

2. Engine

20. General

Compression ratio, fuel octane requirements, output, torque

Engine type/number*	Compression ratio	Research octane number		Output kW at r/s	Max. torque Nm at r/s
		leaded petrol permitted?	minimum octane nr. (RON)		
B16F 109 '91	10:1	No	95 -	69/95	132/45
B16F 109 '92	10:1	No	95 -	62/95	125/65
B16F 109 '93-	10:1	No	95 -	61/92	125/67
B16F 109 **** '95-	10:1	Yes	95 -	61/92	125/67
B18K 102	9.5:1	Yes	95 -	59/90	128/55
B18K(D) 102	9.5:1	No	95 -	57/90	127/55
B18KP 111	9.5:1	Yes	95 -	66/97	131/60
B18KP(D) 111	9.5:1	No	95 -	64/95	130/60
B18E 104	10.5:1	Yes	95 -	80/97	140/68
B18E(D) 104	10.5:1	No	95 -	78/97	139/67
B18E(S) 105	10.5:1	Yes	95 -	80/97	140/70
B18EP 115	10:1	Yes	95 -	78/92	145/65
B18FP 115	10:1	No	95 -	75/92	142/65
B18FP 230	10:1	No	95 -	75/92	142/65
B18FP(M) 230	10:1	Yes	95 -	78/92	145/65
B18U 103	9.7:1	No	95 -	66/100	140/42
B18U 113 (CVT)	9.7:1	No	95 -	66/100	140/42
B18U 200	9.7:1	No	95 -	66/100	140/42
B18U 203 (CVT)	9.7:1	No	95 -	66/100	140/42
B18U(M)	9.7:1	Yes	95 -***	66/100	140/42
B18F 106	9.5:1	No	95 -	70/90	140/68
B18FT 107**	8.1:1	No	95 -	88/90	175/70
B18FT(M) 107**	8.1:1	Yes	95 -	90/90	175/70
B18FT 107	8.1:1	No	95 -	88/92	175/55
B18FT(M) 107	8.1:1	Yes	95 -	88/92	175/55
B20F 116/118 '93	9.5:1	No	95 -	81/92	165/58
B20F(M) 208/209 '94-	9.8:1	Yes	95 -	80/87	165/58
B20F 208/209 '94-	9.8:1	No	95 - ***	80/87	165/58
D19T 204 '94	20.5:1	Min. cetane number:CN 48		66/71	175/38
D19T 206/266 '95-	20.5:1			66/72	180/37

* Alongside the oil dipstick on the cylinder block

** Up to chassis no. -013838 (440/460) and -540197 (480).

*** Australia, Taiwan, Thailand: RON 92

**** Version with lead-resistant Lambda sensor: leaded petrol (Egypt)

Other general data

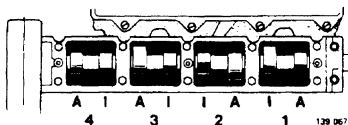
Engine type	B16	B18U	B18U	B18FP	B18	B20F	D19T
Engine number		103/113	200/203	230	Others		
Number of cylinders	4	4	4	4	4	4	4
Displacement cm ³	1596	1794	1783	1710	1721	1998	1870
Bore mm	78	82.7	82.7	81	81	82.7	80
Stroke mm	83.5	83.5	83	83	83.5	93	93
Firing order	1-3-4-2						
Compression pressure*	B18E	B18U, B20F	B18F	B18FT /FT(M)	B18,B16 Others		D19T
..... MPa.	1.2-1.4	1.2-1.3	1.4-1.5	1.1-1.3	1.1-1.3		1.6-2.4
..... Bar	12-14	12-13	14-15	11-13	11-13		16-24

* Compression measured with hot engine, fully opened throttle valve and with the engine turned over by the starter motor at 4.2-5.0 r/s (250-300 r/min); the maximum permitted relative pressure difference between the cylinders is 1 bar (0.1 MPa).

Valve train

Valve clearances (measured with engine cold)

I = inlet valve
A = exhaust valve



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B16, D19T, B20, B18 excl. FT engines	When checking	When adjusting
Inlet valves mm	0.15 - 0.25	0.20
Exhaust valves mm	0.35 - 0.45	0.40
B18FT engines		
Inlet valves mm	0.15 - 0.25	0.20
Exhaust valves mm	0.45 - 0.55	0.50
Tappet pad thickness D19T 206/266 mm	2.50 - 3.70 (increasing by increments of 0.05)	
Tappet pad thickness, other engines mm	3.25 - 4.30 (increasing by increments of 0.05) 4.30 - 4.50 (increasing by increments of 0.10)	

When changing tappet pads, the piston must not be at T.D.C. The crankshaft must be rotated an additional 45°. otherwise the valves may strike the piston when the tappets are depressed.

Cylinder head gasket - D19T

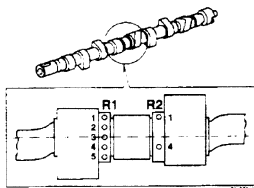
Marks (hole pattern)	0	00	000
Thickness of cylinder head gasket mm	1.5	1.4	1.6

Camshafts

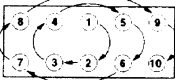
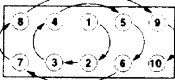
B16, B18, B20	B18K	B18KP B18F	B18E/ E(S) E(D)	B16F EP/FP B20F	B18FT FTM**	B18FT FTM	B18U	B20F ('94-)
Identification (hole pattern) . . .	1-2	1-2-3	1-3	1-4	1-3-5	2-3	1-2-3-4	2-5
Max. cam lift:								
inlet cam mm	8.23	9.42	10.49	10.45	9.49	9.3	9.8	10.22
exhaust cam mm	8.44	9.42	10.49	10.28	9.13	9.0	9.3	10.30
Values with a theoretical valve clearance of mm	0.4	0.5	0.5	0.7	0.52	0.28	0.7	0.7
inlet valve opens BTDC °	4	8	16	7/13*	5	14	3	5
inlet valve closes ABDC °	40	52	64	50/44*	55	58	49	43
Values with a theoretical valve clearance of mm	0.5	0.5	0.5	0.7	0.65	0.57	0.7	0.7
exhaust valve opens BBDC . . . °	40	52	64	51/57*	43	55	40	52
exhaust valve closes ATDC . . . °	4	8	16	6/0*	9	7	5	1
end float mm	0.048-0.133							
Radial clearance mm	0.050-0.150							

* B16F from chassis no. 358976- ** Up to chassis no. -013838 (440/460) and -540197 (480).

D19	D19T '94	D19T '95-
Identification (hole pattern) . . .	1-3-4	1-3-4
Max. cam lift:		
inlet cam mm	8.29	8.50
exhaust cam mm	9.65	10.34
Values with a theoretical valve clearance of mm	0.7	0.7
inlet valve opens BTDC °	1	0
inlet valve closes ABDC °	22	18
Values with a theoretical valve clearance of mm	0.7	0.7
exhaust valve opens BBDC . . . °	43	41
exhaust valve closes ATDC . . . °	2	0
end float mm	0.048-0.133	
Radial clearance mm	0.050-0.150	



Tightening the cylinder head bolts

Stage	Petrol engines 10 mm socket wrench 115-8462	Diesel engines Torx 55 951-2128	General Lightly oil the screw thread and the mating surface of the bolt heads. Insert the bolts and secure finger-tight. Tighten in the correct sequence. 
1	Tighten to 30 Nm		Tighten in the correct sequence. 
	Tighten to 70 Nm	Angle-tighten 50±4° further*	
	Wait at least three minutes for the head gasket to bed down properly Slacken all the bolts in the reverse sequence.		
2	Tighten to 20 Nm	Tighten to 25 Nm	* Tighten in a single uninterrupted movement with special tool 951-2050.
	Angle-tighten 123 ±2° further*	Angle-tighten 213 ±7° further*	
	In this operation the tightening torque must be between 90 and 160 Nm.	Let the engine warm up until the cooling fan starts to turn. Then let it cool down to workshop temperature. (about 2.5 hours)	
3	-	Angle-tighten 120 ±7° further*	

Tightening torques

The tightening torques specified here apply to oiled bolts and nuts; degreased (washed) components must be oiled before fitting.

	Nm
Main bearing journals/caps	65
Big-end bearing caps	45
Flywheel bolts (use new bolts)	55
Camshaft sprocket	50
Crankshaft pulley bolt	95
Oil sump bolts	13
Valve cover nuts	10
Timing chain tensioner nut	40
Idler pulley bolt	30
Tensioner bolts	15
Timing gear cover	6
Camshaft bearing cap, M6	9
Camshaft bearing cap, M8	20
Water pump housing and cover	12
Engine mounting pads (front)	40
Bracket, engine-gearbox	40
Cylinder block, plug (TDC check)	20
Studs in cylinder head	10
Bolts, countershaft sprocket	50
Intermediate shaft end plate, bolts	13
Crankshaft end plate, bolts	15
Water pump pulley	20
Cover, timing gear	8
Engine mounting pad to bracket	90
D19T Vibration damper between engine and body.	21
Bracket on gearbox	40
Bracket between engine and body	85