



# FOR AGRICULTURAL MACHINERY

Head office: Ultuna, UPPSALA 7, Sweden

Testing Stations for Agricultural, Forestry and Garden Machines:

(South Sweden)

(Middle Sweden)

(North Sweden)

ALNARP

Ultuna, UPPSALA 7

Röbäcksdalen, TEG

Testing Station for Dairy Machines: ALNARP

## TEST BULLETIN : OEEC No. 002

Date of Approval: 6th July 1960

**TEST IN ACCORDANCE WITH OEEC TEST CODE FOR  
AGRICULTURAL TRACTORS**

### **Tractor Bolinder-Munktell/Volvo BM/T 350**

Test requested by:

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

Manufactured by:

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

Date of test: April 1960



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



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## Section I

### Specification of tractor

#### Tractor:

Make: AB Bolinder-Munktell of the Volvo-group  
Model: BOLINDER-MUNKTELL/VOLVO BM/T 350  
Type: Diesel  
No: 2826

#### Engine:

Make: Own make; Model 1113, direct injection diesel engine, No. 14000-3136.

Rated output: 46 hp<sub>metric</sub> at 1500 r/m, 52 hp<sub>metric</sub> at 1800 r/m.

Cylinders: 3 cylinders, vertical, in-line, 111,12 mm bore × 130 mm stroke, compression ratio 16,5:1; replaceable wet cylinder liners, overhead valves.

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

Minimum speed: (For full load work) Not specified.

Fuel system: Fuel: Diesel oil.  
Injection pump: Bosch PE 3 B 80 E 310 RS 1337/11.  
Injection nozzles: Bosch DLLA 150 S 720.  
Injection timing 30° before T.D.C.; injection pressure 135—140 kp/cm<sup>2</sup>.  
Capacity of fuel tank: 65 litres.

Governor: Bosch RQV 200-900 B 333/1, centrifugal type.  
Governed range of engine speed 400 to 1800 r/m.

Air cleaner: Mann und Hummel, oil bath, oil capacity 0,9 litre.

Oiling system: Forced feed from gear type pump. Recommended oil SAE 20-20 W heavy duty oil, below 0°C 10-10 W. Filter Fram, full flow. Recommended oil change period, 125 hours. Oil capacity 10,5 litres.

Cooling system: Pressurised, (0,38—0,45 kp/cm<sup>2</sup>) impeller assisted with 4-blade belt driven fan, thermostat and radiator shutter for temperature control. Cooling water capacity 14 litres.

#### Transmission:

Clutch: Borg and Beck 13 in. diameter, single plate, dry, foot-pedal operated.

Gearbox: Own make, sliding gear type and constant mesh, 10 forward speeds and 2 reverse.

Differential: Crown wheel and pinion, differential and spur gear final drive. Differential lock fitted. Total transmission oil capacity 53 litres.

Gear No	Number of engine revolutions for one revolution of driving wheel	Theoretical travelling speed for rated speed of engine km/h	
		1500 r/m	1800 r/m
I	187,29	1,99	2,38
II	124,35	3,00	3,60
III	100,95	3,70	4,44
IV	73,97	5,05	6,06
V	67,03	5,57	6,69
VI	49,11	7,60	9,12
VII	44,83	8,33	10,0
VIII	29,77	12,5	15,1
IX	25,82	14,5	17,3
X	17,15	21,8	26,1
Reverse I	104,88	3,56	4,27
Reverse II	69,64	5,36	6,44

**Steering device:** Worm and roller type (Gemmer) with single drop arm and fixed length drag link.

**Brakes:** Hand brakes—none fitted.

**Foot brakes—shoe and drum type on differential half shafts, enclosed in capsules; independent or combined foot-pedal operated, latch on foot-pedals for parking.**

#### **Wheels:**

**Steering wheels:** Two at front. Tyres, 7.50—18, 4-ply rating pneumatic, track 1330 mm and 1430 mm, changed by off-set wheel centres.

**Driving wheels:** Two at rear. Tyres 14—30, 6-ply rating pneumatic, track 1440 mm by 100 mm steps to 1940 mm, changed by reversing wheel centres and off-set lugs on rims.

Maximum possible weight on each tyre 1780 kg.

#### **Belt pulley:**

**Location:** Rearmounted and p.t.o. driven.

**Diameter/width:** 300 mm/170 mm

**Speed:** 1013 r/m (at 1500 r/m engine speed)

**Belt linear speed:** 15,9 m/s

**Direction of rotation:** Optional

#### **Power take off:**

**Main:** 6-spline, 34,9 mm (1 3/8 in.) diameter, at rear of tractor.

**Height above ground:** 640 mm

Speed: 540 r/m (at 1500 r/m engine speed)  
Direction of rotation: Clockwise viewed from tractor rear.  
Independent hand-lever operated multi-disc clutch.

**Power lift:** Own make, single acting. Independent pump drive, working pressure 115—120 kp/cm<sup>2</sup>. Oilflow 38 l/min at 120 kp/cm<sup>2</sup> and 1800 r/m engine speed. Oil capacity 18 litres, force at end of lower links 1200 or 1300 kp depending on position of lift links. Diameter of hitch pin hole 28,4 mm (1,135 in.)

**Drawbar:** Swinging drawbar. Heights above ground minimum 200 mm, maximum 425 mm. Lateral adjustment, total 680 mm. Vertical adjustment by stretching screws and horizontal adjustment on drawbar frame.

Distance from rear axle: 820 mm to rear

**Hitch:**

Height above ground: 321 mm  
Distance from rear axle: 475 mm to rear

**Electrical equipment:**

Voltage: 12  
Generator: Bosch LJ/GJM 130/12/1500 R 28  
Battery: 152 amp-hour  
Starting device: Bosch BNG 4/12 C RS 215, 4 hp solenoid engaged starter motor.

**Overall dimensions:**

Overall length: 3,45 m  
Overall width: 1,74 m (to end of rear axle)  
Overall height: 2,38 m (to top of exhaust pipe)  
Minimum ground clearance: 0,47 m (to front axle, without drawbar)

**Weights:**

	Without additional weight, kg	With maximum additional weight, kg
On front wheels	933	1 220
On rear wheels.	1 932	3 560
Total.....	2 865	4 780



## Section 2

### Laboratory tests

#### I Compulsory tests:

Belt test

Date and location of tests: April 19—20, 1960, Ultuna, Uppsala 7

Type of dynamometer: Electrical swinging frame

Position of governor control: Index for belt work

Fuel: Diesel oil, density 0,823 at 20°C, Cetane No. 54

Oil: Heavy Duty, SAE 20

#### 1. Sustained power tests

Duration of test h	Power hp <sub>metric</sub>	Engine speed r/m	Torque kpm	Spec. fuel consumption g/hph	Fuel temp. °C	Oil temp. °C	Coolant temp. °C	Air temp. °C	Atmos. press. mmHg	Remarks
2	45,1	1 496	21,6	186	31	89	77	18	771	Max. power Speed less than at max. torque
1	30,3	990	21,9	188	33	86	79	22	771	

#### 2. Varying speed tests

Power hp <sub>metric</sub>	Engine speed r/m	Fuel consumption			Temperature			Atmospheric conditions		Remarks
		kg/h	hph/kg	g/hph	fuel °C	oil °C	coolant °C	temp. °C	press. mm Hg	
45,4	1 500	8,49	5,35	187	30	80	74	23	775	Rated speed for belt and p. t. o. work
1,6	1 659	2,29	0,70	1 435	29	77	71	18	775	Lowest recorded
51,9	1 801	9,90	5,24	191	27	89	76	15	771	Rated speed for drawbar work
2,3	1 920	2,96	0,78	1 290	32	85	65	21	775	Lowest recorded

#### II Supplementary tests:

Power take off test

Date and location of tests: April 21, 1960, Ultuna, Uppsala 7

Type of dynamometer: Hydraulic

Position of governor control: Index for belt and p.t.o. work

Fuel: Diesel oil, density 0,823 at 20°C, Cetane No. 54

Oil: Heavy Duty, SAE 20

## 1. Sustained power tests

Power	Engine speed	Torque	Spec. fuel consumption	Fuel temp.	Oil temp.	Coolant temp.	Air temp.	Atmos. press.	Remarks
hp <sub>metric</sub>	r/m	kpm	g/hph	°C	°C	°C	°C	mm Hg	
47,6 32,9	1 504 1 019	22,7 23,2	179 182	21 20	83 89	75 75	13 11	759 759	Max. power Speed less than at max. torque

## 2. Varying speed tests

Power	Engine speed	Fuel consumption			Temperature			Atmospheric conditions		Remarks
		kg/h	hph/kg	g/hph	Fuel °C	oil °C	coolant °C	temp. °C	press. mm Hg	
hp <sub>metric</sub>	r/m									
47,6	1 500	8,52	5,59	179	21	83	75	13	759	Rated speed for belt and p. t. o. work
1,8	1 649	2,16	0,83	1 204	18	76	72	17	759	Lowest recorded
54,5	1 800	9,95	5,48	182	20	81	74	12	759	Rated speed for drawbar work
2,6	1 930	2,78	0,94	1 070	15	77	72	13	759	Lowest recorded

## Section 3

### Drawbar tests on drum dynamometer

Date of tests: April 27—29, 1960

Type of surface: Concrete

Position of governor control: Fully open

Type of tyre: Rear, Good Year 14—30, 6-ply rating

Front, Good Year 7.50—18, 4-ply rating

Fuel: Diesel oil, density 0,823 at 20°C, Cetane No. 54

Oil: Heavy Duty SAE 20

### A. Tests with maximum additional weight

#### Weight of tractor

without ballast: Front 933 kg, rear 1932 kg

with ballast: » 1220 » » 3560 »

» » : Total 4780 »

#### Weight of ballast

front: 287 kg (2 weights per wheel, 90 kg, water 54 kg per wheel)

rear: 1628 kg (8 weights per wheel, 460 kg, water 254 kg per wheel)

Tyre pressure, rear: 1,1 kp/cm<sup>2</sup>

Height of drawbar

above ground: 425 mm

## 1. Maximum powers and pulls

Gear No.	Maximum Powers							Maximum Pulls	
	Power hp <sub>metric</sub>	Corresponding pull kp	Wheel slip %	Speed km/h	Engine temp. °C	Air temp. °C	Atmos. press. mm Hg	Pull kp	Reason for stall
1	34,1	4 320	17,5	2,13	74	11	762	4 425	Wheelspin Engine stall
2	45,7	3 870	13	3,19	75	11	762	4 185	
3	46,5	3 045	8,5	4,12	75	9	762	3 270	» »
4	48,0	2 220	6	5 83	75	9	762	2 380	» »
5	48,3	2 030	5,5	6,42	76	10	762	2 185	» »
6	48,7	1 460	3,5	9,01	76	13	760	1 580	» »
7	47,8	1 310	3,5	9,85	76	12	760	1 415	» »
8	47,0	840	2	15,1	75	13	760	925	» »
9	46,5	720	1,5	17,4	76	11	760	785	» »
10	43,7	440	1	26,8	76	12	760	495	» »

## 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 %
	Spec. fuel consumption g/hph	hph/kg	Corresponding pull kp	
1	227	4,41	4 050	2 400—4 425 kp
2	208	4,82	3 250	1 950—4 185 »
3	208	4,82	2 550	1 560—3 270 »
4	207	4,83	2 030	1 250—2 380 »
5	203	4,92	1 800	1 160—2 185 »
6	201	4,98	1 400	860—1 580 »
7	204	4,90	1 400	820—1 415 »
8	207	4,83	900	540— 925 »
9	211	4,75	760	460— 785 »
10	222	4,51	465	330— 495 »

## B. Test without ballast

Weight of tractor

front: 933 kg

rear: 1932 kg

total: 2865 kg

Tyre pressure, rear: 1,1 kp/cm<sup>2</sup>

Height of drawbar

above ground: 425 mm

## 1. Maximum powers and pulls

Gear No.	Maximum Powers							Maximum Pulls	
	Power	Corresponding pull	Wheel slip	Speed	Engine temp.	Air temp.	Atmos. press.	Pull	Reason for stall
	hp/metric	kp	%	km/h	° C	° C	mm Hg	kp	
1	22,2	2 800	17,5	2,14	72	15	765	2 800	Wheelspin
2	33,3	2 710	14,5	3,32	73	15	765	2 780	»
3	40,8	2 660	13,5	4,14	73	14	765	2 750	»
4	46,5	2 200	9	5,71	75	14	765	2 400	Engine stall
5	48,0	2 030	7,5	6,39	75	12	765	2 215	»
6	48,7	1 480	5	8,88	75	12	765	1 605	»
7	48,1	1 335	4,5	9,73	75	11	769	1 455	»
8	49,0	875	3	15,11	75	10	769	960	»
9	48,4	750	2,5	17,4	75	10	769	815	»
10	46,6	475	1,5	26,5	77	11	769	530	»

## 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 %
	Spec. fuel consumption g/hph	hph/kg	Corresponding pull kp	
1	254	3,95	2 520	1 900—2 800 kp
2	224	4,45	2 620	1 650—2 780 *
3	213	4,71	2 350	1 440—2 750 *
4	209	4,79	1 950	1 100—2 400 *
5	204	4,90	1 770	1 100—2 215 *
6	200	5,00	1 580	850—1 605 *
7	203	4,94	1 200	770—1 455 *
8	200	5,00	900	550— 960 *
9	202	4,96	800	470— 815 *
10	202	4,96	530	360— 530 *

## Section 4

### I Location of centre of gravity:

Tractor with tanks filled, with driver, without water in tyres and ballast weight—730 mm forward of rear wheel centre.

Tractor with tanks filled, with driver, fully ballasted—590 mm forward of rear wheel centre.

### II Turning space and turning radius:

Type of wheels: Front 7.50—18, rear 11—38

Tread: Front 1330 mm, rear 1440 mm

Results	With Brakes		Without Brakes	
	Right Hand	Left Hand	Right Hand	Left Hand
Radius of turning space.....	3,7 m	3,5 m	4,1 m	3,9 m
Turning radius.....	3,6 m	3,4 m	4,0 m	3,8 m

## Section 5

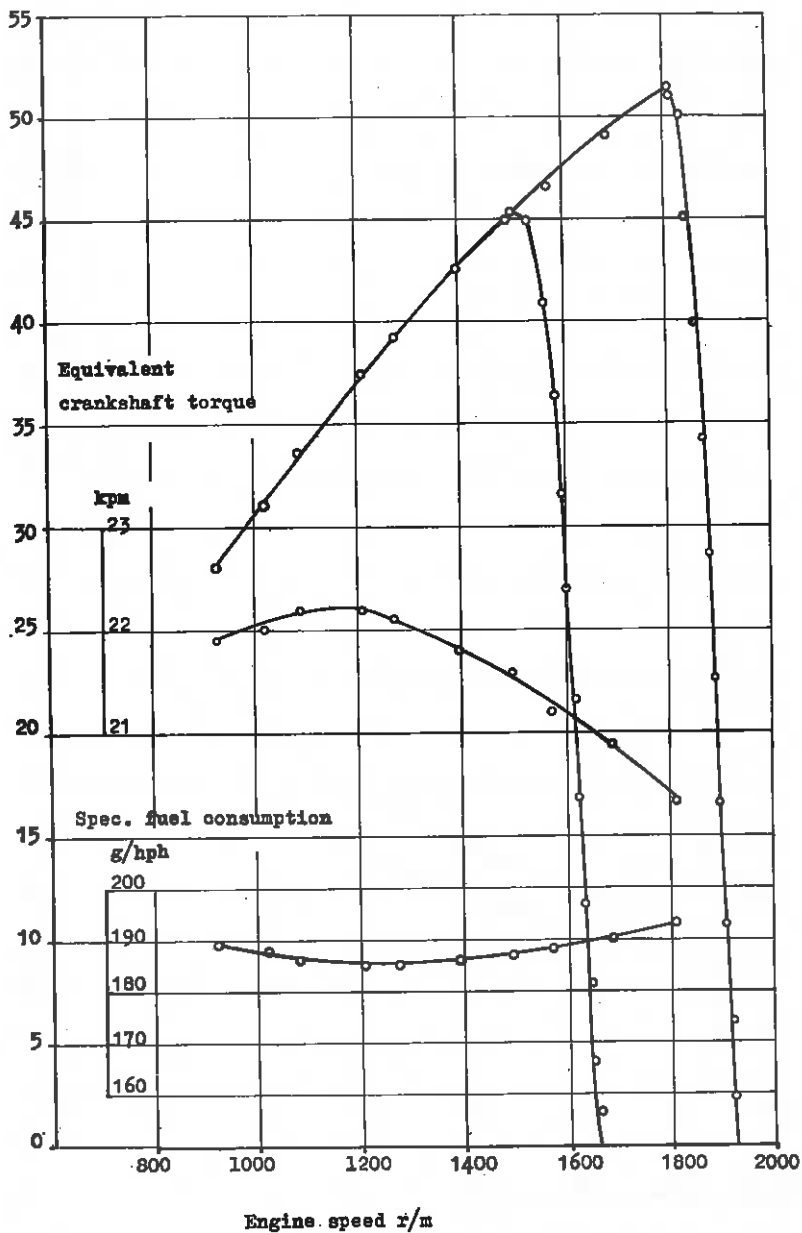
1. Repairs and adjustments during test: None

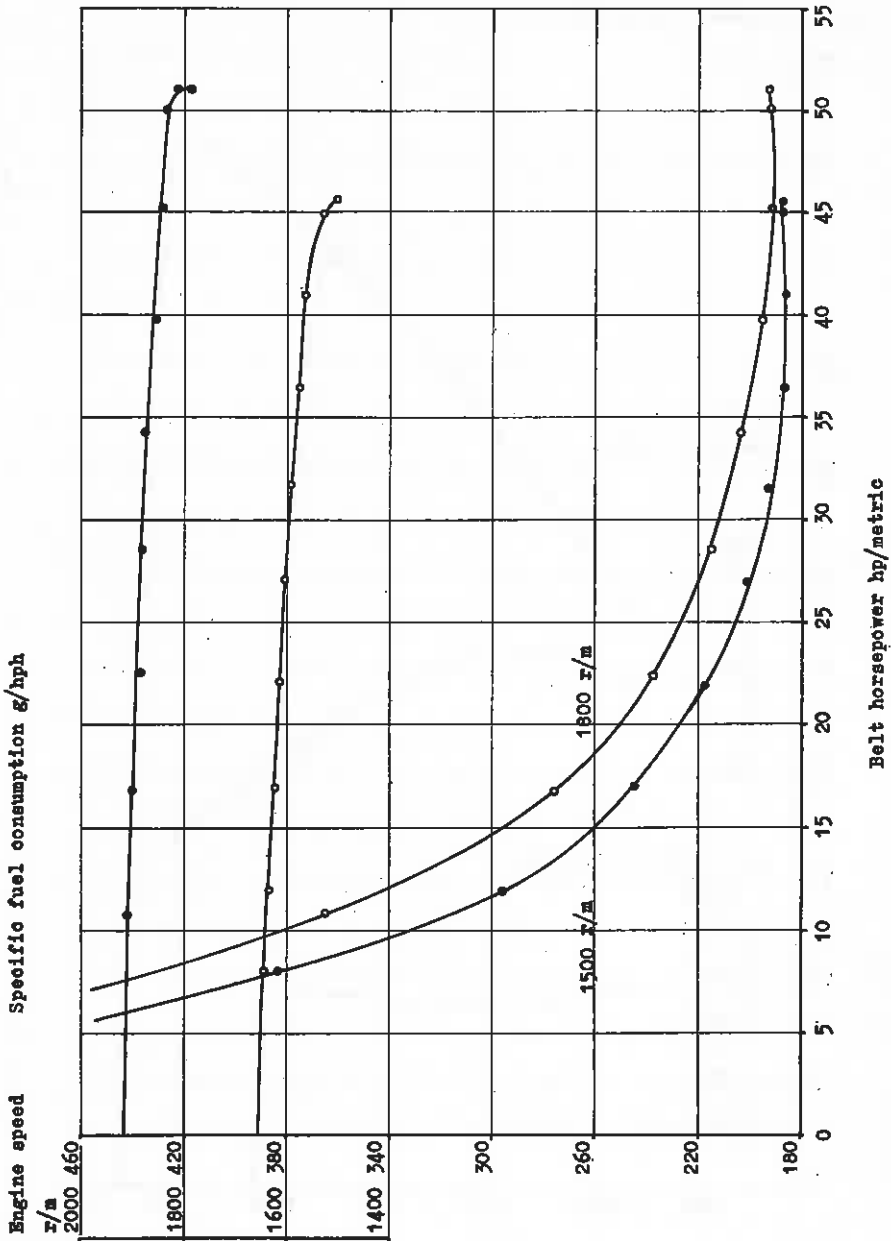
2. Remarks: None

Ultuna, Uppsala 7, 31th May, 1960

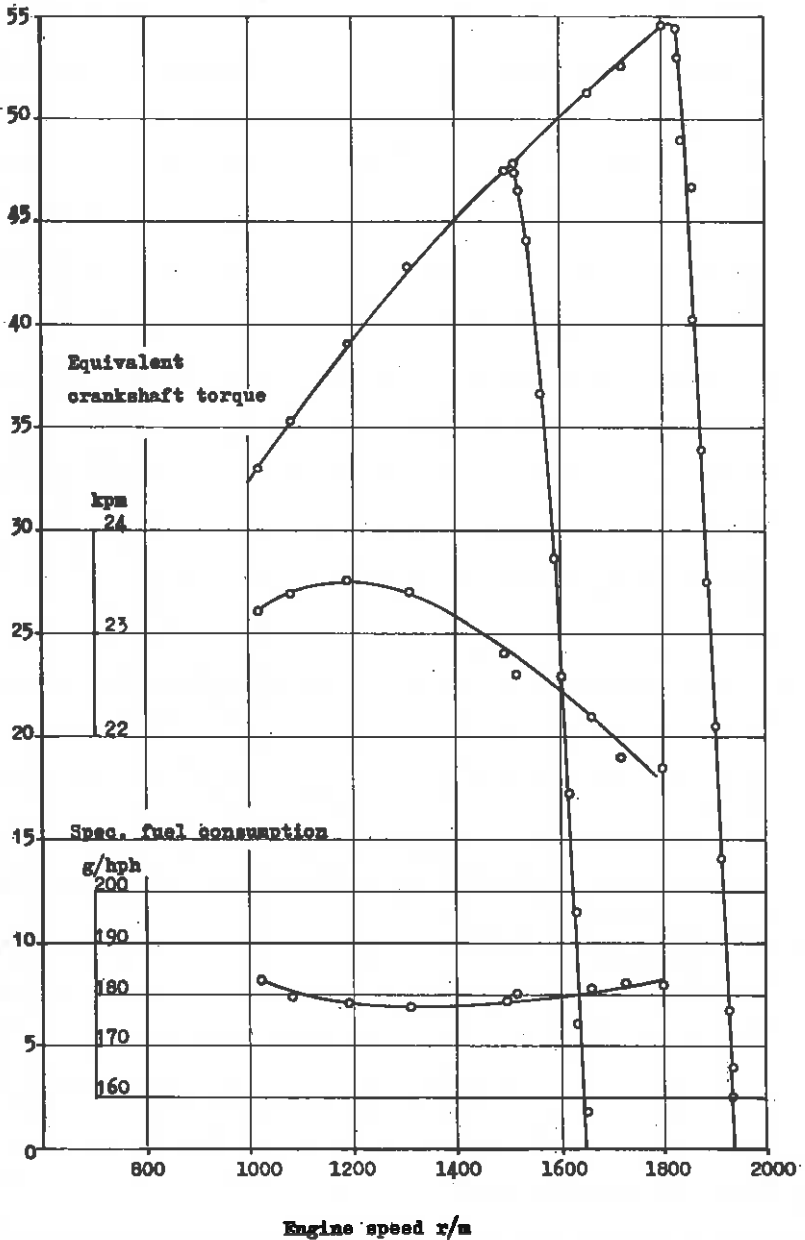
National Swedish Testing Institute for Agricultural Machinery

Belt horsepower hp/metric





P.t.o. horsepower hp/metric

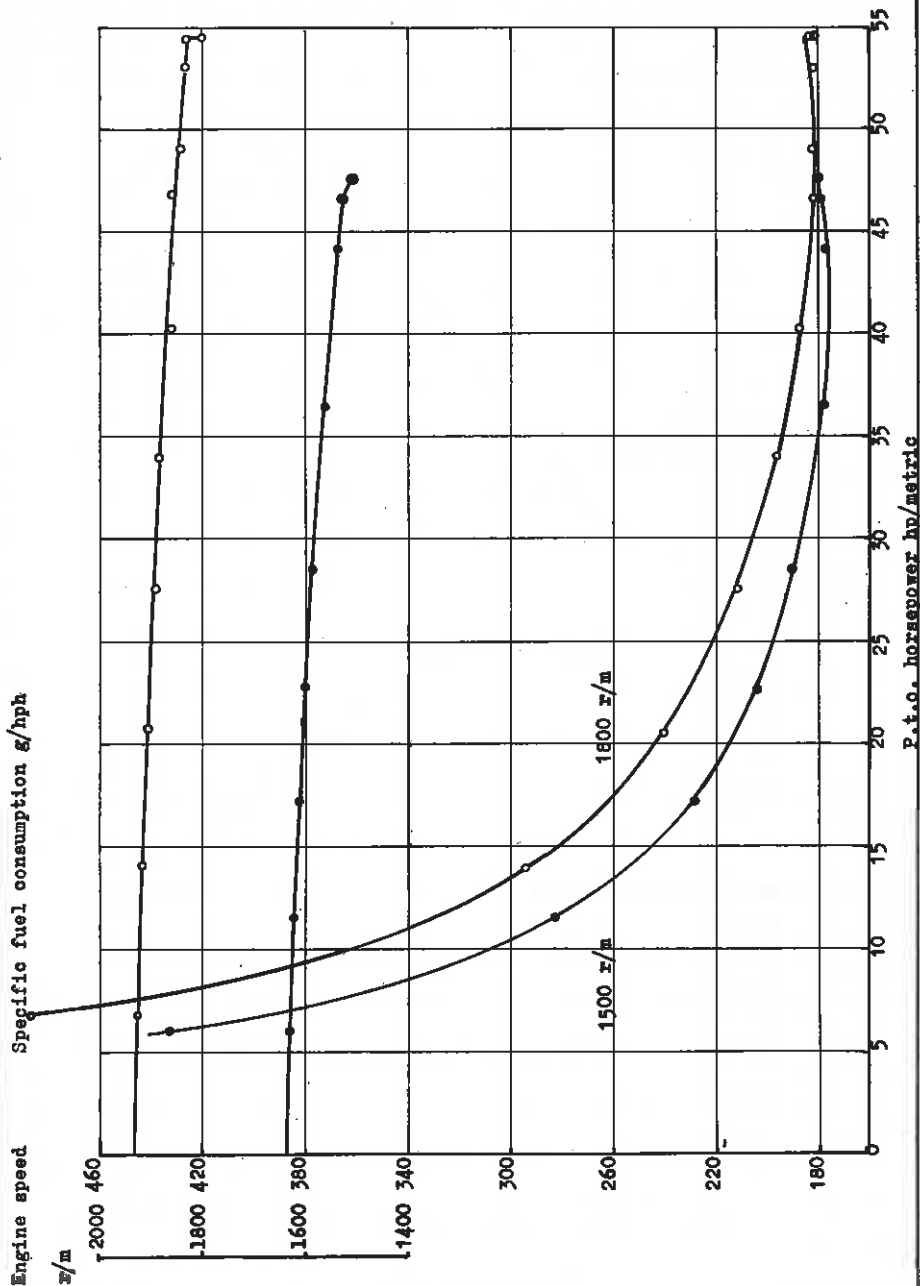


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Machinery

Power take off test  
EM/Volvo 350  
Load-governed speeds

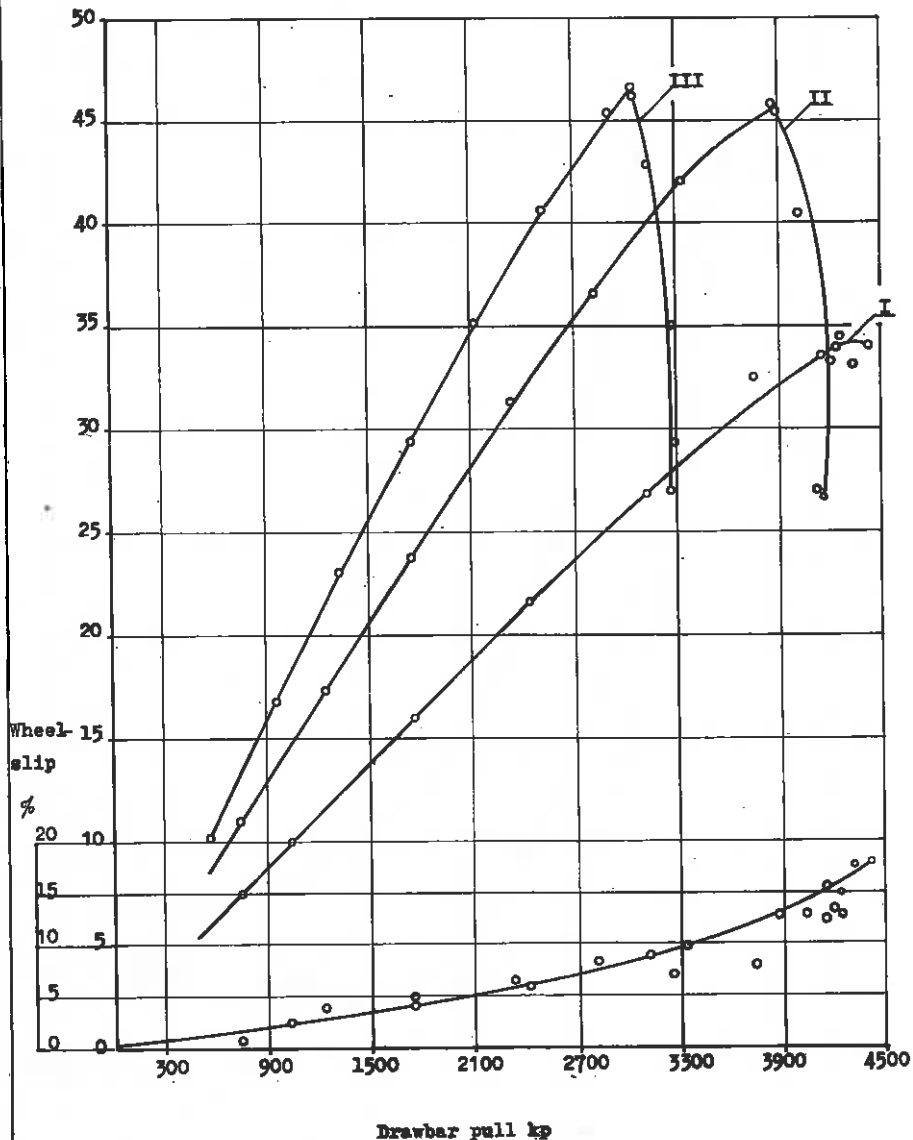
Figure 4

21-4-60

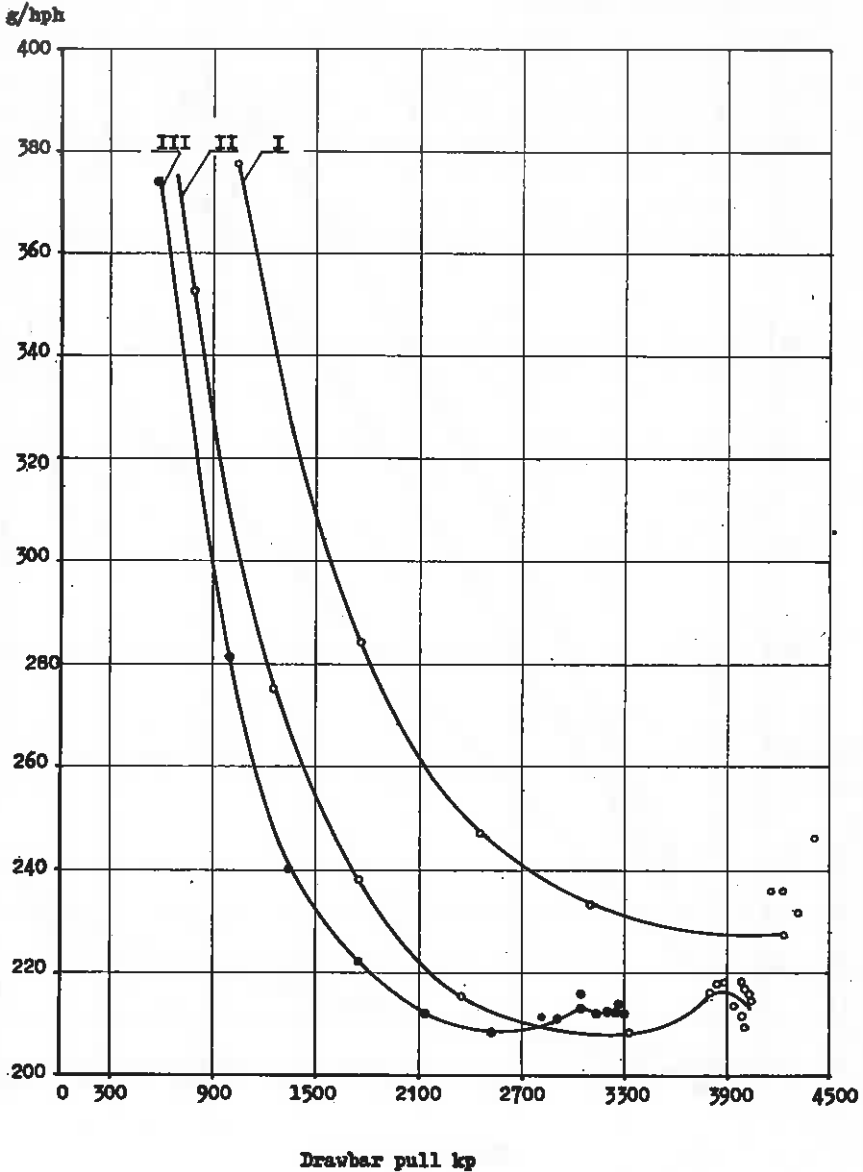


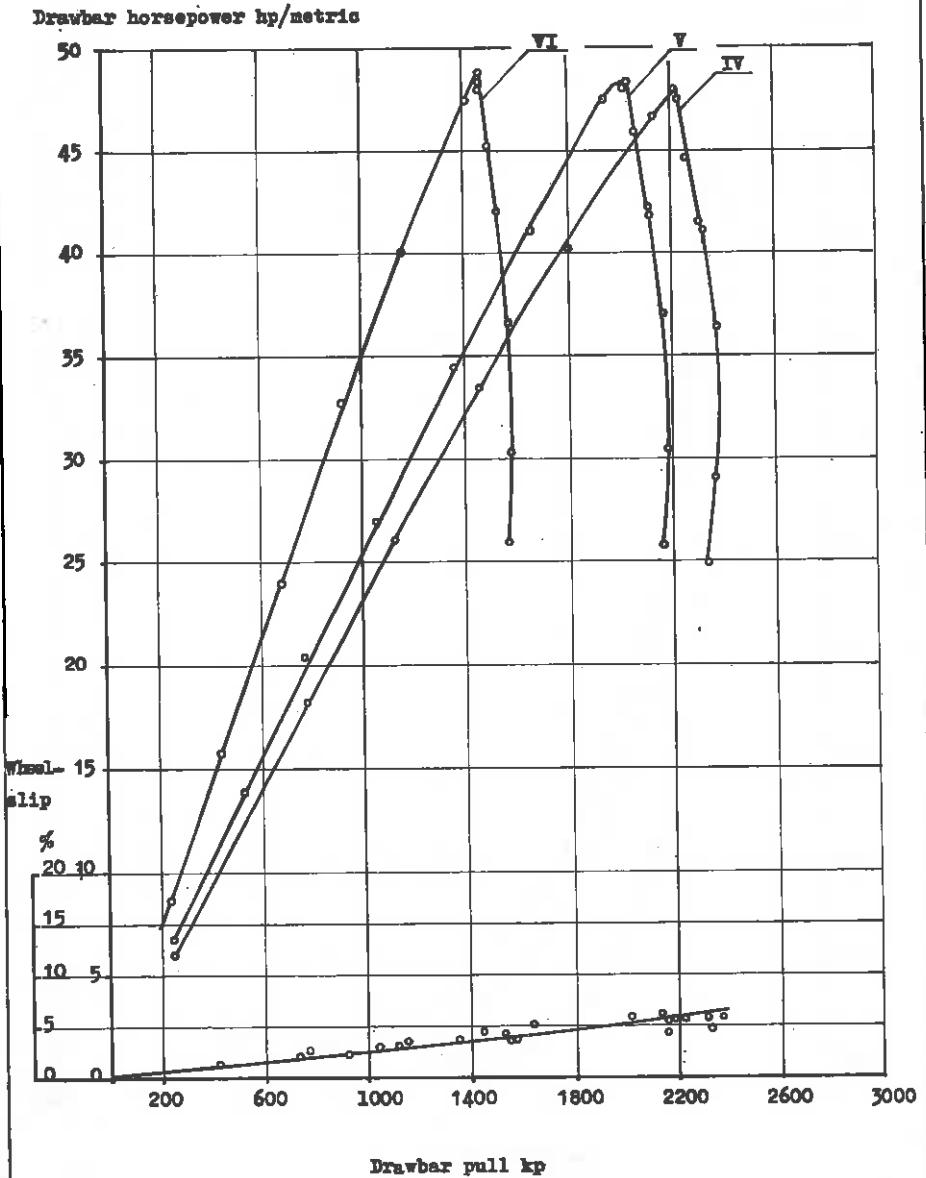


Drawbar horsepower hp/metric



Specific fuel consumption





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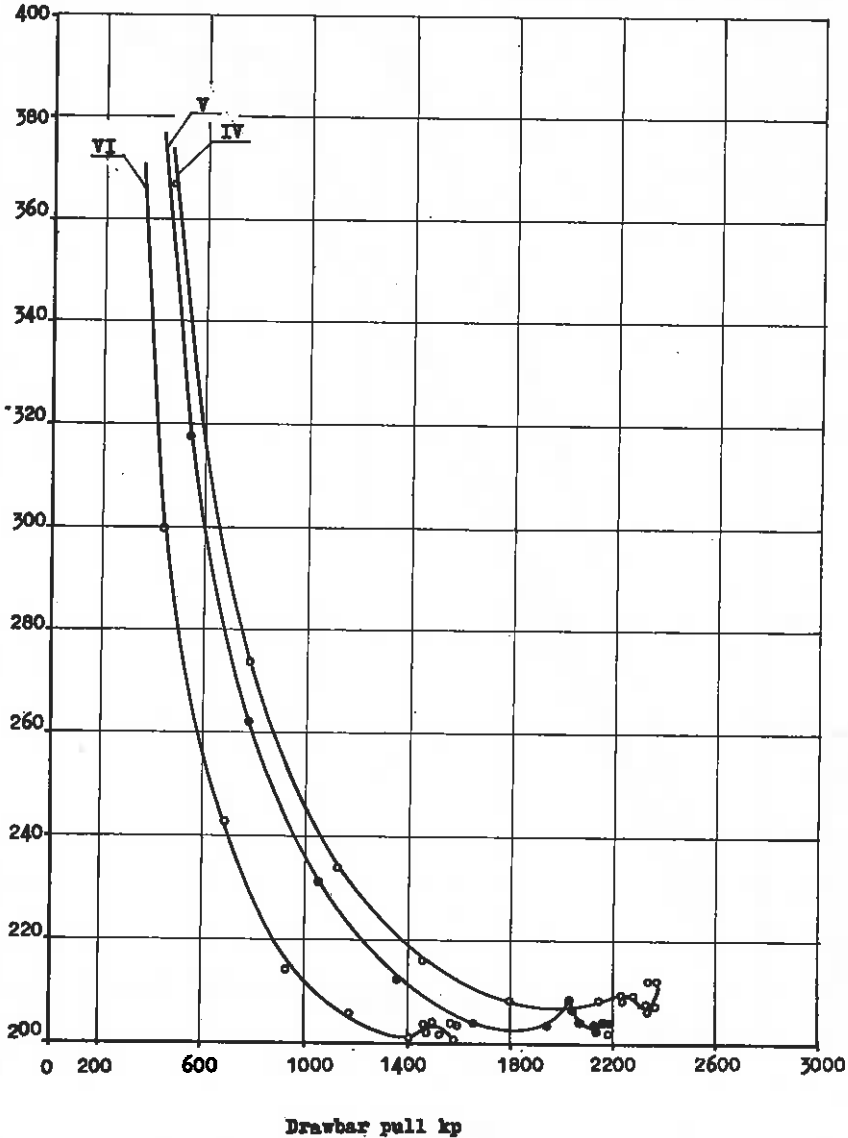
Drawbar test on drumdynamometer  
BM/Volvo 350 with ballast  
Equipped with 14 - 30 tyres  
Gear IV, V and VI

Figure 8.

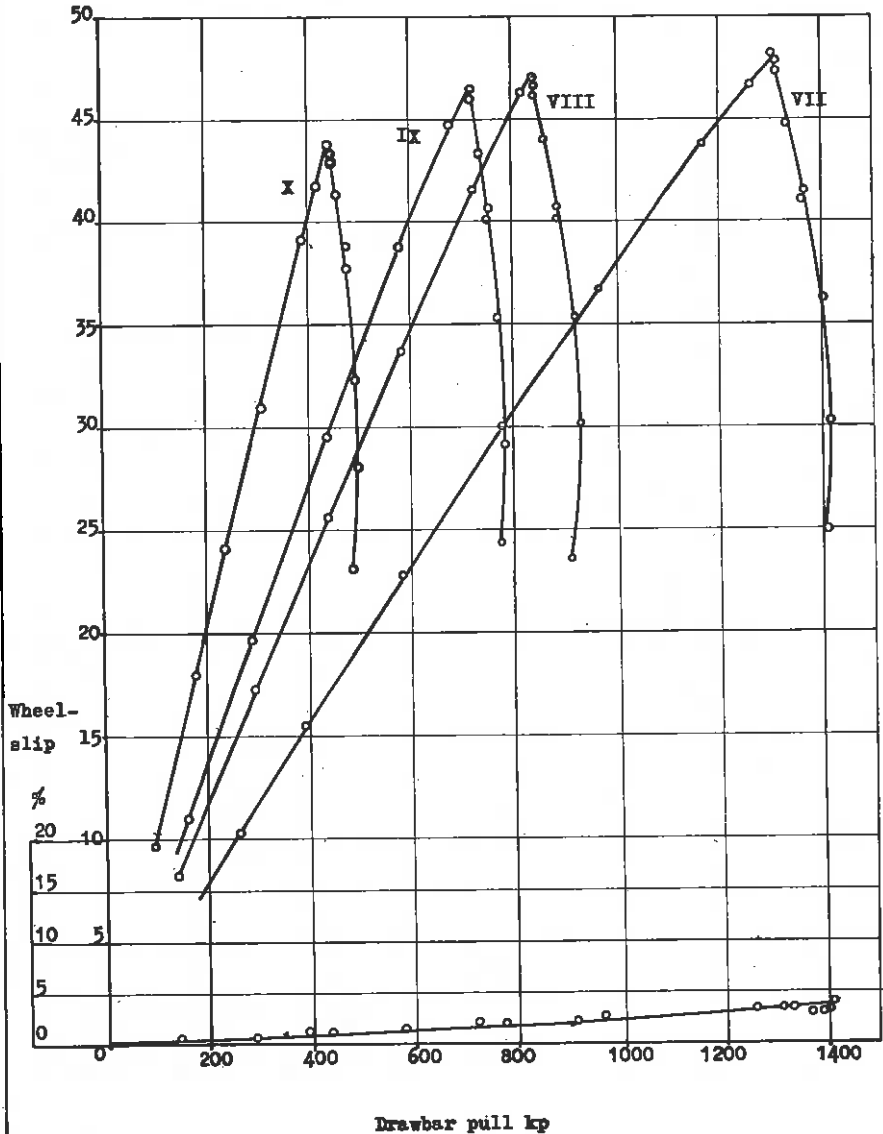
27-4-60

Specific fuel consumption

g/hph

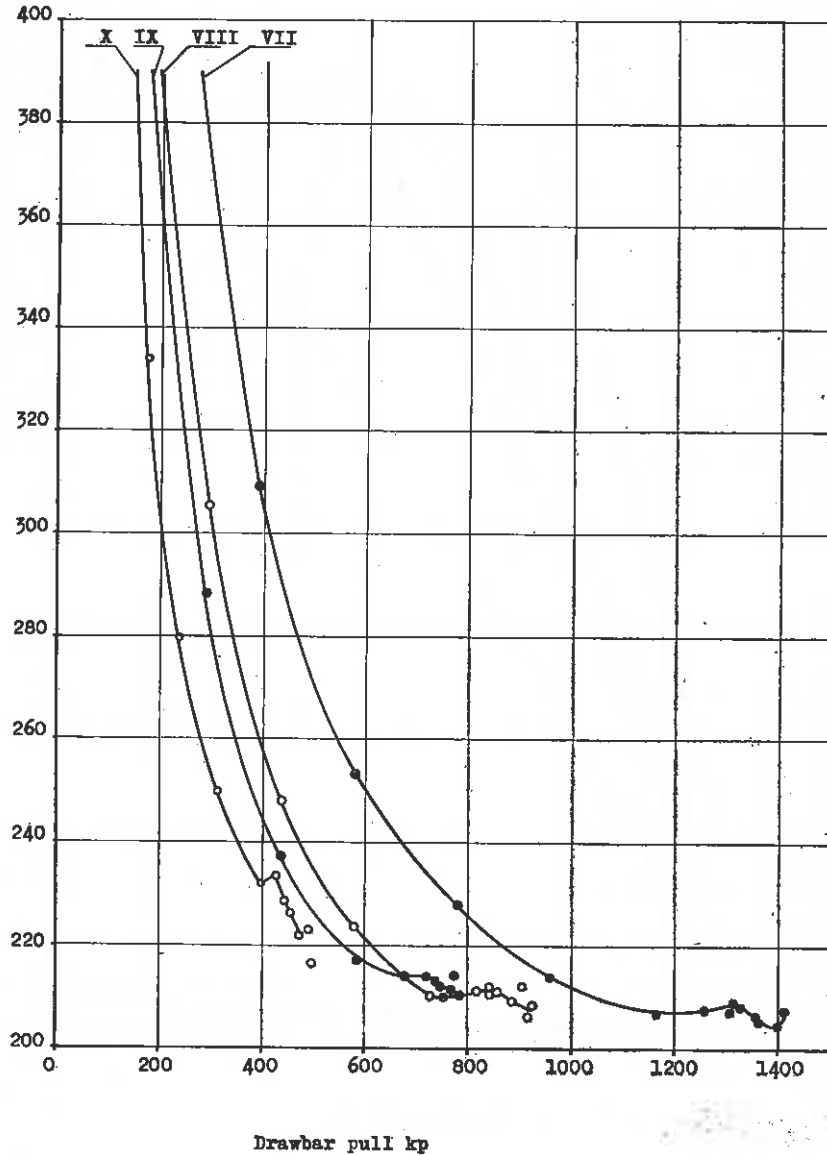


Drawbar horsepower hp/metric



Specific fuel consumption

g/hph



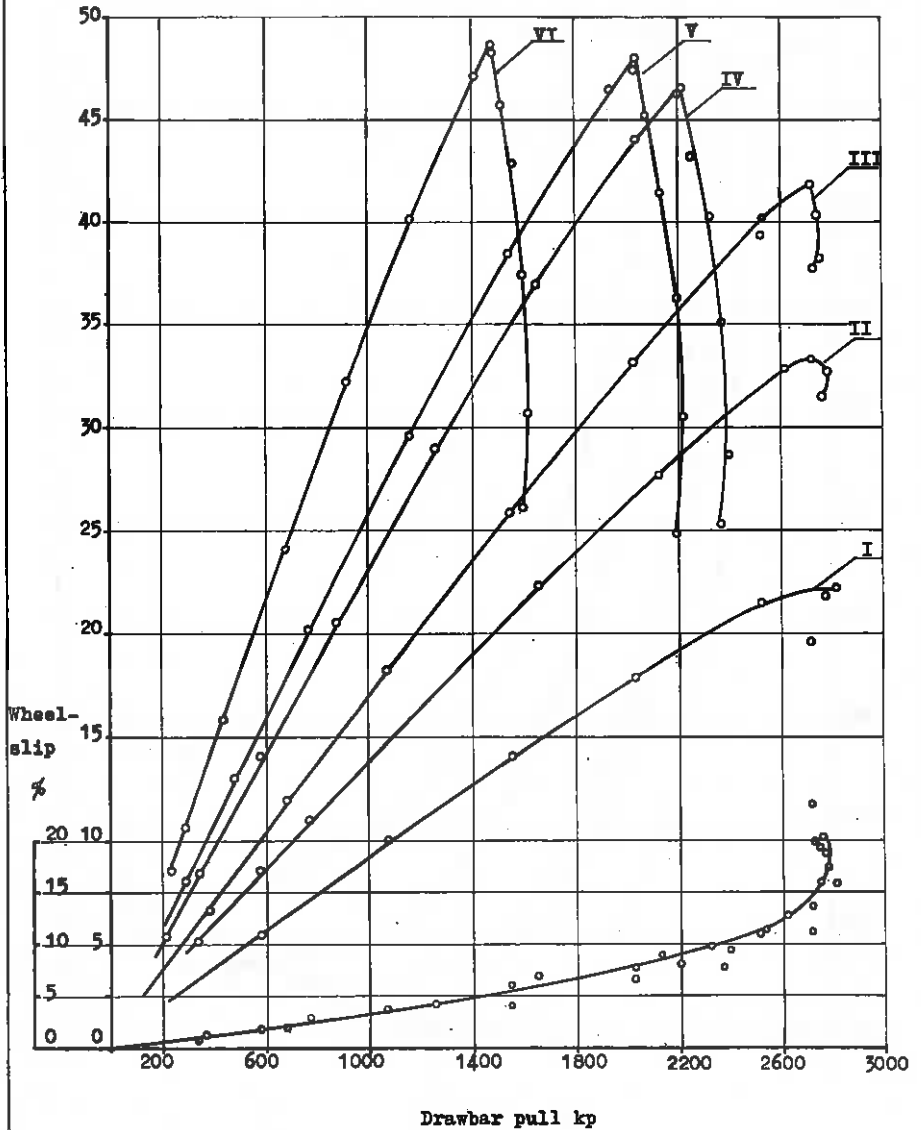
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Machinery

Drawbar test on drumdynamometer  
EM/Volvo 350 without ballast  
Equipped with 14 - 30 tyres  
Gear I, II, III, IV, V and VI

Figure 11

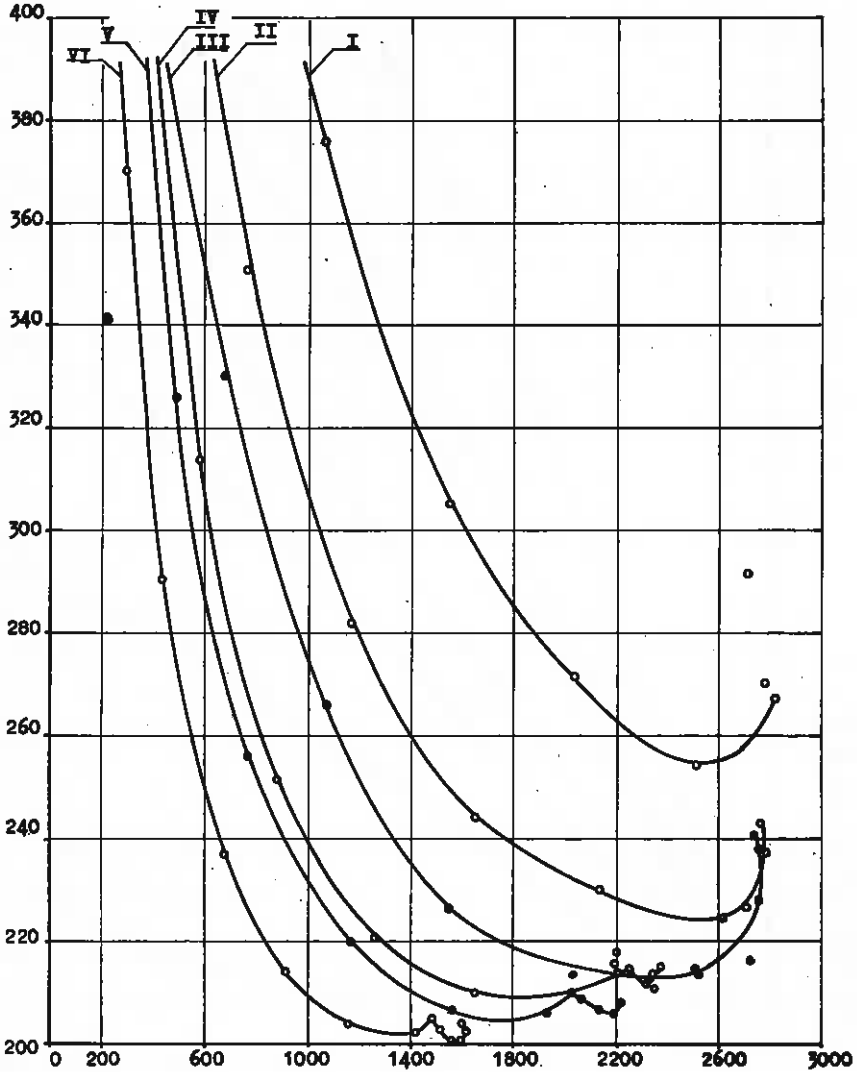
29-4-60

Drawbar horsepower hp/metric



Specific fuel consumption

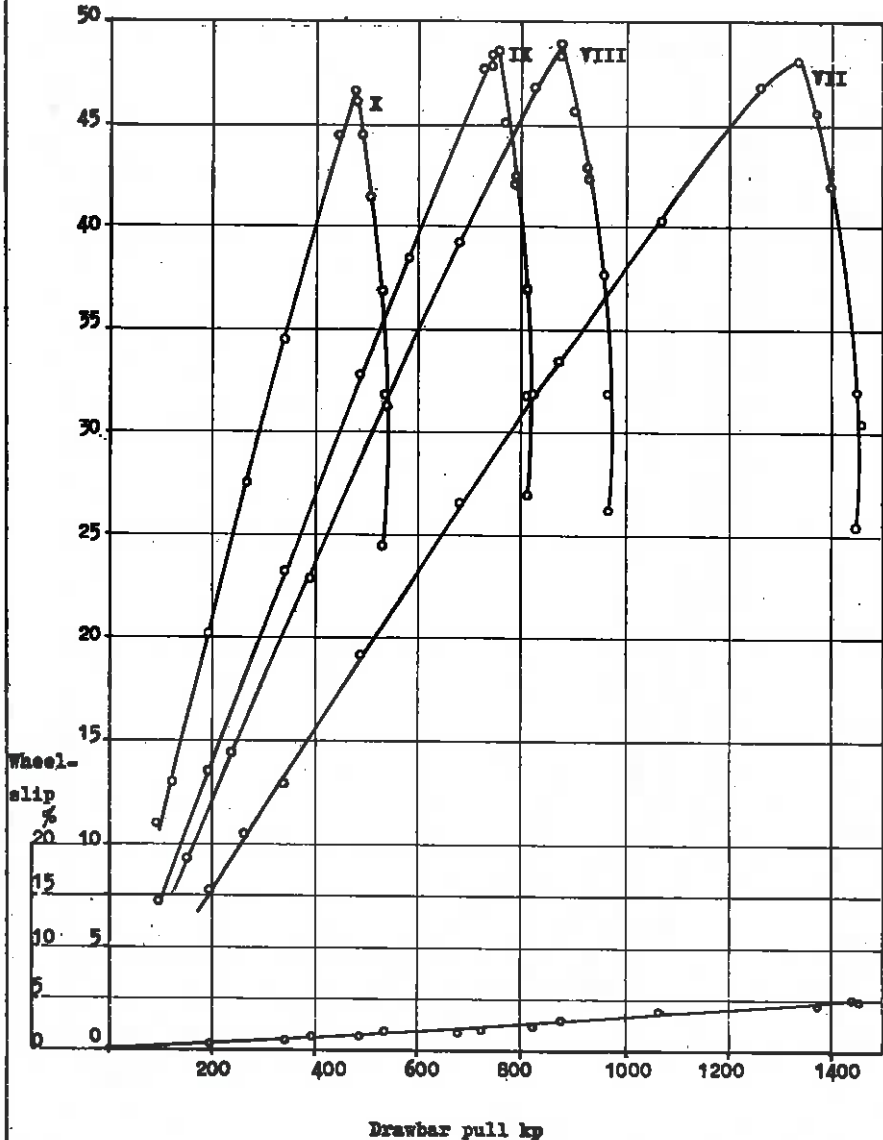
g/hph



Drawbar pull kp



Drawbar horsepower hp/metric



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Drawbar test on drumdynamometer  
HM/Volvo 350 without ballast  
Equipped with 14 - 30 tyres  
Gear VII, VIII, IX and X

Figure 14.

28-4-60

Specific fuel consumption

g/hph

