No. 338/O.E.C.D.

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

NUFFIELD MODEL 460 DIESEL TRACTOR

(Equipped with 14-30 rear tyres)

Manufactured by: Morris Motors Limited,
Wolseley Works, Ward End, Birmingham 8



Date of Tests: February/April 1962
Test No.: R.62064/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: 6th March 1963 *Serial No.:* 035

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:	Nuffield
Model:	460 diesel
No:	Serial No. 34T24047

Engine:

Make:	Morris Motors Ltd, direct injection diesel, Serial No. 38TA/BL/D.101
Cylinders:	4 cylinders, vertical, in-line, 3·94 in. (100 mm) bore × 4·72 in. (120 mm) stroke, compression ratio 16·5:1, replaceable wet cylinder liners, overhead valves
Rated speeds:	2000 rev/min, governor setting—no load engine speed 2120–2160 rev/min.
Minimum speed:	(for full load work). Not specified
Fuel system:	Fuel—Diesel oil Simms Minimec type P4584 injection pump; Simms type N.L. 341 injector nozzles. Manufacturer's production setting for injection pump: 17·65 pt/h (10·0 l/h) to 18·37 pt/h (10·4 l/h) at 1500 rev/min engine speed. Injection pressure 170–180 atm (176–186 kp/sq. cm). A.C. type U fuel feed pump, gauze filters in tank, sediment bowl and feed pump, Simms paper element filter on delivery side of feed pump. Capacity of fuel tank: 14 UKgal (63·6 l)
Governor:	Simms mechanical governor incorporated in injection pump. Governed range of engine speed 600 rev/min to 2160 rev/min
Air cleaner:	A.C. oil bath with pre-cleaner outside hood. Oil capacity 1½ pt (0·85 l)
Oiling system:	Forced feed from gear type pump with floating strainer in sump. S.A.E. 20 oil. Vokes model E 234 oil filter. Recommended oil change period, 200 h. Oil capacity 15 pt (8·5 l)
Cooling system:	Non-pressurised water cooled, impeller assisted thermosyphon with 16 in. (406 mm) dia 2-blade belt driven fan, thermostat and radiator shutters for temperature control. Cooling water capacity 3 UKgal (13·6 l)

Transmission:

Clutch:	Borg and Beck dual dry clutch, two 11 in. (279 mm) dia plates, one foot-pedal operated for gearbox drive and one hand-lever operated for p.t.o. drive
Gearbox:	Own make, sliding gear type, 5 forward speeds and 1 reverse.
Differential:	Crown wheel and pinion and differential with spur gear final drives. Foot-pedal operated differential lock. Total transmission oil capacity 96 pt (54·6 l)

Gear No.	*Number of engine revolutions for one revolution of driving wheel*	*Theoretical travelling speed for 2000 rev/min rated speed of engine, mile/h (km/h)*
1	139·0	2·29 (3·68)
2	88·2	3·62 (5·82)
3	62·6	5·09 (8·19)
4	42·5	7·50 (12·07)
5	18·3	17·43 (28·04)
Reverse	80·0	3·99 (6·42)

Steering device:	Worm and nut type with single drag link, radius rods on front axle
Brakes:	Hand brake—operating both brakes Foot brakes—internal expanding type on final drive pinion shafts, independent or combined foot-pedal operated

Wheels:

Steering wheels:	Two at front. Tyres, 7·50–18, 6-ply pneumatic. Track 53 in. (1346 mm) by 2 in. (51 mm) steps to 71 in. (1803 mm), changed by extending front axle and reversing wheels. Maximum permissible weight on each tyre 1340 lb (608 kg) at 24 lb/sq. in. (1·7 kp/sq. cm), 1700 lb (771 kg) at 36 lb/sq. in. (2·5 kp/sq. cm)
Driving wheels:	Two at rear. Tyres 14–30, 6-ply pneumatic. Track 60 in. (1524 mm) or 70 in. (1778 mm) changed by reversing wheels. Maximum permissible weight on each tyre 3920 lb (1778 kg) at 16 lb/sq. in. (1·1 kp/sq. cm)
Wheelbase:	6 ft 6 in. (1981 mm)

Belt pulley:

Location:	Mounted on left-hand side of gearbox, driven by bevel gears
Diameter × width:	$10\frac{1}{4}$ in. (260 mm) × $6\frac{1}{8}$ in. (165 mm)
Speeds:	1643 rev/min and 4408 ft/min (22·4 m/s) linear speed at 2000 rev/min rated engine speed 1155 rev/min and 3100 ft/min (15·7 m/s) linear speed at 1407 rev/min engine speed
Direction of rotation:	Anti-clockwise viewed from tractor left side

Power take-off

Main:	6-spline, $1\frac{3}{8}$ in. (34·9 mm) dia, at rear of tractor, independent of main clutch, manually engaged by hand-lever operated clutch
Height above ground:	30 in. (762 mm)
Speeds:	755 rev/min at 2000 rev/min rated engine speed 540 rev/min at 1430 rev/min engine speed
Direction of rotation:	Clockwise viewed from tractor rear

Power lift: Own make hydraulic with gear type pump, driven independently of the main clutch, operated either together with, or independently of the power take-off by a selector lever; oil (from transmission) pressure is supplied at 1900 lb/sq. in. (134 kp/sq. cm) to 2200 lb/sq. in. (155 kp/sq. cm) to a ram cylinder and 2 external tappings. Category II implement linkage with automatic depth control from draught response. Maximum load at end of lower links—manufacturer's recommended figures: 2265–2930 lb (1027–1329 kp) depending on link positioning—test figures: 3050–3500 lb (1383–1588 kp) at 2050 lb/sq. in. (144 kp/sq. cm) oil pressure, with lower links horizontal, depending on length of lift rods and their attachment to the lower links which were in the lower position at the pivot for the test. Oil delivery: 7·3 UKgal/min (33·2 l/min) at 2000 rev/min rated engine speed

Drawbar: Swinging drawbar—standard, lateral adjustment 19 in. (483 mm), vertical heights to centre of clevis $12\frac{15}{16}$ in. (329 mm) and $19\frac{11}{16}$ in. (500 mm), distance from rear axle $26\frac{1}{4}$ in. (667 mm) to rear—extension drawbar, as tested, lateral adjustment $28\frac{3}{8}$ in. (721 mm), vertical heights to centre of clevis $11\frac{3}{8}$ in. (289 mm), $14\frac{3}{8}$ in. (365 mm), $16\frac{7}{8}$ in. (429 mm) and $19\frac{7}{8}$ in. (505 mm), distance from rear axle $34\frac{1}{4}$ in. (870 mm) to rear

Hitch: None fitted

Electrical equipment:

Voltage:	12
Generator:	Lucas type C. 39P2
Batteries:	Two 6V Lucas type TR. 19E lead-acid batteries in series, capacity 115 amp h
Starting device:	Lucas 12V type M45G solenoid engaged starter motor

Overall dimensions:

Overall length:	10 ft 8¾ in. (3·27 m) without ballast weights 10 ft 9¾ in. (3·30 m) with external front frame weight fitted
Overall width:	6 ft 4 in. (1·93 m) at 60 in. (1524 mm) track, no ballast weights 8 ft 10 in. (2·69 m) at 60 in. (1524 mm) track, to outside of wheelweights, 11 per wheel
Overall height:	6 ft 8¾ in. (2·05 m) to top of exhaust pipe 5 ft 6⅛ in. (1·68 m) to top of steering wheel
Minimum ground clearance:	10¼ in. (260 mm) to bottom of standard drawbar 9¼ in. (235 mm) to bottom of extended drawbar

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

	Without additional weight, lb (kg)	*With maximum additional weight, lb (kg)*
On front wheels	1829 (830)	2493 (1131)
On rear wheels	3397 (1541)	7636 (3464)
Total	5226 (2371)	10 129 (4595)

Special remarks: Manually engaged excess fuel device fitted for cold starting

PART II

LABORATORY TESTS

1. **Compulsory tests:** Power take-off test
Date and location of tests: 13th February 1962, 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: S.A.E. 20

(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	56·6 (57·4)	2026	146·7 (20·3)	0·435 (195)	86 (30)	228 (109)	200 (93)	72 (22)	29·50 (749)	Maximum power
1	33·7 (34·2)	1131	156·5 (21·6)	0·401 (179)	88 (31)	201 (94)	190 (88)	70 (21)	29·50 (749)	At 85% of engine speed at maximum 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)*	
56·0 (56·8)	2000	2·91 (13·2)	19·2 (4·28)	0·437 (195)	228 (109)	199 (93)	87 (31)	73 (23)	29·50 (749)	Rated engine speed
43·3 (43·9)	1430	2·08 (9·5)	20·8 (4·64)	0·404 (181)	208 (98)	190 (88)	90 (32)	73 (23)	29·50 (749)	P.t.o. speed 540 rev/min
0	2138	0·81 (3·7)	—	—	192 (89)	165 (74)	72 (22)	64 (18)	29·50 (749)	No load

2. **Supplementary tests:** Belt test
Date and location of tests: 27th February 1962, 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: S.A.E. 20

(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	56·8 (57·6)	2020	147·6 (20·4)	0·425 (190)	97 (36)	219 (104)	187 (86)	69 (21)	29·86 (758)	Maximum power
1	30·1 (30·5)	1020	155·0 (21·4)	0·391 (175)	100 (38)	190 (88)	182 (83)	63 (20)	29·86 (758)	At 85% of engine speed at maximum 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)*	
56·6 (57·4)	2000	2·85 (13·0)	19·9 (4·44)	0·423 (189)	220 (104)	188 (87)	99 (37)	71 (22)	29·86 (758)	Rated engine speed
43·0 (43·6)	1407	2·03 (9·2)	21·2 (4·73)	0·397 (178)	201 (94)	186 (86)	102 (39)	71 (22)	29·86 (758)	Belt linear speed 3100 ft/min (15·7 m/s)
1·5 (1·5)	2130	0·83 (3·8)	—	—	199 (93)	156 (69)	88 (31)	66 (19)	29·86 (758)	Lowest recorded

PART III

DRAWBAR TESTS ON ARTIFICIAL TRACK

Date of tests:	20th March to 6th April 1962
Type of track:	Tarmacadam
Position of governor control lever:	Fully open giving no load engine speed of 2120–2160 rev/min
Type of tyre:	Rear—Dunlop 'Fieldmaster,' open centre, 14–30, 6-ply pneumatic Front—Dunlop 'Farm Tractor', 7·50–18, 6-ply pneumatic
Fuel:	Diesel oil, density 0·840 at 60 °F (15·6 °C), Cetane No. 53
Oil:	S.A.E. 20 engine S.A.E. 90 transmission

A. **Tests with maximum additional weight**

Weight of tractor, without driver:

Weight without ballast:	Front—1829 lb (830 kg), rear—3397 lb (1541 kg)
Ballast: front	Weights—nil Water—168 lb (76 kg)
rear	Weights, 11 per wheel—2830 lb (1284 kg) Water—1465 lb (665 kg)
additional	Inner and outer front frame weights—443 lb (201 kg) total
Weight with full ballast:	Front—2493 lb (1131 kg), rear—7636 lb (3464 kg) Total—10 129 lb (4595 kg)
Tyre pressure:	Front—24 lb/sq. in. (1·7 kg/sq. cm) Rear—16 lb/sq. in. (1·1 kp/sq. cm)
Height of drawbar above ground:	16 in. (406 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.)	Corresponding 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
1	**44·5 (45·1)**	**8500 (3856)**	**16·2**	**2036**	**1·96 (3·15)**	**175 (79)**	**42 (6)**	**29·84 (758)**	**9400 (4264)**	**Wheelspin and bouncing**
2	50·5 (51·2)	5550 (2517)	7·2	2025	3·41 (5·49)	182 (83)	42 (6)	29·84 (758)	6200 (2812)	Engine stall
3	50·5 (51·2)	3900 (1769)	5·0	2025	4·86 (7·82)	177 (81)	47 (8)	29·82 (757)	4475 (2030)	Engine stall
4	50·0 (50·7)	2550 (1157)	3·3	2036	7·35 (11·83)	175 (79)	50 (10)	29·82 (757)	2950 (1338)	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	0·521 (233)	16·1 (3·59)	6500 (2948)	4250 – 8870 (1928) (4023)
2	0·498 (223)	16·9 (3·77)	5550 (2517)	3130 – 6200 (M.S.P.) (1420) (2812)
3	0·500 (224)	16·8 (3·75)	3900 (1769)	2200 – 4475 (M.S.P.) (998) (2030)
4	0·503 (225)	16·7 (3·73)	2550 (1157)	1580 – 2950 (M.S.P.) (717) (1338)

B. Tests without ballast

Weight of tractor, without driver:

Weight without ballast: Front—1829 lb (830 kg), rear—3397 lb (1541 kg)
Total—5226 lb (2371 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: 16 in. (406 mm) and 19½ in. (495 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.)	Corresponding 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
2	39·5 (40·1)	4500 (2041)	13·2	2061	3·29 (5·29)	174 (79)	54 (12)	29·74 (755)	4700 (2132)	Wheelspin
3	49·5 (50·2)	3850 (1746)	7·9	2027	4·82 (7·76)	175 (79)	50 (10)	29·74 (755)	4525 (2053)	Engine stall
4	51·0 (51·7)	2600 (1179)	5·0	2035	7·36 (11·84)	170 (77)	50 (10)	29·74 (755)	3000 (1361)	Engine stall
The following results were obtained with a drawbar height of 19½ in. (495 mm)										
2	41·6 (42·2)	4850 (2200)	14·9	2053	3·22 (5·18)	175 (79)	51 (11)	29·74 (755)	5050 (2291)	Wheelspin

PART IV

1. Location of centre of gravity

	Test A, ballasted	Test B, unballasted
Height above ground	29·0 in. (737 mm)	32·2 in. (818 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	18·9 in. (480 mm)	26·5 in. (673 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—53 in. (1346 mm), rear—60 in. (1524 mm)

	With brakes		Without brakes	
	Right-hand	Left-hand	Right-hand	Left-hand
Radius of turning space	10 ft 11 in. (3·3 m)	11 ft 0 in. (3·4 m)	11 ft 9 in. (3·6 m)	12 ft 5 in. (3·8 m)
Turning radius	10 ft 6 in. (3·2 m)	10 ft 7 in. (3·2 m)	11 ft 9 in. (3·6 m)	12 ft 0 in. (3·7 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: 30th November 1962

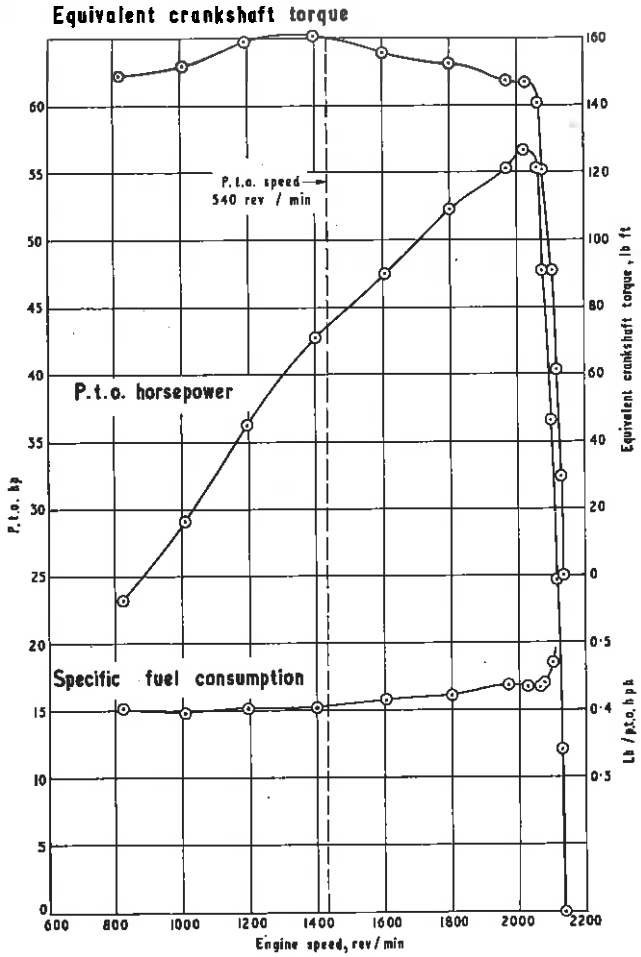


FIG. 1. Power take-off test

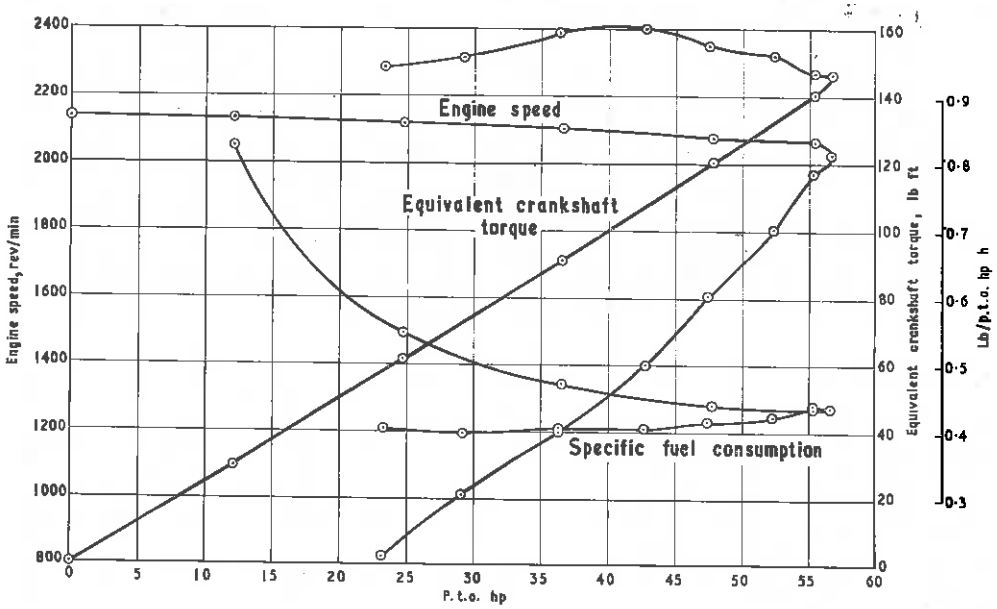


FIG. 2. Power take-off test

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