STATENS MASKIN-PROVNINGAR

NATIONAL MACHINERY TESTING INSTITUE

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TEST BULLETIN: OECD No. 900

Date of approval 1984-09-05

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

AGRICULTURAL TRACTOR ZETOR 7211

Manufactured by:
Agrozet-Zetor, Brno, Czechoslovakia

Test No. 6563

Test bulletin: OECD No. 900

Agricultural tractor Zetor 7211

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.

TABLE OF CONTENTS

Tractor manufacturer's name and address:	Agrozet-Zetor, Brno, Czechoslovakia
Submitted for test by:	Zetor Sweden AB, Helsingborg, Sweden
Selected for test by:	The manufaturer with the agreement of the testing institute
Place of running in:	Agrozet-Zetor, Brno, Czeckoslovakia
Duration of running in:	60 hours

Specifikation of tractor

Make	Zetor
Model	7211
Type	Rear wheel driven, unit construction
Serial No.	509

Engine

Make	Zbrojovka
Model	7201
Type	4-stroke, direct injection, diesel engine, water cooled
Serial No.	075
Cylinder Number	4
Disposition	Vertical, in-line
Bore/Stroke	102/110 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, PP4M8K 1e 3113, in-line type
Manufacturer's production setting	Fuel delivery 11.2–11.8 cm^3 for 200 injections at 1100 rev/min pump speed (bench test figures), injection timing 22.5° + 1° before T.D.C.
Make, type and model of injectors	Motorpal, multihole injection nozzles (4 holes) DOP 160S 430 in nozzle holders VA 78 S 453 a 2683
Manufaturer's production setting	16.5 + 0.8 MPa

Governor

Make	Motorpal
Type	Mechanical, incorporated in fuel injection pump, RV 3 M 300/1100-2534
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)
Oil capacity	1.3 dm^3
Exhaust silencer	Expansion chamber type Dimensions: 93×160×582×1503 mm Vertical outside bonnet on left hand-side, debouch 2.69 m above ground
Lubrication system	
Type	Forced feed from gear type pump with metal strainer in oil sump
Make and type of filter	Full flow, centrifugal, RHP 2/A, Motor C. Budejovice, service period 200 h
Oil capacity	12 m^3
Changing period	200 h
Recommended oil	Engine oil according to API SC/CB, SAE 20W/30
Cooling system	
Type	Water cooled assisted by centrifugal pump, 380 mm dia 6-blade belt driven fan
Coolant capacity	10.5 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–12 V
Cold starting aids	Device for increasing fuel delivery incorporated in fuel injection pump
Electrical system	
Voltage	12 V
Generator	
Make	Pal Magneton
Type	Alternator, 443 113 516 184, 14V/55A
Battery	
Make	Akuma
Type	12 D 2.1 Lead-acid, 1 battery 12 V
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	Zetor
Type	Sliding gear. Gearbox with 5 forward speeds and 1 reverse. Reduction gearbox with 2 ranges
No. of speeds	Totally 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 + 3.8 dm^3 (Includes volume necessary for power lift)
Filter	Full-flow oil filter with replaceable paper element, changing period 600 hours. Suction filter with magnetic element, cleaning period 200 hours
Change period	1200 hours
Recommended oil	According to API GL-4, SAE 80W

Front axle and final drive

Make and type	Zetor not driven

Gear	Number of engine revolutions for one revolution of driving wheels	Nominal travelling speed at rated engine speed*	
		km/h	m/s
Forward			
1L	344.8	1.88	0.52
2L	264.9	2.44	0.68
3L	190.1	3.40	0.95
4L	133.5	4.84	1.35
5L	97.3	6.65	1.85
1H	81.4	7.95	2.21
2H	62.5	10.35	2.88
3H	44.9	14.41	4.00
4H	31.5	20.54	5.70
5H	23.0	28.13	7.81
Reverse			
L	255.5	2.53	0.70
H	61.2	10.57	2.94

* With tyre rolling radius index of 780 mm (Tyres 16.9/14-34)

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	750 mm in tractor's median plane, distance to the rear axle centre 268 mm

Proportional engine speed p.t.o.

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 engine speed. Direction of rotation: clockwise, viewed facing driving end.

Proportional ground speed p.t.o.

Reduction gear in high position	Distance travelled for one revolution of the p.t.o. 349 mm. Number of p.t.o. revolutions for one revolution of driving wheel 14.04. Direction of rotation: clockwise, viewed facing driving end.
Reduction gear in low position	Distance travelled for one revolution of the p.t.o. 82 mm. Number of p.t.o. revolutions for one revolution of driving wheel 59.46. Direction of rotation: clockwise, viewed facing driving end.

Belt pulley (Not fitted for test)

Power lift

Make	Zetor
Type	Single acting. Gear type pump with 2 shiftable speeds. Independent pump drive from p.t.o. intermediate shaft. Working pressure 16.0–18.0 MPa. Oil supplied from rear axle housing to ram cylinder. Oil capacity: 25 dm^3 Oil capacity available for external use 10 dm^3 (stationary and moving). Category 2 implement linkage according to ISO 730 with top link sensing. Draught, mixed and position control. Four operating levers. External tappings: 2 single acting or 1 double acting.
Dimensions	Length of lower links: 856 mm –"– top link: 590–770 mm –"– lift rods: 455–585 mm Vertical adjustment: 169–490 mm above ground in lowest position.

Drawbar

Height above ground 455–540 mm.
Vertical distance relative to p.t.o. 210/295 mm below.
Horizontal distance from rear axle 680 mm.
Position relative to p.t.o. 410 mm.
Lateral and longitudinal adjustment: none
Coupling pin diameter 30 mm.

Hitch

Height above ground 540 mm, vertical distance relative to p.t.o. 210 mm below, horizontal distance from rear axle 443 mm, position relative to p.t.o. 180 mm. Permissible vertical load 15 kN.

Hitch (Continental type)

Height above ground 775–975 mm, adjustable in 5 steps, vertical distance relative to p.t.o. 25–225 mm above, hitch-hole diameter 35 mm, horizontal distance from rear axle 618 mm, position relative to p.t.o. 355 mm.
Permissible vertical load 10.0 kN.

Steering

Make: NSK – Japan; Technometra – Radotin.

Type: Mechanical power assisted, hydraulic pump directly driven by the engine with own oil circuit.
Oil capacity 4.4 dm^3.
Recommended oil ISO VG 22

Change period: 1200 hours

Filter: Full-flow oil filter with replaceable paper element.

Brakes

Make: Zetor

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 7.50–20/6-ply rating, cross-ply tyres.
Maximum permissible mass on each tyre 850 kg at 250 kPa pressure.
Track width 1430, 1655, 1805 mm by changing length of front axle.

Driving wheels: Two at rear.
Type: Pneumatic, multirib 16.9/14–34/8-ply rating, cross-ply tyres.
Maximum permissible mass on each tyre 2380 kg at 170 kPa pressure.
Track width 1425, 1500, 1575, 1650, 1725, 1800 mm changed by reversing wheel centres and off-set lugs on rims.

Wheelbase

2257 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	Zetor
Type	BK 6011

Number of grease points

Whole tractor	22

Overall dimensions (Tyre size front 7.50-20, rear 16.9/14-34)

	Length, m	Width[1], m	Height[2], m
With ballast	3.76	2.23	2.69
Without ballast	3.76	2.23	2.69

Minimum ground clearance 415 mm to underside of drawbar frame.

[1] With track width of 1800 mm (front wheels)
[2] Measured to top of exhaust pipe.

Lighting

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

	Height above ground of centre	Size	Distance from outside edge of tractor to centre[2]
	mm	mm	mm
Head lights	1100	130	805
Side lights	**1505**	**40×55[1]**	**260**
Rear lights	1560	70×105[1]	225
Reflectors	1100	80	85

[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	1090 kg
	Part of mass on rear wheels	2100 kg
	Total mass	3190 kg
With ballast	Part of mass on front wheels	1250 kg
	Part of mass on rear wheels	2870 kg
	Total mass	4120 kg
Ballast	Front: Frame and front weights	total 160 kg
	Rear: Weights	total 270 kg
	Liquid	total 500 kg

Track setting

Front: 1430 mm
Rear: 1425 mm

Fuel and lubricants used in tests

Diesel fuel to Swedish Standard SS 155432. Density at 15°C 0.840 g/cm^3. Viscosity at 20°C 3.2 mm^2/s. Cetane number 49. Engine oil. According to API SC/CB, OA-M5AD (SAE 20W/30). Transmission oil. According to API GL-4, OA-PP80 (SAE 80W)

Compulsory tests

1. Main power take-off performance

Date and location of tests: 1983-09-23, 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								
At 2-hour test								
43.9	2200	596	13.74	11.54	73.0	0.263	11.48	3.19
At rated engine speed								
43.9	2200	596	13.74	11.54	73.0	0.263	11.48	3.19
Varying loads, the governor hand lever in the position corresponding to maximum power								
(1) 85% of the torque at max. power, rated engine speed								
38.4	2266	614	12.36	10.38	75.0	0.270	11.20	3.11
(2) Unloaded								
0.3	2384	646	4.20	3.53	– –	– –	– –	– –
(3) 50% of the torque defined in (1)								
19.8	2336	633	7.90	6.64	93.1	0.335	9.03	2.51
(4) Maximum power								
43.8	2200	596	13.63	11.45	72.6	0.261	11.57	3.21
(5) 25% of the load defined in (1)								
10.0	2362	640	5.89	4.95	136.8	0.492	6.14	1.71
(6) 75% of the load defined in (1)								
29.3	2300	623	9.99	8.39	79.6	0.286	10.56	2.93
Varying loads, the governor hand lever in the position corresponding to standard p.t.o. speed at full load (540 rev/min)								
(1) 85% of the torque at maximum power								
35.9	2041	553	10.99	9.23	71.4	0.257	11.76	3.27
(2) Unloaded								
0.2	2215	600	3.61	3.03	– –	– –	– –	– –
(3) 50% of the torque defined in (1)								
18.7	2130	577	7.12	5.98	88.7	0.319	9.47	2.63
(4) Maximum power								
41.1	1993	540	12.44	10.45	70.6	0.254	11.90	3.30
(5) 25% of the torque defined in (1)								
9.5	2163	586	5.26	4.42	129.1	0.465	6.51	1.81
(6) 75% of the torque defined in (1)								
27.6	2089	566	9.05	7.60	76.6	0.276	10.97	3.05

Standard specific fuel consumption:
75.0(0.270)/93.1(0.335) g/MJ(kg/kWh)
71.4(0.257)/88.7(0.319) g/MJ(kg/kWh)

No load maximum engine speed	2384 rev/min
Torque at maximum power	191 Nm
Maximum torque	212 Nm at 1384 rev/min engine speed

Mean atmospheric conditions:	Temperature	19°C
	Pressure	101.6 kPa
	Rel. humidity	50%
Maximum temperatures:	Coolant	79°C
	Engine oil	98°C
	Fuel	20°C
	Engine air intake	24°C

2. Drawbar performance

Date of tests: 1984-12-09 – 14
Type of track: Drum dynamometer with concrete surface
Height of drawbar above ground

unballasted	530 mm
ballasted	510 mm

Tyre inflation pressure:

unballasted	80 kPa
ballasted	100 kPa

Results see Table 1.
Engine oil consumption during ten hours duration of test (iii and iv) was 32 g/h. Test (iv) was carried out with additional ballast. Power, speed, slip and fuel consumption do not correspond to test (ii) gear 3 L.

Table 1. Drawbar performance

Gear	Power	Draw-bar pull	Speed		Engine speed		Wheel slip	Spec. fuel consumption		Spec. energy		Temperature			
												Coo-lant	Fuel	Engine oil	Transm. oil
	kW	kN	m/s	km/h	rev/s	rev/min	%	g/MJ	kg/kWh	MJ/l	kWh/l	°C	°C	°C	°C
i) Maximum power (unballasted tractor)															
3L	19.8	24.4	0.81	2.92	38.6	2318	15.5	114.5	0.414	7.30	2.03	51	15	43	27
4L	27.9	24.7	1.13	4.07	37.8	2268	15.2	98.5	0.355	8.53	2.37	79	18	59	32
5L	36.7	24.3	1.51	5.44	36.7	2200	14.8	87.8	0.316	9.56	2.66	80	18	90	66
1H	37.4	19.8	1.89	6.80	36.7	2200	10.8	85.7	0.309	9.80	2.72	80	18	94	63
2H	38.9	15.3	2.54	9.14	36.7	2200	8.1	82.6	0.297	10.18	2.83	80	18	92	72
3H	39.3	10.8	3.64	13.10	36.7	2200	5.4	82.0	0.295	10.25	2.85	80	18	90	67
4H	38.6	7.3	5.29	19.04	36.7	2200	3.8	83.4	0.300	10.07	2.80	80	18	91	74
ii) Maximum power (ballasted tractor)															
1L	13.8	30.7	0.45	1.62	39.1	2345	15.0	122.6	0.442	6.85	1.90	79	17	86	68
2L	18.2	31.3	0.58	2.09	38.7	2320	15.4	108.9	0.392	7.71	2.14	79	18	84	66
3L	25.0	31.3	0.80	2.88	38.3	2300	15.2	98.2	0.353	8.56	2.38	80	17	81	65
4L	34.3	31.3	1.10	3.96	37.2	2233	15.0	89.6	0.322	9.38	2.61	79	19	74	63
5L	38.1	24.4	1.56	5.62	36.7	2200	11.0	84.6	0.305	9.92	2.75	80	18	90	71
1H	38.8	20.3	1.91	6.88	36.7	2200	8.9	83.1	0.299	10.11	2.81	80	18	91	75
2H	39.7	15.5	2.56	9.22	36.7	2200	6.7	81.2	0.292	10.34	2.88	79	18	89	76
3H	39.4	10.8	3.65	13.14	36.7	2200	4.5	81.4	0.293	10.32	2.87	79	17	90	77
4H	38.4	7.3	5.26	18.94	36.7	2200	2.8	83.2	0.299	10.10	2.81	79	18	92	81
iii) Five hour test at 75% pull at maximum power															
1H	31.0	15.2	2.04	7.34	37.9	2275	5.2	84.2	0.303	9.98	2.77	79	17	89	82
iv) Five hour test corresponding to 15% wheelslip															
3L	26.4	31.3	0.84	3.02	38.1	2288	12.3	--	--	--	--	79	22	93	99

Atmospheric conditions

	Temperature	Relative humidity	Pressure
	°C	%	kPa
Maximum power			
unballasted tractor	13–22	36	99.3
ballasted tractor	13–21	65	99.8
Five hour tests			
at 75% pull at max power	8–11	20	101.3
at max. pull	15–22	44	101.4

3. Turning space and turning circle

Details of wheel equipment: As in specification without ballast
Track of wheels: Front 1430 mm
Rear 1425 mm

	With brakes		Without brakes	
	Left-hand m	Right-hand m	Left-hand m	Right-hand m
Radius of turning space	3.54	3.47	3.99	3.97
Radius of turning circle	3.35	3.28	3.80	3.78

4. Location of centre of gravity

Height above ground	1008 mm
Distance forward from the vertical plane containing the axis at rear wheels	754 mm
Distance from the median plane	2 mm (to the left)

5. Braking

Date of tests: 1984-03-20 – 04-06.
Tractor masses during brake tests:
Front: 1500 kg Rear: 3600 kg Total: 5100 kg

Type 0 (ordinary cold service braking device performance) test

Speed before application of brakes:
ballasted tractor 28.9 km/h, unballasted tractor 29.4 km/h

Ballasted	Braking device control force,	N	565*	505	470	330	270	200
	Mean deceleration,	m/s^2	4.23	3.90	3.50	2.50	2.00	1.50
Unballasted	Braking device control force,	N	580*	360	325	265	200	150
	Mean deceleration,	m/s^2	3.87	3.62	3.00	2.50	2.00	1.50

* Locked

Type I (fade) test

Braking device control force,	N	810*	650	540	440	335	240
Mean deceleration	m/s^2	4.19	3.50	3.00	2.50	2.00	1.50

* One wheel locked

Brakes were heated by Towing
Comments on deviation and vibration None

Parking braking device test

		18 per cent slope		12 per cent slope with trailer of 3000 kg	
		Up	Down	Up	Down
Braking device control force	N	440	300	440	300

6. Measurement of external noise level

Date of test: 1984-03-19
Type of sound level meter: Brüel & Kjær 2204
Type of track: Tarmac

Result of tests:

Gear 5 High
Travelling speed before acceleration: 21.6 km/h
Sound level: 88 dB(A)

7. Noise measurement at the driver's ear

Date and location of tests: 1983-09-08, Alnarp, Sweden
Type of sound level meter: Brüel & Kjær 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)	N
all openings closed					
1H*	20.5	1.94	7.0	84	– –
5L	23.0	1.58	5.7	85	82.5
4H	8.0	5.41	19.5	85	– –
1H*	light load	2.36	8.5	80.5	– –
Top gear	light load	8.33	30.0	80	– –

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

8. Power lift and hydarulic pump performance

Date of test: 1983-11-24

Hydraulic fluid

Make and type: The same as transmission
Viscosity: Min. 7.5 mm^2/s (cSt) 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 the hitch points	196	662	23.5	14.4	21.6	– –
On the frame	195	864	17.5	14.4	26.8	19*

Temperatur of hydraulic fluid at start of test 50°C

* Tilt angle of mast from vertical position to uppermost position 10°

Hydraulic pump performance

Tapping point	Double acting external tapping
Opening pressure of the relief valve	16.2/14.7* MPa
Sustained pressure with relief valve open	16.4/16.4* MPa
Pump delivery rate at rated engine speed:	
at minimum pressure	0.58/0.94* l/s (34.9/56.6* l/min)
Hydraulic power at:	
90 per cent of relief valve setting	8.1/12.4* kW
corresponding delivery rate	0.55/0.84* l/s (32.8/50.3* l/min)
pressure	14.8/14.8* MPa
Maximum hydraulic power:	8.7/12.8* kW
corresponding delivery rate	0.54/0.87* l/s (32.3/52.1* l/min)
pressure	16.2/14.7* MPa
Temperature of hydraulic fluid	60–62°C

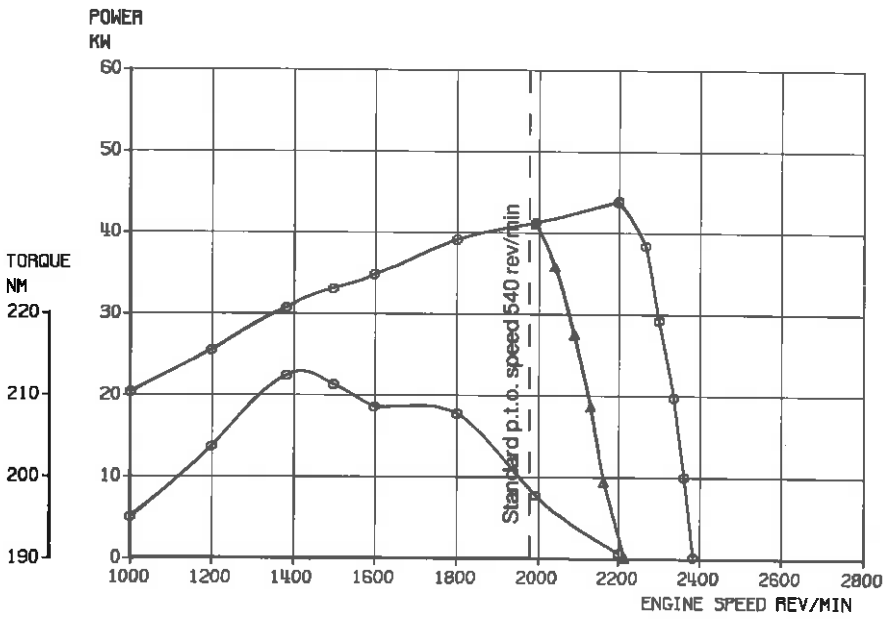
* Hydraulic pump with 2 shiftable speeds.

Table 2. Linkage geometry when connected to the standard frame

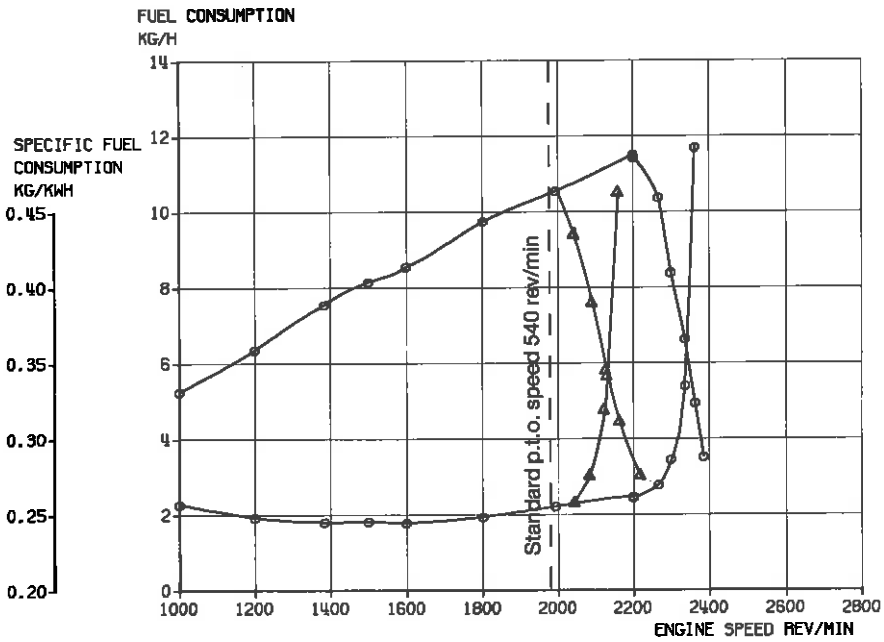
Projected length in side view		
Lower links	856 mm	
Lift arms	320 mm	
Lift rods	567 mm	
Top link	684 mm	
Distance of lift rod connection point from pivot point of lower link	400 mm	
The following dimensions are given relative to the rear wheel centre line, situated 770 mm above the ground level		
Lower link pivot point	83 mm behind	138 mm below
Top link pivot point	288 mm behind	229 mm above
Lift arm pivot point	30 mm behind	363 mm above
Maximuim and minimum height of lower link hitch points	88 mm above	574 mm below
Height of lower link hitch points when locked in transport position	88 mm above	—

Ultuna, Uppsala 1984-06-27
NATIONAL MACHINERY TESTING INSTITUTE

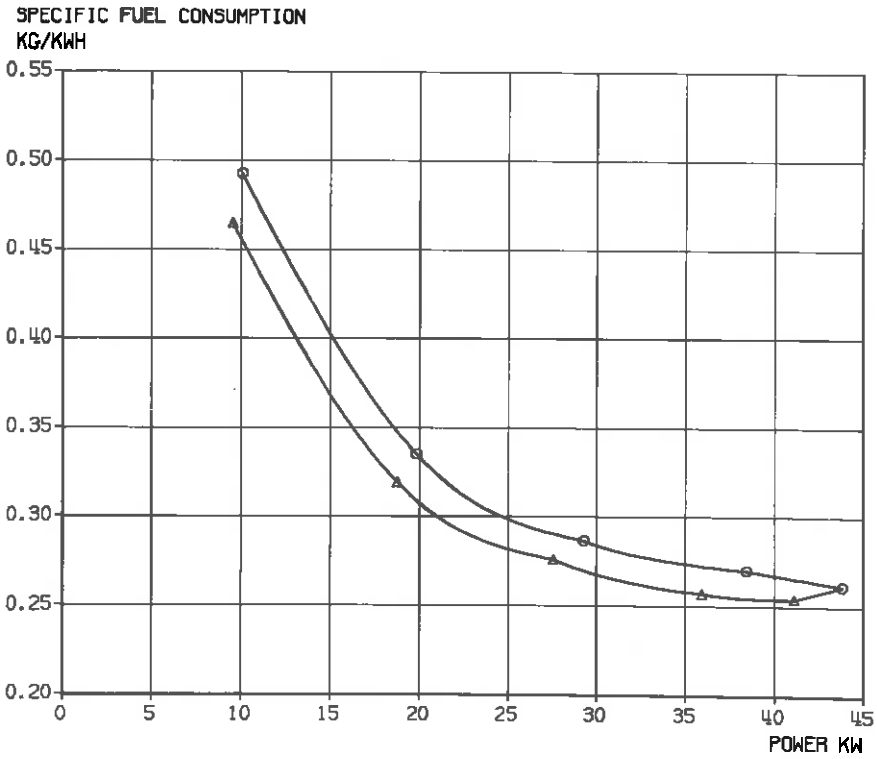
National Machinery Testing Institut	**Power take-off test Zetor 7211**	Figure 1



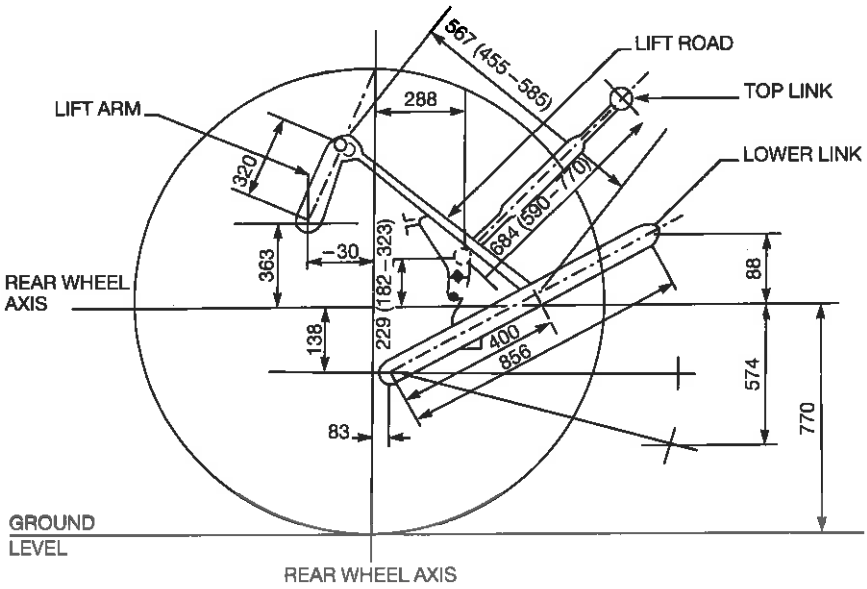
National Machinery Testing Institut	**Power take-off test Zetor 7211**	Figure 2



National Machinery Testing Institut	**Power take-off test Zetor 7211**	Figure 3



National Machinery Testing Institut	**LINKAGE GEOMETRY – ZETOR 7211 When connected to the standard frame**	Figure 4



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