O. E. C. D. Report No. : 477

Report on test in accordance with

O. E. C. D. Test Code for Agricultural Tractors

MITSUBISHI FARM TRACTOR D 1800

Manufactured by : Mitsubishi Heavy Industries Ltd.
Sagamihara Machinery Works,
Kanagawa, Japan



Test No. : 49002/O.E.C.D.
Date of test : June - September 1974

This report has been approved by the O. E. C. D. Coordinating Centre (C. N. E. E. M. A., France) as being in accordance with the O.E.C.D. Tractor Test Code Date of Approval : 15th April, 1975 Serial No. : 477

INSTITUTE OF AGRICULTURAL MACHINERY

OMIYA SAITAMA JAPAN

TABLE OF CONTENTS

	page	fig.
Specification of tractor	1	
Fuels and lubricants used in tests	4	
Compulsory tests	5	
Power take-off	5	1
Drawbar	7	2, 3 and 4
Turning space and turning circle	8	
Location of centre of gravity	8	
Braking	8	
Noise measurement	9	
Power lift and hydraulic pump performance	10	
Repairs and adjustments, remarks	13	
Performance curves	14	

Tractor manufacturer:	Mitsubishi Heavy Industries Ltd. Sagamihara Machinery Works Kanagawa, Japan
Submitted for test by:	The manufacturer
Selected by:	The manufacturer with the agreement of the I. A. M.
Place of running-in:	Mitsubishi Limited
Duration of running-in:	60 hours

SPECIFICATION OF TRACTOR

Tractor

Make:	Mitsubishi Heavy Industries Ltd.
Model:	Mitsubishi farm tractor D 1800
Type:	Four wheel, rear wheel driven
Serial No.:	M61-60908

Engine

Make:	Mitsubishi Motor Co., Ltd.
Model:	MITSUBISHI KE 95
Type:	Water cooled, 4 stroke indirect injection diesel
Serial No.:	1045
Cylinders:	2 cylinders, vertical in line, 85 mm bore x 85 mm stroke, capacity 964 cm^3, compression ratio 20 : 1, overhead valves, replaceable wet cylinder liners
Fuel system:	Gravity feed, TOKYO ROKI replaceable paper filter, fuel tank capacity 20 l, NIPPON DENSO PFR-2K injection pump, serial No. 3M0064, manufacturer's production setting for injection pump; 0.0355 cm^3/stroke at 2400 rev/min engine speed, NIPPON DENSO ND-DNOS 34 injection nozzles, injection pressure 120 kg/cm^2
Governor:	MITSUBISHI MOTOR centrifugal variable speed governor, governed range of engine speed 800 - 2600 rev/min, rated engine speed 2400 rev/min
Air cleaner:	TOKYO ROKI dry type with replaceable paper element, pre-cleaner none
Lubrication system:	Forced feed from gear-type pump with metal strainer in sump, replaceable cartridge-type paper element full flow filter, oil capacity 4 l, recommended oil change period 100 hours, cartridge change period 100 hours, recommended oil viscosity HD
Cooling system:	Water cooled, impeller assisted with 320 mm dia 4-blade belt driven fan, cooling water capacity 4.5 l, pressurized at 0.7 kg/cm^2
Starting system:	Electrical, 12V MITSUBISHI ELECTRIC MLAO2-1 solenoid engaged starter motor, electrical glow plug and excess fuel injection for cold starting

Electrical system :	Voltage ;	12, negative earth
	Generator ;	MITSUBISHI ELECTRIC AH 2015S
	Battery ;	JAPAN STORAGE BATTERY N50Z, capacity 60 Ah at 20 hour rating

Transmission

Clutch :	DAIKIN single dry clutch, 184 mm dia plate, operated by single foot pedal
Gearbox :	Own make, mechanical type with sliding gear, 3-stage group gear giving 9 forward speeds and 3 reverse
Rear axle and final drive :	Own make, crown wheel and bevel pinion with spur gear final drives, pedal operated mechanical differential lock
Oil capacity :	Gearbox 12 l, final reduction units 0.2 l each, recommended oil change period 600 hours, recommended oil viscosity ; winter SAE 80 summer SAE 90

Gear ratios and speeds

Gear	Number of engine revolution for one revolution of driving wheel	*Nominal travelling speed for 2400 rev/min rated speed of engine, km/h
Forward		
1	486. 57	0. 86
2	340. 18	1. 23
3	242. 46	1. 73
4	167. 60	2. 50
5	117. 18	3. 57
6	83. 51	5. 01
7	63. 11	6. 63
8	44. 13	9. 48
9	31. 45	13. 30
Reverse		
1	303. 07	1. 38
2	104. 39	4. 01
3	39. 31	10. 64

*Calculated with a tyre rolling radius of 462.5 mm

Power take-off

At rear of tractor, 35 mm dia, 6-spline acc. to JIS standard(see page 13), height above ground 500 mm in tractor's median plane, proportional engine speed giving 530, 750, 1017 and 1265 rev/min at 2400 rev/min rated engine speed, 540 rev/min at 2446 rev/min engine speed, direction of rotation clockwise viewed from driving end

Belt pully

Optional, not fitted on tractor tested

Power lift

Own make, hydraulic, gear type pump directly from engine, supplies oil to a single acting ram and 3 external tappings, maximum oil pressure 130 ± 5 kg/cm^2, JIS 0 implement linkage with nudging system, oil capacity and oil changing period in common with transmission box (see page 2)

Drawbar

Linkage drawbar, optional, not fitted on tractor tested

Hitch

Optional, clevis type, at rear of tractor, height above ground 378 mm, distance from rear axle 395 and 448 mm, position relative to p. t. o. 172 and 225 mm to rear

Steering

Ball and nut type with single drag link

Brakes

Mechanically acting as internal shoe type, acting on brake drums on differential half shafts, operated by foot pedals, operated independently or together by pedal, fixed by ratchet both pedals of the foot brake for parking

Wheels

Steering wheels: Two at front, OHTSU FO-1 4.00-12 tyres, 4 ply rating, maximum permissible weight on each tyre 245 kg at 3.25 kg/cm^2 pressure, track width 800 -850 mm by 2 steps changed by reversing wheel

Driving wheels: Two at rear, OHTSU AT-12 7-24 high lug tyres, 4 ply rating, maximum permissible weight on each tyre 555 kg at 1.8 kg/cm^2 pressure, track width 800-950 mm by 2 steps changed by reversing wheel

Wheel base: 1360 mm

Lighting

	Height above Ground of centre cm	Size cm	Distance from outside edge of tractor to centre cm
Headlights	94	11 dia	46
Reflectors	111	4 dia	20

Number of grease Points: (whole tractor) 9

CONDITIONS DURING TEST

Weights

Tractor (Without driver but with tanks full)

	Front kg	Rear kg	Total kg
Without ballast	325	442	767
With ballast	434	560	994

Ballast

	No. of weights	Total weight kg	Water kg
Front wheels	4	26	—
Rear wheels	6	141	—
Additional	3	60	Front flame weights

Track setting — Front wheels track width 850 mm
Rear wheels track width 950 mm

Overall dimensions

	Length m	Width m		Heights m	
		Max.	Min.	With exhaust	Without exhaust
With ballast	2.80	1.16	1.01	1.92	—
Without ballast	2.66	1.16	1.01	1,92	—

Remarks: Length with three point linkage

Seat — TAIYO SEISAKUSHO, seat with rubber damper, pan seat with cushion, range of adjustment 60 mm fore and aft

FUELS AND LUBRICANTS USED IN TESTS

Fuel: Diesel oil, specific gravity 0.8306 at 15 °C, viscosity at 30 °C 3.382 cSt, Cetane No. 57, to No. 2 JIS

Engine oil : MITSUBISHI 30 DIAMOND HD, viscosity at 37.8 °C 112 cSt

Transmission oil : 80 FUSO EP, viscosity at 37.8 °C 102 cSt

COMPULSORY TESTS

(1) MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 22nd June, 1974; I. A. M., Omiya, JAPAN

Type of dynamometer: DC Electrical, MEIDENSHA EB-DH

Horsepower (metric) hp	Speed		Fuel consumption		
	Engine rev/min	p. t. o. rev/min	l/h	g/metric hph	metric hph/l
MAXIMUM POWER - 2 hours test					
16.8	2400	530	4.91	241	3.42
STANDARD p. t. o. SPEED (540 rev/min)					
16.7	2446	540	4.86	239	3.44
PART LOADS					
(Ⅰ)14.8	2492	550	4.01	223	3.69
(Ⅱ) 0	2605	575	1.29	—	—
(Ⅲ) 7.5	2550	563	2.44	268	3.07
(Ⅳ)16.8	2400	530	4.91	241	3.42
(Ⅴ) 3.9	2578	569	1.85	389	2.11
(Ⅵ)10.9	2528	558	3.05	230	3 57

No load maximum engine speed :	2605 rev/min	
Equivalent crankshaft torque at maximum power :	5.01 kgm	
Maximum torque :	5.13 kgm at 1800 rev/min of the engine	
Means atmospheric conditions :	temperature ;	26 °C
	pressure ;	753 mmHg
	relative humidity ;	78%
	coolant ;	93 °C
	engine oil ;	104 °C
	fuel ;	26 °C

(*) The recommended speed for drawbar work was not expressly specify by the manufacturer.

(2) DRAWBAR PERFORMANCE

Date of tests: 3rd to 7th September, 1974
Type of track: Concrete
Height of drawbar above ground: 360 mm

Gear No.	Speed km/h	Horse-power (metric) hp	Drawbar pull kg	Engine speed rev/min	Slip of wheels %	Fuel Consumption		Temperature			Atmospheric Conditions		
						Metric drawbar hph/l	g/metric drawbar hph	Fuel °C	Coolant °C	Engine oil °C	Temper-ature °C	Relative humidity %	Pressure mmHg
	(Ⅰ) MAXIMUM POWER (ballasted)												
1	0.79	0.88	300	2616	15.4	0.57	1422	47	68	79	33	63	756
2	1.15	1.28	300	2600	15.8	0.75	1074	45	69	78	33	63	756
3	1.62	1.68	280	2592	15.1	1.00	807	48	70	79	32.5	63	756
4	2.30	2.65	310	2582	14.7	1.41	572	49	69	80	33	65	756
5	3.28	3.64	300	2568	15.0	1.69	478	49	73	79	33	65	756
6	4.54	5.21	310	2552	15.4	2.00	402	50	77	81	33	65	756
7	5.98	6.64	300	2530	14.9	2.27	353	52	82	83	33	65	756
8	8.32	*9.55	310	2499	15.1	2.50	321	55	85	88	33	65	756
9	11.41	11.83	280	2392	12.4	2.41	332	55	82	85	31.5	65	756
	(Ⅱ) FIVE HOUR TEST at 75% of pull at maximum power												
7	5.69	9.16	435	2516	16.4	2.60	309	52	78	89	31	62	756
	(Ⅲ)+ FIVE HOUR TEST at pull corresponding to 15% wheelslip in test (Ⅰ)												
8	8.76	—	310	—	—	—	—	51	77	84	31	51	761
	(Ⅳ) MAXIMUM POWER (unballasted)												
1	0.83	0.80	260	2636	14.8	—	—	44	62	79	29	72	761
2	1.15	1.15	270	2620	15.8	—	—	44	62	79	29.5	69	761
3	1.62	1.56	260	2618	15.1	—	—	44	62	78	29.5	69	761
4	2.34	2.34	270	2609	15.6	—	—	42	62	75	29	72	761
5	3.31	3.19	260	2589	14.8	—	—	43	64	79	29	72	761
6	4.61	4.44	260	2574	15.2	—	—	44	65	79	30	69	761
7	6.05	6.05	270	2554	15.2	—	—	46	65	79	30	69	761
8	8.60	8.60	270	2525	14.9	—	—	47	72	81	30	69	761
9	11.63	*11.63	270	2441	15.0	—	—	51	88	83	31	67	761

Total oil consumption during ten hours duration of tests (Ⅱ) and (Ⅲ): 17 g/h

* Maximum power available at 15% wheelslip

\+ Test (Ⅲ) was carried out with additional ballast and the results for power, slip and fuel consumption have no practical significance.

(3) TURNING SPACE AND TURNING CIRCLE

Details of wheel equipment: As in specification, without ballast
Track of wheels: front 850 mm, rear 950 mm

Results	With brakes		Without brakes	
	right-hand m	left-hand m	right-hand m	left-hand m
Radius of turning space	2.09	2.13	2.32	2.37
Radius of turning circle	2.01	2.05	2.24	2.29

(4) LOCATION OF CENTRE OF GRAVITY

mm

Height above ground	660
Distance forward from the vertical plane containing the axis of the rear wheels	534
Distance from the median plane	0

(5) BRAKING

Date of tests: 11th September, 1974
Type of track: Concrete
Type of decelerometer: YOSHIDA SEIKI Co., Ltd., Type 106-2C
Weight of ballasted tractor: 1030 kg

COLD BRAKES

		Ballasted	Without ballast
Travelling speed of the tractor	km/h	14.2	14.2
(1) Deceleration	m/s^2	4.9	4.9
(2) Stopping distance	m	2.0	2.2
(3) Force exerted on the brake pedal	kg	25.0	25.0
(4) Force exerted on the brake pedal to achive a deceleration of 2.5 m/s^2	kg	10.0	10.0

BRAKE FADE CHARACTERISTICS (hot tests)

		Ballasted
Deceleration hot/deceleration cold x 100	%	96
Stopping distance cold/stopping distance hot x 100	%	91
Force on pedal cold/force on pedal hot x 100	%	100

PARKING BRAKE

Efficiency of parking latch: Satisfactory facing up and down slope

(6) MEASUREMENT OF AMBIENT NOISE

Date of tests: 10th September, 1974

Type of sound level meter: RION type NA-07A

Type of track: Concrete

Results of tests: Gear 9th

Travelling speed before acceleration 11.1 km/h

Sound level 78 dB(A)

(7) NOISE MEASUREMENT AT THE DRIVER'S EAR LEVEL

Date of tests: 10th September, 1974

Type of sound level meter: RION type NA-07A

Type of track: Concrete

Type of frequency analyser: RION type SA-55

Results of tests

Gear	Travelling speed km/h	dB(A)	Sones
7th	4.92	93	81

(8) POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of tests: 25th June, 1974; I. A. M., Omiya, JAPAN

Hydraulic fluid

make and type: 80 FUSO EP

viscosity: 112 cSt (37.8°C)

viscosity index: 102

Type of linkage lock for transport: Hydraulic

Pump characteristics

i) Opening pressure of the relief valve (manufacturer's figures): 115 kg/cm²

Sustained pressure of the open relief valve: 128 kg/cm²

ii) Pump delivery rate at minimun pressure and rated engine speed: 12.6 l/min

iii) Pump delivery rate: 13.2 l/min

Delivery pressure: 115 kg/cm²

Power: 3.37 metric hp

Linkage geometry

	Maximum mechanical advantage	Minimum mechanical advantage
Projected length in side view		
lower links, mm	715	715
lift arms, mm	300	300
lift rods, mm	422	538
top link, mm	—	—
Distance of lift rod connection point from pivot point of lower link, mm	522	522
The following dimension are given relative to the rear wheel centre line, situated 463mm above the ground level		
Lower link pivot point	38 mm behind, 57 mm below	38 mm behind, 57 mm below
Top link pivot point	178 mm behind, —	178 mm behind, —
Lift arm pivot point	37 mm behind, 345 mm above	37 mm behind, 345 mm above
Maximum and minimum height of lower link hitch points	316 mm above, 157 mm below	157 mm above, 397 mm below
Height of lower link hitch points when locked in transport position	316 mm above, —	— —

Lifting height in relation to a horizontal line through the lower link pivoting point, cm

		−34	−30	−25	−20	−15	−10	− 5	0	+ 5	+10	+15	+20	+21. 5	+25	+30	+35	+37
Lift force at the hitch points kg (Values for the pressure at maximum hydraulic horsepower, calculated from measurements made at maximum pressure)	max. mech. advantage	—	—	—	—	—	795	700	700	680	650	635	620	—	620	615	580	550
	min. mech. advantage	585	580	585	585	590	580	585	585	585	570	575	535	535	—	—	—	—
	Maximum force exerted throughout whole range 550kg Force at which front of tractor is calculated to lift with maximum allowable front ballast 790 kg																	
	Pressure 122 kg/cm²																	

REPAIRS AND ADJUSTMENTS DURING TEST:		None
REMARKS	:	After checking up the power take-off spline dimensions, the length of effective spline was found not in conformity with JIS standard.
Officer in charge	:	S. ARAI
Head of Testing Division	:	M. ARIYOSHI
Date	:	19th February, 1975

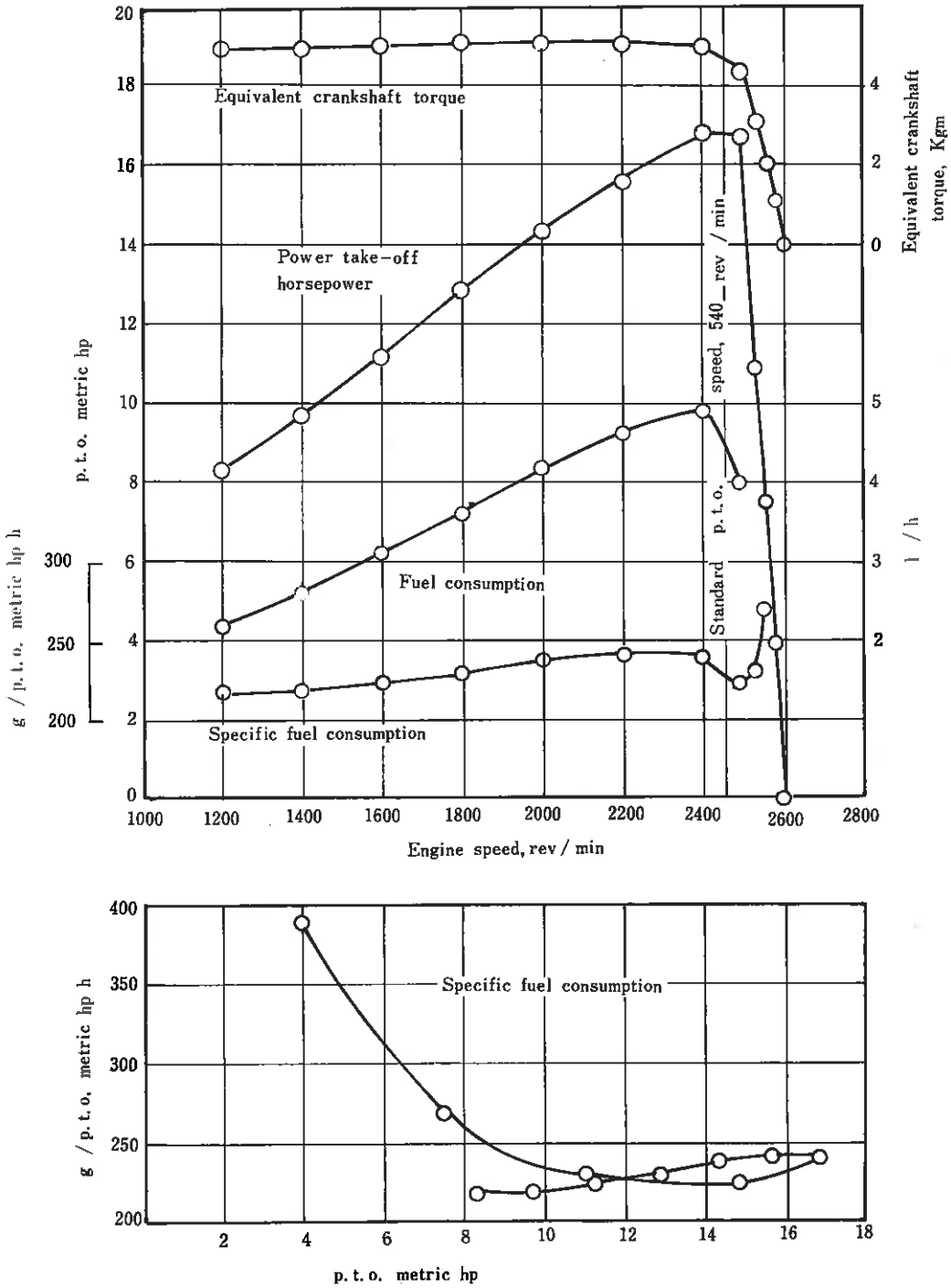


Fig. 1 Power take-off test

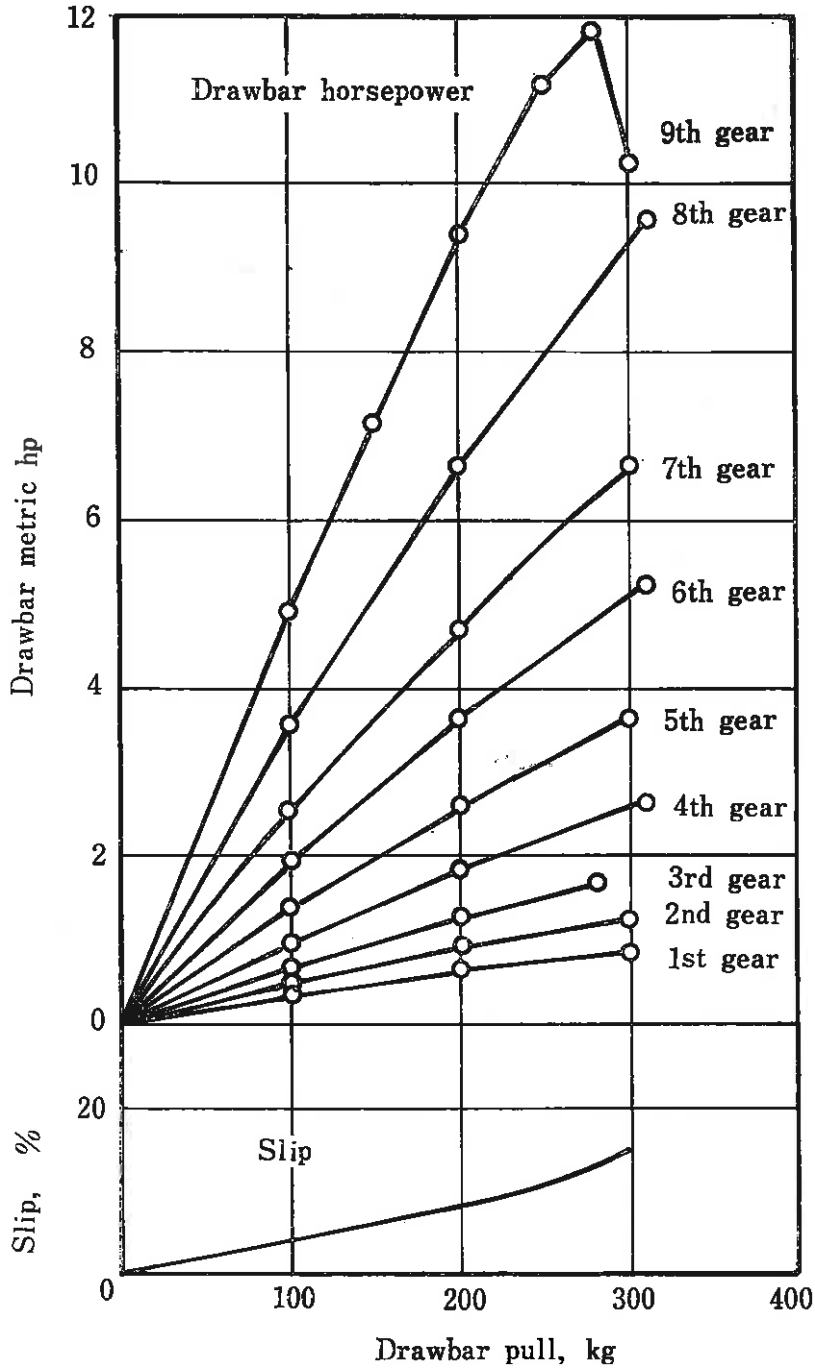


Fig. 2 Drawbar-test on concrete, with ballast

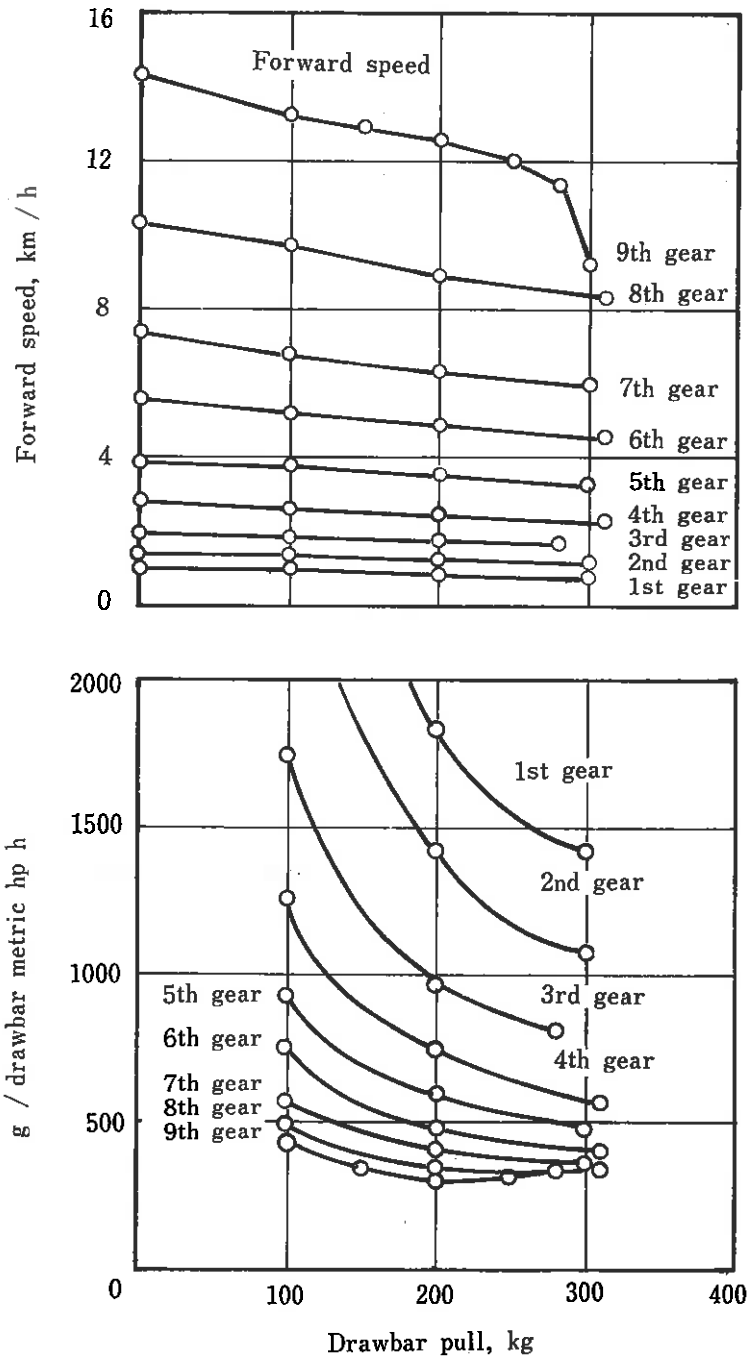


Fig. 3 Drawbar-test on concrete, with ballast

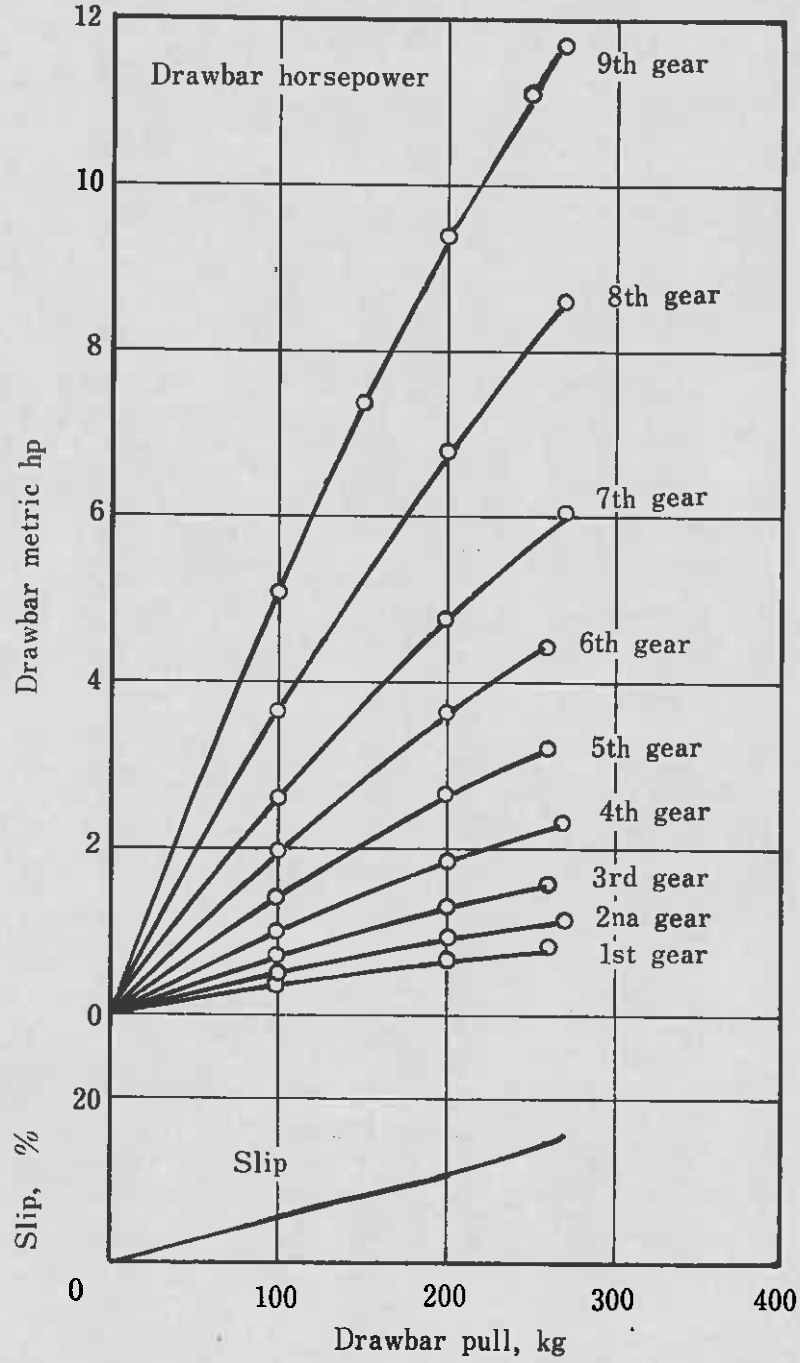


Fig. 4 Drawbar-test on concrete, without ballast