CAMTC

Report on test in accordance with the OECD STANDARD CODE I for the Official Testing of Agricultural Tractor Performance

OECD Approval No: 1600 FULL CODE
Approval Date: 4.Mar. 1996



SHUANGMA–500 (2WD) TRACTOR

Manufactured by: Shenyang Tractor Works
Shenyang, Liaoning, China
Test No: 95OS206
Date of test: Nov. 1995

China Agricultural Machinery Testing Centre
40 Shi Li He Donghuan Nanlu
100021, Beijing, China

SM−500 CAMTC OECD No. 1600 FULL CODE

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- Tractor manufacturer's name and address:	Shenyang Tractor Works, Shenyang, Liaoning, China
- Location of tractor assembly:	The manufacturer
- Submitted for test by:	The manufacturer
- Selected for test by:	The manufacturer with the agreement of the CAMTC
- Place of running—in:	The manufacturer
- Duration of running—in:	60 h
- Location of test:	CAMTC, Beijing, China

I. SPECIFICATIONS OF TRACTOR

TRACTOR

- Make:	SHUANGMA
- Model:	500
- Type:	2WD
- Number of driving wheels:	2
- Serial No :	950361
- lst serial No :	3775

ENGINE

- Make / Model / Type:	Shanghai Tractor & Internal Combustion Engine Corporation, 495A-17, 4 stroke, Water cooling naturally aspirated indirect injection, spherical combustion chamber
- Serial No:	023622

Cylinders

- Number / disposition:	4, vertical
- Bore / stroke:	95 / 115 mm / mm
- Capacity:	3260 cm^3
- Compression ratio:	16.5 / 1
- Arrangement of valves:	Overhead, in line
- Cylinder liners:	Dry

Fuel system

– Fuel feed system:	Forced feed by pump
– Make / Model / Type of fuel filter(s):	Shanghai Filter Works, C0708, paper cartridge, replaceable
– Capacity of fuel tank:	80 dm^3
– Make / Model / Type of injection pump:	Shanghai Injector and Plunger Pump Works, No. I , plunger pump
– Serial No	950655
– manufactuer's production setting of injection pump:	
• Flow rate (rated engine speed and full load) :	12.0 dm^3 / h
• Timing:	25 ° ~27 ° before T.D.C.
– Make / Model / Type of injectors:	Shanghai Injector and Plunger Pump Works, long-neck closed single hole
– Injection pressure:	$17.2^{+0.5}$ MPa

Governor

– Make / Model / Type:	Shanghai Injector and Plunger pump Works, steel-ball, all-speed, centrifugal
– Governed range of engine speed:	From 550 to 2160 rev / min
– rated engine speed:	2000 rev / min

Air cleaner

– Pre—cleaner	
• Make / Model / Type:	Shanghai Automobile accessory Works, centrifugal
• Locaton of air intake:	Left-hand side of engine
– Main cleaner	
• Make / Model / Type:	Shanghai Automobile accessory Works, oil bath with mesh screen
– Maintenance indicator:	None

Lubrication system

– Type of feed pump:	Rotor
– Type of filter(s):	J0810, full flow, paper, replaceable
– Number:	1

Cooling system

– Type of coolant:	Water
– Type of pump:	Centrifugal, belt driven
– Specification of fan:	
– Number of fan blades:	4
– Fan diameter:	380 mm
– Coolant capacity:	5.7 dm^3
– Type of temperature control:	Thermostat
– Superpressure system:	None

Starting system

– Make / Model / Type:	Shanghai Automobile Motor Works, 2Q2C
– Starter motor power rating:	1.84 kW
– Cold starting aid:	Electrothermal plug
– Safety device:	Main shift lever in neutral position

Electrical system

– Voltage:	12V
– Generator	
• Make / Model / Type:	Shanghai Automobile Motor Works, JF1211Z, alternator, belt driven
• Power:	0.2 kW
– Battery (number of accumulators):	3Q-135, 2
• Rating:	135 Ah at 20 hours

Exhaust system

– Make / Model / Type:	Shanghai Tractor & Internal Combustion Engine Corporation, vertical, expension type silencer
– Location:	Left-hand side of engine

TRANSMISSION TO WHEELS

Clutch (travel and power take-off)

– Make / Model / Type:	Shenyang Tractor Works, dry, dual-acting
– Number of plates:	2
– Diameter of plates:	316 mm
– Method of operation:	Mechanically by pedal

Gear box

- Make / Model / Type: Shenyang Tractor Works, mechanical
- Arrangement: GEAR BOX with 4 forward and 1 reverse speed GROUP GEAR with 2 ranges (Low and High)
- Number of gears: 8 forward and 2 reverse
- Available options: None

Rear axle and final drives

- Make / Model / Type: Shenyang Tractor Works, Spiral bevel gear with differential, planetary final drives
- Differential lock:
  - Type: Splined sleeve
  - Method of engagement: Hand lever operated
  - Method of disengagement: Self—disengaging

Front axle and final drives

- Make / Model / Type: Shenyang Tractor Works, balanced arm type
- Differential lock: None

Total ratios and travelling speeds

Gear No	Group or range	Number of engine revolutions for one revolution of the driving wheels	Nominal travelling speed (*) at rated engine speed of 2000 rev / min km / h
1	L1	158.30	3.50
2	L2	109.01	5.12
3	L3	78.01	7.15
4	L4	56.69	9.85
5	H1	45.51	12.26
6	H2	31.36	17.80
7	H3	22.43	24.88
8	H4	16.29	34.25
R1	L	166.38	3.33
R2	R	48.52	11.50

(*) Calculated with a tyre dynamic radius index of 740 mm (ISO 4251 / 1—1992).

POWER TAKE—OFF

Main power take—off

− Type:	Semi−independent
− Method of engagement:	Driven by the 2nd plate of the main clutch
− Number of shafts:	1
− Method of changing power take−off shaft speeds:	By shifting gear lever

Power take—off proportional to engine speed

540 rev / min

− Location:	At rear of the tractor
− Diameter of power take—off shaft end:	34 mm
− Number of splines:	21, not in conformity with ISO 500 / 1991
− Height above ground:	640 mm
− Distance from the median plane of the tractor:	0 mm
− Distance behind rear wheel axis:	285 mm
− PTO speed at rated engine speed (2000 rev / min):	591 rev / min
− Engine speed at standard power take—off speed:	1828 rev / min
− Ratio of rotation speeds (engine speed / p.t.o speed):	3.3846
− Power restriction and maximum torque:	33 kW 655 N・m
− Direction of rotation (viewed from behind tractor):	Clockwise

1000 rev / min

− Location:	Ar rear of tractor
− Diameter of power take—off shaft end:	34 mm
− Number of splines:	21, not in conformity with ISO 500 / 1991
− Height above ground:	640 mm
− Distance from the median plane of the tractor:	0 mm
− Distance behind rear wheel axis:	285 mm
− PTO speed at rated engine speed (2000 rev / min):	930 rev / min
− Engine speed at standard power take—off speed:	2150 rev / min

- Ratio of rotation speeds (engine speed / p.t.o speed):	2.1505
- Direction of rotation (viewed from behind tractor):	Clockwise

Power take—off proportional to ground speed

- PTO speed:	540 rev / min
- Travelling distance for one revolution of power take—off shaft:	99～966 mm
- Number of power take—off shaft revolutions for one revolution of (rear) driving wheels:	5～47

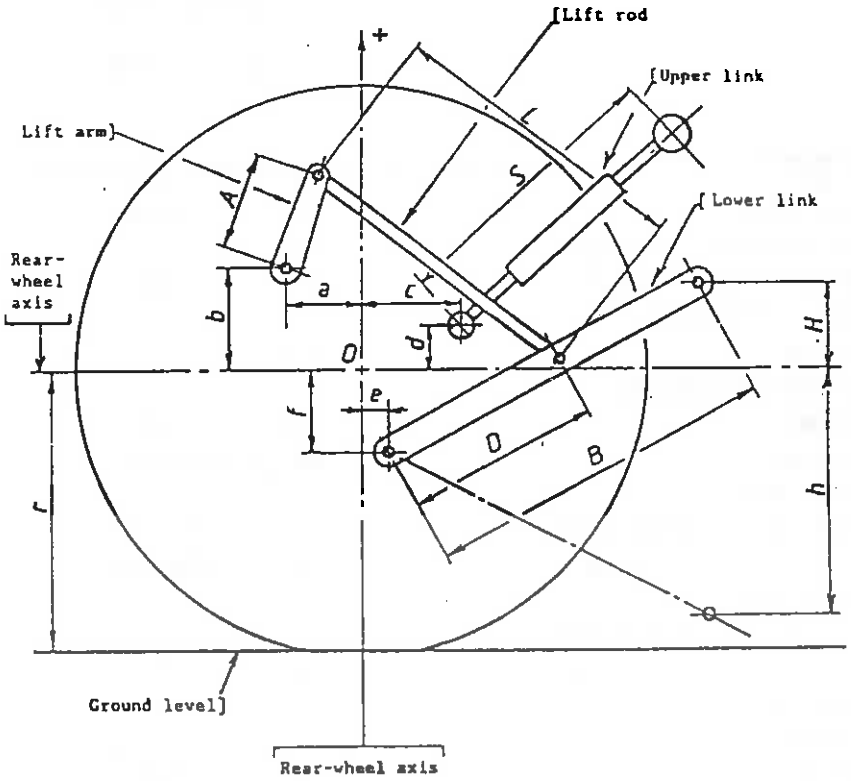
Optional power take—off: None

POWER LIFT

- Make / Model / Type:	Shenyang Tractor Works
- Type of hydraulic system:	Separated units, open centre system
- Type and number of cylinders:	Single acting, 1
- Type of linkage lock for transport:	Hydraulic lock
- Relief valve pressure setting (tolerance):	12.25～13.52 MPa
- Opening pressure of cylinder safety valve:	None
- Lift pump type:	CBN-E316, gear pump
- Transmission between pump and engine:	Gear, driven from engine
- Type and number of filters:	Screen filter, 1
- Site of oil reservoir:	Above the clutch housing
- Type, number and location of tapping points:	Thread, KZE10,2, right side of gear box housing
- Maximum volume of oil available to external cylinders:	20 dm^3

Three—point linkage

- Category:	2, in conformity with categories 2 of ISO 730 / 1-1990
- Category adapter:	None


Lift rod
Upper link
Lift arm
Lower link
Rear-wheel axis
A
S
L
a
c
b
d
O
H
e
f
D
B
h
r
Ground level
Rear-wheel axis

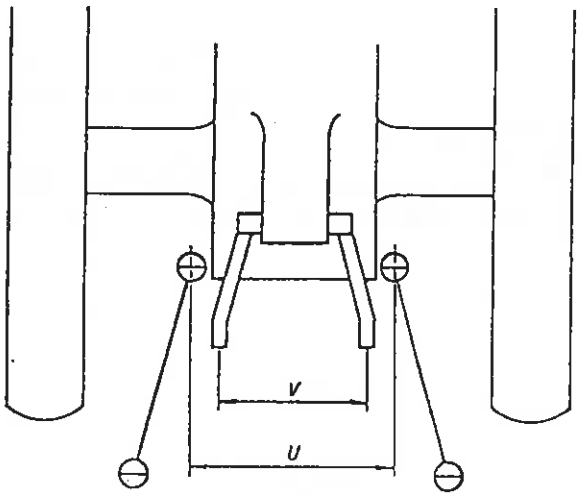

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u

Table 1.1—Dimensions of linkage geometry (when connected to the standard frame)

		Dimension or range mm	Settings used in test mm
Length of lift arms	(A)	310	310
Length of lower links	(B)	1000	1000
Distance of lift arm pivot : horizontally	(a)	68	68
point from rear wheel axis : vertically	(b)	329	329
Horizontal distance between the 2 lower link points	(u)	585	585
Horizontal distance between the 2 lift arm end points	(v)	630	630
Length of upper link	(S)	from 535 to 800	680
Distance of upper link pivot point from rear : horizontally	(c)	246、276	276
wheel axis: vertically	(d)	945、985	985
Distance of lower link pivot point from rear : horizontally	(e)	44	44
wheel axis: vertically	(f)	191	191
Distance of lower link pivot points to lift rod pivot points on lower links	(D)	550	550
Length of lift rods	(L)	from 480 to 650	585
Height of lower hitch points relative to the rear wheel axis:			
− in low position	(h)	from 346 to 685	507
− in high position	(H)	from 79 to 344	165
Height above ground of lower hitch points when locked in transport position(*)		from 820 to 1085	

(*) Assuming (r) = tyre dynamic radius index of 740 mm (ISO 4251 / 1—1992).

SWINGING DRAWBAR

− Type: Clevis

− Height above ground:

. Maximum: 423 mm

. Minimum: 423 mm

- Type of adjustment:	None
- Distance of hitch point from rear wheel axis, horizontally	800 mm
- Distance of hitch point from power take-off shaft end	
. Vertically:	189 mm
. Horizontally:	515 mm
- Lateral adjustment (centre of clevis)	
. Right hand:	150 mm
. Left hand:	150 mm
- Distance of pivot point from rear wheel axis, horizontally:	250 mm
- Diameter drawbar pin hole:	31 mm
- Maximum vertical permissible load:	2 kN

TRAILER HITCH

- Type:	Clevis
- Hole diameter:	43 mm
- Height above ground:	656、736 mm
- Distance of hitch point from rear wheel axis, horizontally:	693、740 mm
- Distance of hitch point from power take—off shaft end	
. Vertically:	50、130 mm
. Horizontally:	408、455 mm
- Maximum vertical permissible load:	8 kN

STEERING

- Make / Model / Type:	Shenyang Tractor Works, Worm and roller
- Method of operation:	Manual operated

BRAKES

Service brake

- Make / Model / Type:	Shenyang Tractor Works, disk type
- Method of operation:	Operated by pedals, coupled or independent
- Trailer braking take-off:	Air brake, operated by tractor pedals

Parking brake

- Type: Mechanical
- Method of operation: Pedals locked by ratchet

WHEELS

- Number
  - Front: 2 steering
  - Rear: 2 driving
- Wheelbase: 2210 mm
- Track width adjustment:

	Minimum mm	Maximum mm	Adjustment method
Front	1385	1585	Extending telescopic
Rear	1425	1697	Reversing wheels and off−set lug rims

CAB

- Make / Model / Type: Owm make
- Manufacturer's name and address: ShenYang Tractor Works
- Protective device: Cab
- Tiltable / not tiltable: Not tiltable

DRIVER'S SEAT

- Make / model / Type: Shenyang Tractor Works
- Type of suspension: None
- Type of damping: Spring
- Range of adjustment
  - Longitudinal: 165 mm
  - Vertical: 75 mm

LIGHTING

	Height above ground of centre mm	Size mm	Distance from outside side edge to median plane of tractor mm
Headlights	985	Φ150	585
Sidelights	1520	95×60	765
Rearlights	1680	145×70	825
Reflectors	1520	90×60	660

Ⅱ、TEST CONDITIONS

Overall dimensions

	Length	Width		height at top of	
		minimum	maximum	Cabin	exhaust silencer
	mm	mm	mm	mm	mm
Ballasted	3780	1730	1780	2505	2275
Unballasted	3780	1730	1780	2510	2278

Ground clearance(unballasted tractor): 288 mm

– Clearance-limiting part: Under the rear axle housing

Tractor mass

with cab:

	Ballasted		Unballasted	
	Without driver kg	With driver kg	Without driver kg	With driver kg
Front	974	982	915	922
Rear	1967	2034	1708	1776
Total	2941	3016	2623	2698

Ballast

	Weights		Water kg
	Number	Total mass kg	
Front	1	54	—
Rear	8	264	—

Tyres and track width specifications

	Front	Rear
Tyres:		
• dimensions	6.5-16	11-38
• ply rating	6	8
• type	Cross ply	Cross ply
• maximum load (tyre manufacturer's)	6.20 kN	13.7 kN
• maximum load (tractor manufacturer's)	5.20 kN	10.0 kN
• inflation pressure (tyre manufacturer's)	250 kPa	143 kPa
• dynamic radius index	348 mm	740 mm
Chosen track width:	1385mm	1425mm

Oils and lubrication

-Capacity and change interval

	Capacity dm^3	Oil change h	Filter change h
Engine	9	120	120
Gear box	22.2	1000	—
Front axle	—	—	—
Rear axle	Common with gear box		—
Final drive (front)	—	—	—
Final drive (rear)	0.89×2	1000	—
Hydraulic system	25	1000	—
Steering	1.1	1000	—

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−Specifications:

	Recommended	Used during test
Engine oil • Type: • Viscosity: • Classification:	 SAE 10 W / 30 11.4 cSt at 100℃ API CC	 CA−30 10.0 cSt at 100℃ GB5323−85
Transmission oils • Type: • Viscosity: • Classification:	 85W / 90 15～19 cSt at 100℃ API GL−2	 HL−20 17.8−22 cSt at 100℃ SY 1103−77
Hydraulic fluid • Type: • Viscosity: • Classification:	Same as engine oil	Same as engine oil
Steering oil • Type: • Viscosity: • Classification:	Same as trans.oil	Same as trans.oil

Grease:

• Number of lubrication points: 24

Fuel

− Type: Standard diesel fuel in conformity with national standard GB10327−89

− Density at 15℃ 0.847 g / cm^3

Ⅲ、TEST RESULTS

COMPULSORY TESTS RESULTS

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1. MAIN POWER TAKE-OFF

- Date and location of tests: 23. Oct. 1995, CAMTC
- Type of dynamometer: SCHENCK eddy-current brake W400

Power	Speed		Fuel consumption			Specific energy
	Engine	P.T.O.	Hourly		Specific	
kW	rev / min		kg / h	l / h	g / kWh	kWh / l
1.1 MAXIMUM POWER-TWO HOURS TEST						
34.77	1895	560	10.47	12.39	301.1	2.81
1.2 POWER AT RATED ENGINE SPEED						
34.03	2000	591	10.11	11.96	297.0	2.85
1.3 STANDARD POWER TAKE-OFF SPEED (540 ± 10 rev / min)						
33.83	1828	540	10.16	12.02	300.3	2.81
1.4 PART LOADS 1.4.1 the torque corresponding to maximum power at rated engine speed						
34.03	2000	591	10.11	11.96	297.0	2.85
1.4.2 85% of torque obtained in 1.4.1						
29.13	2007	593	8.70	10.30	298.8	2.83
1.4.3 75% of torque defined in 1.4.2						
22.01	2027	599	6.76	8.00	307.1	2.75
1.4.4 50% of torque defined in 1.4.2						
14.84	2051	606	4.87	5.76	328.0	2.58
1.4.5 25% of torque defined in 1.4.2						
7.52	2075	613	3.42	4.05	455	1.86
1.4.6 unloaded						
0	2092	618	2.21	2.62	/	/

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Power	Speed		Fuel consumption			Specific energy
	Engine	P.T.O.	Hourly		Specific	
kW	rev / min		kg / h	l / h	g / kWh	kWh / l
1.5 PART LOADS AT STANDARD POWER TAKE-OFF SPEED (540 rev / min) 1.5.1 the torque corresponding to maximum power						
33.83	1828	540	10.16	12.02	300.3	2.81
1.5.2 85% of torque obtained in 1.5.1						
29.07	1848	546	8.79	10.40	302.3	2.80
1.5.3 75% of torque defined in 1.5.2						
22.12	1878	555	6.84	8.10	309.4	2.73
1.5.4 50% of torque defined in 1.5.2						
15.02	1912	565	4.87	5.76	324.0	2.61
1.5.5 25% of torque defined in 1.5.2						
7.52	1926	569	3.28	3.88	436.0	1.94
1.5.6 unloaded						
0	1946	575	1.94	2.30		

- No load maximum engine speed: 2902 rev / min
- Torque (equivalent crankshaft) at maximum power: 175.2 N・m
- Torque (equivalent crankshaft) at rated engine Speed: 162.5 N・m
- Maximum torque (equivalent crankshaft): 178.5 N・m (engine speed 1523 rev / min)
- Mean atmospheric conditions
  - Temperature: 20℃
  - Pressure: 101.0 kPa
  - Relative humidity: 72%
- Maximum temperatures
  - Coolant: 92℃
  - Engine oil: 107℃
  - Fuel: 20℃
  - Engine air intake: 20℃

2. HYDRAULIC POWER AND LIFTING FORCE

- Date of tests: 19. Oct . 1995

2.1 HYDRAULIC POWER TEST

- Sustained pressure with relief valve open: 13.0 MPa
- Pump delivery rate at minimum pressure: 36.0 l / min

	Flow rate	Pressure	Power
	l / min	MPa	kW
Flow rate corresponding to a hydraulic pressure equivalent to 90 percent of the actual relief valve pressure setting and corresponding hydraulic power	12.0	11.7	2.34
Flow rate and hydraulic pressure corresponding to maximum hydraulic power	33.6	8.0	4.48

- Tapping point used for test: At right side of gear box housing
- Temperature of hydraulic fluid: 63℃

2.2 POWER LIFT TEST

	at the hitch point	on the frame
Height of lower hitch points above ground in down position	233 mm	180 mm
Vertical movement	672 mm	741 mm
Maximum corrected force exerted through full range	13.18 kN	9.58 kN
Corresponding pressure of hydraulic fluid	11.7 MPa	11.7 MPa
Moment about rear wheel axis	13.8kN・m	15.8 kN・m
Maximum tilt angle of mast from vertical	/ degrees	8 degrees

−Linkage settings for test−see Table 1.1 and Figures 1.1

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	−369	−316	−300	−200	−100	0	+100	+200	+300	+356	+372
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure setting or to maximum power delivered by the hydraulic system, which is lower)											
at the hitch point kN		13.18	13.36	14.21	14.47	14.63	14.61	14.06	13.64	13.46	
Corresponding pressure: 11.7 MPa											
at the frame kN	14.23		13.89	13.35	12.75	12.10	11.29	10.63	9.92		9.58
Corresponding pressure: 11.7 MPa											

3. DRAWBAR PERFORMANCE

− Date of tests: 24～27. Oct. 1995
− Type of track: Concrete

		Tyre inflation pressure	
	Height of drawbar above ground	Front	Rear
Unballasted	650 mm	250 kPa	143 kPa
Ballasted	647 mm	250 kPa	143 kPa

Gear and range	Power	Drawbar Pull	Speed	Engine speed	Slip of wheels	Specific fuel consumption	Specific energy	Temperature			Atmospheric conditions		
								Fuel	Coolant	Engine oil	Temperature	Relative humidity	Pressure
	kW	kN	km / h	rev / min	%	g / kWh	kWh / l	℃	℃	℃	℃	%	kPa
3.1 MAXIMUM POWER IN TESTED GEARS (unballasted tractor)													
1(L1)	17.17	19.38	3.19	2028	15	351.2	2.42	25	78	80	13	52	101.1
2(L2)	24.85	19.36	4.62	2024	15	322.3	2.63	27	80	84	13	52	101.1
3(L3)	28.63	15.50	6.65	1910	11	359.8	2.34	30	85	87	13	52	101.1
4(L4)	29.56	11.72	9.08	1905	8	352.8	2.41	31	87	90	13	52	101.1
5(H1)	30.50	8.70	12.62	1896	6	343.0	2.48	33	90	92	13	52	101.1
6(H2)	29.22	5.65	18.62	1891	5	358.7	2.37	33	92	95	13	52	101.1
3.2 MAXIMUM POWER IN TESTED GEARS (ballasted tractor)													
1(L1)	18.03	20.22	3.21	2026	15	344.4	2.46	26	76	81	13	52	101.1
2(L2)	25.75	20.24	4.58	2023	15	356.5	2.38	27	79	84	13	52	101.1
3(L3)	29.00	15.63	6.68	1903	8	357.9	2.37	29	82	88	13	52	101.1
4(L4)	29.74	11.50	9.31	1902	5	351.0	2.42	32	86	91	13	52	101.1
5(H1)	30.17	8.73	12.44	1897	4	347.4	2.44	34	89	93	13	52	101.1
6(H2)	28.65	5.44	18.96	1889	3	365.4	2.32	35	93	96	13	52	101.1
3.3.1 FIVE HOUR TEST at 75 percent of pull at maximum power													
5(H1)	24.02	6.59	13.12	1995	5	326.0	2.60	29	85	88	13	52	101.1
3.3.2 FIVE HOUR TEST at pull corresponding to 15 percent wheelslip													
2(L2)	25.85	20.23	4.60	2020	—	—	—	28	80	83	13	52	101.1

Oil consumption during ten hours duration of tests 3.3.1 and 3.3.2 65 g / h

4. TURNING AREA AND TURNING CIRCLE

Details of wheel equipment:

	Tyre size	Track width
front:	6.5—16	1415
rear:	11 —38	1425

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
	m	m	m	m
Radius of turning area	3.50	3.51	3.99	4.03
Radius of turning circle	3.39	3.40	3.88	3.92

5. LOCATION OF CENTRE OF GRAVITY

Height above ground:	854 mm
Distance forward from the vertical plane containing the axis of the rear wheels:	755 mm
Distance from the median plane of the tractor:	To the left 5 mm

6. BRAKING

- Date of tests: 24. Oct. 1995

6.1 COLD SERVICE BRAKING DEVICE TEST

Speed before application of brakes: 37.5 km / h

Ballasted tractor	Braking device control force N	300	340	430	560	600
	Mean deceleration m / s^2	2.50	2.71	3.01	3.17	3.17
Unballasted tractor	Braking device control force N	300	340	430	560	600
	Mean deceleration m / s^2	2.61	2.80	3.10	3.21	3.21

6.2 FADE TEST

Speed before application of brakes: 37.2 km / h

Ballasted tractor	Braking device control force N	300	340	430	560	600
	Mean deceleration m / s^2	2.10	2.30	2.71	3.00	3.00

Maximum deviation of tractor from its original course: 80 mm
Abnormal vibration: None
Brakes were heated by: Driving

6.3 PARKING BRAKING DEVICE TEST

	Up	Down
Braking device control force N	230	160

7. MEASUREMENT OF EXTERNAL NOISE LEVEL

- Date of test: 27. Oct. 1995
- Type of sound level meter: B & k 2235
- Type of track: Concrete
- Gear number: 8
- Travelling speed before acceleration: 26.7 km / h
- Sound level: 84.9 dB(A)

Ⅳ. REPAIRS AND ADJUSTMENTS DURING TESTS: None

V. REMARKS: None

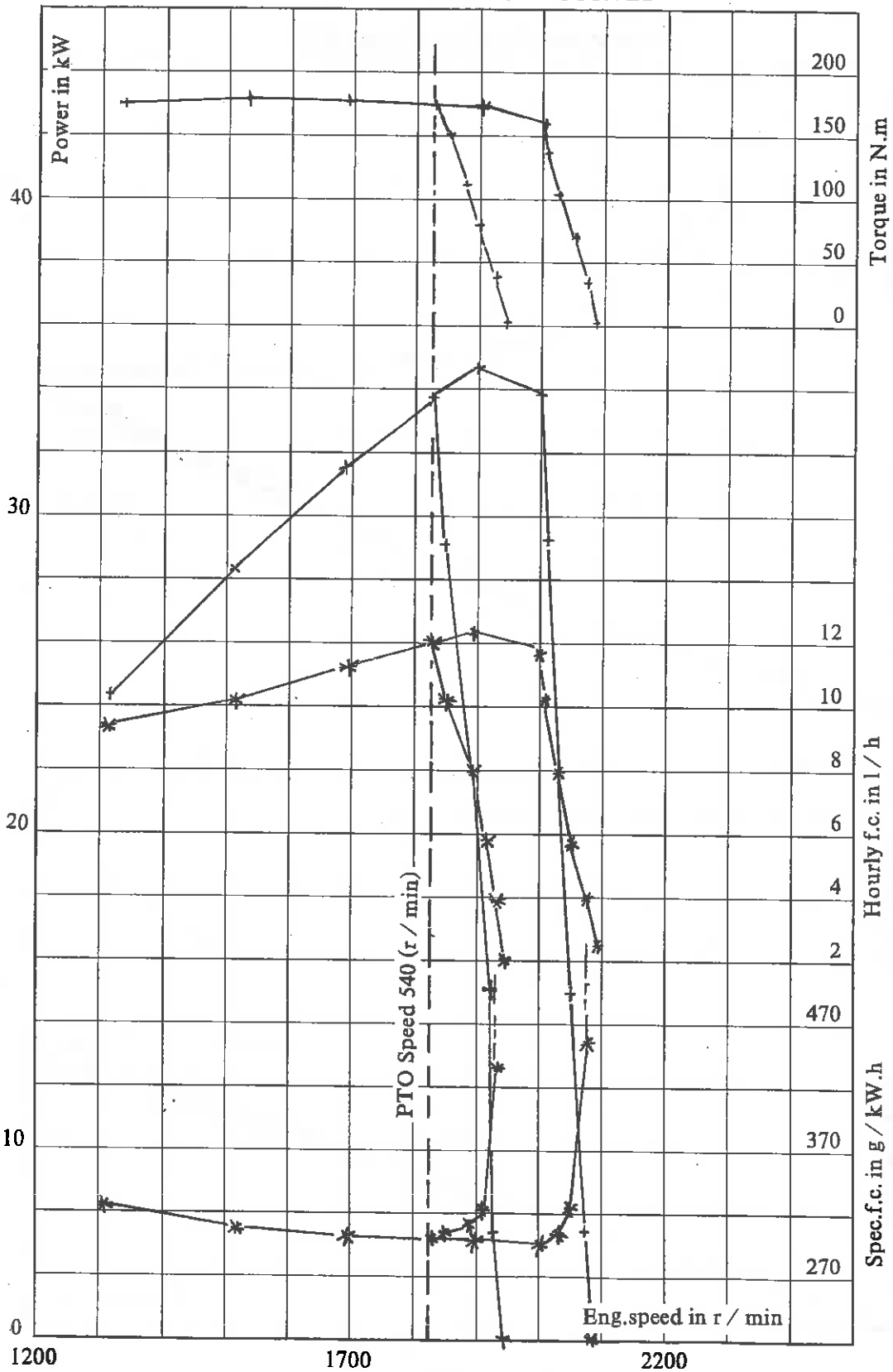
Test carried out by: Baiyuchun, Gengzhanbin, Tianli
Xiong jin xuan, liuqin, Chen xing he

Officer in Charge: Wangyuanxiang

Chief of Tractor Testing Division: Lixijiang 李希江

For the director: Wangliansheng

ANNEX
MAIN POWER TAKE-OFF CURVES



ANNEX

MAIN POWER TAKE-OFF CURVES

