NATIONAL MACHINERY TESTING INSTITUTE

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TEST BULLETIN: OECD No. 804

Date of approval 1981-06-28

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

AGRICULTURAL TRACTOR ZETOR 5011

Manufactured by: Zetor, 632 00 BRNO, Czechoslovakia

Test No. 5569

Test Bulletin: OECD No. 804

Agricultural Tractor ZETOR 5011



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:	30 hours

Specification of tractor

Tractor	
Make	ZETOR
Model	5011
Type	Four wheel, rear wheel driven, unit construktion
Serial No.	1007
Engine	
Make	Zbrojovka
Model	5001
Type	4-stroke, direct injection diesel engine, water cooled
Serial No.	0107
Cylinder Number	3
Disposition	Vertical, in-line
Bore/Stroke	102 mm/110 mm
Capacity	2.696 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, PP3A8K 315g-2442, 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	Motopal
Type	Mechanical, incorporated in fuel injection pump, RV 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 Diameter 110 mm, length 470 mm Vertical outside bonnet on left hand-side, debouch 2.62 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 replaceable element filter 03-9810.00 AB Jablonec. Service period 200 h
Oil capacity	9 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	9.5 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
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	19 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	476.521	1.11	0.31
2	320.242	1.66	0.46
3	229.804	2.32	0.64
4	149.701	3.55	0.98
5	89.623	5.92	1.65
1 – High	111.435	4.76	1.32
2	74.889	7.09	1.97
3	53.740	9.88	2.74
4	35.008	15.16	4.21
5	20.959	25.33	7.03
Reverse			
Low	365.076	1.45	0.40
High	85.374	6.22	1.73

* With tyre rolling radius of 640 mm (Tyres 14.9/13-28).

Power take off	ZETOR
Make	At rear of tractor
Location	Independent p.t.o. Engaged by hand lever operated disc clutch
Type of drive	According to ISO 500
Dimensions	6 (dia. 34.9 mm)
No. of splines	
Height above ground	665 mm, in tractor's median plane, distance to the rear axle centre 230 mm
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

Belt pulley
(Not fitted for test)

Power lift

Make	Own make
Type	Single acting. Gear type pump. Independent pumpdrive. Working pressure 16.0—18.0 MPa. Oil supplied from rear axle housing to ram cylinder. Oil capacity: 19 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 475 mm. Horizontal distance from rear axle 575—620 mm. Position relative to p.t.o. 355—400 mm. Lateral adjustment 200 mm from centre position. Pivot position relative to real wheel centre 230 mm forward. Coupling pin diameter 30 mm
Hitch	Height above ground 575—875 mm, adjustable in 7 steps, hitch hole 26 mm diam., horizontal distance from rear axle 575 mm, position relative to p.t.o. 355 mm.

Steering

Make	NSK — Japan
Type	Ball circulating steering

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 6.50—16/6-ply rating, crossply tyres. Maximum permissible mass on each tyre 615 kg at 310 kPa pressure. Track width 1280, 1375, 1750 changed by extending axle
Driving wheels	Two at rear. Type: Pneumatic, multirib 14.9/13—28/8-ply rating, crossply tyres. Maximum permissible mass on each tyre 1880 kg at 180 kPa pressure. Track width 1350, 1425, 1500, 1575, 1650, 1725, 1800 mm changed by reversing wheel centres and off-set lugs or rims.
Wheelbase	2025 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 6911

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	1035	130	775
Side lights	1390	60×145[1]	240
Rear lights	1430	70×210[1]	165

[1] Rectangular
[2] With track width of 1425 mm Rear wheels
1280 mm Front wheels

Conditions during test

Masses:	Tractor without driver but with tanks full.	
Without ballast	Part of mass on front wheels	930 kg
	Part of mass on rear wheels	1 670 kg
	Total mass	2 600 kg
With ballast	Part of mass on front wheels	1 090 kg
	Part of mass on rear wheels	2 350 kg
	Total mass	3 440 kg
Ballast	Front: Frame and front weights — total	160 kg
	Rear: Weights — total	300 kg
	Liquid total:	380 kg
Track setting during tests	Front: 1 280 mm Rear: 1 425 mm	

Overall dimensions

	Length, m	Width,[1] m	Height,[2] m
With ballast	3.43	1.84	2.62
Without ballast	3.40	1.81	2.62

Minimum ground clearance 440 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: 1980-07-01, 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								
31.5	2200	596	9.88	8.20	72	0.260	11.5	3.19
The speed recommended by the manufacturer for drawbar work								
31.5	2200	596	9.88	8.20	72	0.260	11.5	3.19
Varying loads at rated engine speed								
(1) 85% of the torque obtained at maximum power								
28.0	2972	622	9.02	7.49	74	0.267	11.2	3.11
(2) Unloaded								
0.3	2374	643	3.07	2.55	–	–	–	–
(3) 50% of the load defined in (1)								
14.3	2345	635	5.90	4.90	95	0.343	8.7	2.42
(4) Maximum power								
31.8	2194	594	9.86	8.18	71.5	0.257	11.6	3.22
(5) 25% of the load defined in (1)								
7.2	2363	640	4.31	3.58	139	0.499	5.99	1.66
(6) 75% of the load defined in (1)								
21.2	2326	630	7.47	6.20	81	0.292	10.2	2.83
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								
26.3	2064	559	8.07	6.70	71	0.255	11.7	3.25
(2) Unloaded								
0.2	2171	588	2.47	2.05	–	–	–	–
(3) 50% of the load defined in (1)								
13.5	2127	576	5.25	4.36	89.5	0.323	9.3	2.58
(4) Maximum power								
29.8	1994	540	8.96	7.44	69.5	0.250	12.0	3.33
(5) 25% of the load defined in (1)								
6.8	2145	581	3.76	3.12	127	0.458	6.5	1.81
(6) 75% of the load defined in (1)								
20.1	2101	569	6.69	5.55	77	0.276	10.8	3.00

Standard specific fuel consumption: g/MJ (kg/kWh)
a) 74 (0.267)
b) 95 (0.343)
c) 71 (0.255)
d) 89.5 (0.323)

No load, maximum engine speed		2374 rev/min
Equivalent crankshaft torque at maximum power		137 Nm
Maximum equivalent crankshaft torque		147 Nm at 1600 rev/min engine speed
Mean atmospheric	temperature	16°C
	pressure	101.0 kPa
	relative humidity	41%
Maximum temperature	coolant	82°C
	engine oil	98°C
	fuel	19°C
	air intake	22°C

2. Drawbar performance

Date of tests:	1980-08-29—09-04/1981-06-05
Type of track:	Drum dynamometer with concrete surface
Height of drawbar above ground:	unballasted 660 mm ballasted 640 mm
Tyre inflation pressure:	unballasted 90 kPa ballasted 110 kPa

Results see Table 1

Engine oil consumption during ten hours duration of test (ii) was 4 g/h. Test (iv) was carried out with additionel ballast. Power, speed, slip and fuel consumption do not correspond to test (ii) gear 4L.

Table 1. Drawbar performance

Gear	Power	Draw-bar pull	Speed		Engine speed		Wheel slip	Spec. fuel consumption		Spec. energy		Temperature				Atmospheric conditions		
						rev/			kg/			Coo-lant	Fuel	Engine oil	Transm. oil	Tempe-rature	Rel. hum.	Pressure
	kW	kN	m/s	km/h	rev/s	min	%	g/MJ	kWh	MJ/l	kWh/l	°C	°C	°C	°C	°C	%	kPa
i) Maximum power (unballasted tractor)																		
4 L	17.6	20.0	0.88	3.17	38.9	2332	15.0	105	0.378	7.9	2.20	82	21	83	51	19	60	101.7
1 H	23.9	20.4	1.17	4.21	38.5	2310	15.0	94	0.339	8.8	2.45	74	21	82	43	19	60	101.7
5 L	26.4	18.6	1.42	5.11	36.7	2200	13.4	90	0.324	9.2	2.56	85	21	80	48	19	60	100.7
2 H	27.0	15.4	1.75	6.30	36.7	2200	9.9	88	0.315	9.5	2.63	85	22	77	34	15	60	100.7
3 H	27.3	10.8	2.53	9.11	36.7	2200	6.7	87	0.315	9.5	2.64	84	21	78	38	17	60	100.7
4 H	26.7	6.7	4.00	14.40	36.7	2200	4.1	89	0.320	9.3	2.59	85	22	82	41	18	60	100.7
ii) Maximum power (ballasted tractor)																		
1 L	7.0	25.1	0.28	1.01	39.4	2361	15.0	153	0.552	5.4	1.50	79	19	94	52	21	37	100.5
2 L	10.3	25.1	0.41	1.48	39.2	2352	15.0	129	0.464	6.4	1.79	82	20	94	51	21	37	100,5
3 L	14.4	25.3	0.57	2.05	39.0	2338	15.0	111	0.399	7.5	2.08	83	20	92	50	21	37	100.5
4 L	21.8	25.4	0.86	3.10	38.4	2307	15.0	96	0.346	8.6	2.40	84	22	90	49	20	37	100.5
1 H	26.0	22.8	1.14	4.10	36.7	2200	12.9	88	0.317	9.4	2.62	83	20	96	57	21	37	100.5
5 L	26.4	18.1	1.46	5.26	36.7	2200	9.7	88	0.315	9.5	2.64	84	20	94	53	21	37	100.5
2 H	27.0	15.1	1.79	6.44	36.7	2200	7.9	85	0.305	9.8	2.72	83	20	97	58	22	37	100.5
3 H	26.9	10.5	2.56	9.22	36.7	2200	5.3	85	0.306	9.8	2.71	83	20	97	59	22	37	100.5
iii) Five hour test at 75% of pull at maximum power																		
2 H	21.7	11.3	1.92	6.91	38.6	2313	5.8	91	0.328	9.1	2.53	84	20	100	–	16	54	101.0
iv) Five hour test corresponding to 15% wheelslip																		
4 L	23.1	25.7	0.90	3.24	38.5	2308	11.5	90	0.322	9.3	2.58	85	21	102	110	22	62	101.1

3. Turning space and turning circle

Details of wheel equipment: As in specification without ballast
Track of wheels: Front 1 280 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	3.09	3.23	3.58	3.75
Radius of turning circle	2.89	3.03	3.38	3.55

4. Location of centre of gravity

Height above ground	936 mm
Distance forward from the vertical plane containing the axis at rear wheels	706 mm
Distance from the median plane	0 mm

5. Braking

Date of tests: 1980-10-02
Tractor masses during brake tests:

Front kg	Rear kg	Total kg
1040	3000	4040

Type 0 (ordinary cold service braking device performance) test

Speed before application of brakes 27.3 km/h

Ballasted	Braking device control force, N	550*	425	400	310	270
	Mean deceleration, m/s²	4.34	3.75	3.46	2.50	1.84
Unballasted	Braking device control force, N	—	430	330	290	250
	Mean deceleration, m/s²	—	3.81	3.09	2.50	1.88

Type I (fade) test

Braking device control force, N	580*	530	460	340	290
Mean deceleration, m/s²	4.09	4.04	3.54	2.50	2.01

* Not locked

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

Parking braking device test

	18 per cent slope		12 per slope with trailer of 2 620 kg	
	Up	Down	Up	Down
Braking device control force, N	392	341	353	176

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 85 dB(A)

7. Noise measurement at the driver's ear

Date and location of tests: 1980-05-08, 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 (*)	12.9	1.89	(6.8)	84
2 High (*)	light load	2.19	(7.9)	82
top gear	light load	7.72	(27.8)	82.5

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

8. Power lift and hydraulic pump performance

Date and location of tests: 1980-12-09 – 17

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	92	649	10.5	14.4	8.68	–
On the frame	17	821	6.6	14.4	9.49	18

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

Hydraulic pump performance

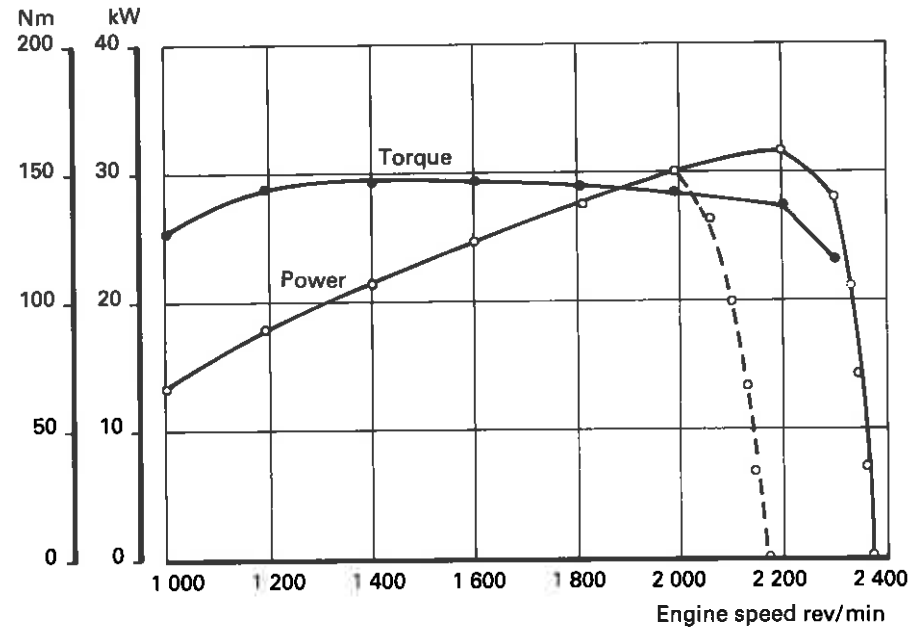
Tapping point:	Double acting external tapping
Pressure specified by the manufacturer for external hydraulic motor	–
Openeing pressure of the relief valve	15.5 MPa
Sustained pressure with relief valve open	17.2 MPa
Opening pressure of the unloaded valve	–
Closing pressure of the unloaded valve	–
Pump delivery rate at rated engine speed:	
at minimum pressure	0.39 l/s (23.3 l/min)
at 90 % of opening pressure of the relief valve	0.23 l/s (13.6 l/min)
Hydraulic power at 90 % of opening pressure of the relief valve	3.2 kW
Temperature of hydraulic fluid	60–63°C

Table 2. Linkage geometry when connected to the standard frame

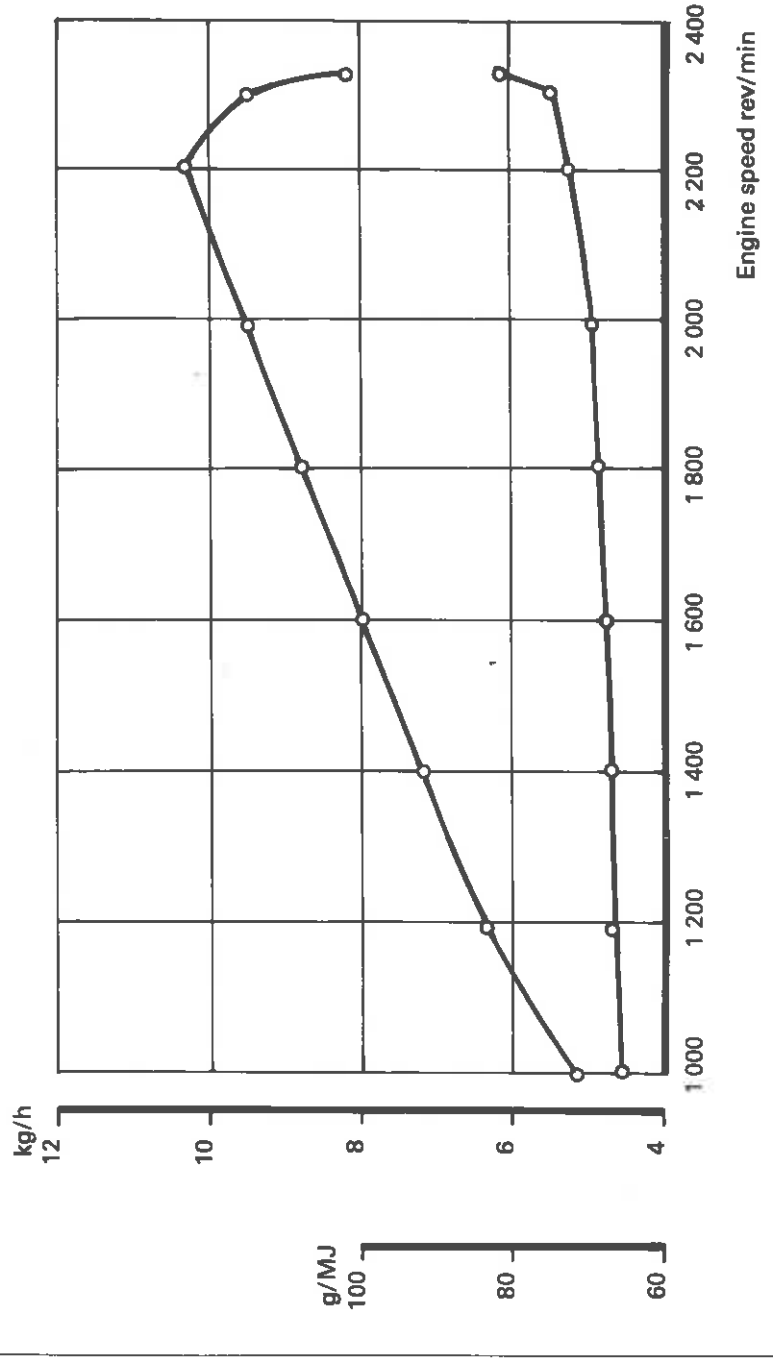
Projected length in side view	
lower links, mm	782.5
lift arms, mm	320
lift rods, mm	520
top link, mm	588
Distance of lift rod connection point from pivot point of lower link, mm	391
The following dimensions are given relative to the rear wheel centre line, situated 640 mm above the ground level	
Lower link pivot point	45 mm behind, 122 mm below
Top link pivot point	263 mm behind, 240 mm above
Lift arm pivot point	15 mm behind, 342 mm above
Maximum and minimum height of lower link hitch points	109 mm above, 540 mm below
Height of lower link hitch points when locked in transport position	109 mm above, –

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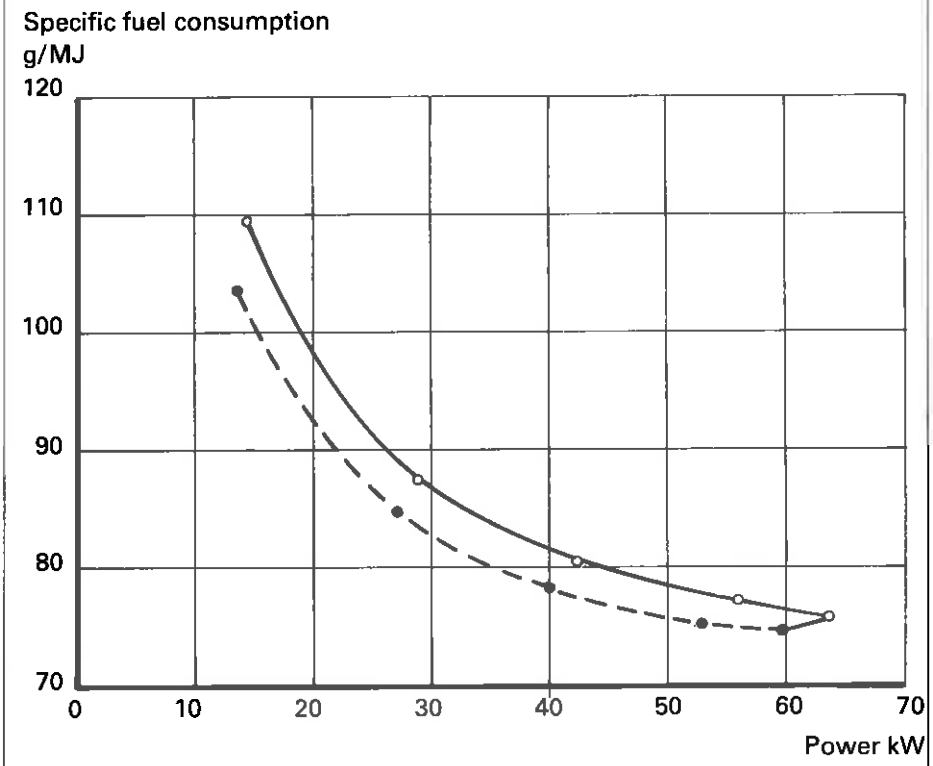
National Machinery Testing Institute	**Power take-off test Zetor 5011**	Figure 1



National Machinery Testing Institute	**Power take-off test Zetor 5011**	Figure 2



National Machinery Testing Institute	**Power take-off test Zetor 5011**	Figure 3



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