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Test 1199: Yanmar YM 240 Diesel

Nebraska Tractor Test Lab

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NEBRASKA TRACTOR TEST 1199 – YANMAR YM 240 DIESEL

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
Rated Engine Speed—Two Hours (PTO Speed—588 rpm)								
19.76	2400	1.308	0.457	15.11	210	64	75	29.070
Standard Power Take-off Speed (540 rpm)—One Hour								
18.75	2205	1.245	0.459	15.05	207	64	75	29.060
VARYING POWER AND FUEL CONSUMPTION—Two Hours								
17.38	2479	1.156	0.459	15.03	194	67	76	.....
0.00	2581	0.369	.....	.....	165	66	75	.....
8.91	2544	0.726	0.562	12.28	158	66	75	.....
19.99	2400	1.347	0.465	14.84	201	65	74	.....
4.48	2562	0.534	0.823	8.39	153	66	75	.....
13.22	2519	0.930	0.486	14.22	172	67	75	.....
Av 10.66	2514	0.844	0.546	12.64	174	66	75	29.050

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
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours 7th (3-H) Gear											
16.54	1273	4.87	2400	6.76	1.340	0.559	12.35	173	42	48	28.885
75% of Pull at Maximum Power—Ten Hours 7th (3-H) Gear											
13.58	990	5.14	2504	5.69	1.137	0.578	11.95	139	32	33	28.962
50% of Pull at Maximum Power—Two Hours 7th (3-H) Gear											
9.57	677	5.30	2541	4.16	0.923	0.666	10.37	131	35	35	28.855
50% of Pull at Reduced Engine Speed—Two Hours 8th (4-H) Gear											
9.33	665	5.26	1591	4.39	0.778	0.576	11.98	148	34	34	28.895
MAXIMUM POWER WITH BALLAST											
10.86	2343	1.74	2518	14.88	4th Gear (1-H)	151	44	50	28.870		
13.01	2442	2.00	2518	13.70	5th Gear (4-L)	136	28	30	29.110		
16.02	1978	3.04	2402	11.56	6th Gear (2-H)	180	44	51	28.870		
16.60	1279	4.86	2401	6.98	7th Gear (3-H)	180	44	51	28.870		
15.99	755	7.95	2402	4.21	8th Gear (4-H)	174	43	50	28.870		

VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST 7th (3-H) Gear

Pounds Pull	1279	1369	1441	1479	1454	1507	1396
Horsepower	16.60	15.86	14.78	13.26	11.17	9.63	7.15
Crankshaft Speed rpm	2401	2156	1917	1680	1438	1199	955
Miles Per Hour	4.86	4.35	3.85	3.36	2.88	2.40	1.92
Slip of Drivers %	6.98	7.41	7.84	8.09	8.01	8.09	7.75

TRACTOR SOUND LEVEL WITHOUT CAB

	dB(A)
Maximum Available Power 2 Hours	90.5
75% of Pull at Max. Power 2 Hours	88.5
50% of Pull at Max. Power 2 Hours	88.5
50% of Pull at Reduced Engine Speed 2 Hours	84.5
Bystander in 8th (4-H) gear	78.0

TIRES, BALLAST AND WEIGHT

	With Ballast	Without Ballast
Rear Tires		
Ballast	—No., size, ply & psi	Two 9.5/9-24; 4; 14
	—Liquid	136 lb each
	Cast Iron	430 lb each
Front Tires		
Ballast	—No., size, ply & psi	Two 4.00-15; 4; 36
	—Liquid	None
	Cast Iron (front end)	220 lb total
Height of drawbar	16.5 inches	16.5 inches
Static weight with operator—rear	2220 lb	1165 lb
front	1085 lb	785 lb
total	3305 lb	1950 lb

The Agricultural Experiment Station
Institute of Agriculture and Natural Resources
University of Nebraska—Lincoln
H. W. Ottoson, Director

Department of Agricultural Engineering

Dates of Test: November 24, 1975 to January 5, 1976

Manufacturer: YANMAR DIESEL ENGINE CO., LTD. 62 Chayamachi, Kita-Ku, Osaka, Japan

FUEL, OIL AND TIME Fuel Diesel No 2 Cetane No 51.7 (rating taken from oil company's typical inspection data Specific gravity converted to 60°/60° 0.8293 Weight per gallon 6.905 lb Oil SAE 20-20W API service classification SB/SE-CA/CD To motor .977 gal Drained from motor .834 gal Transmission and final drive lubricant John Deere Hy-GARD Total time engine was operated 68 hours.

ENGINE Make Yanmar Diesel Type 2 cylinder Serial No TR 2A 09247 Crankshaft mounted lengthwise Rated rpm 2400 Bore and stroke 3.543 x 3.543 Compression ratio 20.1 to 1 Displacement 70 cu. in. Cranking system 12 volt Lubrication pressure Air cleaner dry non woven fabric element Oil filter full flow treated paper element Fuel filter treated paper element Muffler vertical Cooling medium temperature control none.

CHASSIS Type standard Serial No 00333 Tread width rear 39.4" front 33.1" Wheel base 58.7" 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 26.4" Vertical distance above roadway 26.6" 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 0.5 second 1.0 third 1.4 fourth 2.0 fifth 2.3 sixth 3.6 seventh 5.4 eighth 8.6 reverse 1.0 and 3.6 Clutch single plate dry disc operated by foot pedal Brakes internal expanding shoes operated by two foot pedals Steering mechanical Turning radius (on concrete surface with brake applied) right 84" left 84" (on concrete surface without brake) right 92" left 92" Turning space diameter (on concrete surface with brake applied) right 182" left 182" (on concrete surface without brake) right 198" left 198" Power take-off 540 rpm at 2205 engine rpm.

REPAIRS and ADJUSTMENTS: Air intake hose was replaced with new model on prelim. run.

REMARKS: All test results were determined from observed data obtained in accordance with SAE and ASAE test code or official Nebraska test procedure. Fuel temperature at injection pump was 166°F. Five gears were chosen between tangential pull limit of driving tires and 15 mph (only one gear permitted over 8 mph).

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1199.

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.



YANMAR YM 240 DIESEL