FINNISH RESEARCH INSTITUTE OF ENGINEERING IN AGRICULTURE AND FORESTRY
(VAKOLA)

Testing, research and development of the machines used in agriculture, gardening, forestry, dairy, household work and home industries

Address: Rukkila, 00001 Helsinki 100, Finland

TEST BULLETIN: O.E.C.D. No. 538

Report on test in accordance with O.E.C.D. Standard Code for the Official Testing of Agricultural Tractors



VALMET 110 id DIESEL TRACTOR

Manufactured by: Valmet DO Brasil, Magi das Cruzes (SP), Brazil

This report has been approved by the O.E.C.D. Coordinating Centre (C.N.E.E.M.A. France) as being in accordance with the O.E.C.D. Standard Code for the Official Testing of Agricultural Tractors

Date of approval: 1977-07-07 **Serial No. 538**

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This bulletin is based on engineering tests in accordance with the O.E.C.D. Standard Code for the Official Testing of Agricultural Tractors. It does not contain an evaluation of the performance of the tractor on practical farm work.

Helsinki 1977. Government Printing Centre

Tractor manufacturer's name and address:	Valmet DO Brasil S.A. Indústria e Comércio de Tratores, Magi das Cruzes-Estado de Sao Paulo, Brazil
Submitted for test by:	The manufacturer
Selected by:	The manufacturer with the agreement of the institute
Place of running-in:	Valmet DO Brasil S.A., Sao Paulo, Brazil
Duration of running-in:	15 h

SPECIFICATION OF TRACTOR

Tractor

Make:	Valmet Do Brasil S.A. Indústria è Comércio de Tratores
Model:	1101d
Type:	Standard four wheel, rear wheel driven
Serial No.:	11011062

Engine

Make:	MWM Motores Diesel S.A.
Model:	D 225-6TVA
Type:	4-stroke, direct injection diesel, water cooled
Serial No.:	02250610468
Cylinders:	6 cylinders, vertical, in line, 100 mm bore, 120 mm stroke, capacity 5658 cm^3, compression ratio 18:1, overhead valves, wet replaceable cylinder liners
Fuel system:	BOSCH type FP/KS 22 AD piston type fuel feed pump, one prefilter CAV type SSV-5836A120A in the suction pipe, one double filter BOSCH type FJ/DF11/A, two fuel tanks, total capacity 120 liters, BOSCH in-line injection pump type PES 6A 80D 320 RS1271, serial no. 527 2961, manufacturer's production setting 18,720 kg/h at 2300 RPM rated engine speed and at specific gravity 0,830 at 20°C, BOSCH type DLL 150/4 injector nozzles, injector setting $17{,}7^{+0{,}4}$ MPa (180^{+5} kp/cm^2), injection timing 30° before T.D.C.
Governor:	BOSCH type EP/RSV, mechanical governed range of engine speed 600...2480 RPM, rated engine speed 2300 RPM
Air cleaner:	MANN-LOZ oil-bath type with centrifugal pre-cleaner, oil capacity 2 litres
Lubrication system:	Forced feed from gear type pump with metal strainer in sump, full flow replaceable element filter MANN W9.62/9, total oil capacity 15 litres, recommended oil change period 120 h, recommended type of oil MIL-L-2104C
Cooling system:	Water cooled, pressurized at 39...49 kPA(0,4...0,5 kp/cm^2), impeller assisted with a 445 mm diameter belt driven 6-blade fan, thermostat for temperature control, cooling water capacity 16 litres.
Starting system:	Electrical, BOSCH type JD-12V3PS 2,2 kW (3 hp), solenoid engaged starter motor, operable only when main gear selector is in neutral position

Electrical system:	Voltage:	12V, negative earth
	Generator:	Alternator BOSCH type KI 14V23A20 (320 W)
	Battery:	one lead acid, 12V, capacity 135 Ah (SAE 20 hours)

Transmission

Clutch: AMORTEX, dry single plate 350 mm diameter, pedal operated with master and slave hydraulic cylinders

Optional clutch: (not fitted on tractor tested) AMORTEX, dry double plate, both plates 310 mm diameter. PTO part hand-lever operated. Driving part pedal operated with master and slave hydraulic cylinders

Gearbox: Own make, 8 forward and 2 reverse speeds, four synchromesh, reverse and dual range synchromesh, reduction gears

Rear axle and final drive: Own make, crown wheel and pinion with bevel gear type differential. Final drive with spur gear. Pedal operated differential lock

Oil Capacities: Transmission: 32 litres
Final drives: 6,5 litres each
Recommended oil change period 720 h
Recommended type of oil MIL-L-2105 B

Gear	Number of engine revolution for one revolution of wheel	Nominal travelling speed x) at 2300 RPM rated speed of engine (km/h)
Forward		
1 (1L)	212,67 : 1	3,2
2 (1H)	128,44 : 1	5,2
3 (2L)	94,75 : 1	7,1
4 (2H)	57,18 : 1	11,8
5 (3L)	45,35 : 1	14,8
6 (4L)	35,63 : 1	18,9
7 (3H)	27,54 : 1	24,4
8 (4H)	21,54 : 1	31,2
Standard Low reverse		
1 (RL)	199,71 : 1	3,4
2 (RH)	120,67 : 1	5,6
Optional 1) fast reverse		
1 (RL)	131,73 : 1	5,0
2 (RH)	79,57 : 1	8,3

1) not fitted on tractor tested. Specification by the manufacturer.

x) with 18.4-34 rear tyres, measured rolling radius 775 mm and inflation pressure 108 kPa (1,1 kp/cm²)

Power take-off Main: Non-independent, at rear of the tractor in vertical centre plane, 6 splines, 1¾ in (44,3 mm) diameter, height above ground 770 mm, proportional engine speeds

Standard	I	540 rpm at 1747 rpm engine speed
	II	1000 rpm at 2270 rpm engine speed
Maximum	I	710 rpm at 2300 rpm engine speed
	II	1013 rpm at 2300 rpm engine speed
Ground drive: distance travelled for 1 revolution of p.t.o. shaft: 0,146 m. No. of p.t.o. revolutions for one revolution of driving wheel: 33,211		

direction of rotation clockwise viewed facing driving end, speed selection by means of a lever, independent

type is optional.

Optional power take-off: (not fitted on tractor tested)

One power take-off in front of engine. Direction of rotation clockwise viewed facing driving end. Same speed as engine speed.

Belt pulley (optional equipment): Attacheable to rear of tractor in two alternative horizontal positions, p.t.o. driven, manually engaged, 270 mm diameter x 165 mm face width

Speeds

I 1065 RPM giving 900 m/min linear belt speed at 2300 RPM rated engine speed

II 1520 RPM giving 1278 m/min linear belt speed at 2300 RPM rated engine speed

direction of rotation: optional

Power lift: Own make, live hydraulic with gear type double pump driven from engine, supplying oil to ram cylinder, external tapping and power steering. Category 2 three point linkage with draught, position and pressure controls, adjustable draught response and speed to drop implement, vertical lift movement above ground: 40...750 mm or 490...1040 mm according to lift rod length (710 - 890 mm)

Oil capacity: 27 litres
Recommended type of oil: SAE 30

Drawbar: Swinging type at the rear of the tractor, height above ground 510 mm, distance from rear axle 595 - 705 - 815 - 925 mm, 260 mm under p.t.o. shaft and 220 - 330 - 440 - 550 mm behind it, hole diameter 33 mm, distance of pivot point to rear axle center 135 mm

Steering: Own make fully hydrostatic steering system with an independent pump and with two steering cylinders, steering valve Orbit OSPA 160, oilflow 16 l/min at 1000 engine speed, max. pressure 6,9 MPa (70 kp/cm^2)

Brakes: Own make, hydraulically operated double disc dry type on differential half shafts, independent or combined pedal operated, hand lever with ratchet operating both brakes for parking

Wheels

Steering wheels: Two 9.00-16" tyres at front, 10 PR, maximum permissible weight on each tyre 12,3 kN (1250 kp) at 387 kPa (3,95 kp/cm^2) pressure. Track widths 1500 - 1600 - 1700 mm changed by extending front axle

Driving wheels: Two 18.4/15-34" tyres at rear, 6 PR, maximum permissible weight on each tyre 22,1 kN (2255 kp) at 108 kPa (1,1 kp/cm^2) pressure. Track widths 1605 - 1835 - 1935 mm changed by reversing wheel centers and offset lug type rims

Wheel base: 2785 mm

Lighting

	Height above ground of centre (cm)	Diameter (cm)	Distance from outside edge of tractor to centre (cm) [1]
Head lights	99,5	13,5	86,0
Side lights	173,0	two 3,8 x 9,0	26,0
Rear lights	173,0	two 3,8 x 9,0	26,0
Reflectors	173,0	two 3,8 x 9,0 [2]	26,0

1) with 1605 mm rear wheel track.

2) rear lights are reflectors too.

Unrestricted beam angle of headlight in plan view: 110°.

Number of grease points

Whole tractor: 10

CONDITIONS DURING TEST

Weights

Tractor (without driver but with full tanks and frame)

	Front (kg)	Rear (kg)	Total (kg)
without ballast	1297	2629	3926
with ballast	1810	4158	5968

Ballast

	No. of weights	Total weight (kg)	Water (kg)
Front	10 + frame	455	-
Rear	10 (5 per wheel)	825	762

Track setting

During test 1605 mm

Overall dimensions

	Length (m)	Width (m)	Height (m)
With ballast	4,63	2,22	2,61
Without ballast	4,23	2,10	-

Overall height measured to top of frame.

Ground clearance 420 mm below the drawbar

Seat Rigiflex DS20/B1 upholstered cushion and backrest, helical spring with hydraulic damper, adjustable for 50 - 100 kg driver's weight, range of adjustment 80 mm fore and aft.

FUELS AND LUBRICANTS USED IN TESTS

Fuel: Shell diesel oil, specific gravity 0,830 at 15°C

Engine oil: Castrol SAE 10

Transmission oil: Castrol 80-90 EP

Hydraulic fluid: Castrol 5W10

COMPULSORY TESTS

1. MAIN POWER-TAKE-OFF PERFORMANCE

Date and locations of tests: 1976-12-16, Helsinki, Finland

Type of dynamometer: Schenk U1-30 water brake

Horsepower metric hp kW	Speed		Fuel consumption		
	Engine rev/min	p.t.o. rev/min	kg/h	Specific g/metric hph g/kWh	metric hph/l kWh/l
MAXIMUM POWER - 2 hours test					
101,6 74,7	2318	716	19,1	188 256	4,40 3,23
STANDARD p.t.o. SPEED (540 rev/min)					
85,1 62,6	1747	540	15,6	183 249	4,53 3,33
THE SPEED RECOMMENDED BY THE MANUFACTURER FOR DRAWBAR WORK					
100,5 73,9	2300	710	19,0	189 257	4,39 3,23
PART LOADS					
(i) 89,4 65,7	2396	740	16,6	186 253	4,47 3,29
(ii) -	2526	780	5,6	-	-
(iii) 45,9 33,8	2454	758	10,1	220 299	3,76 2,77
(iv) 101,6 74,7	2318	716	19,1	188 256	4,40 3,23
(v) 22,9 16,8	2474	764	7,2	316 430	2,63 1,93
(vi) 68,3 50,2	2429	750	13,0	191 260	4,35 3,20

No load maximum engine speed: 2526 rev/min

Equivalent crankshaft torque at maximum power: 308 Nm (31,4 kpm)

Maximum equivalent crankshaft torque: 360 Nm (36,7 kpm)
at 1467 rev/min of the engine

Mean atmospheric conditions: temperature 16 °C
pressure 1033 m bar (775 mm Hg)
relative humidity 60 %

Maximum temperatures
coolant 82 °C
engine oil 98 °C
fuel 37 °C
engine air intake 24 °C

(i) = 85 % of the torque at maximum power

(ii) = unloaded

(iii) = 50 % of the load defined in (i)

(iv) = maximum power

(v) = 25 % of the load defined in (i)

(vi) = 75 % of the load defined in (i)

2. DRAWBAR PERFORMANCE

Date of tests: 1976-05-10, 05-11 and 07-07, Helsinki
Type of track: tarmacadam
Height of drawbar above ground: 510 mm

Gear	Speed km/h	Power metric hp kW	Drawbar pull kp kN	Engine speed rev/min	Slip of wheels %	Fuel g/hph g/kWh
(i) Maximum power (ballasted)						
1 (L1)	2,9	38,8 28,5	3630 35,6	2431	13,8	297 404
2 (H1)	4,7	65,2 47,9	3740 36,7	2373	12,9	252 343
3 (L2)	6,7	84,9 62,4	3440 33,7	2363	8,5	290
4 (H2)	11,5	86,6 63,7	2020 19,8	2369	3,2	216 294
5 (L3)	13,7	71,7 52,7	1410 13,8	2197	2,7	254 345
6 (L4)	16,2	67,1 49,3	1110 10,9	2033	2,6	257 350
(ii) Five hour test at 75 % of pull at maximum power						
4 (H2)	11,5	72,0 53,0	1680 16,5	2293	2,9	239 325
(iii) Five hour test at pull corresponding to 15 % wheelslip in test (i						
2 (H1)	4,6	63,1 46,4	3690 36,2	2372	14,9	-
(v) Maximum power (unballasted)						
1 (L1)	2,9	30,7 22,6	2820 27,7	2452	12,4	-
2 (H1)	4,8	50,2 36,9	2830 27,8	2409	12,9	-
3 (L2)	6,6	67,2 49,4	2760 27,1	2395	11,2	-
4 (H2)	11,3	87,0 64,0	2090 20,5	2357	5,7	-
5 (L3)	13,6	83,7 61,5	1660 16,3	2238	5,3	
6 (L4)	16,5	80,0 58,8	1310 12,9	2122	5,0	-

Total oil consumption during ten hours duration of test (ii) and (iii)

on	Temperature			Atmospheric conditions			
/1 /1	Fuel °C	Coolant °C	Engine oil °C	Temperature °C	Relative humidity %	Pressure mm Hg m bar	
0 6	24	68	59	18,4	24	766	1019
9 7	26	70	64	18,4	24	766	1019
6	27	70	68	19,0	27	766	1019
4 2	27	70	68	21,0	27	766	1019
7 0	28	71	68	21,0	28	762	1014
4 9	28	71	68	21,0	28	762	1014
7 5	37	78	89	22,0	32	753	1009
	39	80	96	22,0	32	753	1009
	24	70	59	16,0	68	742	987
	24	70	60	16,0	68	742	987
	24	70	59	16,0	68	742	987
	24	70	59	16,0	68	742	987
	24	70	60	16,0	68	742	987
	24	70	60	16,0	68	742	987

3. TURNING SPACE AND TURNING CIRCLE

Details of wheel equipment: As in specification without ballast

Track of wheels: Front: 1600 mm
Rear: 1605 mm

Results	With brakes		Without brakes	
	right-hand m	left-hand m	right-hand m	left-hand m
Radius of turning space	5,09	5,34	6,14	6,24
Radius of turning circle	4,85	5,10	5,90	6,00

4. LOCATION OF CENTRE OF GRAVITY

	mm 6·
Height above ground	1030
Distance forward from the vertical plane containing the axis of the rear wheels	920
Distance from the median place	0

5. BRAKING

Date of tests: 1976-05-12 and 1976-06-29

Type of track: tarmacadam

Type of decelerometer: Moto Meter

Weight of ballasted tractor: 6043 kg

Cold brakes

		Ballasted	Without ballast
Travelling speed of the tractor	km/h	25,0	25,0
Maximum deceleration	m/s^2	4,6	4,3
Stopping distance	m	6,8	7,6
Force exerted on the brake pedal	N (kp)	600 (61)	570 (58)
Force exerted on the brake pedal to achieve a deceleration of 2.5 m/s^2 N (kp)		290 (30)	230 (24)

Brake fade characteristics (hot tests)

Deceleration, hot/deceleration, cold x 100 94 %

Stopping distance, cold/stopping distance, hot x 100 97 %

Force on pedal, cold/force on pedal, hot x 100 68 %

Parking brake

Efficiency of handbrake facing up slope: good

down slope: good

Pull on handbrake 314 N 32 kp

6. MEASUREMENT OF AMBIENT NOISE

Date of tests:	1976-07-07	
Type of sound level meter:	Brüel & Kjaer, 2203	
Type of track:	tarmacadam	
Results of tests:	gear	8 th
	travelling speed before acceleration	23,2 km/h
	sound level:	96 dB(A)

7. NOISE MEASUREMENT AT THE DRIVER'S EAR IEVEL

Date of tests:	1976-07-07
Type of sound level meter:	Brüel & Kjaer 2203
Type of track:	tarmacadam
Type of frequency analyser:	Brüel & Kjaer 2112 + 2305

Results of tests

Gear	Travelling speed[1] km/h	dB(A)	Sones
3 (L2)	7,1	97	131
8 (H4)	31,2	100	173

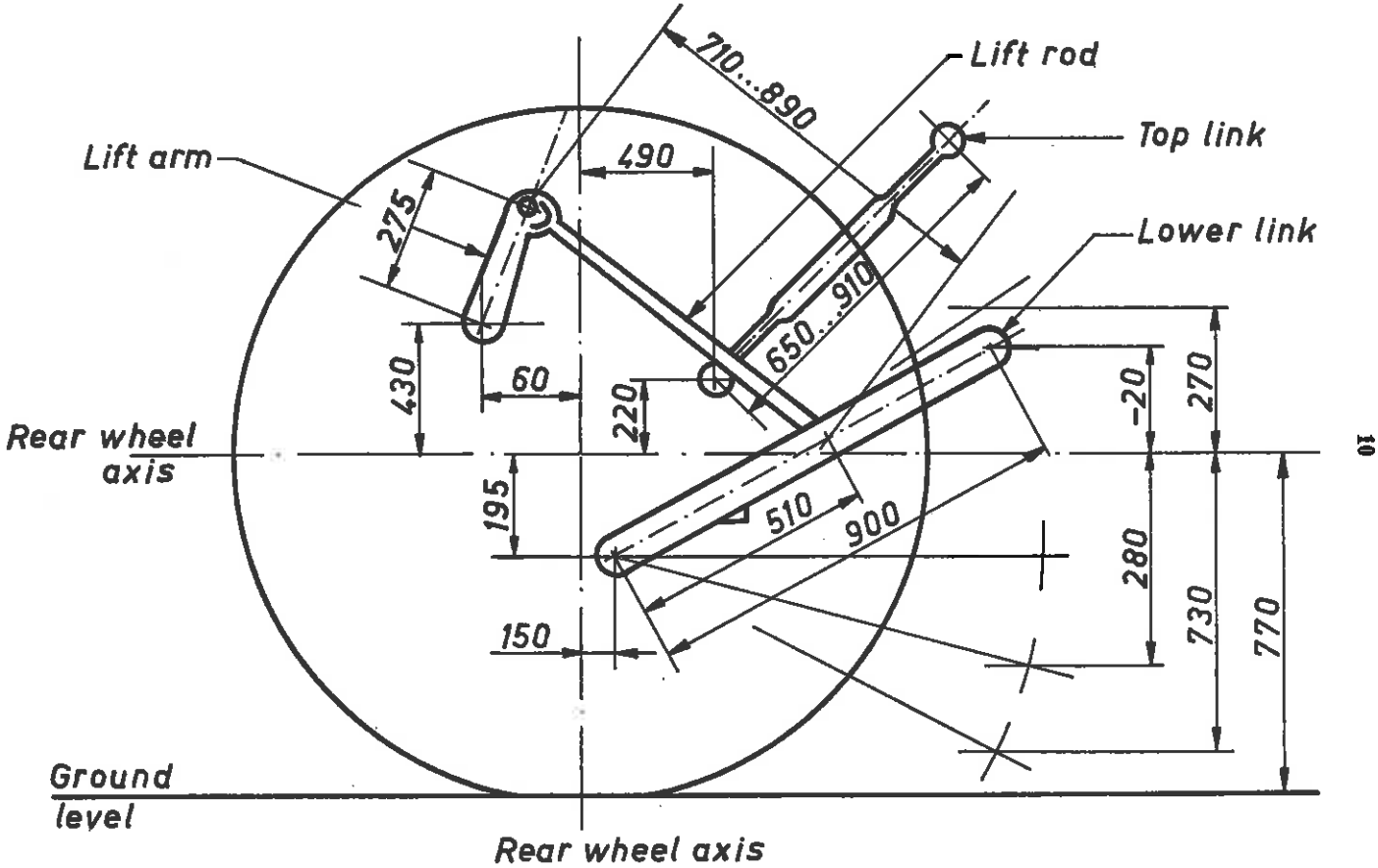
1) The first gear tested corresponds to the travelling speed nearest to 7,5 km/h.

8. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of tests:	1976-03-25 and 04-14, Helsinki
Hydraulic fluid:	Castrol 5 W 20
Type of linkage lock for transport:	hydraulic

Pump characteristics:

Opening pressure of the relief valve:	19,2 MPa 196 kp/cm^2
Sustained pressure by the open relief valve:	19,6 MPa 200 kp/cm^2
Pump delivery rate at external tapping at minimum pressure and rated engine speed:	43,8 l/min
at maximum hydraulic power:	38,8 l/min
delivery pressure:	18,6 MPa 190 kp/cm^2
power	12,0 kW 16,3 metric hp


710...890
Lift rod
Top link
Lift arm
490
275
Lower link
650...910
430
60
220
-20
270
Rear wheel axis
195
510
900
280
730
770
150
Ground level
Rear wheel axis

Linkage geometry when connected to the standard frame

	Maximum mechanical advantage	Minimum mechanical advantage
Projected length in side view		
lower links, mm	900	900
lift arms mm	275	275
lift rods mm	730	880
top link mm	740	740
Distance of lift rod connection point from pivot point of lower link mm	510	510
The following dimensions are given relative to the rear wheel centre line, situated 770 mm above the ground level		
Lower link pivot point	150 mm behind, 195 mm below	150 mm behind, 195 mm below
Top link pivot point	490 mm behind, 220 mm above	490 mm behind, 220 mm above
Lift arm pivot point	60 mm forward, 430 mm above	60 mm forward, 430 mm above
Maximum and minimum height of lower link hitch points	270 mm above, 280 mm below	20 mm below, 730 mm below
Height of lower link hitch points when locked in transport position	Any height within limits given above	Any height within limits given above

Lifting heights in relation to a horizontal line through the lower link pivoting point

		-53	-43	-32	-21	-8	0	+2	+13	+21	+36	+46	cm
Lifting force at the hitch points. Values corresponding to the Maximum hydraulic power pressure (19,2 MPa) calculated from measurements made at Maximum pressure (19,6 MPa)	max.mech. advantage					3310 32,5		3310 32,5	3010 29,6	2750 27,0	2770 27,2	2340 23,0	kp kN
	min.mech. advantage	2680 26,3	2670 26,2	2630 25,8	2530 24,8	2500 24,6		2380 23,4	2340 23,0	2340 23,0			kp kN
	Maximum force exerted throughout whole range 2340 kp 23,0 kN Front of tractor does not lift with maximum allowable front ballast												
		-52	-40	-34	-21	-8	0	+11	+20	+29	+37	+46	cm
Lifting force at the frame. Values corresponding to the Maximum hydraulic power pressure (19,2 MPa) calculated from measurements made at Maximum pressure (19,6 MPa)	max.mech. advantage					3120 30,6		2880 28,3	2540 24,9	2250 22,1	2060 20,2	1910 18,7	kp kN
	min.mech. advantage	2450 24,0	2540 24,9	2540 24,9	2250 22,1	2110 20,7		2060 20,2	1910 18,7				kp kN
	Maximum force exerted throughout whole range 1910 kp 18,7 kN Force at which front of tractor lifts with maximum allowable front ballast 2600 kp 25,5 kN												

OPTIONAL TESTS

MAIN POWER-TAKE-OFF PERFORMANCE

Date and locations of tests: 1976-03-05, Helsinki, Finland

Type of dynamometer: Schenk U1-30 water brake

Horsepower metric hp kW	Speed		Fuel consumption		
	Engine rev/min	p.t.o. rev/min	l/h	Specific g/metric hph g/kWh	metric hph/l (kWh/l)
MAXIMUM POWER - 2 hours test					
104,5 76,9	2318	1021	22,6	180 245	4,62 3,40
STANDARD p.t.o. SPEED (1000 rev/min)					
102,0 75,0	2270	1000	22,4	182 248	4,55 3,35
THE SPEED RECOMMENDED BY THE MANUFACTURER FOR DRAWBAR WORK					
103,4 76,0	2300	1013	22,6	181 246	4,58 3,36
PART LOADS					
(i) 91,5 67,3	2386	1051	20,1	182 248	4,55 3,35
(ii) 0 0	2508	1105	6,1	-	-
(iii) 47,7 35,1	2447	1078	12,7	221 300	3,76 2,76
(iv) 104,5 76,9	2318	1021	22,6	180 245	4,62 3,40
(v) 24,0 17,7	2470	1088	8,8	304 414	2,73 2,01
(vi) 70,7 52,0	2415	1064	16,4	193 262	4,31 3,17

No load maximum engine speed: 2508 rev/min

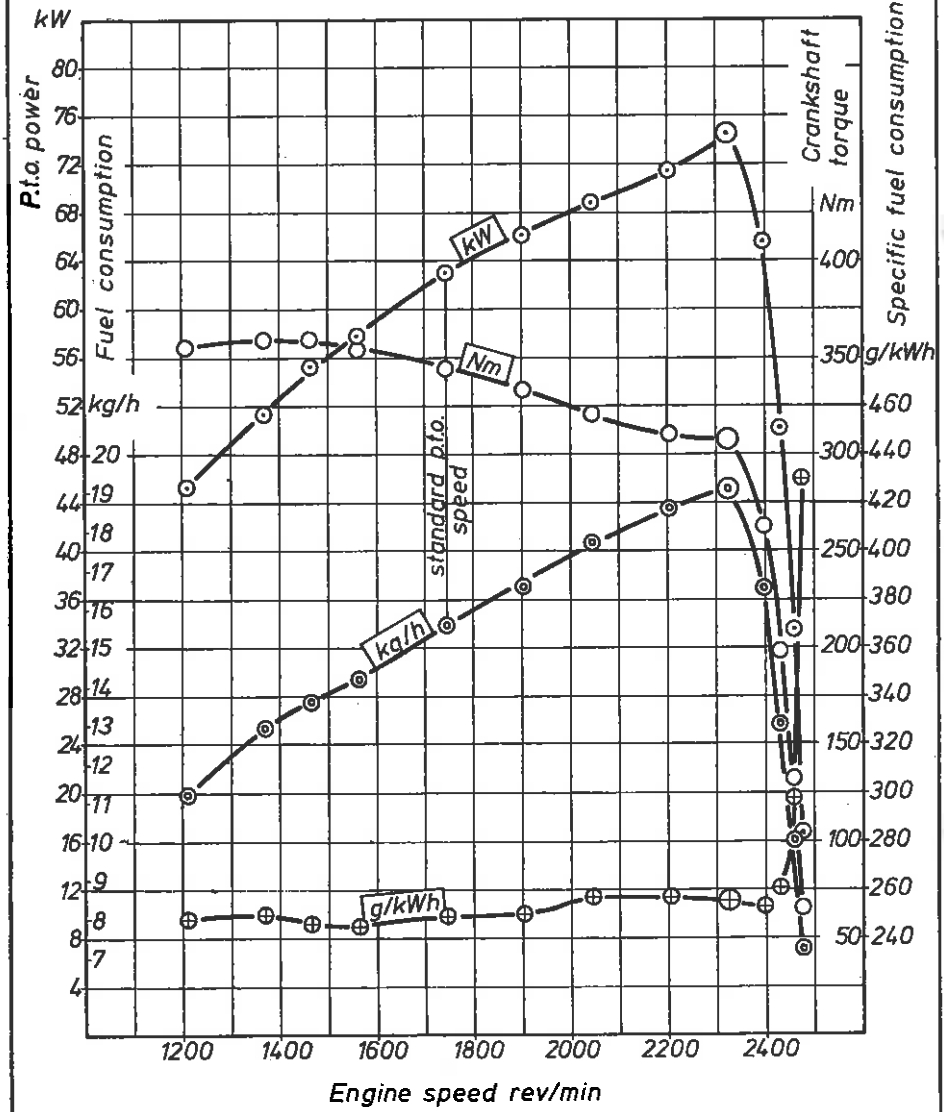
Equivalent crankshaft torque at maximum power: 317 Nm 32,2 kpm

Maximum equivalent crankshaft torque:
at 1466 rev/min of the engine 365 Nm 37,2 kpm

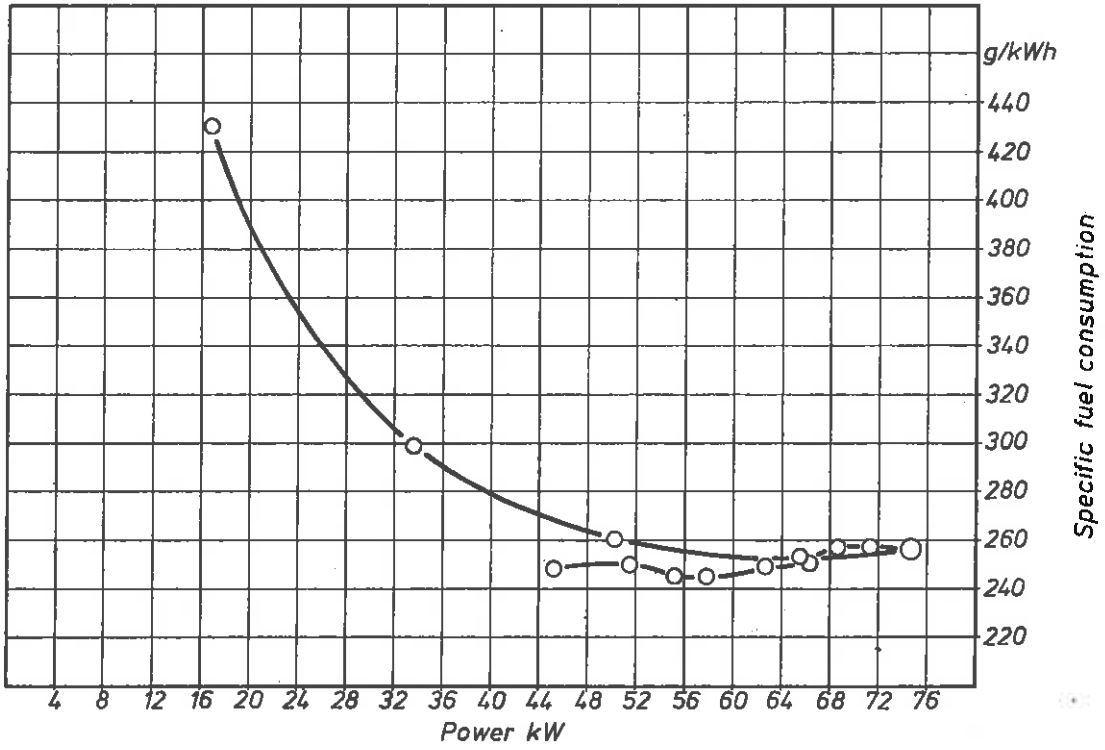
Mean atmospheric conditions:
temperature 18 °C
pressure 1042 m bar 782 mm Hg
relative humidity 41 %

Maximum temperatures:
coolant 87 °C
engine oil 101 °C
fuel 47 °C
engine air intake 31 °C

Finnish Research Institute of Engineering in Agriculture and Forestry	Power take-off test	Valmet 110 id diesel tractor



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