NATIONAL SWEDISH TESTING INSTITUTE
FOR AGRICULTURAL MACHINERY

Head office: Ultuna, 750 07 UPPSALA 7, Sweden

Testing Stations for Agricultural, Forestry and Garden Machines:

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TEST BULLETIN: OECD No. 239

Date of Approval: 24th July, 1968

REPORT ON TEST IN ACCORDANCE WITH OECD TEST CODE FOR AGRICULTURAL TRACTOR

BM/Volvo T-600 diesel tractor

Manufactured by:

AB Bolinder-Munktell of the Volvo-group, ESKILSTUNA, Sweden

TEST BULLETIN: OECD No. 239

BM/Volvo T-600 diesel tractor



Manufactured by: AB Bolinder-Munktell of the Volvo-group, Eskilstuna, Sweden

This Bulletin is based on engineering tests in accordance with the OECD Tractor Code. It does not contain an evaluation of the performance of the tractor on practical farm work.

Specification of tractor

Manufacturer:	AB Bolinder-Munktell, Eskilstuna, Sweden
Submitted for test by:	The manufacturer
Selected by:	National Testing Institute for Argicultural Machinery
Place of running in:	AB Bolinder-Munktell, Eskilstuna
Duration of running in:	125 hrs, p.t.o. 105 hours, transmission 20 hours

Tractor

Make:	AB Bolinder-Munktell of the Volvo group
Type:	Diesel
Model:	BM/Volvo T-600
Serial No.:	2406

Engine

Make:	AB Bolinder-Munktell
Type:	Direct injection diesel engine
Model:	1113 A
Serial No.:	17000—46069

Cylinders

Number:	3
Disposition:	Vertical, in line
Bore/stroke:	111.12 mm, 130 mm
Capacity:	3780 cm^3
Compression ratio:	16.5:1
Arrangement of valves:	Overhead
Cylinder liners:	Wet, replaceable, centrifugally cast cylinder liners

Fuel system

Type of fuel feed:	AC, mechanical type VF fuel feed pump
Type, make and model of fuel filters:	Twin bowl, series flow filter, C.A.V. 2FS 584 5010 Replaceable paper filter elements
Capacity of fuel tank:	63 litres
Type, make and model of injection pump:	In line pump Simms "Minimec" P 4766 Serial No: 2666
Manufacturers production setting:	15.5—15.9 cc for 200 injections at 900 r/m pump speed (test bench figures)
Type, make and model of injectors:	Simms type N 1320
Manufacturers production setting:	Opening pressure 200 kp/cm^2

Governor	
Make:	Simms
Type:	Mechanical leaf spring governor, incorporated in fuel injection pump.
Range of speed:	Governed range of engine speed 600—2135 r/m. Rated engine speed 1950 r/m
Air cleaner	
Make:	Mann & Hummel
Type:	Oil bath
Oil capacity:	0.9 litres
Pre-cleaner:	Optional as extra equipment: Mann & Hummel centrifugal pre-cleaner LB6-00
Lubrication system	
Type:	Forced feed from gear type pump with metal strainer in oil sump
Type and number of filters:	Full flow replaceable paper element filter
Oil capacity:	10.5 litres including oil filter
Recommended oil change period:	125 hrs
Cooling system	
Type:	Water cooled, impeller assisted with 406 mm dia., belt driven 4-blade fan
Coolant capacity:	14 litres
Means of temperature control:	Thermostat
Pressure details:	0.38—0.45 kp/cm²
Starting system	
Make:	Bosch
Type:	J D 12 V 4 PS. Electrical, solenoid engaged starter
Aids for cold starting:	Manually operated excess fuel and retarding device
Electrical system	
Voltage:	12 V
Generator:	Bosch, type 0 101302035 G 14 V 16 A 21
Battery:	Tudor, type 6 EX 11, lead-acid
Capacity and rating:	160 Ah

Transmission

Clutch:	Borg and Beck single plate dry clutch 13 in (330 mm) dia., pedal operated.
Gearbox:	Own make, sliding gear and constant mesh. 10 forward speeds and 2 reverse.

Rear axle and final drive: Crown wheel and pinion, differential and spur gear final drive. Pedal operated differential lock.

Oil capacities: Gearbox, rear axle and final drive: 53 litres. Change period: once a year.

Gear	Number of engine revolutions for one revolution of driving wheels	Nominal travelling speed for rated speed of engine (rolling radius 715 mm) km/h
Forward		
1	192.94	2.72
2	128.01	4.10
3	104.00	5.05
4	83.74	6.27
5	69.00	7.61
6	55.56	9.46
7	46.18	11.38
8	30.64	17.15
9	26.60	19.75
10	17.64	29.78
Reverse		
low	108.05	4.86
high	71.69	7.33

Power take off At rear of tractor. 6 splines, 1 3/8 in (34.9 mm). Height above ground 696 mm. Proportional engine speed: 540 r/m at 1500 r/m engine speed.
Direction of rotation: clockwise viewed from driving end. Proportional ground speed: distance travelled for 1 revolution of p.t.o. 101 mm. Number of p.t.o. revolutions for one revolution of driving wheel 44.1. Direction of rotation: clockwise viewed facing driving end with tractor in forward gear. Independent hand-lever operated multi-disc clutch.

Belt pulley (not fitted for test) Rearmounted and p.t.o. driven. Dimensions: 300/170 mm diameter and width of face. Linear speed 20.7 m/min and 1320 r/m at rated engine speed 1950 r/m. Engine speed 1500 r/m at standard linear speed 16 m/min. Direction of rotation: optional.

Power lift Own make, single acting. Independent pump drive, working pressure 135—140 kp/cm². Oil capacity 14 litres. Vertical lift movement above ground. Max. 420 mm to 875 mm. Min. 0 mm to 580 mm. Category 2, 28.4 mm implement linkage.

Drawbar Swinging drawbar. Height above ground max. 645 mm, min. 390 mm. Vertical adjustment by stretching screws and horisontal adjustment on drawbar frame. Distance from rear axle 805 mm, position relative to p.t.o. 345 mm, lateral adjustment ±350 mm. Pivot position relative to rear wheel centre 140 mm forward.

Hitch

Height above ground 405 mm. Distance from rear axle 520 mm. Position relative to p.t.o. 60 mm forward.

Steering

ZF-Gemmer, worm and roller type with single drop arm and fixed length drag link.

Brakes

Own make, shoe and drum type mounted on differential half shafts. Independent or combined pedal operated latch on pedals for parking.

Wheels

Steering wheels

Two at front. Type: pneumatic, Triple Rib, 7.50—18, 4-ply rating. Maximum permissible weight on each tyre 560 kg at 1.7 kp/cm². Track width 1355 and 1455 mm. Changed by off-set wheel centres.

Driving wheels

Two at rear. Type: pneumatic, 16.9/14—34, 6-ply rating. Maximum permissible weight on each tyre: 1870 kg at 1.1 kp/cm² pressure. Track width 1550 and 1650 mm. Wheelbase: 2308 mm.

Seat

Own make. Parallellogram linkage. Suspension by coil spring. Damping by hydraulic shock absorber. Adjustable for driver's weight. Range of adjustment 60 mm fore and 60 mm aft.

Number of grease points

27

Overall dimensions

Overall length, without ballast weights 3.72 m
" " with " " 3.95 m
Overall width, without ballast weights 1.99 m
" " with " " 2.35 m
Overall height 2.40 m

Lighting

	Height above ground of centre cm	Diameter cm	Distance from outside edge of tractor to centre cm
Head lights ...	103	12	64
Side lights	164	5	36.5
Rear lights ...	148.5	5.6	35.5
Reflektor	60	7.6	57

Tractor and ballast weights

(Without driver but with tanks full and safety frame)

Weight without ballast:

Front 950 kg
Rear 2070 kg
Total 3020 kg

Ballast	Front:	Frame and 8 front weights, total 450 kg
	Rear:	10 weights per wheel, total 1070 kg liquid 610 kg
Weight with full ballast:	Front	1475 kg
	Rear	3675 kg
	Total	5150 kg

Fuels and lubricants used in tests

Laboratory tests

Fuel:	Diesel oil, density 0.812 g/cm³ at 20°C. Cetane number 52
Engine oil:	Shell Rotella SAE 20
Transmission oil:	Transmission oil SAE 90

Track tests

Fuel:	Diesel oil, density 0.812 g/cm³ at 20°C. Cetane number 52
Engine oil:	Shell Rotella SAE 20
Transmission oil:	Transmission oil SAE 90

Compulsory tests

1. Main power take-off performance

Date and location of tests: 16—17 January 1968, Ultuna, Uppsala, Sweden

Type of dynamometer: Eddy current, Zöllner

Horse-power hp/metric	Speed		Fuel consumption		
	Engine r/m	P.t.o. r/m	l/h	g/hph	hph/l
Maximum power—2 hour test					
60.1	1951	702	13.36	181	4.5
Standard P.t.o. speed (540 r/m)					
49.2	1500	540	10.51	174	4.7
Part loads					
52.3	1999	720	11.58	180	4.5
0.8	2118	763	3.49	—	—
26.9	2056	740	7.21	217	3.7
60.5	1962	706	13.49	181	4.5
13.6	2091	753	5.22	311	2.6
40.0	2034	732	8.82	190	4.3

No load maximum speed 2118 r/m. Equivalent crankshaft torque at maximum power 22.1 kpm

Maximum equivalent crankshaft torque 23.8 kpm at 1350 r/m engine speed

Mean atmospheric conditions:	Temperature	17°C
	Pressure	755 mm Hg
	Relative humidity	23 %
Maximum temperature:	Coolant	89°C
	Engine oil	102°C
	Fuel	20°C

2. Drawbar performance on drum dynamometer

Date of test: 5—27 March 1968

Type of track: Concrete

Height of drawbar above ground: 550 mm

Tests were carried out with radial type tyres.

Results see table on page 12.

3. Turning space and turning circle

Details of wheel equipment: As in specification without ballast

Track of wheels; Front 1352 mm
Rear 1550 mm

	With brakes		Without brakes	
	Left-hand	Right-hand	Left-hand	Right-hand
Radius of turning space	3.38 m	3.53 m	3.96 m	4.02 m
Radius of turning circle	3.28 m	3.43 m	3.86 m	3.92 m

4. Location of centre of gravity

Heigt above ground	942 mm
Distance forward from the vertical plane containing the axis of the rear wheels	703 mm
Distance from the medium plane of the tractor	0 mm

5. Braking

Date of tests: 23—29 November 1967

Type of track: Concrete

Cold brakes

Travelling speed 25 km/h	Tractor without ballast	Tractor with ballast
Deceleration..... m/s²	4.8	4.8
Stopping distance ..... m	4.6	5.1
Force on pedal..... kp	48	53

Brake fade characteristics (hot tests)

Deceleration	hot/cold	91 %
Stopping distance	cold/hot	89 %
Force on pedal	cold/hot	100 %

Parking brake (latch on pedals)

Satisfactory hot and cold, 68 kp pedal force
Handbrake not fitted

6. Measurement of ambient noise emitted by the tractor

Date of tests:	24 Januari 1968
Type of sound level meter:	Brüel & Kjær, Type 2203
Type of track:	Concrete
Results of test:	Gear 10, travelling speed 24.0 km/h, sound level 89 dBA

7. Noise measurements at the driver's ear level

Date of tests:	22—23 January 1968
Type of sound level meter and octave filter:	Brüel & Kjær, type 2203 with octave filter set type 1613
Type of track:	Concrete

Result of test

Gear	Travelling speed km/h	Loudness sones
5	7.20	131
4	5.93	161

Tractor fitted with safety frame

8. Power lift and hydraulic pump performance

Date of tests:	15 february and 10 May 1968
Hydraulic fluid	
Type:	Hydraulic oil SAE 5W/10W
Viscosity:	15 cst. at 50° C
Type of linkage lock for transport:	Hydraulic, opening pressure of the cylinder over pressure relief valve (manufacturer's figure) 175 kp/cm²

	Vertical movement mm	Maximum force exerted through full range kp	Pressure kp/cm²
Linkage giving maximum mechanical advantage			
At lower hitch points (height in down position 220 mm)	442	1985	140
At frame (height in down position 351 mm)	420	1455	135
Linkage giving minimum mechanical advantage			
At lower hitch points (height in down position 192 mm)	516	1960	140
At frame (height in down position 236 mm)	475	1490	135

Pump characteristiscs

i) Opening pressure of the relief valve	135 kp/cm²
Sustained pressure of the open relief valve	140 kp/cm²
Pump delivery rate at rated engine speed	
ii) at minimum pressure	40 l/min
iii) at maximum hydraulic power	
delivery	32 l/min
pressure	125 kp/cm²
power	8,9 hp metric

Optional tests

9. Optional engine test (performance at the engine crankshaft)

Date and location of tests: 19—21 February 1968, Ultuna, Uppsala, Sweden

Type of dynamometer: Eddy current, Zöllner

Horse power metric hp	Engine speed	Fuel consumption		
		l/h	g/hph	hph/l
Maximum power—2 hour test				
62.4	1950	13.53	176	4.6
Parts loads				
55.0	2021	11.79	174	4.7
1.8	2134	3.34	—	—
28.1	2068	7.32	211	3.9
62.9	1963	13.55	175	4.6
14.3	2107	5.14	291	2.8
42.0	2058	9.43	183	4.4

Optimum fuel consumption recorded:		163 g/hph at 36.3 hp and 1274 r/m
No load, maximum engine speed:		2134 r/m
Crankshaft torque at maximum power:		22,9 kpm
Maximum crankshaft torque:		24,4 kpm at 1400 r/m
Mean atmospheric conditions:	Temperature	16° C
	Pressure	753 mm Hg
	Relative humidity	14 %
Maximum temperature:	Coolant	87° C
	Engine oil	103° C
	Fuel	18° C

Repairs, adjustments and remarks during tests: None

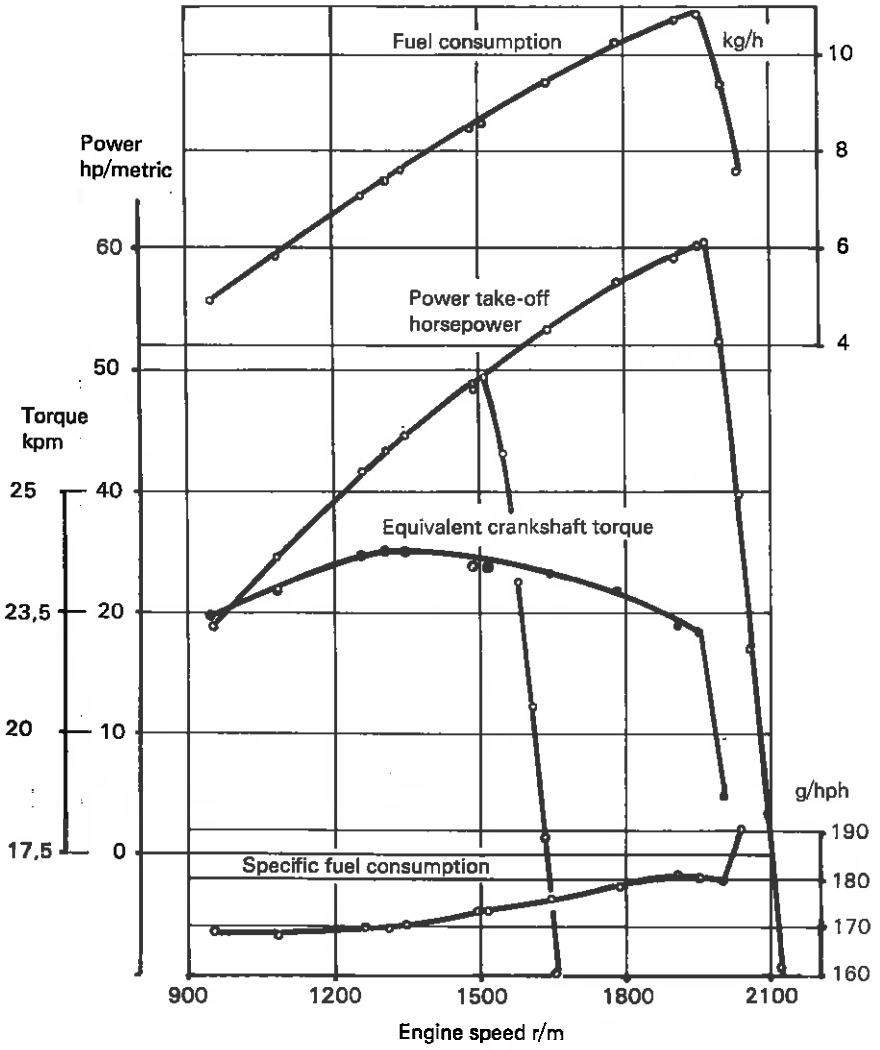
Ultuna, Uppsala, 3rd July, 1968
National Swedish Testing Institute for Agricultural Machinery

Gear	Horse-power	Draw-bar pull	Speed	Engine speed	Wheel slip	Specific fuel consumption		Temperature °C			Atmospheric conditions		
								Cool-ant	Fuel	Engine oil	Temper-ature	Rela-tive hu-midity	Pres-sure
	hp/ metric	kp	km/h	r/m	%	g/hph	hph/l				°C	%	mm Hg
i) Maximum power (ballasted)													
1	38.8	4026	2.60	2009	8.9	231	3.5	78	16	73	16	35	748
2	51.1	3558	3.88	1955	8.0	217	3.7	80	16	86	18	35	748
3	52.7	2857	4.98	1953	4.4	210	3.9	85	15	91	17	36	748
4	52.6	2296	6.18	1963	3.7	213	3.8	84	17	86	17	35	748
5	53.1	1899	7.56	1955	3.6	209	3.9	78	17	89	18	35	748
6	53.3	1508	9.54	1953	1.8	207	3.9	79	17	94	17	36	748
7	52.5	1230	11.52	1955	1.5	211	3.8	84	15	92	17	36	748
ii) Five hour test at 75 % pull at maximum power													
4	41.3	1725	6.47	2009	2.4	213	3.8	80	16	90	18	21	762
iii*) Five hour test at a pull corresponding to 9 % wheelslip in test i)													
1	39.8	4002	2.69	2007	6.7	220	3.7	81	17	90	17	21	762
iv) Maximum power (unballasted)													
3	44.2	2522	4.74	1992	12.0	223	3.6	78	17	87	15	36	741
4	50.4	2265	6.01	1953	7.8	223	3.6	87	18	—	18	41	761
5	53.3	1950	7.38	1951	6.5	205	4.0	86	16	89	18	41	761
6	54.4	1564	9.40	1951	4.1	201	4.0	85	15	92	16	40	766
7	53.3	1261	11.42	1951	3.3	205	4.0	83	15	91	17	40	766
8	53.2	827	17.37	1951	2.5	205	4.0	84	14	92	17	40	766
9	53.0	709	20.18	1959	2.0	209	3.9	82	17	90	16	41	761

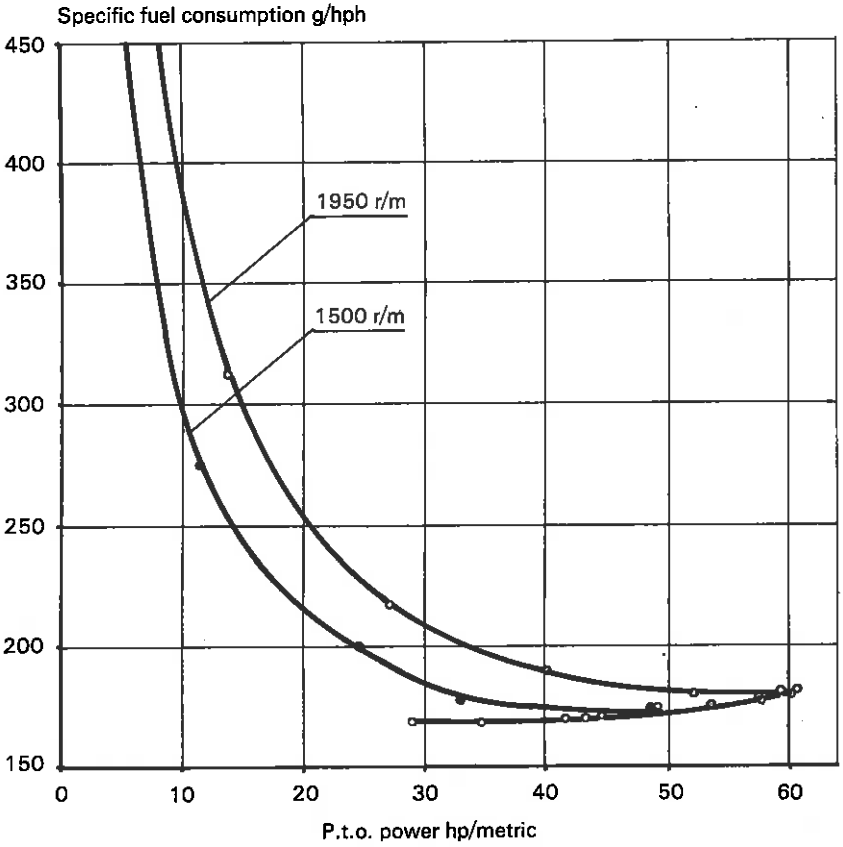
Total oil consumption during ten hours duration of test ii) and iii) 18 g/h

* Test iii) was carried out with additionat ballast. Power, slip and fuel consumption do not correspond to test i) gear 1

National Swedish Testing Institute for Agricultural Machinery	**Power take-off test BM/Volvo T-600**	Figure 1
		16—17. 1. 68



National Swedish Testing Institute for Agricultural Machinery	**Power take-off test BM/Volvo T-600**	Figure 2
		16—17. 1. 68

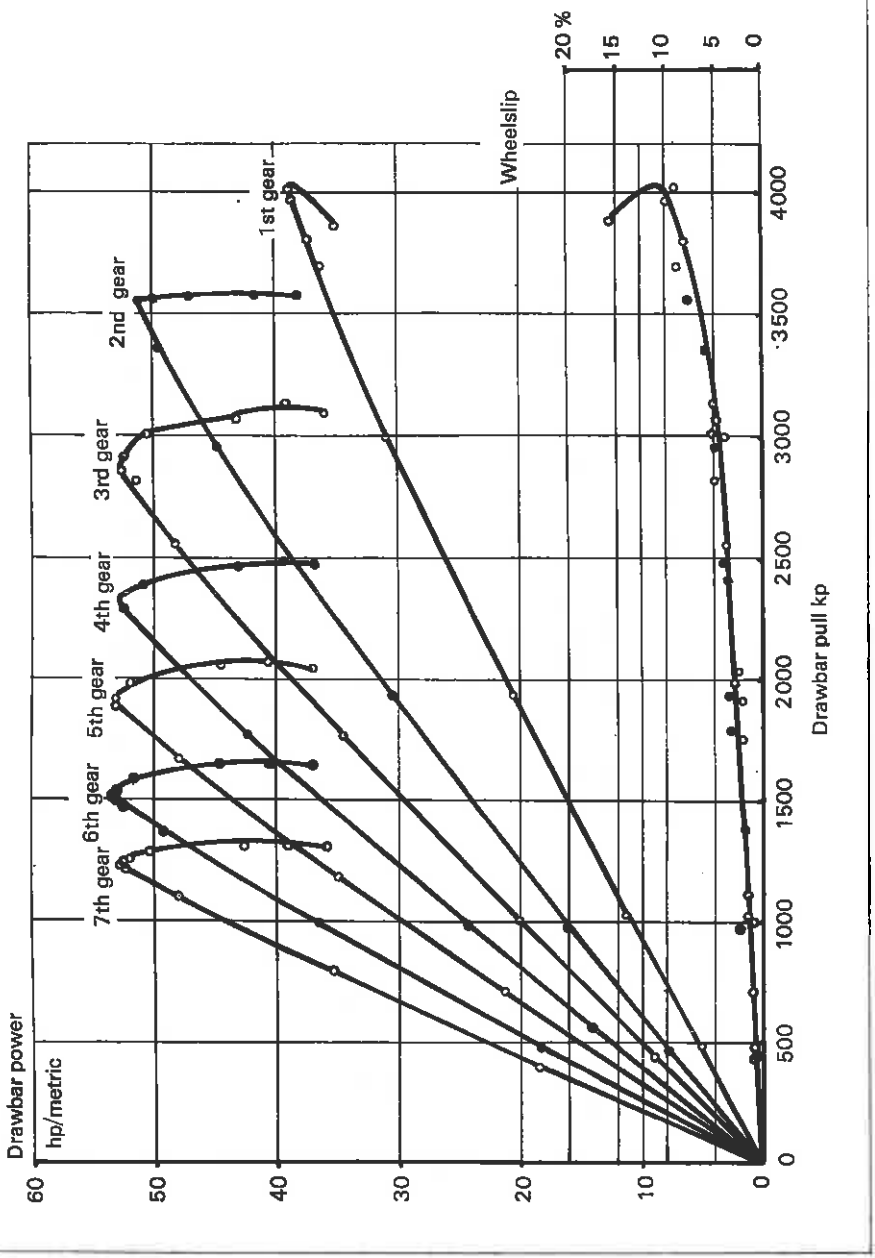


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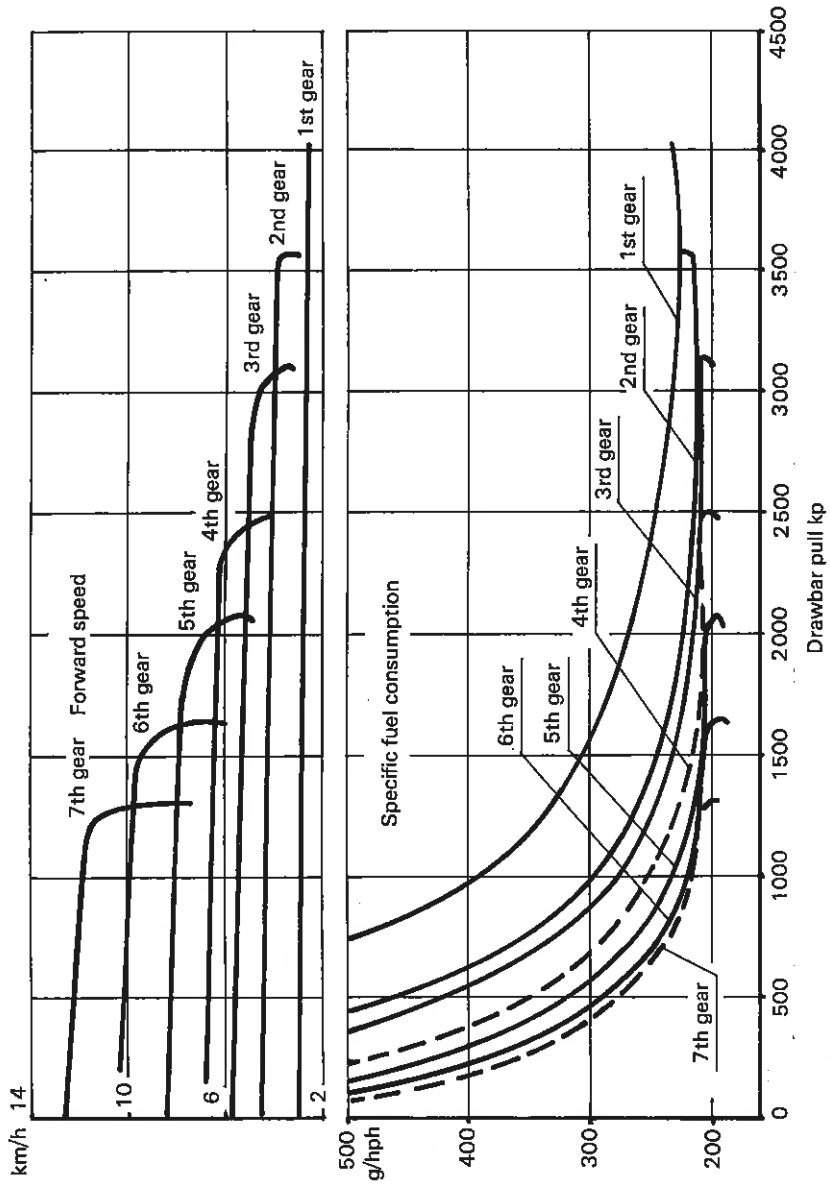
Drawbar test on drum dynamometer BM/Volvo T-600 With ballast

Figure 3

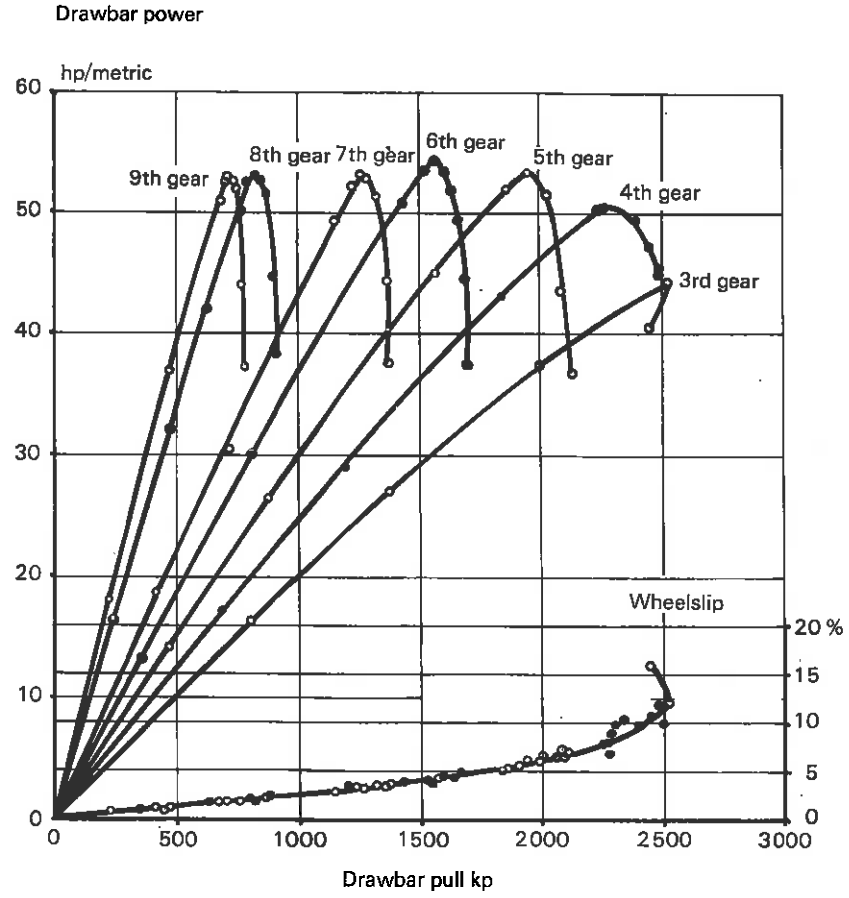
5—8. 3. 68



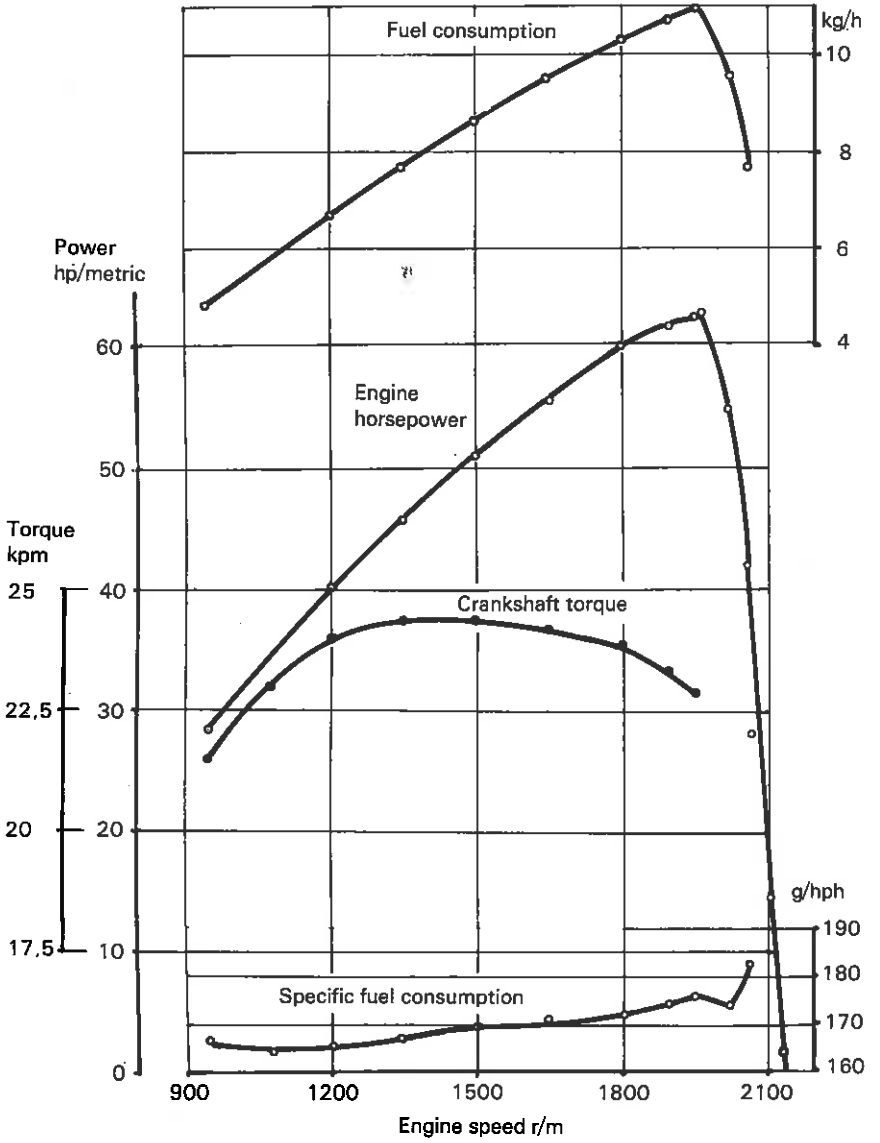
National Swedish Testing Institute for Agricultural Machinery	**Drawbar test on drum dynamometer BM/Volvo T-600 With ballast**	Figure 4
		5—8. 3. 68



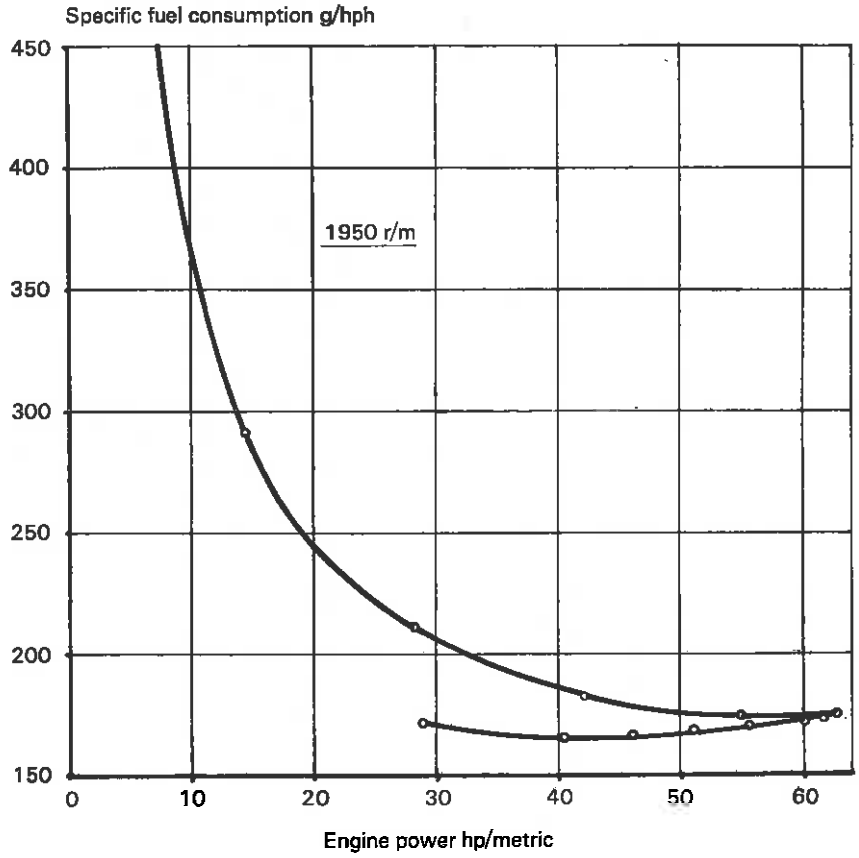
National Swedish Testing Institute for Agricultural Machinery	**Drawbar test on drum dynamometer BM/Volvo T-600 Without ballast**	Figure 5
		20—21. 3. 68
		26—27. 3. 68



National Swedish Testing Institute for Agricultural Machinery	**Engine test** **BM/Volvo T-600**	Figure 6 19—21. 2. 68



National Swedish Testing Institute for Agricultural Machinery	**Engine test BM/Volvo T-600**	Figure 7 19—21. 2. 68

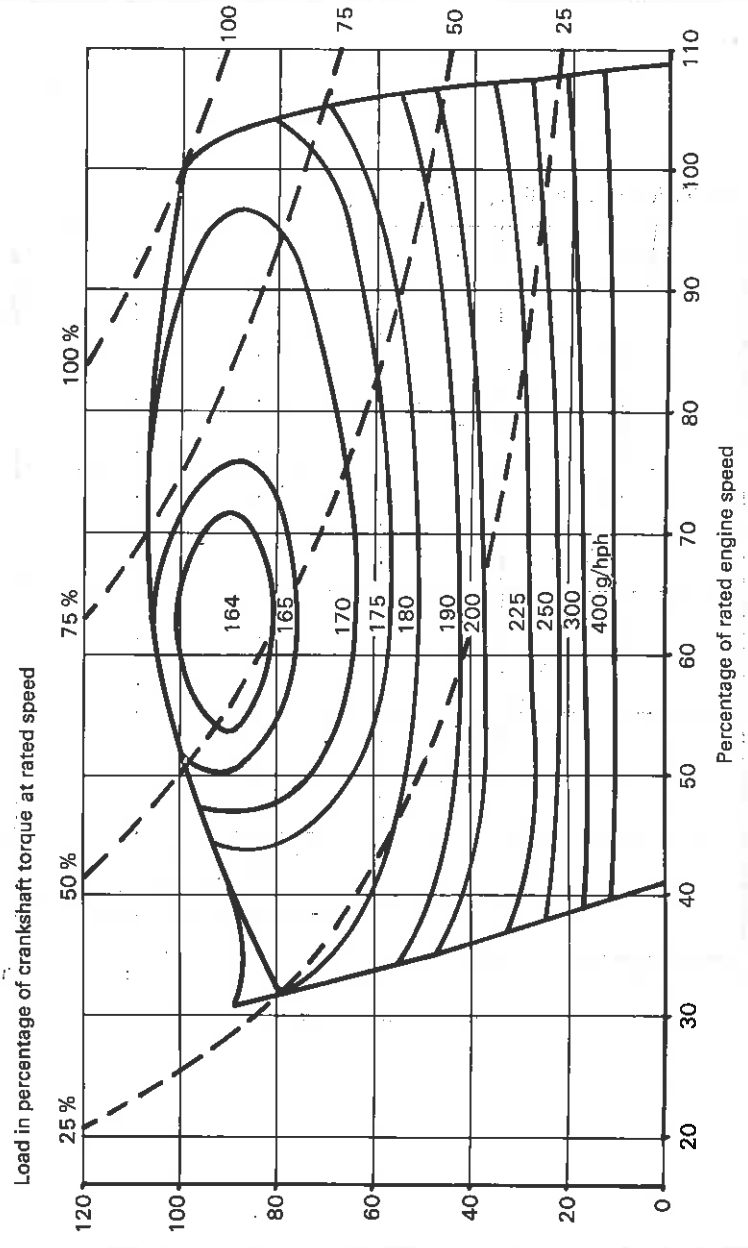


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Engine test
BM/Volvo T-600

Figure 8

19—21. 2. 68



Printed in Sweden
ESSELTE AB, STHLM 66 812653
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