No. 312/O.E.C.D

REPORT ON TEST IN ACCORDANCE WITH O.E.C.D. TEST CODE FOR AGRICULTURAL TRACTORS

MASSEY-FERGUSON MODEL MF-35X DIESEL TRACTOR

WITH A3 152X 3-CYLINDER ENGINE

Manufactured by: Massey-Ferguson (Manufacturing) Ltd,
Banner Lane, Coventry



Date of tests: December 1961/January 1962
Test No.: R.62006/O.E.C.D

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: 10th May 1962 *Serial No.:* 022

The British Society for Research in Agricultural Engineering
NATIONAL INSTITUTE OF AGRICULTURAL ENGINEERING
WREST PARK SILSOE BEDFORDSHIRE

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

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PART I

SPECIFICATION OF TRACTOR

Tractor:

Make:	Massey-Ferguson
Model:	MF-35X
Type:	A3.152X, 3-cylinder diesel
No.:	Serial No. SNM.261245

Engine:

Make:	F. Perkins Ltd, type A3.152X, indirect injection diesel, Serial No. CL.1885781 XC
Cylinders:	3 cylinders, vertical, in-line, 3·6 in. (91·4 mm) bore × 5 in. (127·0 mm) stroke, compression ratio 17·5:1, replaceable chromium plated steel dry liners, overhead valves
Rated speeds:	2250 rev/min, governor setting—no load engine speed 2375 ± 25 rev/min
Minimum speed:	(For full load work) Not specified
Fuel system:	Fuel—Diesel oil C.A.V. type D.P.A. 3232378 injection pump, Serial No. R81757; C.A.V. type BDL.11OS6267 injector nozzles. Manufacturer's production setting for injection pump: 12·21 pt/h (6·94 l/h) to 12·74 pt/h (7·24 l/h) at 1400 rev/min engine speed, bench test figures. Injection pressure 120–135 atm (124–140 kp/sq. cm). A.C. type YE fuel feed pump, sediment bowl on feed pump, one Purolator and one C.A.V. paper filter in series. Capacity of fuel tank: 8½ UKgal (38·6 l)
Governor:	C.A.V. mechanical incorporated in injection pump. Governed range of engine speed 450 rev/min to 2400 rev/min
Air cleaner:	A.C. oil bath with centrifugal pre-cleaner outside hood. Oil capacity 0·77 pt (0·44 l)
Oiling system:	Forced feed from gear type pump with metal strainer in sump. Multi-purpose 20W/30 oil. A.C. full flow replaceable cartridge element oil filter. Recommended oil change period, 120 h. Oil capacity, engine sump 9·8 pt (5·6 l)
Cooling system:	Pressurised water cooled, 7 lb/sq. in. (0·49 kp/sq. cm), impeller assisted with 15½ in. (394 mm) dia 4-blade belt driven fan, thermostat for temperature control. Cooling water capacity 2 UKgal (9·1 l)

Transmission:

Clutch:	Auburn Laycock dual, two plates 9 in. (229 mm) dia and 11 in. (279 mm) dia for p.t.o. shaft and gearbox drive respectively, dry, foot-pedal operated
Gearbox:	Own make, sliding gear type, 6 forward speeds and 2 reverse, comprising 3 speed gearbox and dual range epicyclic reduction gear at output end
Differential:	Final drive with crown wheel and pinion and differential. No differential lock fitted. Total transmission oil capacity 53 pt (30·1 l)

Gear No.	*Number of engine revolutions for one revolution of driving wheel*	*Theoretical travelling speed for 2250 rev/min rated speed of engine, mile/h (km/h)*
1	205·5	1·49 (2·40)
2	137·0	2·23 (3·59)
3	74·7	4·09 (6·58)
4	51·4	5·94 (9·56)
5	34·2	8·92 (14·35)
6	18·7	16·32 (26·26)
R. Low	150·9	2·02 (3·25)
R. High	37·7	8·10 (13·03)

Steering device:	Recirculating ball type with double drop arms and drag links
Brakes:	Hand brake—not fitted Foot brakes—internal expanding type on differential half shafts, independent or combined foot-pedal operated, ratchet on pedals for parking

Wheels:

Steering wheels:	Two at front. Tyres, 6·00–16, 6-ply pneumatic. Track 48 in. (1219 mm) by 4 in. (102 mm) steps to 80 in. (2032 mm), changed by extending front axle and reversing wheels. Maximum permissible weight on each tyre: 1065 lb (483 kg) at 36 lb/sq. in. (2·5 kp/sq. cm).
Driving wheels:	Two at rear. Tyres, 11–28, 6-ply pneumatic. Track 48 in. (1219 mm) by 4 in. (102 mm) steps to 76 in. (1930 mm), changed by reversing wheel centres and offset lugs on rims. Maximum permissible weight on each tyre: 2550 lb (1157 kg) at 20 lb/sq. in. (1·4 kp/sq. cm).
Wheelbase:	6 ft 0 in. (1829 mm)

Belt pulley:

Location:	At rear of tractor in three alternative positions, p.t.o. driven, heavy duty unit
Diameter × width:	9 in. (229 mm) × 6½ in. (165 mm)
Speeds:	1504 rev/min giving 3544 ft/min (18·0 m/s) linear speed at 2250 rev/min rated engine speed 1316 rev/min giving 3100 ft/min (15·7 m/s) linear speed at 1968 rev/min engine speed
Direction of rotation:	Optional, related to position of unit

Power take-off:

Main:	Manually engaged proportional engine speed or proportional ground speed, 6-spline, 1⅜ in. (34·9 mm) dia, at rear of tractor
Height above ground:	19 in. (483 mm)
Proportional engine speed:	Speed, at 2250 rev/min rated engine speed: 810 rev/min at 1500 rev/min engine speed: 540 rev/min Independent of main clutch
Direction of rotation:	Clockwise viewed from tractor rear
Proportional ground speed:	1 revolution of p.t.o. for approx. 20 in. (508 mm) of travel
Direction of rotation:	Clockwise viewed from tractor rear in forward gear

Power lift: Own make, live hydraulic with 4-cylinder piston type pump supplying oil (from transmission) pressure at 2350 lb/sq. in. (165 kp/sq. cm) minimum—2800 lb/sq. in. (197 kp/sq. cm) maximum (depending on flow through relief valve) to single acting ram cylinder and 3 external tappings. Category I implement linkage with controls for draught, response and position, with overload release. Maximum load at end of lower links—manufacturer's recommended figures: 2600 lb (1179 kp) for field work, 1800 lb (816 kp) for road work—test figures 3300 lb (1497 kp) at 2650 lb/sq. in. (186 kp/sq. cm) oil pressure with lower links horizontal. Oil delivery at 2000 rev/min engine speed: 3·1 gal/min (14·1 l/min) at 2000 lb/sq. in. (141 kp/sq. cm) with oil temperature corresponding to viscosity of 250 S.U.S. (54 centistokes)

Drawbar: Fixed on hydraulically controlled implement linkage with central hole and 4 holes 2⅛ in. (54 mm) apart either side of centre line, vertical adjustment from 11 in. (279 mm) to 24 in. (610 mm), changed by adjustable stay links. Distance from rear axle: 29½ in. (749 mm) as tested

Hitch: Optional (not fitted)
Height above ground: 13⅜ in. (333 mm)
Distance from rear axle: 7⅞ in. (200 mm)

Electrical equipment:

Voltage:	12
Generator:	Lucas type C39P2
Battery:	Lucas type HV17A/8 lead-acid, capacity 96 amp h
Starting device:	Lucas 12 V type 45GRF15 solenoid engaged starter motor, C.A.V. inlet manifold flame type cold starting aid

Overal dimensions:

Overall length:	9 ft 9 in. (2·97 m) as tested
Overall width:	5 ft 4 in. (1·63 m) at 52 in. (1321 mm) track, no ballast weights 6 ft 9⅜ in. (2·07 m) at 52 in. (1321 mm) track, to outside of wheelweights, 10 per wheel
Overall height:	5 ft 3 in. (1·60 m) to top of pre-cleaner 4 ft 6 in. (1·37 m) to top of steering wheel
Minimum ground clearance:	12⅝ in. (321 mm) to bottom of gearbox

Weights: With full fuel tank, oil, cooling water, no driver

	Without additional weight, lb (kg)	*With maximum additional weight, lb (kg)*
On front wheels	1387 (629)	2071 (939)
On rear wheels	1871 (849)	4922 (2233)
Total	3258 (1478)	6993 (3172)

Special Remarks: None

PART II

LABORATORY TESTS

1. **Compulsory tests:** Power take-off test
   Date and location of tests: 12th December 1961; N.I.A.E., Silsoe, Beds, U.K.
   Type of dynamometer: Water brake, Heenan and Froude
   Fuel: Diesel oil, density 0·840 at 60 °F (15·6 °C), Cetane No. 53
   Oil: Multi-purpose 20W/30

(1) *Sustained power tests:*

Duration of test, h	*Horse-power (Metric h.p.)*	*Engine speed, rev/min*	*Torque, lb ft (kpm)*	*Specific fuel consumption, lb/h.p. h (g/metric h.p. h)*	*Fuel temp, °F (°C)*	*Oil temp, °F (°C)*	*Coolant temp, °F (°C)*	*Air temp, °F (°C)*	*Atmos. pressure, in. Hg (mm Hg)*	*Remarks*
2	40·1 (40·7)	2347	89·7 (12·4)	0·472 (211)	87 (31)	225 (107)	181 (83)	67 (19)	29·47 (749)	Max. power
1	23·1 (23·4)	1105	110·0 (15·2)	0·420 (188)	81 (27)	194 (90)	190 (88)	62 (17)	29·47 (749)	At 85% of engine speed at max. torque

(2) *Varying speed tests:*

Horse-power (Metric h.p.)	*Engine speed, rev/min*	*Fuel consumption*			*Temperature*			*Atmos. conditions*		*Remarks*
		UK gal/h (l/h)	*H.p. h/ UKgal (Metric h.p. h/l)*	*Lb/h.p. h (g/metric h.p. h)*	*Oil, °F (°C)*	*Coolant, °F (°C)*	*Fuel, °F (°C)*	*Temp, °F (°C)*	*Pressure, in. Hg (mm Hg)*	
39·3 (39·9)	2250	2·19 (10·0)	18·0 (4·02)	0·467 (209)	221 (105)	184 (84)	89 (32)	67 (19)	29·47 (749)	Rated engine speed
31·3 (31·7)	1500	1·57 (7·1)	20·0 (4·46)	0·420 (188)	205 (96)	191 (88)	85 (29)	64 (18)	29·47 (749)	P.t.o. speed 540 rev/min
0	2400	0·72 (3·3)	—	—	192 (89)	152 (67)	69 (21)	64 (18)	29·47 (749)	No load

2. **Supplementary tests:** Engine test (in installed condition)
   Date and location of tests: 20th December 1961, N.I.A.E., Silsoe, Beds, U.K.
   Type of dynamometer: Water brake, Heenan and Froude
   Fuel: Diesel oil, density 0·840 at 60 °F (15·6 °C), Cetane No. 53
   Oil: Multi-purpose 20W/30

(1) *Sustained power tests:*

Duration of test, h	*Horse-power (Metric h.p.)*	*Engine speed, rev/min*	*Torque, lb ft (kpm)*	*Specific fuel consumption, lb/h.p. h (g/metric h.p. h)*	*Fuel temp, °F (°C)*	*Oil temp, °F (°C)*	*Coolant temp, °F (°C)*	*Air temp, °F (°C)*	*Atmos. pressure, in. Hg (mm Hg)*	*Remarks*
2	41·9 (42·5)	2330	94·5 (13·1)	0·453 (203)	86 (30)	220 (104)	190 (88)	68 (20)	30·46 (774)	Max. power
1	23·7 (24·0)	1088	114·3 (15·8)	0·415 (186)	87 (31)	192 (89)	193 (89)	61 (16)	30·46 (774)	At 85% of engine speed at max. torque

(2) *Varying speed tests:*

Horse-power (Metric h.p.)	Engine speed, rev/min	Fuel consumption: UK gal/h (l/h)	Fuel consumption: H.p. h/UKgal (metric h.p. h/l)	Fuel consumption: Lb/h.p. h (g/metric h.p. h)	Temperature: Oil, °F (°C)	Temperature: Coolant, °F (°C)	Temperature: Fuel, °F (°C)	Atmos. conditions: Temp, °F (°C)	Atmos. conditions: Pressure, in. Hg (mm Hg)	Remarks
40·8 (41·4)	2250	2·19 (10·0)	18·6 (4·15)	0·450 (201)	220 (104)	189 (87)	88 (31)	64 (18)	30·46 (774)	Rated engine speed
32·5 (33·0)	1500	1·58 (7·2)	20·6 (4·60)	0·408 (182)	197 (92)	194 (90)	84 (29)	66 (19)	30·46 (774)	P.t.o. speed 540 rev/min
0	2395	0·72 (3·3)	—	—	154 (68)	163 (73)	61 (16)	67 (19)	30·46 (774)	No load

3. **Supplementary tests:** Belt test

Date and location of tests: 14th December 1961, N.I.A.E., Silsoe, Beds, U.K.

Type of dynamometer: Electrical swinging frame

Fuel: Diesel oil, density 0·840 at 60 °F (15·6 °C), Cetane No. 53

Oil: Multi-purpose 20W/30

(1) *Sustained power tests:*

Duration of test, h	Horse-power (Metric h.p.)	Engine speed, rev/min	Torque, lb ft (kpm)	Specific fuel consumption lb/h.p. h (g/metric h.p. h)	Fuel temp, °F (°C)	Oil temp, °F (°C)	Coolant temp, °F (°C)	Air temp, °F (°C)	Atmos. pressure, in. Hg (mm Hg)	Remarks
2	38·3 (38·8)	2334	86·3 (11·9)	0·496 (222)	88 (31)	228 (109)	192 (89)	67 (19)	30·26 (769)	Max. power
1	22·4 (22·7)	1097	107·4 (14·9)	0·442 (198)	87 (31)	193 (89)	194 (90)	60 (16)	30·26 (769)	At 85% of engine speed at max. torque

(2) *Varying speed tests:*

Horse-power (Metric h.p.)	Engine speed, rev/min	Fuel consumption: UK gal/h (l/h)	Fuel consumption: H.p. h/UKgal (metric h.p. h/l)	Fuel consumption: Lb/h.p.h (g/metric h.p. h)	Temperature: Oil, °F (°C)	Temperature: Coolant, °F (°C)	Temperature: Fuel, °F (°C)	Atmos. conditions: Temp, °F (°C)	Atmos. conditions: Pressure, in. Hg (mm Hg)	Remarks
38·0 (38·5)	2250	2·20 (10·0)	17·3 (3·86)	0·485 (217)	224 (107)	191 (88)	89 (32)	67 (19)	30·26 (769)	Rated engine speed
36·1 (36·6)	1968	1·99 (9·0)	18·1 (4·04)	0·463 (207)	222 (106)	191 (88)	91 (33)	66 (19)	30·26 (769)	Belt linear speed 3100 ft/min (15·7 m/s)
0	2397	0·73 (3·3)	—	—	192 (89)	151 (66)	75 (24)	64 (18)	30·26 (769)	No load

PART III

DRAWBAR TESTS ON ARTIFICIAL TRACK

Date of tests:	23rd–30th January 1962
Type of track:	Tarmacadam
Position of governor control lever:	Fully open giving no load engine speed of 2375 $\pm$ 25 rev/min
Type of tyre:	Rear—Goodyear, straight bar open centre, 11–28, 6-ply pneumatic Front—Goodyear, Super Rib, 6·00–16, 6-ply pneumatic
Fuel:	Diesel oil, density 0·840 at 60 °F (15·6 °C), Cetane No. 53
Oil:	Multi-purpose S.A.E. 20W/30 (engine and transmission)

A. Tests with maximum additional weight

Weight of tractor, without driver:

Weight without ballast:	Front—1387 lb (629 kg), rear—1871 lb (849 kg)
Ballast: front	Weights, 3 per wheel—587 lb (266 kg) Water—97 lb (44 kg)
rear	Weights, 10 per wheel—2379 lb (1079 kg) Water—672 lb (305 kg)
Weight with full ballast:	Front—2071 lb (939 kg), rear—4922 lb (2233 kg) Total—6993 lb (3172 kg)
Tyre pressure:	Front—36 lb/sq. in. (2·5 kp/sq. cm) Rear—20 lb/sq. in. (1·4 kp/sq. cm)
Height of drawbar above ground:	17½ in. (445 mm)

(1) *Maximum powers and pulls*

	Maximum powers								*Maximum pulls*	
Gear No.	*Horse-power (Metric h.p.)*	*Corres-ponding pull, lb (kp)*	*Wheel slip, %*	*Engine speed, rev/min*	*Speed, mile/h (km/h)*	*Engine coolant temp, °F (°C)*	*Air temp, °F (°C)*	*Atmos. press, in. Hg (mm Hg)*	*Pull, lb (kp)*	*Reason for stall*
1	21·2 (21·5)	6300 (2858)	20·1	2379	1·26 (2·03)	164 (73)	45 (7)	29·75 (756)	6750 (3062)	Wheelspin and bouncing
2	31·3 (31·7)	6100 (2767)	17·9	2345	1·92 (3·09)	178 (81)	45 (7)	29·75 (756)	6750 (3062)	Wheelspin and bouncing
3	35·3 (35·8)	3350 (1520)	6·3	2305	3·95 (6·36)	180 (82)	46 (8)	29·75 (756)	4125 (1871)	Engine stall
4	35·9 (36·4)	2275 (1032)	3·9	2327	5·92 (9·53)	175 (79)	43 (6)	29·75 (756)	2850 (1293)	Engine stall
5	35·4 (35·9)	1500 (680)	2·4	2312	8·85 (14·24)	175 (79)	45 (7)	29·75 (756)	1875 (851)	Engine stall

(2) *Fuel consumption*

Gear No.	*Optimum fuel consumption*			*Range of pull, lb (kp) over which specific fuel consumption does not exceed optimum consumption by more than 10%*
	Specific fuel consumption, lb/h.p. h (g/metric h.p. h)	*Drawbar h.p. h/ UKgal (drawbar metric h.p. h/l)*	*Corresponding pull, lb (kp)*	
1	0·674 (301)	12·5 (2·79)	5650 (2563)	3950 — > 6500 (1792) (2948)
2	0·584 (261)	14·4 (3·21)	5650 (2563)	3580 — > 6100 (1624) (2767)
3	0·550 (246)	15·3 (3·41)	3350 (1520)	2260 — 4125 (M.S.P) (1025) (1871)
4	0·540 (242)	15·6 (3·48)	2275 (1032)	1720 — 2850 (M.S.P) (780) (1293)
5	0·552 (247)	15·2 (3·39)	1500 (680)	1140 — 1875 (M.S.P) (517) (851)

B. Tests without ballast:

Weight of tractor without driver:

Weight without ballast: Front—1387 lb (629 kg), rear—1871 lb (849 kg)
Total—3258 lb (1478 kg)

Tyre pressure: Front—20 lb/sq. in. (1·4 kp/sq. cm)
Rear—12 lb/sq. in. (0·8 kp/sq. cm)

Height of drawbar above ground: 17½ in. (445 mm) and 21½ in. (546 mm)

(1) *Maximum powers and pulls*

Gear No.	*Maximum powers*						*Air temp, °F (°C)*	*Atmos. press, in. Hg (mm Hg)*	*Maximum pulls*	
	Horse-power (Metric h.p.)	*Corres-ponding pull, lb (kp)*	*Wheel slip, %*	*Engine speed, rev/min*	*Speed, mile/h (km/h)*	*Engine coolant temp, °F (°C)*			*Pull, lb (kp)*	*Reason for stall*
3	29·7 (30·1)	2950 (1338)	13·0	2363	3·78 (6·08)	174 (79)	40 (4)	29·32 (745)	3200 (1452)	Wheelspin
4	37·0 (37·5)	2450 (1111)	7·2	2296	5·66 (9·11)	175 (79)	35 (2)	29·32 (745)	2950 (1338)	Engine stall
5	37·6 (38·1)	1600 (726)	4·3	2303	8·81 (14·18)	178 (81)	35 (2)	29·32 (745)	1960 (889)	Engine stall
The following results were obtained with a drawbar height of 21½ in. (546 mm)										
3	32·3 (32·8)	3300 (1497)	14·7	2335	3·67 (5·91)	179 (82)	37 (3)	29·32 (745)	3550 (1610)	Wheelspin and bouncing

PART IV

1. **Location of centre of gravity:**

	Test A, ballasted	*Test B, unballasted*
Height above ground	24·3 in. (616 mm)	24·8 in. (629 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	20·8 in. (529 mm)	29·2 in. (741 mm)
Distance from the median plane parallel to the longitudinal axis of the tractor bisecting the track	0	0

2. **Turning space and turning radius:**

Wheel equipment: As for drawbar tests without ballast
Wheel track: Front—48 in. (1219 mm), rear—52 in. (1321 mm)

	With brakes		*Without brakes*	
	Right-hand	*Left-hand*	*Right-hand*	*Left-hand*
Radius of turning space	9 ft 2 in. (2·8 m)	9 ft 5 in. (2·9 m)	9 ft 11 in. (3·0 m)	10 ft 1 in. (3·1 m)
Turning radius	8 ft 10 in. (2·7 m)	9 ft 1 in. (2·8 m)	9 ft 7 in. (2·9 m)	9 ft 9 in. (3·0 m)

PART V

1. **Repairs and adjustments during tests:** None
2. **Remarks:** None

Test Engineers: M. W. JESSON
D. W. SMITH

Head of Tractor Performance Department: T. C. D. MANBY

Date: 27th March 1962

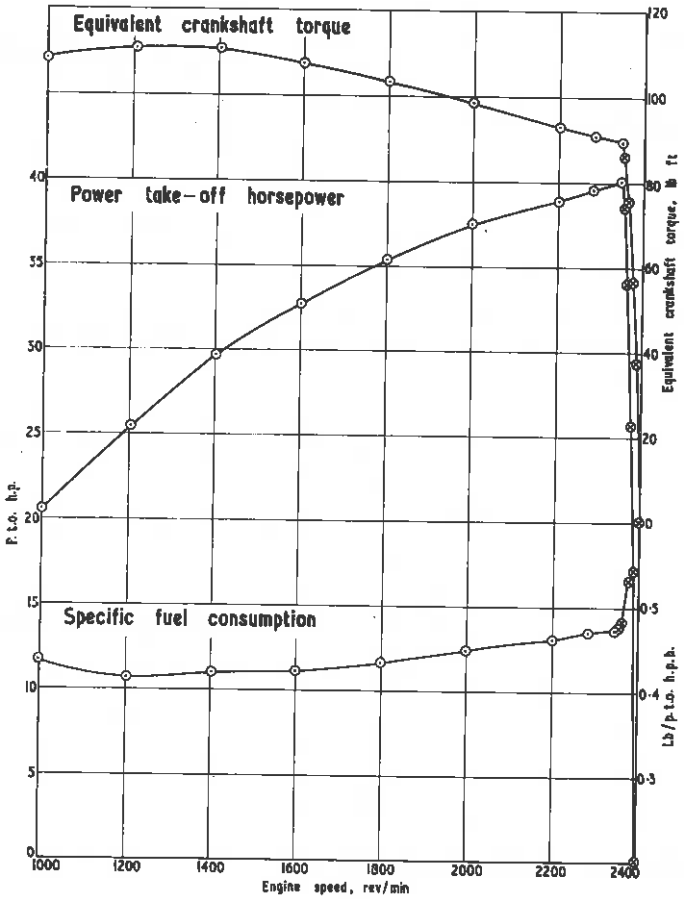


FIG. 1. Power take-off test

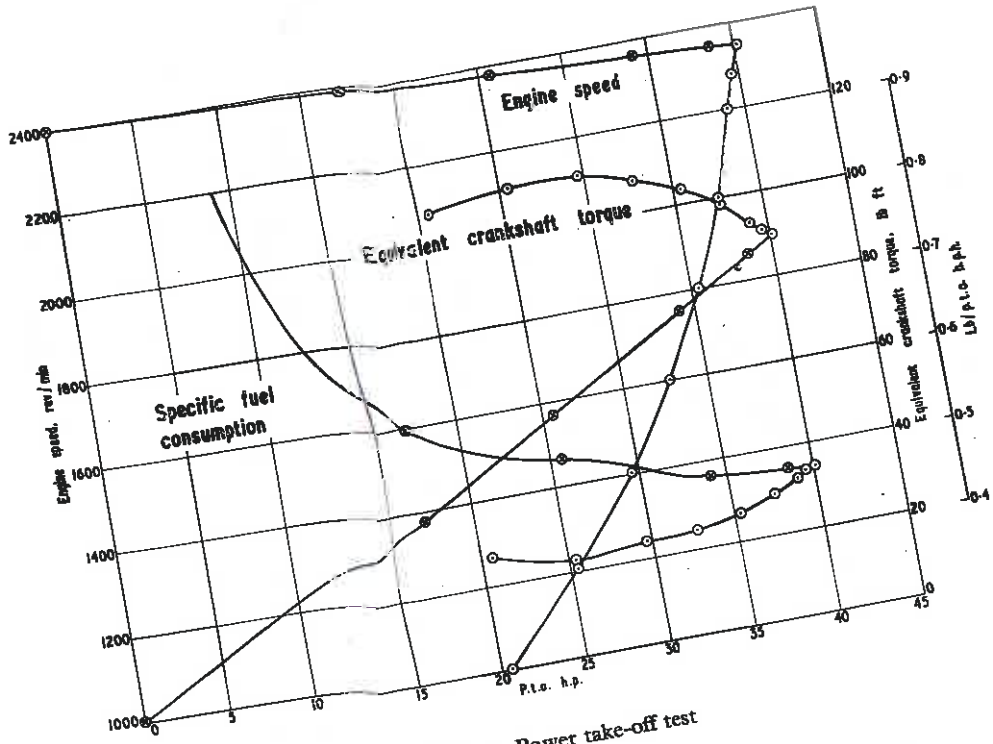


FIG. 2. Power take-off test

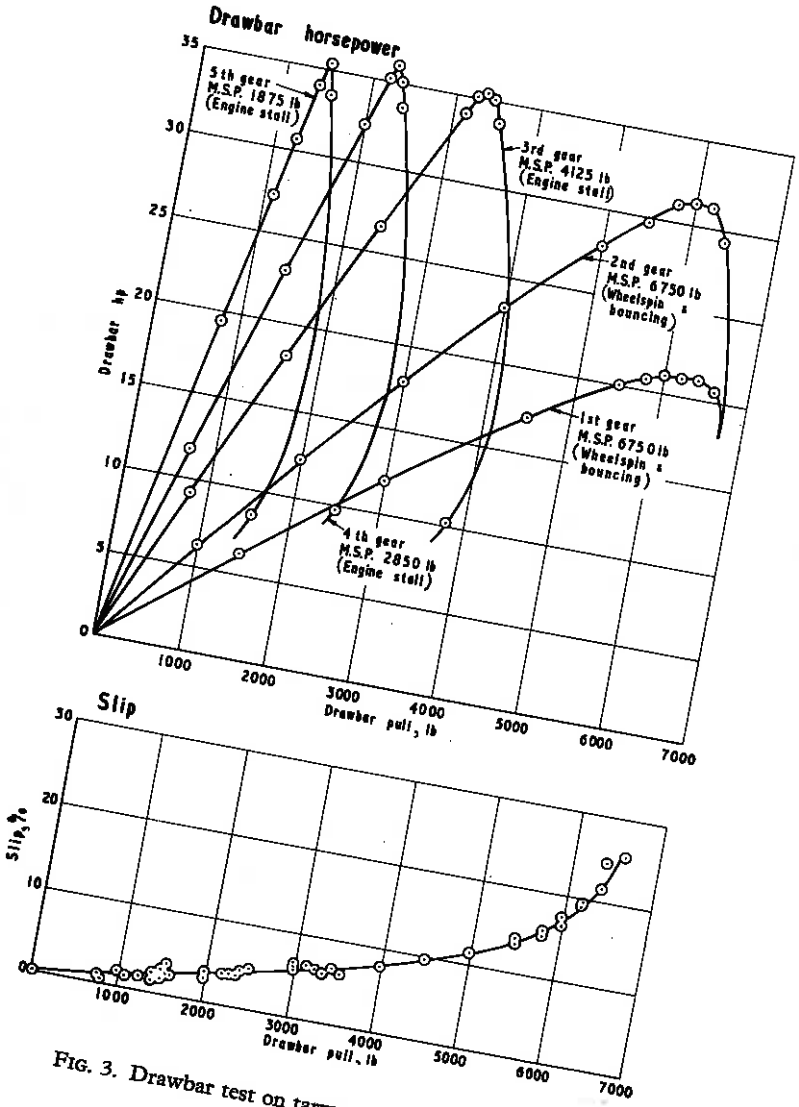


FIG. 3. Drawbar test on tarmacadam, with ballast

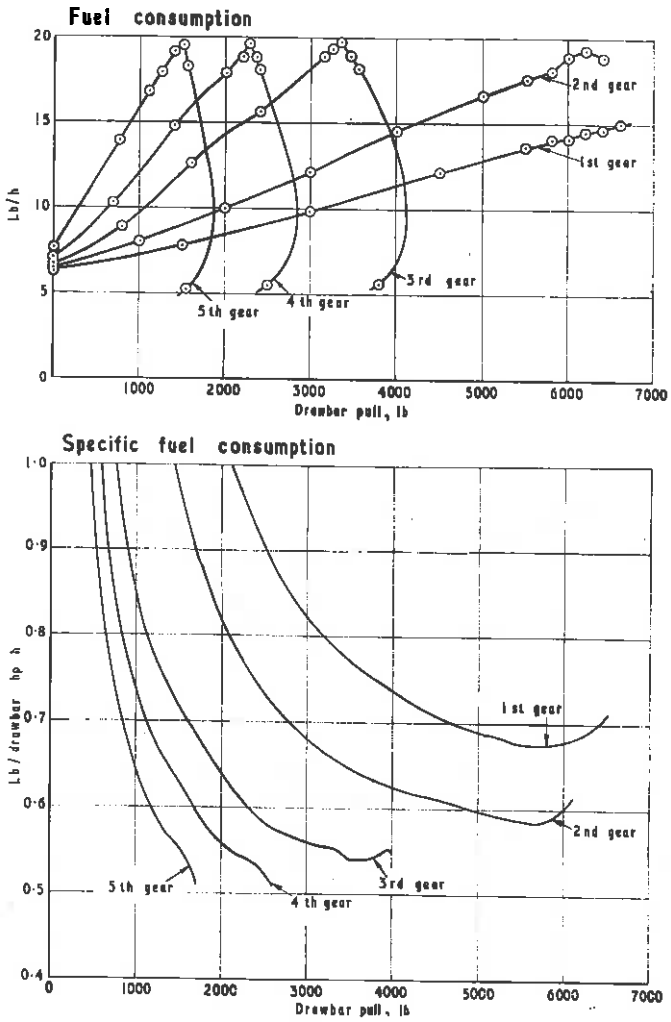


FIG. 4. Drawbar test on tarmacadam, with ballast

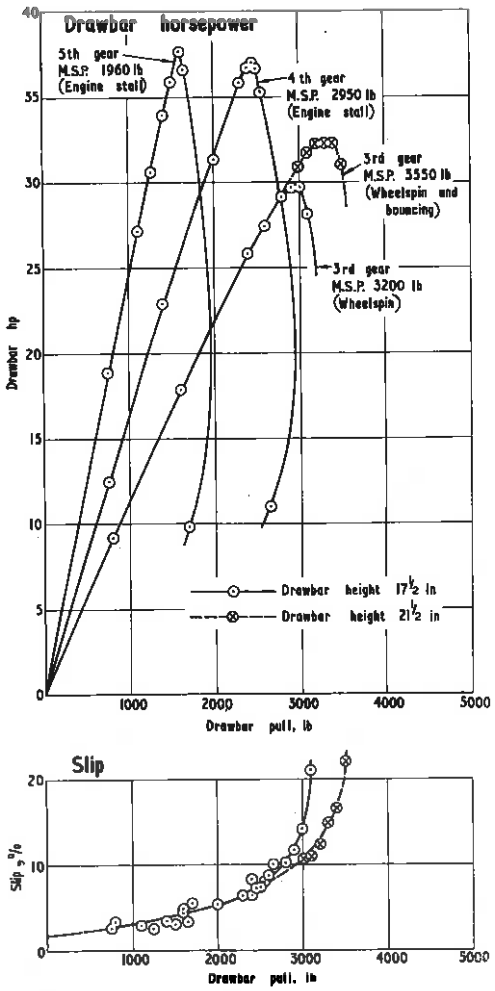


FIG. 5. Drawbar test on tarmacadam, without ballast

Henry Burt & Son Ltd, Mill Street, Bedford