CAMTC

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

OECD Approval No: 1612 FULL CODE

Approval Date: 25 . Apr. 1996



HUNAN–304 (4WD) TRACTOR

Manufactured by: Hengyang Tractor Works
Hengyang, Hunan, China

Test No: 95OS203

Date of test: Aug. 1995

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

HN-304 CAMTC OECD No. 1612 FULL CODE

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– Tractor manufacturer's name and address:	Hengyang Tractor Works Hengyang, Hunan, 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:	CAMTC, Beijing, China
– Duration of running—in:	40 h
– Location of test:	CAMTC, Beijing, China

I. SPECIFICATIONS OF TRACTOR

TRACTOR

– Make:	HUNAN
– Model:	304
– Type:	4WD
– Number of driving wheels:	4
– Serial No :	0028
– Ist serial No :	0028

ENGINE

– Make / Model / Type:	Jianxiang Diesel Engine Works, N385Q, 4 stroke, Water cooling, direct injection, naturally aspirated
– Serial No:	9501

Cylinders

– Number / disposition:	3, vertical
– Bore / stroke:	85 / 95 mm / mm
– Capacity:	1617 cm^3
– Compression ratio:	18 / 1
– Arrangement of valves:	Overhead
– Cylinder liners:	Wet

Fuel system

– Fuel feed system:	Forced feed by pump
– Make / Model / Type of fuel filter(s):	Yiyang Filter Works, C0708A, paper cartridge, replaceable
– Capacity of fuel tank:	26 dm^3
– Make / Model / Type of injection pump:	Wuxi Pump and Injector Works, Series I, 3–cylinder plunger
– Serial No	4276
– manufacturer's production setting of injection pump:	
• Flow rate (rated engine speed and full load) :	6.20 dm^3 / h
• Timing:	26 ° ~29 ° before T.D.C.
– Make / Model / Type of injectors:	Wuxi Pump and Injector Works, S system 4 hole nozzle
– Injection pressure:	$18.13^{+0.49}$ MPa

Governor

– Make / Model / Type:	Wuxi Pump and Injector Works, T7B, centrifugal
– Governed range of engine speed:	From 600 to 2700 rev / min
– rated engine speed:	2400 rev / min

Air cleaner

– Pre—cleaner	
• Make / Model / Type:	Hubei Cleaner Works, 212, metal screen
• Locaton of air intake:	Front side of engine
– Main cleaner	
• Make / Model / Type:	Hubei Cleaner Works, 212, paper cartridge
–Maintenance indicator:	None

Lubrication system

– Type of feed pump:	Rotor
– Type of filter(s):	J0810A, paper, replaceable
– Number:	1

Cooling system

– Type of coolant:	Water
– Type of pump:	Centrifugal, belt driven

– Specification of fan or blower:	Axial flow type, belt driven
– Number of fan blades:	3
– Fan diameter:	340 mm
– Coolant capacity:	8 dm^3
– Type of temperature control:	Thermostat
– Superpressure system:	None

Starting system

– Make / Model / Type:	Liaocheng Electrical Machinery Works, QD1315A, solenoid engaged
– Starter motor power rating:	2.5 kW
– Cold starting aid:	Electrothermal plug
– Safety device:	Main shift lever in neutral position

Electrical system

– Voltage:	12V
– Generator	
• Make / Model / Type:	Wuhan Generator Works, JF11AS,Alternator, belt driven
• Power:	0.35 kW
– Battery (number of accumulators):	6QA-80, 1-
• Rating:	80 Ah at 20 hours

Exhaust system

– Make / Model / Type:	Jianxiang Diesel Engine Works, HN-304
– Location:	Right-hand side of engine

TRANSMISSION TO WHEELS

Clutch

– Make / Model / Type:	Weifang Clutch Works, double function, dry
– Number of plates:	2
– Diameter of plates:	200 mm
– Method of operation:	By pedal

Gear box

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- Make / Model / Type: Own make, HN-304, spur gear
- Arrangement: GEAR BOX with 3 forward and 1 reverse speed GROUP GEAR with 3 ranges (L、M and H)
- Number of gears: 9 forward and 3 reverse
- Available options: Super Lower Speed Device

Rear axle and final drives

- Make / Model / Type: Own make, crown wheel and pinion bevel gear differential, spur gear final drives
- Differential lock:
  - Type: Mechanical, dog-clutch
  - Method of engagement: By pedal
  - Method of disengagement: Self—disengaging

Front axle and final drives

- Make / Model / Type: Own make, bevel gear differential and bevel gear final drives
- 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 2400 rev / min km / h
1	L	312.22	1.43
2	L	211.98	2.11
3	L	159.80	2.80
4	M	96.34	4.65
5	M	65.39	6.85
6	M	49.29	9.09
7	H	34.09	13.14
8	H	23.14	19.35
9	H	17.45	25.67
R1	L	262.93	1.70
R2	M	81.11	5.52
R3	H	28.70	15.61

(*) Calculated with a tyre dynamic radius index of 495 mm (ISO 4251 / 1—1992).

Number of revolutions of front wheels for one revolution of rear wheels: 1.68

POWER TAKE—OFF

Main power take—off

– Type:	Semi-independent
– Method of engagement:	By hand level, Driven by the main clutch
– Number of shafts:	1
– Method of changing power take-off shaft ends and speeds:	Changing speed by lever

Power take—off proportional to engine speed

540 rev / min

– Location:	At rear of the tractor
– Diameter of power take—off shaft end:	35 mm
– Number of splines:	6, in conformity with ISO 500 / 1991
– Height above ground:	494 mm
– Distance from the median plane of the tractor:	0 mm
– Distance behind rear wheel axis:	309 mm
– PTO speed at rated engine speed (2400 rev / min):	624 rev / min
– Engine speed at standard power take—off speed:	2078 rev / min
– Ratio of rotation speeds (engine speed / p.t.o speed):	3.848
– Power restriction and maximum torque:	16.5 kW 280 N • m
– Direction of rotation (viewed from behind tractor):	Clockwise

1000 rev / min

– Location:	Ar rear of the tractor
– Diameter of power take—off shaft end:	35 mm
– Number of splines:	6, in conformity with ISO 500 / 1991
– Height above ground:	494 mm

– Distance from the median plane of the tractor:	0 mm
– Distance behind rear wheel axis:	309 mm
– PTO speed at rated engine speed (2400 rev / min):	1172 rev / min
– Engine speed at standard power take—off speed:	2048 rev / min
– Ratio of rotation speeds (engine speed / p.t.o speed):	2.048
– Direction of rotation (viewed from behind tractor):	Clockwise

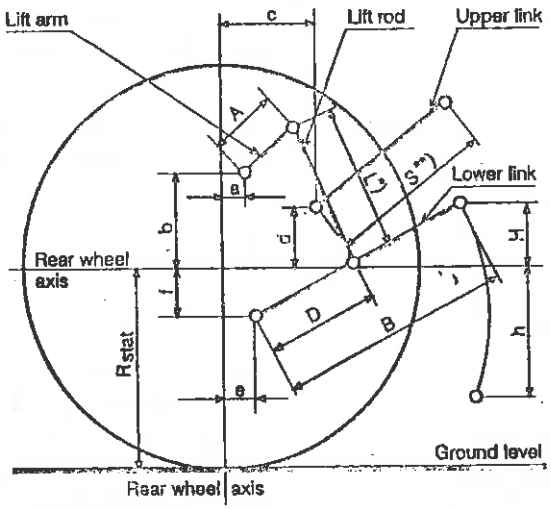
Power take—off proportional to ground speed

– PTO speed:	540 rev / min
– Travelling distance for one revolution of power take—off shaft:	38～687 mm
– Number of power take—off shaft revolutions for one revolution of (rear) driving wheels:	5～81
– Direction of rotation with forward gear engaged (viewed from behind tractor):	Clockwise
Optional power take—off	None

POWER LIFT

– Make / Model / Type:	Beijing No.4 Hydraulic Element Works
– Type of hydraulic system:	Partial 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):	14 ± 0.5 MPa
– Opening pressure of cylinder safety valve (if fitted):	None
– Lift pump type:	CBN310, gear pump
– Transmission between pump and engine:	Gear driven from gear box

– Type and number of filters:	Metal screen, 1
– Site of oil reservoir:	In the transmission housing
– Type, number and location of tapping points:	Thread, M18 × 1.5, 1, front side of hydraulic power lift housing
– Maximum volume of oil available to external cylinders:	8.0 dm^3
Three—point linkage	
– Category:	I, in conformity with categories 1 of ISO 730 / 1–1990
– Category adapter:	None



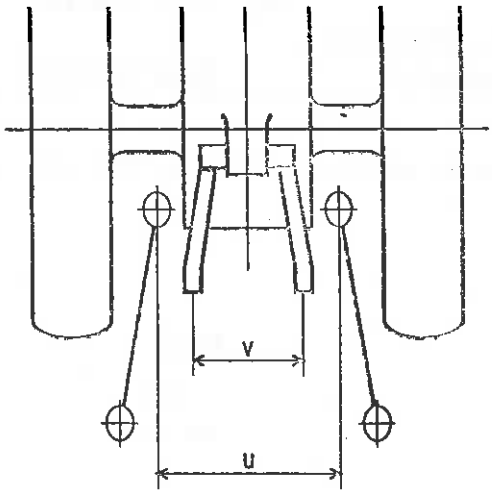


Table 1.1—Dimensions of linkage geometry (when connected to the standard frame)

		Dimension or range mm	Settings used in test mm
Length of lift arms	(A)	190	190
Length of lower links	(B)	695	695
Distance of lift arm pivot : horizontally	(a)	70	70
point from rear wheel axis : vertically	(b)	284	284
Horizontal distance between the 2 lower link points	(u)	403	403
Horizontal distance between the 2 lift arm end points	(v)	330	330
Length of upper link	(S)	from 456 to 643	598
Distance of upper link pivot point from rear : horizontally	(c)	275	275
wheel axis : vertically	(d)	229	229
Distance of lower link pivot point from rear : horizontally	(e)	140	140
wheel axis : vertically	(f)	136	136
Distance of lower link pivot points to lift rod pivot points on lower links	(D)	320	320
Length of lift rods	(L)	from 393 to 534	508
Height of lower hitch points relative to the rear wheel axis:			
– in low position	(h)	from 456 to 116	361
– in high position	(H)	from 76 to 354	117
Height above ground of lower hitch points when locked in transport position(*)		from 419 to 849	

(*) Assuming (r) = tyre dynamic radius index of 495 mm (ISO 4251 / 1—1992).

TRAILER HITCH

– Type:	Fixed
– Hole diameter:	20 mm
– Height above ground:	494 mm

- Distance of hitch point from rear wheel axis, horizontally: 470 mm
- Distance of hitch point from power take-off shaft end
  . Vertically: 0 mm
  . Horizontally: 260 mm
- Maximum vertical permissible load: 10.0 kN

STEERING

- Make / Model / Type: Beijing No.4 Hydraulic Element Works, Hydrostatic steering

Method of operation:
- Pump(s): CBN310 gear pump
- Ram(s): 1,double acting
- Working pressure: 10 MPa

BRAKES

Service brake

- Make / Model / Type: Own make, shoe-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: By hand

WHEELS

- Number
- Front: 2 driving and steering
- Rear: 2 driving
- Wheelbase: 1770 mm

-Track width adjustment:

	Minimum mm	Maximum mm	Adjustment method
Front	1065	1065	None
Rear	1065	1065	None

FRAME

– Make / Model / Type:	Own make
– Manufacturer's name and address:	Hengyang Tractor Works, Hengyang, Hunan, China
– Protective device:	
• Cab / Frame / rollguard / other:	Frame
• Tiltable / not tiltable:	Not tiltable

DRIVER'S SEAT

– Make / model / Type:	Hanjiang Seat Works
– Type of suspension:	Spring
– Type of damping:	None
– Range of adjustment	
• Longitudinal:	25 mm
• Vertical:	0 mm

MISCELLANEOUS

– Additional seat:	None

LIGHTING

	Height above ground of centre mm	Size mm	Distance from outside side edge to median plane of tractor mm
Headlights	1045	75×110	205
Sidelights	1180	65×80	527
Rearlights	1215	70×140	560

Ⅱ、TEST CONDITIONS

Overall dimensions

	Length	Width		height at top of	
		minimum	maximum	Protective structure	exhaust silencer
	mm	mm	mm	mm	mm
Ballasted	3110	1325	1325	2295	1960
Unballasted	3030	1325	1325	2300	1962

Ground clearance(unballasted tractor): 265 mm

– Clearance-limiting part: Under the front axle

Tractor mass

with frame:

	Ballasted		Unballasted	
	Without driver kg	With driver kg	Without driver kg	With driver kg
Front	600	669	576	584
Rear	886	952	770	837
Total	1546	1621	1346	1421

Ballast

	Weights		Water kg
	Number	Total mass kg	
Front	6	60	/
Rear	4	140	/

Tyres specifications

	Front	Rear
Tyres:		
• dimensions	6.00-12	9.5-24
• ply rating	4	6
• type	Cross ply	Cross ply
• maximum load (tyre manufacturer's)	4.61 kN	8.78 kN
• maximum load (tractor manufacturer's)	2.94 kN	7.33 kN
• inflation pressure (tyre manufacturer's)	100～150 kPa	100～150 kPa
• dynamic radius index	295 mm	495 mm
Chosen track width:	1065mm	1065mm

Oils and lubrication

-Capacity and change interval

	Capacity dm^3	Oil change h	Filter change h
Engine	5.5	250	250
Gear box	16.5	500	—
Front axle	6.0	500	—
Rear axle	Common with gear box		—
Final drive (front)	Common with front axle		—
Final drive (rear)	Common with gear box		—
Hydraulic system	Common with gear box		—
Steering	Common with gear box		—

-Specifications (SAE, API,Mil.L, ISO)

	Recommended	Used during test
Engine oil • Type: • Viscosity: • Classification:	SAE 10 W / 30 11.4 cSt at 100℃ API CC	CA-30 10 cSt at 100℃ GB5323-85
Transmission oils • Type: • Viscosity: • Classification:	SAE 80 9.3 cSt at 100℃ API GL-4	N 100 D 110 cSt at 40℃ Q / SH 007.1.23-87
Hydraulic fluid • Type: • Viscosity: • Classification:	Same as trans.oil	Same as trans.oil
Steering oil • Type: • Viscosity: • Classification:	Same as trans.oil	Same as trans.oil

Grease:

• Number of lubrication points: 15

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

1. MAIN POWER TAKE-OFF

- Date and location of tests: 9. Aug. 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						
18.27	2397	623	4.99	5.97	273.1	3.06
1.2 POWER AT RATED ENGINE SPEED						
18.27	2397	623	4.99	5.97	273.1	3.06
1.3 STANDARD POWER TAKE-OFF SPEED (540 ± 10 rev / min)						
17.40	2078	540	4.51	5.39	259.2	3.23
1.4 PART LOADS 1.4.1 the torque corresponding to maximum power at rated engine speed						
18.27	2397	623	4.99	5.97	273.1	3.06
1.4.2 85% of torque obtained in 1.4.1						
16.21	2501	650	4.57	5.47	281.9	2.97
1.4.3 75% of torque defined in 1.4.2						
12.24	2524	656	3.76	4.50	307.2	2.72
1.4.4 50% of torque defined in 1.4.2						
8.25	2551	663	3.02	3.61	366.1	2.28
1.4.5 25% of torque defined in 1.4.2						
4.19	2566	667	2.28	2.73	544.2	1.54
1.4.6 unloaded						
0	2624	682	1.52	1.82	/	/

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						
17.40	2078	540	4.51	5.39	259.2	3.23
1.5.2 85% of torque obtained in 1.5.1						
16.26	2270	590	4.33	5.18	266.3	3.14
1.5.3 75% of torque defined in 1.5.2						
12.34	2289	595	3.51	4.20	284.4	2.94
1.5.4 50% of torque defined in 1.5.2						
8.27	2324	604	2.77	3.31	334.9	2.50
1.5.5 25% of torque defined in 1.5.2						
4.18	2336	607	2.17	2.59	519.1	1.61
1.5.6 unloaded						
0	2386	620	1.31	1.57	–	–

- No load maximum engine speed: 2624 rev / min
- Torque (equivalent crankshaft) at maximum power: 72.8 N • m
- Maximum torque (equivalent crankshaft): 85.0 N • m
  (engine speed: 1647 rev / min)
- Mean atmospheric conditions
  - Temperature: 33℃
  - Pressure: 100.4 kPa
  - Relative humidity: 84%
- Maximum temperatures
  - Coolant: 85℃
  - Engine oil: 106℃
  - Fuel: 33℃
  - Engine air intake: 34℃

2. HYDRAULIC POWER AND LIFTING FORCE

- Date of tests: 15. Aug . 1995

2.1 HYDRAULIC POWER TEST

- Sustained pressure with relief valve open: 13.5 MPa
- Pump delivery rate at minimum pressure: 17.4 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	13.8	12.2	2.81
Flow rate and hydraulic pressure corresponding to maximum hydraulic power	13.8	12.5	2.88

- Tapping point used for test: Front side of hydraulic power lift housing
- Temperature of hydraulic fluid: 63℃
- Opening pressure of the unloading valve: None
- Closing pressure of the unloading valve: None

2.2 POWER LIFT TEST

	at the hitch point	on the frame
Height of lower hitch points above ground in down position	134 mm	56 mm
Vertical movement	478 mm	638 mm
Maximum corrected force exerted through full range	7.03 kN	5.68 kN
Corresponding pressure of hydraulic fluid	12.2 MPa	12.2 MPa
Moment about rear wheel axis	5.87kN・m	8.21 kN・m
Maximum tilt angle of mast from vertical	/ degrees	10 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	-303	-300	-225	-200	-100	0	+100	+200	+253	+300	+335
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			9.27	9.24	9.11	9.06	8.84	8.38	7.03		
Corresponding pressure: 12.2 MPa											
at the frame kN	7.34	7.40		7.05	6.84	6.52	6.28	6.08		5.85	5.68
Corresponding pressure: 12.2 MPa											

3. DRAWBAR PERFORMANCE

- Date of tests: 22~25. Aug. 1995
- Type of track: Concrete

		Tyre inflation pressure	
	Height of drawbar above ground	Front	Rear
Unballasted	497 mm	150 kPa	120 kPa
Ballasted	493 mm	150 kPa	120 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)													
2(L2)	5.89	10.76	1.97	2550	15	511.1	1.64	30	78	90	29	71	100.4
3(L3)	7.48	10.73	2.51	2540	15	452.2	1.85	30	78	90	29	71	100.4
4(M_1)	12.53	10.74	4.20	2540	15	359.7	2.33	31	79	92	30	71	100.4
5(M2)	15.37	8.63	6.41	2398	8	322.0	2.60	31	80	93	30	71	100.4
6(M3)	15.93	6.40	8.96	2400	4	313.6	2.67	33	82	95	30	71	100.4
7(H1)	15.78	4.29	13.24	2403	2	317.7	2.63	34	83	95	30	71	100.4
3.2 MAXIMUM POWER IN TESTED GEARS (ballasted tractor)													
1(L1)	4.44	12.19	1.31	2565	15	536.0	1.56	32	79	90	28	70	100.6
2(L2)	6.60	12.19	1.95	2551	15	491.7	1.70	32	79	90	28	70	100.6
3(L3)	8.55	12.16	2.53	2528	15	419.2	2.00	33	79	91	28	70	100.6
4(M1)	14.08	12.16	4.17	2496	15	340.5	2.46	33	79	93	28	70	100.6
5(M2)	15.95	8.82	6.51	2400	8	308.6	2.71	34	81	95	28	70	100.6
6(M3)	16.25	6.55	8.93	2398	4	306.5	2.73	35	82	85	29	70	100.6
7(H1)	16.02	4.39	13.14	2402	2	300.0	2.79	35	84	96	29	70	100.6
3.3.1 FIVE HOUR TEST at 75 percent of pull at maximum power													
6(M_3)	12.90	4.94	9.40	2486	2	328.4	2.55	33	82	95	29	70	100.6
3.3.2 FIVE HOUR TEST at pull corresponding to 15 percent wheelslip													
4(M_1)	14.12	12.07	4.21	2498	–	–	–	33	80	94	29	70	100.6

Oil consumption during ten hours duration of tests 3.3.1 and 3.3.2: 24 g / h

4. TURNING AREA AND TURNING CIRCLE

Details of wheel equipment:

	Tyre size	Track width
front:	6.00—12	1050
rear:	9.5 —24	1050

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
	m	m	m	m
Radius of turning area	2.93	3.15	3.20	3.55
Radius of turning circle	2.78	3.00	3.05	3.40

5. LOCATION OF CENTRE OF GRAVITY

Height above ground: 590 mm

Distance forward from the vertical plane containing the axis of the rear wheels: 727 mm

Distance from the median plane of the tractor: To the left 3 mm

6. BRAKING

- Date of tests: 24. Aug. 1995

6.1 COLD SERVICE BRAKING DEVICE TEST

Speed before application of brakes: 28.12 km / h

Ballasted tractor	Braking device control force N	150	250	350	450	500
	Mean deceleration m/s^2	1.73	2.25	2.64	3.06	3.29
Unballasted tractor	Braking device control force N	150	250	350	450	500
	Mean deceleration m/s^2	1.69	2.13	2.49	2.90	3.17

6.2 FADE TEST

Speed before application of brakes: 28.12 km / h

Ballasted tractor	Braking device control force N	150	250	350	450	500
	Mean deceleration m / s^2	1.62	2.03	2.44	2.84	3.04

Maximum deviation of tractor from its original course: 0 mm
Abnormal vibration: None
Brakes were heated by: Driving

6.3 PARKING BRAKING DEVICE TEST

	Up	Down
Braking device control force N	205	245

7. MEASUREMENT OF EXTERNAL NOISE LEVEL

- Date of test: 23. Aug. 1995
- Type of sound level meter: B & k 2235
- Type of track: Concrete
- Gear number: 9(H3)
- Travelling speed before acceleration: 21.0 km / h
- Sound level: 83.6 dB(A)

IV. REPAIRS AND ADJUSTMENTS DURING TESTS: None

V. REMARKS: None

Test carried out by: Baiyuchun, Gengzhanbin, Zhangmenghua
Tianli, liuqin, Chenxinghe

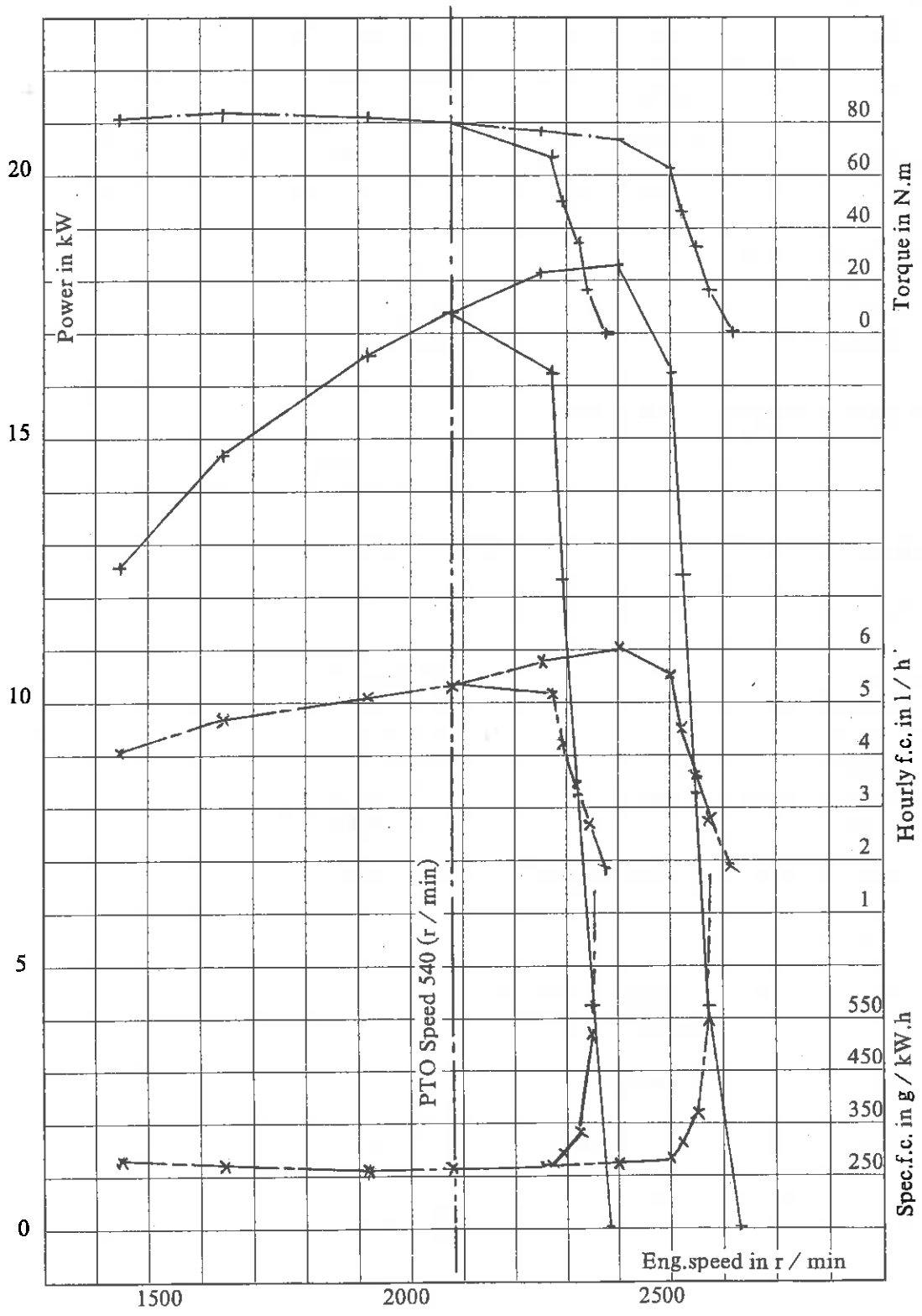
Officer in Charge: Wangyuanxiang

Chief of Tractor Testing Division: Lixijiang

For the director: Wangliansheng

ANNEX

MAIN POWER TAKE-OFF CURVES



ANNEX

MAIN POWER TAKE-OFF CURVES

