SOCIALISTIC REPUBLIC OF CROATIA
INSTITUTE FOR MECHANIZATION IN AGRICULTURE
Z A G R E B

TEST BULLETIN: O. E. C. D. No. 570

Report on test in accordance with O. E. C. D. Standard Code for Agricultural Tractor Performance

Date of Approval: 28th December 1977.

TOMO VINKOVIĆ MODEL TV-418
FOUR - WHEEL - DRIVE DIESEL TRACTOR

Manufactured by: TOMO VINKOVIĆ, Tvornica traktora i ljevaonica, Bjelovar, Yugoslavia
Date of Tests: September 1975. — December 1977.

This report has been approved by the O. E. C. D. Coordinating Centre (C. N. E. E. M. A., Antony, France) as beeing in accordance with the O. E. C. D. Standard Code for Agricultural Tractor Performance.

Serial No. 570

Date of Approval: 28th December 1977.

This bulletin is based on engineering tests in acordance with the O. E. C. D. Tractor Code. It does not contain evaluation of the performance of the tractor on practical farm work.

In this report all performance characteristics are given according to the International System of Units.

The relation with the former Technical System of Units is given by the followig formulas:

Forces:	1 N = 0.102 kp	or	1 kp = 9.81 N
Powers:	1 kW = 1.36 hp	or	1 hp = 0.736 kW
Pressures:	1 bar = 1.02 kp/cm²	or	1 kp/cm² = 0.981 bar
	1000 mbar = 750.1 mm Hg		

TABLE OF CONTENTS

Tractor manufacturer:	TOMO VINKOVIĆ, Tvornica traktora i ljevaonica, Bjelovar
Submitted for test by:	Manufacturer
Selected by:	Manufacturer by agreement with the Institute
Place of running-in:	Zagreb
Duration of running-in:	30 hours

SPECIFICATION OF TRACTOR

Tractor

Make:	TOMO VINKOVIĆ, Tvornica traktora i ljevaonica, Bjelovar
Model:	TV-418
Type:	Articulated four-wheel-drive design
Serial No.:	094

Engine

Make:	LOMBARDINI, Fabrica italiana motori, Reggio-Emilia, Italia
Model:	LDA-100
Type:	Diesel engine, air cooling, 4 stroke cycle, direct injection
Serial No.:	1307085
Cylinder:	1 cylinder, vertical; 100 mm bore, 90 mm stroke, capacity 707 cm^3; compression ratio 17 : 1; overhead valves
Fuel system:	Fuel: commercially available diesel oil; gravity type of fuel feed; BOSCH PFR 1 K 70 A 421/2 injection pump, manufacturer's production setting 40 mm^3/per stroke at rated engine speed; BOSCH type KBL 87 526 injection nozzles; injection pressure 206 bar; injection 29° before TDC; paper cartrige fuel filter; capacity of fuel tank 7 l
Governor:	LOMBARDINI, mechanical centrifugal variable speed type governor; governed range of engine speed 1000 rev/min to 3200 rev/min; rated engine speed 2850 rev/min
Air cleaner:	Oil bath type with pre-cleaner incorporated; oil capacity 0.3 l
Exhaust silencer:	Reflexion type silencer on the right-hand side of engine; mouth showing to the right
Lubrication system:	Forced feed from gear type pump; centrifugal oil filter, period of cleaning 300 hours; oil capacity (engine sump) 2.6 l; recommended oil change period 100 hours; recommended oil type acc. API service classification: Service CD; viscosity SAE 30
Cooling system:	Air cooling from flywheel blower; fan 308 mm dia with 28 blades
Starting system:	Electrical; BOSCH type JD (R) 12 V screw-push stater motor 1.3 kW
Electrical equipment:	Voltage 12 Volt Generator DUCATI, 3 phase alternator 12 V, 7.5 A MUNJA lead acid battery, 12 V, 56 Ah at 20 hours rating

Transmission

Clutch:	Make: POBEDA, Novi Sad, dry single plate clutch, 190 mm dia plate, pedal operated
Gearbox:	Own make; sliding gear type with 3 forward speeds + a 2 forward and 1 reverse range transfer-box at the input end
Front and rear axle and final drive:	Own make, crown and pinion with differential; differential lock fitted on front axle, operated by hand lever;
Oil capacities:	Front axle housing and gearbox 10 1; rear axle housing 6 1; recommended oil changing period 500 hours; recommended oil type acc. API service classification: service GL 3; viscosity SAE 90

Total ratios and speeds:

Speed-range	Gear	Number of engine revolutions for one revolution of driving wheel	Nominal travelling speed at rated engine speed of 2850 rev/min with 6,00—16 tyres, rolling radius 332 mm km/h
low	1.	235.72	1.52
	3.	87.09	4.14
	5.	32.45	11.1
high	2.	160.70	2.24
	4.	59.38	6.07
	6.	22.12	16.3
reverse	1.	160.70	2.24
	2.	59.38	6.07
	3.	22.12	16.3

Power take-off

Type of drive:	Non independent proportional to engine speed p. t. o. directly driven from the transfer box output
Location:	At rear of tractor, in median plane, 275 mm above ground
Dimension:	21.5 mm dia — with 10 splines (not ISO standard)
Speeds:	2 x 2 preselectable speeds: — »Low ratio« p. t. o. selector position: . with transfer-box on the »high range« position 1023.7 rev/min at rated engine speed, . with transfer-box on the »low range« position (or »reverse«) 697.9 rev/min at rated engine speed 540 rev/min standard p. t. o. speed at 2205 rev/min engine speed — »High ratio« p. t. o. selector position: . with transfer-box on the »high range« position 1983.1 rev/min at rated engine speed, . with transfer-box on the »low range« position (or reverse) 1352 rev/min at rated engine speed 1000 rev/min standard p. t. o. speed at 2108 rev/min engine speed
Direction of rotation:	Clockwise (transfer box on high or low position) or anticlockwise (transfer-box on reverse position)

Power lift	Make: PRVA PETOLETKA, Trstenik; disintegrated construction; type 225-9250 gear type pump directly driven by engine, supplies oil to a single acting ram cylinder; maximum oil pressure 118 bar; oil capacity 6.5 l; recommended oil type: hydraulic oil HD, viscosity SAE 70; position control; hydraulic linkage lock for transport
Implement linkage	
At rear:	Two point linkage, not standardised, controlled by power lift; lift height above ground from 160 mm to 485 mm; with links in horizontal position distance of rear plane to rear axle centre 435 mm
Holed bar:	Long bar: attached on the plate of lover links; centre hole and 3 holes 25 mm dia on either side with 80 mm distance each. Height above ground adjustable by power lift.
Towing hitch:	At rear of tractor 275 mm above ground
Steering	Own make spur gear steering, operated by hand wheel
Brakes	
Service brake:	Internal expanding brake, mechanically acting on rear wheels, operated by foot pedal
Parking brake:	Lever operated service brakes
Wheels	Two at front, two at rear, all tyres 6.00 - 16 TR, 4-ply pneumatic, steering by front wheels, all wheel drive; maximum permissible weight on each tyre 375 kg at 1.5 bar; track width 650 mm and/or 880 mm by shifting the hub on the axle shaft
Wheelbase:	1085 mm
Tractor and ballast weights	(without driver, with power lift, full fuel tank and oil, as tested)
Weight of tractor without ballast:	Front axle load: 512 kg Rear axle load: 218 kg Total: 730 kg
Ballast:	Front: 1 weight per wheel 50 kg each = 100 kg Rear: 1 weight per wheel 50 kg each = 100 kg
Weight of tractor with ballast:	Front axle load: 612 kg Rear axle load: 318 kg Total: 930 kg
Seat	Upholstered mold seat with back rest; not spring; in median plane of tractor
Number of grease points	Whole tractor 10

Overall dimensions

Overall lenght:	2300 mm (with implement linkage in horizontal position)
Overall width:	1070 mm at 880 track
Overall height:	1050 mm to the top of steering wheel
Maximum ground clearance:	210 mm — in tractor median plane

Lighting

	Height above ground of centre mm	Dimensions of area mm	Distance from outside edge of tractor to centre mm
Headlights	780	110 Ø	230
Side lights	—	—	—
Rear lights	740	50 x 60	175

Unrestricted beam angle of headlight in plan view 24°

FUELS AND LUBRICANTS USED IN TESTS

Laboratory and track tests

Fuel:	Diesel oil, specific gravity at 15°C 0.833 kg/dm³, cetane No. 58 (commercially available quality acc. to JUS B. H2.411)
Engine oil:	INA SUPER 3 30 (SAE) (acc. JUS B.H3.169) viscosity at 50°C : 8°E
Transmission oil:	INA HYPENOL 90 (SAE) (acc. JUS B.H3.304) viscosity at 50°C : 15°E
Power lift:	INA HIDRAOL 70 HD (acc. JUS B.H3.275) viscosity at 50° : 6.75°E

COMPULSORY TESTS

(1) MAIN POWER TAKE-OFF PERFORMANCE (540 rev/min)

Date and location of tests: 5. September 1975., Zagreb
Type of dynamometer: SCHENK hydraulic dinamometer U1-40

Horsepower, kW	Speeds, Engine rev/min	Speeds, P. t. o. rev/min	Fuel consumption Total l/h	Fuel consumption Total kg/h	Fuel consumption Specific, g/kWh	Specific energy, kWh/l
Maximum power — 2 hour test						
8.24	**2854**	**699**	**3.45**	**2.87**	**348**	**2.39**
Standard p. t. o. speed (540 rev/min)						
7.58	2205	540	2.98	2.48	327	2.55
Speed recommended by the manufacturer for drawbar work						
7.58	3010	737	3.28	2.73	360	2.31
Fuel consumption at part loads						
(i) 85% of torque at maximum power						
7.58	3010	737	3.28	2.73	360	2.31
(ii) unloaded						
0	3220	789	1.44	1.20	—	—
(iii) 50% of the load defined in (i)						
3.94	3136	768	2.14	1.78	450	1.85
(iv) maximum power						
8.24	2854	699	3.45	2.87	348	2.39
(v) 25% of the load defined in (i)						
1.90	3180	779	1.75	1.46	768	1.09
(vi) 75% of the load defined in (i)						
5.52	3105	760	2.59	2.16	390	2.13

No load, maximum engine speed: 3200 rev/min

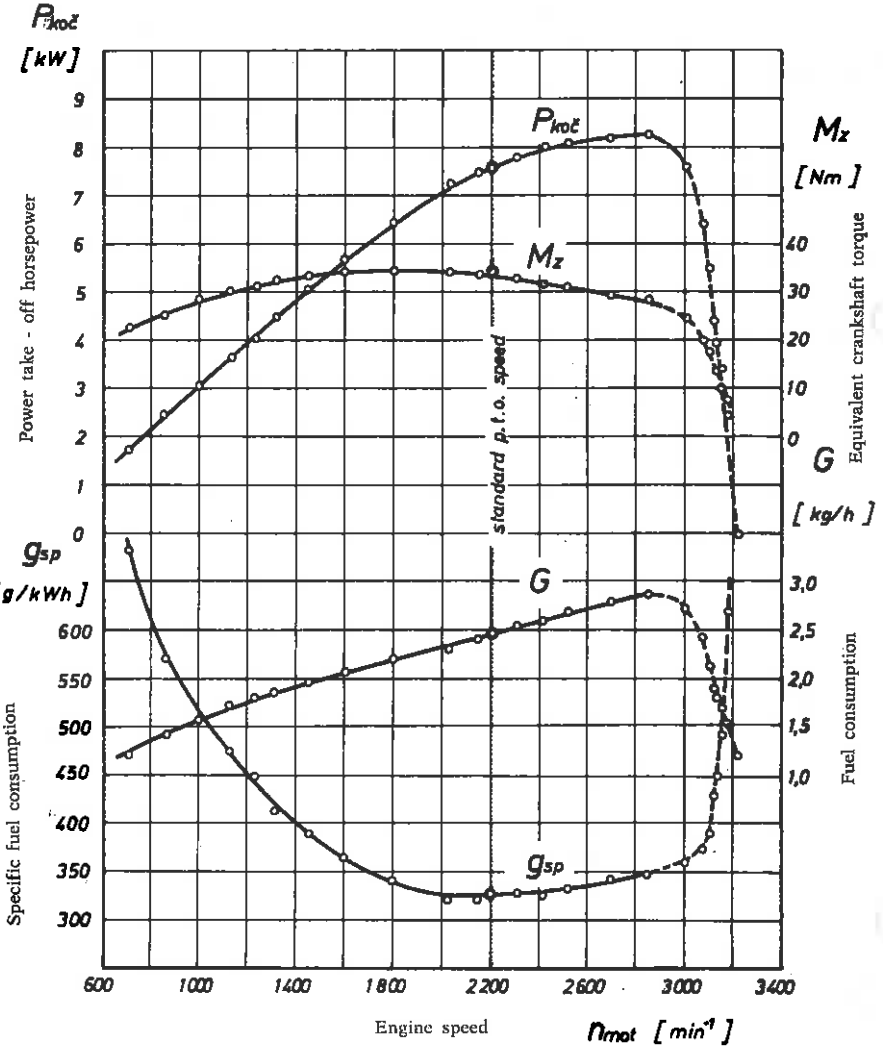
Equivalent crankshaft torque at maximum power: 27.7 Nm

Maximum equivalent crankshaft torque: 34.2 Nm at 1800 rev/min engine speed

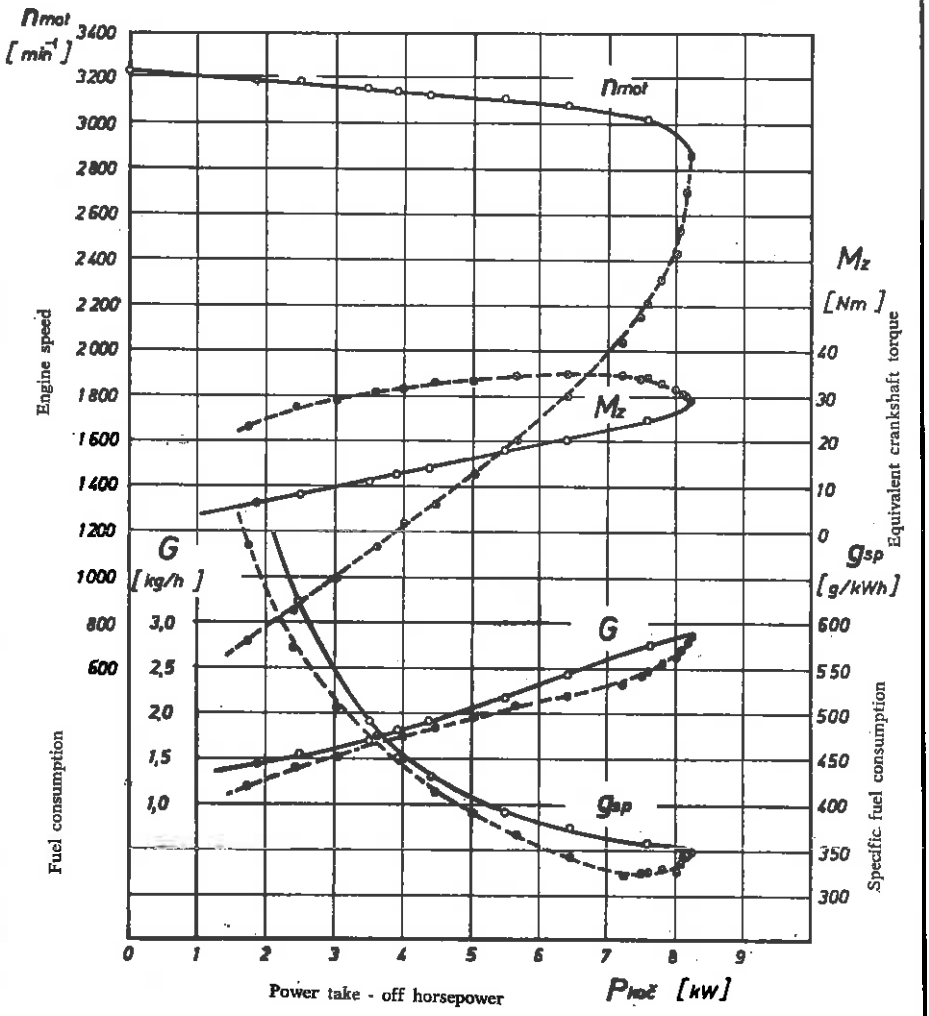
Mean atmosferic conditions: temperature 24°C; pressure 1004 mbar; relative humidity 87%

Maximum temperatures: engine oil 127°C;
coolant not recorded;
fuel 21°C

Power take - off test



Power take - off test



(2) DRAWBAR PERFORMANCE

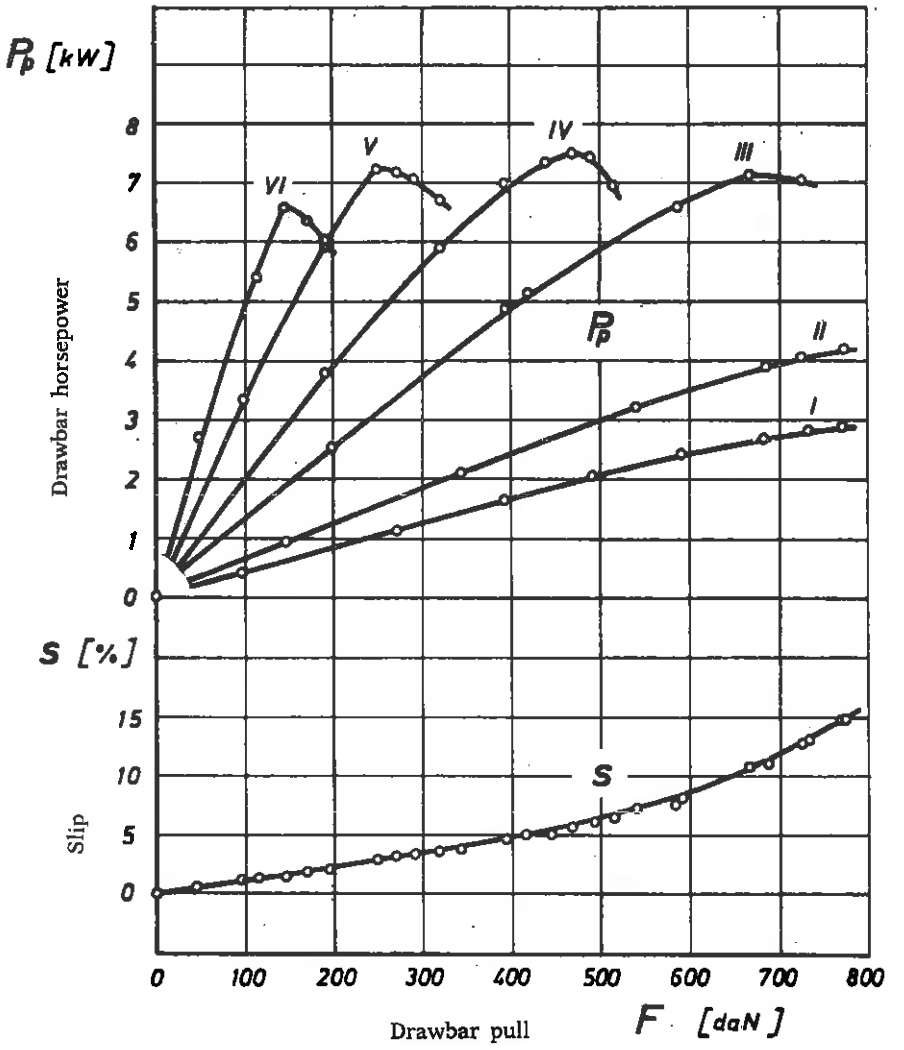
Date of tests: 27th October 1975. — 15th December 1977. Type of track: Tarmacadam Height of drawbar above ground: 230 mm

Gear number	Power, kW	Drawbar pull, N	Speed, km/h	Engine speed, rev/min	Wheelslip, %	Specific energy, kWh/l	Specific fuel consumption, g/kWh	Temperature, Fuel °C	Coolant °C	Engine °C	Atmospheric conditions: Temperature, °C	Relative humidity, %	Pressure, m bar
(i) Maximum power (ballasted)													
1	2.91	7660	1.37	3020	14.8	1.39	600	14	not rec.	64	14	83	995
2	4.20	7710	1.95	2950	14.8	1.69	492	14	not rec.	63	14	83	995
3	7.14	6670	3.85	2850	10.7	2.08	400	10	not rec.	67	10	90	1015
4	7.51	4660	5.80	2840	5.8	2.27	367	10	not rec.	65	10	90	1015
5	7.21	2450	10.6	2840	3.0	2.31	360	10	not rec.	70	11	82	1015
6	6.62	1470	16.1	2770	1.4	2.10	398	11	not rec.	72	11	82	1015
(ii) Five hour test at 75% of pull at maximum power													
3	6.06	5300	4.12	2910	7.7	2.17	384	24	not rec.	86	5	73	1021
(iii) Five hour test at pull corresponding to 15% wheelslip in test (i)													
2*	—	7850	2.00	2960	—	—	—	16	not rec.	84	— 2	96	1027
(iv) Maximum power (unballasted)													
1	2.72	6080	1.37	2980	15.0	not rec.	not rec.	10	not rec.	64	11	82	1017
2	3.39	6080	1.98	2900	15.0	not rec.	not rec.	10	not rec.	66	11	82	1017
3	6.06	5640	3.87	2850	11.9	not rec.	not rec.	11	not rec.	68	12	83	1017
4	7.15	4415	5.82	2850	7.1	not rec.	not rec.	11	not rec.	70	12	83	1018
5	6.48	2160	10.8	2810	3.5	not rec.	not rec.	10	not rec.	72	9	89	1018
6	6.24	1470	15.3	2720	2.2	not rec.	not rec.	10	not rec.	70	9	89	1020

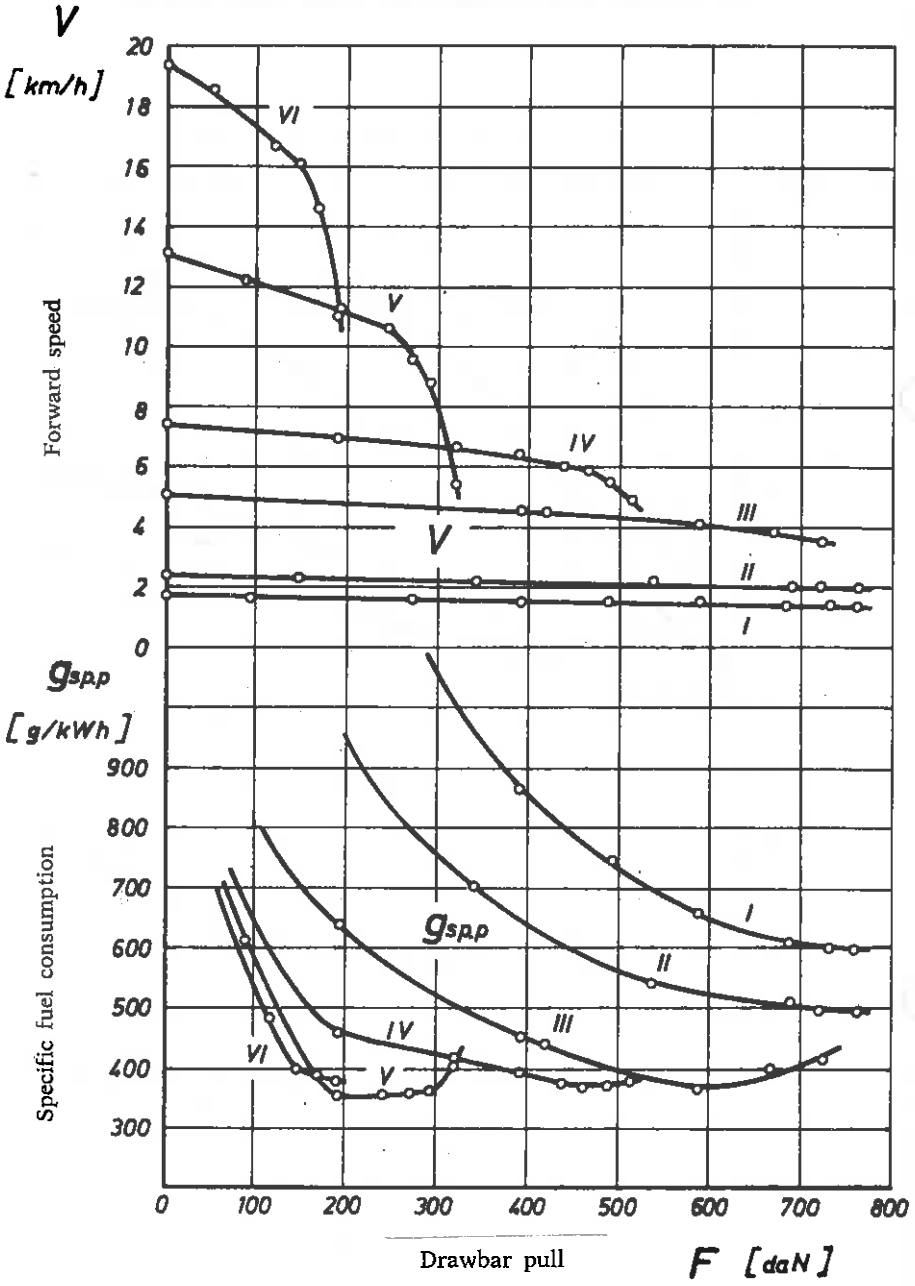
Total oil consumption during ten hours duration of tests (ii) and (iii): 31 g/h

* Test (iii) was carried out with additional ballast and the results for power, slip and fuel consumption have no practical significance

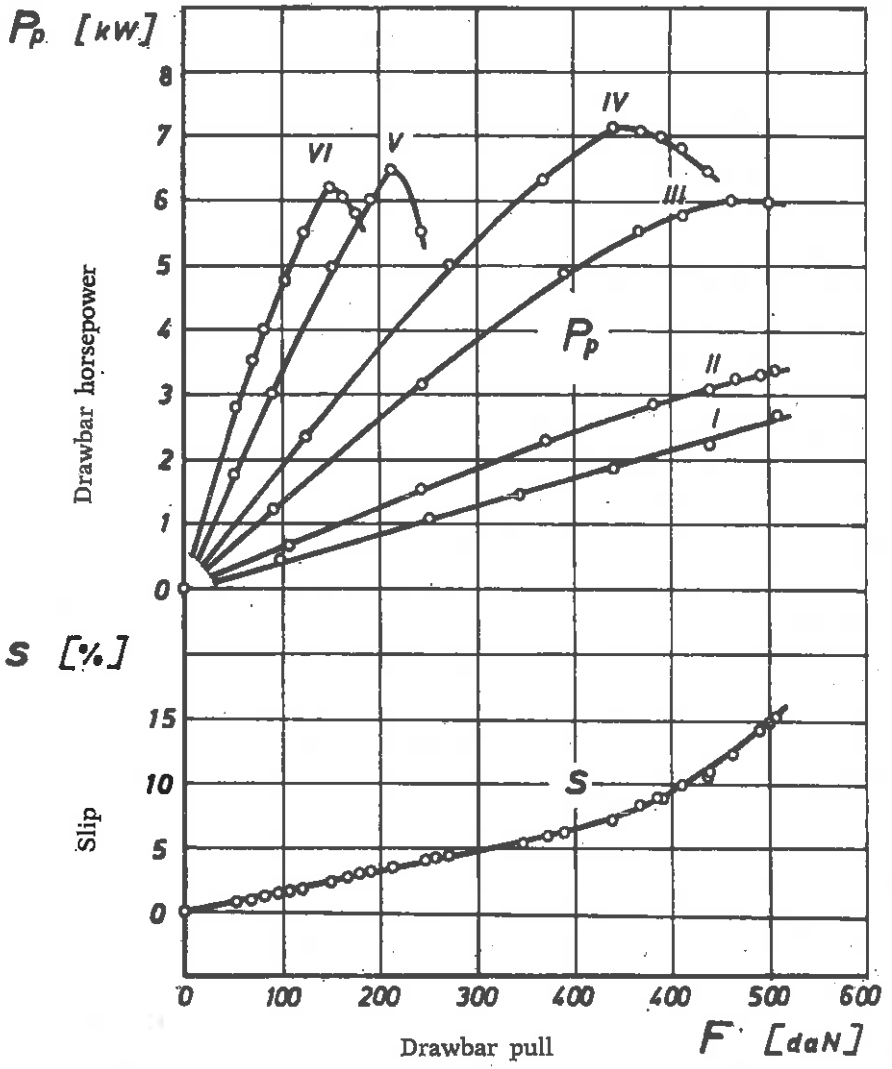
Drawbar test on a tarmacadam track, with ballast



Drawbar test on a tarmacadam track, with ballast



Drawbar test on a tarmacadam track, without ballast



(3 | 4) **TURNING SPACE AND TURNING CIRCLE**

Wheel equipment: front and rear: 6,00 — 16; 4 ply, without ballast

Track of wheels: front and rear: 880 mm

Individual wheel brake not applicable

	Right hand m	Left hand m
Radius of turning space	2.05	2.06
Radius of turning circle	1.97	1.98

(5) **LOCATION OF CENTRE OF GRAVITY** Without ballast

Height above ground	498 mm
Distance forward from the vertical plane containing the axis of the rear wheels	708 mm
Distance from the median plane to the right hand	2 mm

(6) **BRAKING**

Date of tests: 23rd December 1975

Type of track: tarmacadam

Type of decelerometer: MOTO METER, Hermann Schleich, Stuttgart

Weight of ballasted tractor with drier: 1005 kg

		Tractor without ballast	Tractor ballasted
Travelling speed of tractor	km/h	18.5	18.5
Maximum deceleration	m/s^2	4.3	4.2
Stopping distance	m	4.65	4.75
Force exerted on the brake pedal	N	490	470
Force exerted on the brake pedal to achive a deceleration of 2.5 m/s^2	N	195	210

Brake fade characteristics (hot tests)

		With ballast	Without ballast
Maximum deceleration:	hot/cold %	107	91
Stopping distance:	cold/hot %	104	99
Force on pedal:	cold/hot %	113	96
Weight of tractor with driver		1005 kg	805 kg

Efficiency of handbrake: facing up a slope of 16%: good
facing down a slope of 16%: good

Pull on handbrake: 245 N

(7) MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of test: 11th February 1976

Type of sound level meter: Brüel & Kjaer, type 2203

Exhaust location: Silencer on the right-hand of engine, mouth showing to the right

Type of track: Tarmacadam

Results of test: gear: 6 th
travelling speed before acceleration 14.5 km/h
sound level: 90 dB(A)

(8) NOISE MEASUREMENTS AT THE DRIVER'S EAR LEVEL

Date of test: 11th February 1976.

Type of sound level meter and octave filter: Brüel & Kjaer, type 2203 with octave band noise analyzer type 1613

Type of track: Tarmacadam

Type of frequency analyser: Octave filter with eight bands width 37.5 to 9 600 Hz

Results of test:

	Drawbar pull at which the tractor develope the maximum sound level N	Travelling speed km/h	Sound level dB(A)	Loudness, sones
4*	4400	6.7	97	112
5	2000	13.1	97	124

* The first gear tested corresponds to the travelling speed nearest to 7.25 km/h

(9) POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of test: 10th October 1975., Zagreb

Hydraulic fluid: make and type: INA HIDRAOL 70 HD
viscosity: 6.75°E/50°C
viscosity index: 100

Power lift

Type of linkage lock for transport: hydraulic

Opening pressure of the cylinder over - pressure relief valves: no valve fitted

PUMPE CHARACTERISTICS

(i) Opening pressure of relief valve:	120 bar
Sustained pressure by the open relief valve:	118 bar
Pump delivery rate:	
(ii) at minimum pressure:	17,1 1/min
(iii) at maximum hydraulic power:	14,6 1/min
Delivery pressure:	116 bar
Hydraulic power:	2.82 kW

LIFTING FORCES

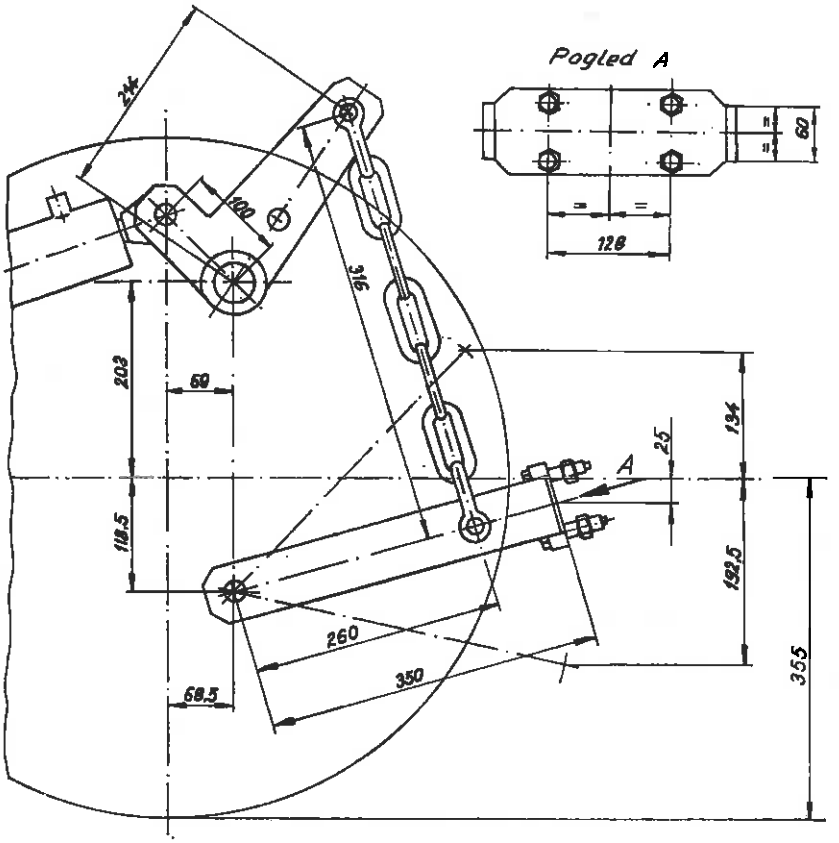
Lifting heights relative to horizontal lower links

mm	— 75	— 50	0	+ 50	+ 100	+ 150	+ 200	+ 250
Force H	7550	7920	8630	9810	10900	11430	9610	7360

Maximum lifting force exerted throughout the whole range 7360 N.
Front of tractor does not lift at maximum lifting force.

The standard frame is not applicable to the special, not standardised design of the power lift

LINKAGE GEOMETRY



Projected lenght in side view:	mm
Lower links	350
Lift arms	214
Lift chains	316
Top link	—
Distance of lift rod connection point from pivot point of lower link	260

The following dimensions are given relative to rear axle centre line 355 mm above ground

Lower link pivot point	68.5 mm behind, 118.5 mm below
Top link pivot point	
Lift arm pivot point	69 mm behind, 203 mm above
Maximum and minimum height of lower link hitch points	134 mm above, 192,5 mm below
Height of lower link hitch points above ground when locked in highest transport position	489 mm

Date: 18th December 1977.

Head of Testing Division: V. OBELIĆ

Director: I. PIRIA