STATENS MASKIN-PROVNINGAR

NATIONAL MACHINERY TESTING INSTITUTE

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TEST BULLETIN: OECD No. 813

Date of approval 1981-10-30

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

AGRICULTURAL TRACTOR ZETOR 6045

Manufactured by: Zetor, 632 00 BRNO, Czechoslovakia

Test No. 5570

Test Bulletin: OECD No. 813

Agricultural Tractor ZETOR 6045



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.

TABLE OF CONTENTS

	Page No.
SPECIFICATION OF TRACTOR	4
CONDITIONS DURING TEST	9
FUEL AND LUBRICANTS USED IN TESTS	9
COMPULSORY TESTS	
1 Main power take-off performance	10
2 Drawbar performance	11
3 Turning space and turning circle	13
4 Location of centre of gravity	13
5 Braking	13
6 Measurement of ambient noise emitted by the tractor	14
7 Noise measurement at the driver's ear level	14
8 Power lift and hydraulic pump performance	14

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:	20 hours

Specification of tractor

Tractor	
Make	ZETOR
Model	6045
Type	Four wheel driven, unit construction
Serial No.	1013
Engine	
Make	Zbrojovka
Model	6001
Type	4-stroke, direct injection diesel engine, water cooled
Serial No.	0108
Cylinder Number	4
Disposition	Vertical, in-line
Bore/Stroke	100 mm/110 mm
Capacity	3.456 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, PP4A 8K 115g-2446, in-line type
Manufacturer's production setting	Fuel delivery 10.0 – 10.5 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 160S 430.4355 in nozzle holders VA 2647
Manufacturer's production setting	15.7+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)
Oil capacity	1.5 dm^3
Exhaust silencer	Expansion chamber type Dimensions: 90×170×575 mm Vertical outside bonnet on left hand-side, debouch 2.70 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 hours
Oil capacity	12 dm^3
Changing period	200 h
Recommended oil	Engine oil according to API-SC/CA SAE 20 W/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, handlever for p.t.o.

Gearbox

Make	Own make
Type	Sliding gear. Gearbox with 5 forward speeds and 1 reverse. Reduction gearbox with 2 ranges. Torque amplifier by pneumatic operated reduction gear, foot pedal operated, self-disengaging
No. of speeds	Totally 20 forward and 4 reverse speeds

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: 32 and 4 l. Change period 1000 hours. Recommended oil: PP80 SAE 80. (API GL4).

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	394.158	1.42	0.39
1L MP**	517.460	1.08	0.30
2L	264.891	2.11	0.59
2L MP	347.754	1.61	0.45
3L	190.084	2.95	0.82
3L MP	249.545	2.24	0.62
4L	123.826	4.52	1.26
4L MP	162.561	3.44	0.96
5L	97.323	5.75	1.60
5L MP	127.766	4.38	1.22
1 – High	93.065	6.02	1.67
1H MP	122.178	4.58	1.27
2H	62.544	8.95	2.49
2H MP	82.109	6.82	1.89
3H	44.881	12.47	3.46
3H MP	58.921	9.50	2.64
4H	29.238	19.15	5.32
4H MP	38.383	14.59	4.05
5H	22.979	24.36	6.77
5H MP	30.167	18.56	5.16
Reverse			
Low	301.976	1.85	0.51
Low MP	396.440	1.41	0.39
High	71.300	7.85	2.18
High MP	93.604	5.98	1.66

* With tyre rolling radius of 699 mm (Tyres 16.9/14-30).
** Reduction gear (24% speed reduction)

Power take off

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	665 mm, in tractor's median plane, distance to the rear axle centre 210 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 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. 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, hitchhole diameter 26 mm, 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 directly driven by the engine with own oil circuit. Oil capacity 4.4 dm^3. Recommended oil ATF-200. Change period: 1000 hours

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 and driving wheels	Two at front. Type: Pneumatic, multirib 11.2/10—24/6-ply rating, crossply tyres. Maximum permissible mass on each tyre 1045 kg at 170 kPa pressure. Track width 1510 mm.
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	2220 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	26

Overall dimensions

	Length, m	Width,[1] m	Height,[2] m
With ballast	4.00	1.98	2.70
Without ballast	3.72	1.98	2.70

Minimum ground clearance 362 mm to underside of front axle.

[1] With track width of 1425 mm (Rear 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§)

	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]	165

[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		1 430 kg
	Part of mass on rear wheels		1 920 kg
	Total mass		3 350 kg
With ballast	Part of mass on front wheels		1 830 kg
	Part of mass on rear wheels		2 700 kg
	Total mass		4 530 kg
Ballast	Front: Frame and front weights	total	400 kg
	Rear: Weights	total	300 kg
	Liquid	total	480 kg
Track setting	Front: 1 510 mm		
	Rear: 1 425 mm		

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: 1980-07-07, 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								
40.5	2200	596	12.42	10.31	71	0.255	11.7	3.25
The speed recommended by the manufacturer for drawbar work								
40.5	2200	596	12.42	10.31	71	0.255	11.7	3.25
Varying loads at rated engine speed								
(1) 85% of the torque obtained at maximum power								
36.0	2300	623	11.23	9.32	72	0.259	11.5	3.19
(2) Unloaded								
0.4	2374	643	3.89	3.23	—	—	—	—
(3) 50% of the load defined in (1)								
18.4	2348	636	7.18	5.96	90	0.324	9.2	2.56
(4) Maximum power								
40.8	2200	596	12.36	10.26	70	0.254	11.9	3.30
(5) 25% of the load defined in (1)								
9.3	2363	640	5.35	4.44	134	0.480	6.2	1.72
(6) 75% of the load defined in (1)								
27.4	2330	631	9.19	7.63	78	0.279	10.7	2.97
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								
33.1	2046	554	10.02	8.32	70	0.252	11.9	3.30
(2) Unloaded								
0.4	2145	581	3.14	2.61	—	—	—	—
(3) 50% of the load defined in (1)								
17.0	2105	570	6.35	5.27	86	0.310	9.7	2.69
(4) Maximum power								
37.3	1994	540	11.16	9.26	68	0.246	12.1	3.36
(5) 25% of the load defined in (1)								
8.6	2127	576	4.70	3.90	126	0.455	6.6	1.83
(6) 75% of the load defined in (1)								
25.2	2079	563	8.14	6.76	74	0.268	11.1	3.08

Standard specific fuel consumption: g/MJ (kg/kWh)
a) 72 (0.259)
b) 90 (0.324)
c) 70 (0.252)
d) 86 (0.310)

No load, maximum engine speed		2374 rev/min
Equivalent crankshaft torque at maximum power		176 Nm
Maximum equivalent crankshaft torque		183 Nm at 1800 rev/min engine speed
Mean atmospheric	temperature	18°C
	pressure	101.0 kPa
	relative humidity	75%
Maximum temperature	coolant	84°C
	engine oil	103°C
	fuel	20°C
	air intake	22°C

2. Drawbar performance

Date of tests:	1981-04-29 – 07-01		
Type of track:	Tarmac		
Height of drawbar above ground:	Unballasted 420 mm Ballasted 415 mm		
Tyre inflation pressure:		Unballasted kPa	Ballasted kPa
	Front	120	140
	Rear	100	130

Results see Table 1

Engine oil consumption during ten hours duration of test (iii and iv) was 53 g/h. Test (iv) was carried out with additionel ballast. Power, speed, slip and fuel consumption do not correspond to test (ii) gear L3.

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 sure
	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)																		
3L	21.9	28.5	0.77	2.77	38.7	2320	15.0	—	—	—	—	79	—	91	39	8	35	100.9
4L-MP	25.6	28.8	0.89	3.20	38.4	2302	15.0	—	—	—	—	83	—	90	37	9	35	100.9
5L-MP	31.5	28.1	1.12	4.03	36.7	2200	12.9	—	—	—	—	80	—	87	34	5	35	100.9
4L	31.7	27.6	1.15	4.14	36.7	2200	12.8	—	—	—	—	82	—	88	36	6	35	100.9
1H-MP	31.6	27.0	1.17	4.21	36.7	2200	11.5	—	—	—	—	76	—	66	20	3	35	100.9
5L	32.5	21.4	1.52	5.47	36.7	2200	7.5	—	—	—	—	75	—	86	32	4	35	100.9
1H	33.2	20.5	1.62	5.83	36.7	2200	6.4	—	—	—	—	70	—	58	18	3	35	100.9
2H-MP	33.5	18.3	1.83	6.59	36.7	2200	5.7	—	—	—	—	81	—	78	25	5	35	100.9
2H	33.7	13.6	2.48	8.93	36.7	2200	3.3	—	—	—	—	77	—	73	23	4	35	100.9
3H-MP	33.5	12.8	2.61	9.40	36.7	2200	2.9	—	—	—	—	81	—	84	30	4	35	100.9
ii) Maximum power (ballasted tractor)																		
1L-MP	10.6	37.9	0.28	1.01	39.2	2350	15.0	149	537	5.6	1.54	75	28	92	45	21	49	100.5
1L	14.5	38.2	0.38	1.38	39.0	2340	15.0	118.5	427	7.0	1.94	76	27	91	45	21	49	100.5
2L-MP	16.3	39.0	0.43	1.55	38.9	2333	15.0	111	400	7.5	2.08	78	27	91	43	18	49	100.5
2L	21.8	39.0	0.56	2.02	38.7	2320	15.0	99	357	8.4	2.32	79	27	89	42	20	49	100.5
3L-MP	23.0	39.0	0.59	2.12	38.6	2315	15.0	100	361	8.3	2.30	82	26	87	41	20	49	100.5
3L	30.1	39.6	0.76	2.74	38.1	2285	15.0	92.5	332	9.0	2.50	82	25	83	40	19	49	100.5
4L-MP	32.0	35.9	0.89	3.20	36.7	2200	11.9	88.5	319	9.4	2.60	83	25	80	38	10	49	100.5
5L-MP	33.6	29.0	1.16	4.18	36.7	2200	7.4	84	303	9.9	2.73	77	22	69	34	18	49	100.5
4L	33.1	28.3	1.17	4.21	36.7	2200	7.5	86.5	311	9.6	2.67	78	24	75	36	18	49	100.5
1H-MP	34.0	27.9	1.22	4.39	36.7	2200	6.6	83	300	10.0	2.77	82	30	90	49	19	49	100.5
5L	33.5	21.5	1.56	5.62	36.7	2200	5.5	84.5	304	9.8	2.73	65	22	63	31	17	49	100.5
1H	34.2	21.0	1.63	5.87	36.7	2200	4.2	83.5	301	9.9	2.76	71	30	89	47	19	49	100.5
2H-MP	33.1	17.8	1.86	6.70	36.7	2200	4.4	84.5	305	9.8	2.72	83	31	92	49	19	49	100.5
2H	33.8	13.7	2.47	8.89	36.7	2200	3.3	83.5	301	9.9	2.75	78	31	92	49	19	49	100.5
3H-MP	33.7	12.8	2.63	9.47	36.7	2200	3.0	84	303	9.9	2.74	84	32	96	49	19	49	100.5
iii) Five hour test at 75% pull at maximum power																		
1H	27.5	15.8	1.74	6.26	38.3	2300	3.2	87	313	9.6	2.65	84	30	103	76	19	49	100.5
iv) Five hour test corresponding to 15% wheelslip																		
3L	30.9	39.6	0.78	2.81	38.0	2280	10.8	—	—	—	—	83	—	96	86	19	45	102.1

3. Turning space and turning circle

Details of wheel equipment: As in specification without ballast
Track of wheels: Front 1510 mm
Rear 1425 mm

	With brakes		Without brakes	
	Left-hand m	Right-hand m	Left-hand m	Right-hand m
Radius of turning space	3.96 (4.54)*	3.94 (4.54)	5.44 (5.10)	5.44 (5.12)
Radius of turning circle	3.72 (4.31)	3.71 (4.30)	5.20 (4.86)	5.20 (4.89)

* Figures in brackets indicate that the front-wheel drive is disengaged

4. Location of centre of gravity

Height above ground	880 mm
Distance forward from the vertical plane containing the axis at rear wheels	938 mm
Distance from the median plane	11 mm (To the left)

5. Braking

Date of tests: 1980-10-09—1981-01-22
Tractor masses during brake tests:

Front kg	Rear kg	Total kg
2000	3600	5600

Type 0 (ordinary cold service braking device performance) test

Speed before application of brakes 27.0 km/h

Ballasted	Braking device control force, N	600*	550	485	400	300
	Mean deceleration, m/s²	3.05	2.80	2.50	2.10	1.60
Unballasted	Braking device control force, N	—	450	390	325	250
	Mean deceleration, m/s²	—	3.40	2.98	2.50	2.00

* Not locked

Type I (fade) test

Braking device control force, N	600*	550	470	400	340
Mean deceleration, m/s²	3.25	3.00	2.50	1.94	1.46

* Not locked

Maximum deviation of tractor from its original course	0 m
Abnormal vibration	None
The brakes were heated by	Towing

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	464	386	373	353

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 20.1 km/h
Sound level 88.0 dB(A)

7. Noise measurement at the driver's ear

Date and location of tests: 1980-05-23, 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*	13.5	2.50	(9.0)	87
2 High*	light load	2.94	(10.6)	82
Top gear	light load	7.56	(27.2)	84.5

* Gear corresponds to the nominal travelling speed nearest to 2.08 m/s (7.5 km/h)
Reduction gear 2 High MP only for temporary use.

8. Power lift and hydraulic pump performance

Date of tests: 1980-12-11/1981-03-24

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 hitch points	239	619	17.5	14.4	15.1	–
On the frame	174	822	10.5	14.4	15.5	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	–
Opening pressure of the relief valve	14.0/14.0* MPa
Sustained pressure with relief valve open	17.6/17.6* MPa
Opening pressure of the unloaded valve	–
Closing pressure of the unloaded valve	–
Pump delivery rate at rated engine speed:	
at minimum pressure	0.39/0.66*l/s (23.4/39.7*l/min)
at 90 % of opening pressure of the relief valve (12.6/12.6*MPa)	0.26/0.56*l/s (15.8/33.7*l/min)
Hydraulic power at 90 % of opening pressure of the relief valve	3.3/7.0* kW
Temperature of hydraulic fluid	60 – 63°C

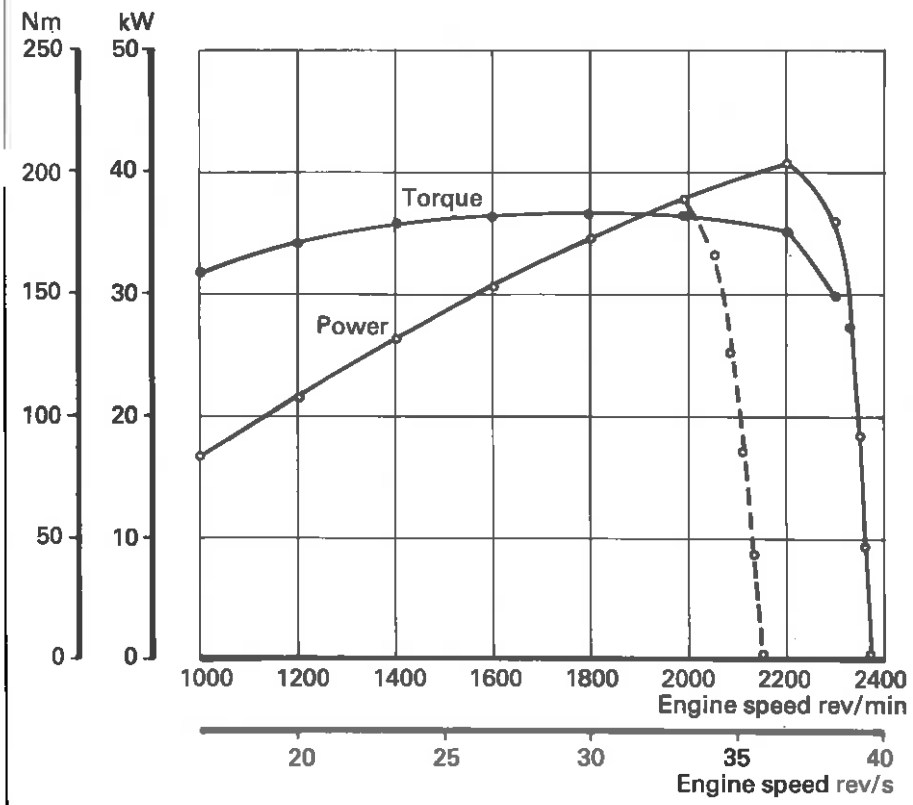
* Hydraulic pump with 2 shiftable speeds

Table 2. Linkage geometry when connected to the standard frame

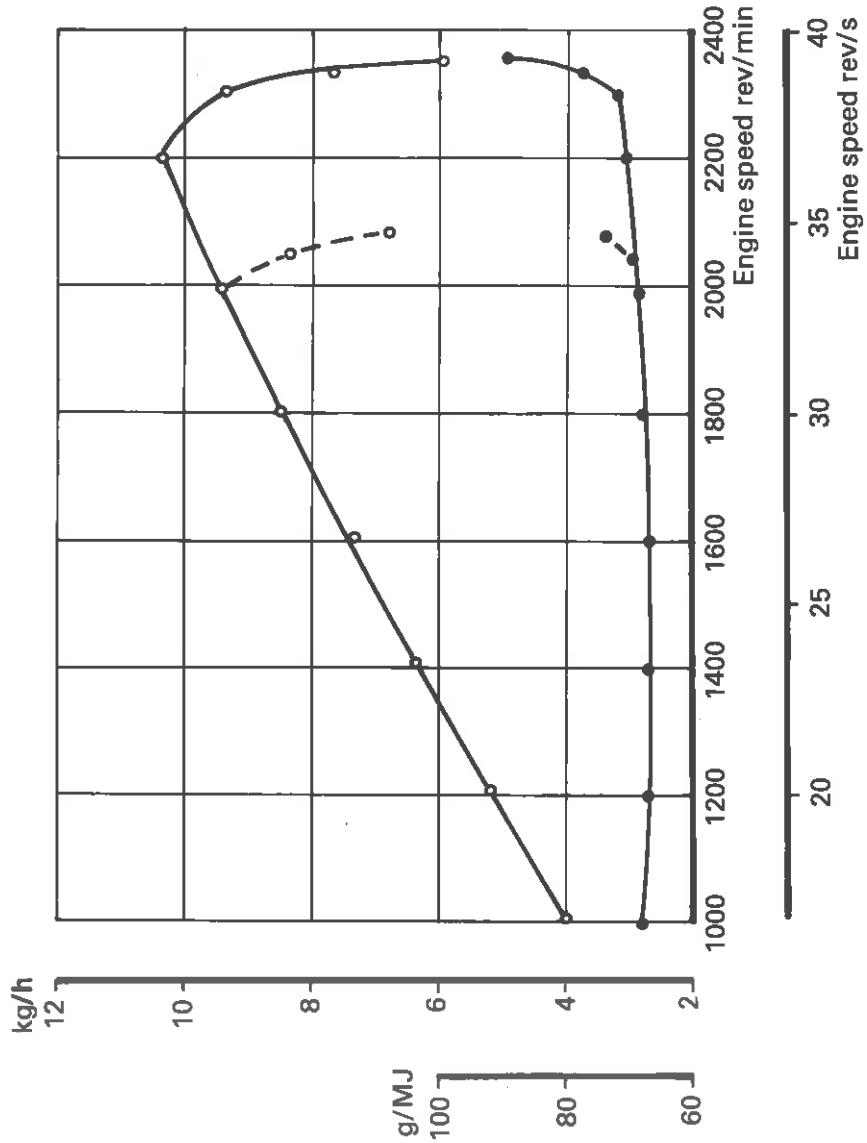
Projected length in side view	
lower links, mm	782.5
lift arms, mm	320
lift rods, mm	520
top link, mm	580
Distance of lift rod connection point from pivot point of lower link, mm	391
The following dimensions are given relative to the rear wheel centre line, situated 699 mm above the ground level	
Lower 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	159 mm above, 460 mm below
Height of lower link hitch points when locked in transport position	159 mm above

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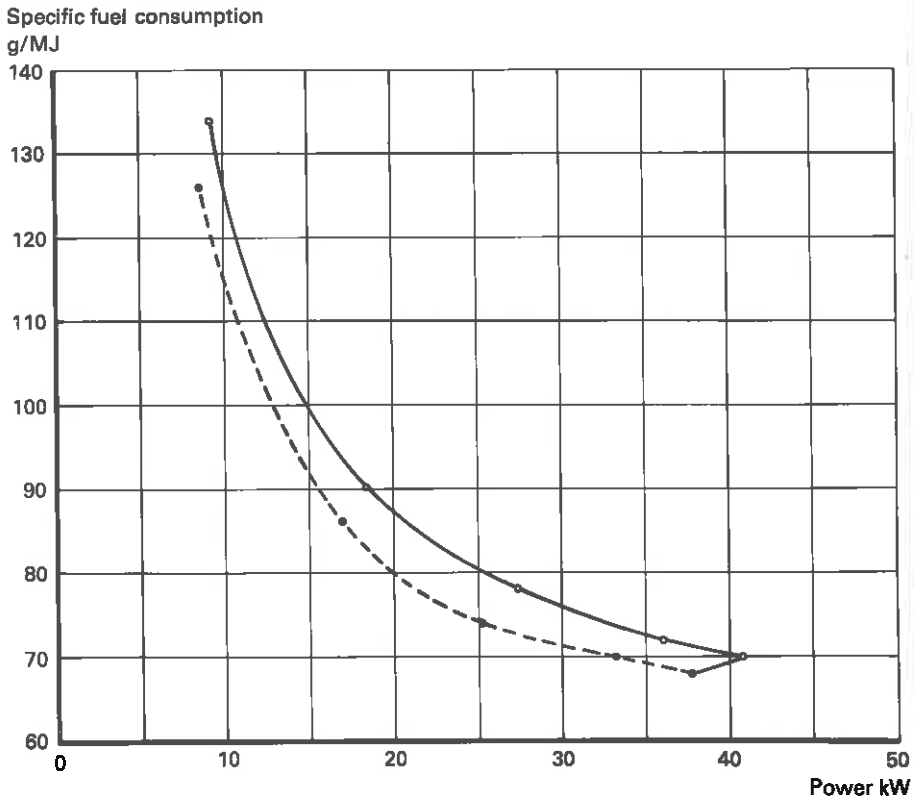
National Machinery Testing Institute	**Power take-off test Zetor 6045**	Figure 1



National Machinery Testing Institute	**Power take-off test Zetor 6045**	Figure 2



National Machinery Testing Institute	**Power take-off test Zetor 6045**	Figure 3



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