



NATIONAL SWEDISH TESTING INSTITUTE FOR AGRICULTURAL MACHINERY

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TEST BULLETIN: OECD No. 604

Date of approval 1979-01-31

**REPORT ON TEST IN ACCORDANCE WITH OECD TEST CODE FOR
THE OFFICIAL TESTING OF AGRICULTURAL TRACTORS**

VOLVO BM T 500 diesel tractor

Manufactured by:

VOLVO BM AB, S-631 85 Eskilstuna, Sweden

TEST BULLETIN: OECD No. 604

VOLVO BM T 500 diesel tractor



This Bulletin is based on engineering tests in accordance with OECD Tractor Code.

It does not contain an evaluation of the performance of the tractor on practical farm work.

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XII

Tractor manufacturer's name and address:	Volvo BM AB S-631 85 Eskilstuna, Sweden
Submitted for test by:	The manufacturer
Selected by:	The manufacturer
Place of running in:	Volvo BM, Eskilstuna
Duration of running in:	105 h, p t o 85 h, transmission 20 h

Specification of tractor

Tractor

Make:	Volvo BM
Model:	T 500
Type:	Four wheel, rear wheel driven, diesel
Serial No:	2636

Engine

Make:	Perkins
Model:	D 39 T
Type:	Direct injection, 4-stroke, diesel engine
Serial No:	236 U 154832 L
Cylinders Number:	4
Disposition:	Vertical, in line
Bore/stroke	98, 43 mm/127 mm
Capacity:	3.86 dm ³
Compression ratio:	16:1
Arrangement of valves:	Overhead
Cylinder liners:	Dry, replaceable, cast iron liners

Fuel system

Type of fuel feed:	AC-Delco mechanical diaphragm feed pump, type E/FP 65209 B
Make, type and model of fuel filters:	Primary filter CAV FAS 5836 320 Secondary filter CAV FS 5836 130 Series flow filter Replaceable paper filter elements
Capacity of fuel tank:	88 dm ³
Make, type and model of injection pump:	CAV DPA 3342 F 170 (Distributor type)
Manufacturer's production setting:	Fuel delivery 13.64—14.32 l/h at 2 200 r/min engine speed. Fuel density 0.83 g/cm ³ at 15°C. Injection timing 22° before T.D.C.
Make, type and model of injectors:	CAV nozzle BDLL 150 S 6556 in nozzleholders BKBL 67 S 5151
Manufacturer's production setting:	16.7—17.6 MPa

Governor

Make	CAV
Type:	Mechanical, incorporated in fuel injection pump
Range of speed:	Governed range of engine speed 500—2 450 r/min

Air cleaner

Make: Own.
Type: Dry replaceable paper element filter. Filter element Mann & Hummel C 17225/3 and CF 800 (safety cartridge).

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: 8 dm³ including oil filter.
Changing period: 125 h
Recommended oil: Engine oil according to API-CC (MIL-L2104 B) SAE 10W/30.

Cooling system

Type: Water cooled, impeller assisted with 413 mm dia., belt driven 4-blade fan
Coolant capacity: 13 dm³ including cabin heater
Means of temperature control: Thermostat
Pressure details: 22.6—31.4 kPa

Starting system

Make: Bosch
Type: JD 12 V 4 (3 kW) Electrical, solenoid engaged starter
Aids for cold starting: CAV Thermostart in inlet manifold

Electrical system

Voltage: 12 V
Generator
Make: S.E.V. Alternateurs
Type: Alternator 702204 02 14 V 35 A 490 W
Battery
Make: Tudor
Type: 6 E 5 P Lead-acid, two batteries 12 V parallel
Capacity and rating: 140 Ah, 20 hours rating

Transmission

Clutch
Make: Laycock
Type and diameter of disc: Single plate dry clutch, 11 in (279 mm) diameter with 2×4 sintered friction pads.
Method of operation: Foot pedal

Gearbox

Make: International Harvester
Type: Constant mesh with synchronizer. Gearbox with 4 forward speeds and 1 reverse. Rangebox with 2 ranges.
No of speeds: 8 forward and 4 reverse

Rear axle and final drive

Make: International Harvester
Type: Crown wheel and pinion, differential and epicyclic gear final drive.
Pedal operated differential lock

Oil capacity:

Gearbox, rear axle and final drive: 34–52 dm³. Change period: 800 hours. Recommended oil according to VOLVO specification 97306–12

Gear number	Number of engine revolutions for one revolution of driving wheels	Nominal travelling speed for rated speed of engine km/h*
Forward		
1	206.30	2.9
2	150.26	3.9
3	104.70	5.6
4	77.51	7.6
5	63.68	9.3
6	46.27	12.7
7	32.20	18.3
8	23.85	24.7
Reverse		
1	137.38	4.3
2	100.17	5.9
3	71.12	8.3
4	51.52	11.4

* Calculated with tyre rolling radius of 711 mm.

Power take off

At rear of tractor 6 splines 1 3/8 in (34.9 mm). Engaged by hydraulically operated multidisc clutch with handlever control. Height above ground 711 mm*. Proportional engine speed 612 r/m at 2 200 r/m engine speed. Engine speed 1 940 r/m at standard p t o speed 540 r/min). Direction of rotation: Clockwise viewed facing driving end.

Belt pulley

(Not fitted for test)

Rear mounted and p t o driven. Dimensions: 225/160 mm diameter and width of face. Linear speed 15,0 m/s and 1 270 r/min at rated engine speed 2 200 r/min.

Direction of rotation: Optional.

Power lift

Make:

International Harvester

Type:

Single acting. Gear type pump. Independent pump drive. Working pressure 17.5–18.2 MPa. Oil supplied from rear axle housing to ram cylinder. Oil capacity: 34–52 dm³. Category 2 implement linkage with top link sensing. Draught and position control. Two operating levers.

Vertical lift movement above ground. Highest adjustment 200 mm to 890 mm, lowest adjustment 165 mm to 890 mm. External connections:

1 single acting and 1 double acting

Drawbar

Swinging drawbar. Height above ground 371 mm*. Horizontal distance from rear axle 760 mm, position relative to p t o 360 mm. Lateral adjustment 245 mm from centre position. Pivot position relative to rear wheel centre 44 mm forward.

Hitch

Height above ground 421 mm*. Distance from rear axle 450 mm, position relative to p t o 50 mm.

Steering**Make:****Type:**

Danfoss Orbitrol

Hydrostatic power assisted, single cylinder acting on centre steering arm.

Brakes**Make:****Type:**

International Harvester

Hydraulically actuated wet disc brakes mounted on planetary gear shafts.

Independent or combined pedal operated. Parking brake with hand lever operated band brake on differential pinion shaft.

Wheels**Steering Wheels:**

Two at front. Type: Pneumatic, multirib 10.00—16/8 ply rating. Maximum permissible mass on each tyre 1 190 kg at 270 kPa pressure. Track width 1 465, 1 565, 1 665, 1 770, 1 870 or 1 970 mm changed by extending axle.

Driving wheels:

Two at rear. Type: Pneumatic 16.9/14—34/6 ply rating. Maximum permissible mass on each tyre 2 015 kg at 127 kPa pressure. Track width 1 520, 1 620, 1 720, 1 820 or 1 920 mm changed by reversing wheel centres and off-set lugs on rims.

Wheelbase:

2 170 mm.

Seat**Make:****Type:**

Bostrom, model XL 101 Argus de Luxe

Torsion bar suspension, adjustable to driver's mass. Damping by hydraulic shock absorber. Range of adjustment 150 mm fore and aft and 62 mm up and down.

Number of grease points**Whole tractor:**

13

Overall dimensions

	Length, m	Width, m ¹	Height, m ²
With ballast	3.85	2.17	2.70
Without ballast	3.65	1.95	2.70

¹ With track width of 1 520 mm.² Measured to top of exhaust pipe.**Lighting**

The lighting system is in accordance with the national Swedish regulations for road traffic (FK 20 §)

	Height above ground of centre mm	Diameter mm	Distance from outside edge of tractor to centre mm ²)
Head lights	1 080	120	810
Side lights	1 600	70×160 ¹	290
Rear lights	1 620	70×160 ¹	260
Reflectors	760	80	370

¹ Rectangular² With track width of 1 520 mm

Conditions during test

Masses

Tractor without driver but with tanks full

Without ballast

Part of mass on front wheels 1 015 kg

Part of mass on rear wheels 1 965 kg

Total mass 2 980 kg

With ballast

Part of mass on front wheels 1 270 kg

Part of mass on rear wheels 3 930 kg

Total mass 5 200 kg

Ballast

Front: Frame and front weights total 220 kg

Rear: Weights, total 1 390 kg

Liquid, total 610 kg

Track setting during tests

Front: 1 465 mm

Rear: 1 520 mm

Fuel and lubricants used in tests

Laboratory and track tests

Fuel: Diesel oil, density 0.830 g/cm³ at 20°C, cetane number 50 (SIS 15 54 32)

Engine oil: Shell Rotella T SAE 10 W/30

Transmission oil: VOLVO specification 97306-12

Compulsory tests

1. Main power take-off performance

Date of tests: 1976-09-20- -24

Location of tests: Ultuna, S-750 07 UPPSALA 7, Sweden

Type of dynamometer: Eddy current, make Zöllner

Power kW	Speed		Fuel consumption			Percent of torque obtained at maximum power
	Engine r/min	P.t.o. r/min	l/h	g/MJ	MJ/l	
Maximum power — 2 hour test						
42.1	2 202	613	14.42	79	10.5	100
Standard p.t.o. speed (540 r/min)						
39.6	1 940	540	13.00	75.5	11.0	107
Part loads						
37.7	2 319	646	13.68	83.5	9.9	85
0.6	2 390	665	4.95	—	—	1
19.2	2 360	657	8.79	105.5	7.9	42.5
41.1	2 206	614	14.41	81	10.2	100
9.6	2 367	659	6.69	160	5.2	21
28.5	2 339	651	11.01	89	9.3	64

No load maximum engine speed 2 390 r/min

Equivalent crankshaft torque at maximum power 183 Nm

Mean atmospheric conditions:

Temperature 17°C
Pressure 103.3 kPa (775 mm Hg)
Relative humidity 51 %

Maximum temperatures:

Coolant 82°C
Engine oil 108°C
Fuel 21°C

2. Drawbar performance

Date of tests: 1977-02-21 - 03-03
Type of track: Drum dynamometer with concrete surface
Tractor mass:
unballasted,
with driver: 3 050 kg
Tractor mass:
ballasted,
with driver: 5 270 kg
Height of drawbar
above ground: unballasted 460 mm
ballasted 445 mm

Results see table 1

Engine oil consumption during ten hours duration of test (ii) and test (iii) was 28 g/h. Test (iii) was carried out with additional ballast. Power, speed, slip, and fuel consumption do not correspond to test (i) gear 1.

3. Turning space and turning circle

Details of wheel

equipment: As in specification, without ballast
Track of wheels: Front 1 465 mm
Rear 1 520 mm

	With brakes		Without brakes	
	Left-hand m	Right-hand m	Left-hand m	Right-hand m
Radius of turning space	3.82	3.64	4.15	3.94
Radius of turning circle	3.64	3.46	3.97	3.76

4. Location of centre of gravity

Height above ground	835 mm
Distance forward from the vertical plane containing the axis at rear wheels	702 mm
Distance from the median plane	5 mm

5. Braking

Date of tests: 1977-10-12 and 1977-10-18

Type of track: Tarmacadam

Table 1. Drawbar performance

Gear	Power kW	Drawbar pull kN	Speed km/h	Engine speed r/min	Wheel slip %	Specific fuel consumption		Coolant	Temperature °C				
						g/MJ	MJ/l		Fuel	Engine oil	Transm. oil		
i) Maximum power (ballasted tractor)													
1	29.9	39.6	2.72	2 317	13.3	101	8.2	79	17	96	47		
2	34.1	34.4	3.57	2 206	12.0	97	8.6	82	17	98	56		
3	35.2	23.4	5.42	2 200	7.1	93	8.9	82	18	107	65		
4	35.5	17.1	7.48	2 200	5.4	92	9.0	82	18	107	64		
5	35.4	13.9	9.18	2 198	4.2	92	9.0	82	17	102	49		
6	33.2	9.4	12.74	2 199	3.3	100	8.3	82	18	104	48		
7	30.4	5.9	18.54	2 200	1.9	107	7.8	82	18	106	53		
ii) Five hour test at 75 % pull at maximum power													
4	28.4	12.8	8.00	2 320	4.0	100	8.3	81	17	107	68		
iii) Five hour test at a pull corresponding to 15 % wheel slip in test i)													
1	30.4	39.6	2.80	2 300	10.0	99	8.4	82	18	110	68		
iv) Maximum power (unballasted tractor)													
2	24.0	22.7	3.80	2 320	15.0	107	9.1	80	19	102	42		
3	32.4	22.7	5.13	2 307	15.0	99	8.4	82	19	101	51		
4	35.1	17.5	7.22	2 199	9.5	95	8.7	82	20	106	70		
5	35.4	14.2	8.96	2 200	8.4	92	9.0	82	20	108	73		
6	36.2	10.3	12.68	2 205	5.7	93	8.9	83	18	100	58		
7	35.7	6.9	18.60	2 209	4.1	93	8.9	83	19	108	65		
8	34.3	4.9	25.39	2 202	2.7	97	8.6	83	18	106	59		

Cold brakes

Stopping performance

Travelling speed of the tractor 25 km/h		Unballasted tractor	Ballasted tractor
Deceleration	m/s ²	4.5	4.9
Stopping distance	m	5.6	5.3
Force on pedal	N	560	765
Force on pedal to achieve a deceleration of 2.5 m/s ²	N	275	460

Parking brake

Tractor facing up 16 % slope: Force on lever 265 N
tractor does not move

Tractor facing down 16 % slope: Force on lever 265 N
tractor does not move

Hot brakes

Brake fade characteristics

Travelling speed of the tractor 25 km/h	Unballasted tractor	Ballasted tractor
Deceleration hot/cold %	92	100
Stopping dist cold/hot %	92	100
Force on pedal cold/hot %	110	100

6. Measurement of ambient noise

Date of test: 1976-11-11
Type of sound level meter: Brüel & Kjær, type 2204
Type of track: Tarmacadam
Results of tests
Travelling speed: 20.0 km/h, gear 8
Sound level: 91 dB(A)

7. Noise measurement at the driver's ear level

Date of tests: 1976-11-11
Type of sound level meter: Brüel & Kjær, type 2204
Type of track: Tarmacadam

Results of tests

Gear	Travelling speed km/h	Sound level dB(A)
4	8.0	87.5

8. Power lift and hydraulic pump performance

Date of tests: 1978-02-10

Hydraulic fluid: Same as in the transmission

Type of linkage lock

for transport: Hydraulic, opening pressure of the cylinder over pressure relief valve (manufacturer's figure) 18.2 – 20 MPa

Pump characteristics

1. Opening pressure and sustained pressure of the relief valve 16.5 and 17.1 MPa respectively
2. Pump delivery rate at minimum pressure and rated engine speed 0.59 l/s (35.3 l/min)
3. Pump delivery rate 0.47 l/s (28.3 l/min)
Delivery pressure 16.7 MPa
Power 7.8 kW

Lifting forces

At the hitch points

Lifting heights in relation to a horizontal line through the lower links pivoting points in mm.

-498	-400	-300	-250	-200	-100	0	100	150	200	250	300	333
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Maximum mechanical advantage

Lifting force kN¹

—	—	—	15.9*	16.9	18.9	20.4	21.5	—	22.2	22.1	22.4	22.6
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Minimum mechanical advantage

Lifting force kN¹

14.9*	16.3	17.4	—	18.0	18.8	19.1	18.8	19.0	—	—	—	—
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* Maximum force exerted throughout whole range indicated.

Force at which front of tractor is calculated to lift with maximum allowable front ballast is in excess of measured values.

¹ Values calculated for the pressure at maximum hydraulic power (16.7 MPa) from measurements made at maximum pressure 17.7 MPa.

At the standard frame — Maximum mechanical advantage

Lifting heights in relation to a horizontal line through the lower links pivoting points in mm.

	-478	-400	-300	-200	-100	0	100	200
	-456	-377	-276	-178	-82	0	95	176

At the frame

At the hitch points

Lifting force in kN¹

	15.7*	16.7	16.7	17.0	17.7	17.7	17.1	16.5
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At the standard frame — Minimum mechanical advantage

Lifting heights in relation to a horizontal line through the lower links pivoting points in mm.

-558	-500	-400	-300	-200	-100	0	100	200	300
-448	-396	-318	-235	-153	-76	0	77	154	224

At the frame

At the hitch points

Lifting force in kN¹

11.9*	12.3	13.3	14.0	14.7	14.9	14.8	14.3	13.9	13.2
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¹ Values calculated for the pressure at maximum hydraulic power (16.7 MPa) from measurements made at maximum pressure 17.7 MPa.

* Maximum force exerted throughout whole range indicated.

Force at which front of tractor is calculated to lift with maximum allowable front ballast is in excess of measured values.

Linkage Geometry when connected to the standard frame

	Maximum mechanical advantage	Minimum mechanical advantage
Projected length in side view		
Lower links	813 mm	813 mm
Lift arm	298 mm	298 mm
Lift rods	733 mm	733 mm
Top link	604 mm	617 mm
Distance of lift rod connection point from pivot point of lower link	500 mm	500 mm
Dimensions relative to rear axle center line 725 mm above ground		
Lower link pivot point	172 mm behind, 172 mm below	172 mm behind, 130 mm below
Top link pivot point	281 mm behind, 236 mm above	281 mm behind, 192 mm above
Lift arm pivot point	66 mm behind, 287 mm above	66 mm behind, 287 mm above
Max and min height of lower hitch points at tests	4 mm above, 628 mm below	94 mm above, 578 mm below
Max and min height of lower hitch points by adjustment of lift rods	173 mm above, 633 mm below	169 mm above, 667 mm below
Height of lower hitch points when locked in the highest transport position	898 mm above ground	894 mm above ground

Optional engine test

9. Performance at the engine crankshaft

Date of tests: 1977-05-03- -05
 Location of tests: ULTUNA, S-750 07 UPPSALA 7, Sweden
 Type of dynamometer: Eddy current, make Zöllner

Power kW	Engine speed r/m	Fuel consumption			Percent of torque obtained at maximum power
		l/h	g/MJ	MJ/l	
Maximum power — 2 hour test					
48.7	2 200	14.29	67.5	12.3	100
Part loads					
43.2	2 299	12.75	68	12.2	85
4.3	2 374	4.77	—	—	8
22.1	2 343	8.12	85	9.8	42.5
49.1	2 201	14.31	67	12.4	100
11.1	2 363	6.01	125	6.6	21
33.0	2 323	10.27	72	11.5	64

No load maximum engine speed 2 380 r/min. Crankshaft torque at maximum power 212 Nm.
 Maximum crankshaft torque 244 Nm at 1 300 r/min engine speed.

Mean atmospheric conditions

Temperature 17°C
 Pressure 102.8 kPa (771 mm Hg)
 Relative humidity 50 %

Maximum temperatures

Coolant 82°C
 Engine oil 109°C
 Fuel 22°C

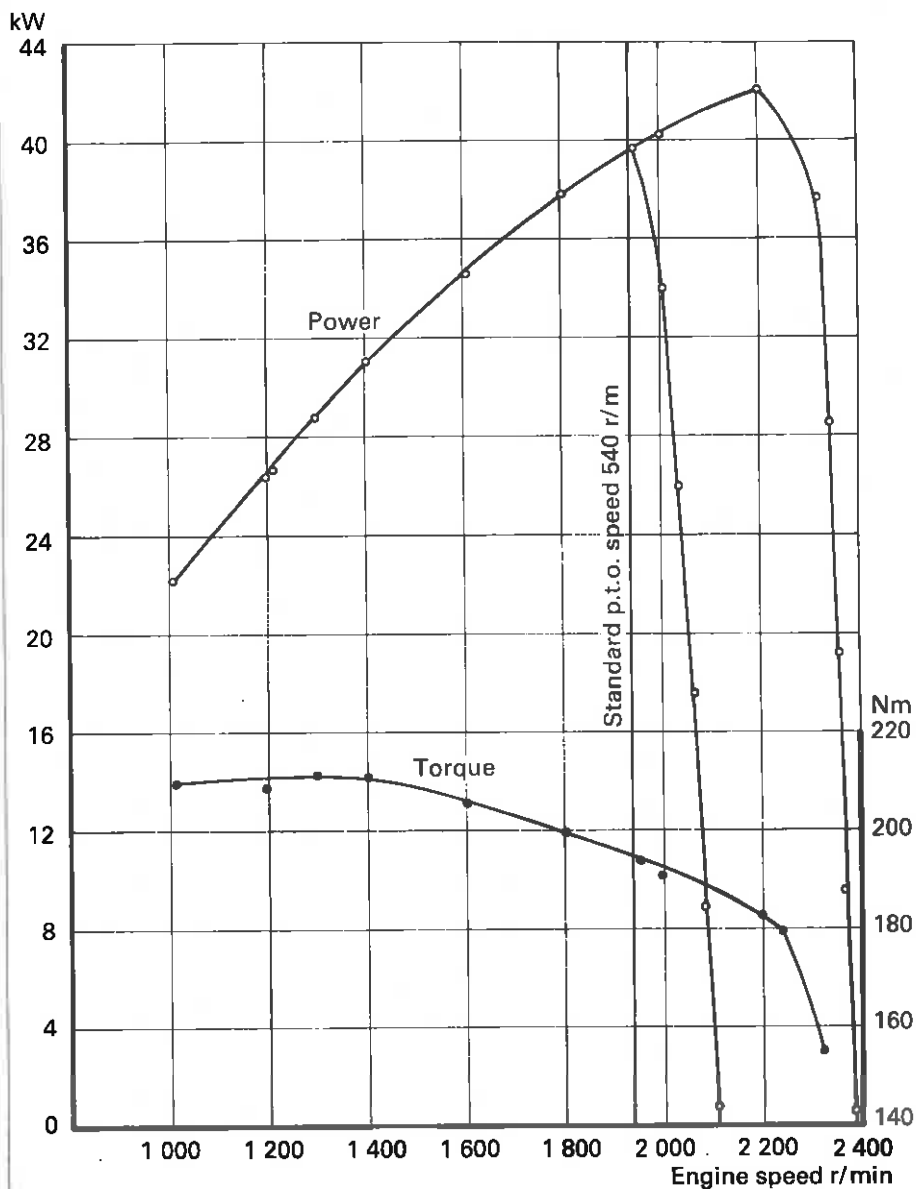
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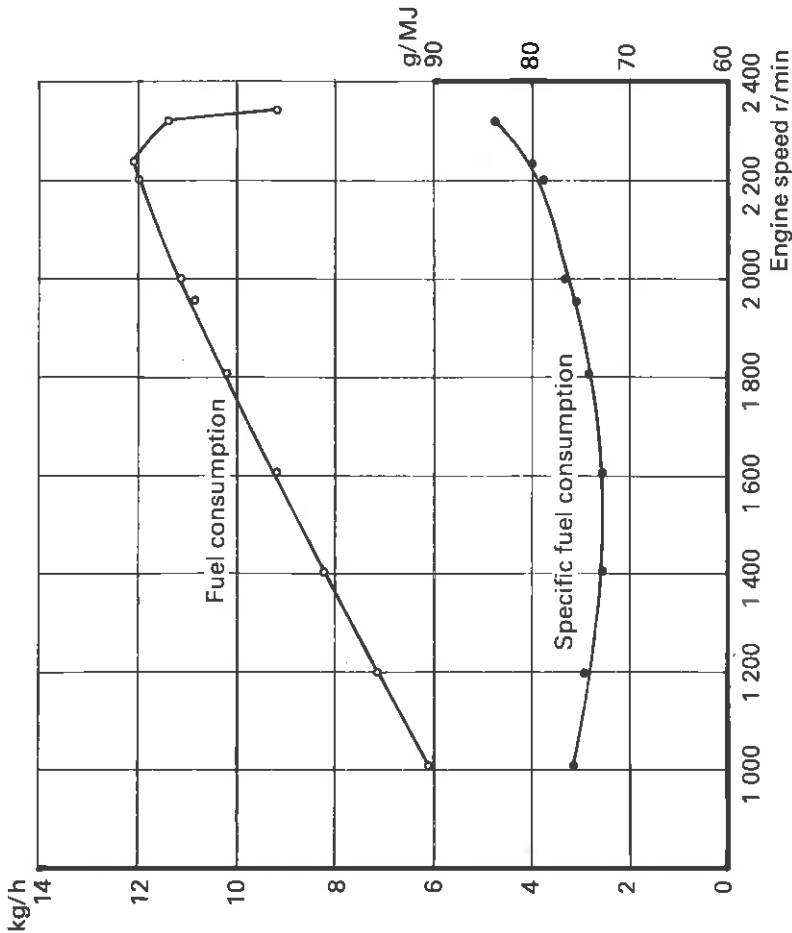
Atmospheric conditions

	Temperature °C	Relative humidity %	Pressure kPa (mm Hg)
Maximum power (ballasted tractor)	16 – 18	35 – 40	101.2 (759)
Five hour test at 75 % pull at max power	18	35 – 40	101.9 (764)
Five hour test at max pull	16 – 18	35 – 40	101.9 (764)
Maximum power (unballasted tractor)	15 – 18	35 – 40	99.9 (749)

Power take-off test VOLVO BM T 500

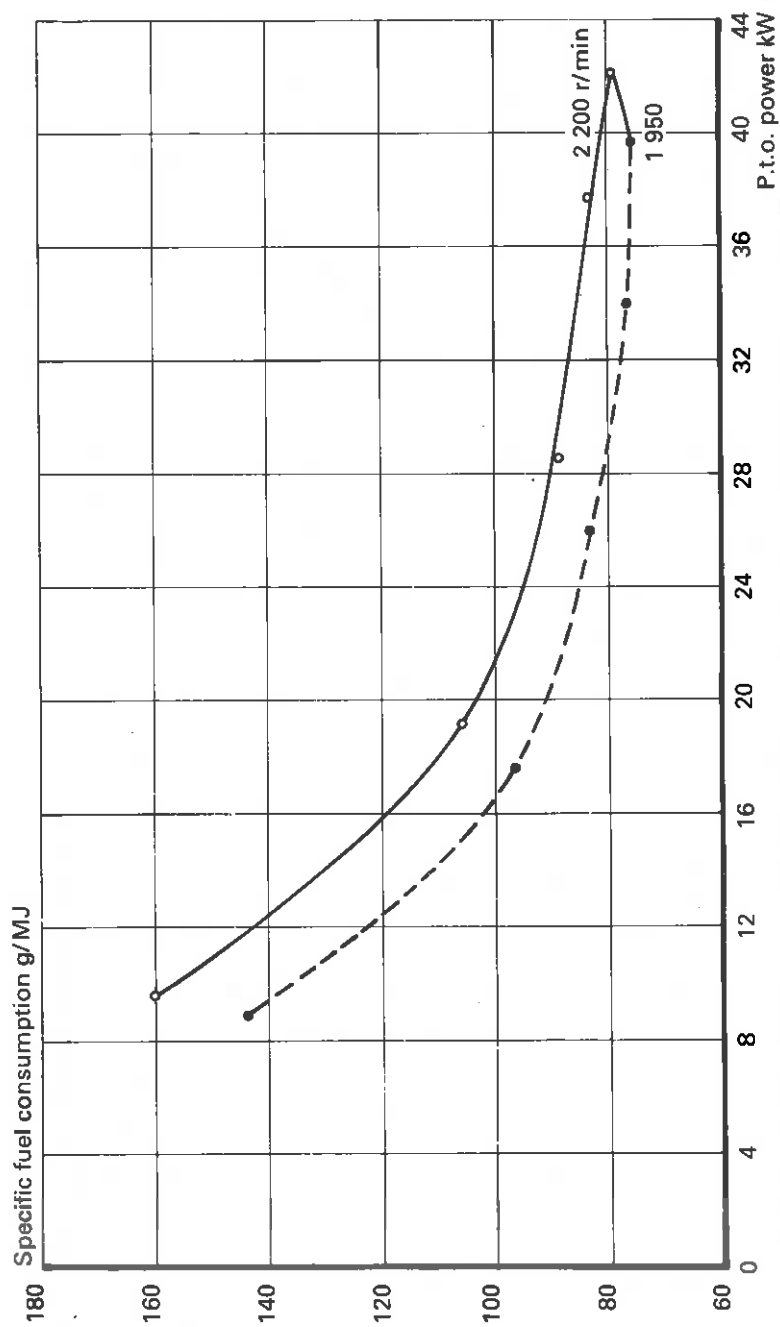
Figure 1





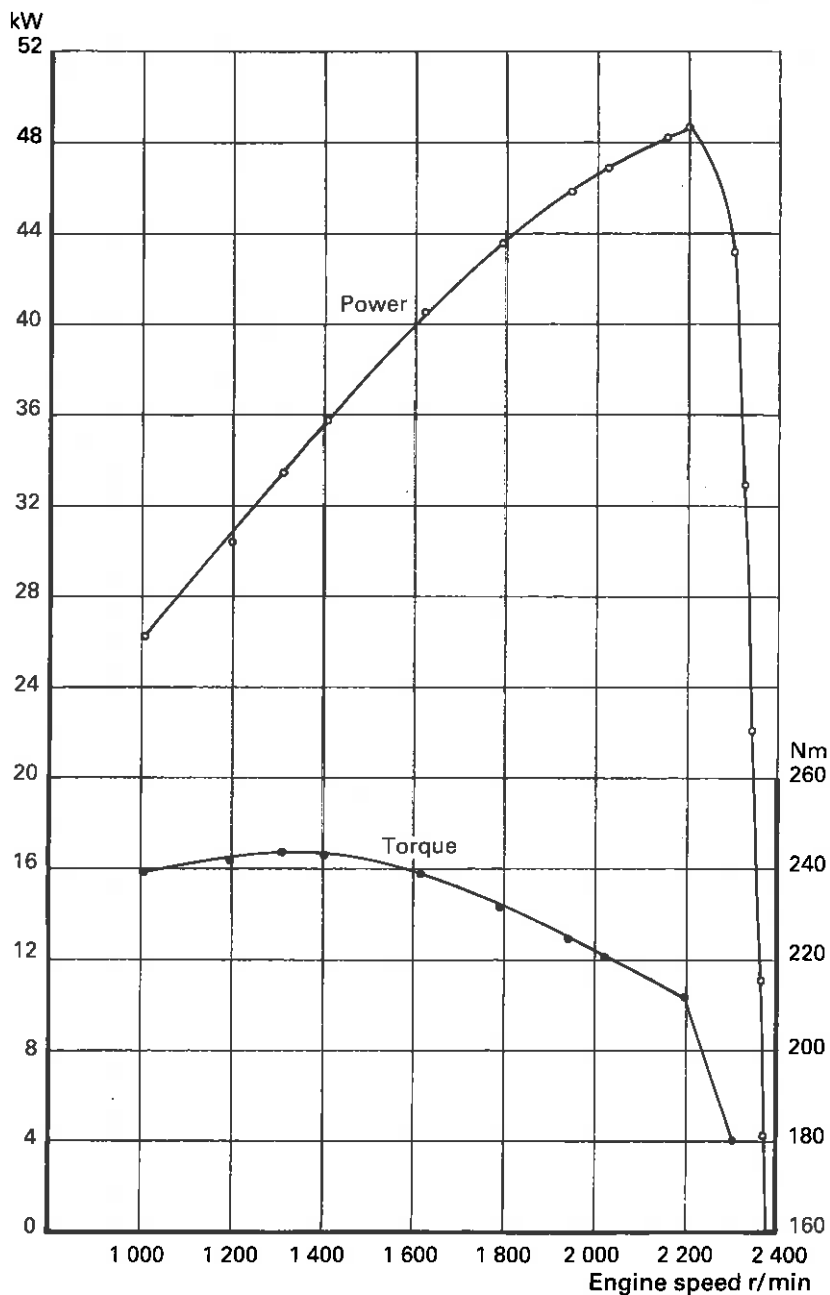
**Power take-off test
VOLVO BM T 500**

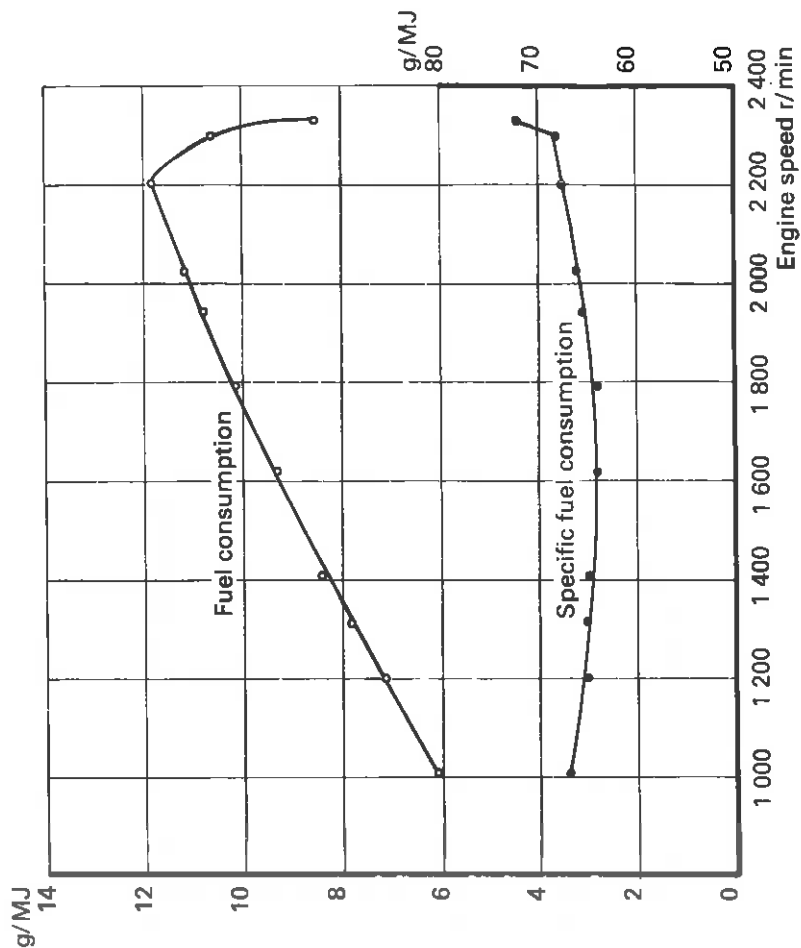
Figure 3



Engine test VOLVO BM T 500

Figure 4





Engine test
VOLVO BM T 500

Figure 6

