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

TEST BULLETIN: O.E.C.D. No. 1353 RESTRICTED CODE

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



VALMET 6600 (4WD)

Manufactured by: Valmet Tractors Inc.
SF-44200 Suolahti, Finland

Date of approval: 29th January 1992
Serial No. 1353 RESTRICTED CODE

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 an 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 Tractors Inc. SF-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 Corporation, Tourula
Duration of running-in	67 h
Location of test	VAKOLA, Finland

I SPECIFICATIONS OF TRACTOR TRACTOR

Make/Model/Type	Valmet/6600/Four wheel drive, unit construction
Number of driving wheels	4
Serial number	651858
First serial number	651858

ENGINE

Make/Model/Type	Valmet/420 DS/water cooled, direct injection diesel engine, turbocharged
Serial number	95614

Cylinders

Number	4
Disposition	Vertical, in line
Bore/Stroke	108 mm/120 mm
Capacity	4400 cm^3
Compression ratio	16,5:1
Arrangement of valves	Overhead
Cylinder liners	Wet

Supercharging

Make/Model	Schwitzer/S1B
Pressure	0.13 MPa

Fuel system

Fuel feed system	Mechanical piston type feed pump
Fuel filters	Bosch (paper)
Capacity of fuel tank	165 dm^3
Injection pump	Bosch PES 4A, in line
Serial number of injection pump	6227395

Manufacturer's production setting of injection pump	98 mm^3/stroke at rated engine speed and full load[x)]
Flow rating at rated engine speed and full load	20,2 dm^3/h
Timing	19° before TDC
Injectors	Stanadyne NBS 770620, multihole
Injection pressure	23 MPa

Governor

Make/Model/Type	Bosch RSV/centrifugal
Governed range of engine speed	From 750 to 2450 rev/min
Rated engine speed	2225 rev/min

Air cleaner

Pre-cleaner	
Make/Model/Type	Valmet/cyclon type
Location of air intake	Above engine hood
Main cleaner	
Make/Model/Type	Valmet/dry cleaner with safety element
Location of air intake	Above engine hood
Maintenance indicator	Electrical

Lubrication system

Type of pump	Gear pump
Type of filters	One full flow oil filter with replaceable paper element
Number	1

Cooling system

Type of coolant	Anti-freeze
Type of pump	Centrifugal
Number of fan blades	6
Fan diameter	483 mm
Coolant capacity	15,5 dm^3
Type of temperature control	Thermostat
Superpressure system	50 kPa

Starting system

Make/Model/Type	Magnetti Marelli/Electrical solenoid starting motor

x) The given figure is based on fuel pump bench test according to ISO 4010, for actual fuel consuption see the test results, main power take-off test

Starter motor power rating	3 kW
Cold starting aid	Thermostart, automatic fuel exess and injection delay
Safety device	Only operable when clutch pedal is pressed
Electrical system	
Voltage	12 V
Generator	
Make/Model/Type	Magnetti Marelli/A127-65
Power	870 W
Battery	
Number	1
Rating	158 Ah at 20 hours
Exhaust system	
Make/Model/Type	Valmet/Ebersprächer/ muffler, expansion chamber type
Location	Vertical on the right hand side, debouch 2840 mm above ground
TRANSMISSION	
Clutch (travel alone)	
Make/Model/Type	Fichtel & Sachs 330 WGSZX/ Dry
Number of plates	1
Diameter of plates	330 mm
Method of operation	Mechanical pedal operated
Gear box	
Make/Model/Type	Valmet/GL 420/constant mesh fully synchronized with shuttle gear
Arrangement	Synchromesh gear box with 4 speeds, synchromesh group gear with 3 forward ranges, (LL with dog clutch, M and H); 1 quick-shift gear (L and H); and 1 directional shift gear (reverse range)
Number of gears	24 forward, 24 reverse
Available options	Voith turbo 390 TD VA, turbin clutch
Rear axle and final drives	
Make/Model/Type	Valmet/crown wheel and pinion differential, planetary final drives

Differential lock

Type	Multidisc
Method of engagement	Electrohydraulically by a press button
Method of disengagement	Electrohydraulically by a press button

Front axle and final drives

Make/Model/Type	Sige/CS 17 SD 01/crown wheel and pinion differential

Differential lock

Type	Limit slip
Method of engagement	Automatic
Method of disengagement	Automatic

Total ratios and travelling speeds

Gear	Group	Quick shift	Number of engine revolutions for one revolution of the driving wheels		Nominal travelling speed[1] at rated engine speed of 2225 rev/min, km/h	
			forward	reverse	forward	reverse
1	LL	L	817.032	797.265	0.8	0.9
1	LL	H	650.483	634.746	1.1	1.1
2	LL	L	573.080	559.215	1.2	1.2
2	LL	H	456.260	445.221	1.5	1.5
3	LL	L	407.822	397.956	1.7	1.7
3	LL	H	324.689	316.834	2.1	2.2
4	LL	L	288.470	281.491	2.4	2.4
4	LL	H	229.666	224.110	3.0	3.1
1	M	L	193.188	188.510	3.6	3.7
1	M	H	153.808	150.086	4.5	4.6
2	M	L	135.505	132.230	5.1	5.2
2	M	H	107.883	105.273	6.4	6.5
3	M	L	96.430	94.100	7.1	7.3
3	M	H	76.773	74.916	9.0	9.2
4	M	L	68.209	66.560	10.1	10.3
4	M	H	54.305	52.991	12.7	13.0
1	H	L	61.915	60.420	11.1	11.4
1	H	H	49.294	48.102	14.0	14.3
2	H	L	43.429	42.380	15.8	16.2
2	H	H	34.576	33.739	19.9	20.4
3	H	L	30.905	30.160	22.2	22.8
3	H	H	24.605	24.010	27.9	28.6
4	H	L	21.861	21.330	31.5	32.2
4	H	H	17.404	16.983	39.5	40.5

1) Calculated with a tyre dynamic radius index of 820 mm (ISO 4251/1-1984)

Number of revolutions of front wheels for one revolution of rear wheels	1,3151

POWER TAKE-OFF

Main power take-off

Type	Independent
Method of engagement	Hand lever operated electrohydraulical multiplate clutch together with a collar shifter
Number of shafts	1
Method of changing power take-off shaft ends	Changeable shaft and speed changing happens with a collar shifter

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	778 mm
Distance from the median plane of the tractor	0 mm
Distance behind rear-wheel axis	242 mm
PTO speed at rated engine speed (2225 rev/min)	641 rev/min
Engine speed at standard PTO speed 540 rev/min	1874 rev/min
Ratio of rotation speeds (engine speed/PTO speed)	3,471
Power restriction and maximum torque	None
Direction of rotation (viewed from behind tractor)	Clockwise

1000 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, additional: 21, in conformity with ISO 500/1979
Height above ground	778 mm
Distance from the median plane of the tractor	0 mm
Distance behind rear-wheel axis	424 mm
PTO speed at rated engine speed (2225 rev/min)	1070 rev/min
Engine speed at standard PTO speed 1000 rev/min	2080 rev/min

Manufacturer's production setting of injection pump	98 mm^3/stroke at rated engine speed and full load[x)]
Flow rating at rated engine speed and full load	20,2 dm^3/h
Timing	19° before TDC
Injectors	Stanadyne NBS 770620, multihole
Injection pressure	23 MPa

Governor

Make/Model/Type	Bosch RSV/centrifugal
Governed range of engine speed	From 750 to 2450 rev/min
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Air cleaner

Pre-cleaner	
Make/Model/Type	Valmet/cyclon type
Location of air intake	Above engine hood
Main cleaner	
Make/Model/Type	Valmet/dry cleaner with safety element
Location of air intake	Above engine hood
Maintenance indicator	Electrical

Lubrication system

Type of pump	Gear pump
Type of filters	One full flow oil filter with replaceable paper element
Number	1

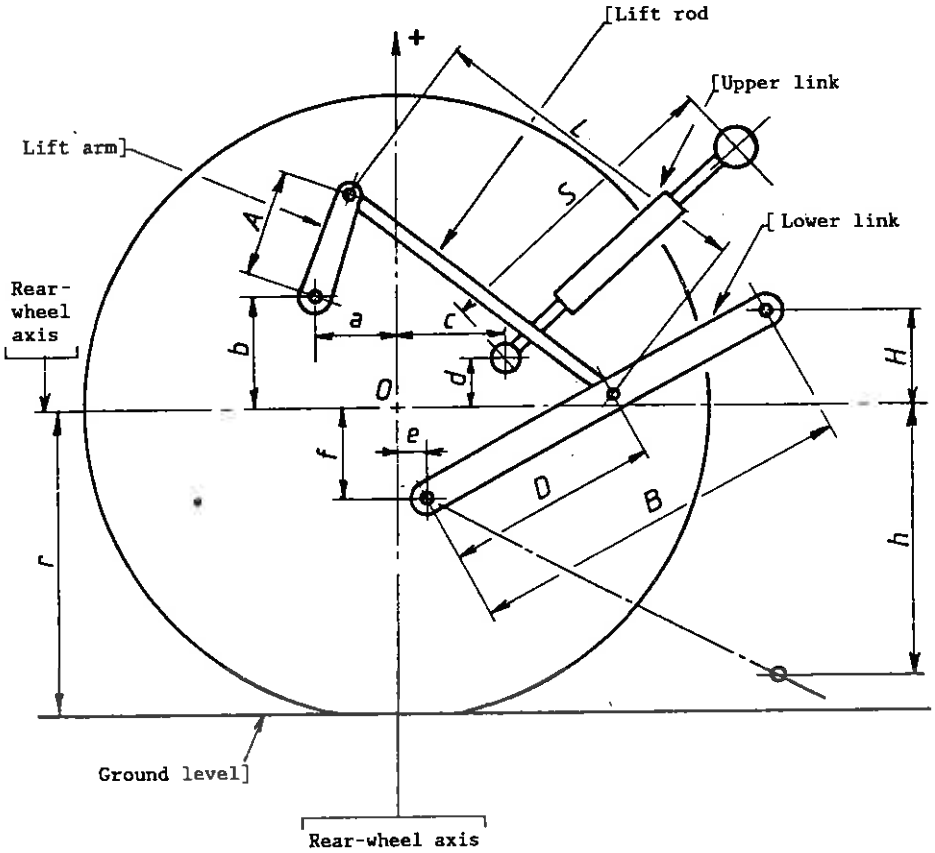
Cooling system

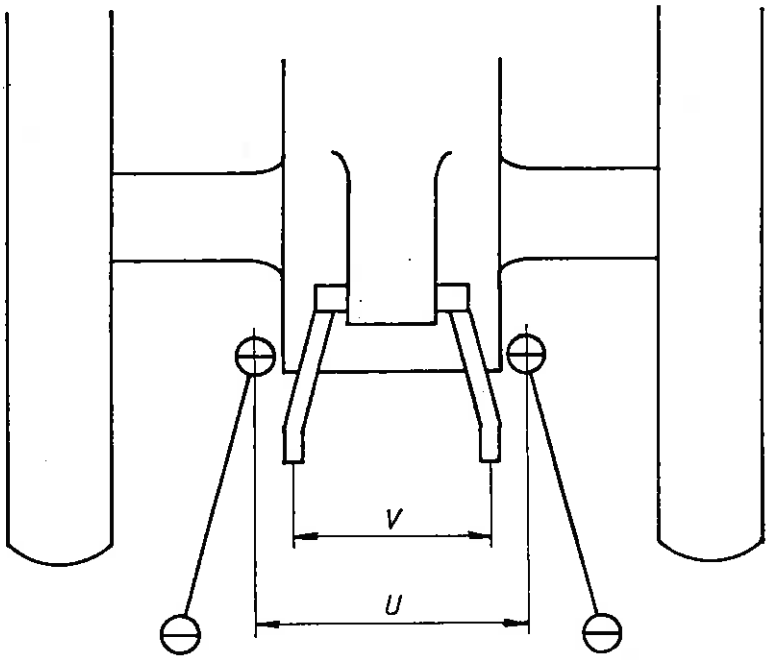
Type of coolant	Anti-freeze
Type of pump	Centrifugal
Number of fan blades	6
Fan diameter	483 mm
Coolant capacity	15,5 dm^3
Type of temperature control	Thermostat
Superpressure system	50 kPa

Starting system

Make/Model/Type	Magnetti Marelli/Electrical solenoid starting motor

x) The given figure is based on fuel pump bench test according to ISO 4010, for actual fuel consuption see the test results, main power take-off test


[Lift rod
[Upper link
Lift arm]
[Lower link
Rear-wheel axis
+
L
S
A
a
c
b
d
O
H
e
f
D
B
h
r
Ground level]
Rear-wheel axis


V
U

		Dimension or range mm	Settings used in test mm
Length of lift arms	(A)	350	350
Length of lower links	(B)	920	920
Distance of lift arm pivot point from rear-wheel axis : horizontally : vertically	(a) (b)	-120 282	-120 282
Horizontal distance between the 2 lower link point	(u)	610	610
Horizontal distance between the 2 lift arm end points	(v)	600	600
Length of upper link	(S)	from 585 to 800	660
Distance of upper link pivot point from rear wheel axis : horizontally : vertically	(c) (d)	420, 430, 440 305, 230, 155	430 230
Distance of lower link pivot point from rear wheel axis : horizontally : vertically	(e) (f)	192 265	192 265
Distance of lower link pivot points to lift rod pivot points on lower links	(D)	342, 384, 440	440
Length of lift rods	(L)	from 600 to 710	660
Height of lower hitch points relative to the rear-wheel axis : in low position : in high position	(h) (H)	from 490 to 750 from 275 to -10	620 105
Height above ground of lower hitch points when locked in transport position (*)		70-1095	

(*) Assuming r = 820 mm tyre dynamic radius index of ISO 4251/1-1984.

Table 1.1 Dimensions of linkage geometry

TRAILER HITCH

Type	Hitch-hook
Hook diameter	47 mm
Height above ground	550 mm
Distance of hitch point from rear-wheel axis, horizontally	466 mm
Distance of hitch point from power take-off shaft end:	
- vertically	228 mm
- horizontally	42 mm behind
Maximum vertical permissible load	53 kN

POWER TAKE-OFF

Main power take-off

Type	Independent
Method of engagement	Hand lever operated electrohydraulical multiplate clutch together with a collar shifter
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1000 rev/min

Location	At the rear of the tractor
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Distance behind rear-wheel axis	424 mm
PTO speed at rated engine speed (2225 rev/min)	1070 rev/min
Engine speed at standard PTO speed 1000 rev/min	2080 rev/min

2.2 Power lift test

	At the hitch point	On the frame
Height of lower hitch points above ground in down position	200 mm	200 mm
Vertical movement	675 mm	620 mm
Maximum corrected force exerted through full range	56.6 kN	40.6 kN
Corresponding pressure of hydraulic fluid	18.1 MPa	18.1 MPa
Moment about rear-wheel axis	62.9 kNm	69.9 kNm
Maximum tilt angle of mast from vertical		14 degrees

Lifting heights relative to the horizontal plane including the lower link pivot points									
mm	-355	-300	-200	-100	0	100	200	300	320
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90 % of the actual relief valve pressure setting or to maximum power delivered by the hydraulic system, whichever is lower)									
At the hitch points kN	59.1	58.7	58.5	58.4	57.5	57.4	57.4	57.6	56.6
Corresponding pressure: 18.1 kPa									
At the frame kN		56.2	53.7	51.4	49.1	47.1	44.4	41.0	40.6
Corresponding pressure: 18.1 MPa									

3. DRAWBAR POWER AND FUEL CONSUMPTION

Date of tests 31.7.1991

Type of track Tarmacadam

		Tyre inflation presssure	
	Height of drawbar above ground	Front	Rear
Unballasted	560 mm	160 kPa	160 kPa

Tyres and track width specifications

	Front	Rear
Tyres:		
- dimensions	14.9 R 28	18.4 R 38
- load index	128	146
- type	radial	radial
- maximum load (tyre manufacturer's)	18 kN	30 kN
- inflation pressure (tyre manufacturer's)	160 kPa	160 kPa
- dynamic radius index	640 mm	820 mm
Chosen track width	1780 mm	1720 mm

Oils and lubrication (Capacity and change interval)

	Capacity dm^3	Oil change h	Filter change h
Engine	16	200	200
Gear box *)	43	800	400
Front axle	8	800	-
Final drive (front axle)	2 x 1	800	-

*) Includes rear axle, final drive (rear), hydraulic system and steering

	Recommended	Used during test
Engine oil		Neste Delta Tractor Super
- Type		
- Viscosity	10W/30 +30-20°C 5W/20 -10..-30°C	10 W/30
- Classification	API CD	API GL 5
Transmission oils		Neste Delta Tractor Super
- Type		
- Viscosity	10W/30, 5W/30 5W/20 -10..-30°C	10 W/30
- Classification	API - GL 4(STOU)	API GL 5
Front axle		Texaco Hypoid
- Type		
- Viscosity	80W/90	80 W/90
- Classification	API GL-5 (EP)	EP

Grease — Universal grease

Number of lubrication points — 29

Fuel

Type — Dieseloil, in conformity with national standards

Density at 15 °C — PTO test 841 g/dm^3
drawbar power test 835 g/dm^3

REPAIRS — None

REMARKS — None

III. TEST RESULTS

COMPULSORY TEST RESULTS

1. MAIN POWER TAKE-OFF

- Date and location of tests: 27.6.1991 VAKOLA
- Type of dynamometer: Schenk W 400

Power	Speed		Fuel consumption			Specific energy
	Engine	P.T.O.	Hourly		Specific	
kW	rev/min		kg/h	l/h	g/kWh	kWh/l
1.1 MAXIMUM POWER - TWO-HOUR TEST						
73.1	2152	1035	16.8	20.0	230	3.65
1.2 POWER AT RATED ENGINE SPEED						
72.4	2225	1070	17.2	20.4	237	3.54
1.3 STANDARD POWER TAKE-OFF SPEED (1000 REV/MIN)						
71.8	2079	1000	16.4	19.5	228	3.69
1.4 PART LOADS 1.4.1 The torque corresponding to maximum power at rated engine						
72.4	2225	1070	17.2	20.4	237	3.54
1.4.2 85 % of torque obtained in 1.4.1						
62.2	2249	1082	14.9	17.8	240	3.50
1.4.3 75 % of torque defined in 1.4.2						
47.5	2287	1100	12.6	15.0	265	3.17
1.4.4 50 % of torque defined in 1.4.2						
32.0	2308	1110	9.6	11.4	299	2.81
1.4.5 25 % of torque defined in 1.4.2						
16.3	2360	1135	7.3	8.7	449	1.87
1.4.6 Unloaded						
-	2395	1152	4.5	5.3	-	-
1.5 PART LOADS AT STANDARD POWER TAKE-OFF SPEED (1000 REV/MIN) 1.5.1 The torque corresponding to maximum power						
71.8	2079	1000	16.4	19.5	228	3.69
1.5.2 85 % of torque obtained in 1.5.1						
62.0	2112	1016	14.5	17.2	233	3.61
1.5.3 75 % of torque defined in 1.5.2						
46.7	2123	1021	11.4	13.6	244	3.45
1.5.4 50 % of torque defined in 1.5.2						
31.7	2154	1036	8.9	10.5	279	3.01
1.5.5 25 % of torque defined in 1.5.2						
16.2	2202	1059	6.4	7.7	398	2.11
1.5.6 Unloaded						
-	2239	1077	3.9	4.6	-	-

Gear and range	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													
M3H	57.7	25.5	8.2	2151	9.3	291	2.87	51	80	94	25	55	101.8
3.2.2.1 75 % of pull at maximum power at rated speed													
M3H	46.3	19.1	8.7	2228	6.5	304	2.74	57	79	107	32	55	101.8
3.2.2.2 50 % of pull at maximum power at rated speed													
M3H	32.7	12.9	9.1	2272	3.9	359	2.32	55	79	100	31	55	101.8
3.2.2.3 Next higher gear at reduced engine speed, same pull and travelling speeds as in 3.2.2.1													
M4L	46.4	19.1	8.7	1988	6.9	289	2.89	54	79	99	28	55	101.8
3.2.2.4 Next higher gear at reduced engine speed, same pull and travelling speeds as in 3.2.1.2													
M4L	31.9	12.8	9.0	1986	4.1	314	2.66	53	79	98	29	55	101.8

2.2 Power lift test

	At the hitch point	On the frame
Height of lower hitch points above ground in down position	200 mm	200 mm
Vertical movement	675 mm	620 mm
Maximum corrected force exerted through full range	56.6 kN	40.6 kN
Corresponding pressure of hydraulic fluid	18.1 MPa	18.1 MPa
Moment about rear-wheel axis	62.9 kNm	69.9 kNm
Maximum tilt angle of mast from vertical		14 degrees

Lifting heights relative to the horizontal plane including the lower link pivot points									
mm	-355	-300	-200	-100	0	100	200	300	320
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90 % of the actual relief valve pressure setting or to maximum power delivered by the hydraulic system, whichever is lower)									
At the hitch points kN	59.1	58.7	58.5	58.4	57.5	57.4	57.4	57.6	56.6
Corresponding pressure: 18.1 kPa									
At the frame kN		56.2	53.7	51.4	49.1	47.1	44.4	41.0	40.6
Corresponding pressure: 18.1 MPa									

3. DRAWBAR POWER AND FUEL CONSUMPTION

Date of tests 31.7.1991

Type of track Tarmacadam

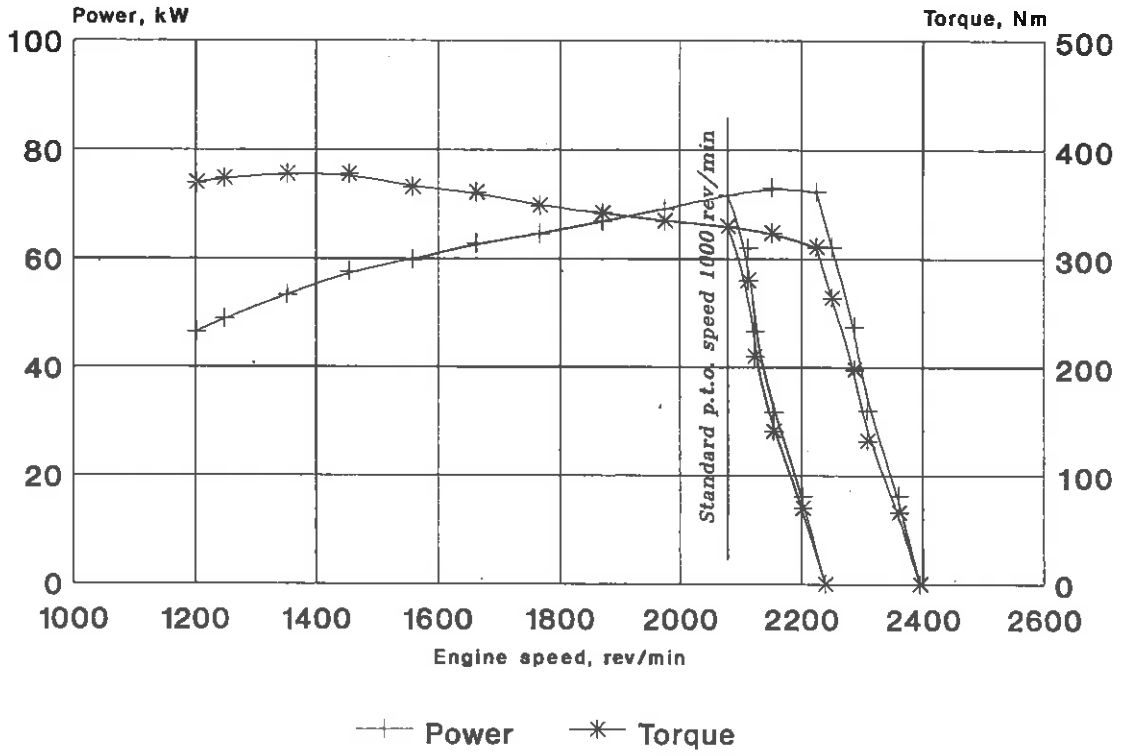
		Tyre inflation presssure	
	Height of drawbar above ground	Front	Rear
Unballasted	560 mm	160 kPa	160 kPa

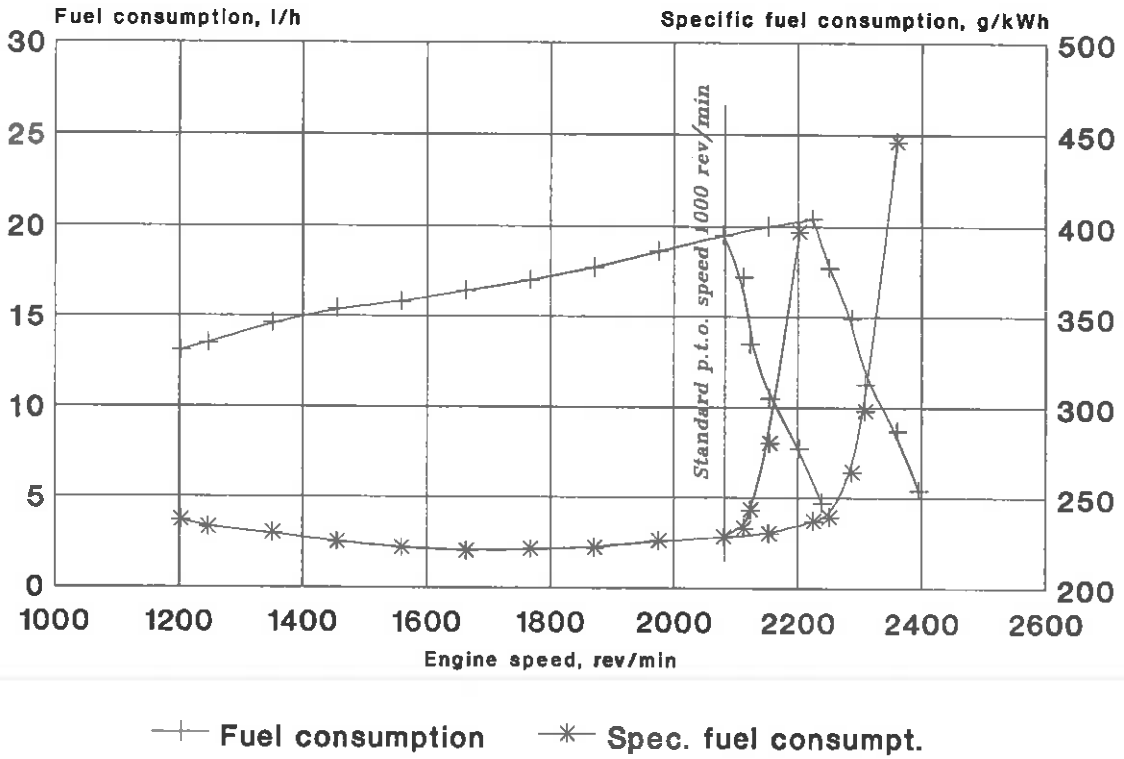
Gear and range	Power	Drawbar pull	Speed	Engine speed	Slip of wheels or track	Specific fuel consumption	Specific energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine Oil	Temperature	Relative humidity	Pressure
	kW	kN	km/h	rev/min	%	g/kWh	kWh/l	°C	°C	°C	°C	%	kPa
3.1 MAXIMUM POWER IN TESTED GEARS													
LL4L	20.3	33.7	2.2	2295	15.0	494	1.69	47	79	94	24	55	101.8
LL4H	26.0	34.3	2.7	2298	15.0	417	2.00	48	79	93	26	55	101.8
M1L	29.6	32.9	3.2	2288	15.0	391	2.13	45	79	90	25	55	101.8
M1H	35.9	31.3	4.1	2280	14.8	354	2.36	45	79	88	24	55	101.8
M2L	41.4	32.8	4.6	2255	15.0	340	2.46	47	79	91	25	55	101.8
M2H	51.0	32.1	5.7	2242	15.0	327	2.56	48	80	92	25	55	101.8
M3L	54.3	31.9	6.1	2161	15.0	311	2.69	50	80	93	25	55	101.8
M3H	57.7	25.5	8.2	2151	9.3	291	2.87	51	80	94	25	55	101.8
M4L	57.6	22.1	9.4	2153	7.9	298	2.80	52	80	94	26	55	101.8
H1L	57.9	20.1	10.4	2144	6.7	298	2.81	50	80	93	26	55	101.8
M4H	57.4	17.3	12.0	2138	5.3	298	2.81	50	80	92	24	55	101.8
H1H	59.0	15.8	13.4	2161	5.1	287	2.91	51	80	93	25	55	101.8
H2L	57.4	13.5	15.4	2167	4.0	301	2.77	50	79	92	25	55	101.8
H2H	58.0	10.7	19.5	2158	2.6	295	2.84	50	80	91	26	55	101.8
H3L	56.6	9.2	21.8	2151	1.9	304	2.75	50	80	91	26	55	101.8
H3H	52.1	6.8	27.5	2141	1.5	334	2.50	51	80	91	26	55	101.8

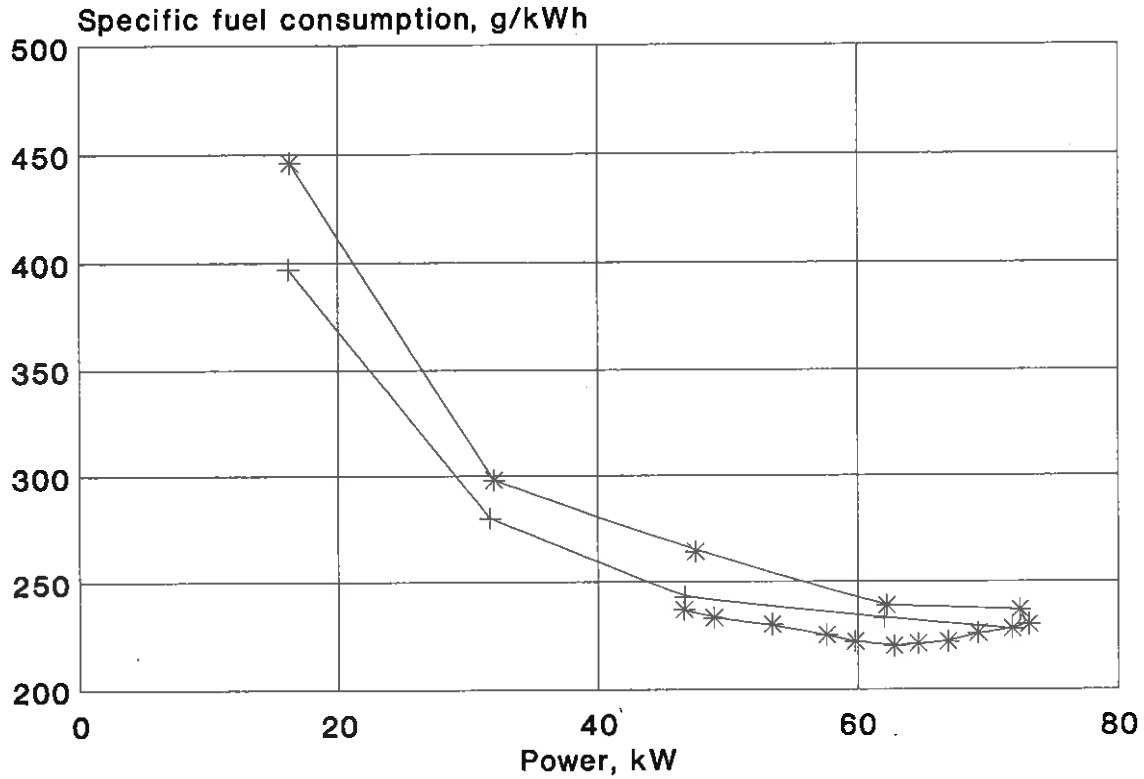
3.2 FUEL CONSUMPTION

Gear and range	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													
H1H	59.0	15.8	13.4	2161	5.1	287	2.91	51	80	93	25	55	101.8
3.2.1.1 75 % of pull at maximum power at rated speed													
H1H	45.0	11.8	13.7	2176	3.8	314	2.66	52	78	93	28	55	101.8
3.2.1.2 50 % of pull at maximum power at rated speed													
H1H	30.4	7.8	14.0	2205	2.5	362	2.31	52	79	98	27	55	101.8
3.2.1.3 Next higher gear at reduced engine speed, same pull and travelling speeds as in 3.2.1.1													
H2L	45.8	12.0	13.7	1923	3.6	276	3.02	55	79	101	27	55	101.8
3.2.1.4 Next higher gear at reduced engine speed, same pull and travelling speeds as in 3.2.1.2													
H2L	30.9	7.8	14.1	1954	2.3	322	2.60	55	79	101	29	55	101.8

Gear and range	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													
M3H	57.7	25.5	8.2	2151	9.3	291	2.87	51	80	94	25	55	101.8
3.2.2.1 75 % of pull at maximum power at rated speed													
M3H	46.3	19.1	8.7	2228	6.5	304	2.74	57	79	107	32	55	101.8
3.2.2.2 50 % of pull at maximum power at rated speed													
M3H	32.7	12.9	9.1	2272	3.9	359	2.32	55	79	100	31	55	101.8
3.2.2.3 Next higher gear at reduced engine speed, same pull and travelling speeds as in 3.2.2.1													
M4L	46.4	19.1	8.7	1988	6.9	289	2.89	54	79	99	28	55	101.8
3.2.2.4 Next higher gear at reduced engine speed, same pull and travelling speeds as in 3.2.1.2													
M4L	31.9	12.8	9.0	1986	4.1	314	2.66	53	79	98	29	55	101.8


Power, kW
Torque, Nm
100
80
60
40
20
0
500
400
300
200
100
0
1000
1200
1400
1600
1800
2000
2200
2400
2600
Standard p.t.o. speed 1000 rev/min
Engine speed, rev/min
Power
Torque


Fuel consumption, l/h
Specific fuel consumption, g/kWh
30
25
20
15
10
5
0
500
450
400
350
300
250
200
1000
1200
1400
1600
1800
2000
2200
2400
2600
Standard p.t.o. speed 1000 rev/min
Engine speed, rev/min
Fuel consumption
Spec. fuel consumpt.



STATE RESEARCH INSTITUTE OF ENGINEERING IN AGRICULTURE AND FORESTRY

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