NATIONAL MACHINERY TESTING INSTITUTE

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TEST BULLETIN: OECD No. 806

Date of approval 1981-05-14

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

AGRICULTURAL TRACTOR ZETOR 7011

Manufactured by: Zetor, 632 00 BRNO, Czechoslovakia

Test No. 5571

Test Bulletin: OECD No. 806

Agricultural Tractor ZETOR 7011



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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Tractor manufacturer's name and address:	ZETOR — Brno. Czechoslovakia
Submitted for test by:	The manufacturer
Selected by:	The manufacturer
Place of running in:	National Machinery Testing Institute, Sweden
Duration of running in:	19 hours

Specification of tractor

Tractor	
Make	ZETOR
Model	7011
Type	Four wheel, rear wheel driven, unit construktion
Serial No.	1010
Engine	
Make	Zbrojovka
Model	7001
Type	4-stroke, direct injection diesel engine, water cooled
Serial No.	0117
Cylinder Number	4
Disposition	Vertical, in-line
Bore/Stroke	102 mm/110 mm
Capacity	3 595 dm^3
Compression ratio	17:1
Arrangement of valves	Overhead
Cylinder liners	Wet, replaceable
Fuel system	
Type of fuel feed	Mechanical fuel feed pump, CD1A Motorpal (Piston type)
Make, type and model of fuel filters	Autobrzdy 03-9800.00, full flow replaceable paper element filter
Fuel tank capacity	70 dm^3
Make, type and model of injection pump	Motorpal, PP4A8K 115g-2444, in-line type
Manufacturer's production setting	Fuel delivery 10.5 — 11.0 cm^3 for 200 injections at 1100 rev/min pump speed (bench test figures), injection timing 24.5° — 2°, before T.D.C.
Make, type and model of injectors	Motorpal, multihole injection nozzles DOP 150S 335.4359 in nozzle holders VA 2646
Manufacturer's production setting	14.7+0.8 MPa
Governor	
Make	Motorpal
Type	Mechanical, incorporated in fuel injection pump, RU 10A
Range of engine speed	Governed range of engine speed 600 — 2460 rev/min
Rated engine speed	2200 rev/min

Air cleaner	
Make	Sandrik
Type and model of cleaner:	Oil type, 9420.11 pre-cleaner PC 250 (Centrifugal type)
Oil capacity	1.5 dm^3
Exhaust silencer	Expansion chamber type Dimensions: 90×170×575 mm Vertical outside bonnet on left hand-side, debouch 2.65 m above ground
Lubrication system	
Type	Forced feed from gear type pump with metal strainer in oil sump
Make and type of filters:	Full flow, centrifugal, RHP 2/A, Motor, C. Budejovice. Service period 100 and 200 h
Oil capacity	12 dm^3
Changing period	200 h
Recommended oil	Engine oil according to API-SC/CA SAE 20W/30
Cooling system	
Type	Water cooled (thermosyphon) assisted by centrifugal pump, 380 mm dia 6-blade belt driven fan
Coolant capacity	13 dm^3
Means for temperature control	Thermostat
Pressure	Over pressure 30—40 kPa
Starting system	Electrical
Make	Pal Magneton
Type	443 115 144 722 electrical, solenoid-engaged starter motor, 2.9 kW
Cold starting aids	Motorpal ZS-10-969, incorporated in fuel injection pump
Electrical system	
Voltage	12V
Generator	
Make	Pal Magneton
Type	Alternator 443 113 516 030, 35 A
Battery	
Make	AKUMA
Type	6T 150 Lead-acid, 1 battery 12V
Capacity	150 Ah at 20 h rating
Transmission	
Clutch	
Make	Zbrojovka
Type and diameter of disc	Double plate dry clutch, 280 mm dia, with organic friction material
Method of operation	Foot pedal for gearbox, hand lever for p.t.o.

Gearbox

Make	Own make
Type	Sliding gear. Gearbox with 5 forward speeds and 1 reverse. Reduction gearbox with 2 ranges
No. of speeds	10 forward and 2 reverse

Rear axle and final drive

Make	ZETOR
Type	Crown wheel and pinion, differential and spur gear final drive. Pedal operated self-disengaging differential lock
Oil capacity	Gearbox, rear axle and final drive 25 and 4 l Change period: 1000 hours. Recommended oil PP80. SAE 80

Gear number	Number of engine revolutions for one revolution of driving wheels	Nominal travelling speed for rated engine speed* km/h	m/s
Forward			
1 – Low	517.460	1.12	0.31
2	347.754	1.67	0.46
3	249.545	2.32	0.65
4	162.561	3.57	0.99
5	97.323	5.96	1.65
1 – High	122.178	4.75	1.32
2	82.109	7.06	1.96
3	58.921	9.84	2.73
4	38.383	15.10	4.20
5	22.979	25.23	7.01
Reverse			
Low	396.440	1.46	0.41
High	93.604	6.19	1.72

* With tyre rolling radius of 699 mm (Tyres 16.9/14-30).

Power take off

Make	ZETOR
Location	At rear of tractor
Type of drive	Independent p.t.o. Engaged by hand lever operated disc clutch 2 shiftable speeds 540/1000 rev/min
Dimensions	According to ISO 500
No. of splines	6 (dia. 34.9 mm)
Height above ground	705 mm, in tractor's median plane, distance to the rear axle centre 268 mm
540 rev/min p.t.o. speed	596 rev/min at rated engine speed; standard p.t.o. speed 540 rev/min at 1994 rev/min engine speed. Direction of rotation clockwise viewed facing driving end
1000 rev/min p.t.o. speed	1073 rev/min at rated engine speed; Standard p.t.o. speed 1000 rev/min at 2050 rev/min. Direction of rotation clockwise viewed facing driving end

Belt pulley
(Not fitted for test)

Power lift

Make	Own make
Type	Single acting. Gear type pump with 2 shiftable speeds. Independent pumpdrive. Working pressure 16.0—18.0 MPa. Oil supplied from rear axle housing to ram cylinder. Oil capacity: 25 dm^3. Category 2 implement linkage according to ISO 730 with top link sensing. Draught, mixed and position control. Four operating levers. External tappings: 1 single acting or 1 double acting
Drawbar	Swinging drawbar. Height above ground 515 mm. Horizontal distance from rear axle 623—668 mm. Position relative to p.t.o. 355—400 mm. Lateral adjustment 170—200 mm from centre position. Pivot position relative to real wheel centre 180 mm forward. Coupling pin diameter 30 mm
Hitch	Height above ground 630—930 mm, adjustable in 7 steps, hitch hole 26 mm diam., horizontal distance from rear axle 623 mm, position relative to p.t.o. 355 mm. Permissible vertical load 11.8 kN

Steering

Make	NSK — Japan. Technometra — Radotin
Type	Mechanical power assisted, hydraulic pump with own oil circuit

Brakes

Make	Own make
Type	Hydraulically actuated, dry drum brakes mounted on final 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 7.50—16/6-ply rating, crossply tyres. Maximum permissible mass on each tyre 745 kg at 280 kPa pressure. Track width 1430, 1655, 1805 changed by extending axle
Driving wheels	Two at rear. Type: Pneumatic, multirib 16.9/14—30/8-ply rating, crossply tyres. Maximum permissible mass on each tyre 2245 kg at 170 kPa pressure. Track width 1425, 1500, 1575, 1650, 1725, 1800 mm changed by reversing wheel centres and off-set lugs or rims.
Wheelbase	2247 mm

Seat

Make	ZETOR, model 5911, 5400
Type	Mechanical suspension, adjustable to driver's mass. Damping by hydraulic shock absorber. Range of adjustment 150 mm forward and backwards and 60 mm up and down

Protective cab

Make	Own make
Type	BK 5911

Number of grease points
Whole tractor 24

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

	Height above ground of centre mm	Size mm	Distance from outside edge of tractor to centre[2] mm
Head lights	1040	130	820
Side lights	1480	60×145[1]	300
Rear lights	1495	70×210[1]	155

[1] Rectangular
[2] With track width of 1425 mm Rear wheels
1430 mm Front wheels

Conditions during test

Masses:	Tractor without driver but with tanks full.	
Without ballast	Part of mass on front wheels	1 060 kg
	Part of mass on rear wheels	1 870 kg
	Total mass	2 930 kg
With ballast	Part of mass on front wheels	1 220 kg
	Part of mass on rear wheels	2 600 kg
	Total mass	3 820 kg
Ballast	Front: Frame and front weights — total	160 kg
	Rear: Weights — total	300 kg
	Liquid total:	430 kg
Track setting during tests	Front: 1 430 mm Rear: 1 425 mm	

Overall dimensions

	Length, m	Width,[1] m	Height,[2] m
With ballast	3.75	1.85	2.65
Without ballast	3.72	1.85	2.65

Minimum ground clearance 480 mm to underside of drawbar frame.

[1] With track width of 1425 mm
[2] Measured to top of exhaust pipe

Fuel and lubricants used in tests

Diesel fuel to Swedish Standard SS 155432. Density at 15°C 0.830 g/cm³. Viscosity at 20°C 3.2 mm²/s. Cetane number 49.
Engine oil Benzina M5AD*
Transmission oil Benzina PP 80**

* Corresponds to SAE 20W/30 API SC/CA
** Corresponds to SAE 80 API GL4

Compulsory tests

1. Main power take-off performance

Date and location of tests: 1980-07-03, Ultuna, Uppsala, Sweden
Type of dynamometer: Eddy current, make Zöllner

Power	Speed rev/min		Fuel consumption				Specific energy	
kW	Engine	p.t.o.	l/h	kg/h	g/MJ	kg/kWh	MJ/l	kWh/l
Maximum power — 2 hours test								
43.8	2200	596	13.77	11.43	72.5	0.261	11.5	3.18
The speed recommended by the manufacturer for drawbar work								
43.8	2200	596	13.77	11.43	72.5	0.261	11.5	3.18
Varying loads at rated engine speed								
(1) 85% of the torque obtained at maximum power								
38.6	2282	618	12.11	10.05	72.3	0.260	11.5	3.19
(2) Unloaded								
0.3	2367	641	3.81	3.16	—	—	—	—
(3) 50% of the load defined in (1)								
19.7	2334	632	7.64	6.34	89.3	0.321	9.3	2.58
(4) Maximum power								
44.4	2200	596	13.69	11.36	71.1	0.256	11.7	3.24
(5) 25% of the load defined in (1)								
9.9	2352	637	5.57	4.62	129.1	0.465	6.4	1.79
(6) 75% of the load defined in (1)								
29.4	2315	627	9.78	8.12	76.7	0.276	10.8	3.01
Varying loads, the governor hand lever in the position corresponding to the standard p.t.o. speed at full load (540 rev/min)								
(1) 85% of the torque obtained at maximum power								
36.5	2079	563	10.99	9.12	69.4	0.250	12.0	3.32
(2) Unloaded								
0.3	2175	589	3.18	2.64	—	—	—	—
(3) 50% of the load defined in (1)								
18.8	2142	580	6.83	5.67	83.9	0.302	9.9	2.75
(4) Maximum power								
41.5	1994	540	12.48	10.36	69.4	0.250	12.0	3.32
(5) 25% of the load defined in (1)								
9.5	2160	585	5.04	4.18	122.3	0.440	6.8	1.89
(6) 75% of the load defined in (1)								
27.8	2116	573	8.96	7.44	74.2	0.267	11.2	3.11

Standard specific fuel consumption: g/MJ (kg/kWh)
a) 72.3 (0.260)
b) 89.3 (0.321)
c) 69.4 (0.250)
d) 83.9 (0.302)

No load, maximum engine speed		2367 rev/min
Equivalent crankshaft torque at maximum power		190 Nm
Maximum equivalent crankshaft torque		200 Nm at 1600 rev/min engine speed
Mean atmospheric	temperature	17°C
	pressure	101.6 kPa
	relative humidity	57%
Maximum temperature	coolant	83°C
	engine oil	104°C
	fuel	21°C
	air intake	23°C

2. Drawbar performance

Date of tests:	1980-08-25 – 28
Type of track:	Drum dynamometer with concrete surface
Height of drawbar above ground:	unballasted 695 mm
	ballasted 645 mm
Tyre inflation pressure:	unballasted 100 kPa
	ballasted 130 kPa

Results see Table 1

Engine oil consumption during ten hours duration of test (ii) was 2.4 g/h. Test (iv) was carried out with additional ballast. Power, speed, slip and fuel consumption do not correspond to test (ii) gear 1H.

Table 1. Drawbar performance

Gear	Power	Draw-bar pull	Speed		Engine speed		Wheel slip	Spec. fuel consumption		Spec. energy		Temperature				Atmospheric conditions		
						rev/ min			kg/ kWh			Coo-lant °C	Fuel °C	Engine oil °C	Transm. oil °C	Tempe-rature °C	Rel. hum. %	Pressure kPa
	kW	kN	m/s	km/h	rev/s		%	g/MJ		MJ/l	kWh/l							
i) Maximum power (unballasted tractor)																		
1 H	28.3	24.6	1.15	4.14	38.6	2317	15.0	93.3	0.336	8.9	2.47	80	20	79	48	18	52	101.0
5 L	34.9	24.6	1.42	5.11	38.1	2285	15.0	89.9	0.324	9.2	2.57	80	21	86	51	19	52	101.0
2 H	37.3	22.2	1.68	6.05	36.8	2205	12.3	86.8	0.312	9.6	2.66	80	22	89	38	20	52	101.0
3 H	39.0	15.8	2.47	8.89	36.7	2200	7.6	83.6	0.301	9.9	2.76	80	21	90	42	19	52	101.0
4 H	38.9	9.9	3.93	14.15	36.7	2200	4.6	83.9	0.302	9.9	2.75	80	21	88	45	20	52	101.0
ii) Maximum power (ballasted tractor)																		
1 L	8.9	30.6	0.29	1.04	39.5	2372	15.0	155.0	0.558	5.4	1.49	73	21	87	55	20	68	102.0
2 L	13.0	31.0	0.42	1.51	39.3	2358	15.0	124.8	0.449	6.6	1.85	75	21	84	54	20	68	102.0
3 L	18.0	31.1	0.58	2.09	39.1	2345	14.8	108.6	0.391	7.6	2.12	72	20	78	53	19	68	102.0
4 L	27.0	31.0	0.87	3.13	38.6	2314	15.0	95.8	0.345	8.7	2.41	85	21	91	56	20	68	102.0
1 H	35.5	30.9	1.15	4.14	38.1	2288	15.0	88.3	0.318	9.4	2.61	85	22	94	51	19	68	102.0
5 L	38.0	26.2	1.45	5.22	36.7	2200	11.6	86.3	0.311	9.6	2.67	85	21	90	53	20	68	102.0
2 H	38.4	21.8	1.76	6.34	36.7	2200	9.0	85.1	0.306	9.8	2.71	83	21	78	35	19	68	102.0
3 H	39.2	15.5	2.53	9.11	36.7	2200	6.4	83.6	0.301	9.9	2.76	85	22	87	39	20	68	102.0
4 H	38.9	9.8	3.97	14.29	36.7	2200	4.0	84.2	0.303	9.8	2.74	85	22	97	48	21	68	102.0
iii) Five hour test at 75% of pull at maximum power																		
2 H	31.1	16.4	1.90	6.84	38.6	2313	6.5	85.0	0.306	9.8	2.71	85	20	101	85	21	69	102.2
iv) Five hour test corresponding to 15% wheelslip																		
1 H	37.1	30.9	1.20	4.32	38.0	2279	10.3	85.4	0.307	9.7	2.70	85	22	107	105	20	63	101.6

3. Turning space and turning circle

Details of wheel equipment: As in specification without ballast
Track of wheels: Front 1 430 mm
Rear 1 425 mm

	With brakes		Without brakes	
	Left-hand m	Right-hand m	Left-hand m	Right-hand m
Radius of turning space	3.57	3.58	4.01	4.03
Radius of turning circle	3.35	3.36	3.79	3.81

4. Location of centre of gravity

Height above ground	959 mm
Distance forward from the vertical plane containing the axis at rear wheels	794 mm
Distance from the median plane	8 mm (To the left)

5. Braking

Date of tests: 1980-10-02 – 1981-01-21
Tractor masses during brake tests:

Front kg	Rear kg	Total kg
1490	3600	5090

Type 0 (ordinary cold service braking device performance) test

Speed before application of brakes 27.1 km/h

Ballasted	Braking device control force, N	575*	400	345	300
	Mean deceleration, m/s²	4.49	3.19	2.50	1.97
Unballasted	Braking device control force, N	400	340	300	275
	Mean deceleration, m/s²	3.61	3.15	3.01	2.50

Type I (fade) test

Braking device control force, N	600*	550	460	385	350
Mean deceleration, m/s²	4.31	4.29	3.33	2.50	2.00

* Not locked

Maximum deviation of tractor from its original course	None
Abnormal vibration	Towing
The brakes were heated by	

Parking braking device test

	18 per cent slope		12 per slope with trailer of 3000 kg	
	Up	Down	Up	Down
Braking device control force, N	203	247	226	284

6. Measurement of external noise level

Date of tests: 1980-07-17
Type of sound level meter: Brüel & Kjaer 2204
Type of track: Tarmac
Results of tests:
Gear 5 High
Travelling speed before acceleration 20.6 km/h
Sound level 89 dB(A)

7. Noise measurement at the driver's ear

Date and location of tests: 1980-05-09, Alnarp, Sweden
Type of sound level meter: Brüel & Kjaer 2204
Type of track: Tarmac
Cab fitted: Yes

Result of tests

Gear	Drawbar pull at which the tractor develops the maximum sound level kN	Measured travelling speed m/s	(km/h)	Sound level dB(A)
	(i) all openings closed			
2 High (*)	20.1	1.72	(6.2)	87
2 High (*)	light load	2.17	(7.8)	84
top gear	light load	7.67	(27.6)	84.5

(*) Gear corresponds to the nominal travelling speed nearest to 2.08 m/s (7.5 km/h)

8. Power lift and hydraulic pump performance

Date of tests: 1980-12-11 – 15

Hydraulic fluid:

Make and type: The same as transmission
Viscosity: Min. 7.5 mm^2/s at 100°C
Viscosity index: 90
Type of linkage lock for transport: Hydraulic

Power Lift

	Height above ground in down position	Vertical movement	Maximum force exerted through full range	Corresponding pressure of hydraulic fluid	Moment about rear axle	Tilt angle of mast
	mm	mm	kN	MPa	kNm	degrees
At hitch points	266	596	17.3	14.4	15.0	–
On the frame	207	777	11.0	14.4	16.2	18.5

Temperature of hydraulic fluid at start of test 60°C.

Hydraulic pump performance

Tapping point:	Double acting external tapping
Pressure specified by the manufacturer for external hydraulic motor	–
Openeing pressure of the relief valve	13.5/13.5* MPa
Sustained pressure with relief valve open	15.9/15.7* MPa
Opening pressure of the unloaded valve	–
Closing pressure of the unloaded valve	–
Pump delivery rate at rated engine speed:	
at minimum pressure	0.38/0.65*l/s (22.9/38.9*l/min)
at 90 % of opening pressure of the relief valve	0.24/0.47*l/s (14.4/28.5*l/min)
Hydraulic power at 90 % of opening pressure of the relief valve	3.1/5.9* kW
Temperature of hydraulic fluid	60–64°C

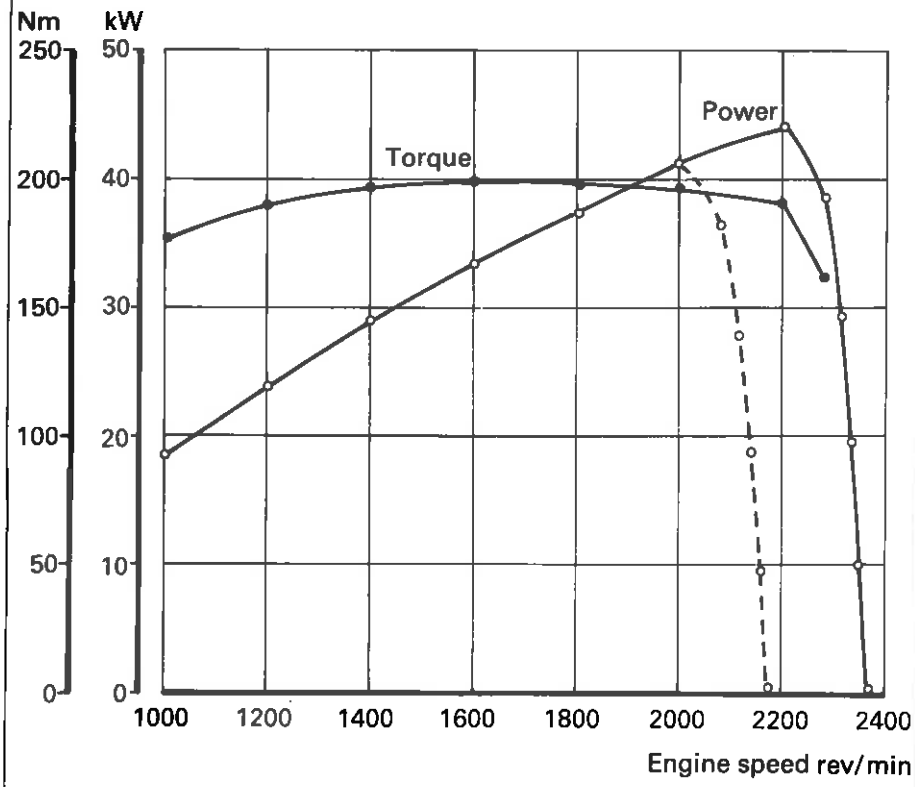
* Hydraulic pump with 2 shiftable speeds

Table 2. Linkage geometry when connected to the standard frame

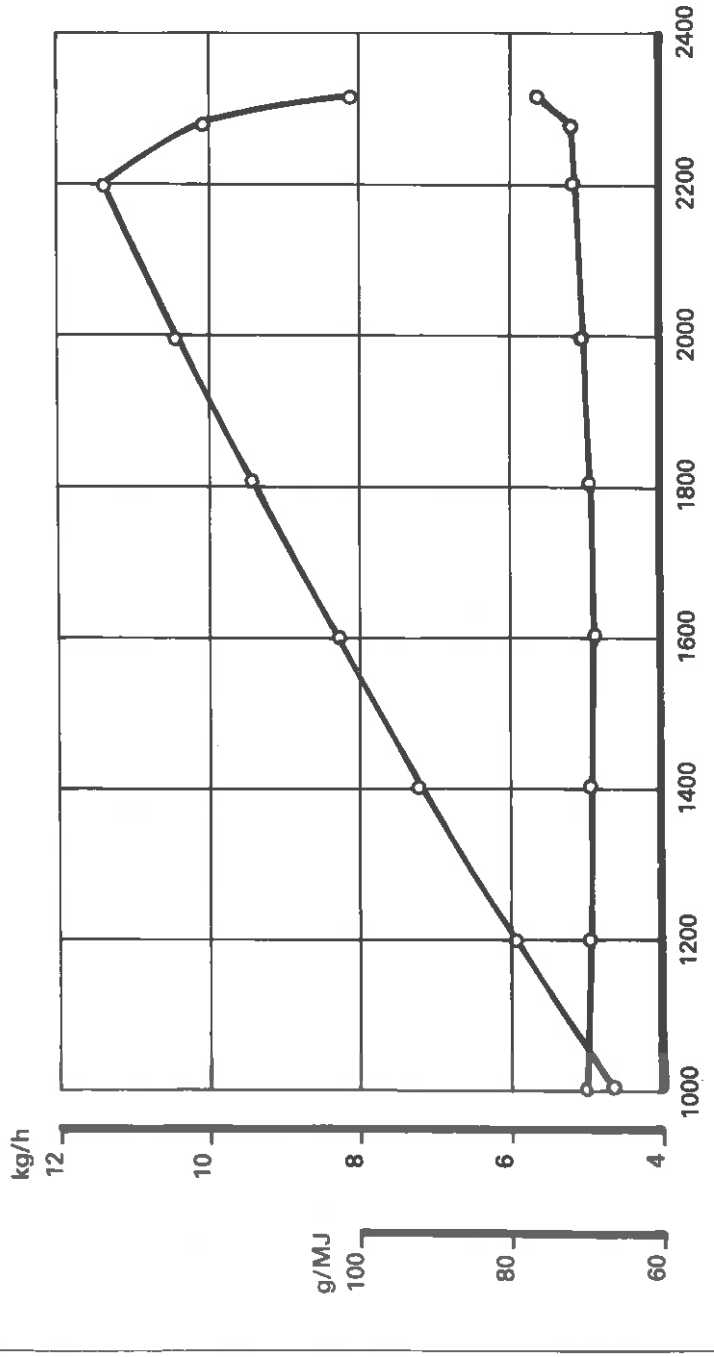
Projected length in side view	
lower links, mm	782.5
lift arms, mm	320
lift rods, mm	520
top link, mm	588
Distance of lift rod connection point from pivot point of lower link, mm	391
The following dimensions are given relative to the rear wheel centre line, situated 699 mm above the ground level	
Lower link pivot point	83 mm behind, 138 mm below
Top link pivot point	293 mm behind, 212 mm above
Lift arm pivot point	35 mm behind, 362 mm above
Maximum and minimum height of lower link hitch points	158 mm above, 433 mm below
Height of lower link hitch points when locked in transport position	158 mm above

Ultuna, Uppsala 1981-03-06
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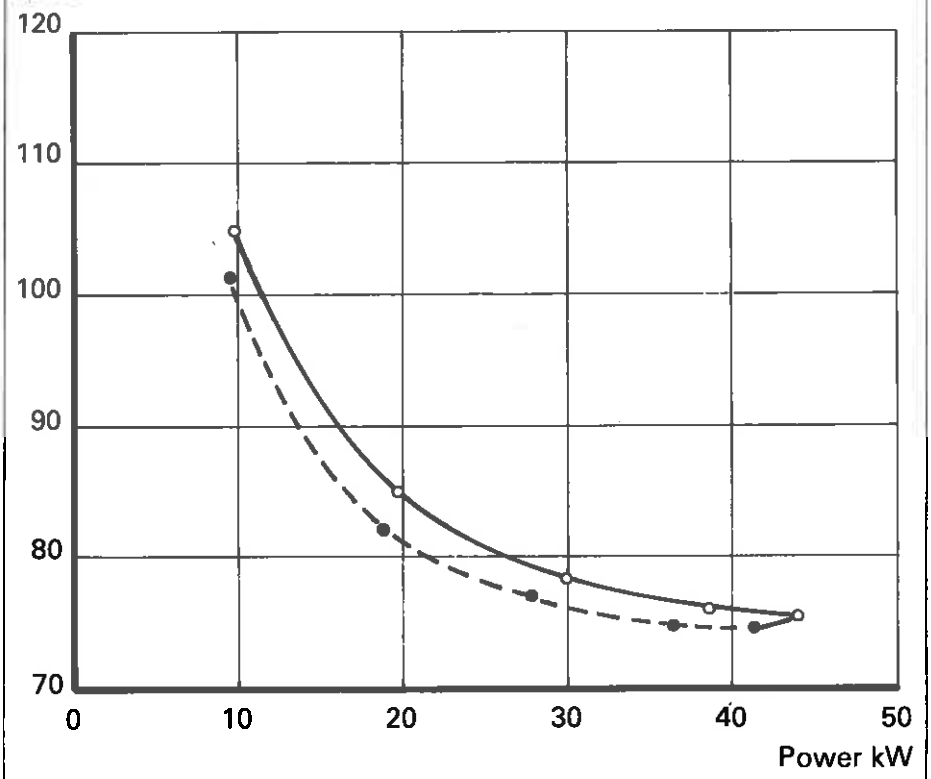
National Machinery Testing Institute	**Power take-off test Zetor 7011**	Figure 1



National Machinery Testing Institute	**Power take-off test Zetor 7011**	Figure 2



National Machinery Testing Institute	**Power take-off test Zetor 7011**	Figure 3



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