9-1-1988

Test 1613: Caterpiller Challenger 65 Diesel 10-Speed

Nebraska Tractor Test Lab
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NEBRASKA OECD TRACTOR TEST 1613—SUMMARY 053
CATERPILLAR CHALLENGER 65 DIESEL
10 SPEED

POWER TAKE-OFF PERFORMANCE

Power HP *(kW)*	Crank shaft speed rpm	Fuel Consumption Gal/hr *(l/h)*	lb/hp.hr *(kg/kW.h)*	Hp.hr/gal *(kW.h/l)*	Mean Atmospheric Conditions
MAXIMUM POWER AND FUEL CONSUMPTION					
Rated Engine Speed—(PTO speed—1025 rpm)					
232.29 *(173.21)*	2101	14.44 *(54.66)*	0.430 *(0.261)*	16.09 *(3.17)*	
Maximum Power (Two hours)					
237.91 *(177.41)*	1900	13.99 *(52.96)*	0.406 *(0.247)*	17.00 *(3.35)*	
Standard Power Take-off Speed (1000 rpm)					
236.30 *(176.21)*	2049	14.36 *(54.35)*	0.420 *(0.255)*	16.46 *(3.24)*	Air temperature
VARYING POWER AND FUEL CONSUMPTION					80°F *(26°C)*
232.29 *(173.21)*	2101	14.44 *(54.66)*	0.430 *(0.261)*	16.09 *(3.17)*	
200.58 *(149.57)*	2148	13.11 *(49.63)*	0.452 *(0.275)*	15.30 *(3.01)*	Relative humidity
155.05 *(115.62)*	2192	10.90 *(41.25)*	0.486 *(0.295)*	14.23 *(2.80)*	58%
105.04 *(78.33)*	2240	8.77 *(33.20)*	0.577 *(0.351)*	11.98 *(2.36)*	Barometer
53.27 *(35.97)*	2272	6.38 *(24.16)*	0.828 *(0.504)*	8.35 *(1.64)*	29.00″ Hg *(98.21 kPa)*
0.54 *(0.40)*	2302	4.65 *(17.58)*	59.997 *(36.495)*	0.12 *(0.02)*	

Maximum Torque 739.3 lb. ft *(1002.3 Nm)* @ 1400 RPM
Maximum Torque Rise 27.3%

DRAWBAR PERFORMANCE
FUEL CONSUMPTION CHARACTERISTICS

Power Hp *(kW)*	Drawbar pull *(kN)*	Speed mph *(km/h)*	Crank-shaft speed rpm	Slip %	Fuel Consumption lb/hp.hr *(kg/kW.h)*	Hp.hr/gal *(kW.h/l)*	Temp.°F *(°C)* cool-ing med	Air dry bulb	Barom. inch Hg *(kPa)*
Maximum Power—3rd Gear									
213.73 *(159.38)*	19577 *(87.08)*	4.09 *(6.59)*	1900	2.14	0.454 *(0.276)*	15.22 *(3.00)*	184 *(84)*	69 *(21)*	28.99 *(98.17)*
75% of Pull at Maximum Power—3rd Gear									
182.06 *(135.76)*	14678 *(65.29)*	4.65 *(7.49)*	2142	1.46	0.502 *(0.305)*	13.77 *(2.71)*	182 *(83)*	76 *(24)*	28.91 *(97.90)*
50% of Pull at Maximum Power—3rd Gear									
125.49 *(93.58)*	9789 *(43.54)*	4.81 *(7.74)*	2203	0.93	0.574 *(0.349)*	12.03 *(2.37)*	179 *(82)*	78 *(26)*	28.89 *(97.83)*
75% of Pull at Reduced Engine Speed—4th Gear									
181.56 *(135.39)*	14676 *(65.28)*	4.64 *(7.47)*	1866	1.46	0.461 *(0.281)*	14.98 *(2.95)*	183 *(84)*	77 *(25)*	28.90 *(97.87)*
50% of Pull at Reduced Engine Speed—4th Gear									
125.54 *(93.62)*	9785 *(43.53)*	4.81 *(7.74)*	1926	0.99	0.512 *(0.311)*	13.50 *(2.66)*	178 *(81)*	78 *(26)*	28.88 *(97.80)*

Location of Test: Center for Agricultural Equipment, Lincoln Nebraska 68583-0832, U.S.A.

Dates of Test: September, 1988

Manufacturer: Caterpillar Inc., 100 N.E. Adams, Peoria, IL 61629 U.S.A.

FUEL AND OIL: Fuel No. 2 Diesel **Cetane No.** 51.2 **Specific gravity converted to 60°/60°F** ***(15°/15°C)***0.8299 **Fuel weight** 6.910 lbs/gal *(0.828 kg/l)* **Oil SAE** 15W40 **Oil consumption for 10 hours** 0.554 gal *(2.097 l)* **Transmission and final drive lubricant** SAE 30W API CD/TO-2

ENGINE: Make Caterpillar Diesel **Type** six cylinder vertical with turbocharger and intercooler **Serial No.** 08Z45452 **Crankshaft** lengthwise **Rated engine speed** 2100 **Bore and stroke** 4.75″ × 6.00″ *(120.6 mm × 152.4 mm)* **Compression ratio** 15 to 1 **Displacement** 638 cu in *(10450 ml)* **Starting system** 12 volt **Lubrication** pressure **Air cleaner** two paper elements and aspirator **Oil filter** one full flow cartridge **Oil cooler** engine coolant heat exchanger for crankcase oil, engine coolant heat exchanger for transmission oil, radiator for steering oil **Fuel filter** one paper cartridge and screen **Muffler** underhood **Exhaust** vertical **Cooling medium temperature control** thermostat.

ENGINE OPERATING PARAMETERS: Fuel rate 92.9-102.6 lb/hr *(42.2-46.6 kg/hr)* **High idle** 2220-2340 rpm **Turbo boost** nominal 14.5-19.7 psi *(100-136 kPa)* as measured 16.0 psi *(110 kPa)*

CHASSIS: Type track layer—rubber track **Serial No.** *7YC00742* **Tread width** 84.6″ *(2150 mm)* **Length of track on ground** 107.6″ *(2733 mm)* **Hydraulic control system** direct engine drive **Transmission** selective gear fixed ratio with full range operator controlled powershift **Nominal travel speeds mph *(km/h)*** first 2.6 *(4.2)* second 4.0 *(6.4)* third 4.7 *(7.5)* fourth 5.3 *(8.6)* fifth 6.1 *(9.9)* sixth 7.0 *(11.3)* seventh 8.1 *(13.0)* eighth 9.3 *(14.9)* ninth 12.0 *(19.2)* tenth 18.1 *(29.1)* reverse 1.9 *(3.1)*, 4.5 *(7.2)* **Clutch** multiple wet disc hydraulically power actuated by foot pedal **Brakes** caliper disc hydraulically power actuated and operated by foot pedal **Steering** differential steering hydrostatically actuated by steering wheel **Power take-off** 1000 rpm at 2050 engine rpm**Unladen tractor mass** 33200 lb *(15059 kg)*.

REPAIRS AND ADJUSTMENTS: No repairs or adjustments.

DRAWBAR PERFORMANCE AT 1900 RPM
MAXIMUM POWER IN SELECTED GEARS

Power Hp *(kW)*	Drawbar pull *(kN)*	Speed mph *(km/h)*	Crank-shaft speed rpm	Slip %	Fuel Consumption lb/hp.hr *(kg/kW.h)*	Fuel Consumption Hp.hr/gal *(kW.h/l)*	Temp.°F *(°C)* cool-ing med	Temp.°F *(°C)* Air dry bulb	Barom. inch Hg *(kPa)*
				1st Gear					
186.56 *(139.12)*	32684 *(145.38)*	2.14 *(3.44)*	2004	13.66	0.534 *(0.325)*	12.95 *(2.55)*	181 *(83)*	66 *(19)*	28.67 *(97.09)*
				2nd Gear					
209.68 *(156.36)*	22912 *(101.92)*	3.43 *(5.52)*	1901	3.37	0.462 *(0.281)*	14.95 *(2.94)*	184 *(84)*	70 *(21)*	28.98 *(98.14)*
				3rd Gear					
213.73	*19577 *(87.08)*	4.09 *(6.59)*	1900	2.14	0.454 *(0.276)*	15.22 *(3.00)*	184 *(84)*	69 *(21)*	28.99 *(98.17)*
				4th Gear					
213.52 *(159.22)*	16978 *(75.52)*	4.72 *(7.59)*	1902	1.72	0.454 *(0.276)*	15.23 *(3.00)*	185 *(85)*	71 *(22)*	28.98 *(98.14)*
				5th Gear					
211.95 *(158.05)*	14674 *(65.27)*	5.42 *(8.72)*	1897	1.41	0.457 *(0.278)*	15.11 *(2.98)*	185 *(85)*	72 *(22)*	28.97 *(98.10)*
				6th Gear					
209.39 *(156.14)*	12583 *(55.97)*	6.24 *(10.04)*	1899	1.14	0.461 *(0.280)*	14.99 *(2.95)*	186 *(85)*	74 *(23)*	28.96 *(98.07)*
				7th Gear					
208.30 *(155.33)*	10912 *(48.54)*	7.16 *(11.52)*	1900	1.04	0.465 *(0.283)*	14.88 *(2.93)*	186 *(86)*	75 *(24)*	28.96 *(98.07)*
				8th Gear					
205.48 *(153.23)*	9358 *(41.62)*	8.23 *(13.25)*	1900	0.88	0.474 *(0.288)*	14.58 *(2.87)*	186 *(86)*	76 *(24)*	28.95 *(98.04)*

DRAWBAR PERFORMANCE AT 2100 RPM
MAXIMUM POWER IN SELECTED GEARS

Power Hp *(kW)*	Drawbar pull *(kN)*	Speed mph *(km/h)*	Crank-shaft speed rpm	Slip %	Fuel Consumption lb/hp.hr *(kg/kW.h)*	Fuel Consumption Hp.hr/gal *(kW.h/l)*	Temp.°F *(°C)* cool-ing med	Temp.°F *(°C)* Air dry bulb	Barom. inch Hg *(kPa)*
				1st Gear					
193.73 *(144.46)*	29766 *(132.41)*	2.44 *(3.93)*	2116	6.78	0.512 *(0.311)*	13.51 *(2.66)*	179 *(81)*	63 *(17)*	28.68 *(97.12)*
				2nd Gear					
204.46 *(152.47)*	20005 *(88.98)*	3.83 *(6.17)*	2101	2.29	0.485 *(0.295)*	14.25 *(2.81)*	182 *(83)*	70 *(21)*	28.99 *(98.17)*
				3rd Gear					
206.28 *(153.83)*	17012 *(75.67)*	4.55 *(7.32)*	2100	1.62	0.480 *(0.292)*	14.41 *(2.84)*	182 *(83)*	69 *(21)*	28.99 *(98.17)*
				4th Gear					
206.42 *(153.92)*	14834 *(65.98)*	5.22 *(8.40)*	2099	1.46	0.48[illegible] *(0.29[illegible])*	14.34 *(2.82)*	183 *(84)*	71 *(22)*	28.98 *(98.14)*
				5th Gear					
204.80 *(152.72)*	12790 *(56.89)*	6.00 *(9.66)*	2099	1.14	0.486 *(0.296)*	14.21 *(2.80)*	183 *(84)*	72 *(22)*	28.97 *(98.10)*
				6th Gear					
200.71 *(149.67)*	10899 *(48.48)*	6.91 *(11.11)*	2098	1.04	0.494 *(0.301)*	13.98 *(2.75)*	184 *(84)*	73 *(23)*	28.97 *(98.10)*
				7th Gear					
199.32 *(148.63)*	9422 *(42.00)*	7.92 *(12.74)*	2098	0.88	0.499 *(0.304)*	13.85 *(2.73)*	184 *(84)*	75 *(24)*	28.96 *(98.07)*
				8th Gear					
194.96 *(145.38)*	8031 *(35.72)*	9.10 *(14.65)*	2099	0.77	0.510 *(0.310)*	13.54 *(2.67)*	184 *(84)*	76 *(24)*	28.95 *(97.04)*

REMARKS: All test results were determined from observed data obtained in accordance with official OECD, SAE and Nebraska test procedures. For the maximum power tests, the fuel temperature at the injection pump was maintained at 133° F *(56.1° C)*. Manufactuers specifications for engine bore, stroke, displacement and compression ratio were not verified.

We, the undersigned, certify that this is a true and correct report of official Tractor Test No. **1613,** Summary 053, April 6, 1989.

LOUIS I. LEVITICUS
Engineer-in-Charge

K. VON BARGEN
R. D. GRISSO
T. L. THOMPSON
Board of Tractor Test Engineers

TIRES AND WEIGHT			**Tested Without Ballast**
Rear Tires	—No., size, ply & psi *(kPa)*		NA
Front Tires	—No., size, ply & psi *(kPa)*		NA
Height of Drawbar			16.5 in *(420 mm)*
Static Weight		Total	33220 lb *(15068 kg)*

THREE POINT HITCH PERFORMANCE (SAE Static Test)

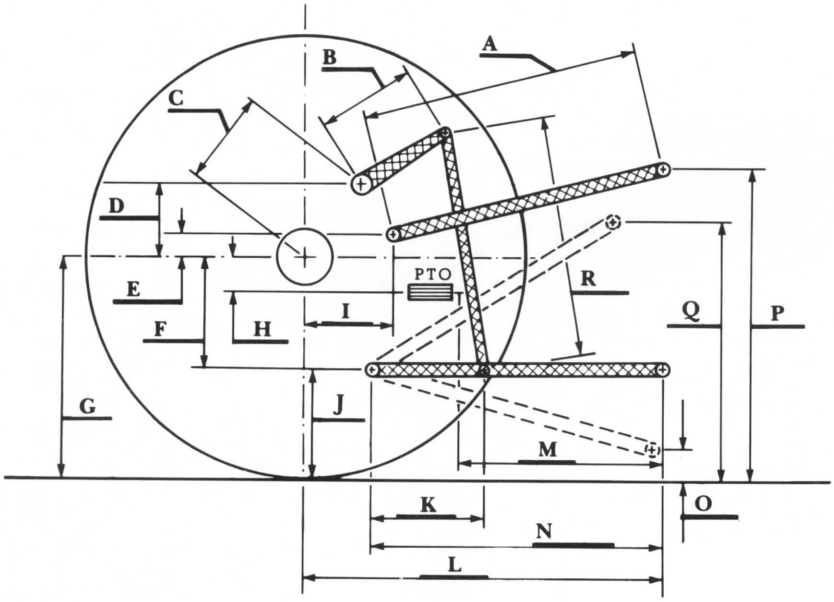
Observed Maximum Pressure psi. *(bar)*	2500 *(172)*
Location	remote outlet
Hydraulic oil temperature °*F*(°*C*)	153 *(67)*
Location	pump inlet
Category	III
Quick attach	no

Hitch point distance to ground level in. *(mm)*	8.2 *(208)*	16.0 *(406)*	24.0 *(610)*	32.0 *(812)*	40.0 *(1016)*
Lift force on frame lb.	31630	26570	22510	18390	12800
" " " " " " *(kN)*	*(140.7)*	*(118.2)*	*(100.1)*	*(81.8)*	*(56.9)*

THREE POINT HITCH PERFORMANCE (OECD Static Test)

CATEGORY: III
Quick Attach: None

Maximum Force Exerted Through Whole Range:	12313 lbs *(54.8 kN)*
i) Opening pressure of relief valve:	NA
Sustained pressure at open relief valve	2500 psi *(172 Bar)*
ii) Pump delivery rate at minimum pressure:	28.2 GPM *(106.7 l/min)*
iii) Pump delivery rate at maximum hydraulic power:	25.6 GPM *(96.9 l/min)*
Delivery pressure:	2250 psi *(155 Bar)*
Power:	33.6 Hp *(25.1 kW)*



Hitch Dimensions as Tested — No Load

	inch	*mm*
A	25.5	*648*
B	21.5	*545*
C	18.6	*472*
D	16.3	*415*
E	16.6	*422*
F	3.9	*98*
G	23.4	*593*
*H	−5.1	*−130*
I	14.6	*370*
J	19.5	*495*
K	21.1	*535*
L	40.6	*1030*
M	25.5	*648*
N	30.1	*765*
O	9.0	*229*
P	41.5	*1054*
Q	37.8	*960*
R	25.8	*655*

*PTO is above rear axle.

TRACTOR SOUND LEVEL WITH CAB	dB(A)
Maximum Available Power—3rd Gear	75.5
75% of Pull at Maximum Power—3rd Gear	75.5
50% of Pull at Maximum Power—3rd Gear	74.5
50% of Pull at Reduced Engine Speed—4th Gear	73.5
Bystander in 10th gear	89.0

Catterpillar Challenger 65 Diesel

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Institute of Agriculture and Natural Resources
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Darrell Nelson, Dean and Director

CENTER FOR AGRICULTURAL EQUIPMENT
DEPARTMENT OF AGRICULTUAL ENGINEERING
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
UNIVERSITY OF NEBRASKA–LINCOLN

TEST REPORT No. 88 - 11

Performance comparison between the Caterpillar Challenger 65 and a Four-Wheel drive articulated tractor.

INTRODUCTION.

The test was requested by Caterpillar Inc. of Peoria, Illinois in addition to the Standard Restricted OECD test — Code II. (See also Nebraska report # 1613). The purpose of this test series was to obtain performance data on two different tractor types on two different surfaces.

TEST PROCEDURE.

The relevant specifications of the Caterpillar Challenger 65 and the Four-wheel drive tractor are presented in Table I.

TABLE I—Tractor Specifications

Make	Caterpillar	Four-wheel drive (*)
Type	Rubber-tracked crawler	Articulated steering
Model	Challenger 65	Powershift
1) PTO pwr @ RES	173.21 kW *(232.92 hp)*	No PTO
2) Eng pwr @ RES	201 kW *(270 hp)*	209 kW *(280 hp)*
3) RES	2100 rpm	2100 rpm
Total weight	15150 kg *(33400 lbs)*	15195 kg *(33500 lbs)*
Tires/Tracks	Width 2×626 mm *(24.6 in)*	Front: 4×20.8-38/8 ply
	Contact Length 2×2718 mm *(107.0 in)*	Rear: 4×20.8-38/8 ply
Tire pressure	Does not apply	Inner: 110 kPa *(16 psi)*
		Outer: 95 kPa *(14 psi)*

1) Challenger 65 — See test # 1613
2) Data from manufacturers literature. Not tested.
3) RES = Rated engine speed
(*) Versatile 876.

Both tractors were operated on a concrete test track and on a Waukesha silty clay loam soil. For each run the soil was chiseled twice to a depth of 30 cm *(12 inch)*, disked, watered and packed. Cone Index readings were taken on the North and South side of the track. The treatments produced readings at the 6 inch level at or above 14.37 kN/m² *(300 psi)*. Average readings for the north and south side are shown in table II for 2″ and 4″ depths.

Table II—Cone Index readings for the soil track.

	DEPTH	
	2″	4″
North Side	4.50 kN/m² *(94 psi)*	8.14 kN/m² *(170 psi)*
South Side	5.03 kN/m² *(105 psi)*	7.47 kN/m² *(156 psi)*

TEST RESULTS.

Table IIIa—Four-wheel drive performance on concrete.

Gear	Power kW *(hm)*	Drawbar Pull kN *(lb)*	Speed km/h *(mph)*	Engine Speed rpm	Slip %
3	138.79 *(186.12)*	116.71 *(26237)*	4.28 *(2.66)*	2074	14.45
4	154.64 *(207.37)*	98.76 *(22203)*	5.64 *(3.50)*	2098	8.75
5	158.52 *(212.57)*	80.65 *(18131)*	7.08 *(4.40)*	2100	6.28
6	153.56 *(205.92)*	62.72 *(14101)*	8.81 *(5.48)*	2099	4.59

TABLE IIIb—Caterpillar Challenger 65 performance on concrete.

Gear	Power kW *(hp)*	Drawbar Pull kN *(lb)*	Speed km/h *(mph)*	Engine Speed rpm	Slip %
1	139.12 *(186.56)*	145.38 *(32684)*	3.44 *(2.14)*	2004	13.66
1	144.46 *(193.73)*	132.41 *(29766)*	3.93 *(2.44)*	2116	6.78
2	152.47 *(204.46)*	88.98 *(20005)*	6.17 *(3.83)*	2101	2.29
3	153.83 *(206.28)*	75.67 *(17012)*	7.32 *(4.55)*	2100	1.62
4	153.92 *(206.42)*	65.98 *(14834)*	8.40 *(5.22)*	2099	1.46

TABLE IIIc—Four-wheel drive performance on soil.

Gear	Power kW *(hp)*	Drawbar Pull kN *(lb)*	Speed km/h *(mph)*	Engine Speed rpm	Slip %
5	125.42 *(168.19)*	74.71 *(16797)*	6.04 *(3.76)*	2098	19.88
5	127.28 *(170.68)*	69.31 *(15582)*	6.61 *(4.11)*	2157	14.84
6	141.46 *(189.70)*	60.73 *(13652)*	8.39 *(5.21)*	2098	9.12

TABLE IIId—Caterpillar Challenger 65 performance on soil.

Gear	Power kW *(hp)*	Drawbar Pull kN *(lb)*	Speed km/h *(mph)*	Engine Speed rpm	Slip %
1	106.51 *(142.83)*	104.62 *(23520)*	3.66 *(2.28)*	2155	14.50
2	129.12 *(173.16)*	106.50 *(23942)*	4.36 *(2.71)*	1695	14.34
2	146.11 *(195.94)*	86.95 *(19548)*	6.05 *(3.76)*	2096	3.92
3	149.16 *(200.02)*	74.11 *(16662)*	7.25 *(4.50)*	2099	2.55
4	146.21 *(196.08)*	63.21 *(14210)*	8.33 *(5.17)*	2097	2.09

REMARKS.

1. The 4wd test on concrete was run in 3rd gear at a slightly lugged down condition in order to reach the 15% slip level. A lower gear could have been used at part load as well. (Table IIIa)
2. The Challenger 65 test on concrete was run twice in 1st gear; at part load in order to produce 7% slip and at full load lugged down in order to produce a slip as close to 15% as possible. (Table IIIb).
3. Fourth gear was not run on the soil track on the Four-wheel drive tractor because the tractor had reached 20% slip in 5th gear at rated engine speed and 15% at reduced load speed. (Table IIIc)
4. First gear in soil on the Challenger 65 was runs as close to 15% slip as possible. However this caused a condition of irregular pull, which made measurement difficult. Therefore the second gear was tested at two levels. One to correspond to about 15% slip and the other at approximately rated engine speed. (Table IIId)

The tests were performed during the fall of 1988 on the concrete and soil track at the Center for Agricultural Equipment, (formerly the Nebraska Tractor Testing Laboratory) University of Nebraska, Lincoln.

I hereby certify that the above data are the actual and correct results of the test series.

Date: June 10, 1989
Lincoln, Nebraska.

For the Center
Dr. Louis I. Leviticus
Associate Director