SOCIALISTIC REPUBLIC OF CROATIA
INSTITUTE FOR MECHANIZATION, TECHNOLOGY AND BUILDINGS IN AGRICULTURE
ZAGREB

TEST BULLETIN: O. E. C. D. No. 863

Report on test in accordance with O. E. C. D. Standard Code for the official testing of Agricultural Tractors

Date of Approval: 14th February 1983



ŠTORE 402 SUPER (2 WD)
AGRICULTURAL TRACTOR

Manufactured by: Slovenske železarne, Železarna Štore
TOZD Tovarna traktorjev, Štore, Yugoslavia

Date of tests: June — November 1981.

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

Date of Approval: 14th February 1983. Serial No. 863.

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

TABLE OF CONTENTS

	Page
Specification of tractor	3
Conditions during test	6
Fuel and lubricants used in tests	6

COMPULSORY TESTS

(1)	Main power take-off performance	7
(2)	Drawbar performance test on tarmacadam track	11
(3)	Turning space and turning circle	12
(4)	Location of centre of gravity	12
(5)	Braking tests	12
(6)	Measurement of external noise level	13
(7)	Noise measurement at the driver's ear	13
(8)	Power lift and hidraulic pump performance	13

In this report all measurements are given in SI units.

The relation with former Technical System of Units is given by the following relations

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:	100 kPa = 1.02 kp/cm² = 750.1 mmHg	or 1 kp/cm² = 98.1 kPa

Tractor manufacturer:	**Slovenske železarne — Železarna Štore** TOZD Tovarna traktorjev
Submitted for test by:	**Manufacturer**
Selected by:	**Manufacturer in agreement with the Institute**
Place of running-in:	**Zagreb**
Duration of running-in:	**60 hours**

SPECIFICATION OF TRACTOR

Tractor	
Make:	**ŠTORE**
Model:	**402 SUPER**
Type:	**Wheel tractor unit construction, rear wheel driven**
Serial No.:	**118353**
Engine	
Make:	**UTB under licence FIAT**
Model:	**8035—01**
Type:	**4 stroke diesel engine, water cooled, direct ignition**
Serial No.:	**193221**
Cylinders:	**3 in line, bore 95 mm, stroke 110 mm, displacement 2340 cm³, compression ratio 17:1, dry cylinder liners, overhead valves**
Fuel sistem:	**Fuel feed pump with double membrane, CAV fuel filter with replaceable cartridge; rotary fuel injection pump CAV DPA 32 33F 330, serial No. 13846 OM; manufacturers production setting 45—48 mm³/stroke at rated engine speed, injection timing $13^0 \pm 1^0$ before TDC, FIAT EPPZ 10 F I injection nozzles, injection pressure 23.0 ± 0.5 MPa.**
Governor:	**CAV mechanical centrifugal variable speed governor; governed range of engine speed 600 to 2600 rev/min; rated engine speed 2500 rev/min.**
Air cleaner:	**Own make; oil bath filter with centrifugal prefilter, oil capacity 0.94 l.**
Exhaust silencer:	**Own make; single chamber absorption type silencer; 78 mm dia × 635 mm; 735 mm long; on the left side of engine showing upward;**
Lubrication system:	**Forced feed from gear pump; oil filter with replaceable cartridge: recommended filter change period 400 hours; recommended oil quality MIL—L 2104 B** **Recommended oil viscosities:** **Above 0°C — SAE 20 W 40** **Below 0°C — SAE 10 W 30** **Oil capacity — 7.3 l** **Recommended oil change period: 200 hours**
Cooling system:	**Water cooling with impeller pump, pressurized system set to 50 kPa overpressure with by-pass thermostat, fan with 6 blades 345 mm diameter; water capacity 9 l.**
Starting system:	**Electrical** **MARELLI solenoid engaged starter motor 12 Volt 3 kW; U. T. B. flame plug in inlet manifold.**
Electrical equipment:	**12 Volt** **U. T. B. type UEPS 11 3-phase alternator 430 W; 1 battery 97 Ah at 20 hours rating; lead acid type.**

Transmission

Clutch: FIAT double effect type clutch 254 mm dia, pedal operated.

Gearbox: Own make; speed change gear with 3 forward + 1 reverse speeds; group gear with 2 forward groups, sliding gear shifted; totally 6 forward + 2 reverse speeds.

Axle and final drive: Own make; bevel gear drive with crown wheel and pinion; bevel gear differential with lock, pedal operated, self disengaging: spur gear final drives.

Transmission lubrication: Gear box, rear axle and hydraulic system: 19.2 l; final drives 2 × 2.8 l; recommended oil type acc. API service classification: service CC; viscosity SAE 30.
Recommended oil change period 1600 hours.

Total ratios and speeds:

Speed range	Gear	Number of engine revolutions for one revolution of driving wheel	Nominal traveling speed for rated speed of engine[1] 2500 rev/min (km/h)
slow	1	191.386	3.03
	2	110.841	5.23
	3	69.980	8.28
	reverse	155.191	3.73
fast	4	54.129	10.71
	5	31.336	18.50
	6	19.779	29.30
	reverse	43.880	13.21

[1] Calculated with a tyre dynamic radius index of 615 mm

Power take-off

Main power take-off: Semi independent p.t.o., driven by the second disc of the dual disc clutch;
Proportional to engine speed: standard p.t.o. speed 540 rev/min at 1908 rev/min of the engine, 708 rev/min at rated engine speed
Proportional to the tractor speed: 15.446 revolutions of the p.t.o. to 1 revolution of wheels; 0.250 m distance covered to 1 revolution of the p.t.o.
P.T.O. 34.9 mm dia with 6 splines in accordance with ISO 500 type 1; 254 mm rear of the rear axle centre line, 584 mm above ground in median plane of the tractor; direction of rotation clockwise viewed from rear of the tractor; p.t.o. speeds can be set by aid of tractor meter.

Power lift: Own make; hydraulic power lift in unit construction; gear type oil pump directly driven by engine feeds oil to the single ram cylinder; single control valve for lifting, loweringl, floating position, draft and position-control; top-link control; maximum working pressure: 16.7 MPa, overpressure relief valve setting: 14.7±0.5 MPa; one external oil tapping. Oil from gearbox and rear axle housing 19.2 l; 10 l of oil may be taken off on exterior oil tapping; recommended oil type acc. API service classification: service CC, viscosity SAE 30; recommended oil change period 1600 hours.

Implement linkage:

Three point linkage category I according to ISO 730/I

Length of lift rods:	410—490 mm
Length of lower links:	820 mm

Lifting range above ground: from 180 mm to 795 mm

Holed bar:

Short bar; fitted on clevis of lower links; width 80 mm, thickness 32 mm; centre hole and 3 holes on each side 22 mm dia at 89 mm distance; height above ground 100 to 880 mm;
Distance of centre hole with lower links in horizontal position:

from axle centre	824 mm
from p.t.o. shaft end	584 mm

Swinging drawbar: Optional; not fitted on tractor tested
Reversible, height above ground adjustable 280—475 mm; hitch hole diametre 25 mm, distance of hitch hole centre adjustable by shifting of the bar: from p.t.o. shaft end: 360 or 440 mm; from rear axle centre: 615 or 695 mm lateraly swingable: 195—220 mm to either side. Distance of pivot point to rear axle centre: 68 mm forward.

Pull attachment: Height above ground 375—445—685 mm; horizontal distance from rear axle: 325 mm; maximum admissible vertical load 1100 kg; position relative to p.t.o.: vertical: 309 mm — 139 mm — 101 mm below
horizontal: 71 mm rear
hitch hole diameter: 28 mm

Steering: Own make;
mechanical globoid worm type, operated by hand wheel.

Brakes

Service brake: Band brakes, mechanically acting on drums on differential half-shafts; pedal operated

Steering brake: Divided pedal on service brake; for normal use locked together.

Parking brake: Operated by hand lever with ratchet; mechanically acting on service brakes.

Wheels:

Steering wheels: 2 pneumatics at front 6.00 R 16 6 ply; maximum permissible weight on each tyre 6.55 kN at 200 kPa pressure, track width 1200—1700 mm, adjustable by extending telescopic half axles.

Driving wheels: 2 pneumatics at rear 13.60/12 R 28; 6 ply; maximum permissible weight on each tyre 18.1 kN at 150 kPa pressure; track width 1305, 1405, 1505, 1605, 1705 mm, adjustable by wheels and offset lug type rims;

Wheelbase: 1900 mm

Lighting

	Heigh from ground to centre mm	Dimensions mm	Distance from outside edge of tractor to centre mm
Headlights	1318	ϕ 130	397
Side lights	1302	50 × 140	165
Rear lights	1237	60 × 160	162
Reflector	1298	ϕ 60	160

Number of grease points: 9 (whole tractor)

Overall dimensions:

	Length m	Width m		Maximum height* m
		max	min	
With ballast	3040	1657	2059	2380
Without ballast	3040	1657	2059	2380

* To the top of exhaust

Ground clearance: 420 mm (at differential)

Seat: Own make; upholstered seat with back rest. Mechanical suspension adjustable to driver's mass. Damping by hydraulic shock absorber; range of vertical adjustment 80 mm, range of horizontal adjustment 65 mm.

CONDITIONS DURING TEST

Masses:

Tractor without driver but with tanks full

	Front kg	Rear kg	Total kg
Without ballast	645	975	1620
With ballast	754	1186	1940

Ballast:

	No. of weights	Total mass kg	Water kg
Front	3 + support	100	—
Rear	2 × 2	220	—

Track setting

During test: front 1400 mm
rear 1305 mm

FUELS AND LUBRICANTS USED IN TESTS

Laboratory and track tests:

Fuel: INA D-2

Density at 15°C	0.835 kg/dm³
Viscosity at 50°C	2.6 cSt
Cetane number	53
Conforms to standard	JUS B. H2. 411.

Engine, transmission and hydraulic oil: INA Super 3 SAE 30

Viscosity at 50°C	8°E

COMPULSORY TESTS

(1) Main power take-off performance

Date and location of tests: 1931. 10. 21. Zagreb

Type of dynamometer: SCHENK hydraulic dynamometer U1—40

Power kW	Speed: Engine rev/min	Speed: p. t. o rev/min	Fuel consumption: hourly l/h	Fuel consumption: hourly kg/h	Fuel consumption: specific kg/kWh	Specific energy kWh/l
Maximum power — 2 hour test						
32.7	2487	704	11.3	9.4	0.288	2.90
The speed recommended by manufacturer for drawbar work						
30.5	2205	624	10.4	8.7	0.286	2.92
Part loads at rated engine speed						
(i) 85 per cent of the torque obtained at maximum power						
27.9	2523	714	9,4	7.8	0.282	2.96
(ii) unloaded						
0	2593	734	3.7	3.1	—	—
(iii) half the torque defined in (i)						
14.1	2562	725	5.8	4.8	0.341	2.45
(iv) the torque corresponding to maximum power						
32.7	2487	704	11.3	9.4	0.288	2.90
(v) one — quarter of the torque defined in (i)						
7.1	2572	728	4.4	3.6	0.511	1.63
(vi) three — quarters of the torque defined in (i)						
21.2	2537	718	7.3	6.1	0.290	2.88
Part loads — standard speed of the p.t.o. (540 rev/min) (i) 85% of the torque obtained at maximum power						
23.8	1961	555	7.4	6.2	0.261	3.20
(ii) unloaded						
0	2109	597	2.7	2.3	—	—
(iii) half the torque defined in (i)						
11.2	2014	570	4.3	3.6	0.319	2.62
(iv) the torque corresponding to maximum power available						
27.2	1908	540	9.1	7.6	0.280	2.98
(v) one — quarter of the torque defined in (i)						
6.3	2067	585	3.1	2.6	0.411	2.03
(vi) three — quarters of the torque defined in (i)						
18.3	2003	567	5.6	4.7	0.256	3.26

STANDARD SPECIFIC FUEL CONSUMPTION (kg/kWh)

a (i)	0.282
a (iii)	0.341
b (i)	0.261
b (iii)	0.319

No load maximum engine speed: 2593 rev/min

Equivalent crankshaft torque at maximum power: 125.6 Nm

Maximum torque: 143 Nm at 1550 rev/min of the engine

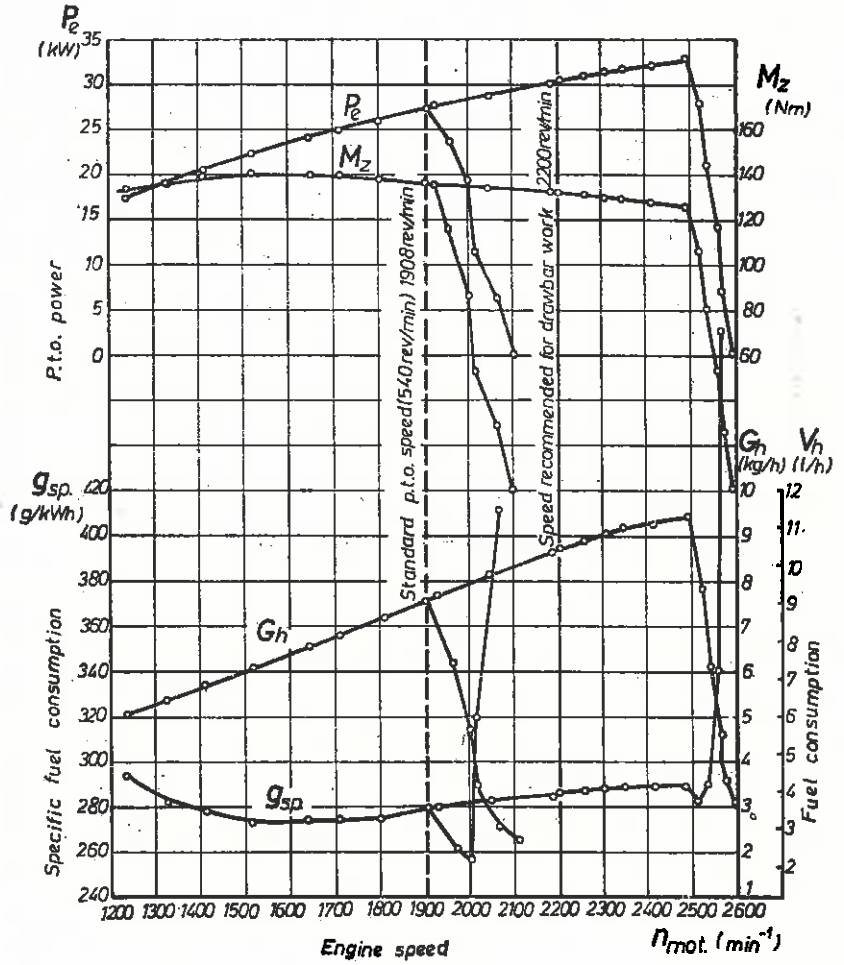
Mean atmospheric conditions :

temperature	22°C
pressure	101.1 kPa
relative humidity	70%

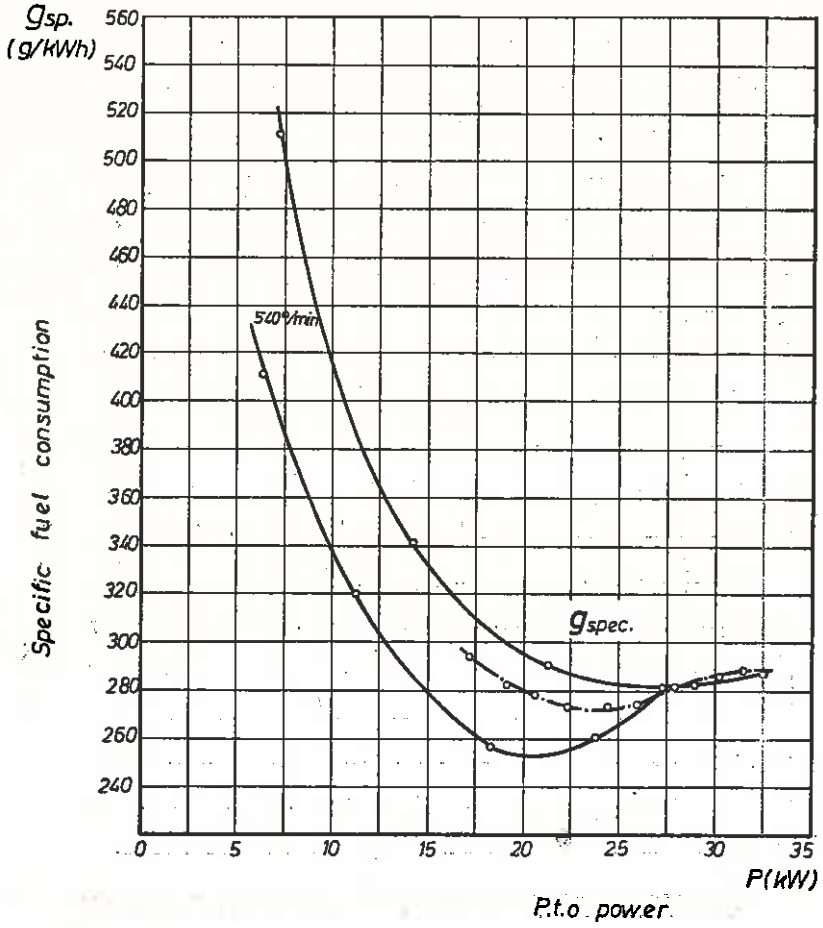
Maximum temperatures:

coolant	86°C
engine oil	140°C
fuel	23°C
engine air intake	25°C

Tractor „ŠTORE" 402 Super



Tractor „ŠTORE" 402 Super



(2) **Drawbar performance**
Date of tests: 1982. 11. 04—10

Type of track: Tarmacadam

Height of drawbar above ground:
Unballasted and ballasted: 480 mm

Tyre inflation pressure
Unballasted and ballasted: Front: 250 kPa
Rear: 150 kPa

Gear	Speed	Power	Drawbar pull	Engine speed	Wheel-slip percent	Specific fuel consumption	Specific energy	Temperature			Atmospheric conditions		
								fuel	coolant	oil	temperature	relative humidity percent	pressure kPa
	km/h	kW	N	rev/min		kg/kWh	kWh/l	°C	°C	°C	°C		
	(i) Maximum power (unballasted)												
1	2.56	8.02	11282	2452	14.4	0.552	1.51	14	80	82	14	65	102.0
2	4.37	13.93	11478	2450	15.5	0.412	2.03	14	82	83	14	65	102.0
3	7.35	20.6	10104	2432	9.5	0.365	2.29	14	83	85	14	65	102.0
4	9.42	25.7	9810	2360	9.2	0.376	2.22	14	85	88	14	65	102.0
5	16.82	25.2	5396	2387	4.8	0.390	2.14	14	85	90	14	65	102.0
	(ii) Maximum power (ballasted)												
1	2.58	8.93	12459	2450	13.2	0.504	1.66	16	76	83	16	66	101.8
2	4.33	15.22	12655	2432	15.2	0.383	2.18	16	80	83	16	66	101.8
3	6.71	23.8	12753	2375	15.9	0.375	2.23	16	82	85	15	66	101.8
4	9.37	26.3	10104	2340	7.5	0.340	2.46	16	85	88	15	67	101.8
5	16.21	25.6	5690	2313	4.0	0.357	2.37	16	85	90	14	67	101.8
	(iii) Five hour test at 75 per cent of pull at maxi mum power												
3	7.35	19.4	9516	2410	7.8	0.380	2.20	13	84	90	14	64	102.0
	(iv) Five hour test at pull corresponding to 15 per cent wheelslip in test (ii)												
2	4.36	14.6	12655	—	—	—	—	15	85	92	15	58	101.8

Ooil consumption during ten hours'testing (iii) and (iv): 15 g/h

STORE 402 SUPER

(3) Turning space and turning circle

Details of wheel equipment: Tractor with ballast
Tyres: Front: 6.00—16
Rear: 13.60/12—28
Track of wheels: Front: 1400 mm
Rear: 1305 mm

	With brakes		Without brakes	
	Left-hand m	Right-hand m	Left-hand m	Right-hand m
Radius of turning space	3.19	3.33	3.49	3.69
Radius of turning circle	3.02	3.16	3.33	3.53

(4) Location of centre of gravity

Height above ground: 726 mm
Distance forward from the vertical plane containing the axis of rear wheels: 1145 mm
Distance from the median plane: 0 mm

(5) Braking

Date of tests: 1981. 11. 12.
Tractor masses during brake tests

	Front kg	Rear kg	Total kg
Ballasted	762	1258	2020
Unballasted	653	1047	1700

Type 0 (ordinary cold service braking device performance) test

Speed before application of brakes 26.8 km/h

Ballasted	Braking device control force N	120	200	295	392	440	Locked 550
	Mean deceleration m/s^2	0.6	1.0	1.8	2.2	2.7	3.0
Unballasted	Braking device control force N	150	185	303	385	450	Locked 530
	Mean deceleration m/s^2	0.6	1.0	1.9	2.3	2.9	3.1

Type I (fade) test

Braking device control force N	137	255	355	420	Locked 540
Mean deceleration m/s^2	0.6	1.4	1.9	2.2	2.3

Maximum deviation of tractor from its original course: 0 m
Abnormal vibrations: None
The brakes were heated by: The first method

Parking braking device test

Braking device control force N	18 per cent slope		12 per cent slope with trailer of 2.0 tonne	
	Up	Down	Up	Down
	312	341	341	371

(6) Measurement of external noise level

Date of tests:	1931. 11. 02.
Type of sound level meter:	Brüel & Kjaer Type 2203
Type of track:	Tarmacadam
Results of tests:	
Gear:	6
Travelling speed before acceleration:	21.8 km/h
Sound level:	86.4 dB(A)

(7) Noise measurement at the driver's ear

Date of tests:	1931. 11. 02.
Type of sound level meter:	Brüel & Kjaer Type 2203
Type of track:	Tarmacadam
Cab fitted:	No.
Results of tests:	

Gear	Drawbar pull at which the tractor develops the maximum sound level KN	Measured traveling speed km/h	Sound level dB(A)
3*	10	7.4	94.5
3*	light load	8.4	92.0
6	light load	27.0	92.0

* The 3rd gear corresponds to the nominal travelling speed nearest to 7.5 km/h.

(8) Power lift and hydraulic pump performance

Date and location of tests:	1981. 12. 07.
Hydraulic fluid	
Make and type:	INA SUPER 3 SAE 30
Viscosity:	8°E/50°C
Viscosity index:	min 95
Type of linkage lock for transport:	Hydraulic
Power lift	

	Height of lower hitch point above ground in down position mm	Vertical movement mm	Maximum force exerted through full range kN	Corresponding pressure of hydraulic fluid MPa	Moment about rear axle kNm	Maximum tilt angle of mast over range of lift degrees
At hitch points	180	615	11.35	15.2	9.39	—
On the frame	180	710	8.42	15.2	12.10	9

Temperature of hydraulic fluid at start of test: 64°C

Hydraulic pump performance:

Opening pressure of the relief valve:	14.9 MPa
Sustained pressure with relief valve open:	15.2 MPa
Pump delivery rate at minimum pressure, the governor control lever being set for maximum power:	17 l/min
Hydraulic power at 90% of relief valve setting:	3.7 kW
Corresponding delivery rate:	16.2 l/min
Pressure:	13.7 MPa
Temperature of hydraulic fuel:	68°C

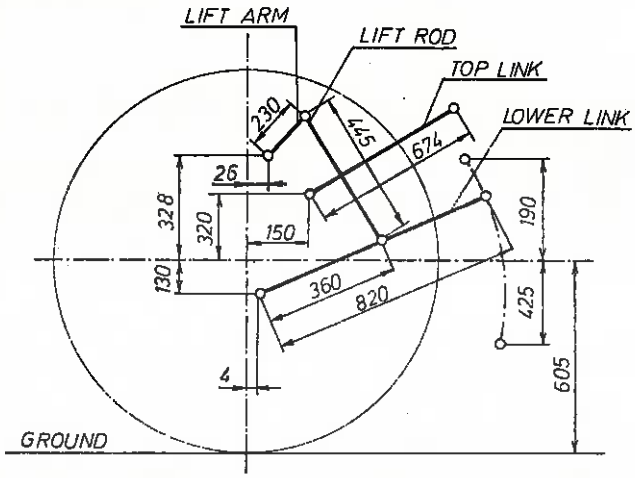
Linkage geometry

Projected length in side view:

Lower links	820 mm
Lift arms	230 mm
Lift rods	410—490 mm
Top link	560—820 mm
Distance of lift rod connection point from pivot point of lower link	368 mm

The following dimensions are given relative to the rear wheel centre line, situated 605 mm above the ground level

Lower link pivot point	4 mm behind,	130 mm below
Top link pivot point	150 mm behind,	320 mm above
Lift arm pivot point	26 mm behind,	328 mm above
Maximum and minimum height of lower link hitch points	190 mm above,	425 mm below
Height of lower link hitch points when locked in transport position	190 mm above	



Date: 23th September 1982.

Head of Testing Division: Dr Ivan Piria

Director: Dr Ivo Todorić