

DATA

ENGINE DATA

Type	Six cylinder in line, 4 stroke
Combustion System	Indirect injection (Ante-Chamber)
Nominal Bore	3.62 in (92.0 mm)
Stroke	4.00 in (101.6 mm)
Compression Ratio	21 : 1
Cubic Capacity	247.3 in ³ (4.052 litres)
Firing Order	1, 5, 3, 6, 2, 4
Lubricating Oil Pressure	30 lbf/in ² (2,1 kgf/cm ²) minimum at maximum engine speed and normal operating temperature
Lubricating Oil Sump Capacity	20 Imperial pints (11.3 litres)

RATING DETAILS(S.A.E.)

Rated Output	98 bph at 3600 rev/min
Maximum Torque	168 lbf ft (21,8 kgf m) at 2200 rev/min

DERATING FOR ALTITUDE

If it is necessary to operate continuously at altitudes above 2,000 ft (600 metres), then it may be necessary to derate the engine by reducing the amount of fuel being fed into the engine. Perkins Engines Limited will advise.

CYLINDER NUMBERING

The cylinders are numbered from front to rear, No. 1 cylinder being at the front.

TIGHTENING TORQUES

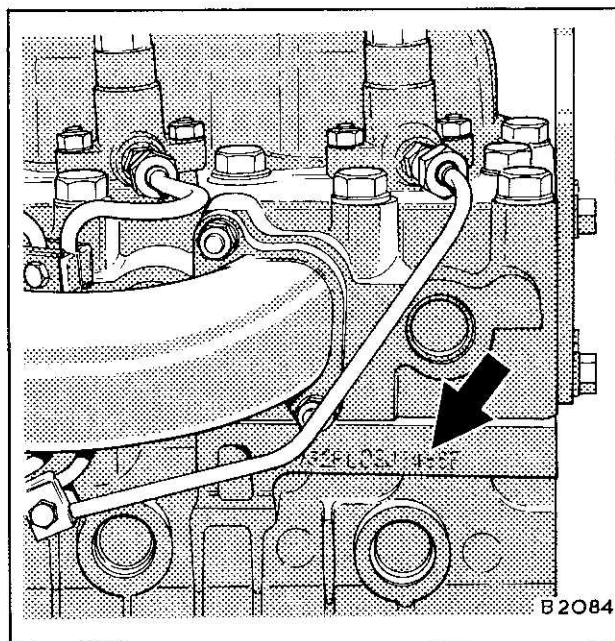
The following figures will apply with the components lightly oiled before assembly.

SECURING ITEMS	lbf ft	Nm
Cylinder Head Setscrews	85	115
Big End Nuts	60	81
Main Bearing Cap Setscrews	85	115
Fuel Injection Pump Drive Gear Nut	51	69
Camshaft Gear Setscrew	51	69
Camshaft Thrust Plate	17	23
Idler Gear Hub Nuts	23	31
Crankshaft Pulley Retaining Setscrew	300	407
Flywheel Setscrews	100	136
Injector Securing Nuts	17	23

ENGINE NUMBER

The engine number is stamped on a machined pad on the left hand side of the engine.

This number should be quoted when requesting information or ordering parts, together with the chassis number into which the engine is fitted.



MANUFACTURING DATA

CYLINDER BLOCK

Total height of cylinder block	283,90/284,00 mm (11.177/11.181 in)
Depth of recess for cylinder liner	3,81/3,86 mm (0.150/0.152 in)
Diameter of recess for cylinder liner	101,35/101,47 mm (3.990/3.995 in)
Parent bore diameter for cylinder liner	96,84/96,86 mm (3.8126/3.8136 in)
Main bearing parent bore diameter	74,07/74,09 mm (2.916/2.917 in)
Camshaft bearing bore diameter — No 1	52,00/52,03 mm (2.0473/2.0485 in)
Camshaft bearing bore diameter — No 2	51,75/51,78 mm (2.0374/2.0386 in)
Camshaft bearing bore diameter — No 3	51,50/51,53 mm (2.0276/2.0288 in)
Camshaft bearing bore diameter — No 4	51,25/51,28 mm (2.0178/2.0189 in)
Bore diameter for tappet	14,29/14,32 mm (0.5625/0.5637 in)

CYLINDER LINERS

Type	Dry, Interference fit
Outside diameter of production liner	96,89/96,91 mm (3.8146/3.8156 in)
Interference fit of production liner in cylinder block parent bore	0,03/0,08 mm (0.001/0.003 in)
Flange thickness	3,76/3,81 mm (0.148/0.150 in)
Outside diameter of flange	100,90/101,00 mm (3.9724/3.9764 in)
Depth of liner flange below top face of cylinder block	0,00/0,10 mm (0.000/0.004 in)
Height of liner above top face of cylinder block ...	0,66/0,79 mm (0.026/0.031 in)
Inside diameter of finished production liner in cylinder block	92,03/92,05 mm (3.6231/3.6241 in)
Overall length of liner	191,02/191,43 mm (7.5205/7.5366 in)
Boring size for service	0,25/0,51/0,76 mm (0.010/0.020/0.030 in) oversize

PISTONS

Type	Flat topped
Piston height in relation to cylinder block top face	0,00/0,10 mm (0.000/0.004 in)
Bore diameter for piston pin	31,74/31,75 mm (1.2495/1.250 in)
Compression ring groove width top, 2nd and 3rd ..	2,43/2,46 mm (0.0958/0,0968 in)
Scraper ring groove width 4th and 5th	4,81/4,86 mm (0.1895/0.1905 in)
Oversize pistons available	0,76 mm (0.030 in)

PISTON RINGS

Top compression	Plain inlaid chrome
2nd and 3rd Compression	Internally stepped
4th Scraper	Chrome Microland
5th Scraper	Maxigroove
Compression ring width top, 2nd and 3rd	2,36/2,38 mm (0.0930/0.0938 in)
Scraper ring width, 4th and 5th	4,74/4,76 mm (0.1867/0.1875 in)
Ring clearance in groove — all rings	0,05/0,10 mm (0.002/0.0038 in)
Ring gaps — top and 2nd	0,40/0,71 mm (0.016/0.028 in)
3rd and 5th	0,28/0,56 mm (0.011/0.022 in)
4th	0,30/0,61 mm (0.012/0.024 in)

Oversize rings are available

PISTON PINS

Type	Fully floating
Outside diameter	31,74/31,75 mm (1.2498/1.2500 in)
Transition fit in piston boss	-0,012/ +0,006 mm (-0.0005/ +0.0002 in)
Clearance fit in small end bush	0,013/0,043 mm (0.0005/0.0017 in)

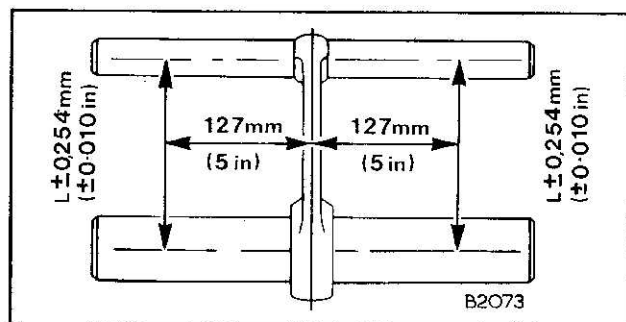
SMALL END BUSHES

Type	Steel backed, bronze lined
Outside diameter	35,01/35,05 mm (1.3785/1.3800 in)
Length	26,6/26,8 mm (1.047/1.055 in)
Interference fit in connecting rod	0,06/0,13 mm (0.0023/0.0052 in)
Inside diameter after reaming	31,76/31,79 mm (1.2505/1.2515 in)

CONNECTING RODS

Type	'H' section
Cap location to connecting rod	Located by close fitting bolts
Big end parent bore diameter	60,83/60,85 mm (2.3950/2.3955 in)
Small end parent bore diameter	34,92/34,96 mm (1.3748/1.3762 in)
Big end width	34,57/34,62 mm (1.361/1.363 in)
Big end side clearance on crankpin	0,24/0,33 mm (0.009/0.013 in)

CONNECTING ROD ALIGNMENT



Large and small end bores must be square and parallel to each other within the limits of $\pm 0,03$ mm (0.010 in) measured 127 mm (5 in) each side of the axis of the rod on test mandrel as shown.

With the small end bush fitted, the limit of $\pm 0,03$ mm (0.010 in) is reduced to $\pm 0,06$ mm (0.0025 in).

CONNECTING ROD BEARINGS

Type	Pre-finished, copper lead lined
Shell thickness	1,829/1,836 mm (0.072/0.0723 in)
Inside diameter	57,16/57,19 mm (2.250/2.2514 in)
Bearing running clearance	0,04/0,08 mm (0.0014/0.003 in)

CRANKSHAFT

Main journal diameter	69,81/69,83 mm (2.7486/2.7491 in)
Main journal width — No 1	35,4/35,6 mm (1.394/1.402 in)
Main journal width — Nos 2 and 3	36,4/36,6 mm (1.433/1.440 in)
Main journal width — No 4	36,49/36,54 mm (1.437/1.439 in)
Main journal width — Nos 5, 6 and 7	36,4/36,6 mm (1.433/1.440 in)
Fillet radii — main journals	3,7/4,0 mm (0.146/0.157 in)
Crankpin diameter	57,11/57,13 mm (2.2485/2.2491 in)
Crankpin width	34,86/34,90 mm (1.372/1.374 in)
Fillet radii — crankpins	3,2/3,6 mm (0.126/0.142 in)
Surface finish — all pins and journals	0,2 – 0,4 microns (8 – 16 micro inches)
Crankshaft end float	0,14/0,39 mm (0.006/0.015 in)
Regrind undersizes — main journals and pins	0,25/0,51/0,76 mm (0.010/0.020/0.030 in)
Maximum run-out alignment	0,05 mm (0,002 in)

Fillet radii and surface finish must be maintained during crankshaft regrinding.

When regrinding, only very light cuts should be used, especially around the fillet radii and adequate cooling should be ensured. After regrinding, the crankshaft should be crack detected and de-magnetised and the oil holes chamfered.

CRANKSHAFT THRUST WASHERS

Type	Steel backed, aluminium tin faced
Position in engine	Cylinder block centre main bearing housing and cap
Thrust washer thickness — standard	2,275/2,325 mm (0.0896/0.0915 in)
Thrust washer thickness — oversize	2,454/2,503 mm (0.0966/0.0985 in)

MAIN BEARINGS

Type	Pre-finished, aluminium tin lined
Shell width	28,5/28,7 mm (1.122/1.130 in)
Shell thickness	2,083/2,089 mm (0.0820/0.0822 in)
Inside diameter	69,89/69,93 mm (2.752/2.753 in)
Main bearing running clearance	0,06/0,11 mm (0.0025/0.0045 in)

CAMSHAFT

No 1 journal diameter	51,91/51,94 mm (2.0437/2.0449 in)
No 2 journal diameter	51,66/51,69 mm (2.0339/2.0351 in)
No 3 journal diameter	51,41/51,44 mm (2.0241/2.0252 in)
No 4 journal diameter	51,16/51,19 mm (2.0142/2.0154 in)
Running clearance — all journals	0,06/0,12 mm (0.0024/0.0047 in)
Cam height	42,59 mm (1.6767 in)
Camshaft end float	0,02/0,18 mm (0.001/0.007 in)
Oilways for rocker shaft lubrication	No 1 journal

CYLINDER HEAD

Cylinder head depth	82,5/82,6 mm (3.248/3.252 in)
Cylinder head skimming allowance	NIL
Leak test pressure	2,1 kgf/cm ² (30 lbf/in ²)
Valve seat angle	Inlet 45° – Exhaust 30°
Valve guide parent bore diameter	12,70/12,73 mm (0.500/0.501 in)
Combustion chamber insert bore diameter	34,93/34,97 mm (1.375/1.377 in)
Combustion chamber insert bore depth	10,79/10,88 mm (0.425/0.428 in)

VALVE GUIDES

Inside diameter	8,00/8,02 mm (0.3148/0.3158 in)
Outside diameter	12,73/12,74 mm (1.5013/0.5017 in)
Interference fit of guide in cylinder head	0,01/0,04 mm (0.0003/0.0017 in)
Overall length of guide	54 mm (2.126 in)
Guide protrusion above spring seating face	16,5 mm (0.650 in)

INLET VALVES

Valve stem diameter	7,93/7,95 mm (0.312/0.313 in)
Clearance fit of valve in guide	0,05/0,10 mm (0.0018/0.0038 in)
Valve head diameter	40,5 mm (1.5945 in)
Valve face angle	45°
Valve head depth below cylinder head face	0,75/0,95 mm (0.0295/0.0375 in)
Overall length	114,38/114,83 mm (4.503/4.521 in)
Sealing arrangement	Oil deflectors

EXHAUST VALVES

Valve stem diameter	7,91/7,94 mm (0.3115/0.3125 in)
Clearance fit of valve in guide	0,06/0,11 mm (0.0023/0.0043 in)
Valve head diameter	35,5 mm (1.3977 in)
Valve face angle	30°
Valve head depth below cylinder head face	0,69/1,20 mm (0.027/0.047 in)
Overall length	114,30/114,90 mm (4.500/4.524 in)
Sealing arrangement	NONE

COMBUSTION CHAMBER INSERTS

Outside diameter of insert	34,86/34,90 mm (1.372/1.374 in)
Clearance fit of insert in bore	0,03/0,13 mm (0.001/0.005 in)
Combustion chamber insert thickness	10,80/10,82 mm (0.425/0.426 in)
Height of insert in relation to cylinder head face ..	0,03 mm (0.001 in) above to 0,08 mm (0.003 in) below
Method of location	By cylinder block face and expansion washer

INNER VALVE SPRINGS

Fitted length	37,8 mm (1.488 in)
Load at fitted length	12,1/13,3 kg (26.6/29.4 lbf)
Free length	44,1 mm (1.736 in)
No. of active coils	5.5
Coiled	Right hand

OUTER VALVE SPRINGS

Fitted length	40,3 mm (1.587 in)
Load at fitted length	17,2/19,1 kg (38/42 lbf)
Free length	45,9 mm (1.807 in)
No. of active coils	3.5
Coiled	Left hand

TAPPETS

Overall length	57,0 mm (2.244 in)
Tappet shank diameter	14,22/14,25 mm (0.560/0.561 in)
Running clearance in tappet block	0,04/0,10 mm (0.0015/0.0037 in)

ROCKER SHAFT

Outside diameter	15,84/15,86 mm (0.6234/0.6244 in)
Clearance of rocker shaft to bush	0,02/0,06 mm (0.0008/0.0024 in)

ROCKER LEVER AND BUSH

Bore diameter for bush	18,26/18,28 mm (0.7188/0.7196 in)
Outside diameter of bush	18,29/18,31 mm (0.7200/0.7208 in)
Interference fit of bush in lever	0,01/0,05 mm (0.0004/0.002 in)
Inside diameter of bush	15,88/15,90 mm (0.6251/0.6258 in)

PUSH RODS

Overall length	216,3/217,05 mm (8.516/8.545 in)
Shank diameter	6,28/6,35 mm (0.247/0.250 in)

CAMSHAFT GEAR

No. of teeth	60
Diameter of bore	28,58/28,60 mm (1.1250/1.1260 in)
Outside diameter of camshaft flange	28,58/28,59 mm (1.1251/1.1257 in)
Transition fit of gear to flange	-0,02/ +0,02 mm (-0.0008/ +0.0008 in)

CRANKSHAFT GEAR

No. of teeth	30
Diameter of bore	38,84/38,86 mm (1.5291/1.530 in)
Outside diameter of crankshaft	38,88/38,90 mm (1.5307/1.5313 in)
Interference fit of gear to crankshaft	0,02/0,06 mm (0.0008/0.0024 in)

IDLER GEAR AND HUB

No. of teeth	57
Parent bore diameter for bush	48,00/48,03 mm (1.8898/1.8908 in)
Outside diameter of bush	48,07/48,10 mm (1.8926/1.8935 in)
Interference fit of bush in gear	0,05/0,10 mm (0.0018/0.0037 in)
Inside diameter of bush finished in position	44,01/44,03 mm (1.7327/1.7334 in)
Outside diameter of hub	43,95/43,98 mm (1.7303/1.7313 in)
Clearance fit of bush on hub	0,03/0,08 mm (0.0013/0.0033 in)
Width of gear assembly	28,75/28,80 mm (1.1319/1.1339 in)
Bearing length of hub	28,95/29,05 mm (1.1398/1.1437 in)
Idler gear end float	0,15/0,30 mm (0.006/0.012 in)

FUEL PUMP DRIVE GEAR

No. of teeth	60
Fit of gear	Tapered

TIMING GEAR BACKLASH

All gears	0,08 mm (0.003 in) minimum
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LUBRICATING OIL PUMP IDLER GEAR AND HUB

No. of teeth	23
Parent bore diameter for bush	25,00/25,02 mm (0.9843/0.9851 in)
Outside diameter of bush	25,04/25,06 mm (0.9856/0.9865 in)
Interference fit of bush in gear	0,01/0,06 mm (0.0004/0.0024 in)
Inside diameter of bush	22,01/22,03 mm (0.8664/0.8672 in)
Outside diameter of hub	21,96/21,98 mm (0.8645/0.8654 in)
Running clearance of gear on hub	0,03/0,07 mm (0.001/0.0027 in)

LUBRICATING OIL PUMP DRIVE GEAR

No. of teeth	37
Bore diameter for drive shaft	14,50/14,52 mm (0.5709/0.5716 in)
Drive shaft diameter	14,49/14,50 mm (0.5704/0.5709 in)
Clearance fit of gear on shaft	0,00/0,03 mm (0.000/0.0012 in)

LUBRICATING OIL PUMP

Type	Rotor
Drive	Through idler gear from crankshaft gear
Clearances:	
Outer rotor to body	0,14/0,25 mm (0.0055/0.010 in)
Inner rotor to outer rotor	0,04/0,20 mm (0.0015/0.008 in)
Rotor end float	0,04/0,10 mm (0.0015/0.004 in)

OIL PRESSURE RELIEF VALVE

Pressure setting	3,8 kgf/cm ² (54 lbf/in ²)
Outside diameter of plunger	15,88/15,89 mm (0.6253/0.6257 in)
Load at 35,7 mm (1.406 in)	12,20/13,90 kg (26.9/30.6 lb)
Load at 48,7 mm (1.917 in)	5,82/7,12 kg (12.8/15.7 lb)

LUBRICATING OIL FILTER

Type	Full flow
Element type	Renewable paper element in bowl
Element by-pass setting	0,8/1,2 kgf/cm ² (11.0/17.0 lbf/in ²)

COOLING SYSTEM

Type	Water pump circulation
Engine water capacity	12,25 litres (21.6 Imp Pints)

THERMOSTAT

Type	Wax pellet
Opening temperature	80-84°C (176.5-183.5°F)
Fully open temperature	95°C (203°F)
Valve lift	10 mm (0.394 in)

WATER PUMP

Type	Centrifugal impeller
Outside diameter of shaft for pulley hub	20,00/20,01 mm (0.7872/0.7877 in)
Diameter of pulley hub bore	19,95/19,97 mm (0.785/0.786 in)
Interference fit of pulley on shaft	0,03/0,07 mm (0.0012/0.0027 in)
Diameter of impeller bore	11,99/12,01 mm (0.472/0.473 in)
Outside diameter of shaft for impeller	12,03/12,04 mm (0.4737/0.4742 in)
Interference fit of impeller on shaft	0,02/0,06 mm (0.0008/0.0024 in)

APPROVED FUEL OIL SPECIFICATIONS

United Kingdom	BS.2869 : Class A1 and A2
United States	A.S.T.M/D.975-66T-Nos. 1-D or 2-D
	VV-F-800a : Grades DF-A, DF-1 or DF-2
Germany	DIN - 51601 (1967)
France	(J.O. 14/9/57) Gas Oil or Fuel Domestique
Italy	CUNA - Gas Oil NC-630-01 (1957)
India	IS : 1460/1968 - Grade Special or Grade A
Sweden	SIS. 15 54 32 (1969)
Switzerland	Federal Military Specification
	9140-335-1404 (1965)

Fuel oils available in territories other than those listed above which are to an equivalent specification may be used.

FUEL LIFT PUMP

Type	Mechanical. Driven by eccentric on camshaft
Static pressure (No delivery)	0,35/0,56 kgf/cm ² (5.0/8.0 lbf/in ²)

FUEL FILTER

Type	Renewable canister with integral element
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FUEL INJECTION PUMP

Make	Diesel Kiki
Type	Distributor type — EP/VM
Pump rotation	Clockwise (from front of engine)
Timing position	6° B.T.D.C. at 1 mm lift on pump setting gauge

ATOMISERS

Make	Diesel Kiki
Nozzle type	Pintle — DN4S1
Diameter of spray hole	1,00 mm (0.039 in)
Needle lift	0,07 mm (0.0276 in)
Setting pressure (new atomisers or reconditioned atomisers with new springs)	150 atm (155 kgf/cm ²) 2200 lbf/in ²
Working pressure	135 atm (139 kgf/cm ²) 1980 lbf/in ²

MAXIMUM WEAR LIMITS**CYLINDER LINERS**

Cylinder bore wear (Rebore or fit new liners)	0,15 mm (0.006 in)
Maximum rebore size	0,76 mm (0.030 in)

PISTONS AND RINGS

Ring lift in piston groove	0,20 mm (0.008 in)
Ring gap in cylinder bore	1,50 mm (0.060 in)

VALVES

Stem diameter (inlet)	7,88 mm (0.3102 in)
(exhaust)	7,87 mm (0.3097 in)
Stem to guide clearance	0,13 mm (0.005 in)
Valve head depth below cylinder head face	1,25 mm (0.049 in)

VALVE SPRINGS

Load at fitted length (inner)	10,8 kg (23.8 lb)
(outer)	15,3 kg (33.7 lb)
Out of squareness limit	3.0 mm per 100 mm (0.03 in per 1 in)

ROCKER LEVERS

Bush to shaft clearance 0.10 mm (0.004 in)

TAPPETS

Clearance in cylinder block bores 0.10 mm (0.004 in)

CAMSHAFT

Journal No 1	51,90 mm (2.0434 in)
Journal No 2	51,65 mm (2.0336 in)
Journal No 3	51,40 mm (2.0237 in)
Journal No 4	51,15 mm (2.0139 in)
Height all cams	42,49 mm (1.6728 in)
End float	0,30 mm (0.012 in)
Shaft run out	0,08 mm (0.0032 in)

CRANKSHAFT

Main bearing clearance	0,14 mm (0.0055 in)
Main journals	69,79 mm (2.7476 in)
Crankpins (big ends)	57,09 mm (2.2476 in)
Ovality	0,013 mm (0.0005 in)
End float	0,40 mm (0.016 in)
Shaft run out	0,05 mm (0.002 in)

CONNECTING RODS

Small end bush clearance on pin	0,06 mm (0.0024 in)
Big end bearing clearance on crankshaft	0,10 mm (0.004 in)

TIMING GEARS

Idler gear bush to hub clearance 0,15 mm (0.006 in)

LUBRICATING OIL PUMP

Outer rotor to body clearance	0,30 mm (0.012 in)
Inner rotor to outer rotor clearance	0,30 mm (0.012 in)
Rotor end float	0.15 mm (0.006 in)