic tires and steel tracks or lugs, respectively. Higher slippage gives widely varying results.

Maximum Pull without Ballast. All added ballast is removed from the tractor. The drawbar pull is determined at slip limits of 15% for pneumatic tires or 7% for steel tracks or lugs. The tractor is operated at the fastest possible travel speed.

Varying Power and Travel Speed with Ballast. Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions: (1) maximum pull is obtained, (2) the maximum slippage limit is reached, or (3) some other operating limit is reached.

For additional information about the **Nebraska Tractor Tests** write to the **Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska.**



INTERNATIONAL FARMALL 656 HYDROSTATIC DIESEL