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VALTION MAATALOUSTEKNOLOGIAN TUTKIMUSLAITOS
STATE RESEARCH INSTITUTE OF ENGINEERING IN AGRICULTURE AND FORESTRY

TEST BULLETIN: O.E.C.D. No. 1243

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



VALMET 355-4 (4 WD)

Manufactured by: Valmet Corporation Tractor Works, Suolahti Finland

Date of approval: 23.3.1990 Serial No. 1243

ISSN 0428-4372

This bulletin is based on engineering tests in accordance with the OECD Restricted Standard Code for the Official Testing of Agricultural Tractors Performance. It does not contain evaluation of the performance of the tractor on practical farm work.

This report has been approved by the OECD Co-ordinating Centre (CEMAGREF France) as being in accordance with the OECD Restricted Standard Code for the Official Testing of Agricultural Tractors.

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Tractor manufacturer's name and address	Valmet Corporation Tractor Works 44200 Suolahti Finland
Location of tractor assembly	Suolahti Finland
Submitted for test by	The manufacturer
Selected for test by	The manufacturer
Place of running-in	Valmet Corp. Jyväskylä
Duration of running-in	60 h

I. SPECIFICATION OF TRACTOR

TRACTOR

Make	Valmet
Model	355-4
Type	Four wheel drive, unit construction
Number of driving wheels	4
Serial number	611090
First serial number	611090

ENGINE

Make	Valmet
Model	TD 33 D 3
Type	Water cooled, direct injection diesel engine, naturally aspirated
Serial number	83891

Cylinders	
Number	3
Disposition	Vertical, in line
Bore / Stroke	108 mm / 120 mm
Capacity	3300 cm^3
Compression ratio	17
Arrangemant of valves	Overhead
Cylinder liners	Wet, replaceable
Supercharging	None
Fuel system	
Fuel feed system	Bosch FP piston type fuel feed pump
Fuel filters	Replaceable cartridge filter and fuel strainer
Capacity of fuel tank	73 l
Injection pump	Bosch PES 3 A, in line
Serial number of injection pump	94106657
Manufacturer's production setting of injection pump	65 mm^3/stroke at 1175 r/min
Flow rating at rated engine speed and full load	12,5 l/h
Timing	21 BTDC
Injectors	Bosch multihole, 8363 39088
Injection pressure	20 MPa

Governer	
Make, model and type	Bosch RSV, centrifugal type
Governed range of engine speed	650 - 2600 r/min
Rated engine speed	2350 r/min
Air cleaner	
Pre-cleaner	Valmet, cyclon type
Main cleaner	Valmet, dry paper cleaner including main element and safety element
Location of air intake	In front of radiator
Maintenance indicator	None
Lubrication system	
Type of pump	Gear pump
Type of filters	One full flow oil filter with replaceable paper element
Cooling system	
Type of coolant	Anti-freeze
Type of pump	Centrifugal
Number of fan blades	6
Fan diameter	430 mm
Coolant capacity	10 l
Type of temperature control	Thermostat
System pressure	40 kPa

Starting system	
Make and model	Lucas M 50
Starter motor power rating	3 kW
Cold starting aid	Excess fuel and automatic injection delay
Safety device	Only operable when clutch pedal is pressed
Electrical system	
Voltage	12 V
Generator	
make	Lucas A 127
power	640 W
Battery	
number	1
rating	130 Ah at 20 hours
Exhaust system	
Make	Valmet, expansion chamber type
Location	On the bonnet, left side, 2550 mm above ground
TRANSMISSION TO WHEELS	
Clutch	
Make	Fichtel & Sachs DuT 295, double clutch
Number of plates	One for travel and one for P.T.O.
Diameter of plates	280 mm
Method of operation	Travel: mechanical pedal operated P.T.O.: mechanical hand lever operated

Gear box

Make	Valmet 220/30, mechanical
Arrangement	Synchromesh gear box with 4 speeds; synchromesh group gear with 2 forward ranges (L and H) and 1 reverse range; 2 hand levers: High-Low lever and 1-4 and R lever
Number of gears	8 forward, 4 reverse
Available options	4 low speed gears, 40 km/h transmission

Rear axle and final drives

Make	Valmet, crown wheel and pinion differential, planetary final drives
Differential lock	
type	Five pins, dog clutch
method of engagement	Mechanical, hand lever
method of disengagement	Spring load

Front axle and final drives

Make	ZF APL 325, crown wheel and pinion differential, planetary final drives
Differential lock	
type	Limited slip
method of engagement and disengagement	Automatic

Total ratios and travelling speeds

Gear	Group	Number of engine revolutions for one revolution of driving wheels	Nominal travelling speed[1] at rated engine speed of 2350 r/min km/h
1	Forward	238,02	2,6
2	Low	173,50	3,5
3		110,08	5,6
4		83,13	7,4
1	Forward	68,80	8,9
2	High	50,15	12,3
3		31,82	19,4
4		24,03	25,6
1	Reverse	175,54	3,5
2		127,95	4,8
3		81,18	7,6
4		61,31	10,0

[1] Calculated with a tyre dynamic radius index of 695 mm (ISO 4251/1-1984)

Number of revolutions of front wheels for one revolution of rear-wheels 1,39

POWER TAKE-OFF

Main power take-off

Type	Independent
Method of engagement	Hand lever
Number of shafts	1
Method of changing power take-off shaft ends	None

Power take-off proportional to engine speed

540 rev/min

Location	At the rear of the tractor
Diameter of power take-off shaft end	34,8 mm
Number of splines	6, in conformity with ISO 500/1979
Height above ground	695 mm
Distance from the median plane of the tractor	0 mm
Distance behind rear-wheel axis	366 mm
P.T.O. speed at rated engine speed, 2350 rev/min	671
Engine speed at standard P.T.O. speed, 540 rev/min	1890
Ratio of speeds, engine speed/P.T.O speed	3,50
Power restriction and maximum torque	None
Direction of rotation, viewed from behind trator	Clockwise
1000 rev/min	Not available
Power take-off proportional to ground speed	Not available

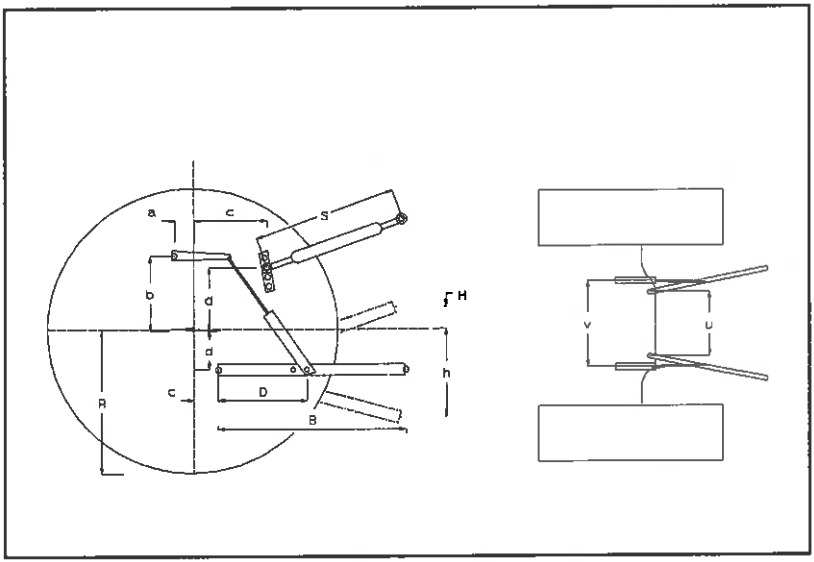
POWER LIFT

Make	Valmet
Type of hydraulic system	Open centre, constant flow
Type and number of cylinders	One single acting
Type of linkage lock for transport	None
Relief valve pressure setting	18+-0,8 MPa

Opening pressure of cylinder safety valve	29 MPa
Lift pump type	Gear pump
Transmission between pump and engine	Gear
Type and number of filters	One full flow pressure filter
Site of oil reservoir	On top of rear axle housing
Type, number and location of tapping points	One single acting tapping at the rear of the tractor
Maximum volume of oil available to external cylinders	24 dm^3

Three point linkage

Category	2, in conformity with ISO 730/1-1977
Category adapter	None



		Dimension or range[1]	Settings used in test
		mm	mm
Length of lift arms	(A)	275	275
Length of lower links	(B)	900	900
Distance of lift arm pivot point from rear-wheel axis:			
- horizontally	(a)	85	85
- vertically	(b)	393	393
Horizontal distance between the two lower link points	(u)	450	450
Horizontal distance between the two lift arm end points	(v)	630	630
Lenth of upper link	(S)	from 590 to 805	625
Distance of upper link pivot point from rear wheel axis			
- horizontally	(c)	344,352,360,366	366
- vertically	(d)	356,310,264,218	218

Distance of lower link pivot point from rear wheel axis			
- horizontally	(e)	118	118
- vertically	(f)	193	193
Distance of lower link pivot points to lift rod pivot points on lower links	(D)	365,445	445
Length of lift rods	(L)	from 550 to 720	670
Height of lower hitch points relative to the rear-wheel axis			
- in low position	(h)	from 230 to 625	495
- in high position	(H)	from 65 to 375	135
Height above ground of lower hitch points when locked in transport position		No locking system available	

[1] Tyre dynamic index r=695 mm (ISO 4251/1-1984)

SWINGING DRAWBAR	Optional, not fitted on tractor tested
TRAILER HITCH	
Type	Hitch-hook
Hook diameter	48 mm
Height above ground	440 mm
Distance of hitch point from rear wheel axis, horizontally	416 mm
Distance of hitch point from power take-off shaft end	
- vertically	240 mm below
- horizontally	50 mm behind
Maximum vertical permissible load	23 kN
STEERING	
Make	Danfoss Orbitrol OSPC 100 ON 150 N, hydrostatic steering
Method of operation	Independant hydraulic circuit for steering
Cylinders	Single central cylinder acting on both steering arms
Working pressure	9 MPa

BRAKES

Service brake

Make	Valmet
Method of operation	Two pedals, mechanically actuated , independant or compined operation
Trailer brake take-off	None

Parking brake

Type	Mechanically connected to both service brakes
Method of operation	Hand lever

WHEELS

Number

- front	Two driving and steering wheels
- rear	Two driving wheels
Wheelbase	2255 mm

Track width adjustment

	Minimum mm	Maximum mm	Adjustment method
Front	1315	1820	Offset lug rims and reversing wheel centres
Rear	1480	2000	Offset lug rims and reversing wheel centres

PROTECTIVE STRUCTURE

Make	Valmet 318 24700 frame, the tractor can be equipped with protective cab

DRIVER'S SEAT

Make	Klepp Elastomat 1050 L
Type of suspension	Spring
Type of damping	Hydraulic damper
Range of adjustment	
- longitudinal	165 mm
- vertical	No adjustment

LIGHTNING

	Height above ground of centre mm	Size mm	Distance from outside edge of lights to median plane of tractor mm
Headlights	1045	90 x 150	223
Sidelights	1640	40 x 100	825
Rearlights	1640	40 x 100	825
Reflectors	1390	40 x 180	773

II. TEST CONDITIONS

Overall dimensions

Length	Width		Height	
	minimum	maximum	at top of frame	at top of exhaust silencer
mm	mm	mm	mm	mm
3850	1965	2485	2460	2550

Ground clearance (unballasted tractor) 405 mm

Clearance limiting part Trailer hitch

Tractor mass (with frame)

	Without driver kg	With driver kg
Front	1130	1145
Rear	1740	1800
Total	2870	2945

Tyres and track width specifications

	Front	Rear
Tyres		
- dimensions	11.2-R24	16.9-R30
- ply rating	8	8
- type	radial	radial
- maximum tyre load	12,3 kN	22,5 kN
- maximum axle load	20,5 kN	38 kN[1]
- tyre pressure	240 kPa	170 kPa
- dynamic radius index	515 mm	695 mm
Chosen track width	1606 mm	1604 mm

[1] 30 kN when trackwidth is over 1600 mm

Oils and lubrication (Capacity and change interval)

	Capacity l	Oil Change h	Filter change h
Engine	7	200	200
Gear box[1]	23	800	400
Front axle	4,5 + 2x0,5	800	-
Hydraulic system and steering	35	800	400

[1] Includes rear axle and final drive

Specifications

	Recommended	Used during test
Engine oil		
- type		Neste Gamma
- viscosity	10 W/30	10 W/30
- classific.	CD	CD
Transmission oils		
- type		Neste MJ
- viscosity	10 W/30	10 W/30
- classific.	GL 4	GL 4
Hydraulic fluid		Neste Nestepaine 32
- type		
- viscosity	5W/20-40	ISO - 32
- classific.	SMR SH-46	

Grease	
- Number of lubrication points	18
Fuel	
Type	Dieseloil in conformity with national standards
Density at 15 °C	841 g/cm^3
REPAIRS	None
REMARKS	None

III TEST RESULTS

COMPULSORY TEST RESULTS

1. MAIN POWER TAKE-OFF

- Date and location of tests: Vihti 6.9.1989
- Type of dynamometer: Schenk W 400

Power	Speed		Fuel consumption			Specific energy
	Engine	P.T.O.	Hourly	Hourly	Specific	
kW	r/min	r/min	kg/h	l/h	g/kWh	kWh/l
1.1 MAXIMUM POWER - TWO-HOUR TEST						
40,1	2350	671	10,3	12,2	256	3,28
1.2 POWER AT RATED ENGINE SPEED						
40,1	2350	671	10,3	12,2	256	3,28
1.3 STANDARD POWER TAKE-OFF SPEED (540 rev/min)						
36,8	1890	540	9,1	10,9	248	3,39
1.4 PART LOADS						
1.4.1 The torque corresponding to maximum power at rated engine speed						
40,1	2350	671	10,3	12,2	256	3,28
1.4.2 85 % of torque obtained in 1.4.1						
34,9	2408	688	9,1	10,9	261	3,22
1.4.3 75 % of torque defined in 1.4.2						
26,5	2433	695	6,9	8,3	262	3,21
1.4.4 50 % of torque defined in 1.4.2						
17,8	2450	700	5,8	6,9	323	2,59
1.4.5 25 % of torque defined in 1.4.2						
9,0	2492	712	4,1	4,9	453	1,85
1.4.6 unloaded						
0	2513	718	2,8	3,4	-	-

Power	Speed Engine	P.T.O.	Fuel consumption Hourly	Hourly	Specific	Specific energy
kW	r/min	r/min	kg/h	l/h	g/kWh	kWh/l
1.5 PART LOADS AT STANDARD POWER TAKE-OFF SPEED (540 rev/min)						
1.5.1 The torque corresponding to maximum power						
36,8	1890	540	9,1	10,9	248	3,39
1.5.2 85 % of torque obtained in 1.5.1						
31,7	1915	547	7,7	9,2	244	3,45
1.5.3 75 % of torque defined in 1.5.2						
24,0	1932	552	6,1	7,2	253	3,32
1.5.4 50 % of torque defined in 1.5.2						
16,2	1953	558	4,6	5,4	282	2,98
1.5.5 25 % of torque defined in 1.5.2						
8,2	1995	570	3,3	4,0	404	2,07
1.5.6 Unloaded						
0	2020	577	2,0	2,5	-	-

- No load maximum engine speed	2513 rev/min
- Torque[1] at maximum power	163 Nm
- Maximum torque[1]	198 Nm
at engine speed	1484 rev/min
- Mean atmospheric	
- Temperature	21 °C
- Pressure	100,7 kPa
- Relative humidity	54 %
- Maximum temperatures	
- Coolant	77 °C
- Engine oil	96 °C
- Fuel	58 °C
- Engine air intake	22 °C

[1] Equivalent crankshaft torque

2. HYDRAULIC POWER AND LIFTING CAPACITY

2.1 HYDRAULIC POWER TEST

Date of tests	6.9.1989
Sustained pressure with relief valve open	18,3 MPa
Pump delivery rate at minimum pressure	31,0 l/min

	Flow rate l/min	Pressure MPa	Power kW
Flow rate corresponding to a hydraulic pressure equivalent to 90 % of the actual relief valve pressure setting and corresponding hydraulic power	29,1	16,5	8,0
Flow rate and hydraulic pressure corresponding to maximum hydraulic power	29,0	17,0	8,2

Tapping point used for test: external tapping.

2.2 POWER LIFT TEST

	Height of lower hitch point above ground in down position mm	Vertical movement mm	Maximum corrected force exerted through full range kN	Corresponding pressure of hydraulic fluid MPa	Moment about rear axle kNm	Max. tilt angle of mast from vertical degrees
at hitch points	200	630	21,3	16,2	70	-
on the frame	200	630	17,8	16,2	70	15

Lifting heights relative to the horizontal plane including the lower link pivot points:

Lifting forces at hitch points (corresponding pressure 16,2 MPa)

mm	-302	-200	-100	0	100	200	328
kN	21,3	22,5	24,4	25,3	25,6	25,9	27,1

Lifting forces at test frame (corresponding pressure 16,2 MPa)

kN	20,1	20,5	20,8	20,6	19,6	18,6	17,8

3. DRAWBAR POWER AND FUEL CONSUMPTION

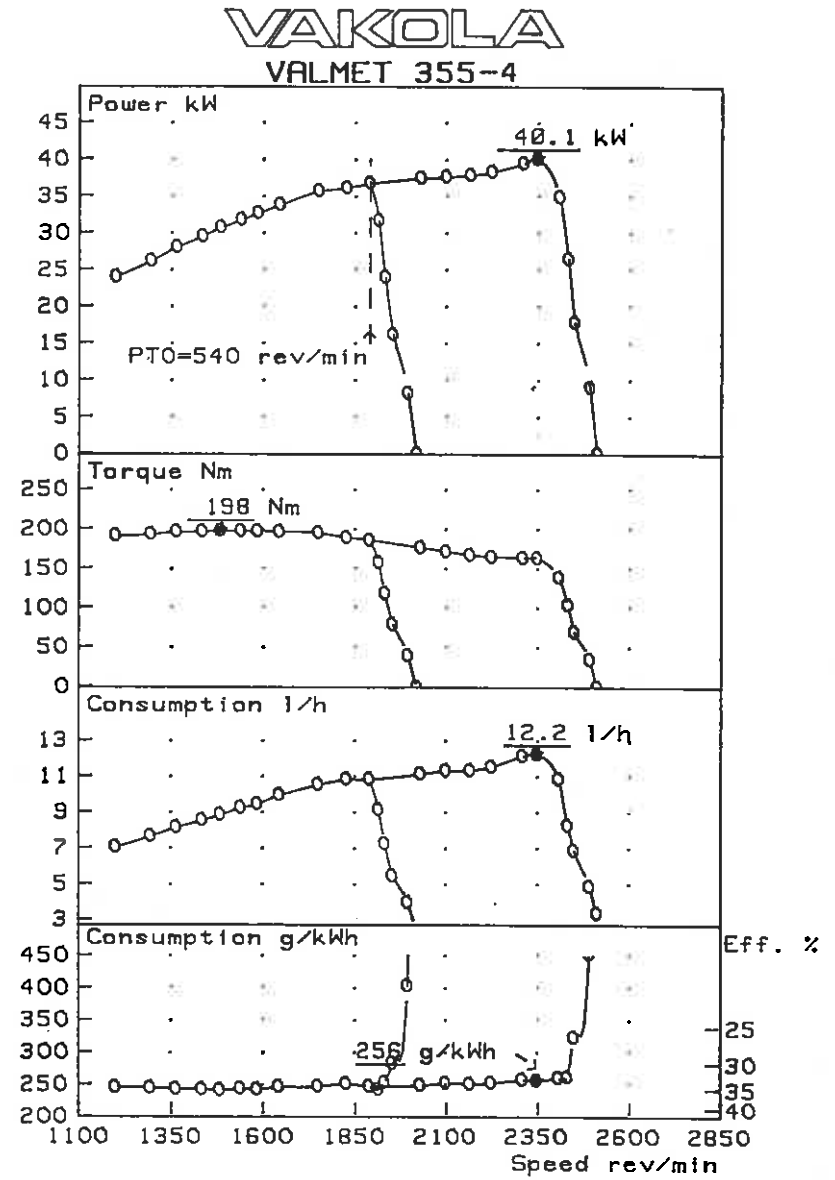
Date of tests 19.10.1989 and 24.10.1989
Type of track Tarmacadam
Height of drawbar above ground 465 mm
Tyre inflation pressure
- front 80 kPa
- rear 80 kPa

Gear	Power	Drawbar pull	Speed	Engine speed	Slip of wheels	Specific consumption	Specific energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temperature	Relative humidity	Pressure
	kW	kN	km/h	rev/min	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.1. MAXIMUM POWER IN TESTED GEARS													
L1	17,7	26,9	2,4	2469	14,9	377	2,23	37	77	93	10	77	101,1
L2	24,3	27,2	3,2	2445	15,0	342	2,46	38	77	97	10	76	101,1
L3	33,6	23,1	5,2	2350	8,2	318	2,65	40	77	98	12	76	101,1
L4	34,0	17,0	7,2	2365	5,8	314	2,68	42	77	101	10	76	101,1
H1	34,7	14,3	8,8	2357	4,1	314	2,68	40	75	99	11	76	101,1
H2	33,6	9,9	12,2	2357	2,4	324	2,59	40	76	100	11	76	101,1
H3	29,7	5,6	19,2	2331	1,1	359	2,34	41	77	101	10	76	101,1

3.2 FUEL CONSUMPTION

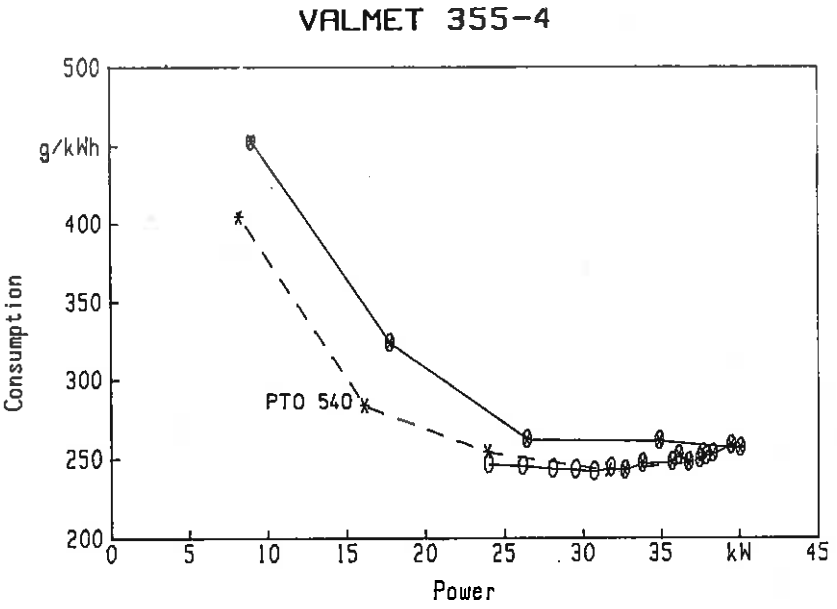
Gear	Power	Drawbar pull	Speed	Engine speed	Slip of wheels	Specific consumption	Specific energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temperature	Relative humidity	Pressure
	kW	kN	km/h	rev/min	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.2.1	In selected gear at maximum power												
II1	34,7	14,3	8,8	2357	4,1	314	2,68	40	75	99	11	76	101,1
3.2.1.1	75 % of pull at maximum power at rated speed												
H1	27,2	10,7	9,2	2444	3,2	316	2,66	37	77	96	13	82	99,3
3.2.1.2	50 % of pull at maximum power at rated speed												
H1	18,7	7,2	9,3	2465	2,4	384	2,19	39	79	99	12	82	99,3
3.2.1.3	Next higher gear at reduced engine speed, same pull and travelling speed as in 3.2.1.1												
H2	27,3	10,7	9,2	1785	4,4	310	2,71	41	74	93	13	82	99,3
3.2.1.4	Next higher gear at reduced engine speed, same pull and travelling speed as in 3.2.1.2												
H2	18,9	7,2	9,5	1829	3,6	334	2,52	39	73	94	13	82	99,3

Gear	Power	Drawbar pull	Speed	Engine speed	Slip of wheels	Specific consumption	Specific energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temperature	Relative humidity	Pressure
	kW	kN	km/h	rev/min	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.2.2	In selected gear nearest to 7,5 km/h												
L4	34,0	17,0	7,2	2365	5,8	314	2,68	42	77	101	10	76	101,1
3.2.2.1	75 % of pull at maximum power at rated speed												
L4	26,8	12,8	7,6	2442	4,4	340	2,48	40	77	97	12	82	99,3
3.2.2.2	50 % of pull at maximum power at rated speed												
L4	18,2	8,5	7,7	2473	3,5	392	2,14	40	75	98	11	82	99,3
3.2.2.3	Next higher gear at reduced engine speed, same pull and travelling speed as in 3.2.2.1												
H1	27,0	12,8	7,6	2035	3,8	299	2,82	39	76	96	12	82	99,3
3.2.2.4	Next higher gear at reduced engine speed, same pull and travelling speed as in 3.2.2.2												
H1	18,9	8,7	7,8	2059	2,7	326	2,58	37	74	95	12	82	99,3



Valmet 355-4 23.3.1990

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