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Test 903: David Brown 990 (Diesel)

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 903 - DAVID BROWN 990 DIESEL

POWER TAKE-OFF PERFORMANCE

Hp	Crank- shaft speed rpm	Fuel Consumption		Hp-hr per gal	Temperature Degrees F			Barometer inches of Mercury
		Gal per hr	Lb per hp-hr		Cooling medium	Air wet bulb	Air dry bulb	
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours								
51.60	2200	3.391	0.456	15.22	200	64	75	28.867
Standard Power Take-off Speed (540 rpm)—One Hour								
44.41	1828	2.714	0.424	16.36	204	64	75	28.885
Standard Power Take-off Speed (1000 rpm)—One Hour								
48.49	2000	3.045	0.436	15.92	200	63	73	28.885
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
45.81	2298	2.889	0.437	15.86	189	64	74	.....
0.00	2331	0.727	.....	.....	167	63	72	.....
22.97	2306	1.661	0.502	13.83	174	63	73	.....
51.85	2200	3.412	0.457	15.20	203	64	75	.....
11.56	2320	1.202	0.721	9.62	167	63	72	.....
34.89	2334	2.232	0.444	15.63	176	63	73	.....
Av	27.85	2.020	0.503	13.79	179	63	73	28.887

DRAWBAR PERFORMANCE

Hp	Draw-bar pull lbs	Speed miles per hr	Crank-shaft speed rpm	Slip of drivers %	Fuel Consumption		Hp-hr per gal	Temp Degrees F			Barom-eter inches of Mercury
					Gal per hr	Lb per hp-hr		Cooling med	Air wet bulb	Air dry bulb	
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—3rd Gear											
43.47	3722	4.38	2201	7.77	3.357	0.536	12.95	210	64	80	28.900
75% of Pull at Maximum Power—Ten Hours—3rd Gear											
35.89	2857	4.71	2305	5.24	2.633	0.509	13.63	183	60	74	29.089
50% of Pull at Maximum Power—Two Hours—3rd Gear											
25.21	1945	4.86	2342	3.83	1.954	0.538	12.90	181	65	80	28.895
MAXIMUM POWER WITH BALLAST											
30.73	6039	1.91	2326	14.96	1st Gear		175	56	63	29.200	
42.40	5165	3.08	2198	12.51	2nd Gear		200	62	75	28.930	
44.58	3813	4.38	2201	7.71	3rd Gear		200	62	74	28.920	
45.26	2790	6.08	2198	5.27	4th Gear		200	62	74	28.930	
44.49	2220	7.52	2200	4.49	5th Gear		200	62	75	28.930	
42.71	1136	14.10	2203	1.87	6th Gear		200	63	77	28.930	
MAXIMUM POWER WITHOUT BALLAST											
39.91	3577	4.18	2262	14.76	3rd Gear		198	71	82	28.855	
VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—3rd Gear											
Pounds pull				3813	3859	3891	3994	3973	3825		
Horsepower				44.58	40.46	36.19	32.40	27.63	22.27		
Crankshaft speed, rpm				2201	1980	1761	1536	1318	1099		
Miles per hour				4.38	3.93	3.49	3.04	2.61	2.18		
Slip of drivers, %				7.71	8.01	8.13	8.13	8.26	8.13		

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 16.9-30; 6; 16	Two 16.9-30; 6; 16
	—Liquid	768 lb each	None
	Cast iron	810 lb each	None
Front tires	—No, size, ply & psi	Two 7.50-16; 6; 28	Two 7.50-16; 6; 28
	—Liquid	None	None
	Cast iron	135 lb each	None
Height of drawbar		20½ inches	21½ inches
Static weight	—Rear	6020 lb	2865 lb
	—Front	2000 lb	1730 lb
Total weight with operator		8195 lb	4770 lb

Department of Agricultural Engineering

Dates of Test: JUNE 11 to JUNE 19, 1965

Manufacturer: DAVID BROWN TRACTORS LTD., MELTHAM, HUDDERSFIELD, YORKSHIRE, ENGLAND

FUEL, OIL and TIME Fuel No 2 diesel Cetane No 57.0 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/69° 0.8331 Weight per gallon 6.937 lb Oil SAE 20-20W API service classification MS, DG, DM To motor 1.692 gal Drained from motor 1.566 gal Transmission lubricant SAE 50 Final drive lubricant SAE 140 Total time engine was operated 44½ hours.

ENGINE Make David Brown Diesel Type 4 cylinder vertical Serial No ADA/47A-54396 Crankshaft mounted lengthwise Rated rpm 2200 Bore and stroke 3⅝" x 4½" Compression ratio 17 to 1 Displacement 185.8 cu in Cranking system 12 volt electric Lubrication pressure Air cleaner oil washed wire mesh Oil filter replaceable treated paper element Fuel filter Primary and secondary filters with replaceable paper elements and sediment bowl Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type Standard Serial No 990/UA-474009 Tread width rear 52" to 76" front 52" to 72" Wheel base 78¾" 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" Vertical distance above roadway 30" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive except when PTO foot clutch is disengaged Transmission selective gear fixed ratio Advertised speeds mph first 2.08 second 3.45 third 4.65 fourth 6.30 fifth 7.71 sixth 14.1 reverse 3.42 and 7.65 Clutch single plate dry disc in combination with PTO clutch operated by single foot pedal Brakes internal expanding shoe operated by hand lever or independently by two foot pedals which may be locked together Steering no power assist Turning radius (on concrete surface with brake applied) right 126" left 126" (on concrete surface without brake) right 138" left 138" Turning space diameter (on concrete surface with brake applied) right 258" left 258" (on concrete surface without brake) right 282" left 282" Belt pulley 1412 rpm at 2000 engine rpm diam 8½" face 5¾" Belt speed 3140 fpm Power take-off 540 rpm at 1828 engine rpm and 1000 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.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 903.

L. F. LARSEN

Engineer-in-Charge

G. W. STEINBRUEGGE, Chairman

J. J. SULEK

D. E. LANE

Board of Tractor Test Engineers

The University of Nebraska Agricultural Experiment Station
E. F. Frolik, Dean; H. H. Kramer, 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 trans-

mission, 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 Power Without Ballast. All added ballast is removed from the tractor. The maximum drawbar power of the tractor is determined by the same procedure used for getting maximum power with ballast. The gear (or travel speed) is the same as that used in the 10-hour test.

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.



David Brown 990 Diesel