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Test 1144: David Brown 990 Diesel (Also Case 990 Diesel) 12-Speed

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 1144 – DAVID BROWN 990 DIESEL ALSO CASE 990 DIESEL 12 SPEED

POWER TAKE-OFF PERFORMANCE

Hp	Crank- shaft speed rpm	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temperature Degrees F Cooling medium	Air wet bulb	Air dry bulb	Barometer inches of Mercury
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours (PTO Speed—1100 rpm)								
53.77	2200	3.469	0.446	15.50	194	63	75	29.003
Standard Power Take-off Speed (1000 rpm)—One Hour								
50.48	2000	3.251	0.446	15.53	198	63	75	29.023
Standard Power Take-off Speed (540 rpm)—One Hour								
46.75	1827	3.055	0.452	15.30	201	62	75	29.035
VARYING POWER AND FUEL CONSUMPTION—Two Hours								
47.76	2300	3.053	0.442	15.64	184	63	80	.....
0.00	2335	0.867	.....	.....	155	63	78	.....
24.04	2315	1.882	0.542	12.77	175	62	79	.....
53.33	2199	3.478	0.451	15.33	199	62	80	.....
12.14	2333	1.353	0.771	8.97	165	62	80	.....
36.04	2313	2.463	0.473	14.63	179	62	81	.....
Av 28.89	2299	2.183	0.523	13.23	176	62	80	29.030

DRAWBAR PERFORMANCE

Hp	Draw- bar pull lbs	Speed miles per hr	Crank- shaft speed rpm	Slip of drivers %	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temp Cool- ing med	Degrees F Air wet bulb	Air dry bulb	Barometer inches of Mercury
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VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST

Maximum Available Power—Two Hours—8th Gear (H-1)											
45.68	3088	5.55	2201	4.64	3.415	0.517	13.37	185	66	70	28.780
75% of Pull at Maximum Power—Ten Hours—8th Gear (H-1)											
37.15	2377	5.86	2297	3.47	2.877	0.536	12.91	178	63	66	28.780
50% of Pull at Maximum Power—Two Hours—8th Gear (H-1)											
25.58	1605	5.98	2320	2.60	2.295	0.621	11.14	175	66	70	28.560
50% of Pull at Reduced Engine Speed—Two Hours—10th Gear (L-3)											
25.35	1593	5.97	1612	2.46	1.771	0.483	14.31	177	66	69	28.550

MAXIMUM POWER WITH BALLAST

39.73	7335	2.03	2274	14.28	3rd Gear (HS-1)	179	57	60	29.100
43.41	6304	2.58	2201	11.53	4th Gear (L-1)	180	59	61	29.100
45.87	3775	4.56	2200	5.79	7th Gear (L-2)	186	67	72	28.800
46.34	3136	5.54	2201	4.71	8th Gear (H-1)	186	67	72	28.800
43.84	2613	6.29	2202	4.06	9th Gear (HS-3)	185	67	72	28.800
43.69	1747	9.38	2201	2.73	11th Gear (H-2)	184	67	72	28.800

VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST 8th Gear (H-1)

Pounds Pull	3136	3269	3366	3398	3473	3134
Horsepower	46.34	43.26	39.50	35.07	30.64	23.12
Crankshaft Speed rpm	2201	1976	1755	1545	1322	1099
Miles Per Hour	5.54	4.96	4.40	3.87	3.31	2.77
Slip of Drivers %	4.71	5.09	5.22	5.22	5.35	4.83

TRACTOR SOUND LEVEL (Without Cab)

	dB(A)
Maximum Available Power 2 Hours	97.0
75% of Pull at Max. Power 10 Hours	96.0
50% of Pull at Max. Power 2 Hours	95.0
50% of Pull at Reduced Engine Speed 2 Hours	93.0
Bystander 12th Gear (H-3)	88.5

TIRES, BALLAST AND WEIGHT

	With Ballast	Without Ballast
Rear Tires	Two 16.9-30;6;18	Two 16.9-30;6;18
Ballast	958 lb each	None
Cast Iron	1030 lb each	None
Front Tires	Two 7.50-16;6;32	Two 7.50-16;6;32
Ballast	None	None
Cast Iron	358 lb each	None
Height of drawbar	18½ inches	19 inches
Static weight with operator—rear	6925 lb	2950 lb
front	2425 lb	1710 lb
total	9350 lb	4660 lb

Department of Agricultural Engineering

Dates of Test: September 17 to October 1, 1973

Manufacturer: DAVID BROWN TRACTORS LTD., Meltham, Huddersfield, Yorkshire, England

FUEL, OIL AND TIME Fuel No 2 Diesel Cetane No 50.1 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8308 Weight per gallon 6.917 lb Oil SAE 20-20W API service classification (Case HDM Oil) To motor 1.703 gal Drained from motor 1.501 gal Transmission and final drive lubricant SAE 20W-40 Total time engine was operated 62½ hours.

ENGINE Make David Brown Dsl Type 4 cylinder vertical Serial No 449001/34248 Crankshaft Mounted lengthwise Rated rpm 2200 Bore and stroke 3.939" x 4.00" Compression ratio 17 to 1 Displacement 194.9 cu in Cranking system 12 volt electric Lubrication pressure Air cleaner oil washed wire mesh with pleated paper precleaner Oil filter full flow with replaceable pleated paper element Fuel filter primary and secondary with replaceable pleated paper elements Muffler vertical Cooling medium temperature control thermostat.

CHASSIS Type Standard Serial No 990/1/856190 Tread width rear 56" to 76" front 52" to 72" Wheel base 79" 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 27.5" Vertical distance above roadway 32" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio Advertised speeds mph first 1.1 second 1.8 third 2.2 fourth 2.8 fifth 3.2 sixth 3.7 seventh 4.7 eighth 5.6 ninth 6.3 tenth 8.1 eleventh 9.3 twelfth 16.1 reverse 1.8, 3.6, 4.7 and 9.3 Clutch single plate dry disc in combination with PTO clutch operated by foot pedal Brakes internal expanding shoe operated by hand lever or independently by two foot pedals Steering hydrostatic Turning radius (on concrete surface with brake applied) right 123" left 123" (on concrete surface without brake) right 138" left 138" Turning space diameter (on concrete surface with brake applied) right 254" left 254" (on concrete surface without brake) right 280" left 280" Power take-off 540 rpm at 1827 engine rpm or 1000 at 2000 engine rpm.

REPAIRS AND ADJUSTMENTS: New injectors were installed during preliminary PTO run.

REMARKS: All test results were determined from observed data obtained in accordance with SAE and ASAE test code or official Nebraska test procedure.

First and second gears were not run as it was necessary to limit the pull in third gear because of the tire tangential pull limitation.

Fifth, sixth, tenth and twelfth gears were not run as test procedure requires only six travel speeds.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1144.

L. F. LARSEN

Engineer-in-Charge

G. W. STEINBRUEGGE, Chairman

W. E. SPLINTER

D. E. LANE

Board of Tractor Test Engineers

The University of Nebraska Agricultural Experiment Station
H. W. Ottoson, Director & Acting Dean; 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. Prior to the maximum power run the tire tread-bar height must be at least 65% of new tread height.

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 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.

Varying Power and Fuel Consumption With Ballast. The varying power runs are made to show the effects 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 4 different runs 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; (3) 50% of the pull at maximum power; and (4) maintaining the same load and travel speed as in (3) by shifting to a higher gear and reducing the engine rpm.

Maximum Power with Ballast. Maximum power is measured on straight level sections of the test course. Data are shown for not more than 6 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 manufacturer's representative has the option of selecting one gear or speed over eight miles per hour. 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.

Varying Drawbar Pull 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.

SOUND MEASUREMENT

Sound is recorded during each of the Varying Power and Fuel Consumption runs as the tractor travels on a straight section of the test course. The dB(A) sound level is obtained with the microphone located near the right ear of the operator. Bystander sound readings are taken with the microphone placed 25 feet from the line of travel of the tractor.

An increase of 10 dB(A) will approximately double the loudness to the human ear.

For additional information about the Nebraska Tractor Tests write to the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska 68503.



DAVID BROWN 990 DIESEL