



# **LOTUS EUROPA**

## **ALL MODELS**

### **Workshop Manual**

**LOTUS CARS LIMITED**

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## INTRODUCTION

This publication is a combined manual covering all models of the Lotus Europa. The front part deals with the features which are peculiar to the Twin Cam and Special models, whereas the latter part of the manual covers the Series 1 and 2 models, and components fitted to Twin Cam and Special which are also fitted on Series 1 and 2 models.

## TECHNICAL DATA.

### DIMENSIONS

Wheelbase	233.7 cm. (92 in.)
Track – Front	135.8 cm. (53.5 in.)
- Rear	134.6 cm. (53 in.)
Overall - Length	400 cm. (157½ in.)
-Width	163.8 cm. (64½ in.)
- Height	107.9 cm. (42½ in.)
Ground Clearance (design)	15 cm. (6 in.)
Turning Circle	12.5m. (41 ft.)
Weight (unladen)	686 kg. (1,513 lbs.)

### CAPACITIES.

Engine Sump (including filter)	4 litres (7½ pts.; 9 U.S. pts.)
Transmission	1.75 litres (3 pts.; 3.6 U.S. pts.)
Coolant (with heater)	10.8 litres (19 pts.; 22.8 U.S. pts.)
Fuel	56 litres (12.5 gal.; 15 U.S. gall.)

### ENGINE.

#### General

Number of cylinders	4
Capacity	1558 cc. (95.06 cu. in.)
Stroke	72.746 mm. (2.864 in.)
Bore - Grade 1	82.550/82.558 mm. (3.2500/3.2503 in.)
- Grade 2	82.558/82.565 mm. (3.2503/3.2506 in.)
- Grade 3	82.565/82.573 mm. (3.2506/3.2509 in.)
- Grade 4	82.573/82.580 mm. (3.2509/3.2512 in.)
Compression - Ratio - Europa TC (All Territories) - Europa Special (UK & Export) - Europa Special (N. America)	9.5 : 1  10.3 : 1  9.5 : 1
- Pressure at sea level (All models, all Territories)	In excess of 11.248 kg.cm.sq. (160 lbs.sq.in.) Each cylinder within 1.41 kg.cm.sq. (20 lbs .sq .in.) of each other.

## Cylinder Head

Material	Aluminium
Gasket	Copper/asbestos
Valve timing	26° B.T.D.C.
- Inlet opens	66° A.B.D.C.
- Inlet closes	66° B.B.D.C.
- Exhaust opens	26° A.T.D.C.
- Exhaust closes	45°
Angle of valve seats and faces	

### Valves:

Head diameter- Inlet - Europa TC (UK & Export)	38.760/38.862 mm. (1.526/1.530 in.)
- Europa TC (N. America)	39.624/39.776 mm. (1.560/1.566 in.)
- Europa Special (All Territories)	39.624/39.776 mm. (1.560/1.566 in.)
- Exhaust (All models, all Territories)	33.553/33.655 mm. (1.321/1.325 in.)
Stem diameter - Inlet and Exhaust	7.874/7.899 mm. (.310/.311 in.)
Stem clearance in guide	
- Inlet	.007/.058 mm. (.0003/.0023 in.)
- Exhaust	.063/.076 mm. (.0025/.0030 in.)
Clearance (cold)	
- Inlet	.127/.177 mm. (.005/.007 in.)
- Exhaust	.228/.279 mm. (.009/.011 in.)

### Valve Springs:

Type	Dual
Free length	
- Inner	28.70 mm. (1.130 in.)
- Outer	36.83 mm. (1.450 in.)
Rate	
- Inner @ 23.4 mm. (.92 in.)	5.6kg. (12.41bs.)
- Inner @ 14.7 mm. (.58 in.)	15.2kg. (33.51bs.)
- Outer @ 29.7 mm. (1.17 in.)	20.4 kg. (45.0 lbs.)
- Outer @ 21.1 mm. (.83 in.)	49.4 kg. (109 lbs.)

### Valve guides:

Length - Inlet	36.608 mm. (1.520 in.)
- Exhaust	37.592 mm. (1.480 in.)
External diameter	
- Std.	12.700/12.713 mm. (.500/.5005 in.)
- O/size	12.852/12.865 mm. (.5060/.5065 in.)
Interference fit (all)	.0127/.0381 mm. (.0005/.0015 in.)
Fitted height above cylinder head	8.128 mm. (.320 in.)
Internal diameter (all) ream after fitting	7.907/7.932 mm. (.3113/.3123 in.)

Bore in cylinder head - Std.	12.674/12.687 mm. (.499/.4995 in.)
- O/size	12.872/12.839 mm. (.505/.5055 in.)
<u>Camshafts</u>	
Journal diameter	25.4/25.413 mm. (1.000/1.0005 in.)
End Float	.076/.254 mm. (.003/.010 in.)
Bearings - Number	5
- Type	Steel backed white metal
- Running clearance	.013/.050 mm. (.0005/.002 in.)
Cam followers:	
Bore in head	34.925/34.940 mm. (1.375/1.3756 in.)
Outside diameter	34.904/34.912 mm. (1.3742/1.3745 in.)
Follower to head clearance	.013/.036 mm. (.0005/.0014 in.)
<u>Jackshaft</u>	
Bearings - Number	3
- Type	Steel backed white metal
- Length - Front	19.05 mm. (.75 in.)
- Centre	16.26 mm. (.64 in.)
- Rear	19.05 mm. (.75 in.)
- Running clearance	.025/.050 mm. (.001/.002 in.)
Journal diameter	39.624/39.637 mm. (1.560/1.5605 in.)
End float	.063/.190 mm. (.0025/.0075 in.)
<u>Crankshaft</u>	
Balance	Within 14.42 gr. cm. (2 oz. in.)
Diameter - Main journals	53.987/54.000 mm. (2.1255/2.1260 in.)
-Crankpin	49.199/49.211 mm. (1.9370/1.9375 in.)
End float - Dimension	.076/.203 mm. (.003/.008 in.)
- Controlled by	Thrust washers on centre main bearing
Bearings - Number	5
- Type	Steel backed, lead bronze with lead overlay
- Running clearance	.038/.076 mm. (.0015/.0030 in.)
Maximum undersize for re-grind	.762 mm. (.03 in.)
<u>Flywheel</u>	
Maximum run out (lateral)	.101 mm. (.004 in.)
Starter ring gear - Run out - Lateral	.406 mm. (.016 in.)
- Radial	.152 mm. (.006 in.)

## Connecting Rod

Type	'H' Section
Material	Steel forging
Distance between centres	12.19/12.24 cm. (4.799/4.801 in.)
Bearings - Type	Steel backed, lead bronze with lead overlay
- Running clearance	.013/.513 mm. (.0005/.0022 in.)
- End float on crankpin	.101/.254 mm. (.004/.010 in.)

Small end bore (bushed) :

Grade 'A' (silver)	20.635/20.637 mm. (.8124/.8125 in.)
Grade 'B' (green)	20.637/20.642 mm. (.8125/.8127 in.)

## Gudgeon (piston) pin

Type	Floating
Location	Circlips
Diameter - Grade 'A'	20.627//20.628 mm. (.8121//.8122 in.)
- Grade 'B'	20.628//20.632 mm. (.8122//.8123 in.)
Class of fit	Finger push fit

## Piston

Type	Solid skirt
Material	Tin plated aluminium alloy
Length	68.250 mm. (2.687 in.)
Compression Height	39.014//39.065 mm. (1.536/1.538 in.)
Maximum permissible weight variation per set	4 grammes
Rings - Compression	2
- Oil Control	1
Diameter - Grade 1	82.466/82.474 mm. (3.2467//3.2470 in.)
-Grade 2	82.474/82.481 mm. (3.2470/3.2473 in.)
- Grade 3	82.481/82.489 mm. (3.2473/'3.2476 in.)
- Grade 4	82.489/82.497 mm. (3.2476/3.2379 in.)
Piston clearance in cylinder bore	.076/.091 mm. (.0030/.0036 in.)
Gudgeon pin bore offset	1.016 mm. (.04 in.) towards thrust face
Ring gap (fitted) - Compression	.229/.356 mm. (.009//.014 in.)
- Oil control	.254/.508 mm. (.010//.020 in.)



Piston ring to groove clearance:

- Compression .041/.091mm. (.0016/.0036 in.)
- Oil control .046/.097 mm. (.0018/.0038 in.)

### LUBRICATION SYSTEM

- Pump: - Type. Eccentric Lobe
- Drive. Gear on Jackshaft
- Inner and outer rotor clearance .15 mm. (.006 in.) Maximum
- Inner and outer rotor float .13 mm. (.005 in.) Maximum
- Outer rotor to housing clearance .25 mm. (.010 in.) Maximum
- Normal pressure (hot) 2.4/2.8 kg. cm. sq. (35/40 lbs. in. sq.)
- Filter Full flow (throw away canister)

### FUEL SYSTEM

- Pump - Operation Lever by eccentric on Jackshaft
- Pressure .087/.176 kg. cm. sq. (1.25/2.5 lbs. in. sq)
- Air cleaner type Paper element, dry
- Carburettor -Type and number Dellorto 40 DHLA, two
- Slow running speed 800 r .p.m.
- Settings:
  - Choke 30 mm.
  - Main jet 115
  - Main air corrector jet 160
  - Slow running jet 50
  - Slow running air corrector jet 7850 - 2
  - Pump jet 8083.40
  - Starter jet 70
  - Main emulsion tube 7772 - 1
  - Starter emulsion tube 7482 - 1
  - Needle valve 7180 - 15
  - Air trumpet length 4.44 cm. (1.75 in.)

Carburetter	- Type and number	Zenith-Stromberg 175 CD 2SE
	- Slow running speed	800/900r.p.m.
	Settings:	
	Needle	B. 1G
	Spring colour	Light blue
	Damper oil	SAE 20W/50

### IGNITION SYSTEM

Type	Coil and distributor
Firing Order	1,3,4,2,
No l Cylinder	Nearest to front of car
Ignition advance control	Fully automatic
Ignition timing (static):	
Dellorto Carburetters	12° B.T.D.C.
Zenith-Stromberg Carburetters	5° B.T.DC.
Coil	Lucas LA.12
Sparking plugs - Type	Champion N7Y
- Gap	.584/.635 mm. (.023/.025 in.)

\*The above ignition setting may need SLIGHT alteration to meet local fuel requirements.

### Distributor

Type	23 D.4
Direction of rotation (from above)	Anti-clockwise
Drive	Gear on jackshaft
Contact breaker gap	.35/.40 mm. (.014/.016 in.)
Contact lever spring tension	.51/.68 kg. (18/24 oz.)
Firing angles	0°, 90°, 180°, 270° ± 10
Cam dwell angle	60° * 3°
Dispatch no. - Dellorto carbs.	41189
- Zenith-Stromberg carbs.	41225 when suction retard capsule fitted

### Centrifugal advance (All distributors)

#### Crankshaft r.p.m.      Crankshaft degrees B.T.D.C. (Add static setting)

Below 1,000	No advance
1,250	2.4
1,500	4.6
1,750	6.8
2,000	9.2
2,250	11.6
2,500	14.0 Maximum advance

### COOLING SYSTEM.

Type	Centrifugal pump and fan
Radiator cap relief valve pressure	.49 kg. cm. sq. (7 lbs. in. sq.)
Thermostat nominal opening temperature	78° C.
Alternator belt tension at top	9.52 mm. (.375 in.)
Impeller vanes to water pump housing clearance	508/.762 mm. (.020/.030 in.)

### CLUTCH

Make and Type	Borg and Beck, diaphragm spring
Operation	Cable
Driven plate diameter	215.9 mm. (8½ in.)
Free movement of withdrawal lever	4.318 mm. (.170 in.)

### TRANSMISSION.

Type	4 forward speeds and reverse
Bearings - Mainshaft	Taper rollers
- Secondary gear cluster	Taper rollers
Bearings - Adjustment	See section 'F' (Transmission)
Gear ratios:	<u>4 speed</u> <u>5 speed</u>
- O/D (5th.)	N/A      0.87 : 1
- 4th.	1.03 : 1      1.21 : 1
- 3rd.	1.48 : 1      1.61 : 1
- 2nd.	2.25 : 1      2.33 : 1
- 1st.	3.61 : 1      3.61 : 1
Reverse	3.08 : 1      3.08 : 1
Final drive -Type	Hypoid gear
- Bearings	- Pinion      Taper rollers
	- Diff./crown wheel      Taper rollers
Drive shaft end-float	.050/.076 mm. (.002/.004 in.)

Bearings adjustment - Pinion bearing pre-load		See Section 'F' (Transmission)
- Crown wheel/pinion		.127/.254 mm. (.005/.010 in) backlash
Number of teeth - Crown wheel		32 ) Type 336/352    34) Type 365
- Pinion		9 ) gearbox        9) gearbox
Speedometer gears :	<u>Driving Gear</u>	<u>Driven Gear</u>
Type 336 & 352 gearbox (4 speed)	6 teeth (X046 F 6049Z)	12 teeth (X046 F 6108Z)
Type 365 gearbox (5 speed)	9 teeth (A074 F 6111 Z)	19 teeth (A074 F 6136Z)
Final drive ratio - 4 speed		3.56:1
-5 speed		3.78:1
Overall ratios:	<u>4 speed</u>	<u>5 speed</u>
- O/D (5th.)	N/A	3.289:1
- 4th.	3.666 : 1	4.574 : 1
- 3rd.	5.268 : 1	6.086 : 1
- 2nd.	8.010 : 1	8.807 : 1
- 1 st.	12.851 : 1	13.646 : 1
- Reverse	10.964 : 1	11.642 : 1

### STEERING

Type	Rack and Pinion
Steering angles - Camber	0° to + 30'
- Castor	2° 30' + 30'
- Swivel pin inclination	9° + 30'
Toe in	4.8 mm. (3/16 in.) to 1.6mm. (1/16 in)
Condition for checking toe in	15 cm. (6 in.) ground clearance at bottom of chassis closing plate.

### FRONT SUSPENSION.

Type	Independent
Spring - Number of coils	13.5
- Wire diameter	10.16 mm. (.40 in.)
- Length -Free	31.77 cm. (12.51 in.)
-Fitted	20.01 cm. (7.88 in.)
- Rate	1.33 kg.m. (116 lbs. in.)
Front hub end float	.05/.10 mm. (.002/.004 in.)

## REAR SUSPENSION.

Type	Independent
Spring - Number of coils	19.6
- Wire diameter	8.23 mm. (.324 in.)
- Length - Free	42.54 cm. (16.75 in.)
- Fitted	25.04 cm. (9.86 in.)
- Rate	.865 kg.m. (75 lbs. in.)
Wheel camber	1° Negative +- 30'
Toe - in	6.35 mm. (¼ in.) to 3.18 mm.(1/8 in.)

## BRAKES.

Make and type	Girling hydraulic (servo assisted)
Front brakes - Disc diameter	24.76 cm. (9.75 in.)
- Pads material	Ferodo FER .2430 F
- Total disc run out	.10 mm. (.004 in.)
Rear Brakes - Drum diameter and width - T/C	20.3cm. (8 in.) x 31.75mm.(1.25 in.)
- Special	20.3cm. (8 in.) x 38.10mm.(1.50 in.)
- Lining material	Don.242
Handbrake type	Mechanical on rear only

## WHEELS AND TYRES.

Wheel - Type	Pressed steel - bolt on
- Size	4½J
Tyres -Type	Dunlop SP Sport with tubes
- Size	155 X HR13
- Pressure (cold):	

At speeds BELOW 160 k.p.h. (100 m.p.h.)

Front 1.27kg.cm.sq. (18 lbs. in. sq.)

Rear 1.97kg.cm.sq. (28 lbs. in. sq.)

At sustained speeds ABOVE 160 k.p.h. (100 m.p.h.)

1.69kg.cm.sq. (241bs.in.sq.)

2.39kg.cm.sq. (341bs.in.sq.)

NOTE: It is not necessary to increase the tyre pressures for any reason other than those given.

\* When inner tubes are fitted, it is essential that these are of the correct type for radial ply tyres.

## Optional Wheels and Tyres.

Wheel - Type	Alloy - Bolt on
- Size	5½J X 13
- Nuts, torque loading	5.53 - 6.22 kg. m. (40-45 lbs. ft.)

Tyres - Type	Firestone Cavalino 'wide oval'
- Size	175/185 x 13
- Pressure (cold):	

<u>At speeds BELOW 160 kph (100 mph)</u>	<u>At sustained speeds ABOVE 160 kph (100 mph)</u>
Front 1.125kg. cm. <sup>2</sup> (161lbs. in. <sup>2</sup> )	1.547kg. cm. <sup>2</sup> (22 lbs. in. <sup>2</sup> )
Rear 1.828kg. cm. <sup>2</sup> (26 lbs. in. <sup>2</sup> )	2.250kg. cm. <sup>2</sup> (32 lbs.in. <sup>2</sup> )

NOTE

It is not necessary to increase the tyre pressures for any reason other than those given.

ELECTRICAL EQUIPMENT

Battery

Type	Exide 6 VTA 29L
Capacity	39amp. hr. @ 20 hr. rating
Voltage and polarity	12 volt Negative earth

Fuses

Quantity	4; 35 amp
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Alternator

Type	AC Delco DN 460
Maximum output	35 amp @ 3,600 r.p.m.
Earth polarity	Negative
Number of poles	14
Stator phases	3

Starter

Type	Lucas M35J
Drive	'SB' (inboard)
Brush tension	.80 kg. (28 oz.)
Light running current	65 amp @ 8,000/10,000 rpm
Lock torque	.97 kg. m. (7 lbs. ft.) @ 350/375 amp

Lamp bulbs (all 12 volts)

Headlamp - RHD	410 (45/40W) with 989 (6W) pilot
- LHD	410 (45/40W) with 989 (6W) pilot
- France	411 (45/40W) yellow with 989 (6W) pilot
- North America	Sealed beam unit

Front and rear indicators	382 (21W)
Indicator repeater	501 (5W capless)
Stop and tall lamps	380 (21/6W)
Rear number plate lamp	254 (6W festoon)
Reverse lamp	273 (21W festoon)
Interior lamp	254 (6W festoon)
Panel (instrument) lamps	987 (2.4W)
Warning lamps	987 (2.4W)

## TORQUE LOADING FIGURES

<u>ENGINE</u>	<u>kg. m.</u>	<u>lbs. ft.</u>
Cylinder head (tighten cold)	8.29 - 8.98	60 - 65
Cylinder head to front cover	1.38 - 2.07	10 - 15
Sparking plugs	3.31 - 3.87	24 - 28
Camshafts - Bearing caps	1.24	9
- Sprockets	3.45 - 4.14	25 - 30
Crankshaft - Main bearing caps	7.60 - 8.29	55 - 60
- Connecting rod (big-end) caps	6.08 - 6.36	44 - 46
- Pulley	3.31 - 3.87	24 - 28
Flywheel	6.22 - 6.91	45 - 50
Front timing cover    1/4" (UNF & UNC)	.69 - .96	5 - 7
5/16" (UNF & UNC)	1.38 - 2.07	10 - 15
- Back plate to cylinder block	.83 - 1.10	6 - 8
Timing chain tensioner   - Sprocket pin	5.53 - 6.22	40 - 45
- Retaining bolt	6.22 - 6.91	45 - 50
- Pivot pin	5.53 - 6.22	40 - 45
Jackshaft - Sprocket	.65 - 2.07	12 - 15
- Thrust plate	.69 - .96	5 - 7
Oil filter centre bolt	1.65 - 2.07	12 - 15
Oil pump to cylinder block	1.65 - 2.07	12 - 15
Oil sump to cylinder block	.83 - 1.10	6 - 8
Oil sump drain plug	2.76 - 3.45	20 - 25
Fuel pump to cylinder block	1.65 - 2.07	12 - 15
Exhaust manifolds to cylinder head	1.65 - 2.07	12 - 15
Rear oil seal carrier (crankshaft) to cyl. block	1.65 - 2.07	12 - 15
Generator to mounting bracket	2.07 - 2.48	15 - 18
Carburettor trumpet nuts	1.10	8
Engine mounting bracket to engine	2.48	18



<u>CLUTCH</u>	<u>kg. m.</u>	<u>lbs. ft.</u>
Clutch housing to gearbox	5.53 - 6.22	40 - 45
clutch assembly to flywheel	1.65 - 2.07	12 - 15

### TRANSMISSION.

Gearbox casing (halves)	See Section 'F'	
Differential case to crown wheel	See Section 'F'	
Differential bearing adjusting nuts	2.07	15
Pinion bearing nut	11.75	85
Speedometer drive worm	See Section 'F'	
Reverse selector pivot	See Section 'F'	
Side cover plates	2.07	15
Gearbox mounting bracket to chassis	4.83	35

### FRONT SUSPENSION & STEERING

Stub axle retaining nut	8.98 - 10.36	65 - 75
Ball joint - To vertical link	5.25 - 5.80	38 - 42
- To upper wishbone	1.65 - 2.07	12 - 15
Lower wishbone - To trunnion *	4.83	35
- To damper *	6.91	50
Inner wishbone retaining nut *	6.91	50
Caliper mounting plate to hub	3.04 - 3.73	22 - 27
Steering arm to vertical link	3.04 - 3.73	22 - 27
Steering tie rod ball joint	3.59 - 3.87	26 - 28
Steering tie rod adaptor	6.91	50
Steering unit mounting clamps to chassis	1.38	10
Steering column impact clamp	3.59 - 4.42	26 - 32

\* Tighten with suspension in static ride condition

### REAR SUSPENSION.

Lower link and damper to bearing housing	7.60	55
Lower link to clutch housing	5.53	40
Lower link mounting bracket to transmission	1.65	12

	<u>kg. m.</u>	<u>lbs. ft.</u>
Bearing housing to radius arm	2.48	18
Radius arm front mounting bolt	4.83	35
Rear damper top mounting	5.53	40

### HUBS

Rear hub to outboard drive shaft*	20.70	150
Brake disc to front hub	3.04 - 3.73	22 - 27
Front hub to spindle nut **	.69 - .83	5 - 6

\*Assemble with Loctite '35'. A rotational free play NOT EXCEEDING .127 mm (005 in.) between the hub and shaft measured at the wheel stud MUST be used for LEFT HAND hubs.

\*\*Tighten nut to this torque loading while rotating the hub to ensure bedding of taper rollers. Slacken nut 'one flat', then insert split pin.

### BRAKE HYDRAULIC SYSTEM CONNECTIONS

3/8 in UNF female (bundy and hose connection)	1.10 - 1.38	8 - 10
3/8 in UNF male (bundy to master cylinder, multi-ways etc.)	.69 - .96	5 - 7
7/16 in. UNF male	1.93 - 2.90	14 - 21
3/8 in. bore servo bundy (5/8 in. male)	1.65 - 2.07	12 - 15
Stop lamp switch	1.65 - 2.07	12 - 15
Brake hose to banjo	1.65 - 2.07	12 - 15
7/16 in. UNF female (bundy to reservoir)	1.65 - 1.93	12 - 14

### Torque Wrenches

Torque wrenches in daily use should be checked at intervals not exceeding 3 months to ensure that accuracy is maintained.

GENERAL NUTS AND BOLTS

	<u>kg. m.</u>	<u>lbs. ft.</u>
1/4 in. UNF and UNC	.69 - .96	5 - 7
5/16 in. UNF and UNC	1.65 - 2.07	12 - 15
3/8 in. UNC	2.35 - 3.04	17 - 22
3/8 in. UNF	3.04 - 3.73	22 - 27
7/16 in. UNC	4.14 - 4.85	30 - 35
7/16 in. UNF	5.53 - 6.22	40 - 45
1/2 in. UNC	6.22 - 6.91	45 - 50
1/2 in. UNF	6.91 - 8.29	50 - 60
9/16 in. UNC	8.29 - 9.68	60 - 70
9/16 in. UNF	8.98 - 10.36	65 - 75
5/8 in. U NC	10.36 - 11.75	75 - 85
5/8 in. UNF	13.82 - 15.20	110 - 110