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## Test 1211: Case M-B 4/94 Diesel (UNIMOG)

Nebraska Tractor Test Lab

University of Nebraska-Lincoln, [tractortestlab@unl.edu](mailto:tractortestlab@unl.edu)

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# NEBRASKA TRACTOR TEST 1211 – CASE M-B 4/94 DIESEL (UNIMOG 406)

## POWER TAKE-OFF PERFORMANCE

Hp	Crank-shaft speed rpm	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Cooling medium	Temperature Degrees F Air wet bulb	Air dry bulb	Barometer inches of Mercury
<b>MAXIMUM POWER AND FUEL CONSUMPTION</b>								
<b>Rated Engine Speed—Two Hours (PTO Speed—1132 rpm)</b>								
73.33	2550	5.187	0.490	14.14	207	57	75	29.030
<b>Standard Power Take-off Speed (540 rpm)—One Hour</b>								
69.65	2221	4.580	0.456	15.21	205	57	76	28.990
<b>Standard Power Take-off Speed (1000 rpm)—One Hour</b>								
70.17	2253	4.638	0.458	15.13	208	56	75	29.020
<b>VARYING POWER AND FUEL CONSUMPTION—Two Hours</b>								
63.42	2599	4.716	0.516	13.45	196	57	77	.....
0.00	2705	2.068	.....	.....	178	58	78	.....
32.25	2630	3.262	0.701	9.89	182	57	78	.....
74.12	2550	5.239	0.490	14.15	203	57	78	.....
16.38	2671	2.687	1.137	6.10	179	58	78	.....
47.84	2618	3.933	0.570	12.17	184	58	78	.....
Av 39.00	2629	3.651	0.649	10.68	187	57	77	.....

## 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 Degrees F Cool-ing med	Air wet bulb	Air dry bulb	Barometer inches of Mercury
<b>VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST</b>											
<b>Maximum Available Power—Two Hours 4th (D-2) Gear</b>											
64.01	4508	5.33	2550	3.37	5.102	0.553	12.55	209	70	86	28.830
<b>75% of Pull at Maximum Power—Ten Hours 4th (D-2) Gear</b>											
51.67	3513	5.52	2618	2.48	4.435	0.595	11.65	189	69	80	28.851
<b>50% of Pull at Maximum Power—Two Hours 4th (D-2) Gear</b>											
34.55	2303	5.63	2650	1.71	3.641	0.731	9.49	180	60	68	28.850
<b>50% of Pull at Reduced Engine Speed—Two Hours 5th (L-3) Gear</b>											
34.86	2326	5.62	1879	1.59	2.704	0.538	12.89	181	69	81	28.860
<b>MAXIMUM POWER WITH BALLAST</b>											
58.69	10558	2.08	2549	13.22	1st (L-1) Gear			196	70	86	28.810
64.19	8618	2.79	2551	8.31	2nd (D-1) Gear			209	66	86	28.750
64.31	5802	4.16	2551	4.42	3rd (L-2) Gear			208	67	86	28.770
66.33	4670	5.33	2551	3.37	4th (D-2) Gear			210	67	85	28.770
65.70	3248	7.59	2550	2.24	5th (L-3) Gear			206	67	86	28.770
65.61	2546	9.67	2550	1.61	6th (D-3) Gear			205	67	86	28.770

## VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST 4th (D-2) Gear

Pounds Pull	4670	5111	5368	5400	5132
Horsepower	66.33	62.72	57.74	52.87	36.30
Crankshaft Speed rpm	2551	2295	2037	1781	1525
Miles Per Hour	5.33	4.78	4.24	3.69	2.65
Slip of Drivers %	3.37	3.60	3.60	3.97	3.78

## TRACTOR SOUND LEVEL WITH CAB

	dB(A)
Maximum Available Power 2 Hours	86.5
75% of Pull at Max. Power 10 Hours	86.0
50% of Pull at Max. Power 2 Hours	88.0
50% of Pull at Reduced Engine Speed 2 Hours	82.5
Bystander in 8th (D-4) Gear	85.5

## TIRES, BALLAST AND WEIGHT

	With Ballast	Without Ballast
<b>Rear Tires</b>	Two 12.5-20; 10; 36	Two 12.5-20; 10; 36
<b>Ballast</b>	None	None
	Cast Iron	None
	(on platform)	None
<b>Front Tires</b>	Two 12.5-20; 10; 36	Two 12.5-20; 10; 36
<b>Ballast</b>	None	None
	Cast Iron	None
	(on bumper)	
<b>Height of drawbar</b>	33.0 inches	33.0 inches
<b>Static weight with operator—rear</b>	6050 lb	3230 lb
<b>front</b>	7060 lb	5260 lb
<b>total</b>	13110 lb	8490 lb

Department of Agricultural Engineering

Dates of Test: May 13 to 21, 1976

Manufacturer: DAIMLER-BENZ A.G., STUTT-GART, GERMANY

**FUEL, OIL AND TIME** Fuel No 2 Diesel Cetane No 51.7 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8328 Weight per gallon 6.934 lb API service classification SB/SE CA/CD To motor 4.206 gal Drained from motor 3.501 gal Transmission and final drive lubricant SAE 80 Total time engine was operated 50 hours.

**ENGINE** Make Daimler-Benz Diesel Type 6 cylinder vertical Serial No 353.902-10-380157 Crankshaft mounted lengthwise Rated rpm 2550 Bore and stroke 3.819" x 5.039" Compression ratio 17 to 1 Displacement 346 cu in Cranking system 12 volt Lubrication pressure Air cleaner dry paper element and centrifugal precleaner with dust evacuation Oil filter one full flow and one by-pass filter elements Oil cooler engine coolant heat exchanger for engine Fuel filter prefilter and two interchangeable felt or paper elements Muffler underslung Cooling medium temperature control thermostat.

**CHASSIS** Type 4-wheel drive Serial No 406 121 10 027194 Tread width rear 63.75" front 63.75" Wheel base 93.75" 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 56.3" Vertical distance above roadway 34.84" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio synchronized transmission Advertised speeds mph first 2.4 second 3.0 third 4.3 fourth 5.4 fifth 7.7 sixth 9.7 seventh 13.9 eighth 17.5 ninth 21.0 tenth 26.5 eleventh 34.6 twelfth 46.0 reverse 3.0, 3.8, 5.4, 6.8 Clutch single dry plate hydraulically operated by foot pedal Brakes dry disc, power assisted, operated by foot pedal Steering hydraulic power assist Turning radius (on concrete surface without brake) right 189.7" left 196" Turning space diameter (on concrete surface without brake) right 417" left 430" Power take-off 540 rpm at 2221 engine rpm and 1000 rpm at 2253 engine rpm

**REPAIRS AND ADJUSTMENTS:** No repairs or adjustments.

**REMARKS:** All test results were determined from observed data obtained in accordance with SAE and ASAE test code or official Nebraska test procedure. Temperature at injection pump return was 156°F. Six gears were chosen up to 15 mph. All drawbar pulls were made from the trailer hitch point.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1211.

LOUIS I. LEVITICUS  
Engineer-in-Charge

G. W. STEINBRUEGGE, Chairman  
W. E. SPLINTER  
D. E. LANE  
Board of Tractor Test Engineers

# EXPLANATION OF TEST REPORT

## GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories may be disconnected only when the means for disconnecting can be reached from the operator station. 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 use.

## 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 mph. The slip 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 68583.



CASE M-B-4/94 DIESEL (UNIMOG 406)