O.E.C.D. Approval No. 470
Report 636
September 1974

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

ESCORT MODEL 335 TRACTOR

Test No: R.74/7759/O.E.C.D.

Manufacturer: Escorts Limited,
Tractor and Engineering Division,
18/4, Mathura Road,
Faridabad, India.

NATIONAL INSTITUTE OF AGRICULTURAL ENGINEERING
Wrest Park . Silsoe . Bedford

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.

TABLE OF CONTENTS

	Page	Fig.
Specification of tractor	4	
Fuels and lubricants used in tests	7	
Compulsory tests		
Power take-off performance	8	1
Drawbar performance	10	
Turning space and turning circle	11	
Location of centre of gravity	11	
Braking	11	
Measurement of ambient noise emitted by the tractor	12	
Noise measurement at the driver's ear level	12	
Power lift and hydraulic pump performance	12	
Repairs and adjustments during tests	16	
Remarks	16	

SPECIFICATION OF TRACTOR

Manufacturer:	Escorts Limited, Tractor and Engineering Division, 18/4, Mathura Road, Faridabad, India
Selected and submitted for test by:	The manufacturer with the agreement of the testing station
Place of running-in:	Faridabad
Duration of running-in:	120 hours

Tractor

Make:	Escort
Model:	335
Type:	Four-wheel, rear wheel driven, unit construction
Serial No.:	A350803923

Engine

Make:	Ursus, Poland
Model:	S-312C
Type:	4-stroke, direct injection diesel
Serial No.:	183377
Cylinders:	2 cylinders, vertical, in-line, 4·02 in (102 mm) bore × 4·72 in (120 mm) stroke, capacity 119·6 in³ (1·961 l), compression ratio 17:1, replaceable wet cylinder liners, overhead valves
Fuel system:	Mico plunger type fuel feed pump with sediment trap on inlet side, Mico dual filter with felt and paper elements on pressure side, capacity of fuel tank 10·8 UK gal (49·0 l); Mico in-line injection pump, Serial No. 3261827, manufacturer's production setting 48 cm³–52 cm³ for 1000 injections at 1000 rev/min pump speed (test bench figures); Mico pintle type HB-DN 4S1 injector nozzles, injection pressure 141 atm (145 kg/cm²)
Governor:	Mico mechanical, incorporated in fuel injection pump, governed range of engine speed 550-2425 rev/min, rated engine speed 2200 rev/min
Air cleaner:	Escort oil bath mounted to right-hand side of hood with cyclonic pre-cleaner above hood, oil capacity 0·9 pt (0·5 l)
Lubrication system:	Forced feed from gear type pump, Ursus centrifugal partial flow filter, oil capacity 10·9 pt (6·2 l), recommended oil; ambient 50–86°F (10–30°C)–SAE 30, above 86°F (30°C)—SAE 40, change period 150 hours
Cooling system:	Water cooled, centrifugal pump with 12·6 in (320 mm) dia, 4-blade belt driven fan, coolant capacity 14·0 pt (8·0 l), thermostat for temperature control, pressurised to 7 lb/in² (0·49 kg/cm²).
Starting system:	Lucas type M45 PE solenoid operated electric starter motor.

Electrical system: Voltage: 12, positive earth
Generator: Lucas type C-40 AQ
Battery: AMCO lead-acid

Transmission

Clutch: Borg and Beck single plate dry clutch, 10 in (254 mm) dia, pedal operated

Gearbox: Escort sliding gear type, 6 forward and 2 reverse speeds

Rear axle and final drive: Escort crown wheel and pinion and differential with reduction gear final drives, pedal operated differential lock

Oil capacities: Gearbox and rear axle 44·0 pt (25·0 l), ambient 50–86°F (10–30°C) –SAE 30, above 86°F (30°C)–SAE 40, final drives 1·8 pt (1·0 l) each recommended oil SAE 140; recommended oil change period 750 hours

Gear	*Number of engine revolutions for one revolution of driving wheel*	**Nominal travelling speed for 2200 rev/min rated speed of engine, mile/h*	*(km/h)*
Forward			
1	266·95	1·12	(1·80)
2	138·39	2·16	(3·48)
3	86·49	3·45	(5·55)
4	65·99	4·52	(7·27)
5	34·17	8·73	(14·05)
6	21·35	13·97	(22·48)
Reverse			
1	318·21	0·94	(1·51)
2	78·59	3·80	(6·11)

*Calculated with the tyre rolling radius of 22·8 in (579 mm)

Power take-off At the rear of the tractor, on median plane, $1\frac{3}{8}$ in (34·9 mm) dia, 6 spline, to I.S.O. Standard for 540 rev/min operation, height above ground $21\frac{1}{8}$ in (537 mm), proportional engine speed giving 550 rev/min at 2200 rev/min rated engine speed, 540 rev/min (standard p.t.o. speed) at 2160 rev/min engine speed; direction of rotation clockwise facing driving end

Belt pulley At rear of tractor driven from p.t.o. shaft, manually engaged, 8·45 in (215 mm) dia × 5·70 in (145 mm) face width, 1375 rev/min giving 3042 ft/min (927 m/min) linear speed at 2200 rev/min rated engine speed, 3100 ft/min (945 m/min) linear speed at 2242 rev/min engine speed, direction of rotation clockwise viewed from left-hand side

Power lift Own make hydraulic, gear type pump driven from gearbox through main clutch, oil from transmission supplied to single acting ram cylinder and external tapping. Category 2 implement linkage with draught or position control and control for external supply

Drawbar Linkage drawbar with $15\frac{7}{8}$ in (22 mm) dia holes, 1 9/16 in (40 mm) apart, vertical heights to centre of drawbar $11\frac{1}{2}$ in (292 mm) to 31 in (787 mm) changed by adjustable stay links, distance from rear wheel centre with lower links horizontal $33\frac{1}{8}$ in (841 mm), position relative to p.t.o. 24 in (610 mm) to rear

Hitch Trailer hitch, height above ground 26¾ in (679 mm), distance from rear wheel centre 15¾ in (400 mm), coupling pin 1·18 in (30 mm) dia

Steering Ursus, bevel pinion and sector gearbox with two drag links

Brakes Own make, mechanical internal shoe type on differential shafts, independent or combined pedal operated, ratchet on brake pedals for parking

Wheels

Steering wheels: Two at the front, Dunlop "Tractor" 6·00–16 tyres, 4-ply rating, maximum permissible weight on each tyre 1080 lb (490 kg) at 36 lb/in² (2·5 kg/cm²), track width 49 in (1245 mm), 52½ in (1334 mm), 62½ in (1588 mm) and 72 in (1829 mm) changed by extending front axle and reversing wheels

Driving wheels: Two at the rear, Dunlop "Field Master" RT40 12·4/11–28 tyres, 6-ply rating, maximum permissible weight on each tyre 2810 lb (1275kg) at 24 lb in² (1·69 kg/cm²), track width 49 in (1245 mm) by 2 in (51 mm) and 4 in (102 mm) steps to 73 in (1854 mm) changed by reversing wheels and offset lug type rims

Wheelbase: 6 ft 1 in (1854 mm)

Lighting

	Height above ground of centre,		*Diameter,*		*Distance from outside edge of tractor at 57 in (1448 mm) wheel track, to centre,*	
	in	*(cm)*	*in*	*(cm)*	*in*	*(cm)*
Headlights	44¾	(114)	4⅞	(12)	20¼	(51)
Side lights	None fitted for test					
Rear lights	45½	(116)	3	(8)	9¼	(23)
Reflectors	None fitted for test					

Number of grease points

Whole tractor: 26

CONDITIONS DURING TESTS

Weights

Tractor (without driver but with tanks full)

	Front,		*Rear,*		*Total,*	
	lb	*(kg)*	*lb*	*(kg)*	*lb*	*(kg)*
Without ballast	1392	(631)	2149	(975)	3541	(1606)
With ballast	1554	(705)	2987	(1355)	4541	(2060)

Ballast

	Number of weights	*Total weight,*		*Water,*	
		lb	*(kg)*	*lb*	*(kg)*
Front wheels	2	162	(73)	nil	
Rear wheels	10	838	(380)	nil	

Track setting during tests

Front: 49 in (1245 mm)

Rear: 57 in (1448 mm)

Overall dimensions

	Length	*Width*	*Height*
With ballast	10 ft 0¾ in (3·07 m)	5 ft 8½ in (1·74 m)	6 ft 6½ in (1·99 m)
Without ballast	10 ft 0¾ in (3·07 m)	5 ft 8½ in (1·74 m)	6 ft 7 in (2·01 m)

Overall height measured to top of exhaust pipe

Seat Own make, pressed steel pan type; parallelogram linkage with hydraulic damper, range of adjustment 4 in (102 mm) fore and aft.

FUELS AND LUBRICANTS USED DURING TESTS

Fuel: Diesel oil, specific gravity 0·839 at 60°F (15·6°C), viscosity 2·46 cSt at 122°F (50°C), Cetane No. 56·5, to Class A, British Standard 2869: 1970.

Engine oil: Series III Quality, viscosity 65 cSt, at 122°F (50°C)

Transmission oil: Mild EP S.A.E. 80, viscosity 54 cSt, at 122°F (50°C)

Final drive reductions: S.A.E. 140, viscosity 210 cSt at 122°F (50°C)

COMPULSORY TESTS

1. Main power take-off performance

Date and location of tests: 30th April 1974, N.I.A.E. Silsoe, Bedford, U.K.

Type of dynamometer: Water brake, Heenan and Froude

Horsepower (Metric hp)	*Speed, rev/min*		*Fuel consumption,*		
	Engine	*P.t.o.*	*UKgal/h (l/h)*	*lb/hp h (g/metric hp h)*	*hp h/UKgal (metric hp h/l)*
Maximum power—2 hour test					
27·8 (28·2)	2250	563	1·67 (7·59)	0·504 (225)	16·6 (3·70)
Standard p.t.o. speed (540 rev/min)					
27·4 (27·8)	2160	540	1·63 (7·41)	0·500 (224)	16·8 (3·75)
The speed recommended by the manufacturer for drawbar work					
27·6 (28·0)	2200	550	1·66 (7·55)	0·503 (225)	16·7 (3·73)
Part loads					
24·2 (24·5)	2306	577	1·40 (6·36)	0·485 (217)	17·3 (3·86)
0	2416	604	0·48 (2·18)	—	—
12·3 (12·5)	2353	588	0·91 (4·14)	0·618 (276)	13·6 (3·03)
27·8 (28·2)	2250	563	1·67 (7·59)	0·504 (225)	16·6 (3·70)
6·2 (6·3)	2360	590	0·72 (3·27)	0·968 (433)	8·7 (1·94)
18·3 (18·6)	2323	581	1·13 (5·14)	0·517 (231)	16·2 (3·61)

No load, maximum engine speed: 2416 rev/min

Equivalent crankshaft torque at maximum power: 64·8 lb ft (9·0 kgm)

Maximum equivalent crankshaft torque: 71·2 lb ft (9·8 kgm) at 1630 rev/min engine speed

Mean atmospheric conditions:	temperature	64°F (18°C)
	pressure	29·47 in Hg (749 mm Hg)
	relative humidity	38%
Maximum temperature:	coolant	189°F (87°C)
	engine oil	213°F (101°C)
	fuel	99°F (37°C)

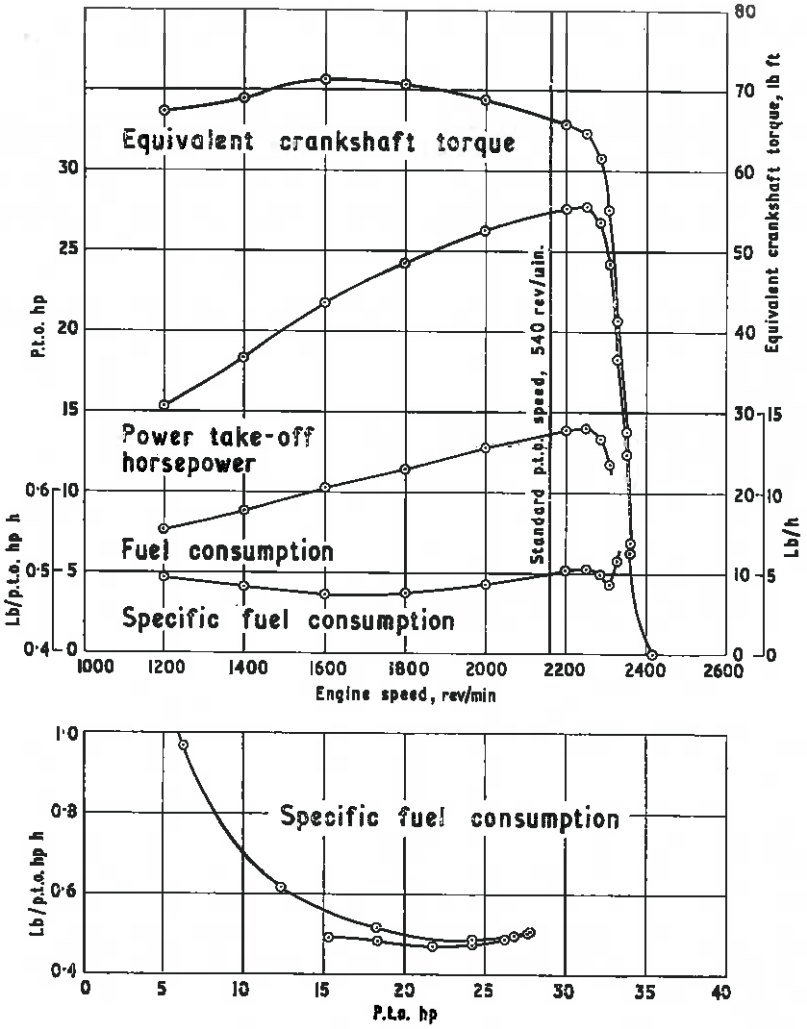

Fig. 1. Power take-off test

2. Drawbar performance

Date of tests: 29th May—18th June 1974 Type of track: Concrete Height of drawbar above ground: 22¼ in (565 mm)

Gear	Horse-power (Metric hp)	Drawbar pull, lb (kg)	Speed, mile/h (km/h)	Engine speed, rev/min	Wheel-slip, %	Specific fuel consumption, lb/drawbar hp h (g/metric drawbar hp/h)	drawbar hp h/UKgal (metric drawbar hp h/l)	Temperature, °F(°C) Coolant	Fuel	Engine oil	Atmospheric conditions Temperature, °F (°C)	Relative humidity, %	Pressure, in Hg (mm Hg)
(i) Maximum power (ballasted)													
1	10·1* (10·2)	3700 (1678)	1·02 (1·64)	2328	15·0	0·776 (347)	10·8 (2·41)	174 (79)	69 (21)	160 (71)	62 (17)	54	29·83 (758)
2	19·5* (19·8)	3700 (1678)	1·98 (3·19)	2287	15·0	0·618 (276)	13·6 (3·03)	178 (81)	70 (21)	186 (86)	56 (13)	82	29·85 (758)
3	24·4 (24·7)	2800 (1270)	3·27 (5·26)	2256	10·0	0·598 (267)	14·0 (3·12)	178 (81)	69 (21)	185 (85)	56 (13)	88	29·85 (758)
4	24·9 (25·2)	2075 (941)	4·50 (7·24)	2276	6·9	0·583 (261)	14·4 (3·21)	175 (79)	65 (18)	175 (79)	56 (13)	88	29·85 (758)
5	22·9 (23·2)	1025 (465)	8·39 (13·48)	2136	3·2	0·635 (284)	13·2 (2·94)	176 (80)	68 (20)	160 (71)	60 (16)	58	29·83 (758)
(ii) Five hour test at 75% of pull at maximum power													
3	19·4 (19·7)	2100 (953)	3·46 (5·57)	2294	6·9	0·533 (238)	15·7 (3·50)	185 (85)	90 (32)	192 (89)	66 (19)	90	29·91 (760)
(iii) †Five hour test at pull corresponding to 15% wheelslip in test (i)													
2	—	3700 (1678)	2·08 (3·35)	—	—	—	—	183 (84)	92 (33)	198 (92)	64 (18)	84	29·91 (760)
(iv) Maximum power (unballasted)													
1	8·6* (8·7)	3100 (1406)	1·04 (1·67)	2343	15·0	—	—	172 (78)	90 (32)	188 (87)	65 (18)	61	30·00 (762)
2	16·5* (16·7)	3100 (1406)	2·00 (3·22)	2307	15·0	—	—	178 (81)	86 (30)	190 (88)	65 (18)	66	30·00 (762)
3	23·8 (24·1)	2750 (1247)	3·25 (5·23)	2237	11·8	—	—	185 (85)	78 (26)	189 (87)	64 (18)	65	30·00 (762)
4	25·3 (25·7)	2150 (975)	4·41 (7·10)	2263	8·7	—	—	186 (86)	69 (21)	166 (74)	64 (18)	70	30·00 (762)
5	24·3 (24·6)	1050 (476)	8·68 (13·97)	2253	5·6	—	—	180 (82)	72 (22)	175 (79)	55 (13)	82	30·00 (762)

Total oil consumption during ten hours duration of tests (ii) and (iii) 0·047 lb/h (21·2 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—49 in (1245 mm)

rear—57 in (1448 mm)

	With brakes		*Without brakes*	
	Right-hand	*Left-hand*	*Right-hand*	*Left-hand*
Radius of turning space	9 ft 6½ in (2·91 m)	9 ft 8 in (2·95 m)	10 ft 9 in (3·28 m)	10 ft 8 in (3·25 m)
Radius of turning circle	9 ft 3½ in (2·83 m)	9 ft 5 in (2·87 m)	10 ft 6 in (3·20 m)	10 ft 5 in (3·18 m)

4. Location of centre of gravity

Height above ground	25·5 in (648 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	27·9 in (709 mm)
Distance from the median plane of the tractor	0

5. Braking

Date of tests: 24th and 25th June 1974

Type of surface: Concrete track

Type of decelerometer: Moto Meter, recording type

Weight of ballasted tractor: 4541 lb (2060 kg)

Cold brakes

	Tractor without ballast		*Tractor ballasted*	
Travelling speed of tractor, mile/h (km/h)	15·5	(25·0)	15·5	(25·0)
Maximum deceleration, ft/s² (m/s²)	14·5	(4·4)	15·0	(4·6)
Stopping distance, ft (m)	21·9	(6·7)	22·0	(6·7)
Force on brake pedal, lb (kg)	118	(54)	135	(61)
Force exerted on brake pedal to achieve a deceleration of 8·2 ft/s² (2·5 m/s²), lb (kg)	67	(30)	76	(34)

Brake fade characteristics (hot tests, ballasted tractor)

Maximum deceleration hot/maximum deceleration cold × 100:	100%
Stopping distance cold/stopping distance hot × 100:	102%
Force on pedal cold/force on pedal hot × 100:	95%
Efficacy of parking latch:	Satisfactory, facing up and down slope

6. Measurement of ambient noise emitted by the tractor

Date of tests:	20th June 1974	
Type of sound level meter:	Brüel and Kjaer 2204	
Type of track:	Concrete	
Results of tests:		
	gear:	6th
	travelling speed before acceleration:	11·6 mile/h (18·7 km/h)
	sound level:	86 dBA

7. Noise measurement at the driver's ear level

Date of tests:	20th June 1974
Type of sound level meter and octave filter:	Brüel and Kjaer 2204 and 1613
Type of track:	Concrete

Gear	*Travelling speed, mile/h (km/h)*	*Sones*	*dBA*
4th	4·4 (7·1)	115	99

8. Power lift and hydraulic pump performance

Date of tests:	26th and 27th June 1974
Hydraulic fluid	
Make and type:	Mild EP S.A.E. 80
Viscosity:	54 cSt at 122°F (50°C)
Type of linkage lock for transport:	Hydraulic
Opening pressure of the cylinder over pressure relief valve (manufacturer's figures):	1991-2134 lb/in² (140-150 kg/cm²)

Pump characteristics

(i) Opening pressure of relief valve: 1200 lb/in² (84 kg/cm²)

Sustained pressure of the open relief valve: 1860 lb/in² (131 kg/cm²)

(ii) Pump delivery rate at minimum pressure and rated engine speed: 3·9 gal/min (17·7 l/min)

(iii) Pump delivery rate at maximum hydraulic power: 3·9 gal/min (17·7 l/min)

Delivery pressure: 1300 lb/in² (91 kg/cm²)

Power: 3·6 hp (3·7 metric hp)

Linkage geometry when connected to the standard frame

	Maximum mechanical advantage		*Minimum mechanical advantage*	
Projected length in side view				
lower links, in (mm)	34·65	(880)	34·65	(880)
lift arms, in (mm)	9·84	(250)	9·84	(250)
lift rods, in (mm)	22·75	(578)	22·75	(578)
top links, in (mm)	24·13	(613)	24·75	(629)
Distance of lift rod connection point from pivot point of lower link, in (mm)	17·09	(434)	17·09	(434)
The following dimensions are given relative to the rear wheel centre line, situated 22·80 in (579 mm) above the ground level				
Lower link pivot point, in (mm)	1·52 (39) forward,	6·42 (163) below	1·52 (39) forward,	6·42 (163) below
Top link pivot point, in (mm)	7·03 (179) behind,	9·10 (231) above	7·03 (179) behind,	6·73 (171) above
Lift arm pivot point, in (mm)	2·27 (58) forward,	13·51 (343) above	2·27 (58) forward,	13·51 (343) above
Maximum and minimum height of lower link hitch points, in (mm)	9·08 (231) above,	14·92 (379) below	9·08 (231) above,	14·92 (379) below
Height of lower link hitch points when locked in transport position, in (mm)	Any height within lift range		Any height within lift range	

Lifting heights in relation to a horizontal line through the lower link pivoting point

	in (cm)	−9½ (24·1)	−9 (22·9)	−8½ (21·6)	−6 (15·2)	−3 (7·6)	0 0	+3 (7·6)	+6 (15·2)	+9 (22·9)	+12 (30·5)	+15 (38·1)	+18 (45·7)	+21 (53·3)	+23 (58·4)
Lifting force at the hitch points, lb(kg) (Values for the pressure at maximum hydraulic horsepower, calculated from measurements made at maximum pressure)	max. mech. advantage			*1469 (666)	1532 (695)	1564 (709)	1604 (728)	1622 (736)	1624 (737)	1629 (739)	1638 (743)	1657 (752)			
	Force at which front of tractor is calculated to lift with maximum allowable front ballast is in excess of measured values.														
	Pressure 1300 lb/in² (91 kg/cm²)														
Lifting force at the frame, lb(kg) (Values for the pressure at maximum hydraulic horsepower, calculated from measurements made at maximum pressure)	max. mech. advantage		1516 (688)		1480 (671)	1449 (657)	1425 (646)	1412 (640)	1352 (613)	1317 (597)	1261 (572)	1215 (551)	1176 (533)	1094* (496)	
	min. mech. advantage	1387 (629)	1380 (626)		1358 (616)	1350 (612)	1341 (608)	1278 (580)	1229 (557)	1185 (538)	1161 (527)	1110 (503)	1070 (485)	1014 (460)	966* (438)
	Force at which front of tractor is calculated to lift with maximum allowable front ballast is in excess of measured values.														
	Pressure 1300 lb/in² (91 kg/cm²)														

*Maximum force exerted throughout whole range

Repairs and adjustments during tests	A split in the fuel tank was repaired and a broken oil pressure pipe to the gauge was replaced during the drawbar tests
Remarks	None

Officer in charge: D. W. SMITH

Head of Tractor and Cultivation Division: J. MATTHEWS

Date: 10th September 1974

Henry Burt & Son Ltd, College Street, Kempston, Bedford