CAMTC

Report on test in accordance with the OECD
STANDARD CODE FULL CODE (CODE I) for
the official testing of agricultural tractors

OECD Approval No: 1505 Full Code
Approval Date: 27 JAN. 1994



TAISHAN-304 (4WD) TRACTOR

Manufactured by Shandong Tractor Works
Yanzhou,Shandong,China

Test No: 93OS207

Date: Nov. 1993

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

TS-304 CAMTC OECD No.1505 Full Code

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TS-304 CAMTC OECD No.1505 Full Code

– Tractor manufacturer's name and address:	Shandong Tractor Works, Yanzhou, Shandong, 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:	Shandong Tractor Works
– Duration of running-in:	50 h
– Location of tests:	CAMTC, Beijing China

I. SPECIFICATIONS OF TRACTOR

TRACTOR

– Make / Model / Type:	Shandong Tractor Works: Taishan-304 (4WD)
– Number of driving wheels:	4
– Serial N ° :	93070
– 1st Serial N ° :	0331

ENGINE

– Make / Model / Type:	Shandong Tractor Works, SD2100, 4 stroke, water cooling, naturally aspirated indirect injection
– Serial N ° :	156

Cylinders

– Number / disposition:	2, Vertical, in-line
– Bore / stroke:	100 / 115 mm / mm
– Capacity:	1806 cm^3
– Compression ratio:	(18~20) : 1
– Arrangement of valves:	Overhead
– Cylinder liners :	Wet

Fuel system

– Fuel feed system:	Forced feed by pump

– Make / Model / Type of fuel filter(s):	Bengbu Tractor Accessory Works, CO708, paper cartridge, replaceable
– Capacity of fuel tank	48 dm^3
– Make / Model / Type of injection pump:	Shandong Pump and Injector Works, BF2I85ZR
– Serial N ° :	1750
– Manufacturer's production setting of injection pump:	
• Flow rate (rated engine speed and full load):	6.85 dm^3 / h
• Timing:	15 ° –19 ° before T.D.C.
– Make / Model / Type of injectors:	Shandong Pump and Injector Works, ZS4SI Single–hole nozzle
– Injection pressure:	11.76+0.98 MPa

Governor

– Make / Model / Type:	Shandong Pump and Injector Works, TIF250–1100TX, centrifugal
– Governed range of engine speed:	From 700 to 2376 rev / min
– Rated engine speed:	2200 rev / min

Air cleaner

– Pre–cleaner	
• Make / Model / Type:	Heze Machine Accessory Works, 295 type, centrifugal
• Location of air intake:	Left–hand side of engine
– Main cleaner	
• Make / Model / Type:	Heze Machine Accessory Works, 295 Type, oil bath with mesh screen
– Maintenance indicator:	None

Lubrication system

– Type of feed pump:	Rotor
– Type of filter(s):	Paper element, 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:	6
• Fan diameter:	310 mm
– Coolant capacity:	10 dm^3
– Type of temperature control:	Thermostat
– Superpressure system:	None

Starting system

– Make / Model / Type:	Shandong Liaocheng Electrical Machinery Works, QD12, solenoid engaged
– Starter motor power rating:	1.47 kW
– Cold starting aid:	Electrothermal plug
– Safety device:	Main shift lever in neutral position

Electrical system

– Voltage:	12 V
– Generator	
• Make / Model / Type:	Shandong Liaocheng Electrical Machinery Works, JF01C, alternator, belt driven
• Power:	0.18 kW
– Battery (Number of accumulators):	3–QA–120, 2
• Rating:	120 Ah at 20 hours

Exhaust system

– Make / Model / Type:	Own make, vertical
– Location:	Right–hand side of engine

TRANSMISSION TO WHEELS

Clutch (travel and power take–off)

– Make / Model / Type:	Own make, dry, single–acting
– Number of plates:	1
– Diameter of plates:	228mm
– Method of operation:	Mechanically, by pedal

Gear box

– Make / Model / Type:	Own make, 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:	Own make, crown wheel and pinion bevel gear differential, spur gear final drives
– Differential lock:	
• Type:	Mechanical
• Method of engagement:	By pedal
• Method of disengagement:	By pedal

Front axle and final drives

– Make / Model / Type:	Own make, spiral bevel gear with differential, bevel gear final drives

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 2200 rev / min km / h
1	L	227.00	1.88
2	L	180.00	2.37
3	L	110.60	3.86
4	L	70.00	6.10
5	H	58.04	7.36
6	H	45.97	9.23
7	H	28.23	15.13
8	H	17.80	23.99
R1	L	244.00	1.75
R2	H	62.20	6.87

(*) Calculated with a tyre dynamic radius index of 515mm (ISO 4251 / 1–1984).

Number of revolutions of front wheels for one revolution of rear wheels: 1.43

POWER TAKE-OFF

Main power take-off

- Type:	Not independent
- Method of engagement:	Driven by the main clutch
- Number of shafts:	1
- Method of changing power take-off shaft and speeds:	Changing speeds by level

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 ISO500 / 1979
- Height above ground:	610 mm
- Distance from the median plane of the tractor:	0 mm
- Distance behind rear wheel axis:	219 mm
- PTO speed at rated enging speed (2200 rev / min):	655 rev / min
- Engine speed at standard power take-off speed:	1813 rev / min
- Ratio of rotation speeds (engine speed / p.t.o speed):	3.3582
- Power restriction and maximum torque:	20.2 kW 340 N • m
- Direction of rotation (viewed from behind tractor):	Clockwise

1000 rev / min

- Location:	At rear of the tractor
- Diameter of power take-off shaft end:	35 mm
- Number of splines:	6, in conformity with ISO500 / 1979
- Height above ground:	610 mm
- Distance from the median plane of the tractor:	0 mm
- Distance behind rear wheel axis:	219 mm

- PTO speed at rated engine speed (2200 rev / min):	1241 rev / min
- Engine speed at standard power take-off speed:	1773 rev / min
- Ratio of rotation speeds (engine speed / p. t. o speed):	1.7734
- Direction of rotation (viewed from behind tractor):	Clockwise

Power take-off proportional to ground speed

- Indicate 540:	
- Travelling distance for one revolution of power take-off shaft:	48～610 mm
- Number of power take-off shaft revolutions for one revolution of (rear) driving wheels:	5～68
- Diretion of rotation with forward gear engaged (viewed from behind tractor):	Clockwise

POWER LIFT

- Make:	Own make
- Type of hydraulic system:	Partial separated units, Draft and position responsive, Open centre system
- Type and number of cylinders: (single- or double-acting):	Single acting, 1
- Type of linkage lock for transport:	Mechanical
- Relief valve pressure setting : (tolerance):	17.65 MPa
- Opening pressure of cylinder safety valve:	None
- Lift pump type:	CBN-F 306 gear pump
- Transmission between pump and engine:	Direct driven from engine
- Type and number of filters:	Mesh screen, 1
- Site of oil reservoir:	In the hydraulic power lift housing
- Type, number and location of tapping points:	Thread, 1, left side of hydraulic power lift housing
- Maximum volume of oil available to external cylinders:	3 dm^3

Three–point linkage

– Category: 1, in conformity with category 1 of ISO 730 / 1–1990

– Category adapter: None

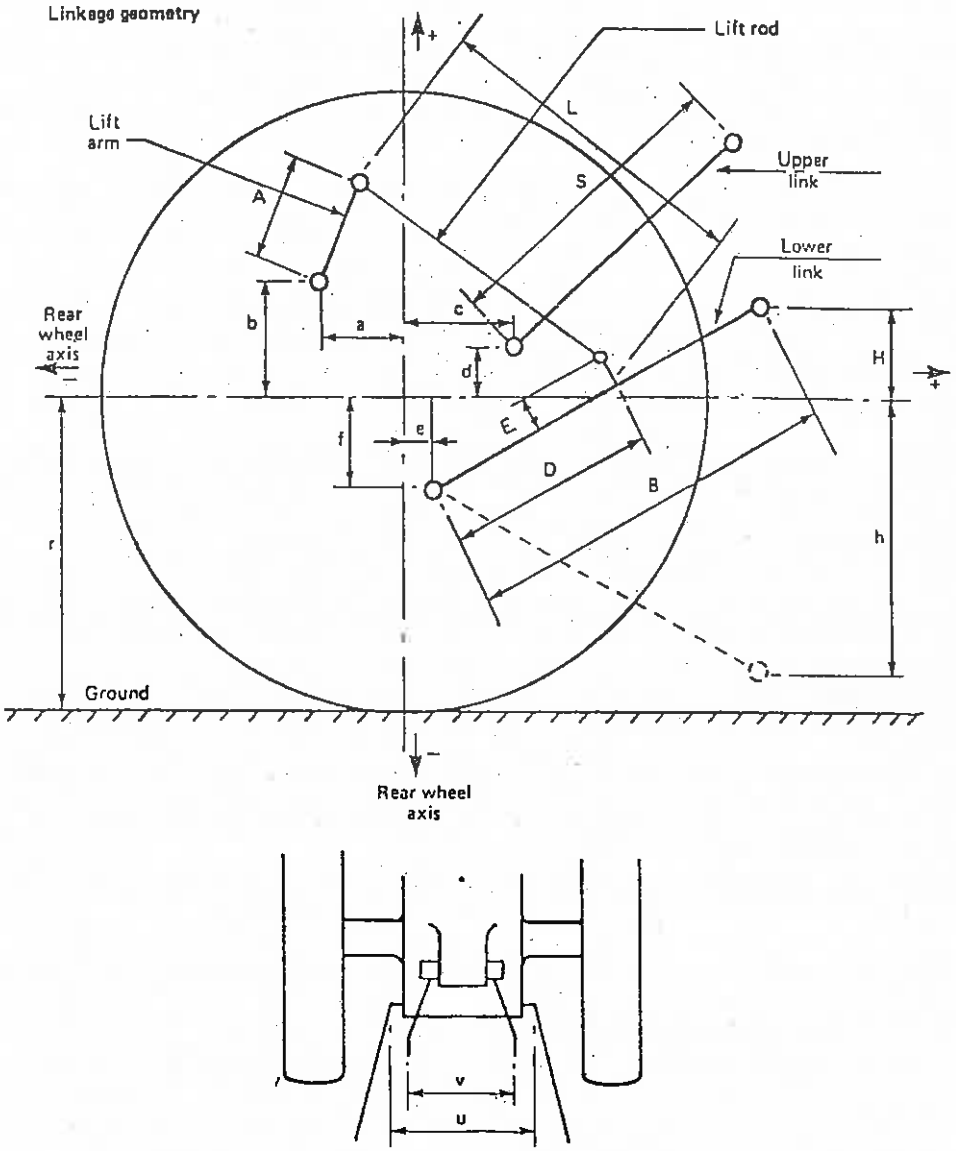


Figure 1: Lift test – Linkage geometry:

Table 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)	174	174
Length of lower links	(B)	772	772
Distance of lift arm pivot : horizontally	(a)	3	3
point from rear wheel axis: vertically	(b)	381	381
Horizontal distance between the two lower link points	(u)	402	402
Horizontal distance between the two lift arm end points	(v)	430	430
Length of upper link	(s)	from 470 to 620	558
Distance of upper link pivot point from rear : horizontally	(c)	238, 243	238
wheel axis : vertically	(d)	342, 372	342
Distance of lower link pivot point from rear : horizontally	(e)	24	24
wheel axis : vertically	(f)	61	61
Distance of lower link pivot points to lift rod pivot points on lower links	(D)	313	313
Length of lift rods	(L)	from 440 to 600	520
Height of lower hitch points relative to the rear wheel axis			
– in low position	(h)	from 195 to 474	322
– in high position	(H)	from 205 to 402	270
Height above ground of lower hitch points when locked in transport position(*)		from 638 to 849	737

(*) Assuming(r) = tyre dynamic radius index of 515mm (ISO 4251 / 1–1984)

TRAILER HITCH

– Type:	Fixed
– Hole diameter:	30 mm
– Height above ground:	571 mm
– Distance of hitch point from rear wheel axis, horizontally:	446 mm
– Distance of hitch point from power take–off shaft end	
• Vertically:	39 mm
• Horizontally:	227 mm
– Maximum vertical permissible load:	10 kN

STEERING

– Make / Model / Type:	Own make, screw–and–nut reciculating–ball–type
– Method of operation:	Manual operated

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

Parking brake

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

WHEELS

– Number	
• Front:	2, driving and steering
• Rear:	2, driving
– Wheelbase:	1740 mm

-Track width adjustment:

	Minimum mm	Maximum mm	Adjustment method
Front	1215	1215	None
Rear	1150	1550	Reversing wheels and off-set lug rims

DRIVER'S SEAT

- Make / Model / Type: Own make, TS-25
- Type of suspension: Spring
- Type of damping: None
- Range of adjustment
  - Longitudinal: 65 mm
  - Vertical: 0 mm

LIGHTING

	Height above ground of centre mm	Size mm	Distance from outside side edge to median plane of tractor mm
Headlights	1170	140 × 90	238
Sidelights	1005	135 × 50	295
Rearlights	1170	162 × 130	578
Brakelight	1030	140 × 60	563

Ⅱ. TEST CONDITIONS

Overall dimensions

	Lenght	Width		Height at top of	
		minimum	maximum	protective structure	exhaust silencer
	mm	mm	mm	mm	mm
Ballasted	3090	1525	1850	/	1958
Unballasted	3090	1450	1850	/	1960

Ground clearance (unballasted tractor): 350 mm

- Clearance-limiting part: Under the front axle

Tractor mass

Without protective structure:

	Ballasted		Unballasted	
	Without driver kg	With driver kg	Without driver kg	With driver kg
Front	729	736	731	736
Rear	974	1042	807	877
Total	1703	1778	1538	1613

Ballast

	Weights		Water kg
	Number	Total mass kg	
Front	/	/	/
Rear	4	165	/
Optinal	/	/	/

Tyres and track width specifications

	Front	Rear
Tyres:		
• dimensions	6.50-16	11.2-24
• ply rating	4	6
• type	cross ply	cross ply
• maximum load(tyre maunfacturer's)	5.05 kN	8.23 kN
• maximum load(tractor maunfacturer's)	3.77 kN	6.19 kN
• inflation pressure(tyre manufacturer's)	255 kPa	127 kPa
• dynamic radius index	366 mm	515 mm
Chosen track width:	1215 mm	1150 mm

Oils and lubrication

-Capacity and change interval:

	Capacity dm^3	oil change h	Filter change h
Engine	6.5-7.5	100-500	200
Gear box	7.0-7.8	1000	
Front axle	1.0-1.5	1000	
Rear axle	common with gear box		
Final drive (front)	2.0×2	1000	
Final drive (rear)	1.6×2	1000	
Hydraulic system(*)	5.5-6.5	1000	

- 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℃ GB 5323—85
Transmission oil • Type: • Viscosity: • Classification:	 SAE 80 9.3 cst at 100℃ API GL—4	 MQB—10 10 cst at 100℃ GB 485-81
Hydraulic fluid • Type: • Viscosity: • Classification:	Same engine oil	Same engine oil
steering oil • Type: • Viscosity: • Classification:	Calcium base grease	Calcium base grease

Grease:

• Number of lubrication points: 17

Fuel

- Type: Standard diesel fuel in conformity with GB10327-89

- Density at 15 ° C: 0.848 g / cm^3

Ⅲ. TEST RESULTS

COMPULSORY TESTS RESULTS

1. MAIN POWER TAKE-OFF

-Date and location of tests: 12. 11. 1993, 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-HOUR TEST						
21.2	2200	655	5.84	6.94	276	3.06
1.2 POWER AT RATED ENGINE SPEED						
21.2	2200	655	5.84	6.94	276	3.06
1.3 STANDARD POWER TAKE-OFF SPEED (540 rev / min)						
18.8	1813	540	4.98	5.91	265	3.18
1.4 PART LOADS 1.4.1 the torque corresponding to maximum power at rated engine speed						
21.2	2200	655	5.84	6.94	276	3.06
1.4.2 85% of torque obtained in 1.4.1						
18.4	2240	667	5.22	6.20	284	2.96
1.4.3 75% of torque defined in 1.4.2						
13.9	2260	673	4.20	4.99	302	2.79
1.4.4 50% of torque defined in 1.4.2						
9.4	2284	680	3.34	3.97	356	2.37
1.4.5 25% of torque defined in 1.4.2						
4.7	2304	686	2.52	2.99	536	1.57
1.4.6 unloaded						
0	2314	689	1.75	2.08	/	/

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						
18.8	1813	540	4.98	5.91	265	3.18
1.5.2 85% of torque obtained in 1.5.1						
16.8	1907	568	4.53	5.38	270	3.12
1.5.3 75% of torque defined in 1.5.2						
12.9	1958	583	3.78	4.49	293	2.87
1.5.4 50% of torque defined in 1.5.2						
8.7	1981	590	2.93	3.48	337	2.50
1.5.5 25% of torque defined in 1.5.2						
4.4	2008	598	2.18	2.59	496	1.70
1.5.6 unloaded						
0	2028	604	1.45	1.72	/	/

- No load maximum engine speed: 2314 rev / min
- Torque (equivalent crankshaft) at maximum power at rated engine speed: 92.0 N • m
- Maximum torque (equivalent crankshaft): 106.3 N • m
  (engine speed: 1501 rev / min)
- Mean atmospheric conditions
  - Temperature: 16 ℃
  - Pressure: 102 kPa
  - Relative humidity: 76%
- Maximum temperatures
  - Coolant: 70℃
  - Engine oil: 96℃
  - Fuel: 24℃
  - Engine air intake: 17℃

2. HYDRAULIC POWER AND LIFTING FORCE

– Date of tests: 6. 12. 1993

2.1 HYDRAULIC POWER TEST

– Sustained pressure with relief valve open: 18.0 MPa

– Pump delivery rate at minimum pressure: 13.6 l/ min

	Flow rate	Pressure	Power
	l/ min	MPa	kW
Flow rate corresponding to a hydraulic pressure equivalent to 90 per cent of the actual relief valve pressure setting and corresponding hydraulic power	10.1	16.2	2.73
Flow rate and hydraulic pressure corresponding to maximum hydraulic power	12.1	15.0	3.02

– Tapping point used for test: Auxilliary service connection

– 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	193 mm	183 mm
Vertical movement	592 mm	689 mm
Maximum corrected force exerted through full range	7.41 kN	5.26 kN
Corresponding pressure of hydraulic fluid	18.0 MPa	18.0 MPa
Moment about rear wheel axis	5.90 kN • m	7.40 kN • m
Maximum tilt angle of mast from vertical	/	9 degrees

- Linkage setting for test-see Table 1 and Figures 1

Lifting heights relative to the horizontal plane including the lower link pivot points											
mm	-271	-261	-200	-100	0	+100	+200	+300	+331	+400	+418
Lifting forces (the values measured are corrected to correspond to a hydraulic pressure equivalent to 90% of the actual relief valve pressure setting)											
at the hitch point kN	/	7.41	7.73	8.08	8.25	8.22	7.95	7.61	7.58		
Corresponding pressure: 18 MPa											
at the frame kN	7.32		7.44	7.28	7.02	6.43	6.01	5.63		5.36	5.26
Corresponding pressure: 18 MPa											

3. DRAWBAR PERFORMANCE

-Date of tests: 24~27. 11. 1993

-Type of track: Concrete

		Tyre inflation pressure	
	Height of drawbar above ground	Front	Rear
Unballasted	540 mm	160 kPa	110 kPa
Ballasted	538 mm	160 kPa	110 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	7.5	12.55	2.14	2275	15	452	1.87	21	70	75	11	50	102.5
3	12.0	12.58	3.42	2250	15	390	2.17	21	72	81	11	50	102.5
4	17.4	10.76	5.82	2206	8	345	2.45	20	75	82	11	50	102.5
5	18.4	9.33	7.11	2198	6	326	2.59	19	80	85	11	50	102.5
6	17.9	7.06	9.12	2205	4	330	2.56	18	81	88	11	50	102.5
3.2 MAXIMUM POWER IN TESTED GEARS (ballasted tractor)													
1	6.5	13.99	1.68	2290	15	480	1.76	21	68	75	10	52	102.4
2	8.3	13.96	2.13	2280	15	424	1.99	20	70	77	10	52	102.4
3	13.2	13.94	3.40	2244	15	374	2.26	20	75	80	10	52	102.4
4	17.7	10.94	5.83	2204	7	335	2.52	19	80	84	10	52	102.4
5	18.3	9.22	7.14	2206	6	320	2.64	18	80	84	10	52	102.4
6	17.8	7.01	9.16	2203	4	338	2.50	17	81	86	10	52	102.4
3.3.1 FIVE HOUR TEST at 75% of pull at maximum power													
5	14.2	6.98	7.34	2240	3	353	2.39	23	75	81	10	52	102.4
3.3.2 FIVE HOUR TEST at pull corresponding to 15% wheelslip													
3	13.2	13.92	3.41	2245	(*)	(*)	(*)	24	74	80	10	52	102.4

Oil consumption during ten hours duration of tests 3.3.1 and 3.3.2: 44.5 g / h

4. TURNING AREA AND TURNING CIRCLE

Details of wheel equipment:

	Tyre size	Track width
front:	6.50-16	1215
rear :	11.2-24	1150

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
	m	m	m	m
Radius of turning area	3.47	3.18	3.92	3.48
Radius of turning circle	3.33	3.04	3.78	3.34

5. LOCATION OF CENTRE OF GRAVITY

- Height above ground: 667 mm
- Distance forward from the vertical plane containing the axis of the rear wheels: 794 mm
- Distance from the median plane of the tractor: 9 mm

6. BRAKING

- Date of tests: 27. 11. 1993
- Type of track: Concrete

6.1 COLD SERVICE BRAKING DEVICE TEST

Speed before application of brakes, 25.5 km / h

Ballasted tractor	Braking device control force N	100	150	250	350	450	550
	Mean deceleration m / s^2	0.74	1.05	1.65	2.35	2.84	3.13
Unballasted tractor	Braking device control force N	100	150	250	350	450	550
	Mean deceleration m / s^2	0.60	0.85	1.44	2.00	2.55	2.85

6.2 FADE TEST

Speed before application of brakes, 25.5 km / h

Ballasted tractor	Braking device control force, N	100	150	250	350	450	550
	Mean deceleration, m / s^2	0.55	0.82	1.35	1.87	2.45	2.78

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

6.3 PARKING BRAKING DEVICE TEST

	Up	Down
Braking device control force, N	307	369

7. MEASUREMENT OF EXTERNAL NOISE LEVEL

- Date of test: 26. 11. 1993
- Type of sound level meter: B&K 2235
- Type of track: Concrete
- Gear number: 8
- Travelling speed before acceleration: 19.1 km / h
- Sound level: 85.7 dB(A)

IV. REPAIRS AND ADJUSTMENTS DURING TESTS: None

V. REMARKS: None

Test carried out by : Gengzhanbin, Baiyuchun

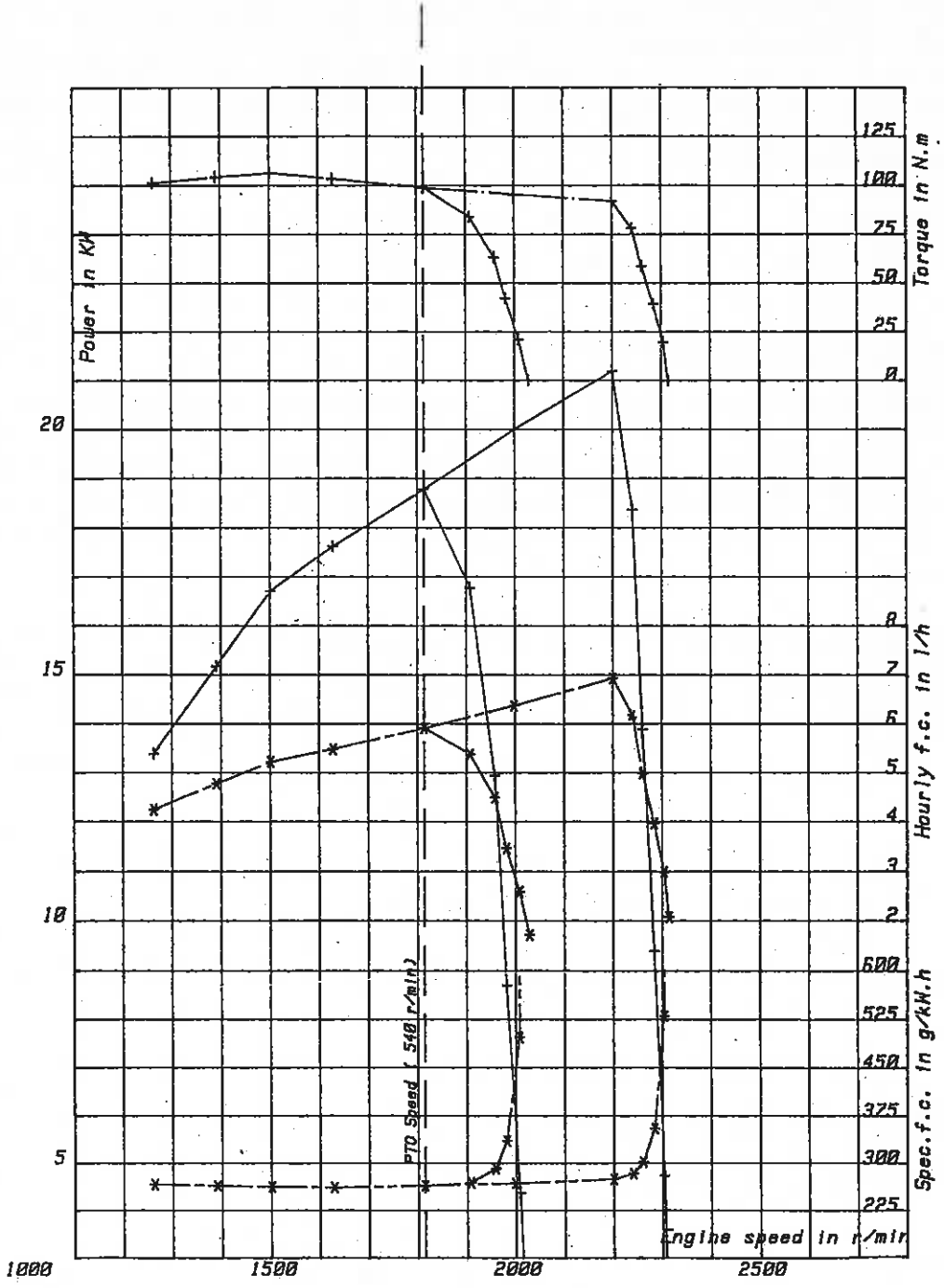
Officer in Charge: WangYuanXiang

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ANNEX

MAIN POWER TAKE–OFF TEST CURVES



MAIN POWER TAKE–OFF TEST CURVES

