NATIONAL SWEDISH TESTING INSTITUTE
FOR AGRICULTURAL MACHINERY

Head office: Ultuna, UPPSALA 7, Sweden

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TEST BULLETIN: OECD No. 087

Date of Approval: 10th August, 1965

TEST IN ACCORDANCE WITH OECD TEST CODE FOR AGRICULTURAL TRACTORS

BM-Volvo 400 Buster diesel tractor

Manufactured by:

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

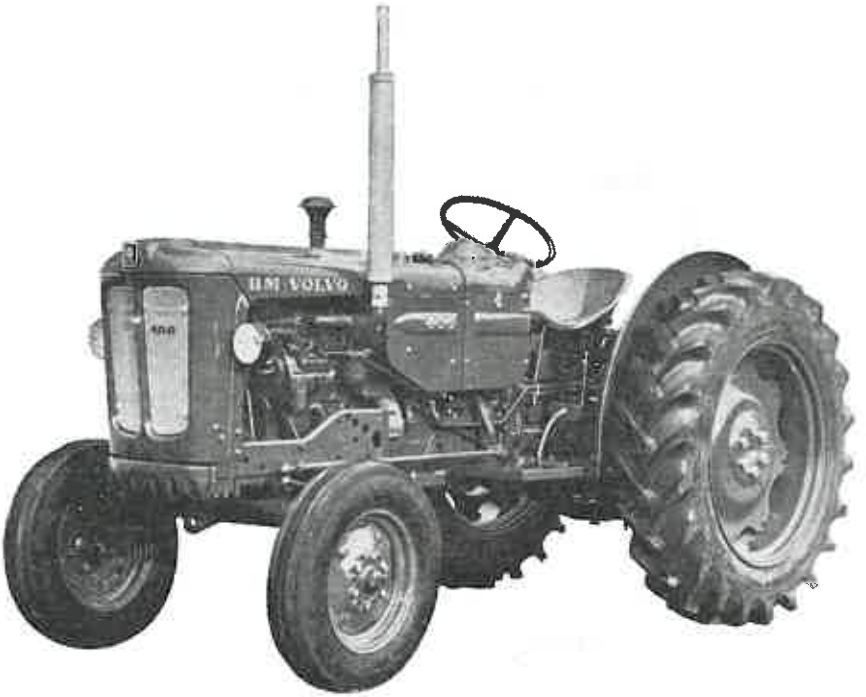
Test requested by:

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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.



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POWER TAKE-OFF TEST

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Part 1

Specification of tractor

Tractor:

Make:	BM-Volvo
Model:	400 Buster
Type:	Wheeled (two-wheel drive)
No.:	Serial No. 3940

Engine:

Make:	Perkins Engines Ltd., Model D 913, direct injection 4-stroke diesel, Serial No. 2203376
Cylinders:	3 cylinders, vertical, in-line, 91.44 mm bore × 127 mm stroke, compression ratio 18.5:1, replaceable dry cylinder liners, overhead valves

Rated speeds: For p.t.o. work 1500 and 1800 r/m
For drawbar work 2250 r/m

Fuel system: Fuel — diesel oil
CAV distributor type DPA 3230070 injection pump;
CAV BDLL 150 S 6372 injection nozzles,
CAV BKBL 67 SD 5151 nozzle holders,
injection timing 24° before T.D.C.,
injector opening pressure 170—185 kp/cm², CAV diaphragm type fuel feed pump, CAV paper element dual filter FS 5836010 on delivery side of feed pump; capacity of fuel tank 45 litres

Governor: CAV mechanical governor; governed range of engine speed 500 r/m to 2250 r/m

Air cleaner: AC-Delco oil bath type, oil capacity 0.7 litre;
optional pre-cleaner Mann & Hummel type LB 4—00

Oiling system: Forced feed from gear type pump;
recommended oil "For service DM-DS"
SAE20-20 W, below 0°C SAE10-10 W;
AC-7961375 oil filter with AC-20 paper element full flow; recommended oil change period 125 hours; oil capacity 6 litres

Cooling system: Pressurised (0.23—0.30 kp/cm²) water cooled,
impeller assisted with 4-blade belt driven fan,
thermostat and radiator curtain for temperature control;
cooling water capacity 8 litres

Transmission:

Clutch: Laycock dual dry clutch, one 11 in. (280 mm) dia plate for gearbox drive and one 9 in. (229 mm) dia plate for p.t.o. drive; foot-pedal operated

Gearbox: Own make with 8 forward speeds and 2 reverse; a sliding gear and constant mesh type 4-speed gearbox with reverse gear and a dual range reduction gear

Gear No.	Number of engine revolutions for one revolution of driving wheel	Theoretical travelling speed for 2250 r/m rated speed of engine, km/h
1 (low 1)	237	2.2
2 (low 2)	156	3.4
3 (low 3)	104	5.1
4 (low 4)	79	6.7
5 (high 1)	57	9.4
6 (high 2)	37	14.3
7 (high 3)	25	21.4
8 (high 4)	19	28.0
Low reverse	202	2.6
High reverse	48	11.0

Differential:	Crown wheel and pinion and differential with spur gear final drives; foot-pedal operated differential lock; total transmission oil capacity 42 litres
Steering device:	ZF model GD28a spec., worm and roller type with single drag link
Brakes:	Hand brake—none fitted Foot brakes—Girling Ausco disc type on differential half-shafts, mechanical; independent or combined foot-pedal operated; ratchet on pedals for parking

Wheels:

Steering wheels:	Two at front; tyres 6.00—16, 4-ply pneumatic; track 1220 and 1390 mm changed by reversing wheels; maximum permissible weight on each tyre 450 kg at 2.25 kp/cm²
Driving wheels:	Two at rear; tyres 12.4/11—32, 6-ply pneumatic; track 1360, 1420, 1490, 1540, 1635 and 1770 mm changed by reversing wheel centres and offset lugs on rims; maximum permissible weight on each tyre 1300 kg at 1.6 kp/cm²
Wheelbase:	2100 mm

Belt pulley:	Not fitted for test
Location:	At rear, p.t.o. driven
Diameter × width:	225 mm × 160 mm
Speeds:	1416 r/m or 1642 r/m and 16.7 or 19.3 m/s at 2250 r/m rated engine speed 1358 r/m and 16 m/s at 2160 r/m or 1860 r/m engine speed
Direction of rotation:	Optional depending on position of unit

Power take-off:

Main:	6-spline, 34.9 mm ($1\,^3/_8$ in.) diameter, in centre-line at rear of tractor; proportional engine speed (two speeds available via hand lever operated gear) or proportional ground speed
Height above ground:	588 mm
Speeds:	Proportional engine speed — 686 r/m or 800 r/m at 2250 r/m rated engine speed, 540 r/m at 1770 or 1519 r/m engine speed; proportional ground speed — one revolution for approximately 125 mm of travel
Direction of rotation:	Clockwise viewed from tractor rear; proportional ground speed — clockwise in forward gears

Power lift: Own make, hydraulic with gear type pump gear driven from the engine crankshaft, pump drive declutchable from driver's seat; single acting ram; tapping for external cylinder; category 1 or 2 implement linkage (reversible lower links) with combined draught and position controls; oil capacity 12—23 litres; maximum working pressure 130—135 kp/cm²; oil delivery 29.4 l/min at maximum working pressure and 2250 r/m rated engine speed; maximum load liftable through complete range of movement at end of lower links
1250 kg with lift rods in foremost position
1300 kg with lift rods in rearmost position

Drawbar: Swinging drawbar; lateral adjustment 610 mm; vertical adjustment from 165 mm to 441 mm by stretching screws; distance from rear axle 758 mm to rear

Hitch: None fitted

Electrical equipment:

Voltage: 12

Generator: Bosch type LJ/GG 130/12/2000 AR 19

Batteries: Two 6 V Tudor type 3E-Ex 10-1 lead-acid in series; capacity 160 Ah

Starting device: Bosch type BNG 4/12 CR 242 starter motor; CAV Thermostart Mark III cold starting aid

Overall dimensions:

Overall length: 3.14 m

Overall width: 1.68 m at 1360 mm track, no ballast weights
2.09 m at 1770 mm track, no ballast weights
2.01 m at 1360 mm track, to outside of wheel weights, 8 outside per wheel

Overall height: 2.12 m to top of exhaust pipe

Minimum ground clearance: 0.44 m (to final drive housing, without drawbar)

Weights:

	Without additional weight, kg	With maximum additional weight, kg
On front wheels	675	833
On rear wheels.	1230	2600
Total.....	1905	3433

Part 2

Laboratory tests

I. Main power take-off test: Compulsory tests

Date and location of tests: 9th and 12th April, 1965, Ultuna, Uppsala 7

Type of dynamometer: Schenck hydraulic brake

Position of governor control: Fully open and relating to standard p.t.o. speed

Fuel: Shell Diesoline, density 0.828 at 20° C, Cetane No. 48

Engine oil: SAE20

Transmission oil: SAE90

Horse-power	Speed		Torque	Fuel consumption			Temperature			Atmospheric conditions	
	engine	p.t.o.					cool-ant	oil	fuel	air temp.	atmos. press.
hp/ metric	r/m	r/m	kpm	kg/h	g/hph	hph/l	°C	°C	°C	°C	mm Hg
A. Maximum power											
43.0	2264	691	13.6	8.14	189	4.38	79	91.5	19	17.5	771.4
B. Power at standard p.t.o. speed											
38.2	1770	540	15.5	6.79	178	4.65	78	94	16.5	17.5	770.5
34.0	1519	540	16.0	5.92	174	4.76	79	89.5	19	18	770.5
C. Power at maximum torque											
31.5	1400	427	16.1	5.45	173	4.79	79	89.5	17.5	18	770.5
D. Power at rated engine speed, 2 h											
42.7	2251	687	13.6	7.97	187	4.43	76	98	19	18.5	771.4
No load, maximum engine speed: 2404 r/m											

Part 3

Drawbar tests on drum dynamometer

Date of tests: 14th—23rd April, 1965

Type of surface: Concrete

Position of governor control lever: Fully open

Type of tyre: Rear, 12.4/11—32, 6-ply pneumatic
Front, 6.00—16, 4-ply pneumatic

Fuel: Shell Diesoline, density 0.828 at 20° C, Cetane No. 48

Engine oil: SAE20
Transmission oil: SAE90

A. Tests with maximum additional weight

Weight of tractor, without driver:

Weight without ballast: Front 675 kg, rear 1230 kg
Ballast front: Weights, 2 per wheel, 120 kg
Safety cab 38 kg
Ballast rear: Weights, 9 per wheel, 990 kg
Water 250 kg
Safety cab 130 kg
Weight with full ballast: Front 833 kg, rear 2600 kg
Total 3433 kg
Tyre pressure: Front 2.25 kp/cm²
Rear 1.6 kp/cm²
Height of drawbar above ground: 441 mm

1. Maximum powers and pulls

Gear No.	Maximum powers								Maximum pulls	
	Horse-power hp/ metric	Corre-sp. pull kp	Wheel-slip %	Engine speed r/m	Speed of travel km/h	Water temp. °C	Air temp. °C	Atm. press. mm Hg	Pull kp	Reason for stall
1	22.7	2910	11.3	2351	2.11	79	19	759.8	2963	Wheelspin
2	33.1	2983	14.0	2295	3.00	75	19.5	759.8	2983	Wheelspin
3	37.9	2119	7.7	2285	4.83	75.5	19	764.4	2498	Engine stall
4	37.9	1601	5.6	2256	6.40	76	18	761.7	1901	Engine stall
5	38.6	1143	3.8	2264	9.12	76	18	761.7	1363	Engine stall
6	37.8	728	2.5	2260	13.94	77.5	18	764.4	878	Engine stall
7	36.1	461	1.6	2255	21.16	75.5	17	761.7	561	Engine stall
8	34.9	338	1.1	2256	27.88	76	17.5	761.7	421	Engine stall

2. Fuel consumption

Gear No.	Optimum fuel consumption			Range of pull over which specific fuel consumption does not exceed the optimum consumption by more than 10 % kp
	g/hph	hph/l	Corre-sponding pull kp	
1	249	3.33	2700	1960—2965
2	221	3.75	2550	1720—2985
3	201	4.12	2440	1440—2500
4	193	4.29	1890	1350—1900
5	186	4.45	1355	1160—1365
6	188	4.40	880	750— 880
7	195	4.25	550	470— 560
8	195	4.25	420	370— 420

B. Tests without ballast

Weight of tractor, without driver:

Weight without ballast: Front 675 kg
Rear 1230 kg
Total 1905 kg

Tyre pressure: Front 2.25 kp/cm²
Rear 1.1 kp/cm²

Height of drawbar above ground: 441 mm

1. Maximum powers and pulls

Gear No.	Maximum powers								Maximum pulls	
	Horse-power hp/ metric	Corre-sp. pull kp	Wheel-slip %	Engine speed r/m	Speed of travel km/h	Water temp. °C	Air temp. °C	Atm. press. mm Hg	Pull kp	Reason for stall
3	25.7	1518	14.7	2351	4.57	74	18	765.0	1518	Wheelspin
4	34.1	1533	13.7	2316	6.00	69	17	763.8	1533	Wheelspin
5	38.9	1182	7.1	2279	8.88	76	18	763.8	1445	Engine stall
6	38.6	761	4.4	2246	13.69	76	19.5	763.8	909	Engine stall
7	38.5	498	3.0	2251	20.90	76.5	19	763.8	598	Engine stall
8	38.1	372	2.3	2261	27.66	77	19	765.0	457	Engine stall

2. Fuel consumption

Gear No.	Optimum fuel consumption			Range of pull over which specific fuel consumption does not exceed the optimum consumption by more than 10 % kp
	g/hph	hph/l	Corresponding pull kp	
3	233	3.55	1360	975—1520
4	220	3.76	1250	840—1535
5	195	4.25	1335	800—1445
6	191	4.34	905	610— 910
7	188	4.40	560	490— 600
8	188	4.40	445	380— 460

Part 4

I. Location of centre of gravity:

Tractor equipped as in	Test 3 A ballasted	Test 3 B unballasted
Distance forward from the vertical plane containing the axis of the rear wheels	499 mm	716 mm
Distance from the median plane parallel to the longitudinal axis of the tractor bisecting the track	0	0

II. Turning space and turning radius:

Wheel equipment: Front 6.00—16
Rear 12.4/11—32

Wheel track: Front 1220 mm
Rear 1360 mm

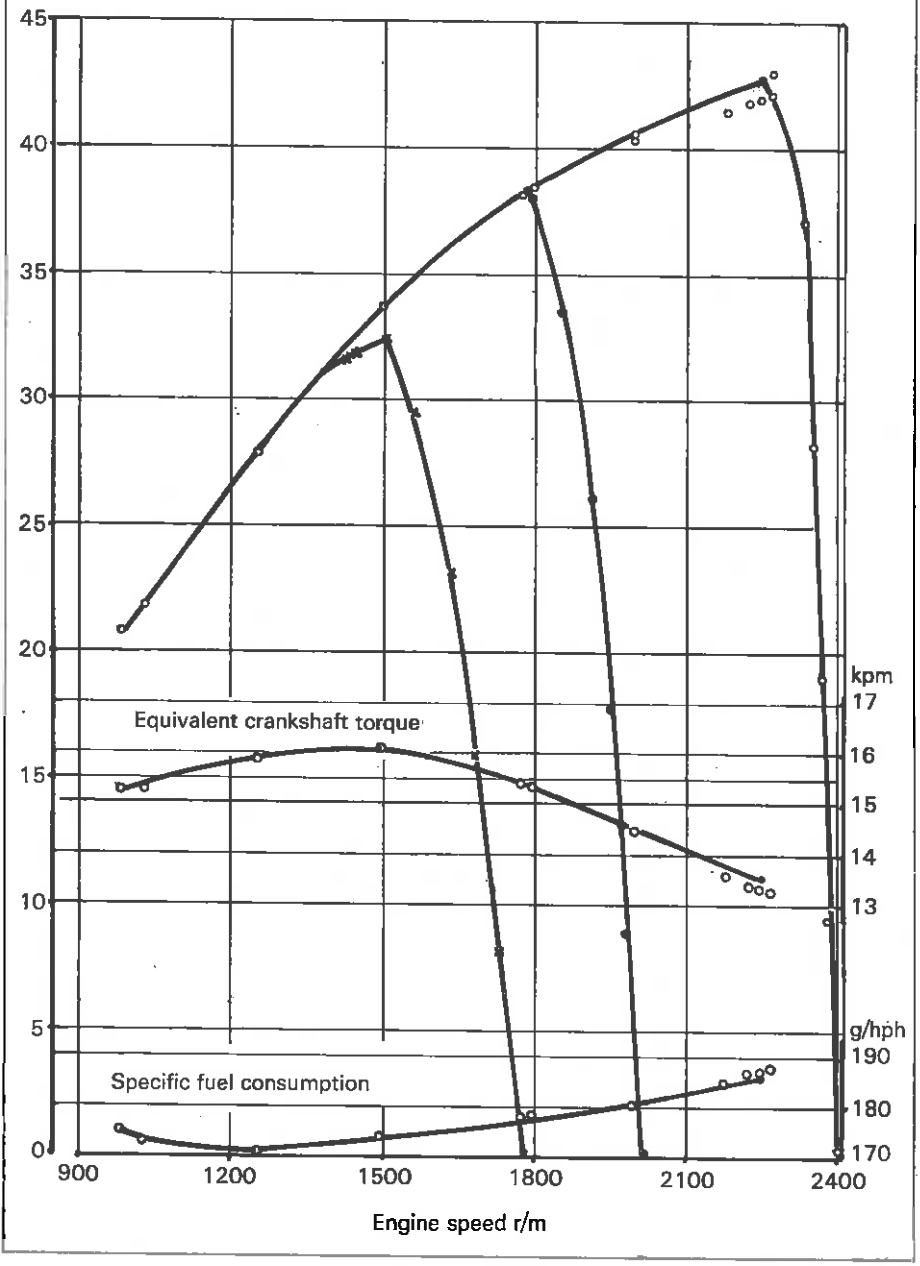
	With brakes		Without brakes	
	Right-hand	Left-hand	Right-hand	Left-hand
Radius of turning space.....	3.0 m	3.1 m	3.6 m	3.7 m
Turning radius.....	2.9 m	3.0 m	3.5 m	3.6 m

Part 5

Repairs and adjustments during tests: None
Remarks: None

Ultuna, Uppsala 7, 15th July, 1965
National Swedish Testing Institute for Agricultural Machinery

National Swedish Testing Institute for Agricultural Machinery	**Power take-off test** **BM-Volvo 400**	Figure 1 9 and 12.4.65

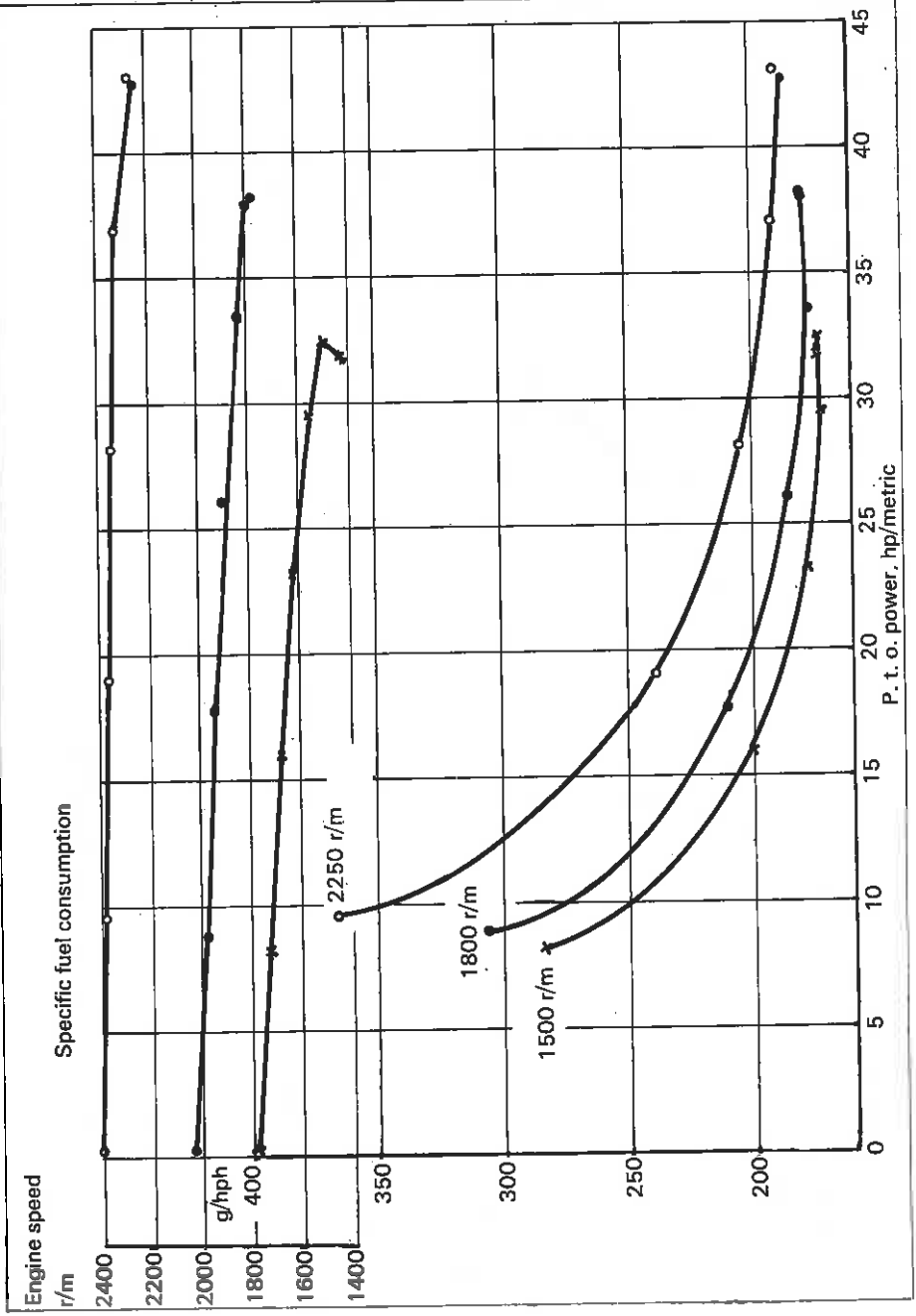


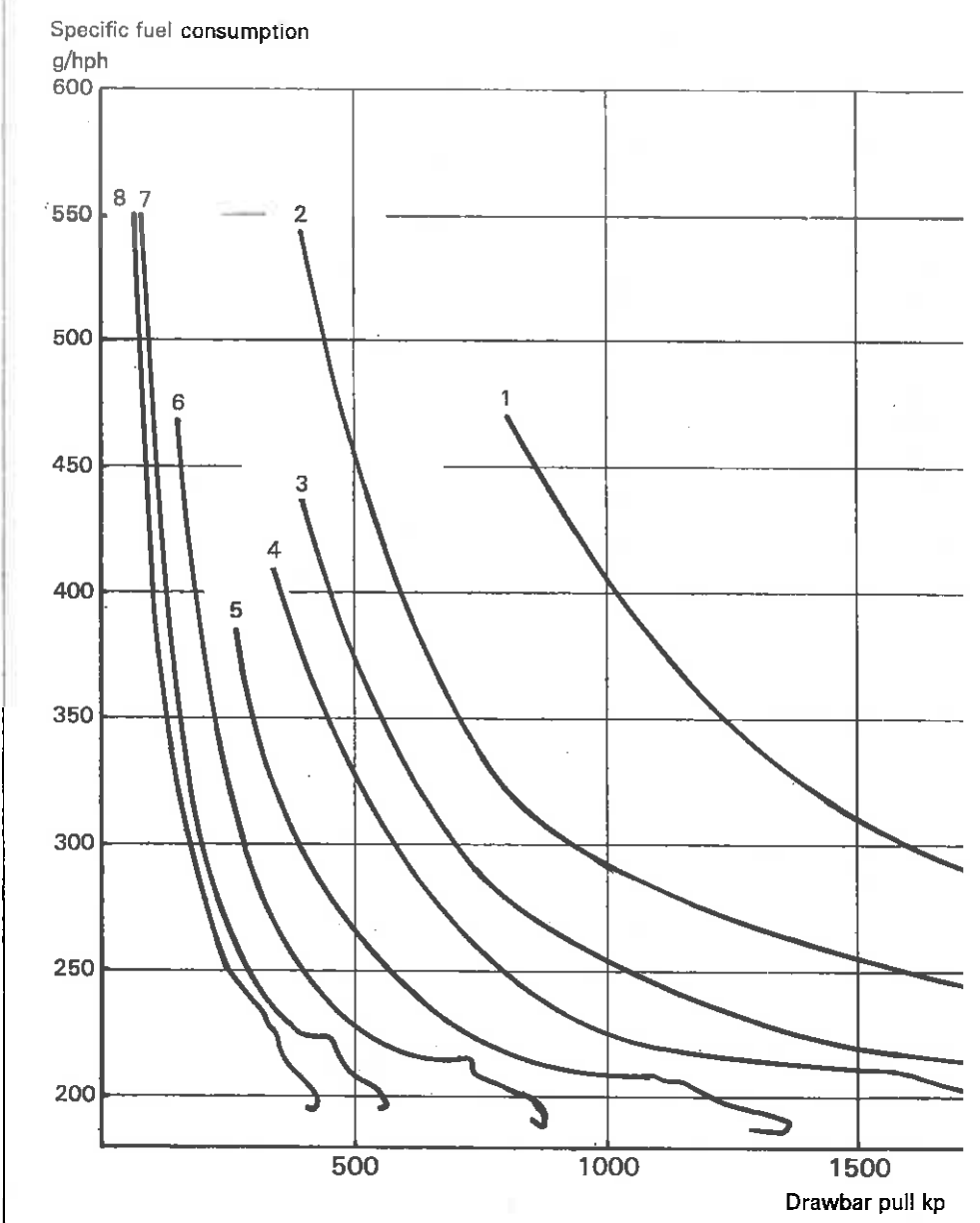
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Power take-off test
BM-Volvo 400

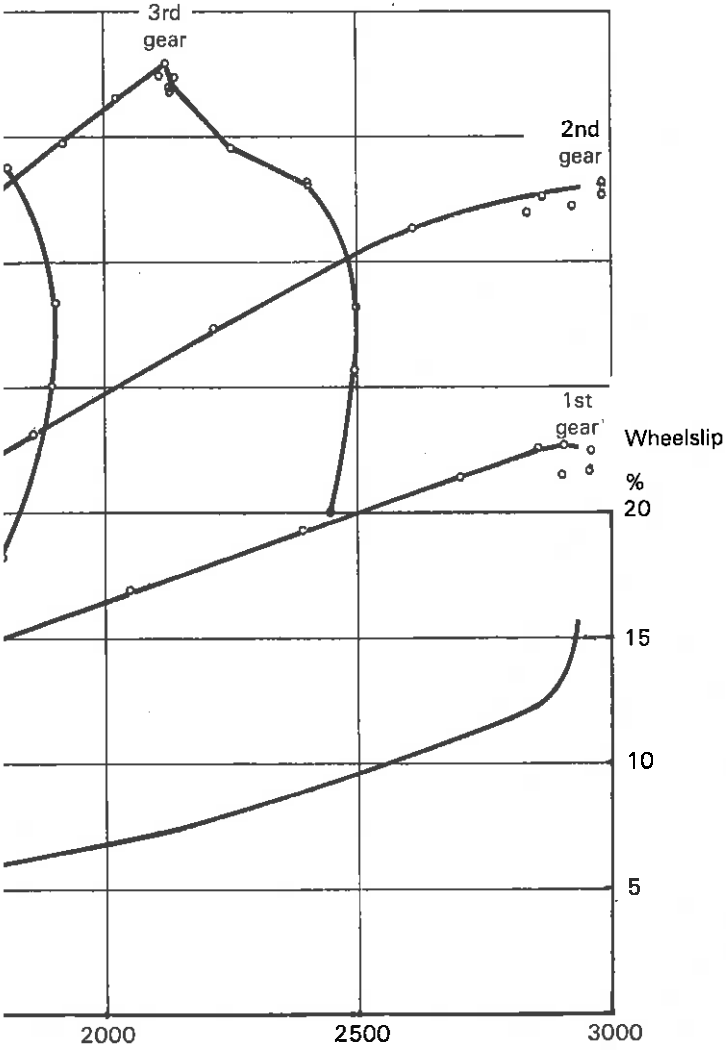
Figure 2

9 and 12.4.65

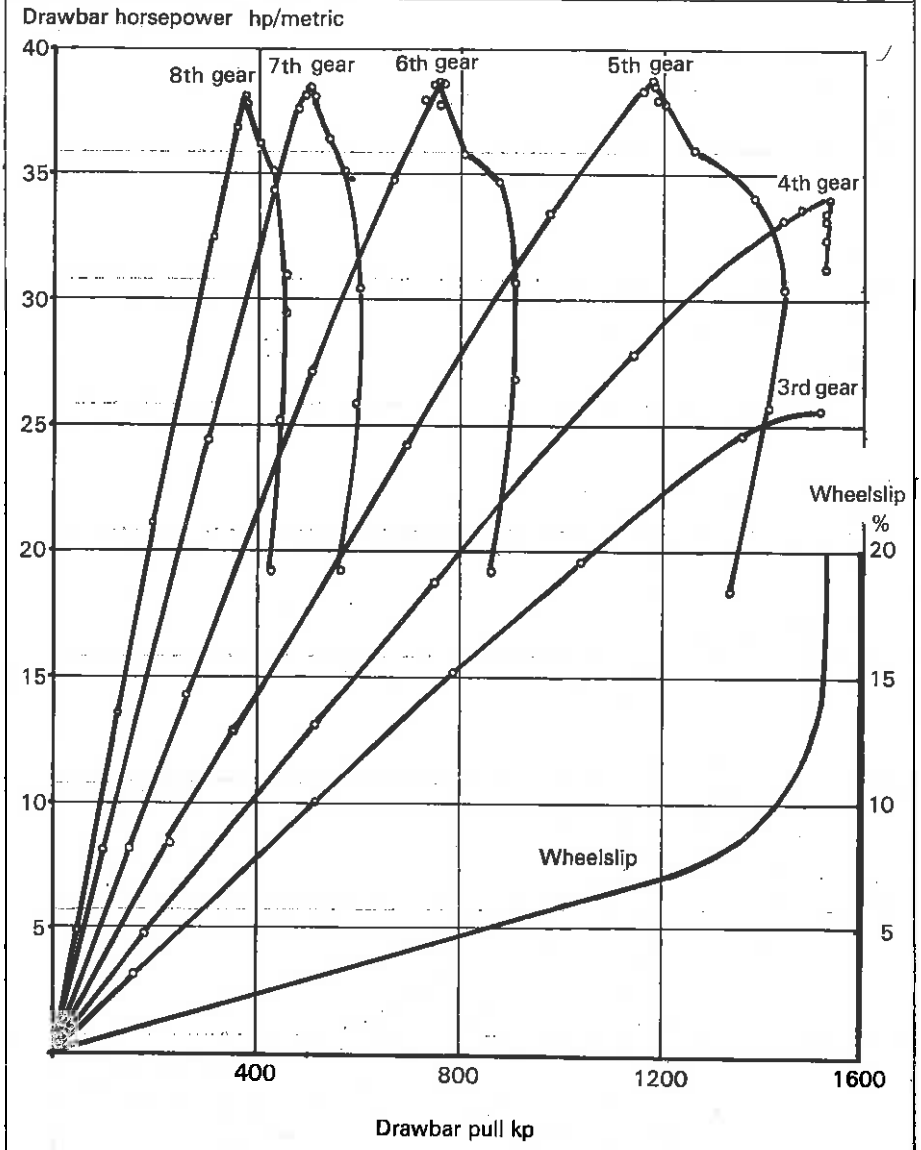



Specific fuel consumption
g/hph
600
550
500
450
400
350
300
250
200
8
7
2
6
1
3
4
5
500
1000
1500
Drawbar pull kp

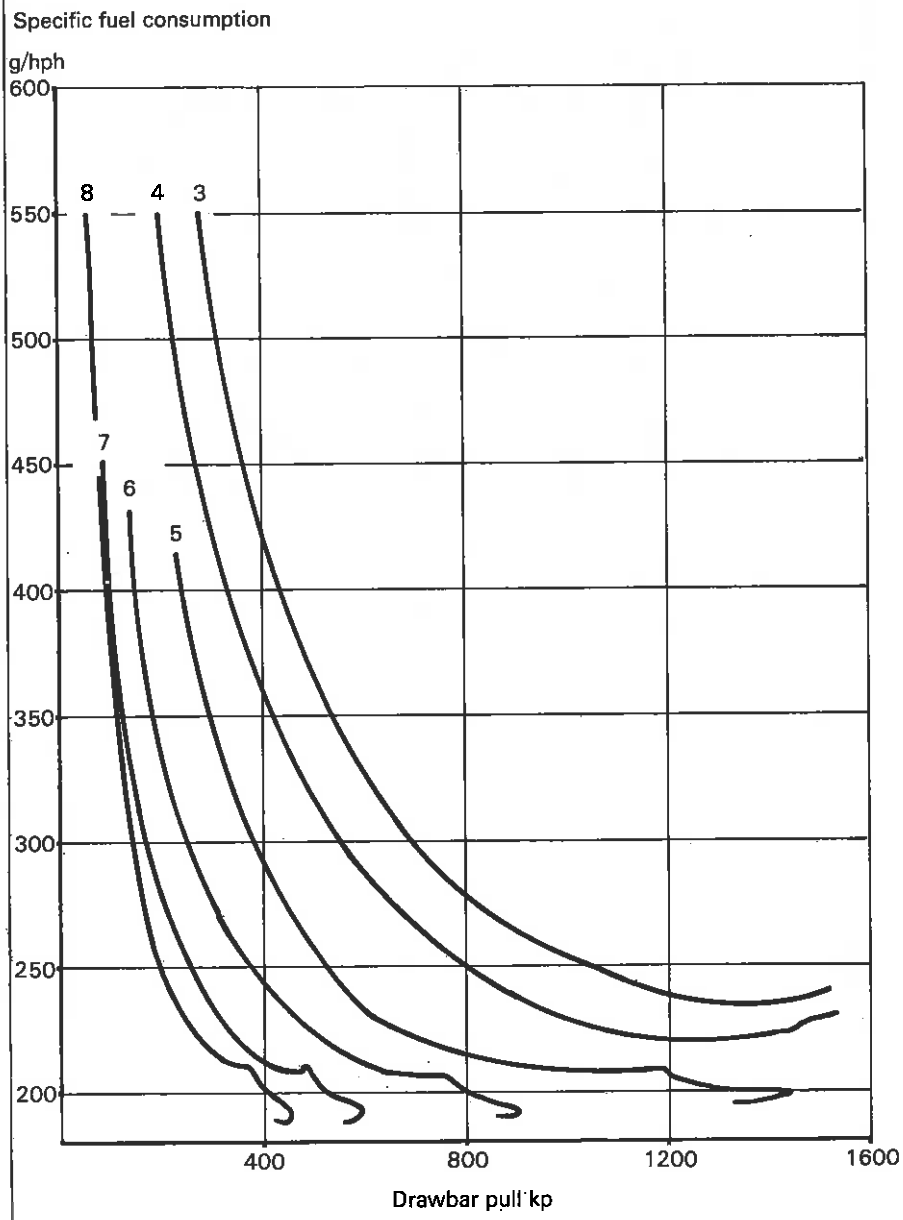
National Swedish Testing Institute for Agricultural Machinery	Drawbar test on drum dynamometer BM-Volvo 400 with ballast, 3433 kg	Figure 3
		22/23.4.65



National Swedish Testing Institute for Agricultural Machinery	Drawbar test on drum dynamometer BM-Volvo 400 without ballast, 1905 kg	Figure 5 14/15.4.65



National Swedish Testing Institute for Agricultural Machinery	Drawbar test on drum dynamometer BM-Volvo 400 without ballast, 1905 kg	Figure 6 14/15.4.65



Printed in Sweden
ESSELTE AB, SYHLM 65 512861
Endast för utlandet