

ENGINE

4G61, 4G63, 4G64

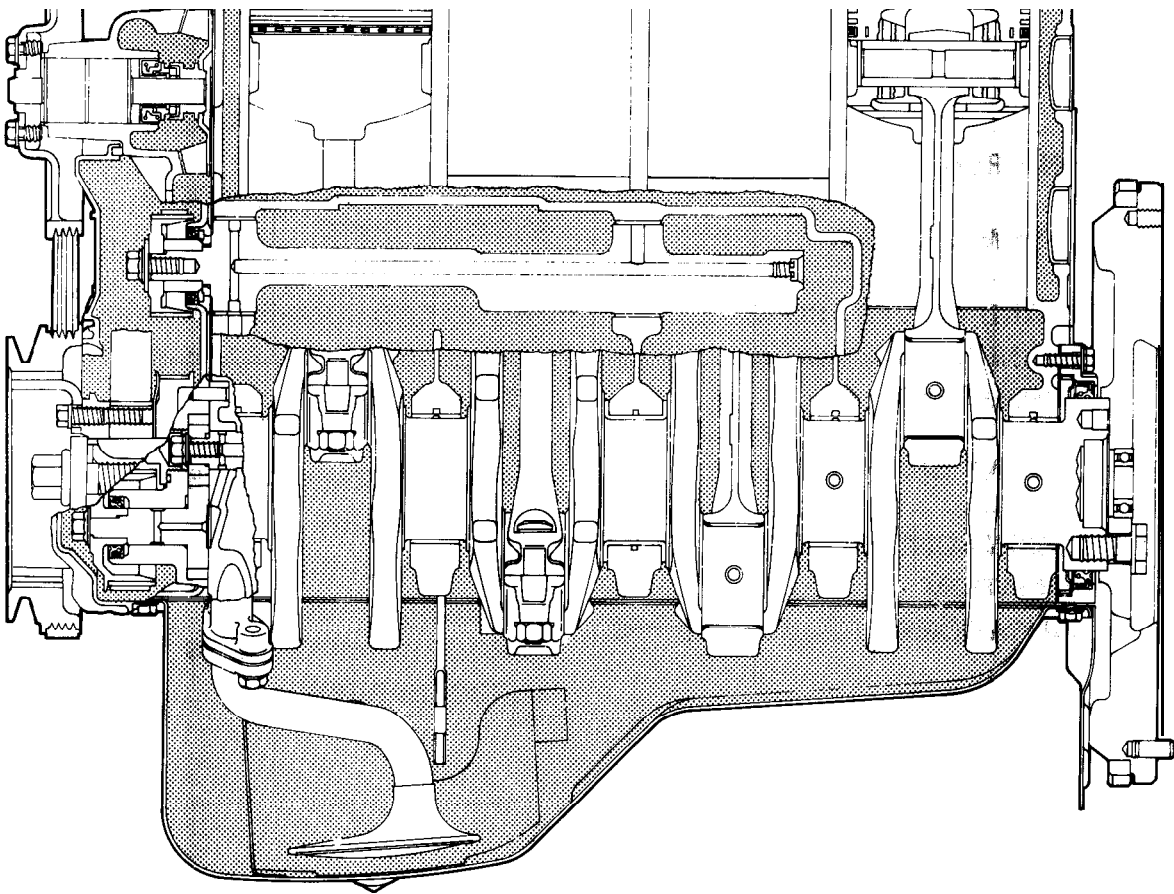
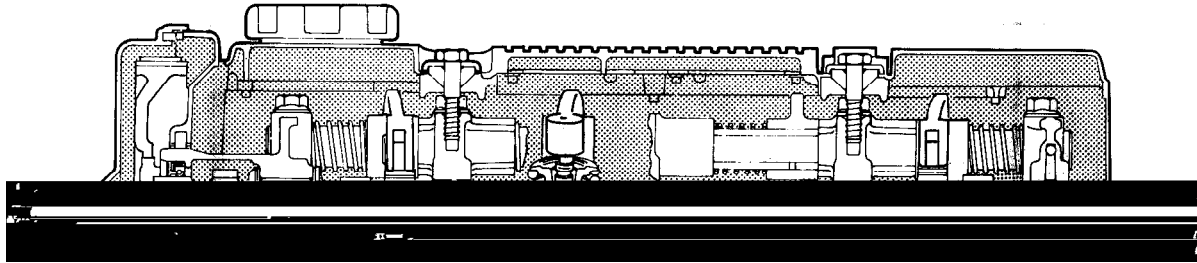
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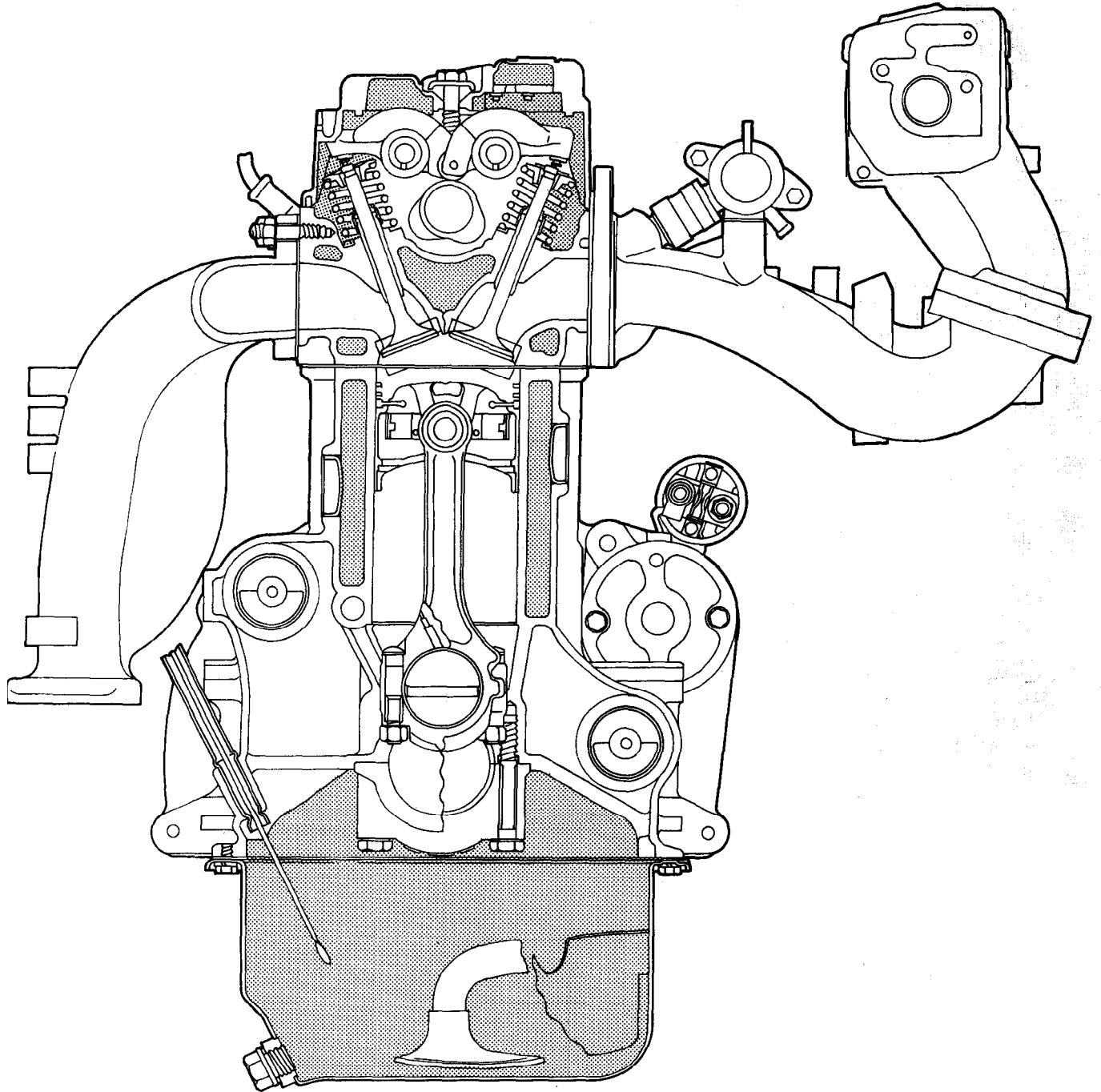
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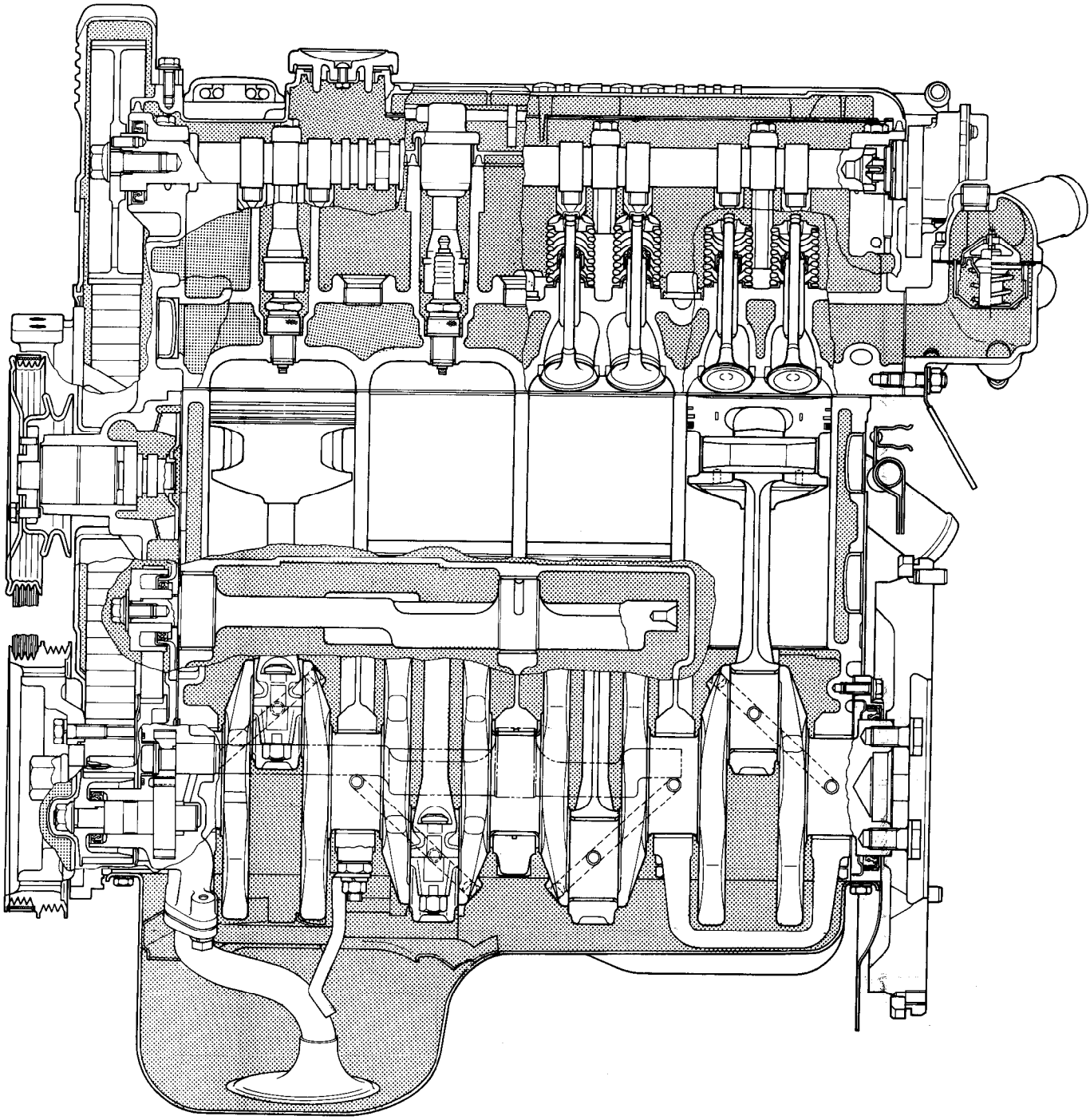
GENERAL INFORMATION

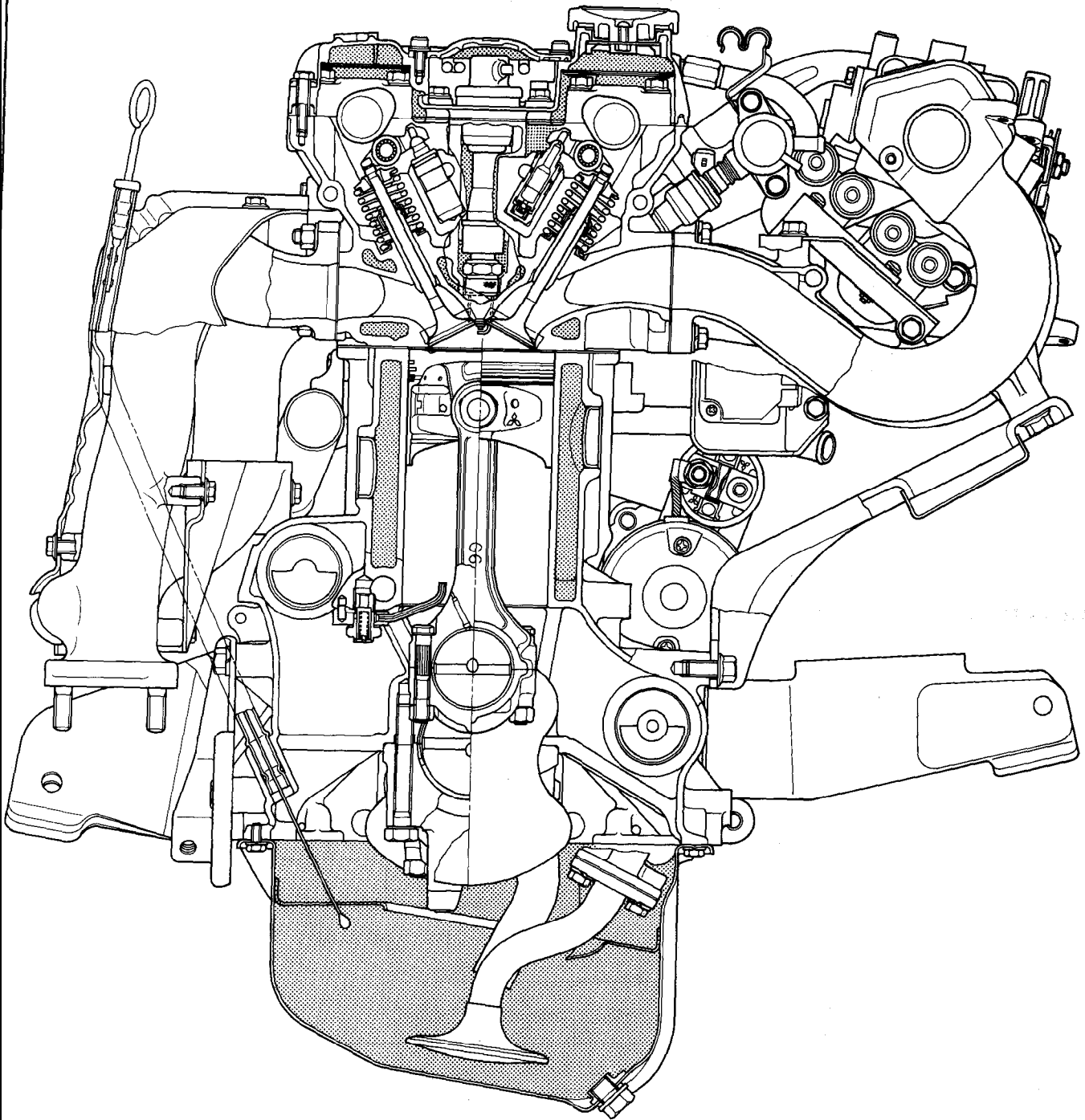
ENGINE SECTIONAL VIEW - SOHC





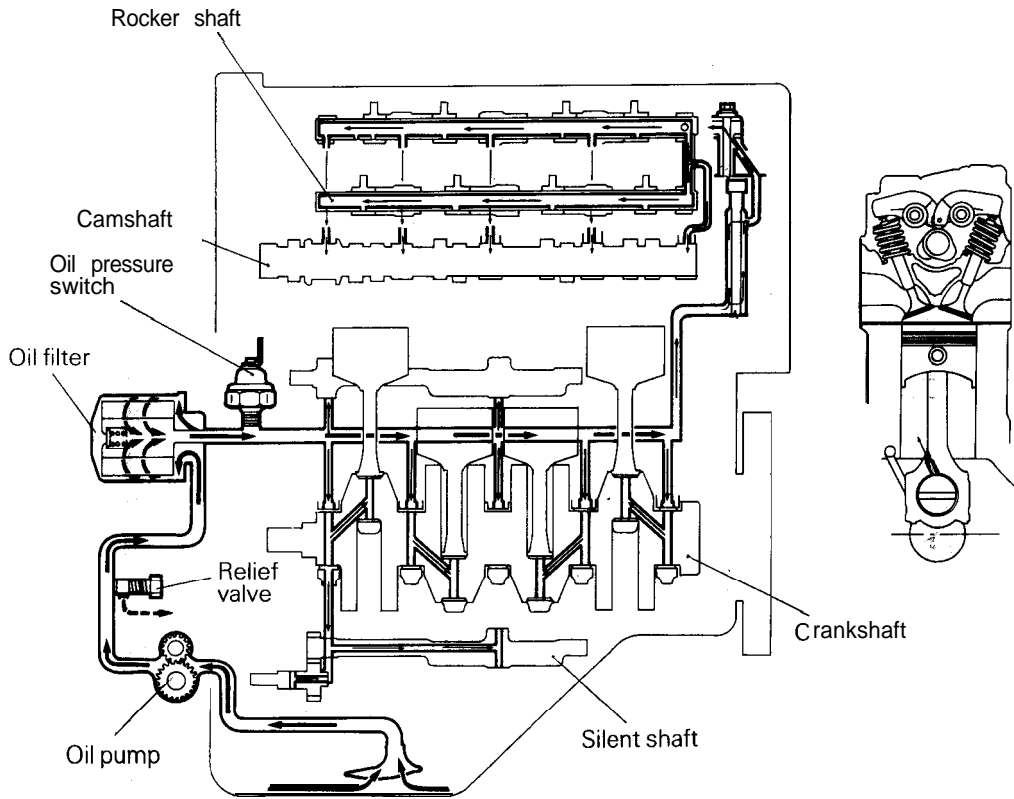
ENGINE SECTIONAL VIEW - DOHC





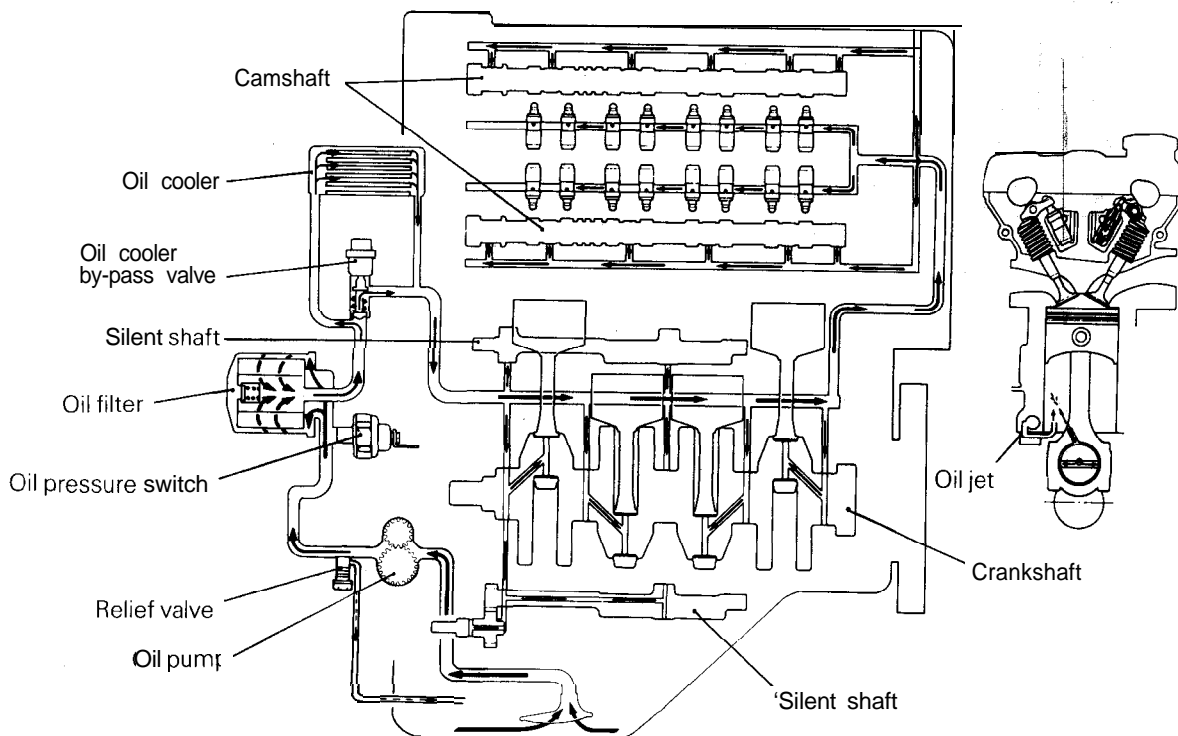
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ENGINE LUBRICATION SYSTEM - SOHC



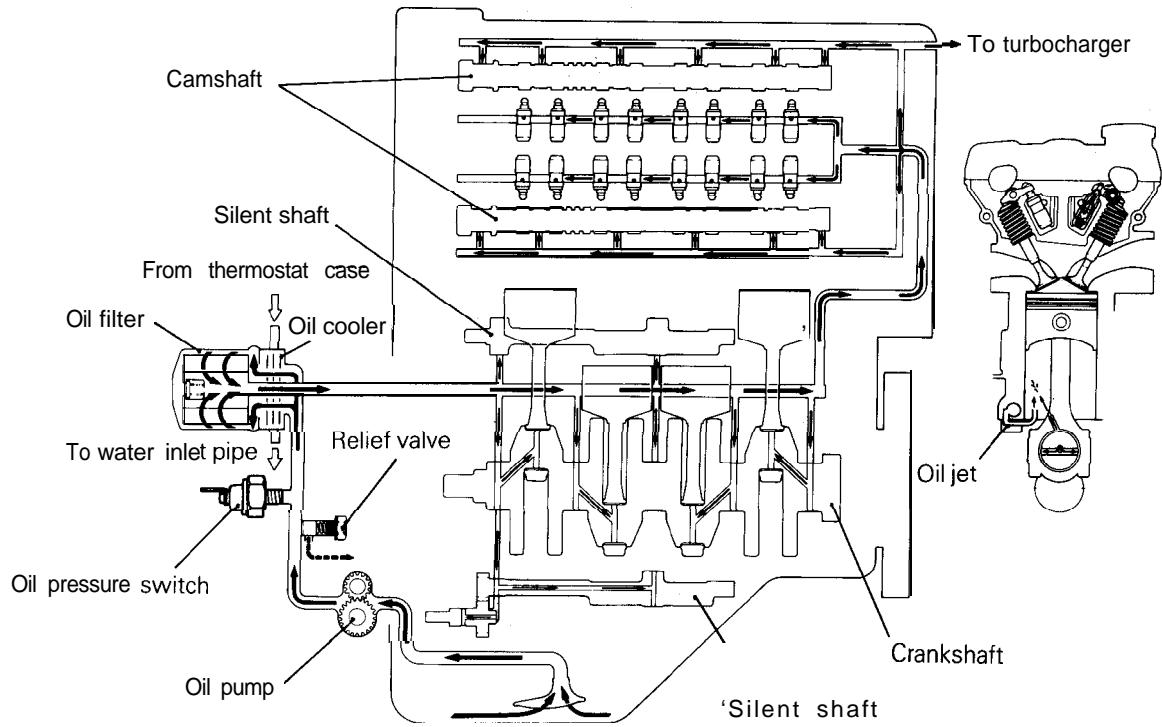
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ENGINE LUBRICATION SYSTEM - DOHC



6LU0055

ENGINE LUBRICATION SYSTEM - DOHC-TURBO



6LU0056

GENERAL SPECIFICATIONS

4G63 SOHC

Type	In-line OHV, SOHC	
Number of cylinders	4	
Combustion chamber	Compact type	
Total displacement cm ³ (cu. in.)	1,997 (121.9)	
Cylinder bore mm (in.)	85 (3.35)	
Piston stroke mm (in.)	88 (3.46)	
Compression ratio	8.5	
Valve timing		
(): camshaft identification mark	(AR)	
Intake valve		
Open BTDC	19"	
Close ABDC	57"	
Exhaust valve		
Open BBDC	57"	
Close ATDC	19"	
Lubrication system	Pressure feed, full-flow filtration	
Oil pump type	Involute gear type	
Cooling system	Water-cooled forced circulation	
Water pump type	Centrifugal impeller type	
EGR system	Single type	
Injector type and number	Electromagnetic 4	
Injector identification mark	N210H	
Throttle position sensor	Variable resistor type	
Closed throttle position switch	Contact type, incorporated in idle speed control motor	

4G64 SOHC

Type	In-line OHV, SOHC	
Number of cylinders	4	
Combustion chamber	Compact type	
Total displacement cm ³ (cu. in.)	2,350 (143.4)	
Cylinder bore mm (in.)	86.5 (3.35)	
Piston stroke mm (in.)	100 (3.46)	
Compression ratio	8.5	
Valve timing		
(): camshaft identification mark	(D)	(AR)
Intake valve		
Open BTDC	20"	19"
Close ABDC	64"	57"
Exhaust valve		
Open BBDC	64"	57"
Close ATDC	20"	19"
Lubrication system	Pressure feed, full-flow filtration	
Oil pump type	Involute gear type	
Cooling system	Water-cooled forced circulation	
Water pump type	Centrifugal impeller type	
EGR system	Single type	
Injector type and number	Electromagnetic 4	
Injector identification mark	N275H	
Throttle position sensor	Variable resistor type	
Closed throttle position switch	Contact switch type, incorporated in idle speed control motor-TRUCK Movable contact type, incorporated in throttle position sensor – EXPO	

4G61 DOHC

Type	In-line OHV, DOHC		
Number of cylinders	4		
Combustion chamber	Pentroof type		
Total displacement cm ³ (cu. in.)	1,595 (97.3)		
Cylinder bore mm (in.)	82.3 (3.24)		
Piston stroke mm (in.)	75 (2.95)		
Compression ratio	3.2		
Valve timing			
(): camshaft identification mark	(E)	(F)	
Intake valve			
Open BTDC	16°	26"	
Close ABDC	48°	38"	
Exhaust valve			
Open BBDC	43°	53"	
Close ATDC	17°	7"	
Lubrication system	Pressure feed, full-flow filtration		
Oil pump type	Involute gear type		
Cooling system	Water-cooled forced circulation		
Water pump type	Centrifugal impeller type		
EGR system	Single type		
Injector type and number	Electromagnetic 4		
Injector identification mark	B275H		
Throttle position sensor	Variable resistor type		
Closed throttle position switch	Contact type		

4G63 DOHC

Type	In-line OHV, DOHC			
Number of cylinders	4			
Combustion chamber	Pentroof type			
Total displacement cm ³ (cu. in.)	1,997 (121.9)			
Cylinder bore mm (in.)	85 (3.35)			
Piston stroke mm (in.)	88 (3.46)			
Compression ratio	7.8 or 9.0 (Specs. varies according to engine model)			
valve timing				
(): camshaft identification mark	(A)	(B,C)	(D,C)	(E,A)
Intake valve				
Open BTDC	26"	21°	21"	16"
Close ABDC	46"	43"	51"	48"
Exhaust valve				
Open BBDC	55"	57"	57"	55"
Close ATDC	3"	15"	15"	9"
Lubrication system	Pressure feed, full-flow filtration			
Oil pump type	Involute gear type			
Cooling system	Water-cooled forced circulation			
Water pump type	Centrifugal impeller type			
EGR system	Single type			
Injector type and number	Electromagnetic 4			
Injector identification mark				
Non-turbo	V24OH			
Turbo for GALANT/ECLIPSEM/T	3450L			
Turbo for ECLIPSE A/T	3390L			
Throttle position sensor	Variable resistor type			
Closed throttle position switch	Contact type			

SERVICE SPECIFICATIONS

mm (in.)

	Standard	Limit
Cylinder head – SOHC		
Flatness of gasket surface	0.05 (.0020)	0.2 (.008)
Grinding limit of gasket surface		*0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block.		
Overall height	89.9 – 90.1 (3.539 – 3.547)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05 (.002)	13.05 – 13.07 (.5138 – .5146)	
0.25 (.010)	13.25 – 13.27 (.5217 – .5224)	
0.50 (.020)	13.50 – 13.52 (.5315 – .5323)	
Oversize rework dimensions of intake valve seat ring hole		
0.30 (.012) 4G63	44.30 – 44.33 (1.7441 – 1.7453)	
4G64	47.30 -47.33 (1.8622 – 1.8634)	
0.60 (.024) 4G63	44.60 – 44.63 (1.7559 – 1.7571)	
4G64	47.60 -47.63 (1.8740 – 1.8752)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.30 (.012) 4G63	38.30 – 38.33 (1.5079 – 1.5091)	
4G64	40.30 – 40.33 (1.5866 – 1.5878)	
0.60 (.012) 4G63	38.60 – 38.63 (1.5197 – 1.5209)	
4G64	40.60 – 40.63 (1.5984 – 1.5996)	
Cylinder head – DOHC		
Flatness of gasket surface	0.05 (.0020)	0.2 (.008)
Grinding limit of gasket surface		*0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block.		
Overall height,	131.9-132.1 (5.193 – 5.201)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05 (.002)	12.05 – 12.07 (.4744 – .4752)	
0.25 (.010)	12.25 – 12.27 (.4823 – .4831)	
0.50 (.020)	12.50 – 12.52 (.4921 – .4929)	
Oversize rework dimensions of intake valve seat ring hole		
0.30 (.012)	35.30 – 35.33 (1.3898 – 1.3909)	
0.60 (.024)	35.60 – 35.63 (1.4016 – 1.4028)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.30 (.012)	33.30 – 33.33 (1.3110 – 1.3122)	
0.60 (.024)	33.60 – 33.63 (1.3228 – 1.3240)	

mm (in.)

	Standard	Limit
Camshaft – SOHC Identification mark: D Cam height Intake Exhaust Identification mark: AR Cam height Intake Exhaust NOTE: The camshaft identification mark is stamped on the rear end of the camshaft. Fuel pump driving cam diameter Journal diameter Oil clearance	 42.40 (1.6693) 42.40 (1.6693) 44.53 (1.7531) 44.53 (1.7531) 38 (1.50) 33.94 – 33.95 (1.3362 – 1.3366) 0.05 – 0.09 (.0020 – .0035)	 41.90 (1.6496) 41.90 (1.6496) 44.03 (1.7335) 44.03 (1.7335)
Camshaft – DOHC Intake Identification mark: A,D Cam height Identification mark: B,C,E,F Cam height Exhaust Identification mark: A Cam height Identification mark: C Cam height Identification mark E,F Cam height NOTE: The camshaft identification mark is stamped on the rear end of the camshaft. Journal diameter Oil clearance	 35.49 (1.3972) 35.20 (1.3858) 35.20 (1.3858) 35.49 (1.3972) 35.91 (1.3744) 25.95 – 25.97 (1.0217 – 1.0224) 0.05 – 0.09 (.0020 – .0035)	 34.99 (1.3776) 34.70 (1.3661) 34.70 (1.3661) 34.99 (1.3776) 34.41 (1.3547)
Locker arm – SOHC I.D. Rocker arm-to-shaft clearance	18.91 – 18.93 (.7445 – .7453) 0.01 – 0.04 (.0004 – .0016)	 0.1 (.004)
lash adjuster break down test Remarks: Diesel fuel at 15 – 20°C (59 – 68°F)	4 – 20 seconds/l mm (.04 in.)	
Locker shaft – SOHC I.D. Overall length Intake Exhaust	18.89 – 18.90 (.7437 – .7441) 385.5 (15.177) 372.5 (14.665)	

mm (in.)

			Standard	Limit
Valve - SOHC				
Overall length	Intake	4G63	109.8 (4.321)	
		4G64	106.6 (4.197)	
	Exhaust	4G63	108.7 (4.280)	
		4G64	105.2 (4.142)	
Stem diameter	Intake		7.96 – 7.98 (.3134–.3142)	
	Exhaust		7.93-7.95 (.3122–.3130)	
Face angle			45° – 45°30'	
Thickness of valve head (margin)	Intake		1.2 (.047)	0.7 (.028)
	Exhaust		2.0 (.079)	1.5 (.059)
Stem-to guide clearance	Intake		0.02 – 0.06 (.0008 – .0024)	0.10 (.004)
	Exhaust		0.05 – 0.09 (.0020 – .0035)	0.15 (.006)
Valve - DOHC				
Overall length	Intake		109.5 (4.311)	
	Exhaust		109.7 (4.319)	
Stem diameter	Intake		6.57 – 6.58 (.2587 – .2591)	
	Exhaust		6.53 – 6.55 (.2571–.2579)	
Face angle			45° – 45°30'	
Thickness of valve head (margin)	Intake		1.0 (.039)	0.7 (.028)
	Exhaust		1.5 (.059)	1.0 (.039)
Stem-to guide clearance	Intake		0.02 – 0.05 (.0008 – .0020)	0.10 (.004)
	Exhaust		0.05 – 0.09 (.0020 – .0035)	0.15 (.006)
Valve spring - SOHC				
Free height			49.8 (1.961)	48.8 (1.921)
Load/installed height N/mm (lbs./in.)			329/40.4 (73/1.591)	
Out-of-squareness			2" or less	Max. 4"
Valve spring - DOHC				
Free height			48.3 (1.902)	47.4 (1.866)
Load/installed height N/mm (lbs./in.)			300/40 (66/1.57)	
Out-of-squareness			1.5" or less	Max. 4"
Valve guide- SOHC				
Overall length	Intake		47 (1.85)	
	Exhaust		52 (2.05)	
I.D.			8.00 – 8.02 (.3150 – .3157)	
O.D.			13.06 – 13.07 (.5142 – .5146)	
Service size			0.05 (.002), 0.25 (.010), 0.50 (.020) over size	
Press-in temperature			Room temperature	

mm (in.)

	Standard	Limit
Valve guide – DOHC		
Overall length	Intake 45.5 (1.791) Exhaust 50.5 (1.988)	
I.D.	6.60 – 6.62 (.2598 – .2606)	
O.D.	12.06 – 12.07 (.4748 – .4752)	
Service size	0.05 (.002), 0.25 (.010), 0.50 (.020) over size	
Press-in temperature	Room temperature	
Valve seat		
Seat angle	43°30' – 44"	
Valve contact width	0.9 – 1.3 (.035 – .051)	
Sinkage		0.2 (.008)
Service size	0.3 (.012), 0.6 (.024) over size	
Silent shaft		
Journal diameter	Right (front) 41.96 – 41.98 (1.6520 – 1.6528) (rear) 40.95 – 40.97 (1.6122 – 1.6130) Left (front) 18.47 – 18.48 (.7272 – 0.7276) (rear) 40.95 – 40.97 (1.6122 – 1.6130)	
Oil clearance	Right (front) 0.03 – 0.06 (.0012 – .0024) (rear) 0.05 – 0.09 (.0020 – .0036) Left (front) 0.02 – 0.05 (.0008 – .0020) (rear) 0.05 – 0.09 (.0020 – .0036)	
Piston – SOHC		
O.D.	4G63 84.97 – 85.00 (3.3453 – 3.3465) 4G64 86.47 – 86.50 (3.404 – 3.4055)	
Piston to cylinder clearance	0.02 – 0.04 (.0008 – .0016)	
Service size	0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
Piston – DOHC		
O.D.	4G61 82.27 – 82.30 (3.2390 – 3.2401) 4G63 – Non-turbo 84.97 – 85.00 (3.3453 – 3.3465) 4G63 -Turbo 84.96 – 84.99 (3.3449 – 3.3461)	
Piston to cylinder clearance	Non-turbo 0.02 – 0.04 (.0008 – .0016) Turbo 0.03 – 0.05 (.0012 – .0020)	
Service size	0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	

mm (in.)

		Standard	Limit
Piston ring – SOHC			
End gap	No. 1 ring	0.25 – 0.40 (.0098 – .0157)	0.8 (.031)
	No. 2 ring		
	4G63	0.20 – 0.35 (.0079 – .0138)	0.8 (.031)
	4G64	0.20 – 0.40 (.0079 – .0157)	0.8 (.031)
	Oil ring	0.20 – 0.70 (.0079 – .0276)	1.0 (.039)
Ring-to-ring groove clearance	No. 1 ring	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
	No. 2 ring	0.02 – 0.06 (.0008 – .0024)	0.1 (.004)
Service size		0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
Piston ring – DOHC			
End gap	No. 1 ring	0.25 – 0.40 (.0098 – .0157)	0.8 (.031)
	No. 2 ring		
	4G61	0.35 – 0.50 (.0138 – .0197)	0.8 (.031)
	4G63	0.45 – 0.60 (.0177 – .0236)	0.8 (.031)
	Oil ring	0.20 – 0.70 (.0079 – .0276)	1.0 (.039)
Ring-to-ring groove clearance	No. 1 ring	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
	No. 2 ring	0.03 – 0.07 (.0012 – .0028)	0.1 (.004)
Service size		0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
Piston pin			
O.D.		21.00 – 21.01 (.8268 – .8272)	
Press-in load N(lbs.)		7,500 – 17,500 (1,653 – 3,858)	
press-in temperature		Room temperature	
Connecting rod			
Big end center-to-small end center length		149.9 – 150.0 (5.902 – 5.906)	
Bend		0.05 (.002)	
Twist		0.1 (.004)	
Big end side clearance		0.10 – 0.25 (.0039 – .0098)	0.4 (.016)
Crankshaft			
End play		0.05 – 0.18 (.0020 – .0071)	0.25 (.0098)
Journal O.D.		56.98 – 57.00 (2.2433 – 2.2441)	
Pin O.D.		44.98 – 45.00 (1.7709 – 1.7717)	
Out-of-roundness and taper of journal and pin		Max. 0.01 (.0004)	
Eccentricity of journal		Max. 0.02 (.0008)	
Oil clearance of journal		0.02 – 0.05 (.0008 – .0020)	0.1 (.004)
Oil clearance of pin		0.02 – 0.05 (.0008 – .0020)	0.1 (.004)

* mm (in)

	Standard	Limit
Cylinder block		
Cylinder I.D.	4G61 4G63 4G64	82.30 – 82.33 (3.2402 – 3.2413) 85.00 – 85.03 (3.3465 – 3.3476) 86.50 – 86.53 (3.4055 – 3.4067)
Flatness of gasket surface		0.05 (.0020)
Grinding limit		0.1 (.004) *0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block.		
Overall height	4G61 4G63 4G64	274.9 – 275.1 (10.823 – 10.831) 283.9-284.1 (11.177-11.185) 289.9 – 290.1 (11.413 – 11.421)
Oil pump		
Side clearance		
Drive gear		0.08 – 0.14 (.0031–.0055)
Driven gear		0.06 – 0.12 (.0024 – .0047)
Drive belt		
Deflection		
V-ribbed type belt	New belt Used belt	7.5 – 9.0 (.30–.35) 8.0 (.32)
V type belt		7.0 – 10.0 (.28–.39)
Tension		
V-ribbed type belt	New belt N (lbs.) Used belt N (lbs.)	500 – 700 (110– 154) 400 (88)
Oil cooler by-pass valve		
Dimension (L)		34.5 (1.358) – normal temperature
By-pass hole closing temperature		40 (1.57) or more
37 – 103°C (207 – 217°F) or more]		
Injector		
Oil resistance		
Non -turbo Ω		13 – 16 at 20°C (68°F)
Turbo Ω		2 – 3 at 20°C (68°F)
Idle speed control motor		
Oil resistance Ω		5 – 35 at 20°C (68°F)
Idle air control motor		
Oil resistance Ω		28 – 33 at 20°C (68°F)
Idle speed control motor position sensor		
SOHC engine for GALANT/TRUCK		
Resistance kΩ		4 - 6

NOTE

O.D.: Outer Diameter

I.D.: Inner Diameter

U.S.: Undersize Diameter

TORQUE SPECIFICATIONS

	Nm	ft.lbs.
Generator and ignition system – SOHC		
Cooling fan bolt	11	8
Water pump pulley bolt – Engine without cooling fan	9	7
Water pump pulley bolt – Engine with cooling fan	11	8
Generator brace bolt	14	10
Generator mounting bolt	24	17
Generator pivot nut	23	17
Crankshaft pulley bolt	25	18
Spark plug	25	18
Distributor nut	11	8
Ignition coil bolt	14	10
Ignition power transistor nut	18	13
Generator and ignition system – DOHC		
Water pump pulley bolt	9	7
Generator brace bolt	14	10
Generator mounting bolt	24	17
Generator pivot nut	23	17
Crankshaft pulley bolt	25	18
Center cover bolt	3	2
Spark plug	25	18
Ignition coil bolt	24	17
Ignition power transistor bolt	11	8
Crankshaft position sensor nut	1	14
Timing belt – SOHC		
Tensioner bolt	49	35
Tensioner spacer	49	35
Oil pump sprocket nut	55	40
Crankshaft sprocket bolt	120	87
Tensioner “B” bolt	19	14
Silent shaft sprocket bolt, right	46	33
Engine supports bracket bolt, left	36	26
Camshaft sprocket bolt	90	65
Timing belt- DOHC		
Tensioner pulley bolt	49	35
Tensioner arm bolt	22	16
Idler pulley bolt	38	27
Oil pump sprocket nut	55	40
Crankshaft sprocket bolt	120	87
Tensioner “B” bolt	19	14
Silent shaft sprocket bolt, right	46	33
Rocker cover bolt	3	22
Camshaft sprocket bolt	90	65
Engine support bracket, left	36	26

	Nm	ft.lbs.
Fuel and emission parts		
EGR valve bolt	19	14
Throttle body stay nut – DOHC	19	14
Throttle body bolt – SOHC	12	9
Throttle body bolt – DOHC	19	14
Fuel pressure regulator bolt	9	7
Fuel rail bolt	12	9
Throttle body		
Throttle position sensor bolt	2	1.4
Idle speed control motor bolt	3.5	2.5
Idle air control motor bolt	3.5	2.5
Intake manifold		
Intake manifold bolt and nut	18	13
Intake manifold nut – DOHC	36	26
Intake manifold stay bolt – SOHC	22	16
Intake manifold stay bolt – DOHC	28	20
Intake manifold plenum bolt and nut	18	13
Intake manifold plenum stay bolt	18	13
Water outlet fitting bolt	19	14
Engine coolant temperature gauge unit	11	8
Engine coolant temperature sensor	30	22
Thermostat case nut	18	13
Exhaust manifold and water pump		
Oil level gauge guide bolt	60	43
Heat protector bolt		
GALANT AND EXPO	14	10
TRUCK	30	22
Exhaust manifold nut – SOHC	18	13
Exhaust manifold nut – DOHC	28	20
Engine hanger bolt – DOHC	14	10
Air outlet fitting bolt	19	14
Turbocharger bolt and nut	60	43
Exhaust fitting bolt	60	43
Water inlet pipe bolt	14	10
Water pump bolt	24	17
Water pipe “A” and “B” eye bolt	43	31
Water pipe “A” bolt	11	8
Water pipe “B” flare nut	45	33
Water pipe bolt		
M8	14	10
M6	11	8
Oil return pipe bolt	9	7
Oil pipe		
Cylinder head side	17	12
Turbocharger side	31	22

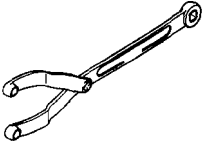
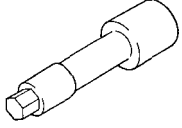
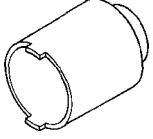
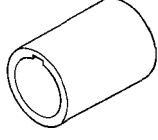
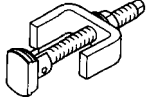
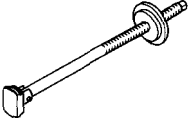
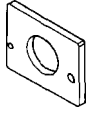
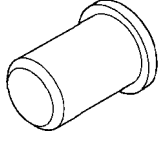
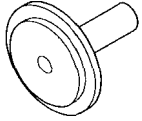
	Nm	ft.lbs.
Turbocharger Turbocharger waste gate actuator bolt	12	9
Rocker arms and camshaft- SOHC Rocker cover bolt Bearing cap bolt M8 x 25 M8 x 65	6 24 20	4 17 14
Cams shafts and rocker arms - DOHC Bearing cap bolt Oil delivery body bolt	20 11	14 8
Cylinder head and valves - SOHC Cylinder head bolt	95	69
Cylinder head and valves- DOHC Cylinder head bolt	110	80
Front case, silent shaft and oil pan Oil cooler bolt Drain plug Oil pan bolt Oil screen bolt and nut Oil pump sprocket bolt Plug Silent shaft, left flange bolt Oil filter bracket bolt Front case bolt M8 M10 Oil cooler by-pass valve Oil pressure switch Oil pressure gauge unit Relief plug Oil pump cover bolt Check valve	43 40 7 19 55 24 37 19 24 31 55 10 55 45 17 33	31 29 5 14 40 17 27 14 17 22 40 7 40 33 12 24
Piston and connecting rod Connecting rod cap nut	52	38
Crankshaft, flywheel and drive plate Flywheel bolt Drive plate bolt Oil seal case bolt Bearing cap bolt – SOHC Bearing cap bolt – DOHC	135 135 11 53 68	98 98 8 38 49

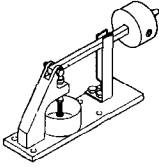

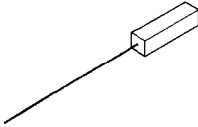
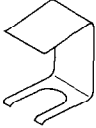
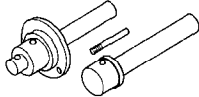

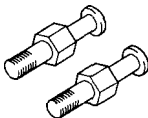
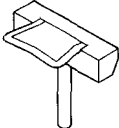
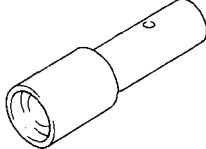
	Nm	ft.lbs.
Bracket		
Left and right engine support bracket bolt	45	33
Roll stopper bracket bolt, front	65	47
Roll stopper bracket bolt, rear	120	87
Engine support bracket bolt, front	60	43
Exhaust pipe support bracket bolt	36	26

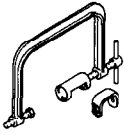
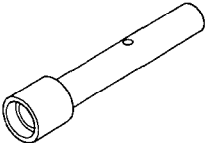
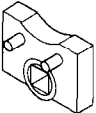
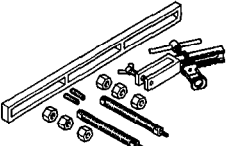
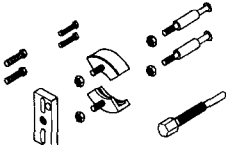
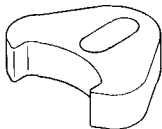
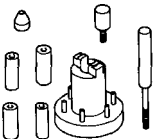
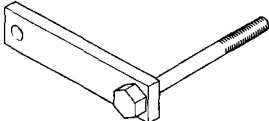
SEALANT

	Specified sealant	Quantity
Rocker cover	3M ATD Part No. 8660 or equivalent	As required
Semi-circular packing	3M ATD Part No. 8660 or equivalent	As required
Oil pan gasket	MITSUBISHI GENUINE PART MD970389 or equivalent	As required
Engine coolant temperature gauge unit	3M ATD Part No. 8660 or equivalent	As required
Engine coolant temperature sensor	3M Nut Locking Part No. 4171 or equivalent	As required
Oil pressure switch	3M ATD Part No. 8660 or equivalent	As required
Oil pressure gauge unit	3M ATD Part No. 8660 or equivalent	As required

SPECIAL TOOLS

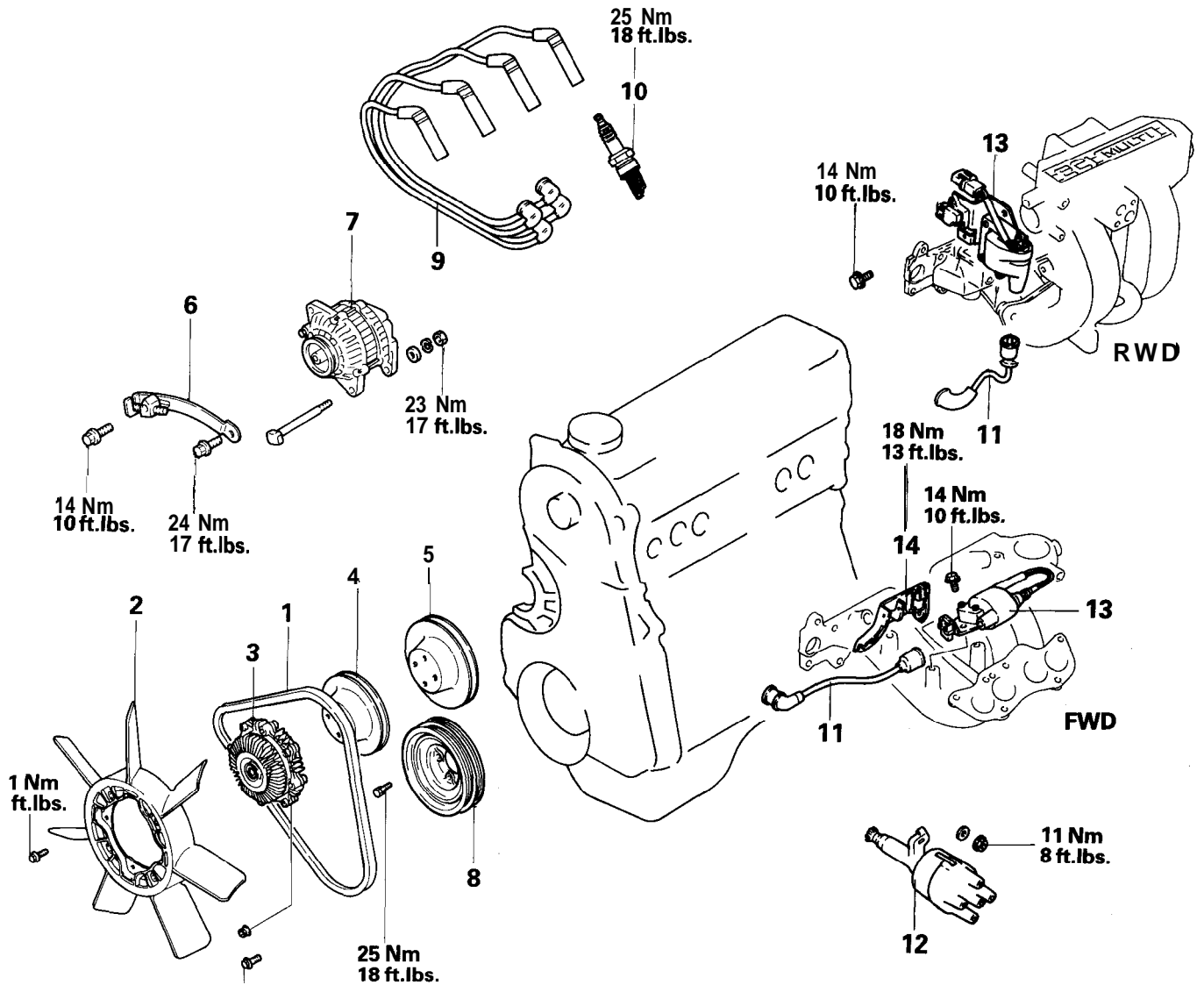
Tool	Number and tool name	Supersession	Application
	MB990767 End yoke holder Use with MD9987 19	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening or torquing bolt. For SOHC engine only
	MD998051 Cylinder head bolt wrench	MD998051-01	Loosening or torquing of cylinder head bolt
	MD998162 Plug wrench	MD998162-01	Removal and installation of front case cap plug
	MD998285 Crankshaft front oil seal guide	MD998285-01	Installation of crankshaft front oil seal
	MD998371 Silent shaft bearing puller	MD998371-01 Use with MIT304204	Removal of silent shaft rear
	MD998372 Silent shaft bearing puller	MD998372-01 Use with MIT304204	Removal of silent shaft rear
	MD998374 Bearing installer stopper	MD998374-0 1	Removal and installation of rear bearing
	MD998375 Crankshaft front oil seal installer	MD998375-01	Installation of crankshaft front oil seal
	MD998376 Crankshaft rear oil seal installer	MD998376-01 Use with MB990938-01	Installation of crankshaft rear oil seal

Tool	Number and tool name	Supersession	Application
	MD998440 Leak-down tester		Leak-down test of lash adjuster
	MD998441 Lash adjuster retainer		Bleeding of air inside the adjuster For SOHC engine only
	MD998442 Air bleed wire		Air bleeding of lash adjuster
	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting of the lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed For SOHC engine only
	MD998705 Silent shaft bearing installer	MD998373-01	Installation of silent shaft bearing
	MD998713 Camshaft oil seal installer	MD998713-01	
	MD998719 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt For SOHC engine only
	MD998727 Oil pan remover		Removal of oil pan
	MD998729 Valve stem seal installer	MD998729-01	Installation of valve stem seal For SOHC engine only

Tool	Number and tool name	Supersession	Application
	MD998735 Valve spring compressor	MD998735-01	Compression of valve spring
	MD998737 Valve stem seal installer	MD998737-01	Installation of valve stem seal For DOHC engine only
	MD998767 Tension pulley wrench	MD998752-01	Installation of auto tensioner For DOHC engine only
	MD998772 Valve spring compressor		Compression of valve spring
	MD998778 Crankshaft sprocket puller		Removal of crankshaft sprocket
	MD998779 Sprocket stopper		Holding silent shaft sprocket
	MD998780 Piston pin setting tool	MIT216941	Removal and installation of piston pin
	MD998781 Flywheel stopper		Holding flywheel

GENERATOR AND IGNITION SYSTEM – SOHC

REMOVAL AND INSTALLATION



9 Nm**
7 ft.lbs.
11 Nm***
8 ft.lbs.

Removal steps

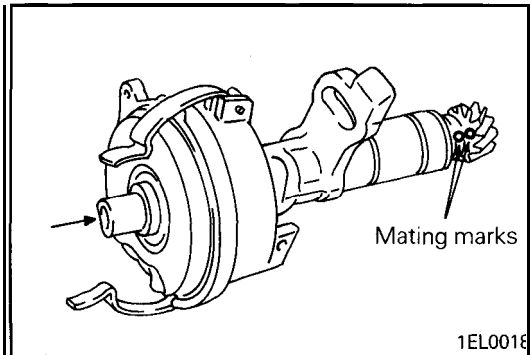
- ▶B▶ 1. Drive belt
2. Cooling fan***
3. Fan clutch***
4. Water pump pulley*
5. Water pump pulley
6. Generator brace
7. Generator
8. Crankshaft pulley
9. Spark plug cable
10. Spark plug
11. High tension cable
- ▶A▶ 12. Distributor
13. Ignition coil
14. Ignition power transistor

NOTE

- * : Engine with power steering
- ** : Engine with cooling fan
- Engine without cooling fan

INSTALLATION SERVICE POINTS**◆A◆ DISTRIBUTOR INSTALLATION**

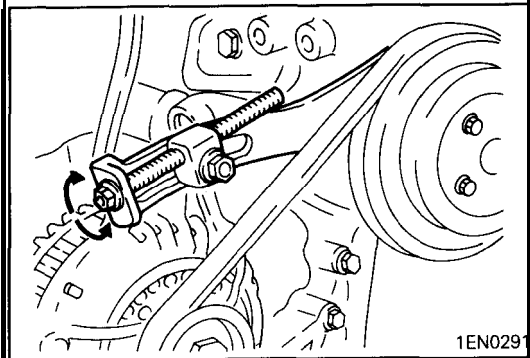
- (1) Align the marks put at the time of disassembly, and install the gear to the distributor shaft.



- (2) When aligning the driven gear's mating mark and the housing's mating marks, make the combination so that notch "A" at the shaft end is at the position shown in the figure, and then align the spring pin holes and drive in a new spring pin.

Caution

Drive in the spring pin so that the slit is at a right angle relative to the shaft.

**◆B◆ DRIVE BELT TENSION ADJUSTMENT****ADJUSTER TYPE**

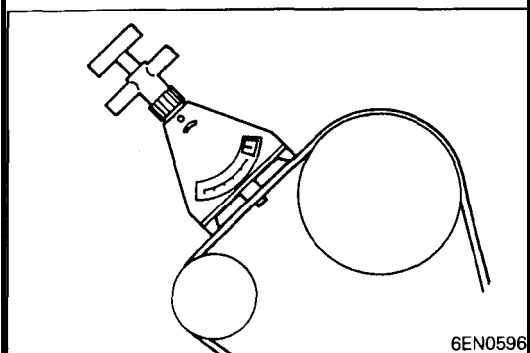
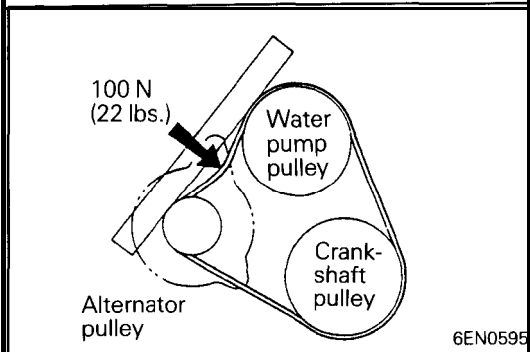
- (1) Adjust the belt deflection to the standard value. Turn the adjusting bolt clockwise to increase the belt tension and turn the adjusting bolt counterclockwise to decrease the belt tension.

Standard value:**V-ribbed type belt**

New belt 7.5 – 9.0 mm (.30 – .35 in.)

Used belt 8.0 mm (.32 in.)

V-type belt 7.0 – 10.0 mm (.28 – .39 in.)



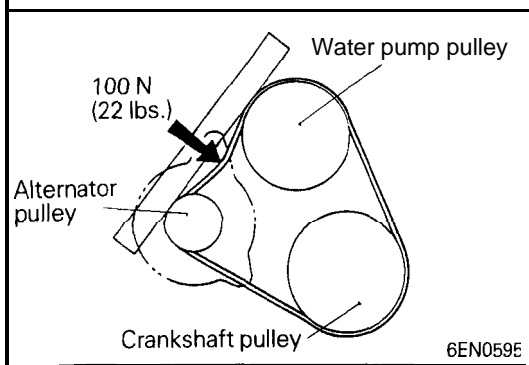
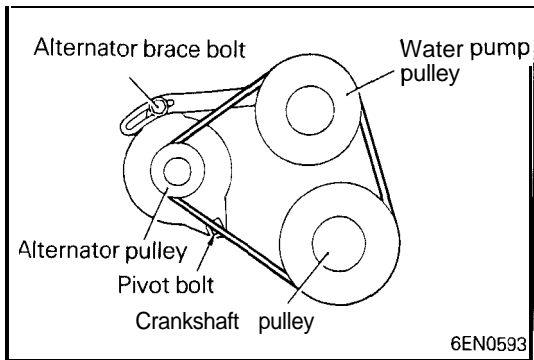
When using a tension gauge for V-ribbed belt only.

Standard value:

New belt 500 – 700 N (110 – 154 lbs.)

Used belt 400 N (88 lbs.)

- (2) Tighten the lock bolt to the specified torque.
- (3) Tighten the nut for the pivot bolt to the specified torque.

**BRACE BOLT TYPE**

- (1) Move the generator to adjust the belt deflection to the standard value.

Standard value:**V-ribbed type belt**

New belt 7.5 – 9.0 mm (.30 – .35 in.)

Used belt 8.0 mm (.32 in.)

V-type belt 7.0 – 10.0 mm (.28 – .39 in.)

When using a tension gauge for V-ribbed belt only.

Standard value:

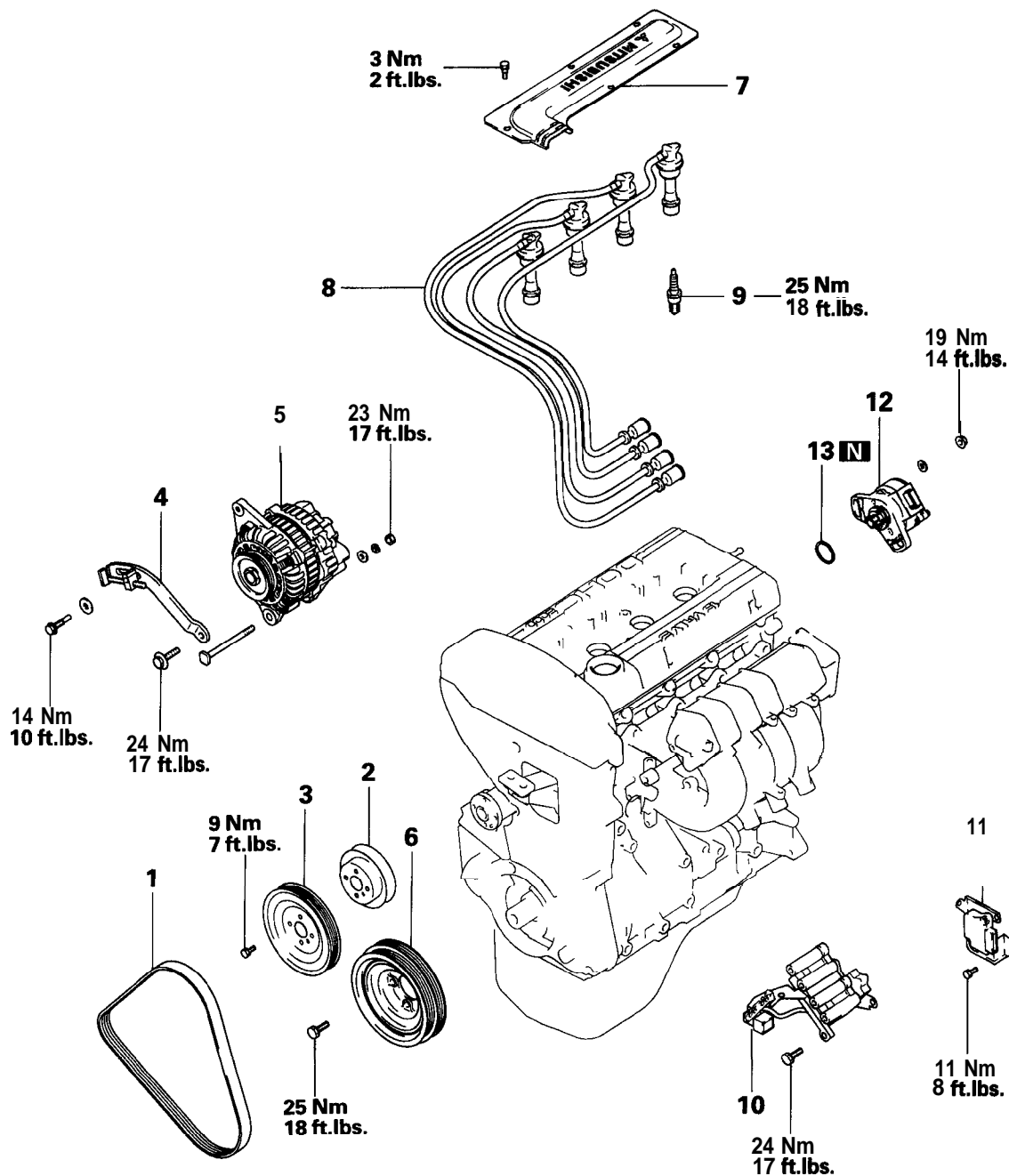
New belt 500 – 700 N (110 – 154 lbs.)

Used belt 400 N (88 lbs.)

- (2) Tighten the brace bolt to the specified torque.
- (3) Tighten the nut for the pivot bolt to the specified torque.

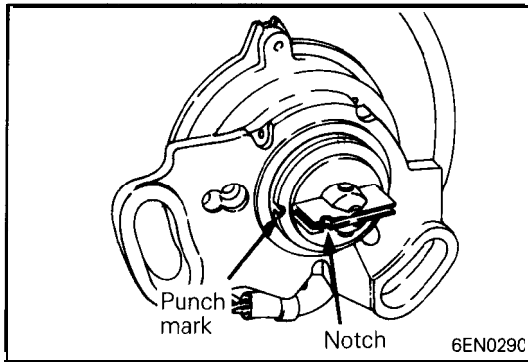
GENERATOR AND IGNITION SYSTEM – DOHC

REMOVAL AND INSTALLATION



Removal steps

- ◆B◆ 1. Drive belt
 2. Water pump pulley
 3. Water pump pulley
 (For driving power steering pump)
 4. Generator brace
 5. Generator
 6. Crankshaft pulley
 7. Center cover
 8. Spark plug cable
 9. Spark plug
 10. Ignition coil
 11. Ignition power transistor
 ◆A◆ 12. Crankshaft position sensor
 13. O-ring



INSTALLATION SERVICE POINTS

◆A◆ CRANKSHAFT POSITION INSTALLATION

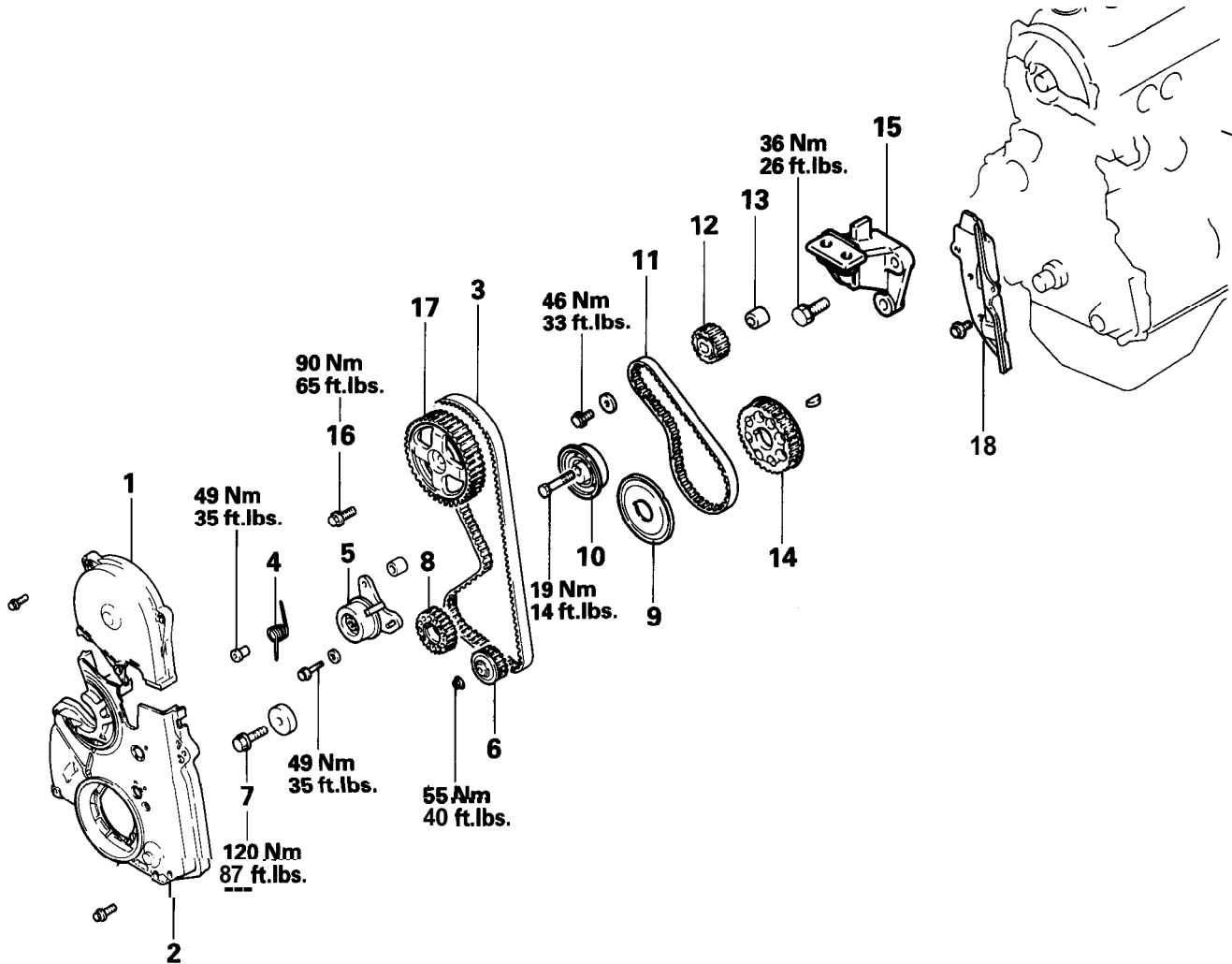
- (1) Turn the crankshaft so that the No. 1 cylinder is at top dead center.
- (2) Align the punch mark on the crankshaft position sensor housing with the notch in the plate.
- (3) Install the crankshaft position sensor on the cylinder head.

◆B◆ DRIVE BELT TENSION ADJUSTMENT

Refer to "◆B◆ DRIVE BELT TENSION ADJUSTMENT" on page 11C-24.

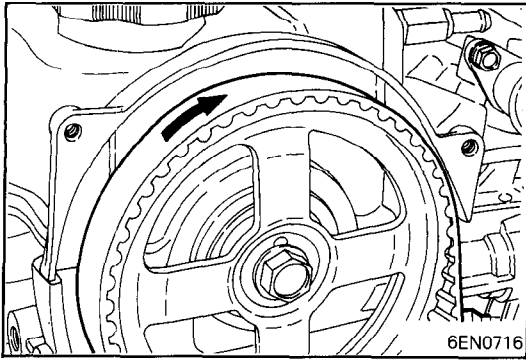
TIMING BELT – SOHC

REMOVAL AND INSTALLATION



Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
- ◊A◊ ◊H◊ 3. Timing belt
- ◊G◊ 4. Tensioner spring
- ◊G◊ 5. Tensioner
- ◊B◊ ◊F◊ 6. Oil pump sprocket
- ◊C◊ ◊E◊ 7. Crankshaft bolt
- ◊D◊ 8. Crankshaft sprocket
9. Flange
10. Tensioner "B"
- ◊E◊ ◊D◊ 11. Timing belt "B"
- ◊F◊ ◊C◊ 12. Silent shaft sprocket, right
- ◊B◊ 13. Spacer
- ◊G◊ 14. Crankshaft sprocket "B"
15. Engine support bracket, left
- ◊H◊ ◊A◊ 16. Camshaft sprocket bolt
17. Camshaft sprocket
18. Timing belt rear cover

**REMOVAL SERVICE POINTS****◊A◊ TIMING BELT REMOVAL**

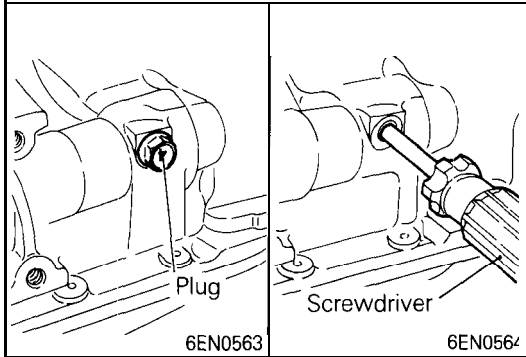
- (1) Mark the belt running direction for reference in reinstallation.

NOTE

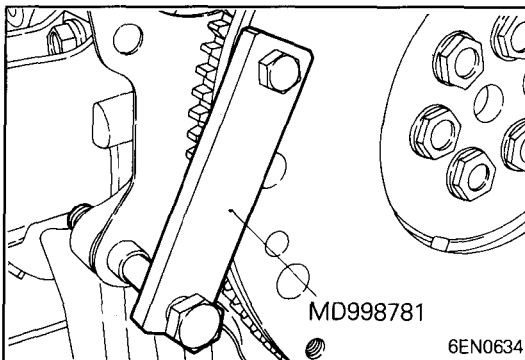
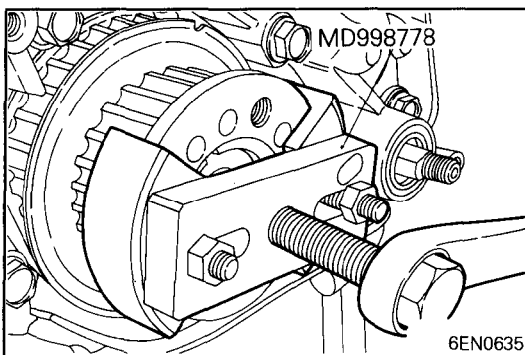
- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part, check the front case oil seals, camshaft oil seal and water pump for leaks.

◊B◊ OIL PUMP SPROCKET REMOVAL

- (1) Remove the plug on the left side of the cylinder block.
- (2) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] to block the left silent shaft.
- (3) Remove the nut.
- (4) Remove the oil pump sprocket.

**◊C◊ CRANKSHAFT BOLT REMOVAL**

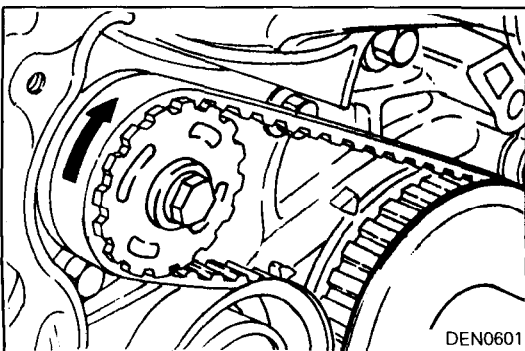
- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Remove the crankshaft bolt.

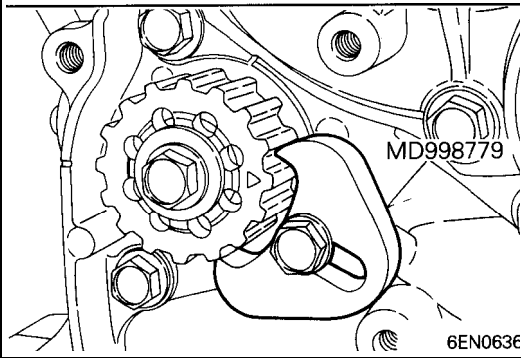
**◊D◊ CRANKSHAFT SPROCKET REMOVAL****◊E◊ TIMING BELT "B" REMOVAL**

- (1) Make a mark on the back of the timing belt indicating the direction of rotation so that it may be reassembled in the same direction if it is to be reused.

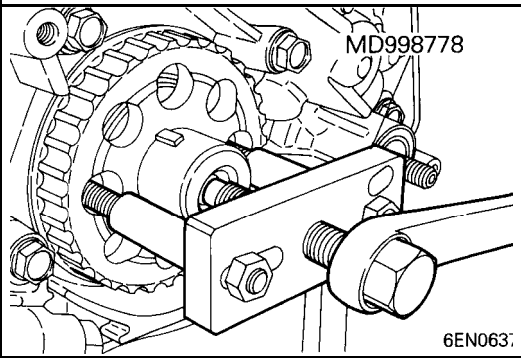
NOTE

- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part, check the front case oil seals, camshaft oil seal and water pump for leaks.

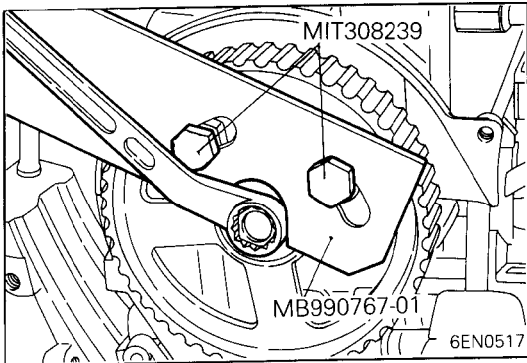




◁F▷ SILENT SHAFT SPROCKET REMOVAL



◁G▷ CRANKSHAFT SPROCKET "B" REMOVAL



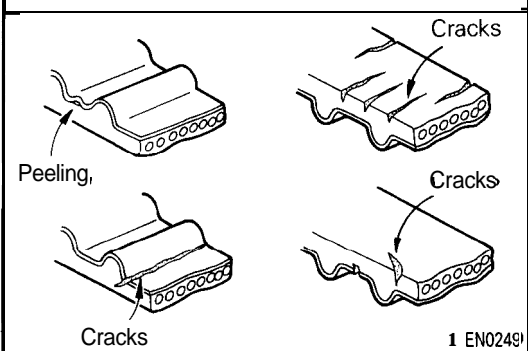
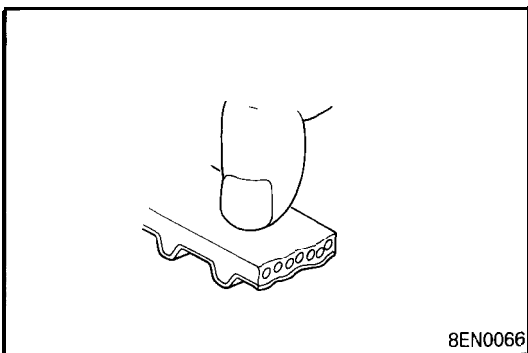
◁H▷ CAMSHAFT SPROCKET BOLT REMOVAL

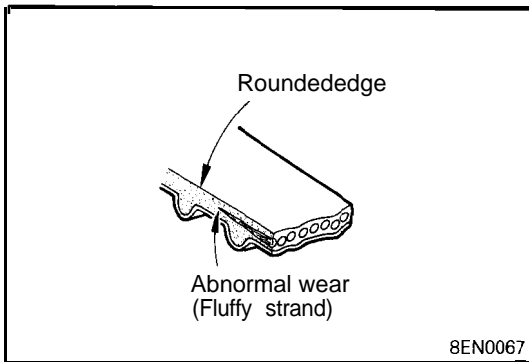
**INSPECTION
TIMING BELT**

Replace belt if any of the following conditions exist.

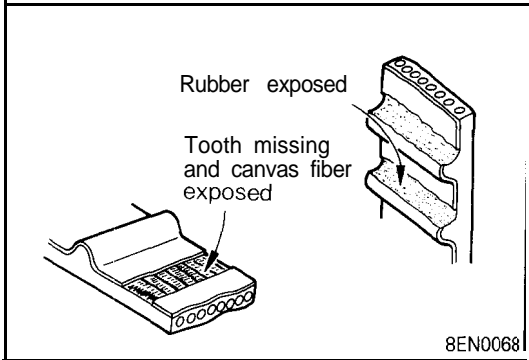
(1) Hardening of back rubber – the back side is glossy without resilience and leaves no indent when pressed with fingernail.

- (2) Cracks on rubber back.
- (3) Cracks or peeling of canvas.
- (4) Cracks on rib root.
- (5) Cracks on belt sides.

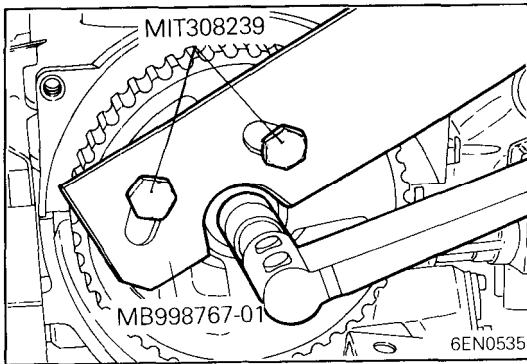




(6) Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.

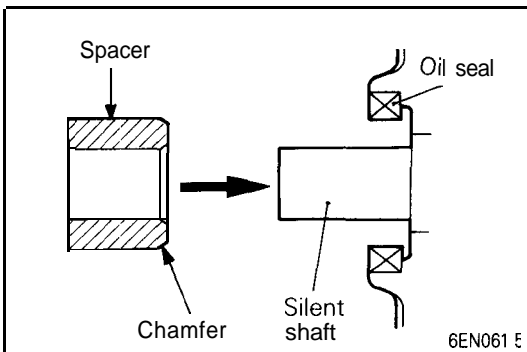


(7) Abnormal wear on teeth.
 (8) Missing tooth.



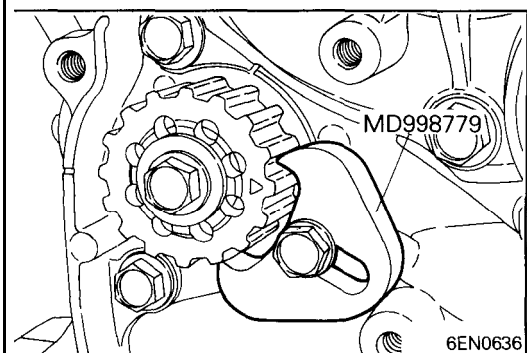
INSTALLATION SERVICE POINTS

▶◀ CAMSHAFT SPROCKET BOLT INSTALLATION

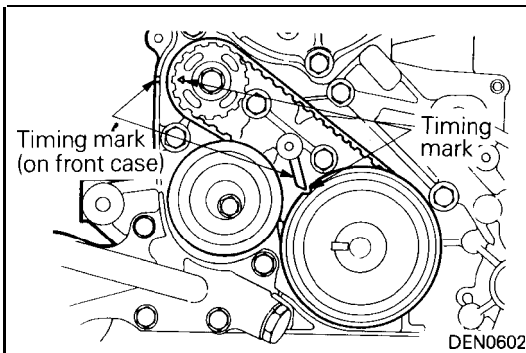


▶◀ SPACER INSTALLATION

(1) Install the spacer with the chamfered end toward the oil seal.

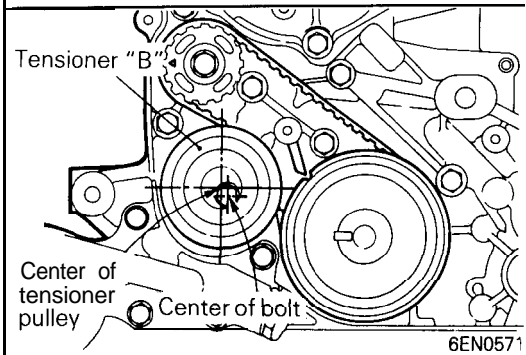


▶◀ SILENT SHAFT SPROCKET INSTALLATION

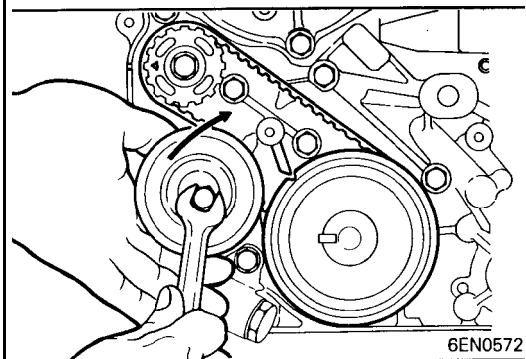


◆D◆ TIMING BELT “B” ‘INSTALLATION

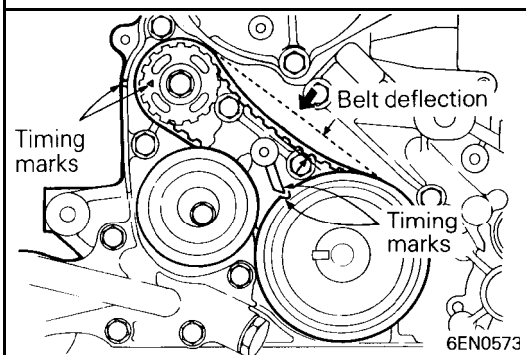
- (1) Align timing marks on the crankshaft sprocket “B” and silent shaft sprocket with the marks on the front case respectively.
- (2) Install the timing belt “B” on the crankshaft sprocket “B” and silent shaft sprocket. There should be no slack on the tension side.



- (3) Make sure that the relationship between the tensioner pulley center and the bolt center is as shown in the illustration.



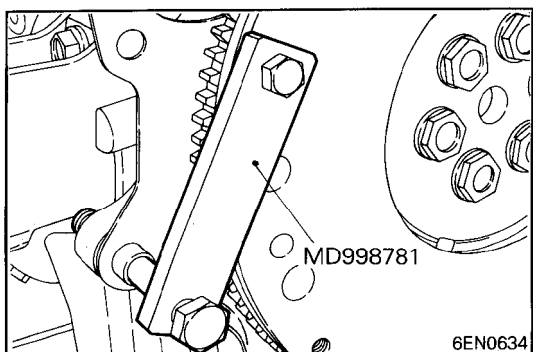
- (4) Move the tensioner “B” in the direction of arrow while lifting with a finger to give a sufficient tension to the tension side of timing belt. In this condition, tighten the bolt to secure tensioner “B”. When the bolt is tightened, use care to prevent shaft from turning together. If the shaft is turned together, the belt will be overtensioned.

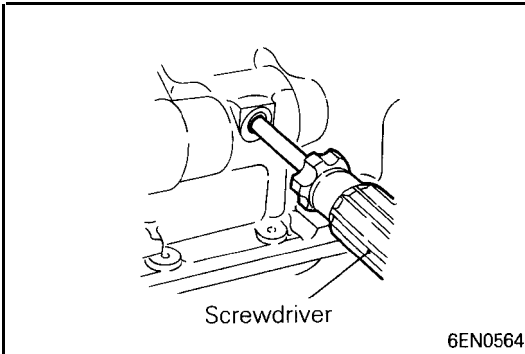


- (5) Check to ensure that the timing marks on the sprockets and front case are in alignment.
- (6) Press with index finger the center of span on the tension side of timing belt “B”. The belt must deflect 5 – 7 mm (.20 – .28 in.).

◆E◆ CRANKSHAFT BOLT INSTALLATION

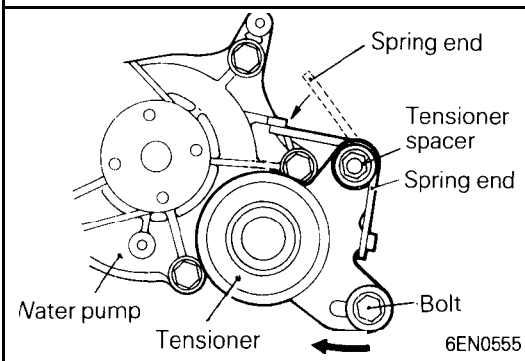
- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Install the crankshaft bolt.





▶F▶ OIL PUMP SPROCKET INSTALLATION

- (1) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the plug hole on the left side of the cylinder block to block the left silent shaft.
- (2) Install the oil pump sprocket.
- (3) Apply an appropriate amount of engine oil to the bearing surface of the nut.
- (4) Tighten the nut to the specified torque.

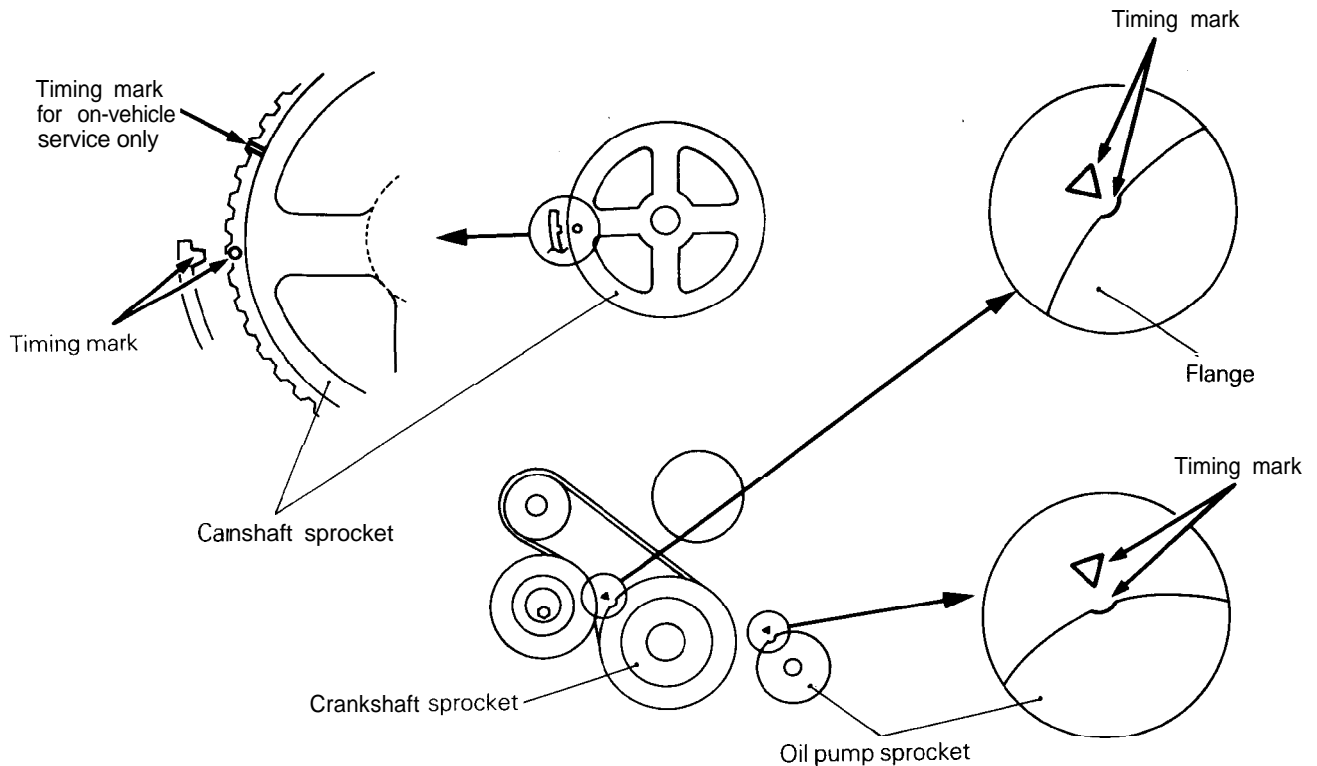


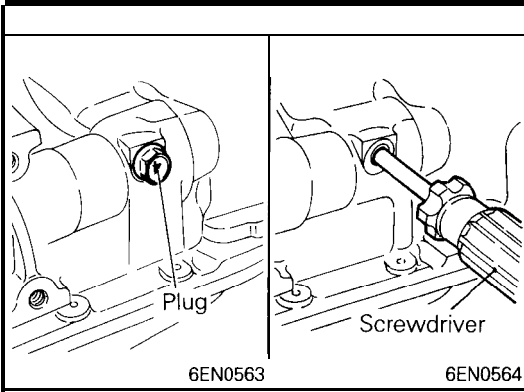
▶G▶ TENSIONER INSTALLATION

- (1) Hook the tensioner spring ends to the water pump body projection and tensioner bracket.
- (2) Move the tensioner fully toward the water pump and tighten the bolt and tensioner spacer.

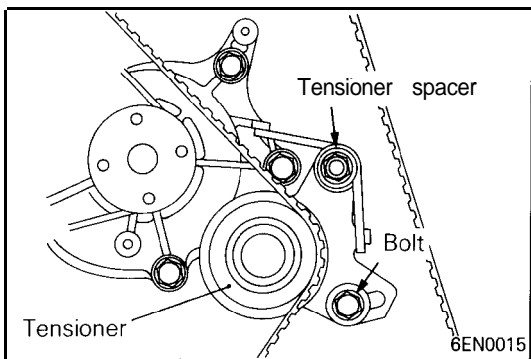
▶H▶ TIMING BELT INSTALLATION

- (1) Align the timing marks on camshaft sprocket and crankshaft sprocket with their mating marks.
- (2) Align the timing mark on the oil pump sprocket with its mating mark.

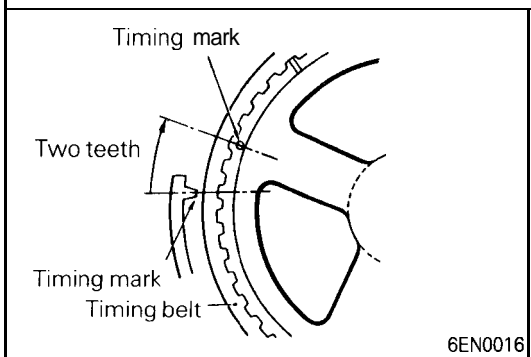




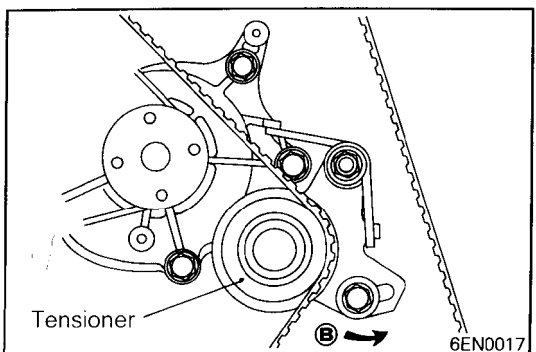
- (3) Remove the plug on the cylinder block and insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the hole (Engine with silent shafts).
If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign the timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) or more. Keep the screwdriver inserted until installation of the timing belt is finished.
- (4) Install the timing belt on the crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order. There should be no slack on the tension side.



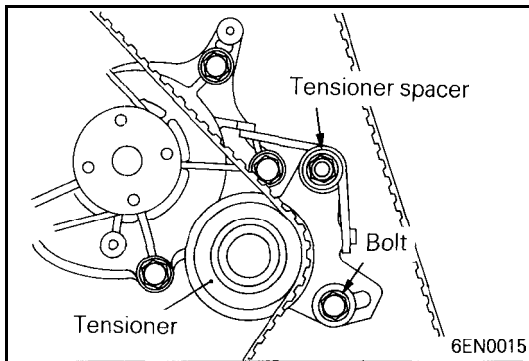
- (5) Loosen the tensioner mounting bolt and tensioner spacer.



- (6) Turn the crankshaft clockwise by two teeth of camshaft sprocket (or crankshaft sprocket).



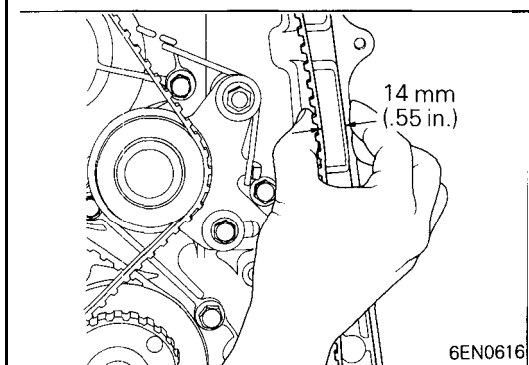
- (7) Apply force to the tensioner in the direction shown by arrow **B** to make the belt engage completely with each sprocket.



- (8) Tighten the tensioner attaching bolt, then tighten the tensioner spacer.

Caution

If the tensioner spacer is tightened first, the tensioner turns as the tensioner spacer is tightened, resulting in an excessive belt tension.

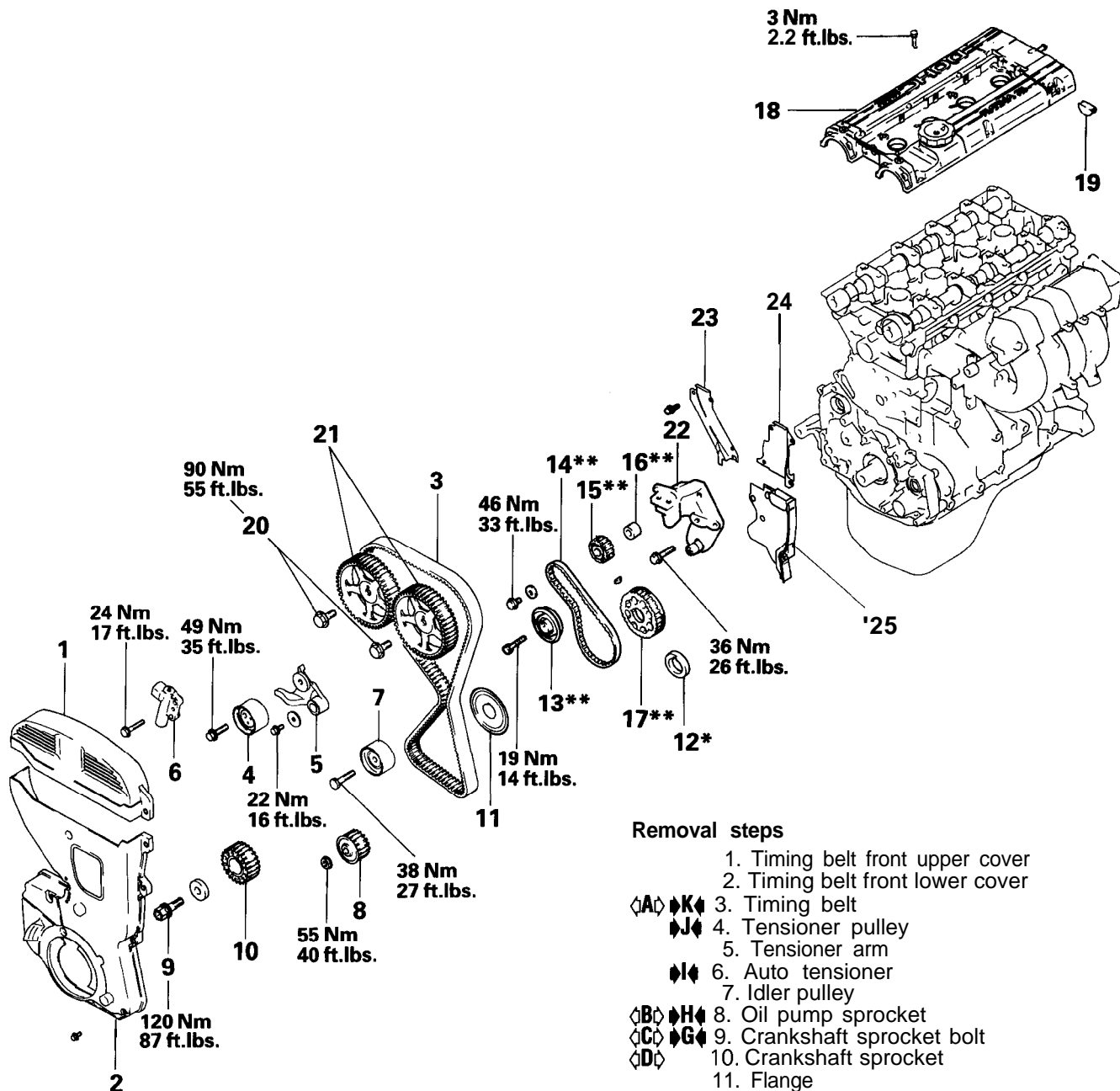


- (9) Hold the center of the tension side span of the timing belt (between the camshaft and oil pump sprockets) between your thumb and index finger as shown. Then, make sure that the clearance between the belt back surface and cover is standard value.

Standard value: 14 mm (.55 in.)

TIMING BELT - DOHC

REMOVAL AND INSTALLATION

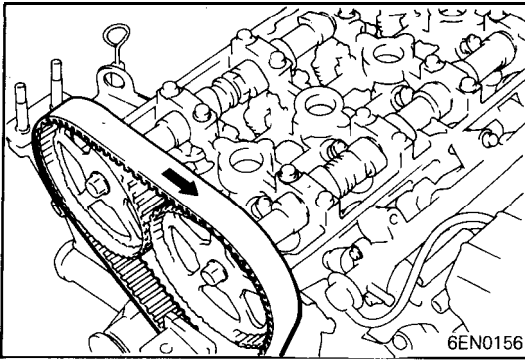


Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
3. Timing belt
4. Tensioner pulley
5. Tensioner arm
6. Auto tensioner
7. Idler pulley
8. Oil pump sprocket
9. Crankshaft sprocket bolt
10. Crankshaft sprocket
11. Flange
12. Spacer*
13. Tensioner "B"***
14. Timing belt "B"***
15. Silent shaft sprocket**
16. Spacer**
17. Crankshaft sprocket "B"***
18. Rocker cover
19. Semi-circular packing
20. Camshaft sprocket bolt
21. Camshaft sprocket
22. Engine support bracket
23. Timing belt rear right cover
24. Timing belt rear left upper cover
25. Timing belt rear left lower cover

NOTE

- * : Engine without silent shafts
 ** : Engine with silent shafts

**REMOVAL SERVICE POINTS****◊A◊ TIMING BELT REMOVAL**

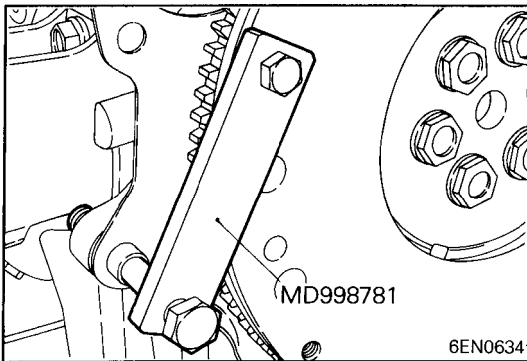
- (1) Make a mark on the back of the timing belt indicating the direction of rotation so that it may be reassembled in the same direction if it is to be reused.

NOTE

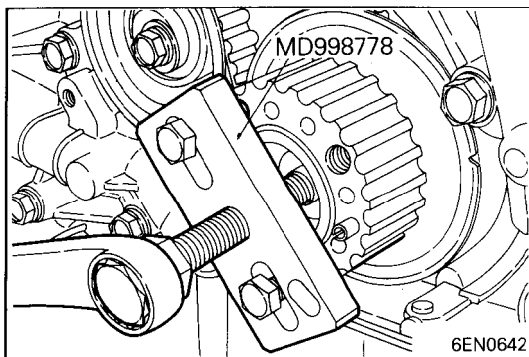
- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part, check the front case oil seals, camshaft oil seal and water pump for leaks.

◊B◊ OIL PUMP SPROCKET REMOVAL (ENGINE WITH SILENT SHAFTS)

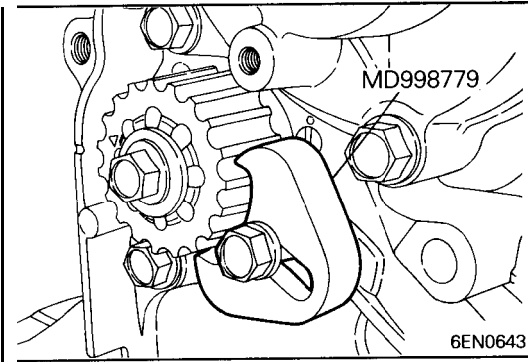
Refer to "◊B◊ OIL PUMP SPROCKET REMOVAL" on page 11 C-29.

**◊C◊ CRANKSHAFT BOLT REMOVAL**

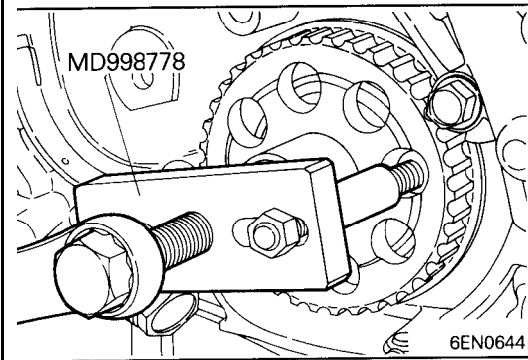
- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Remove the crankshaft bolt.

**◊D◊ CRANKSHAFT SPROCKET REMOVAL****◊E◊ TIMING BELT "B" REMOVAL (ENGINE WITH SILENT SHAFTS)**

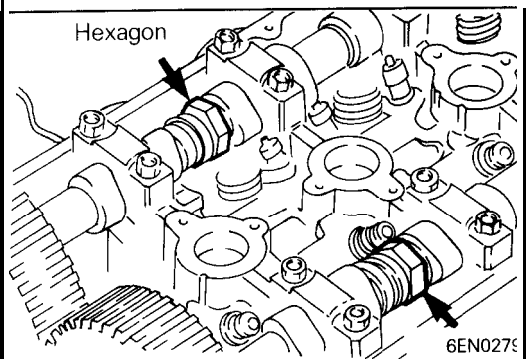
Refer to "◊E◊ TIMING BELT "B" REMOVAL" on page 11 C-29.



◁F▷ SILENT SHAFT SPROCKET REMOVAL



◁G▷ CRANKSHAFT SPROCKET "B" REMOVAL



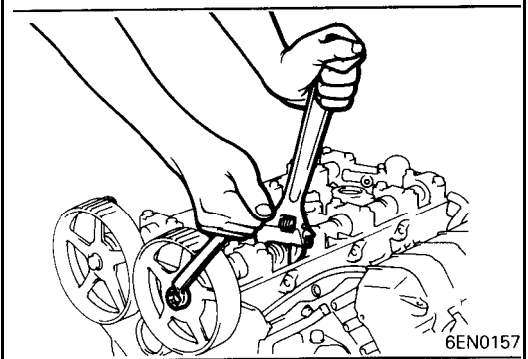
◁H▷ CAMSHAFT SPROCKET REMOVAL

- (1) Using a wrench, hold the camshaft at its hexagon (between the No. 2 and No. 3 journals) and remove the camshaft sprocket bolt.

Caution

Locking the camshaft sprocket with a tool damages the sprocket.

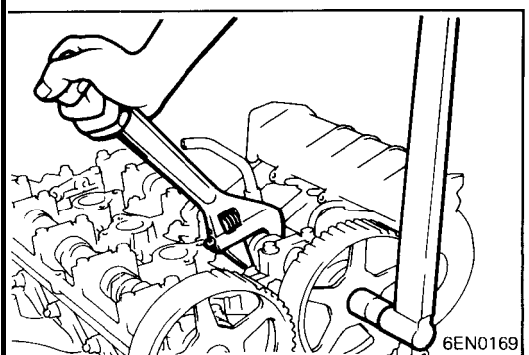
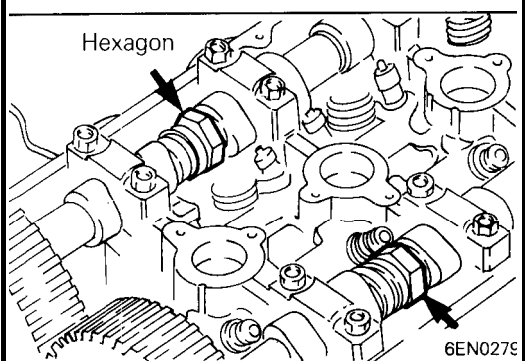
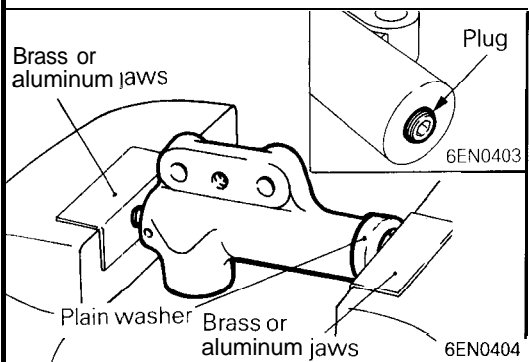
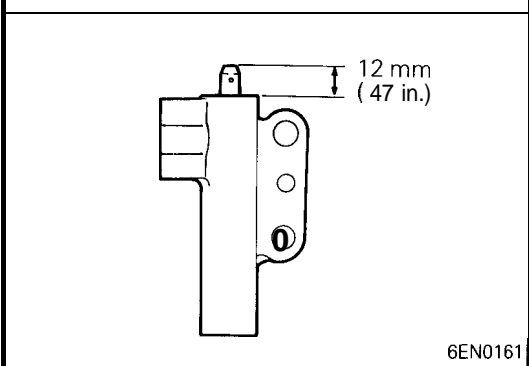
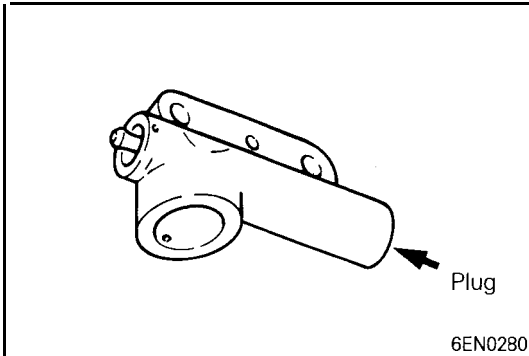
- (2) Remove the camshaft sprockets.



INSPECTION

TIMING BELTS

Refer to "INSPECTION" on page 1 1C-29.



AUTO TENSIONER

- (1) Check the auto tensioner for possible leaks and replace as necessary.
- (2) Check the rod end for wear or damage and replace as necessary.

- (3) Measure the rod protrusion. If it is out of specification, replace the auto tensioner.

Standard value: 12 mm (.47 in.)

- (4) Clamp the auto tensioner in a vise with soft jaws.

Caution

The plug protrudes at the bottom of the auto tensioner. Insert a plain washer as illustrated to prevent the plug from being in direct contact with the vise.

- (5) Turning the vise handle, push in the auto tensioner rod. If the rod can be easily retracted, replace the auto tensioner. You should feel a fair amount of resistance when pushing the rod in.

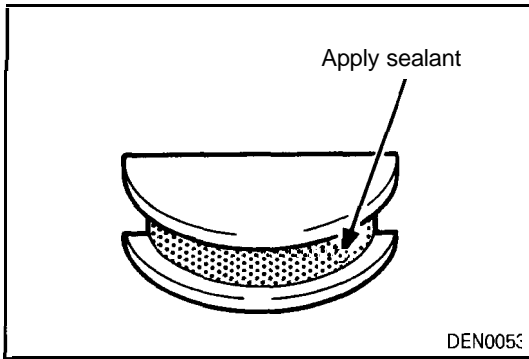
INSTALLATION SERVICE POINTS

◆A◆ CAMSHAFT SPROCKET INSTALLATION

- (1) Using a wrench, hold the camshaft at its hexagon (between the No. 2 and No. 3 journals) and tighten the bolt to the specification.

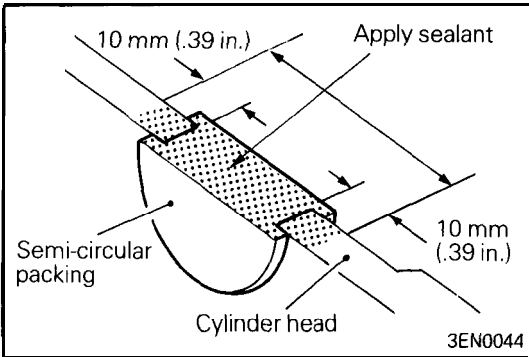
Caution

Locking the camshaft sprocket with a tool damages the sprocket.



▶B▶ SEALANT APPLICATION ON SEMI-CIRCULAR PACKING

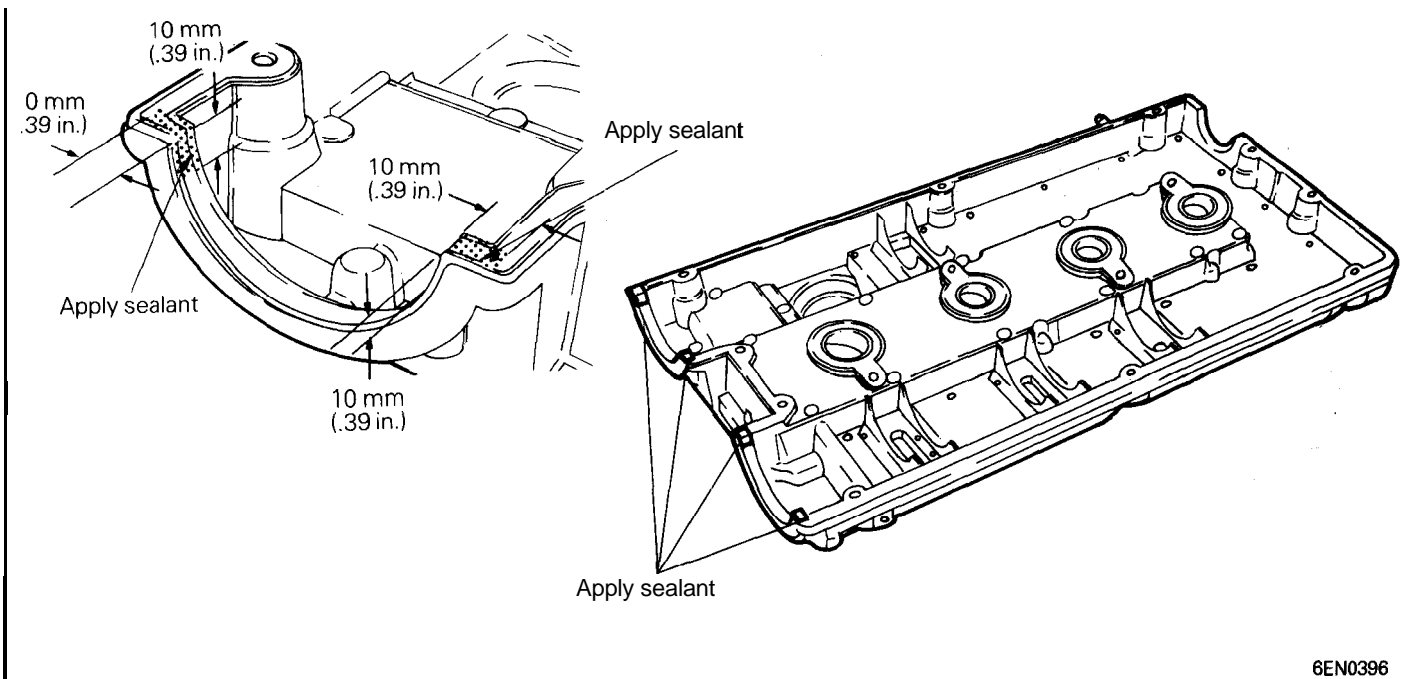
Specified sealant: **3M ATD Part No. 8660** or equivalent



▶C▶ SEALANT APPLICATION ON ROCKER COVER

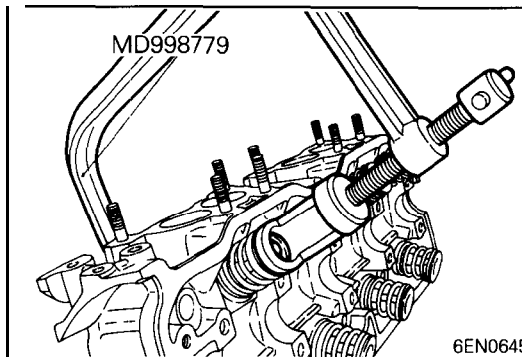
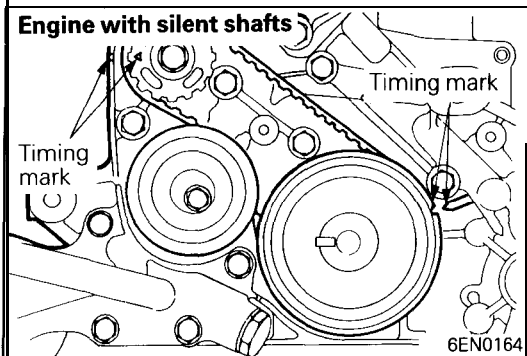
Apply sealant to the areas indicated in the illustration.

Specified sealant: **3M ATD Part No. 8660** or equivalent

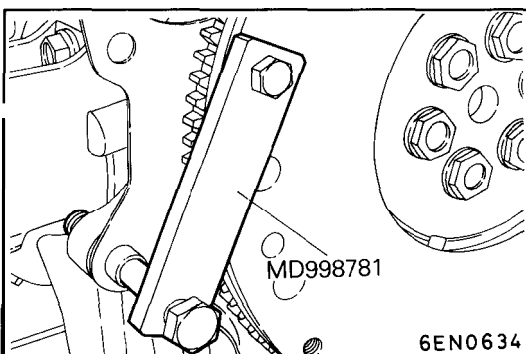


◆D◆ SPACER INSTALLATION (ENGINE WITH SILENT SHAFTS)

Refer to "◆B◆ SPACER INSTALLATION" on page 11C-31.

**◆E◆ SILENT SHAFT SPROCKET INSTALLATION****◆F◆ TIMING BELT "B" INSTALLATION (ENGINE WITH SILENT SHAFTS)**

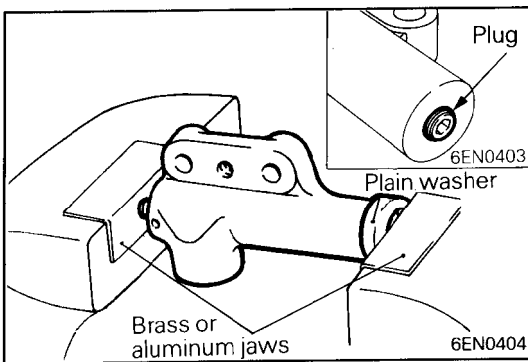
Refer to Page 11 C-32. Note that the timing mark locations differ from those on the single camshaft engine.

**◆G◆ CRANKSHAFT BOLT INSTALLATION**

- (1) Using the special tool, hold the drive plate or flywheel.
- (2) Install the crankshaft bolt.

◆H◆ OIL PUMP SPROCKET INSTALLATION (ENGINE WITH SILENT SHAFTS)

Refer to "◆F◆ OIL PUMP SPROCKET INSTALLATION" on page 11 C-33.

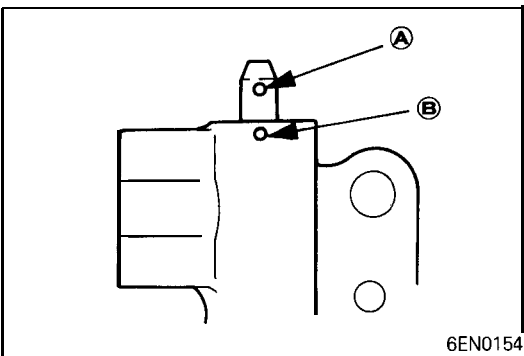


◆◆ AUTO TENSIONER INSTALLATION

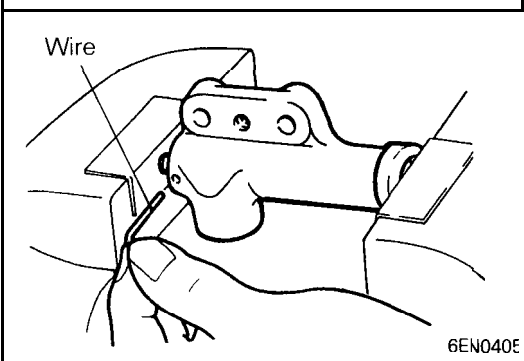
- (1) If the auto tensioner rod is in its fully extended position, reset it as follows.
- (2) Clamp the auto-tensioner in the vise with soft jaws.

Caution

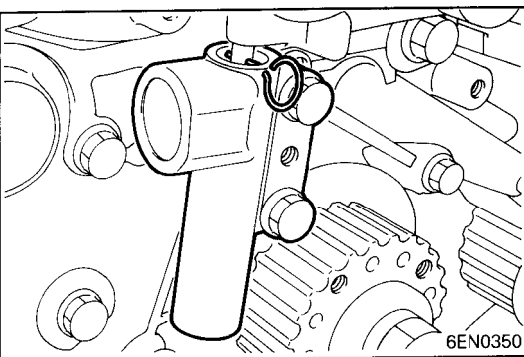
The plug protrudes at the bottom of the auto tensioner. Insert a plain washer as illustrated to prevent the plug from being in direct contact with the vise.



- (3) Push in the rod little by little with the vise until the set hole (A) in the rod is aligned with the hole (B) in the cylinder.



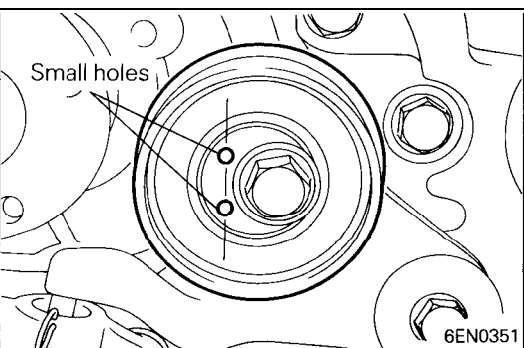
- (4) Insert a wire [1.4 mm (.055 in.) in diameter] into the set holes.
- (5) Unclamp the auto tensioner from the vise.



- (6) Install the auto tensioner to front case and tighten to the specified torque.

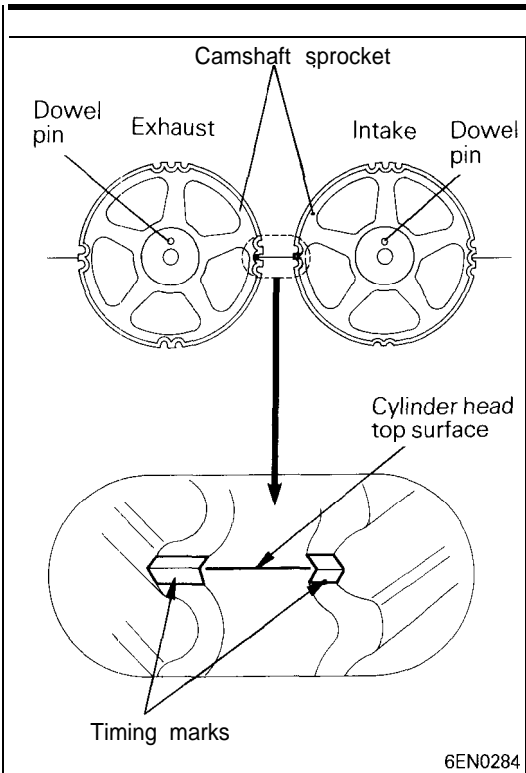
Caution

Leave the wire installed in the auto tensioner.



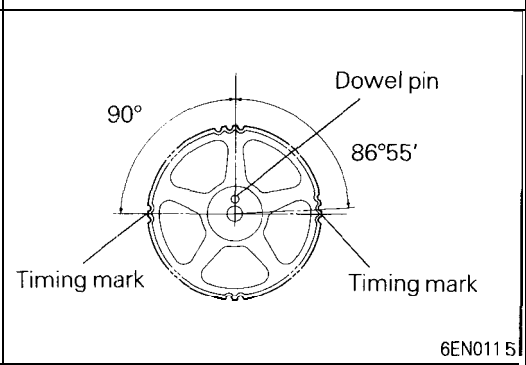
◆◆ TENSIONER PULLEY INSTALLATION

- (1) Install the tensioner pulley in such direction that its two small holes are arranged vertically.



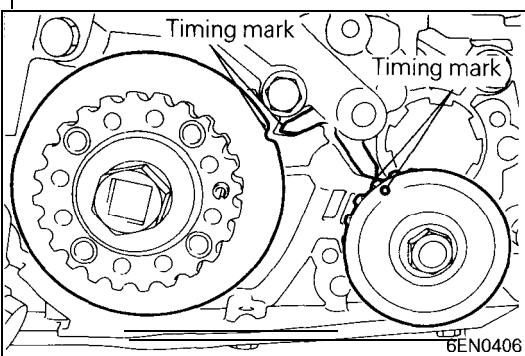
◆K◆ TIMING BELT INSTALLATION

- (1) Turn the two sprockets so that their dowel pins are located on top. Then, align the timing marks facing each other with the top surface of the cylinder head. When you let go of the exhaust camshaft sprocket, it will rotate one tooth in the counterclockwise direction. This should be taken into account when installing the timing belt on the sprockets.

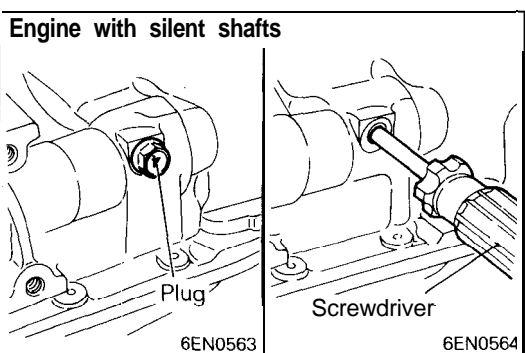


NOTE

The same camshaft sprocket which is provided with two timing marks is used for the intake and exhaust camshafts. When the sprocket is mounted on the exhaust camshaft, use the timing mark on the right with the dowel pin hole on top. For the intake camshaft sprocket, use the one on the left with the dowel pin hole on top.



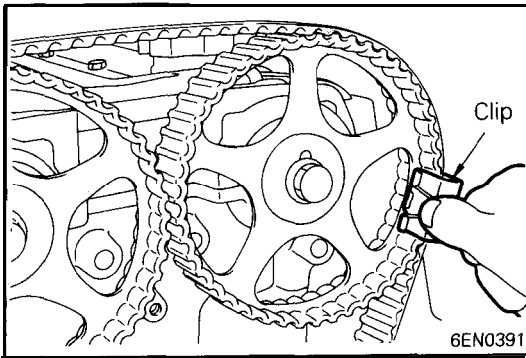
- (2) Align the crankshaft sprocket timing marks.
- (3) Align the oil pump sprocket timing marks (Engine with silent shafts).



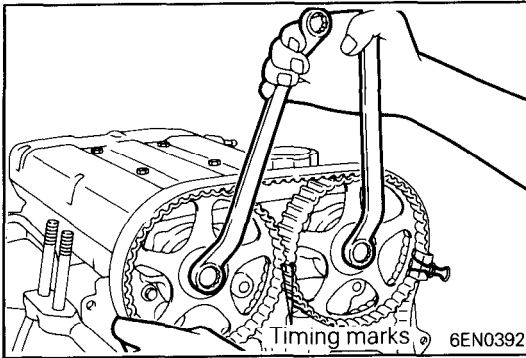
- (4) Insert a Phillips screwdriver [shank diameter 8 mm (.31in.)] through the plug hole (Engine with silent shafts). If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) or more. Keep the screwdriver inserted until the installation of the timing belt is finished.

NOTE

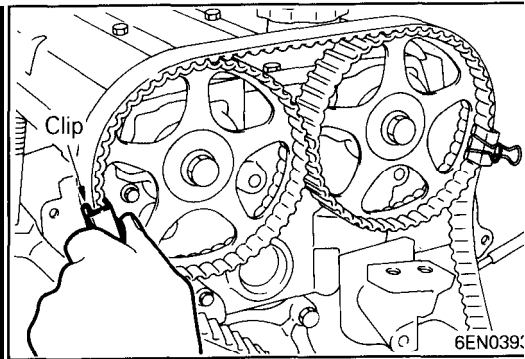
Step (4) is performed to ensure that the oil pump sprocket is correctly positioned with reference to the silent shafts.



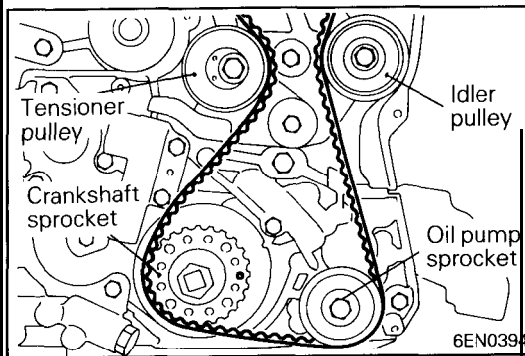
- (5) Thread the timing belt over the intake side camshaft sprocket and fix it at indicated position by a clip.



- (6) Thread the timing belt over the exhaust side sprocket, while aligning the timing marks with the cylinder head top surface using two wrenches.

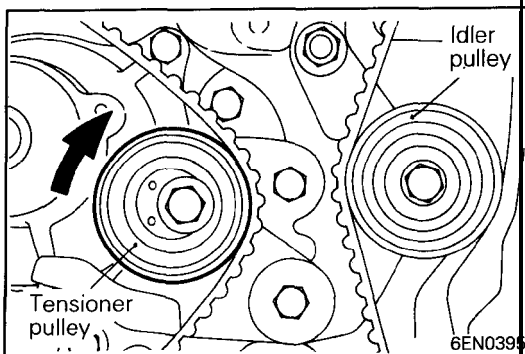


- (7) Fix the belt at indicated position by a clip.



- (8) Thread the timing belt over the idler pulley, the oil pump sprocket, the crankshaft sprocket and the tensioner pulley in the order shown.

- (9) Remove the two clips.

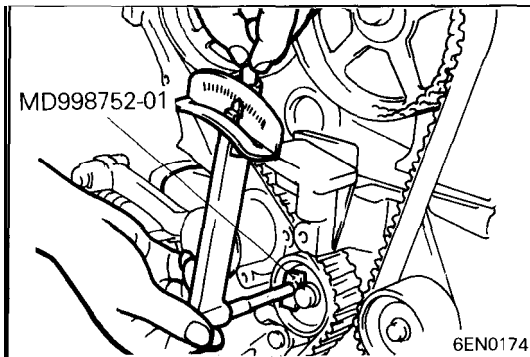


- (10) Lift up the tensioner pulley in the direction of arrow and tighten the center bolt.

- (11) Check to see that all timing marks are lined up.

- (12) Remove the screwdriver inserted in step (4) and fit the plug. (Engine with silent shafts)

- (13) Give the crankshaft a quarter counter-clockwise turn. Then, turn it clockwise until the timing marks are lined up again.



- (14) Install the special tools, Socket Wrench and Torque Wrench, on the tensioner pulley, and loosen the tensioner pulley center bolt.

NOTE

If the special tool is not available, use a commercially available torque wrench that is capable of measuring 0 – 3 Nm (0 – 2.2 ft.lbs.).

- (15) Torque to 2.6 – 2.8 Nm (1.88 – 2.03 ft.lbs.) with the torque wrench.

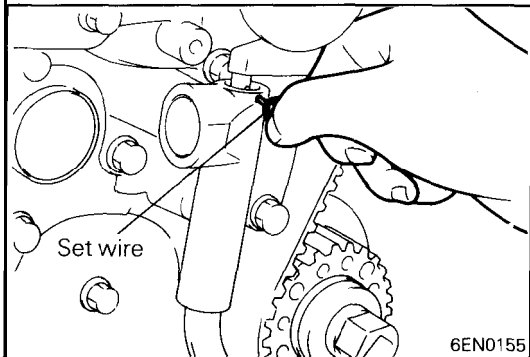
- (16) Holding the tensioner pulley with the special tool and torque wrench, tighten the center bolt to the specification.

- (17) After giving two clockwise turns to the crankshaft, let it alone for approx. 15 minutes. Then, make sure that the auto tensioner setting wire moves freely.

NOTE

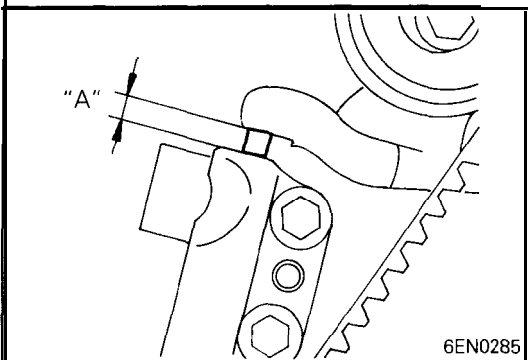
If the wire does not move freely, repeat step (13) above until it moves freely.

- (18) Remove the auto tensioner setting wire.



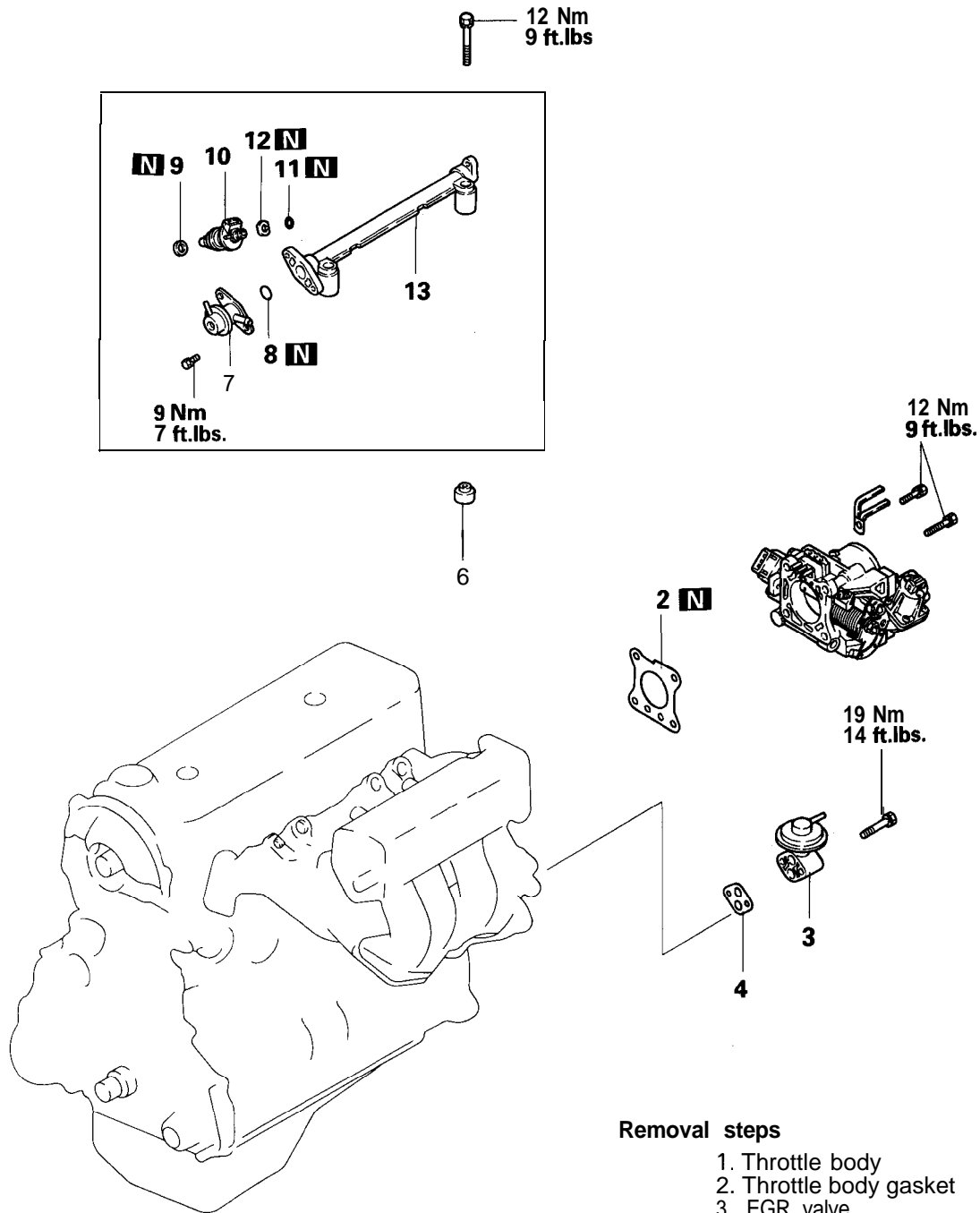
- (19) Measure the distance "A" (between the tensioner arm and auto tensioner body).

Standard value: 3.8 – 4.5 mm (.15 – .18 in.)



FUEL AND EMISSION CONTROL PARTS

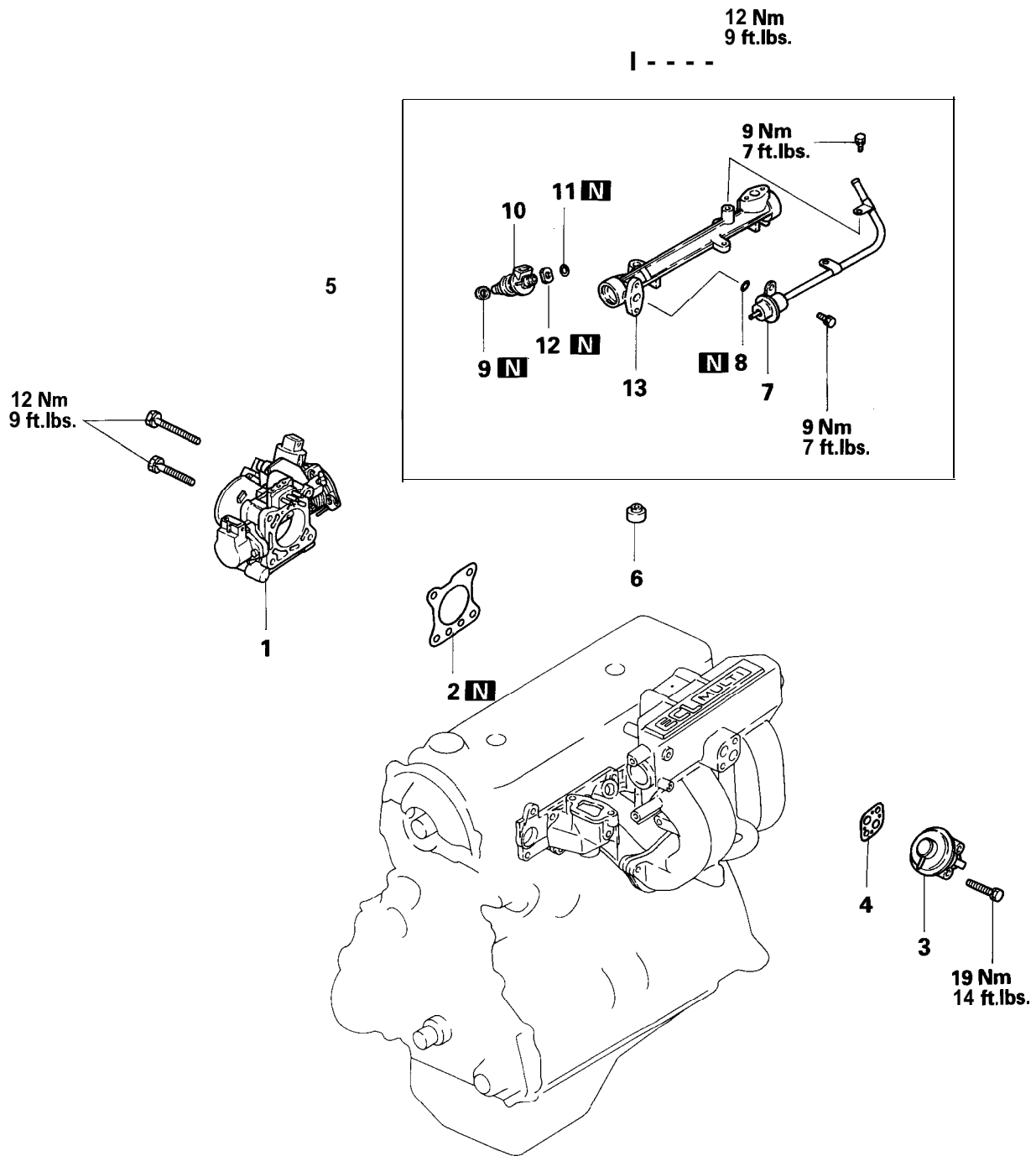
REMOVAL AND INSTALLATION – SOHC for GALANT/EXPO



Removal steps

1. Throttle body
2. Throttle body gasket
3. EGR valve
4. EGR valve gasket
5. Injectors and fuel rail
6. Insulator
7. Fuel pressure regulator
- ▶▶ 8. O-ring
9. Insulator
- ▶▶▶ 10. Injectors
11. O-ring
12. Grommet
13. Fuel rail

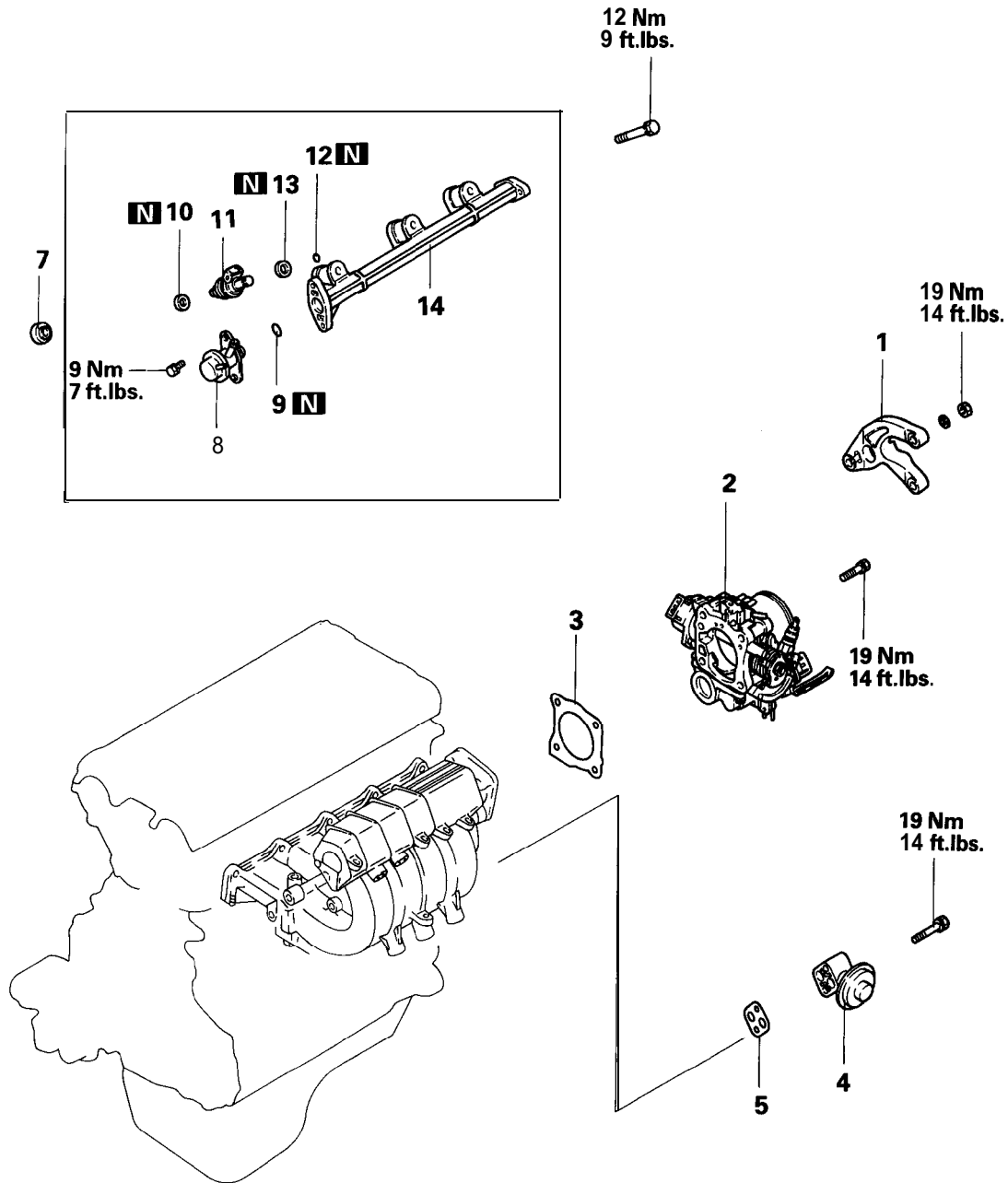
REMOVAL AND INSTALLATION – SOHC for TRUCK



Removal steps

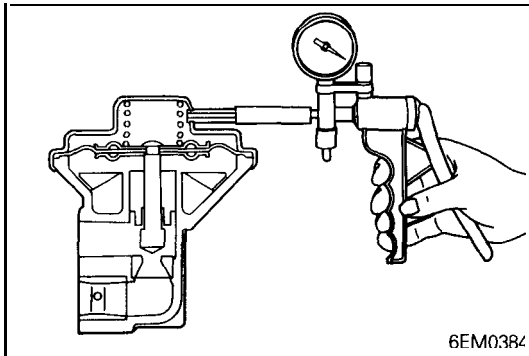
1. Throttle body
2. Throttle body gasket
3. EGR valve
4. EGR valve gasket
5. Injectors and fuel rail
6. Insulator
7. Fuel pressure regulator
- ▶B▶ 8. O-ring
9. Insulator
- ▶A▶ 10. injectors
11. O-ring
12. Grommet
13. Fuel rail

REMOVAL AND INSTALLATION – DOHC

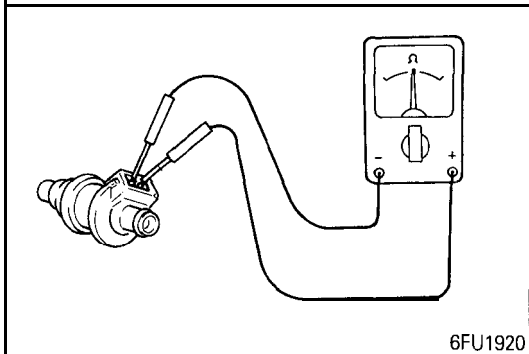


Removal steps

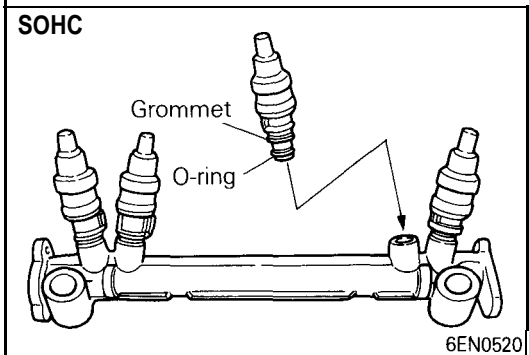
1. Throttle body stay
2. Throttle body
3. Throttle body gasket
4. EGR valve
5. EGR valve gasket
6. Injectors and fuel rail
7. Insulator
8. Fuel pressure regulator
- ◆B◆ 9. O-ring
- ◆A◆ 10. Insulator
- ◆A◆ 11. Injectors
12. O-ring
13. Grommet
14. Fuel rail

**INSPECTION****EGR VALVE**

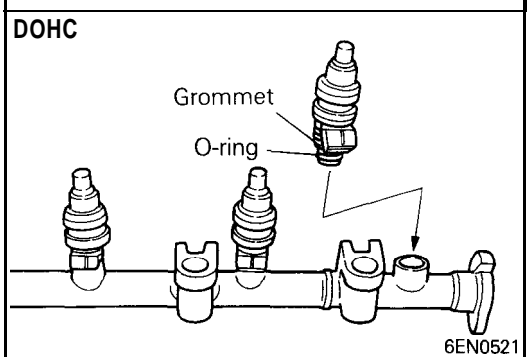
- (1) Check EGR valve for sticking or carbon deposits. If such conditions exist, clean or replace EGR valve.
- (2) Connect a hand vacuum pump to the nipple of EGR valve and plug other nipple.
- (3) Apply a vacuum of 500 mmHg (19.7 in. Hg) to make sure that a vacuum is maintained. If there is a leak, replace the EGR valve. In addition, check the valve for its opening and closing by applying and removing a vacuum.

**INJECTORS**

- (1) Using an ohmmeter (circuit tester), test for continuity between terminals of injector; the circuit should be closed. If failure is detected, replace the injector.

Standard value:**Non-turbo 13 – 16 Ω [at 20°C (68°F)]****Turbo 2 – 3 Ω [at 20°C (68°F)]****SOHC****INSTALLATION SERVICE POINTS****▶▶ INJECTOR INSTALLATION**

- (1) Before installing an injector the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.

**DOHC**

- (2) Install the injectors from the top end into the fuel rail. Be careful not to damage the O-ring during installation.

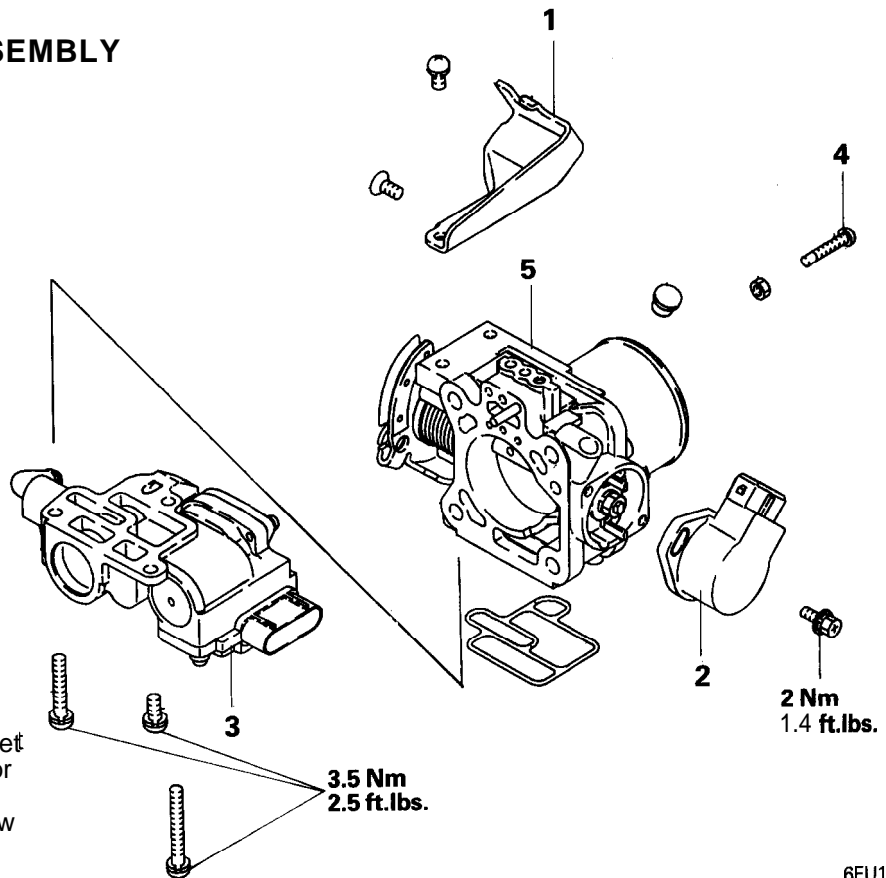
▶▶ FUEL PRESSURE REGULATOR INSTALLATION

- (1) Before installing the pressure regulator the O-ring must be lubricated with a drop of clean engine oil to aid in installation.

THROTTLE BODY

DISASSEMBLY AND REASSEMBLY

SOHC for EXPO

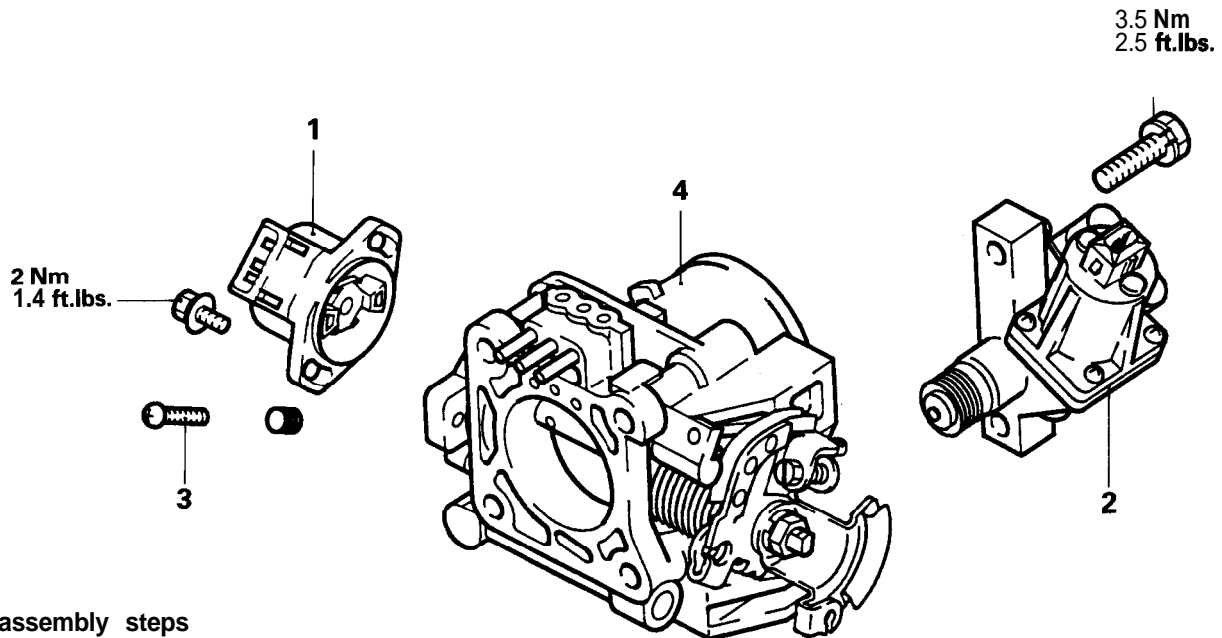


Disassembly steps

- 1. Accelerator wire bracket
- ◊A◊ ◄A◄ 2. Throttle position sensor
- ◊A◊ 3. Idle air control motor
- ◊B◊ 4. Throttle valve set screw
- 5. Throttle body

6FU1857

SOHC for GALANT/TRUCK

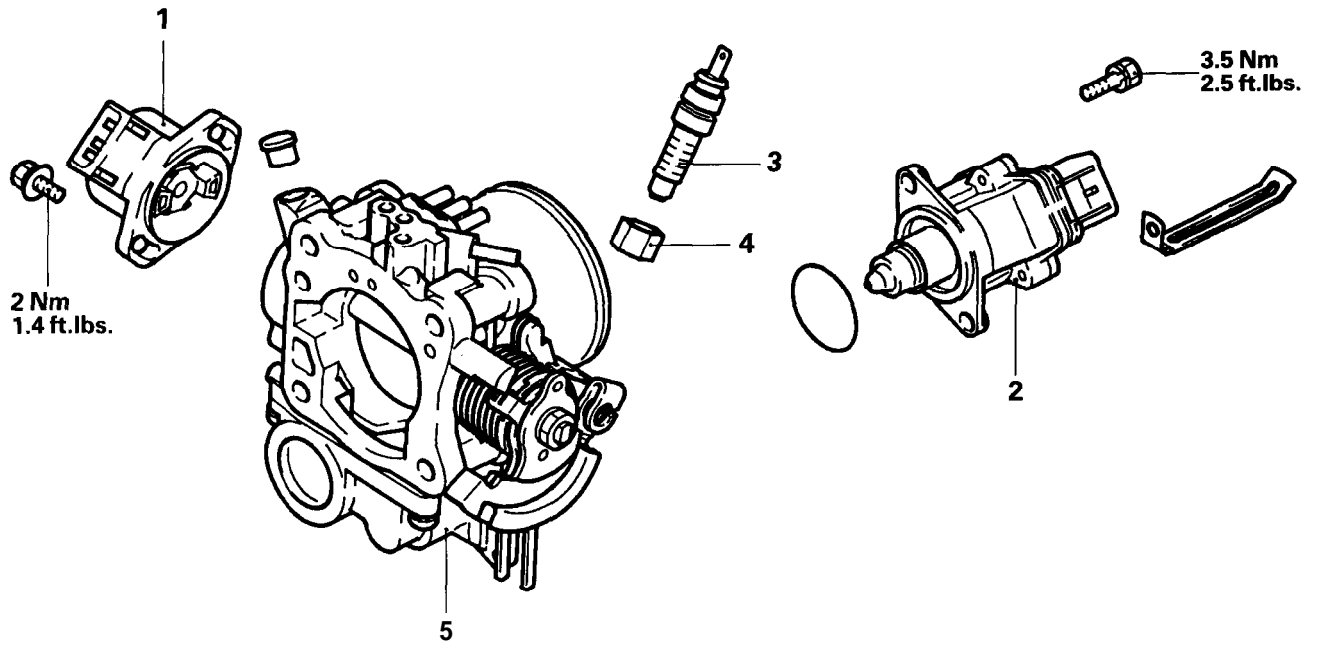


Disassembly steps

- ◊A◊ ◄A◄ 1. Throttle position sensor
- ◊A◊ 2. Idle speed control motor
- 3. Throttle valve set screw
- ◊B◊ 4. Throttle body

6FU1292

DOHC



Disassembly steps

- ◊A◊ ◊A◊ 1. Throttle position sensor
- ◊A◊ 2. Idle air control motor (stepper motor)
- 3. Closed throttle position switch
- 4. Adjusting nut
- ◊B◊ 5. Throttle body

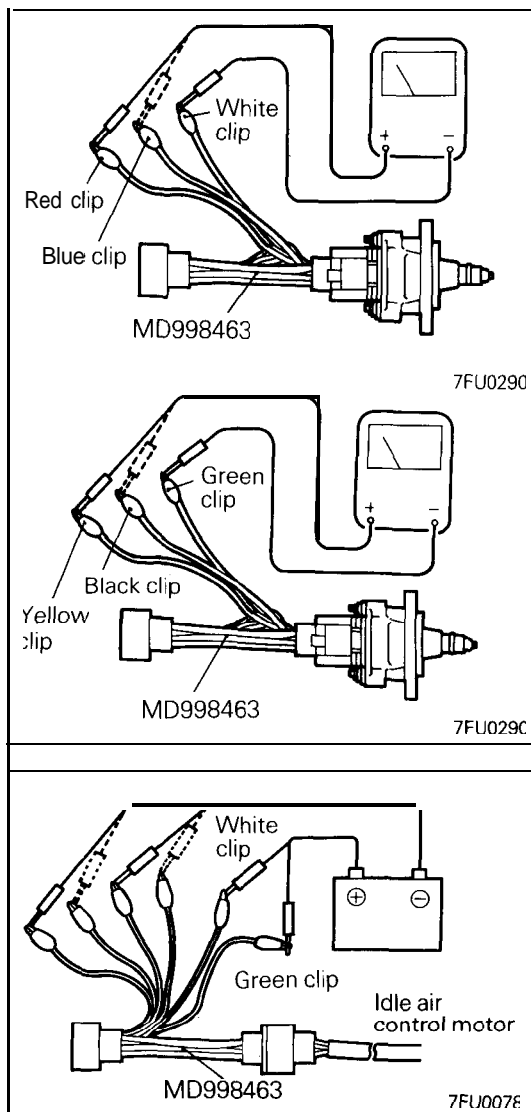
6FU1427

DISASSEMBLY SERVICE POINTS**◊A◊ THROTTLE POSITION SENSOR AND IDLE AIR/SPEED CONTROL MOTOR REMOVAL**

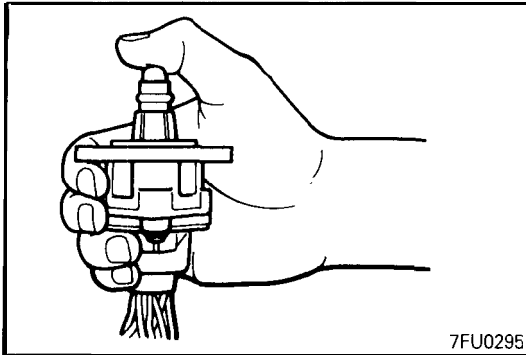
- (1) Do not disassemble the sensor and motor.
- (2) Do not immerse the sensor and motor in cleaning solvent. Clean them with shop towel.

◊B◊ THROTTLE BODY REMOVAL

- (1) Do not remove the throttle valve.
- (2) Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

**Operational Check**

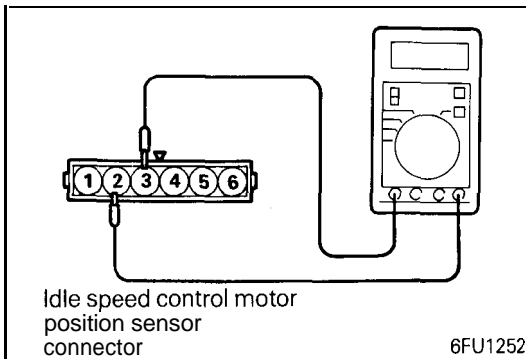
- (1) Connect Test Harness to the idle air control motor connector.
- (2) Connect the positive \oplus terminal of 6 volt battery to white clip and green clip of Test Harness.



(3) Holding the idle air control motor as shown in the illustration, connect the negative \ominus terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.

- ① Connect the negative \ominus terminal of the power supply to the red and black clip.
- ② Connect the negative \ominus terminal of the power supply to the blue and black clip.
- ③ Connect the negative \ominus terminal of the power supply to the blue and yellow clip.
- ④ Connect the negative \ominus terminal of the power supply to the red and yellow clip.
- ⑤ Connect the negative \ominus terminal of the power supply to the red and black clip.
- ⑥ Repeat the tests in sequence from ⑤ to ①.

(4) If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.



IDLE SPEED CONTROL MOTOR POSITION SENSOR – SOHC for GALANT and TRUCK

(1) Measure the resistance between terminals ② and ③

Standard value: 4 – 6 k Ω

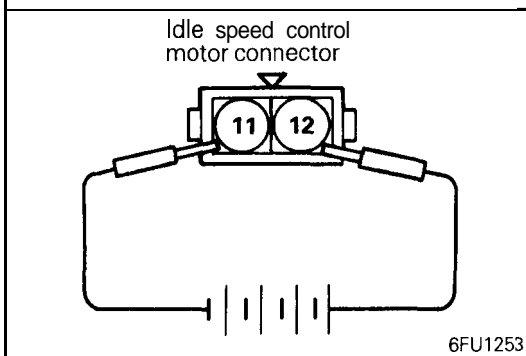
(2) Disconnect the idle speed control motor connector.
 (3) Connect DC 6V between terminals ⑪ and ⑫ of the idle speed control motor connector, and then measure the resistance between terminals ③ and ⑤ of the idle speed control motor position sensor connector when the idle speed control motor is activated (caused to extend and retract).

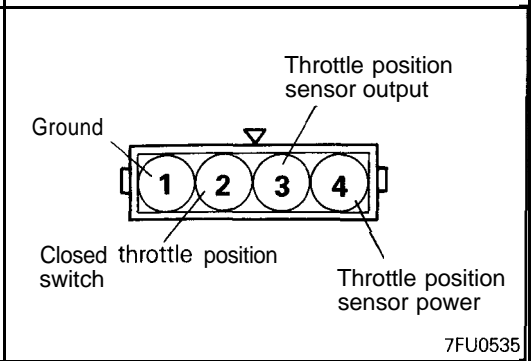
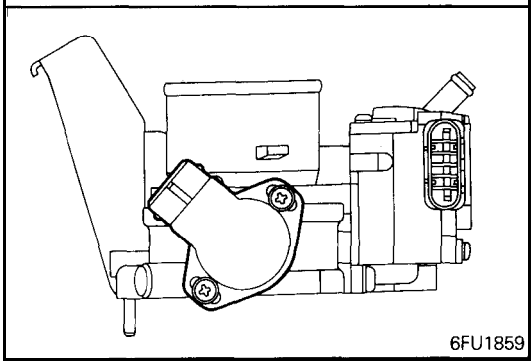
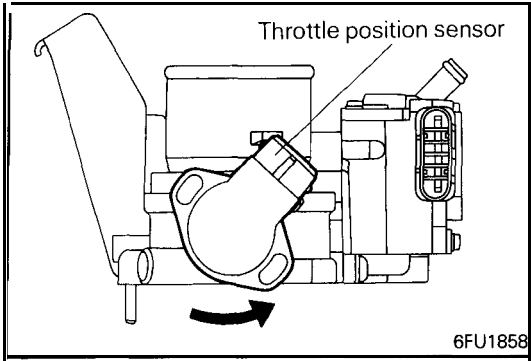
Standard value: It should decrease smoothly as the idle speed control motor plunger retracts.

Caution

Apply only a 6V DC or lower voltage. Application of higher voltage could cause locking of the motor gears.

(4) If there is a deviation from the standard value, or if the change is not smooth, replace the idle speed control motor assembly.





REASSEMBLY SERVICE POINTS

◆A◆ THROTTLE POSITION SENSOR INSTALLATION – SOHC FOR EXPO

(1) Install the throttle position sensor to the throttle body as shown in the illustration.

(2) Turn the throttle position sensor 90° counterclockwise to set it in position and tighten the screws.

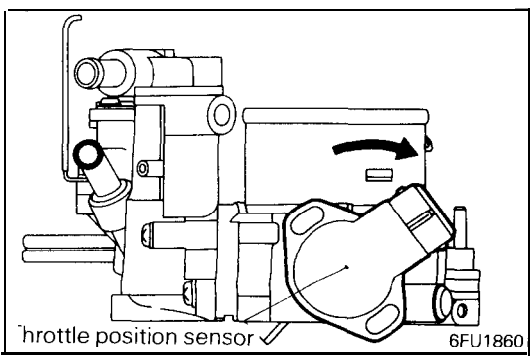
(3) Connect a circuit tester between ① (ground) and ③ (output), or between ② (output) and ④ (power). Then make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.

(4) Check for continuity between terminals ② (closed throttle position switch) and ① (ground) with the throttle valve both fully closed and fully open.

Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

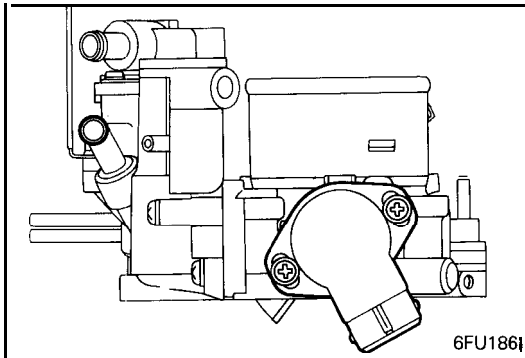
If there is no continuity with the throttle valve fully closed, turn the throttle position sensor clockwise, and then check again.

(5) If the above specifications are not met, replace the throttle position sensor.

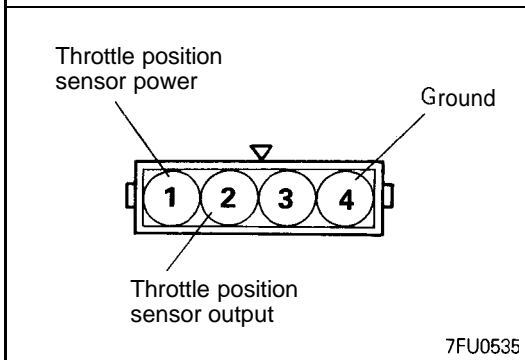


◆B◆ THROTTLE POSITION SENSOR INSTALLATION – GALANT, ECLIPSE, MIRAGE, TRUCK

(1) Install the throttle position sensor to the throttle body as shown in the illustration.



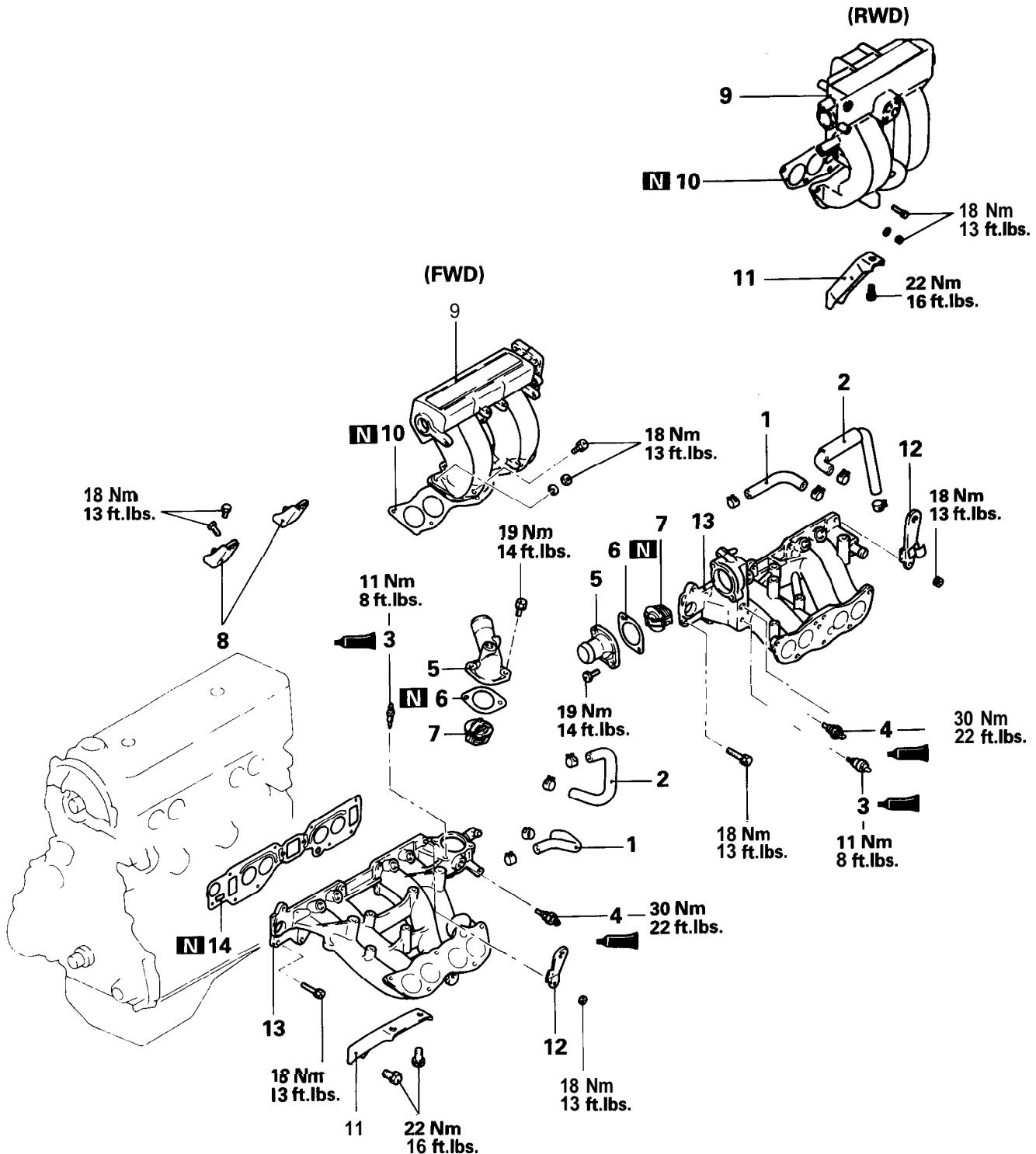
- (2) Turn the throttle position sensor 90° clockwise to set it and tighten the screws.



- (3) Connect a circuit tester between ④ (ground) and ② (output), or between ② (output) and ① (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.

INTAKE MANIFOLD

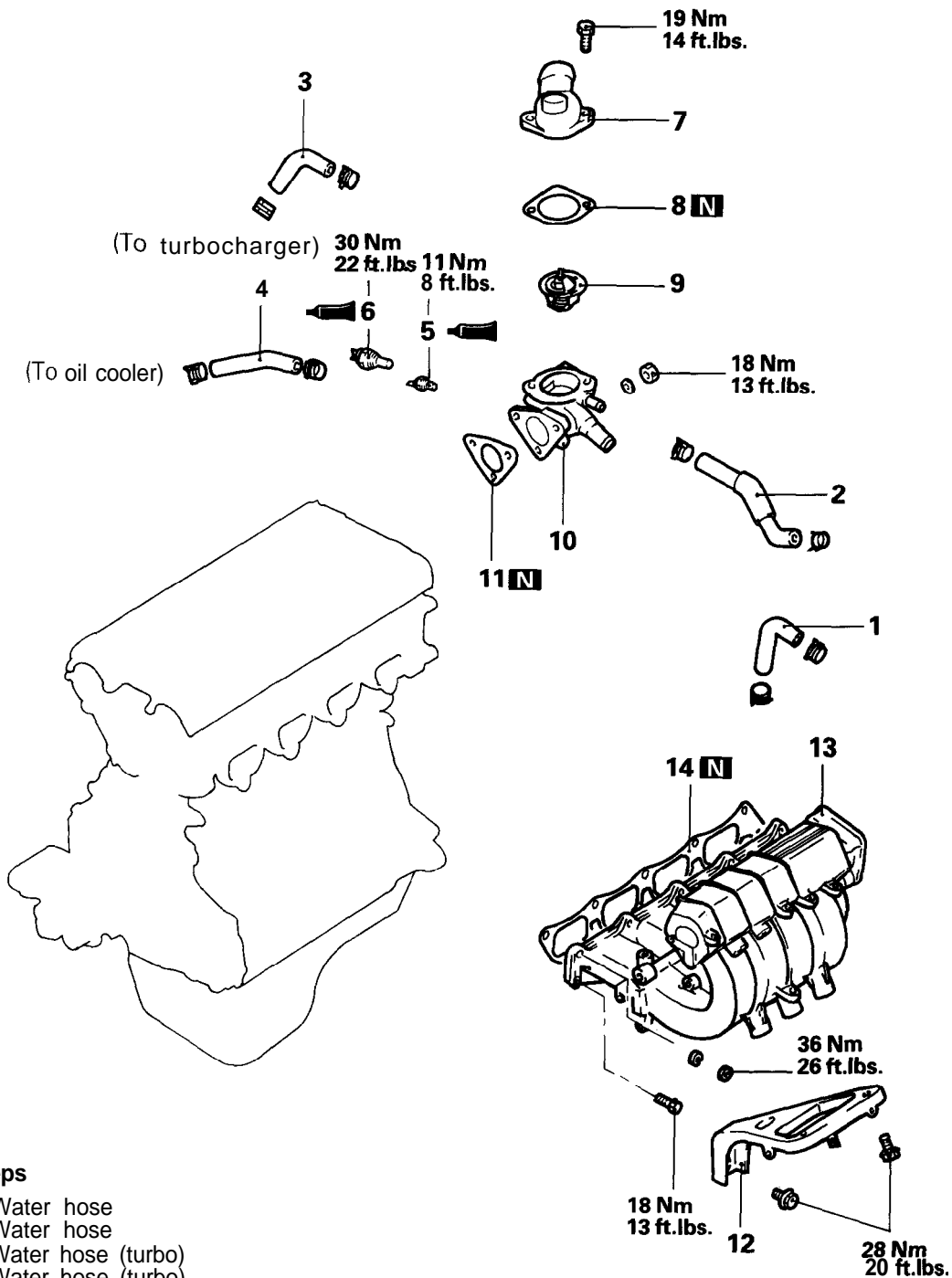
REMOVAL AND INSTALLATION – SOHC



Removal steps

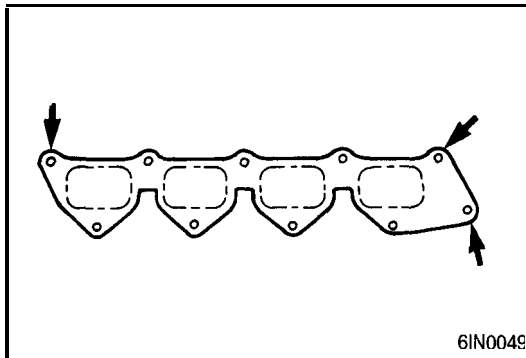
- | | |
|--|-----------------------------------|
| 1. Water hose | 8. Intake manifold plenum stay |
| 2. Water hose | 9. Intake manifold plenum |
| ▶D▶ 3. Engine coolant temperature gauge unit | 10. Intake manifold plenum gasket |
| ▶C▶ 4. Engine coolant temperature sensor | 11. Intake manifold stay |
| ▶B▶ 5. Water outlet fitting | 12. Engine hanger |
| 6. Gasket | 13. Intake manifold |
| 7. Thermostat | 14. Intake manifold gasket |

REMOVAL AND INSTALLATION – DOHC



Removal steps

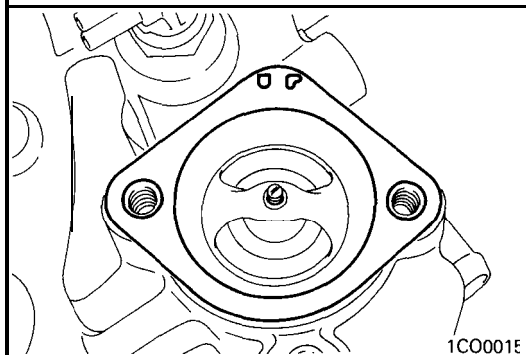
1. Water hose
2. Water hose
3. Water hose (turbo)
4. Water hose (turbo)
- ◆D◆ 5. Engine coolant temperature gauge unit
- ◆C◆ 6. Engine coolant temperature sensor
7. Water outlet fitting
- ◆B◆ 8. Gasket
9. Thermostat
10. Thermostat case
11. Gasket
12. Intake manifold stay
- ◆A◆ 13. Intake manifold
14. Intake manifold gasket



INSTALLATION SERVICE POINTS

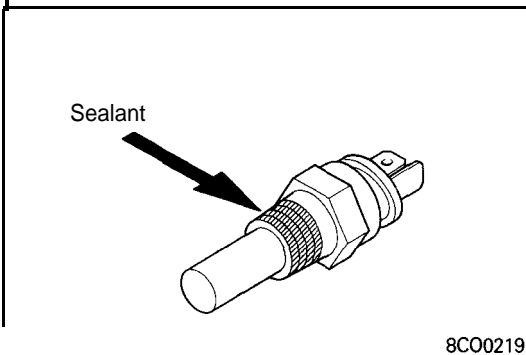
▶A▶ INTAKE MANIFOLD INSTALLATION – DOHC

- (1) Tighten the intake manifold bolts. Note that the bolts installed at the locations indicated in the illustration are tightened to a different torque.



▶B▶ WATER OUTLET FITTING GASKET INSTALLATION (FOR RUBBER COATED METAL GASKET ONLY)

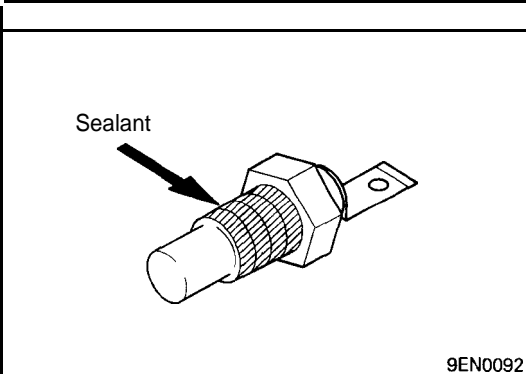
- (1) Install the water outlet fitting gasket with its “UP” mark facing up (toward the water outlet fitting side).



▶C▶ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR

Specified sealant:

3M Nut Locking Part No. 4171 or equivalent

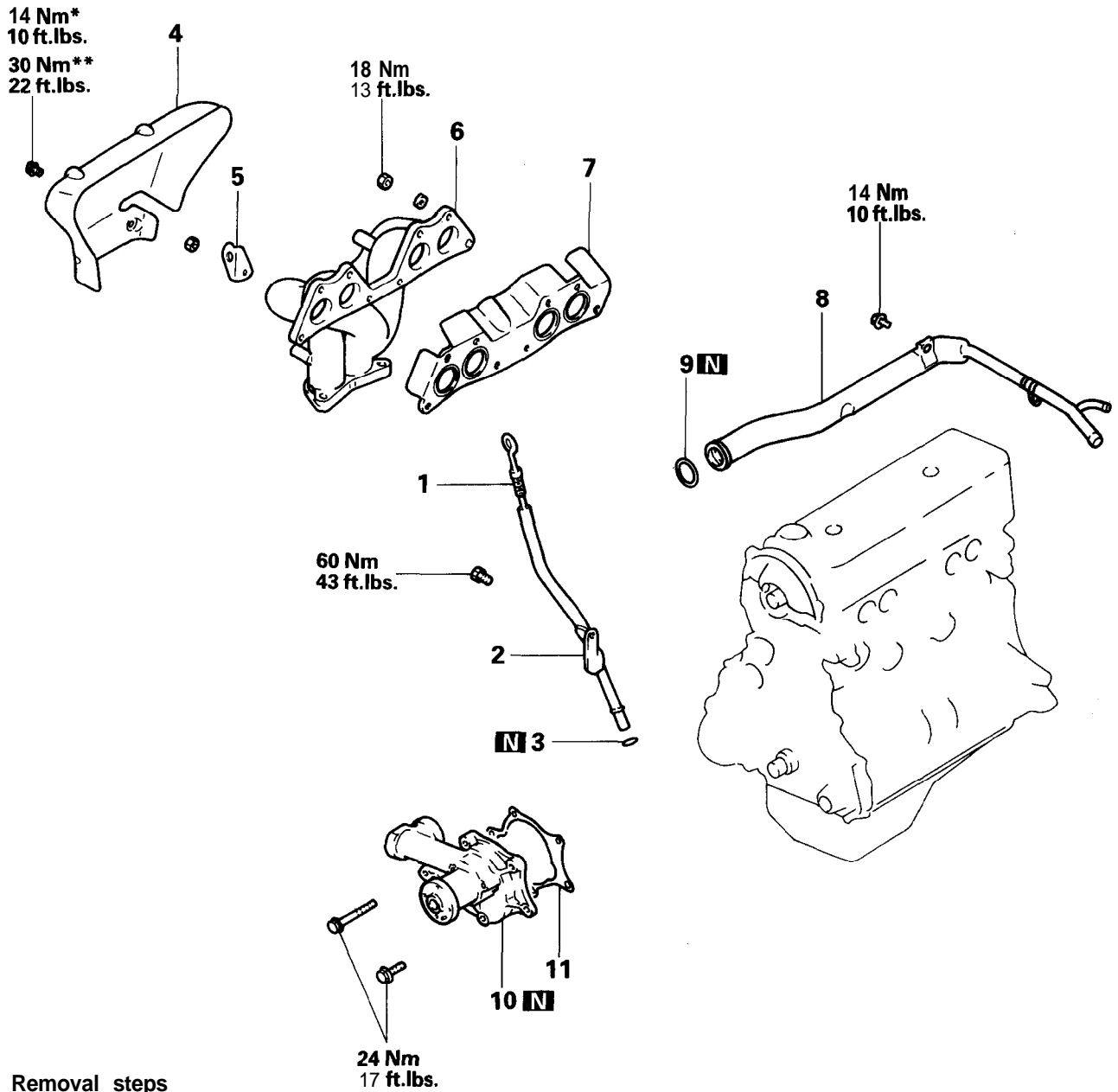


▶D▶ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

Specified sealant: **3M** ATD Part No. 8660 or equivalent

EXHAUST MANIFOLD AND WATER PUMP

REMOVAL AND INSTALLATION – SOHC



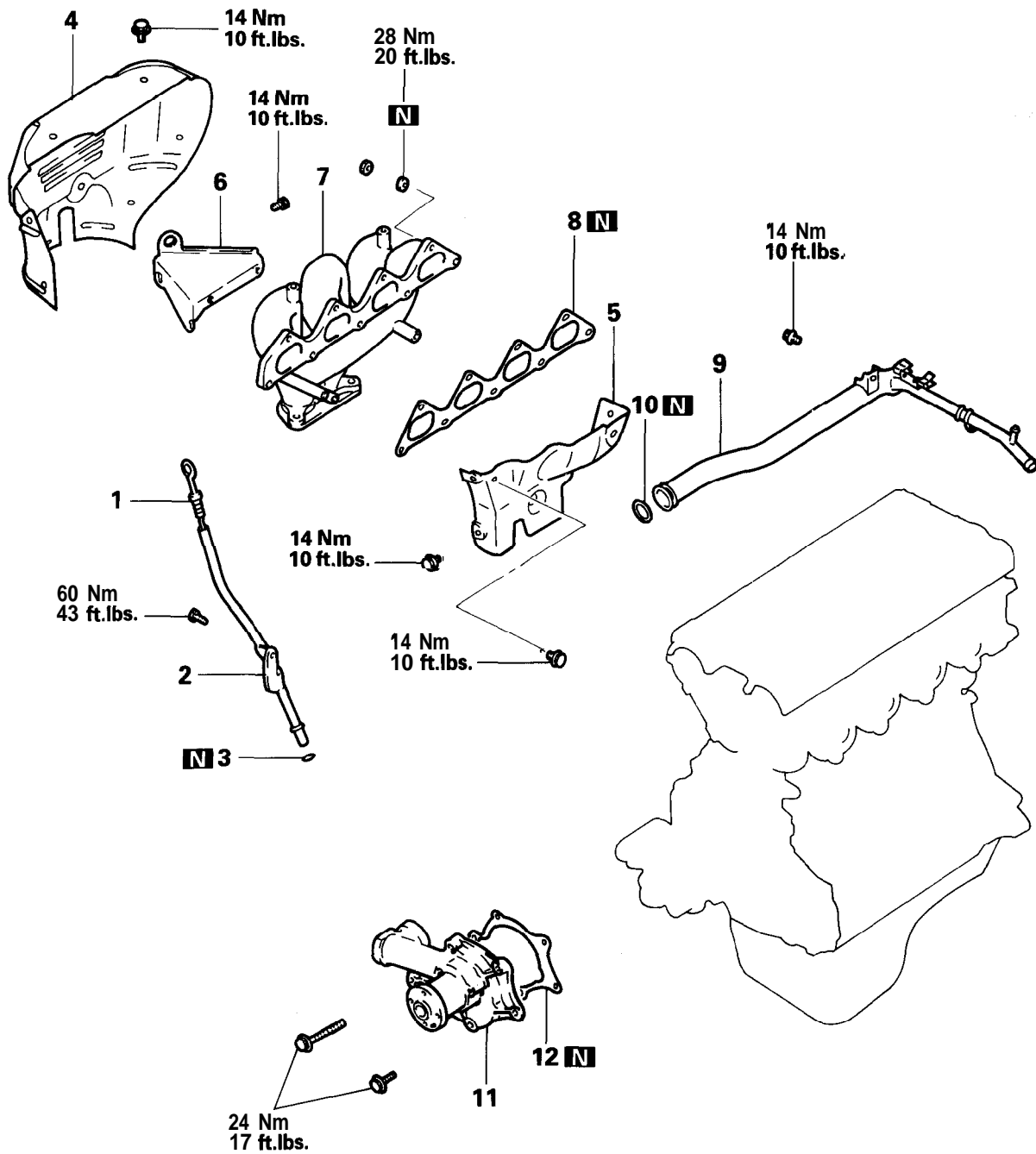
Removal steps

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector
5. Engine hanger
6. Exhaust manifold
7. Exhaust manifold gasket
8. Water inlet pipe
9. O-ring
10. Water pump
11. Water pump gasket

NOTE

- *: GALANT and EXPO
- ** : TRUCK

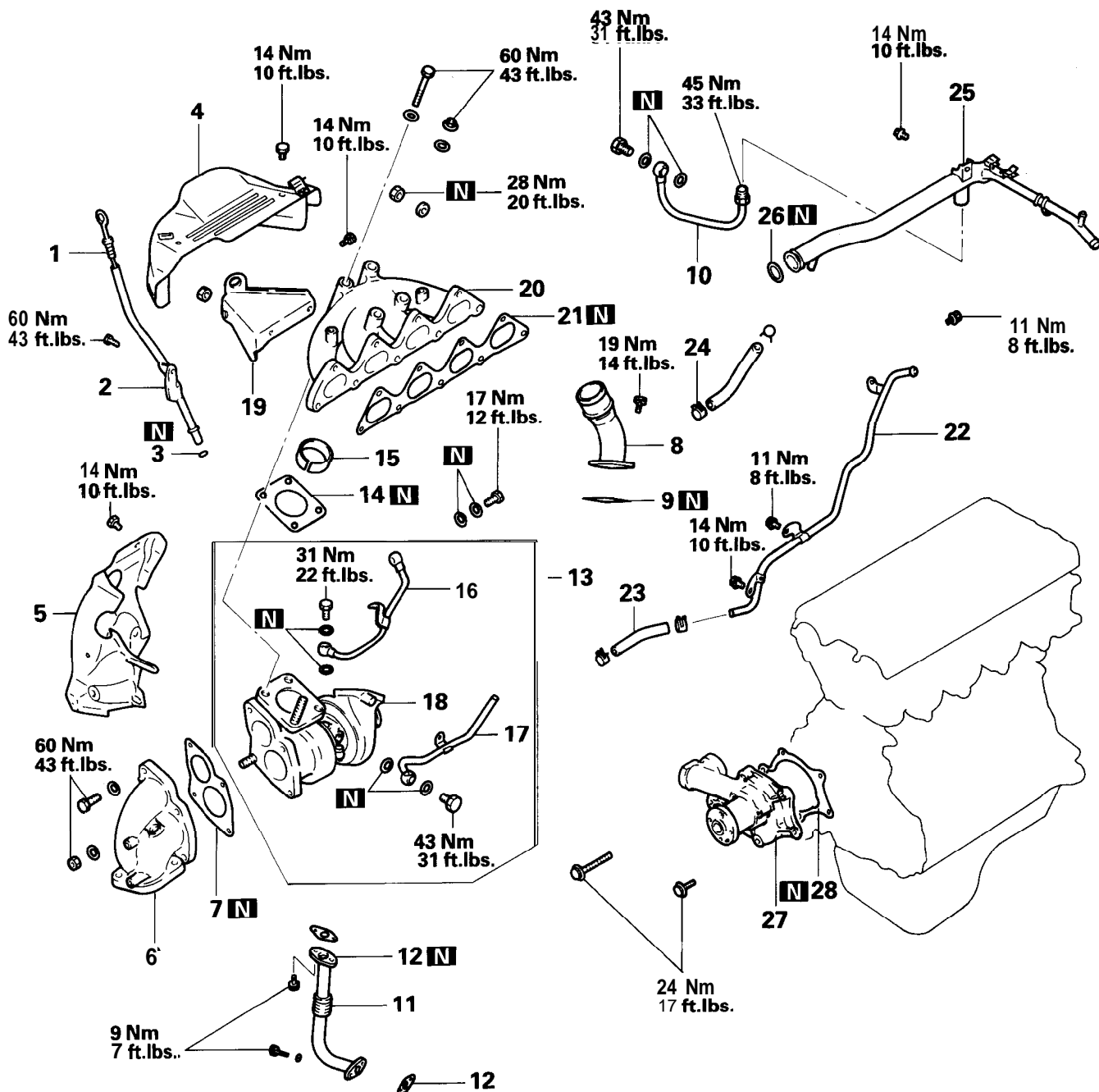
REMOVAL AND INSTALLATION – DOHC FOR NON-TURBO



Removal steps

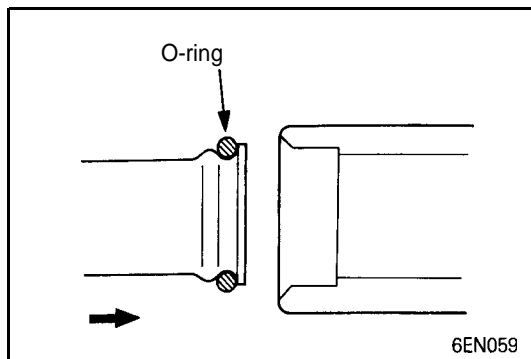
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector "A"
5. Heat protector "B"
6. Engine hanger
7. Exhaust manifold
8. Exhaust manifold gasket
- ▶▶▶ 9. Water inlet pipe
- ▶▶▶ 10. O-ring
11. Water pump
12. Gasket

REMOVAL AND INSTALLATION – DOHC TURBO



Removal steps

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Oil level gauge 2. Oil level gauge guide 3. O-ring 4. Heat protector "A" 5. Heat protector "B" 6. Exhaust fitting 7. Gasket 8. Air outlet fitting 9. Gasket 10. Water pipe "B" 11. Oil return pipe 12. Gasket 13. Turbocharger assembly 14. Gasket | <ul style="list-style-type: none"> 15. Ring 16. Oil pipe 17. Water pipe "A" 18. Turbocharger 19. Engine hanger 20. Exhaust manifold 21. Exhaust manifold gasket 22. Water pipe 23. Water hose 24. Water hose 25. Water inlet pipe 26. O-ring 27. Water pump 28. Gasket |
|--|--|



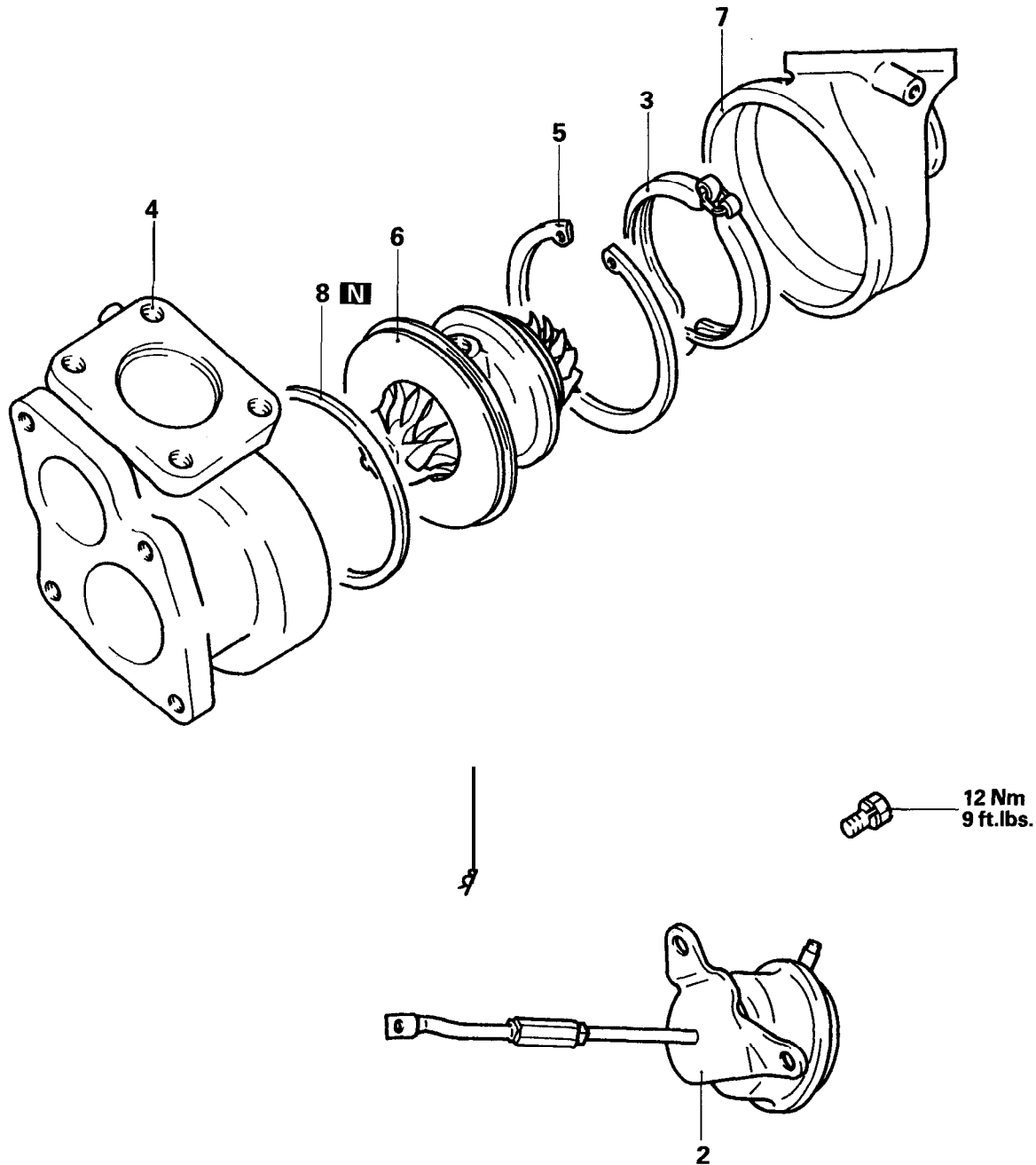
INSTALLATION SERVICE POINT

◆A◆ WATER PIPE/O-RING INSTALLATION

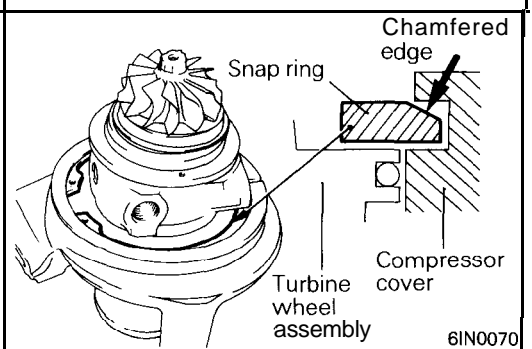
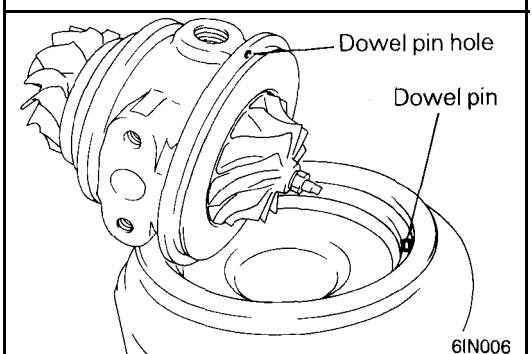
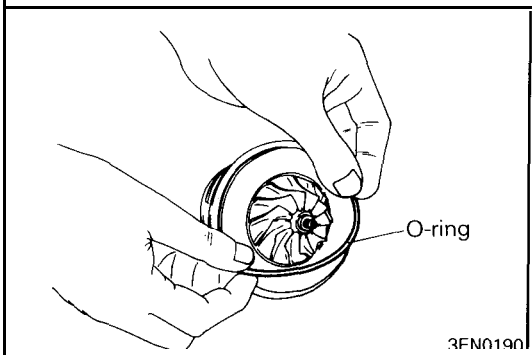
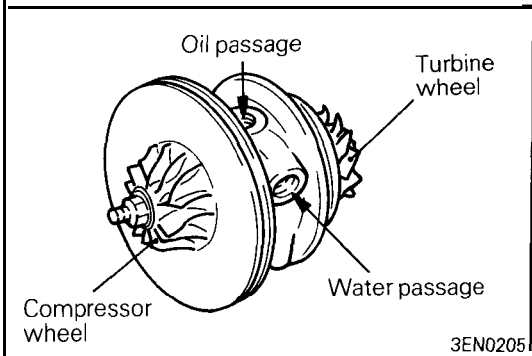
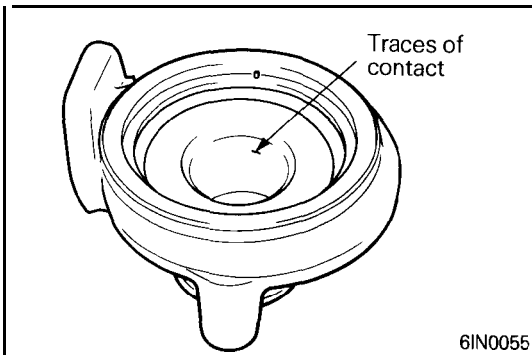
- (1) Wet the O-ring (with water) to facilitate assembly

Caution

Keep the O-ring free of oil or grease.

TURBOCHARGER**DISASSEMBLY AND REASSEMBLY****Disassembly steps**

- ◆F inspection of turbocharger waste gate actuator operation
 1. Snap pin
 2. Turbocharger waste gate actuator
- ◆E 3. Coupling
- ◆D 4. Turbine housing
- ◆C 5. Snap ring
- ◆B 6. Turbine wheel assembly
- 7. Compressor cover
- ◆A 8. O-ring



INSPECTION

TURBINE HOUSING

- (1) Check the housing for traces of contact with the turbine wheel, cracks due to overheating, pitching, deformation and other damage. Replace with a new turbine housing if cracked.
- (2) Operate the waste gate valve lever manually to check that the gate can be opened and closed smoothly.

COMPRESSOR COVER

- (1) Check the compressor cover for traces of contact with the compressor wheel and other damage.

TURBINE WHEEL ASSEMBLY

- (1) Check the turbine and compressor wheel blades for bend, burr, damage, corrosion and traces of contact on the back side and replace if defective.
- (2) Check the oil passage of the turbine wheel assembly for deposit and clogging.
- (3) In the case of water cooled type, check also the water passage for deposit and clogging.
- (4) Check the turbine wheel and compressor wheel for light and smooth turning.

REASSEMBLY SERVICE POINTS

◆A◆ O-RING INSTALLATION

- (1) Apply a light coat of engine oil to a new O-ring and fit the O-ring in the groove of the turbine wheel assembly.

◆B◆ TURBINE WHEEL ASSEMBLY INSTALLATION

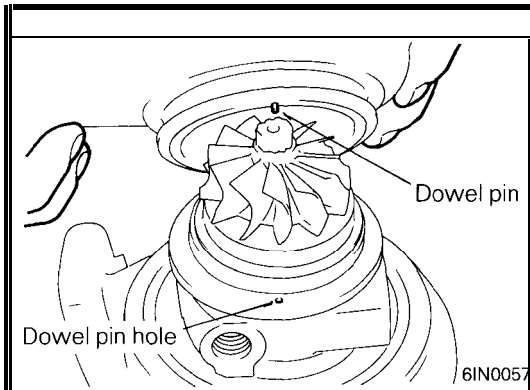
- (1) Install the turbine wheel assembly to the compressor cover while aligning the dowel pin with the dowel pin hole.

Caution

Use care not to damage the blades of turbine wheel and compressor wheel.

◆C◆ SNAP RING INSTALLATION

- (1) Fit the snap ring with its chamfered side facing up.

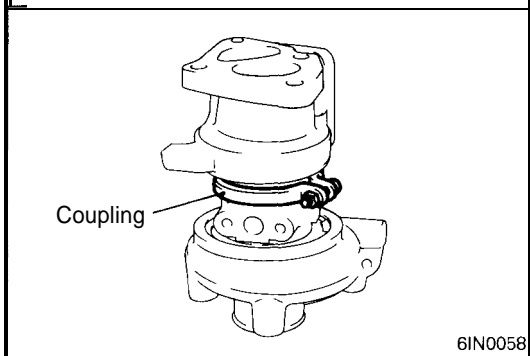


◆D◆ TURBINE HOUSING INSTALLATION

- (1) Install the turbine housing on the compressor cover while aligning the dowel pin with the dowel pin hole.

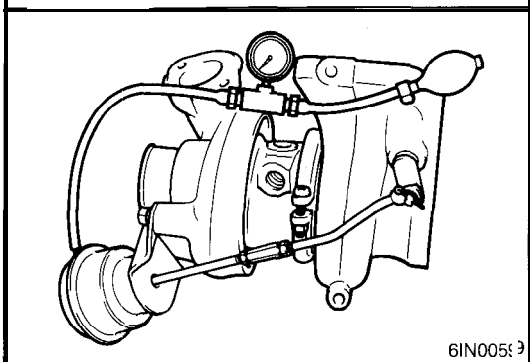
Caution

Use care not to damage the blades of the turbine wheel.



◆E◆ COUPLING INSTALLATION

- (1) Install the coupling and tighten it to the specified torque.



◆F◆ WASTE GATE ACTUATOR OPERATION CHECK

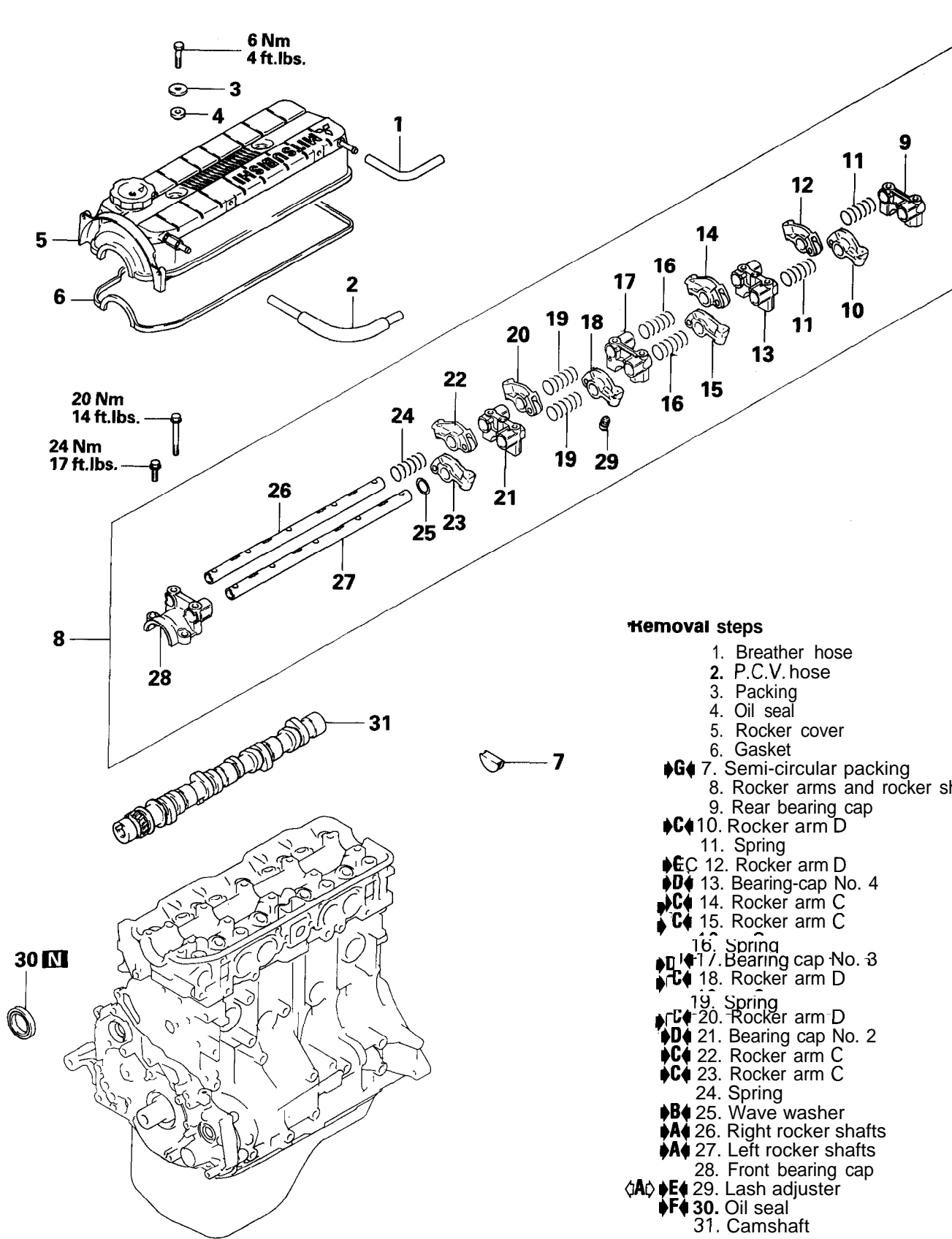
- (1) Using a tester, apply a pressure of approx. 72 kPa (10.3 psi) to the actuator and make sure that the rod moves.

Caution

Do not apply a pressure of more than 85 kPa (12.4 psi) to the actuator. Otherwise, the diaphragm may be damaged. Never attempt to adjust the waste gate valve.

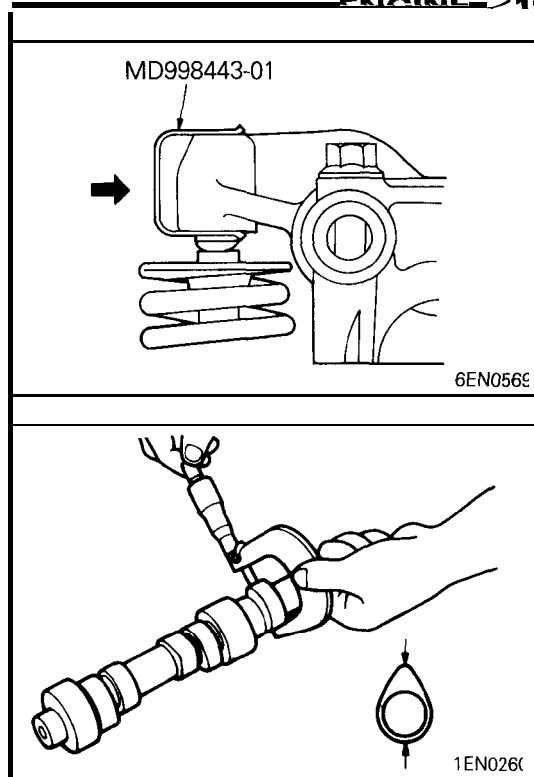
ROCKER ARMS AND CAMSHAFT – SOHC

REMOVAL AND INSTALLATION



Removal steps

1. Breather hose
2. P.C.V. hose
3. Packing
4. Oil seal
5. Rocker cover
6. Gasket
- ↗G↘ 7. Semi-circular packing
8. Rocker arms and rocker shafts
9. Rear bearing cap
- ↗C↘ 10. Rocker arm D
11. Spring
- ↗EC↘ 12. Rocker arm D
- ↗D↘ 13. Bearing-cap No. 4
- ↗C↘ 14. Rocker arm C
- ↗C↘ 15. Rocker arm C
16. Spring
- ↗D↘ 17. Bearing cap No. 3
- ↗C↘ 18. Rocker arm D
19. Spring
- ↗C↘ 20. Rocker arm D
- ↗D↘ 21. Bearing cap No. 2
- ↗C↘ 22. Rocker arm C
- ↗C↘ 23. Rocker arm C
24. Spring
- ↗B↘ 25. Wave washer
- ↗A↘ 26. Right rocker shafts
- ↗A↘ 27. Left rocker shafts
28. Front bearing cap
- ↗A↘ ↗E↘ 29. Lash adjuster
- ↗F↘ 30. Oil seal
31. Camshaft



REMOVAL SERVICE POINT

ROCKER ARM AND CAMSHAFT REMOVAL

- Before removing rocker arms and shafts assembly, install the special tool as illustrated to prevent adjuster from dropping.

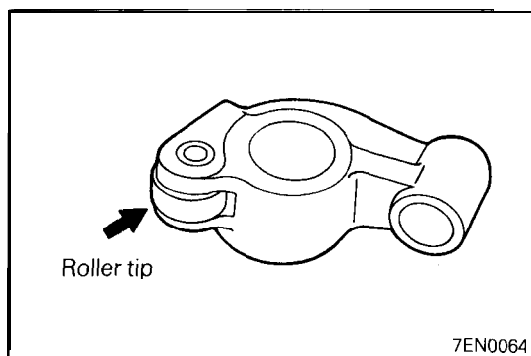
INSPECTION CAMSHAFT

- Measure the cam height

Identification mark	Standard value	Limit
D: Intake	42.40 (1.6692)	41.90 (1.6496)
Exhaust	42.40 (1.6692)	41.90 (1.6496)
AR: Intake	44.53 (1.7531)	44.03 (1.7335)
Exhaust	44.53 (1.7531)	44.03 (1.7335)

NOTE

The camshaft identification mark is stamped on the opposite end of the camshaft sprocket side.



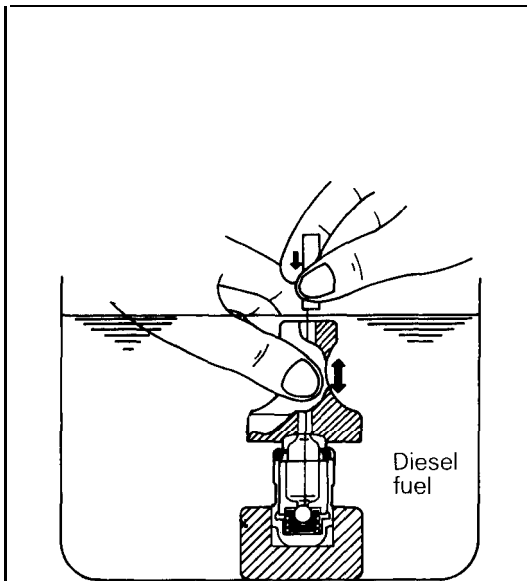
ROCKER ARM

- Check the roller surface. If any dent, damage or seizure is evident, replace the rocker arm.
- Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace the rocker arm.
- Check the inside diameter. If damage or seizure is evident, replace the rocker arm.

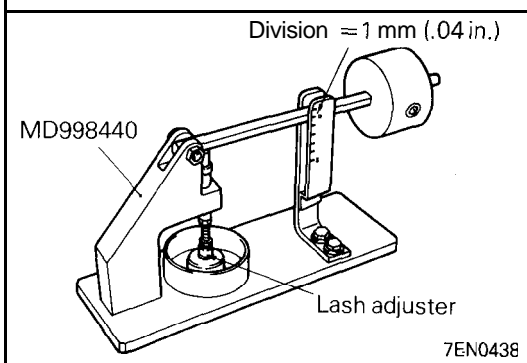
LASH ADJUSTER LEAK DOWN TEST

Caution

- The lash adjuster is a precision part. Keep it free from dust and other foreign matters.
- Do not disassemble the lash adjusters.
- When cleaning the lash adjusters, use clean diesel fuel only.



6EN057I



7EN0438

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) While lightly pushing down the inner steel ball using a small wire, move the plunger up and down four or five times to bleed air.
Use of the retainer facilitates the air bleeding of a rocker arm mounted type lash adjuster.
- (3) Remove the small wire and press the plunger. If the plunger is hard to be pushed in, the lash adjuster is normal. If the plunger can be pushed in all the way readily, bleed the lash adjuster again and test again. If the plunger is still loose, replace the lash adjuster.

Caution

Upon completion of air bleeding, hold the lash adjuster upright to prevent inside diesel fuel from spilling.

- (4) After air bleeding, set the lash adjuster on the special tool (Leak down tester MD998440).
- (5) After the plunger has gone down somewhat (.2 – .5 mm), measure time taken for it to go down 1 mm. Replace if the measured time is out of the specification.

Standard value: 4 – 20 seconds / 1 mm (.04 in.)
[Diesel fuel at 15 – 20°C (59 – 68°F)]

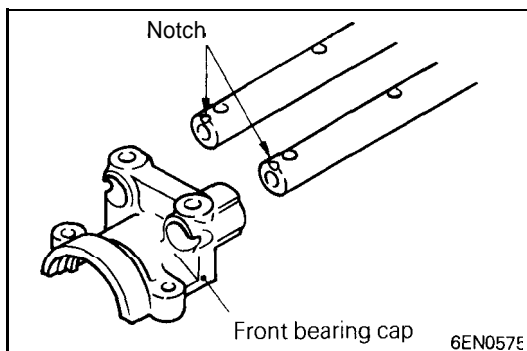
INSTALLATION SERVICE POINTS CAMSHAFT IDENTIFICATION

Identification:

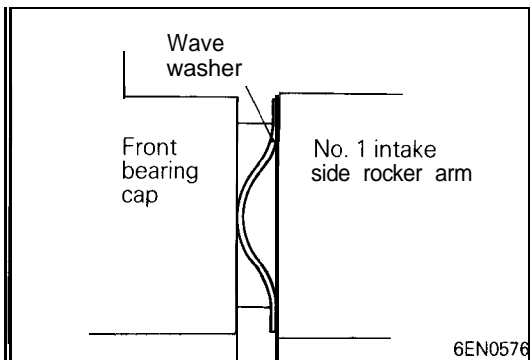
E X P O / GALANT A R
TRUCK D

▶▶ ROCKER SHAFT INSTALLATION

- (1) Insert the rocker arm shaft into the front bearing cap with the notch on the shaft facing up, and insert the installation bolt without tightening it.

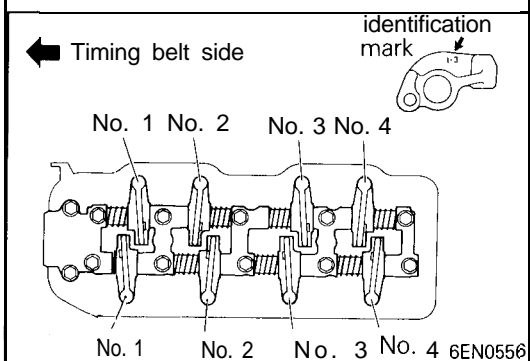


6EN057E



▶B▶ WAVE WASHER INSTALLATION

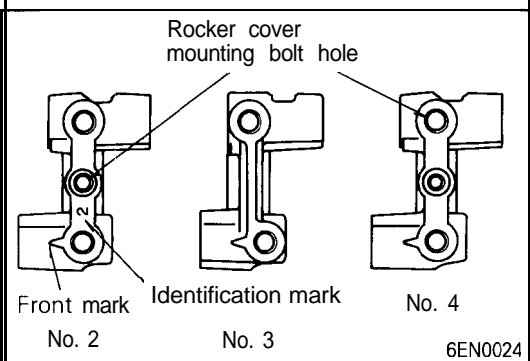
- (1) Install the wave washer in the correct direction as shown.



▶C▶ ROCKER ARM IDENTIFICATION

Identification mark:

- 1 - 3 for No. 1 and 3 cylinders
2 - 4 for No. 2 and 4 cylinders



▶D▶ CAMSHAFT BEARING CAP IDENTIFICATION

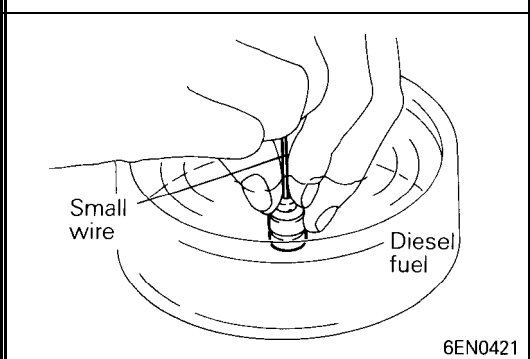
- (1) No. 3 bearing cap looks very similar to No. 2 and No. 4 bearing caps.

Use the identification marks shown at left for identification.

NOTE

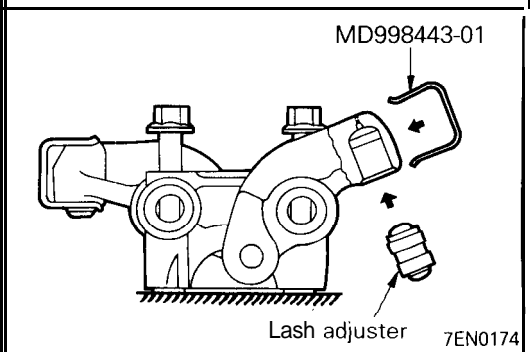
No. 2 bearing cap is the same as No. 4 bearing cap.

- (2) Install the bearing caps with their front marks pointing to camshaft sprocket side.

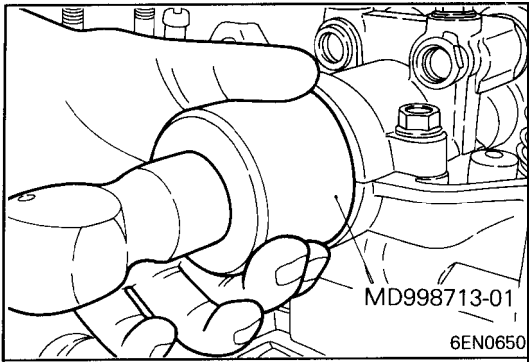


▶E▶ LASH ADJUSTER INSTALLATION

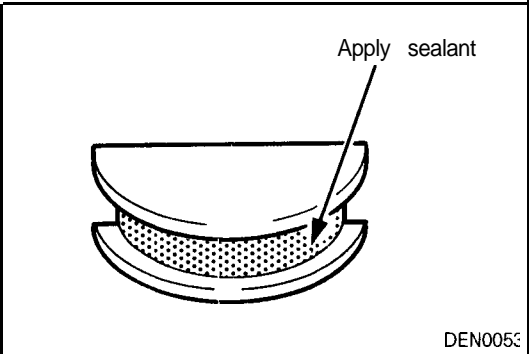
- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) Using a small wire, move the plunger up and down 4 or 5 times while pushing down lightly on the check ball in order to bleed out the air.



- (3) Insert the lash adjuster to rocker arm, being careful not to spill the diesel fuel. Use the special tool to prevent adjuster from falling while installing it.

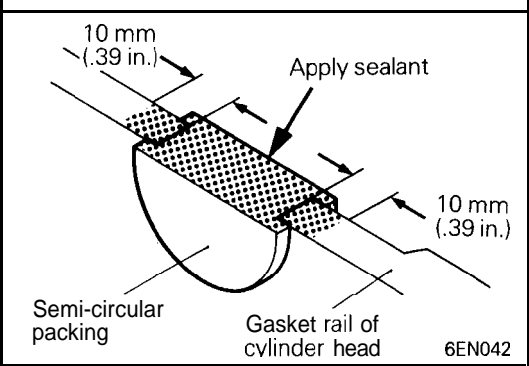


◆F◆ CAMSHAFT OIL SEAL INSTALLATION



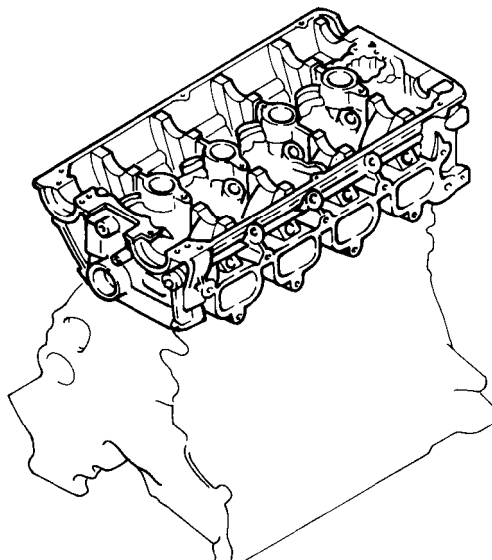
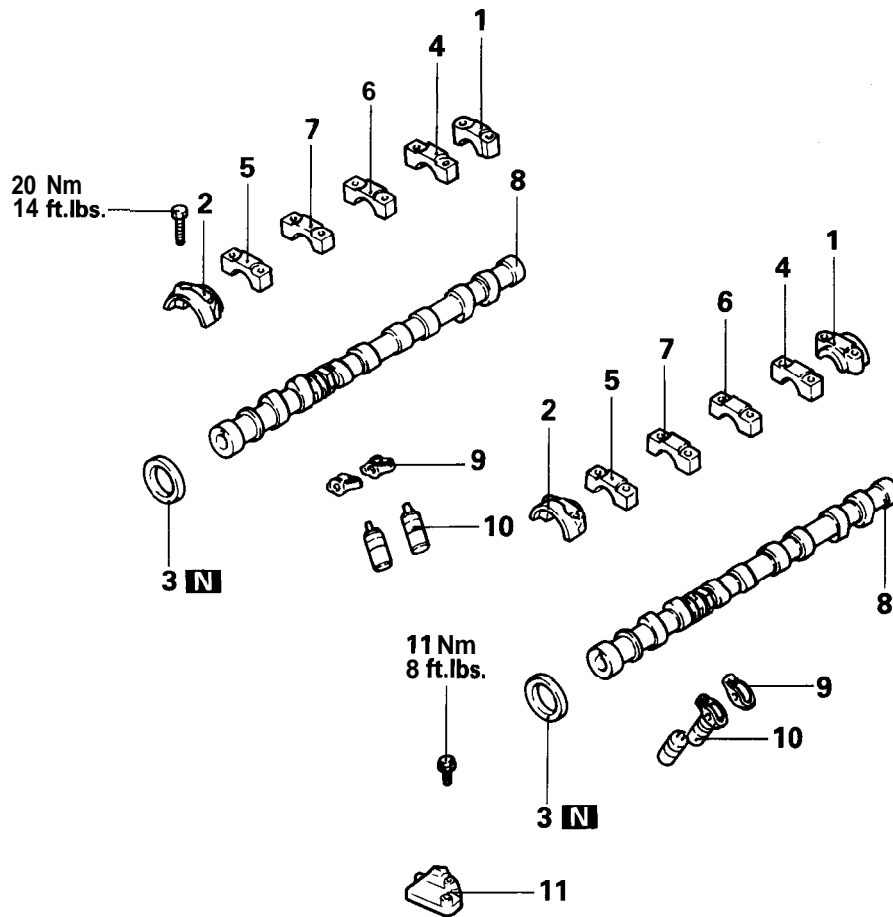
◆G◆ SEMI-CIRCULAR PACKING INSTALLATION

Specified sealant:
3M ATD Part No. 8660 or equivalent



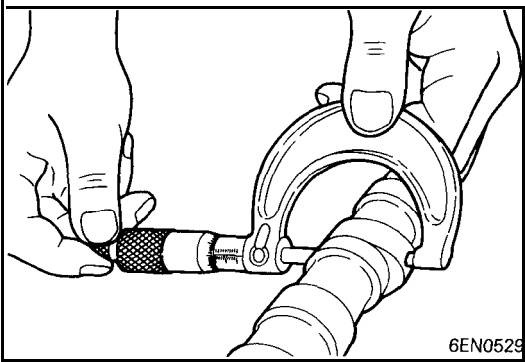
CAMSHAFTS AND ROCKER ARMS – DOHC

REMOVAL AND INSTALLATION



Removal steps

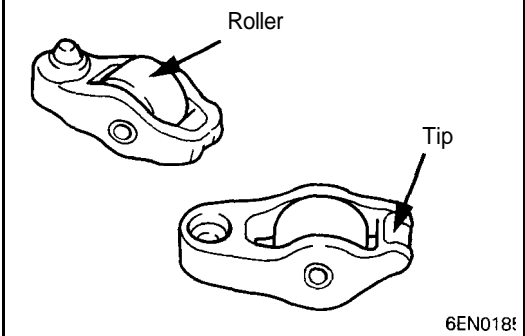
- ➡C 1. Bearing cap rear
- ➡C 2. Bearing cap front
- ➡D 3. Camshaft oil seal
- ➡C 4. Bearing cap No. 5
- ➡C 5. Bearing cap No. 2
- ➡C 6. Bearing cap No. 4
- ➡C 7. Bearing cap No. 3
- ➡B 8. Camshaft
- ➡B 9. Rocker arm
- ➡A 10. Lash adjuster
- 11. Oil delivery body

**INSPECTION****CAMSHAFT**

(1) Measure the cam height.

Identification mark	Standard value	Limit
Intake A,D B,C,F,F	35.49 (1.3972)	34.99 (1.3776)
	35.20 (1.3858)	34.70 (1.3661)
Exhaust A C	35.49 35.20 (1.3972) (1.3858)	34.99 34.70 (1.3776) (1.3661)
	E,F	35.91 (1.3744)

The camshaft identification mark is stamped on the rear end of camshaft.

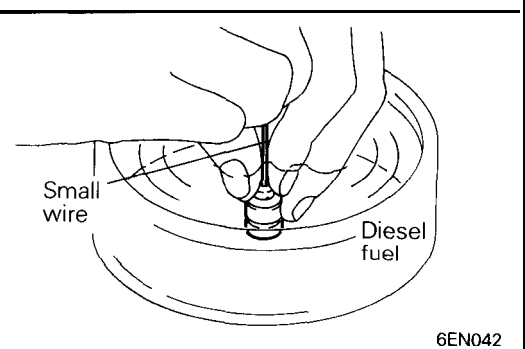
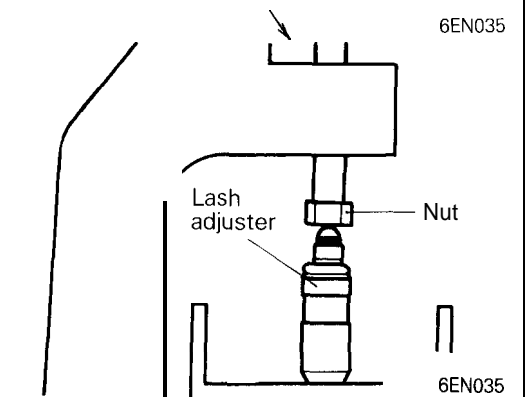
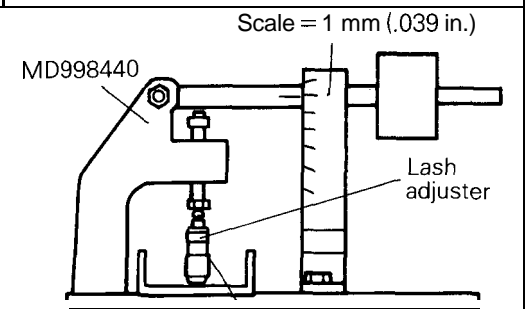
**ROCKER ARM**

- (1) Check the roller surface. If any dent, damage or seizure is evident, replace the rocker arm.
- (2) Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace the rocker arm.
- (3) Check the inside diameter. If damage or seizure is evident, replace the rocker arm.

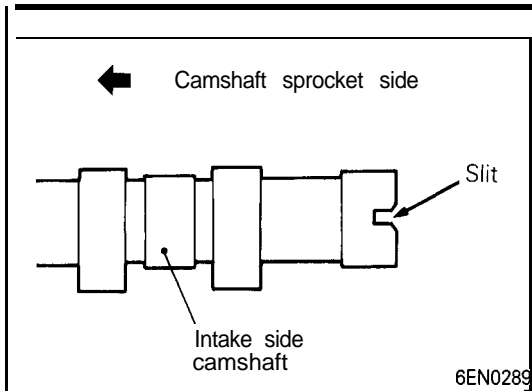
LASH ADJUSTER LEAK DOWN TEST

Refer to "LASH ADJUSTER LEAK DOWN TEST" on pages 11C-67 and 11 C-68 . Also note the following.

When the lash adjuster is set on a tester, remove the adjusting screw of the tester and adjust it to the height of the lash adjuster as shown in the illustration.

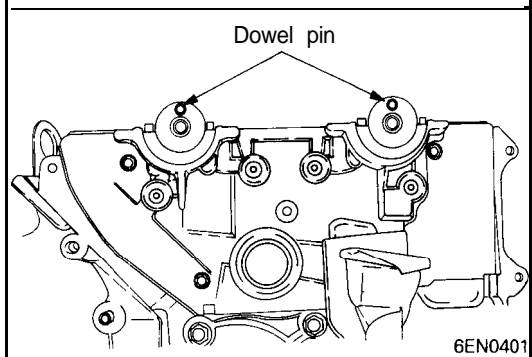
**INSTALLATION SERVICE POINTS****LASH ADJUSTER INSTALLATION**

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) Using a small wire, move the plunger up and down 4 to 5 times while pushing down lightly on the check ball in order to bleed out the air.

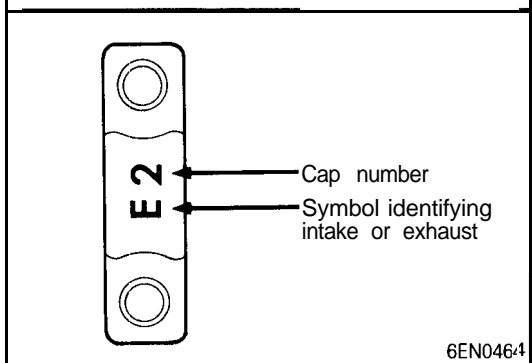


▶B▶ INSTALLATION OF CAMSHAFT

- (1) Apply engine oil to journals and cams of the camshafts.
- (2) Install the camshafts on the cylinder head.
Use care not to confuse the intake camshaft with the exhaust one. The intake camshaft has a slit on its rear end for driving the crankshaft position sensor.

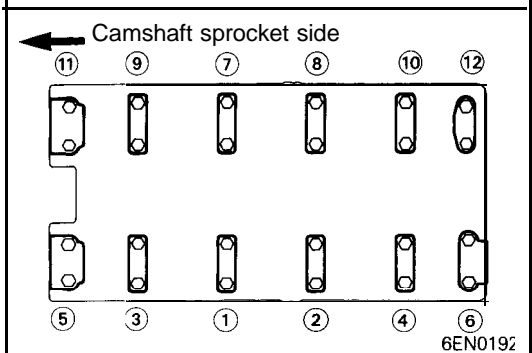


- (3) Install the crankshaft sprocket B or spacer and flange to an end of the crankshaft, and turn the crankshaft until the timing marks are lined up, setting No. 1 cylinder to the TDC.
- (4) Set the camshafts so that their dowel pins are positioned at top.

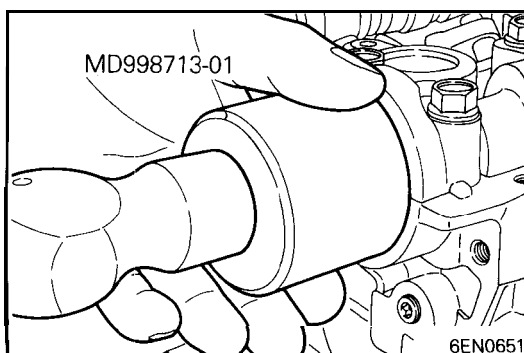


▶C▶ BEARING CAP INSTALLATION

- (1) According to the identification mark stamped on top of each bearing cap, install the caps to the cylinder head. Only "L" or "R" is stamped on No. 1 bearing cap. Cap No. is stamped on No. 2 to No. 5 bearing caps. No. 6 bearing cap has no stamping.
I: For intake camshaft side
E: For exhaust camshaft side



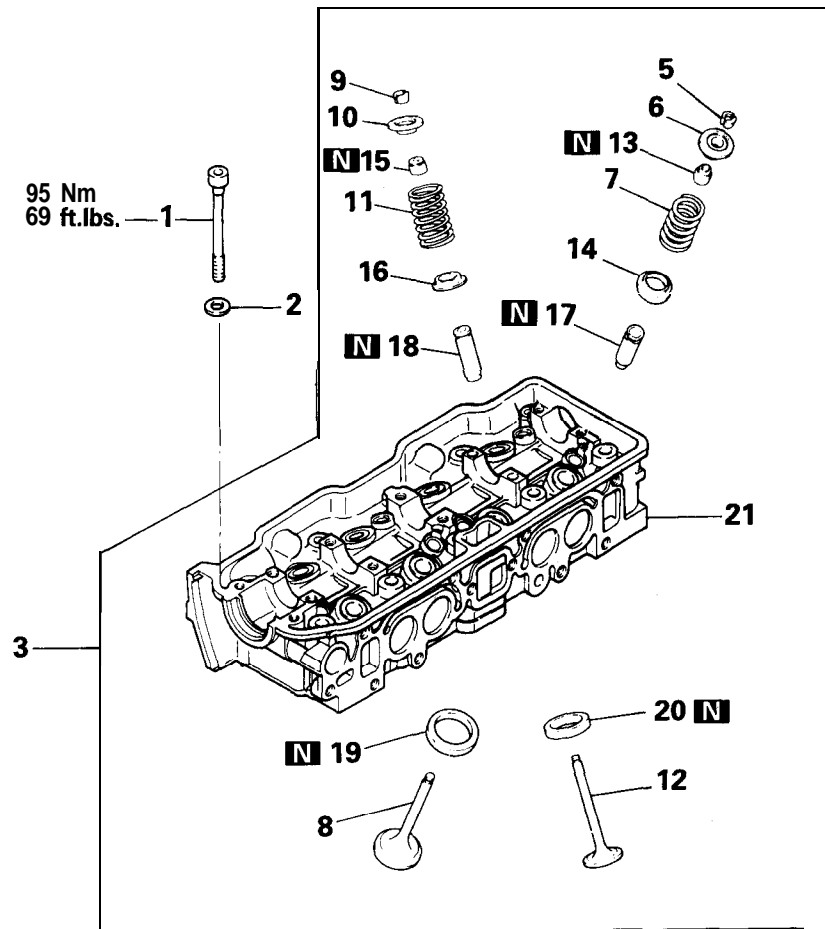
- (2) Tighten the bearing caps in the order shown by torquing progressively in two to three stages.
Tighten to the specification in the final sequence.
- (3) Check to ensure that the rocker arm is held in position on the lash adjuster and valve stem end.



▶D▶ CAMSHAFT OIL SEAL INSTALLATION

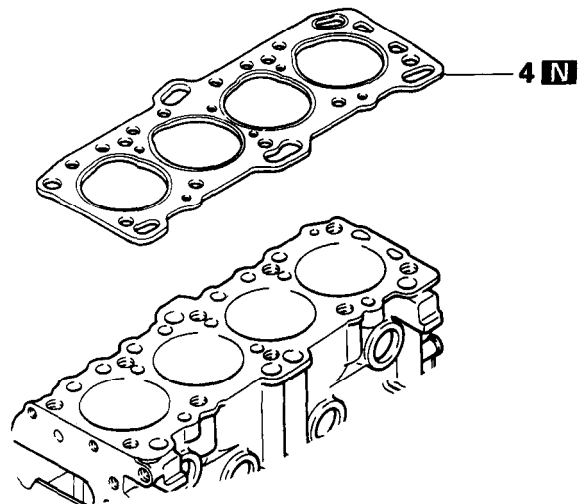
CYLINDER HEAD AND VALVES – SOHC

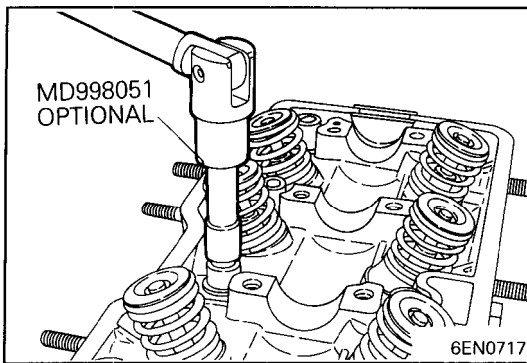
REMOVAL AND INSTALLATION



Removal steps

- ◊A◊▶E◊ 1. Cylinder head bolt
- ▶ 2. Washer
- ▶ 3. Cylinder head assembly
- ▶D◊▶ 4. Gasket
- ◊B◊▶C◊ 5. Retainer lock
- ▶ 6. Valve spring retainer
- ▶B◊▶ 7. Valve spring
- ▶ 8. Intake valve
- ◊B◊▶C◊ 9. Retainer lock
- ▶ 10. Valve spring retainer
- ▶B◊▶ 11. Valve spring
- ◊C◊▶A◊ 12. Exhaust valve
- ▶ 13. Valve stem seal
- ▶ 14. Valve spring seat
- ◊C◊▶A◊ 15. Valve stem seal
- ▶ 16. Valve spring seat
- ▶ 17. Intake valve guide
- ▶ 18. Exhaust valve guide
- ▶ 19. Intake valve seat
- ▶ 20. Exhaust valve seat
- ▶ 21. Cylinder head

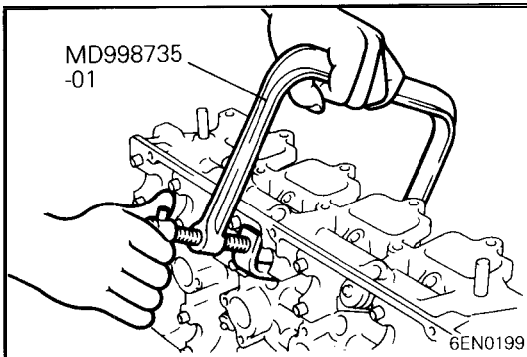


**REMOVAL SERVICE POINTS****PRECAUTION FOR REMOVED PARTS**

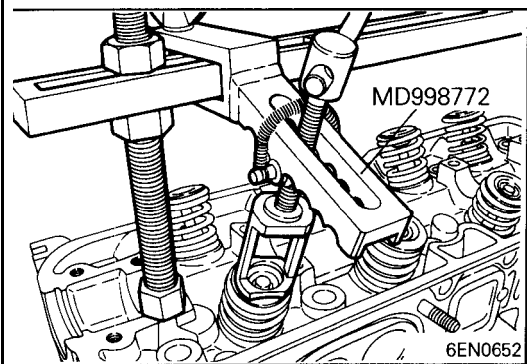
- (1) Keep removed parts in order according to the cylinder number and intake/exhaust.

◁A▷ CYLINDER HEAD BOLT REMOVAL

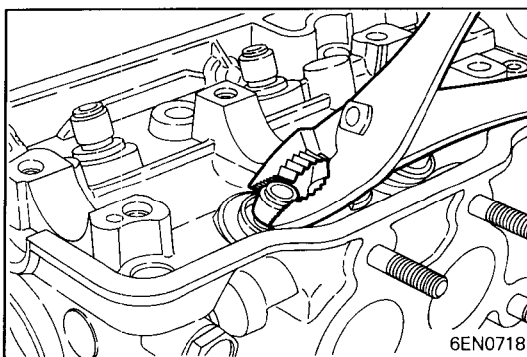
- (1) Using the special tool, loosen the cylinder head bolts. Loosen evenly, little by little.

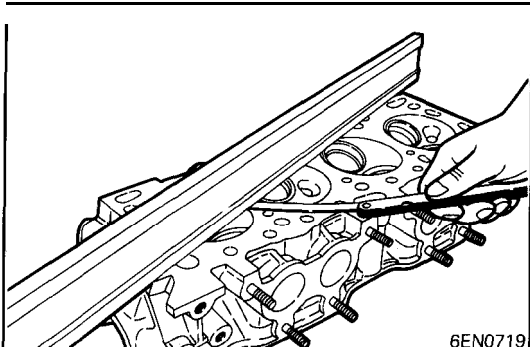
**◁B▷ RETAINER LOCK REMOVAL**

- (1) Using the special tool, compress the spring.
- (2) Remove the retainer locks. Keep removed parts in order according to the cylinder number and intake/exhaust.

**◁C▷ VALVE STEM SEAL REMOVAL**

- (1) Do not reuse valve stem seal.



**INSPECTION****CYLINDER HEAD**

- (1) Check the cylinder head gasket surface for flatness by using a straightedge in the directions of A through G shown in the illustration.

Standard value: 0.05 mm (.0020 in.)

Limit: 0.2 mm (.008 in.)

- (2) If the service limit is exceeded, correct to meet the specification.

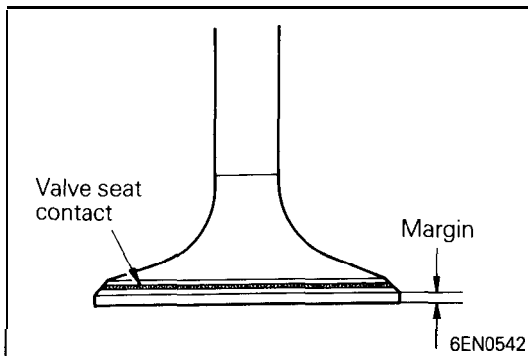
Grinding limit: *0.2 mm (.008 in.)

Caution

*** Total resurfacing depth of both cylinder head and cylinder block.**

Cylinder head height (Specification when new):

89.9 – 90.1 mm (3.539 – 3.547 in.)

**VALVE**

- (1) Check the valve face for correct contact. If incorrect, reface using a valve refacer. The valve seat contact should be maintained uniform at the center of the valve face.
- (2) If the margin exceeds the service limit, replace the valve.

Standard value:

Intake 1.2 mm (.047 in.)

Exhaust 2.0 mm (.079 in.)

Limit:

Intake 0.7 mm (.028 in.)

Exhaust 1.5 mm (.059 in.)

VALVE SPRING

- (1) Measure the free height of spring and, if it is smaller than the limit, replace.

Identification color: White

Standard value: 49.8 mm (1.961 in.)

Limit: 48.8 mm (1.922 in.)

- (2) Measure the squareness of the spring and, if the limit is exceeded, replace.

Standard value: 2" or less

Limit: Max. 4"

VALVE GUIDE

- (1) Measure the clearance between the valve guide and valve stem. If the limit is exceeded, replace the valve guide or valve, or both.

Standard value:

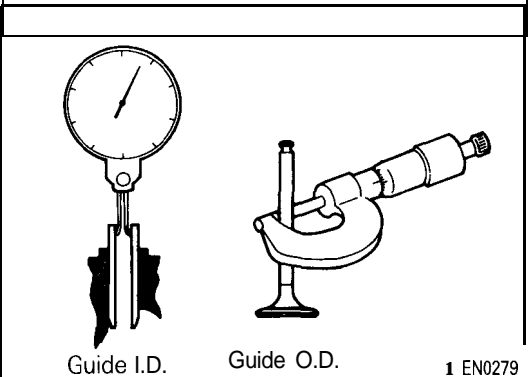
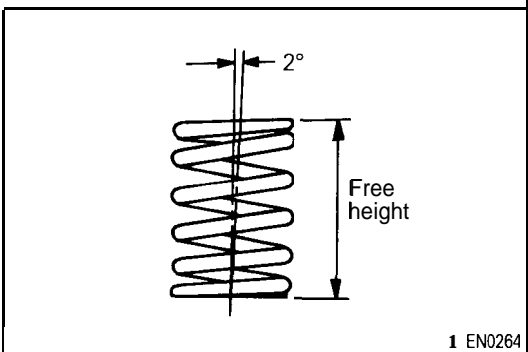
Intake 0.02 – 0.06 mm (.0008 – .0024 in.)

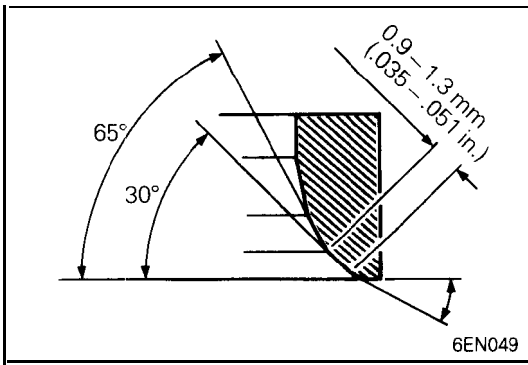
Exhaust 0.05 – 0.09 mm (.0020 – .0035 in.)

Limit:

Intake 0.10 mm (.004 in.)

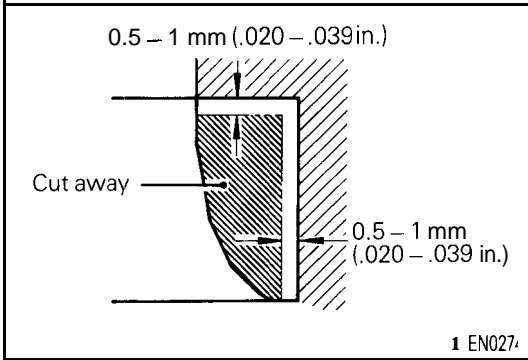
Exhaust 0.15 mm (.006 in.)





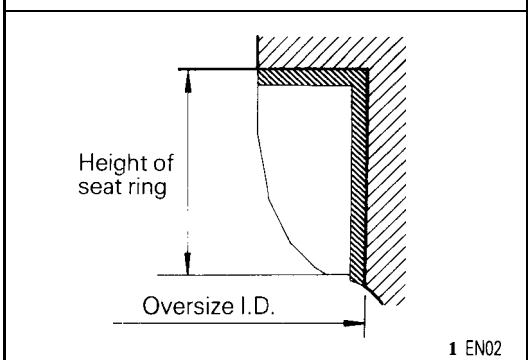
VALVE SEAT RECONDITIONING PROCEDURE

- (1) Before correcting the valve seat, check for clearance between the valve guide and valve and, if necessary, replace the valve guide.
- (2) Using the special tool or seat grinder, correct to obtain the specified seat width and angle.
- (3) After correction, valve and valve seat should be lapped with a lapping compound.



VALVE SEAT REPLACEMENT PROCEDURE

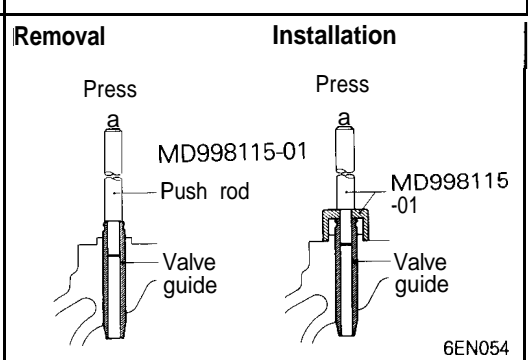
- (1) Cut the valve seat to be replaced from the inside to thin the wall thickness. Then, remove the valve seat.



- (2) Rebore the valve seat hole in the cylinder head to a selected oversized valve seat diameter.

Seat ring hole diameter: See "Service Specifications" on page 11C-10.

- (3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C (482°F) or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.
- (4) Using a valve seat cutter, correct the valve seat to the specified width and angle.
See "VALVE SEAT RECONDITIONING PROCEDURE".



VALVE GUIDE REPLACEMENT PROCEDURE

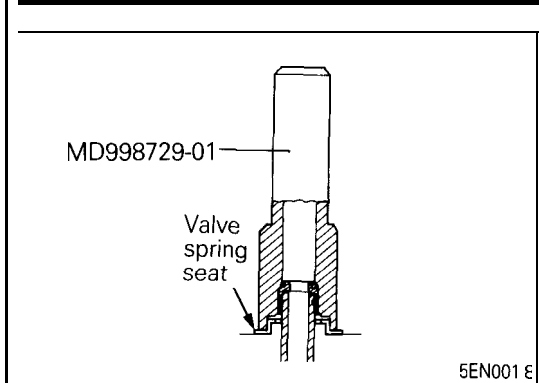
- (1) Using the special tool and a press, remove the valve guide toward cylinder head gasket surface.
- (2) Rebore valve guide hole to the new oversized valve guide outside diameter.

Valve guide hole diameter: See "Service Specifications" on page 11C-10.

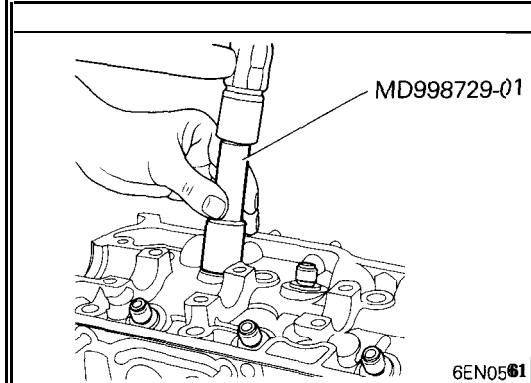
NOTE

Do not install a valve guide of the same size again.

- (3) Using the special tool, press-fit the valve guide, working from the cylinder head top surface.
- (4) After installing valve guides, insert new valves in them to check for sliding condition.
- (5) When valve guides have been replaced, check for valve contact and correct valve seats as necessary.

**INSTALLATION SERVICE POINTS****◆A◆ VALVE STEM SEAL INSTALLATION**

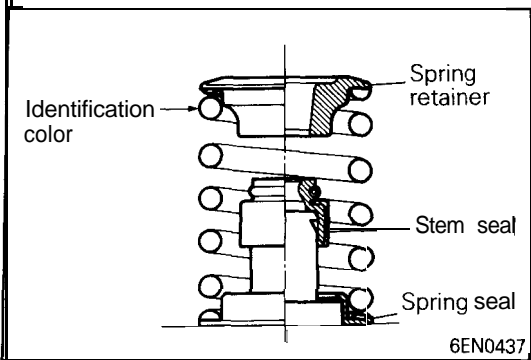
(1) Install the valve spring seat.



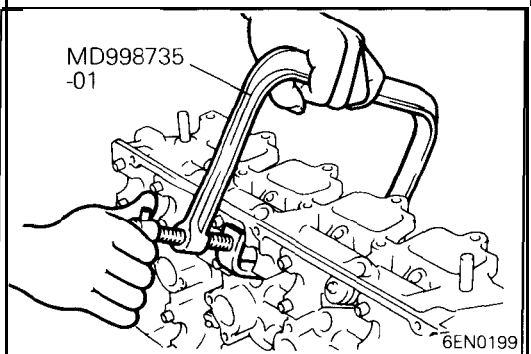
(2) Using the special tool, install a new stem seal to the valve guide.

Caution

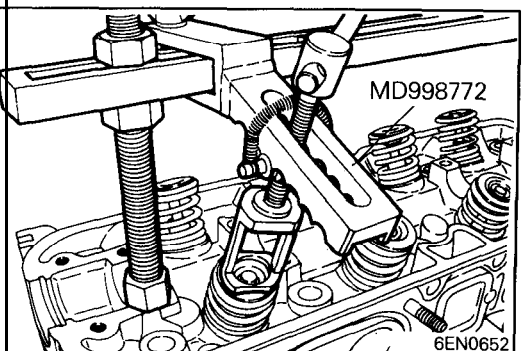
Do not reuse the valve stem seal.

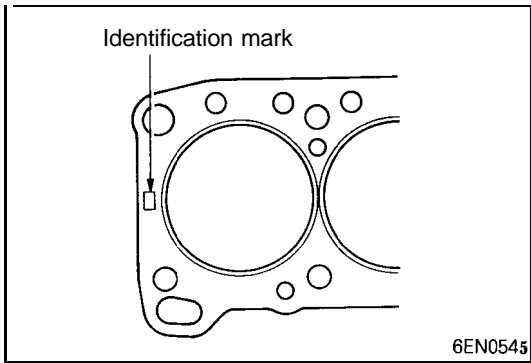
**◆B◆ VALVE SPRING INSTALLATION**

(1) Direct the valve spring end with identification color end toward the spring retainer.

**◆C◆ RETAINER LOCK INSTALLATION**

(1) Using the special tool, compress the valve spring and insert the retainer lock into position.





◆D◆ CYLINDER HEAD GASKET IDENTIFICATION

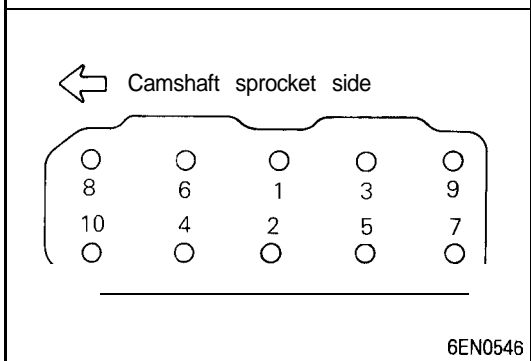
Identification mark:

4G63 63

4G64 64

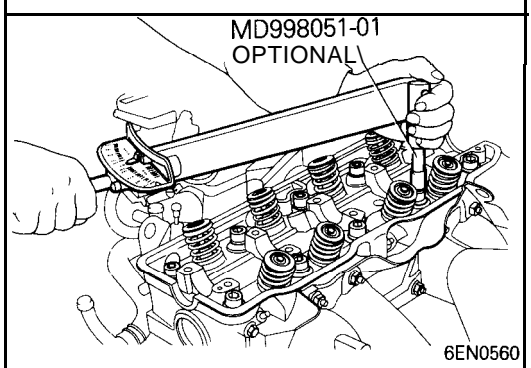
Caution

Do not apply sealant to cylinder head gasket.



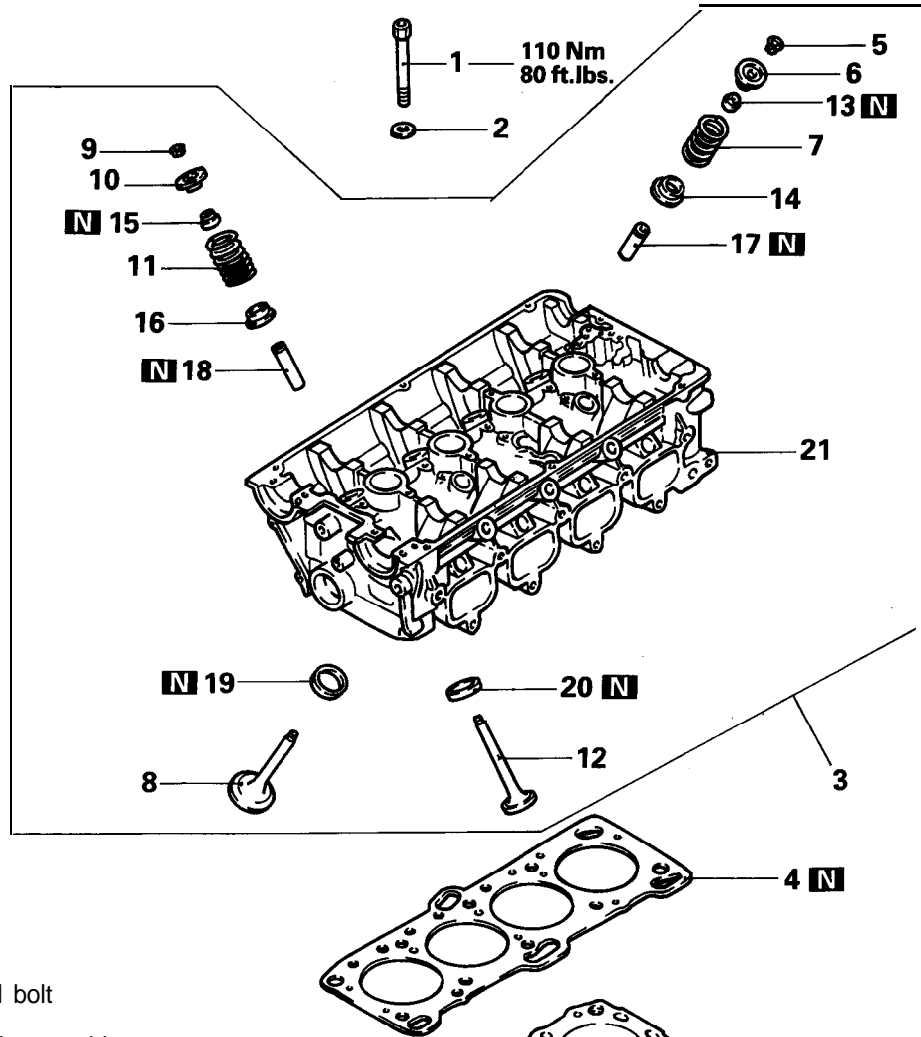
◆E◆ CYLINDER HEAD BOLT INSTALLATION

- (1) Tighten the cylinder head bolts in the sequence shown. Each bolt should be tightened in two to three steps, torquing progressively. Tighten to the specified torque in the final sequence.



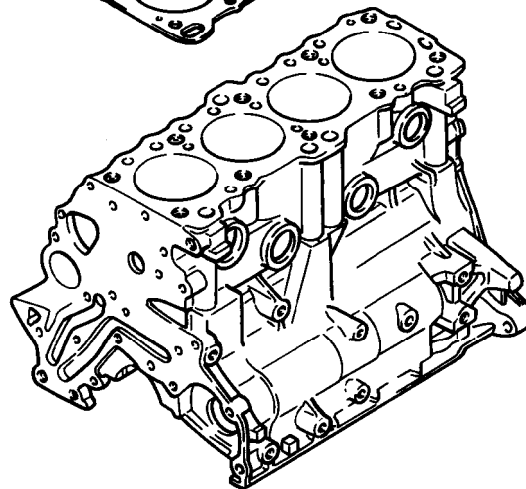
CYLINDER HEAD AND VALVES – DOHC

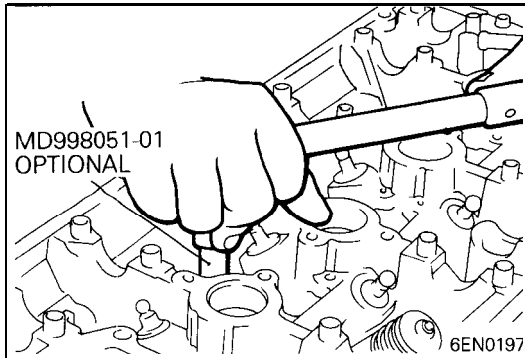
REMOVAL AND INSTALLATION



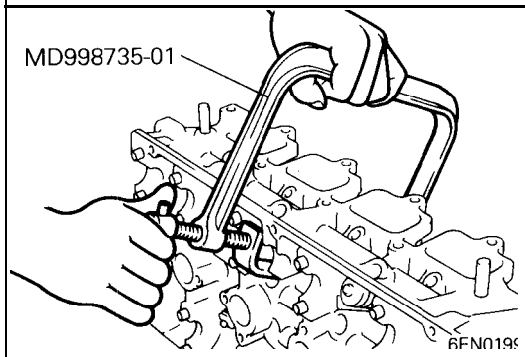
Removal steps

- ◁A▷ ▷E◁ 1. Cylinder head bolt
- 2. Washer
- 3. Cylinder head assembly
- ▷D◁ 4. Gasket
- ◁B▷ ▷C◁ 5. Retainer lock
- ▷B◁ 6. Valve spring retainer
- ▷B◁ 7. Valve spring
- ◁B▷ ▷C◁ 8. Intake valve
- ◁B▷ ▷C◁ 9. Retainer lock
- ▷B◁ 10. Valve spring retainer
- ▷B◁ 11. Valve spring
- ▷B◁ 12. Exhaust valve
- ◁C▷ ▷A◁ 13. Valve stem seal
- ◁C▷ ▷A◁ 14. Valve spring seat
- ◁C▷ ▷A◁ 15. Valve stem seal
- ▷B◁ 16. Valve spring seat
- ▷B◁ 17. Intake valve guide
- ▷B◁ 18. Exhaust valve guide
- ▷B◁ 19. Intake valve seat
- ▷B◁ 20. Exhaust valve seat
- ▷B◁ 21. Cylinder head

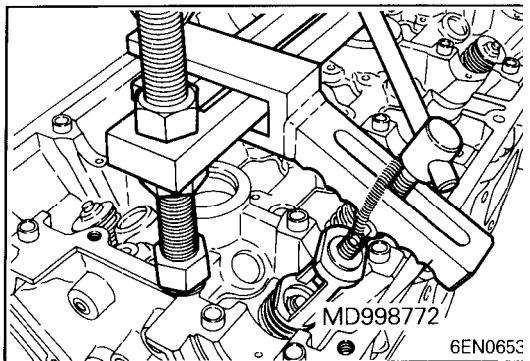


**REMOVAL SERVICE POINTS****◊A◊ CYLINDER HEAD BOLT REMOVAL**

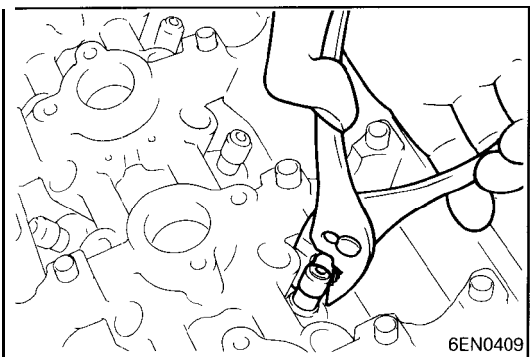
- (1) Using the special tool, loosen the cylinder head bolts. Loosen evenly, little by little.

**◊B◊ RETAINER LOCK REMOVAL**

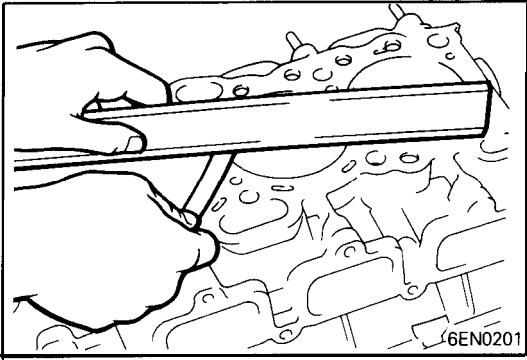
- (1) Using the special tool, compress the spring.
- (2) Remove the retainer locks. Keep removed parts in order according to the cylinder number and intake/exhaust.

**◊C◊ VALVE STEM SEAL REMOVAL**

- (1) Do not reuse the stem seals.

**INSPECTION**

- (1) Only features differing from the single camshaft engine are described in the following. (Refer to Pages 1 1C-76.)



CYLINDER HEAD

Cylinder head height (when new):
131.9 – 132.1 mm (5.193 – 5.201 in.)

VALVE

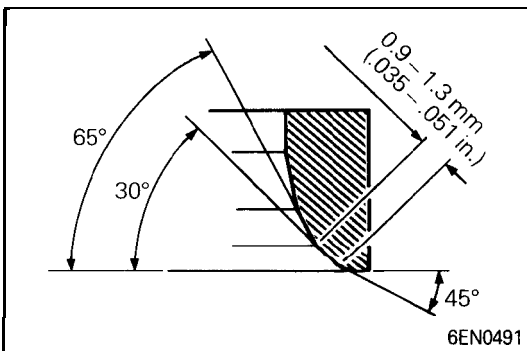
Margin:
Intake 1.0 mm (.039 in.)
Exhaust 1.5 mm (.059 in.)
Limit:
Intake 0.7 mm (.028 in.)
Exhaust 1.0 mm (.039 in.)

VALVE SPRING

Free height: 48.3 mm (1.902 in.)
Limit: 47.4 mm (1.866 in.)
Squareness: 1.5" or less
Limit: Max. 4"

VALVE GUIDE

Valve guide to valve stem clearance:
Intake 0.02 – 0.05 mm (.0008 – .0020 in.)
Exhaust 0.05 – 0.09 mm (.0020 – .0035 in.)
Limit:
Intake 0.10 mm (.004 in.)
Exhaust 0.15 mm (.006 in.)



VALVE SEAT RECONDITIONING PROCEDURE

(1) Refer to Page 11C-77, noting that the only difference is in the special tool (Cutter).

VALVE SEAT REPLACEMENT PROCEDURE

(1) Refer to Page 11C-77 noting that the only difference is in the reboring size.

Intake valve seat hole diameter

0.3 mm (.012 in.) O.S.	35.30 – 35.33 mm (1.3898 – 1.3909 in.)
0.6 mm (.024 in.) O.S.	35.60 – 35.63 mm (1.4016 – 1.4028 in.)

Exhaust valve seat hole diameter

0.3 mm (.012 in.) O.S.	33.30 – 33.33 mm (1.3110 – 1.3122 in.)
0.6 mm (.024 in.) O.S.	33.60 – 33.63 mm (1.3228 – 1.3240 in.)

VALVE GUIDE REPLACEMENT PROCEDURE

(1) Refer to Page 11C-77, noting that there are differences in the diameter of the valve guide hole as well as in the guide's installed height.

Valve Guide Hole Diameter

0.05 mm (.002 in.) O.S.	12.05 – 12.07 mm (.4744 – .4752 in.)
0.25 mm (.010 in.) O.S.	12.25 – 12.27 mm (.4823 – .4831 in.)
0.50 mm (.002 in.) O.S.	12.50 – 12.52 mm (.4921 – .4929 in.)

INSTALLATION SERVICE POINTS

◆A◆ VALVE STEM SEAL INSTALLATION

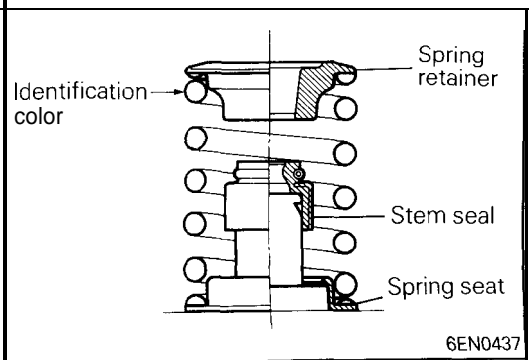
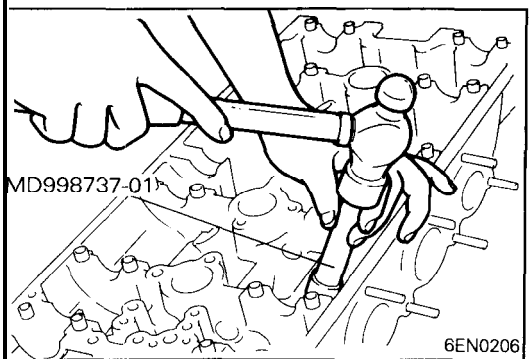
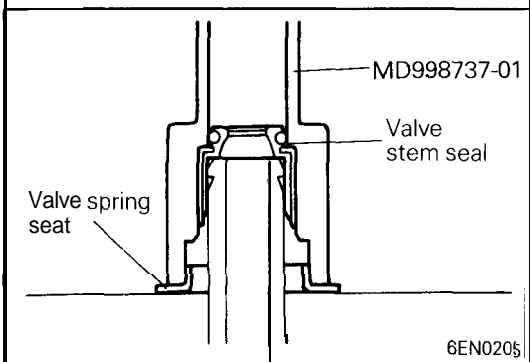
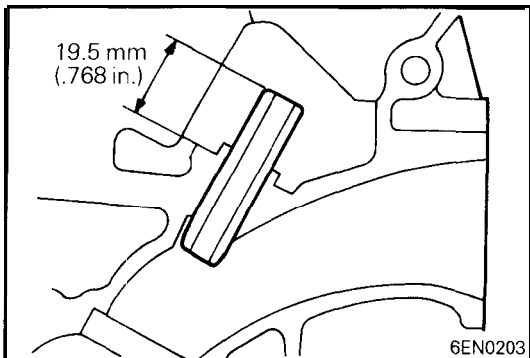
- (1) Install the valve spring seat.
- (2) Using the special tool, install a new stem seal to the valve guide.

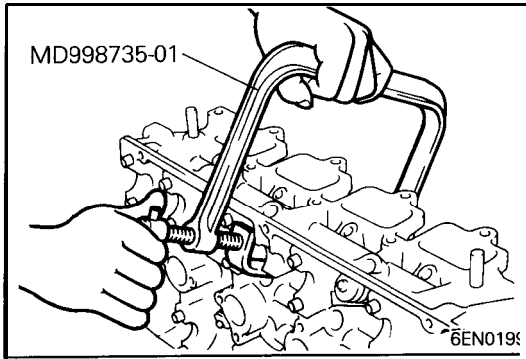
Caution

Do not reuse the valve stem seal.

◆B◆ VALVE SPRING INSTALLATION

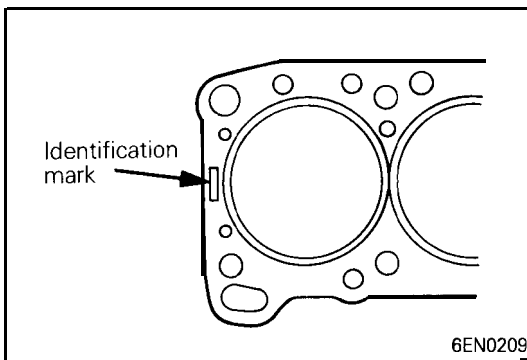
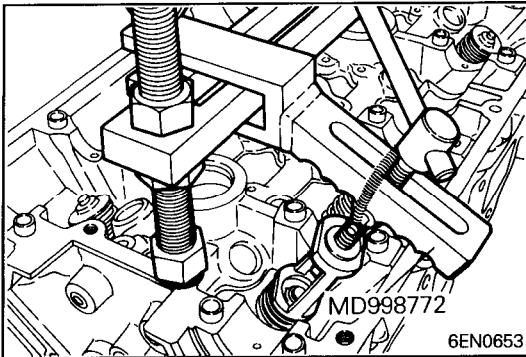
- (1) Install the valve spring so that its end with identification color is positioned on the rocker arm end.





▶C▶ RETAINER LOCK INSTALLATION

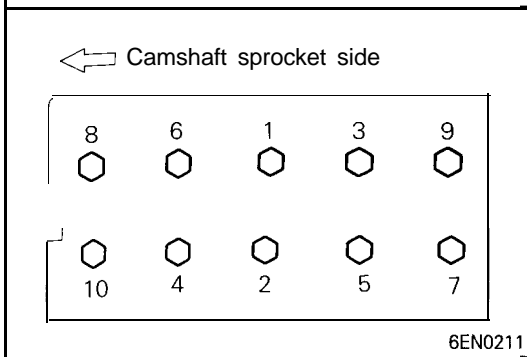
- (1) Using the special tool, compress the valve spring and insert the retainer lock into position.



▶D▶ CYLINDER HEAD GASKET IDENTIFICATION

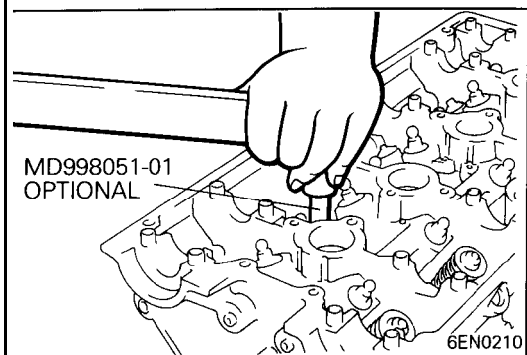
Identification mark:

16 4G61
2 0 4G63



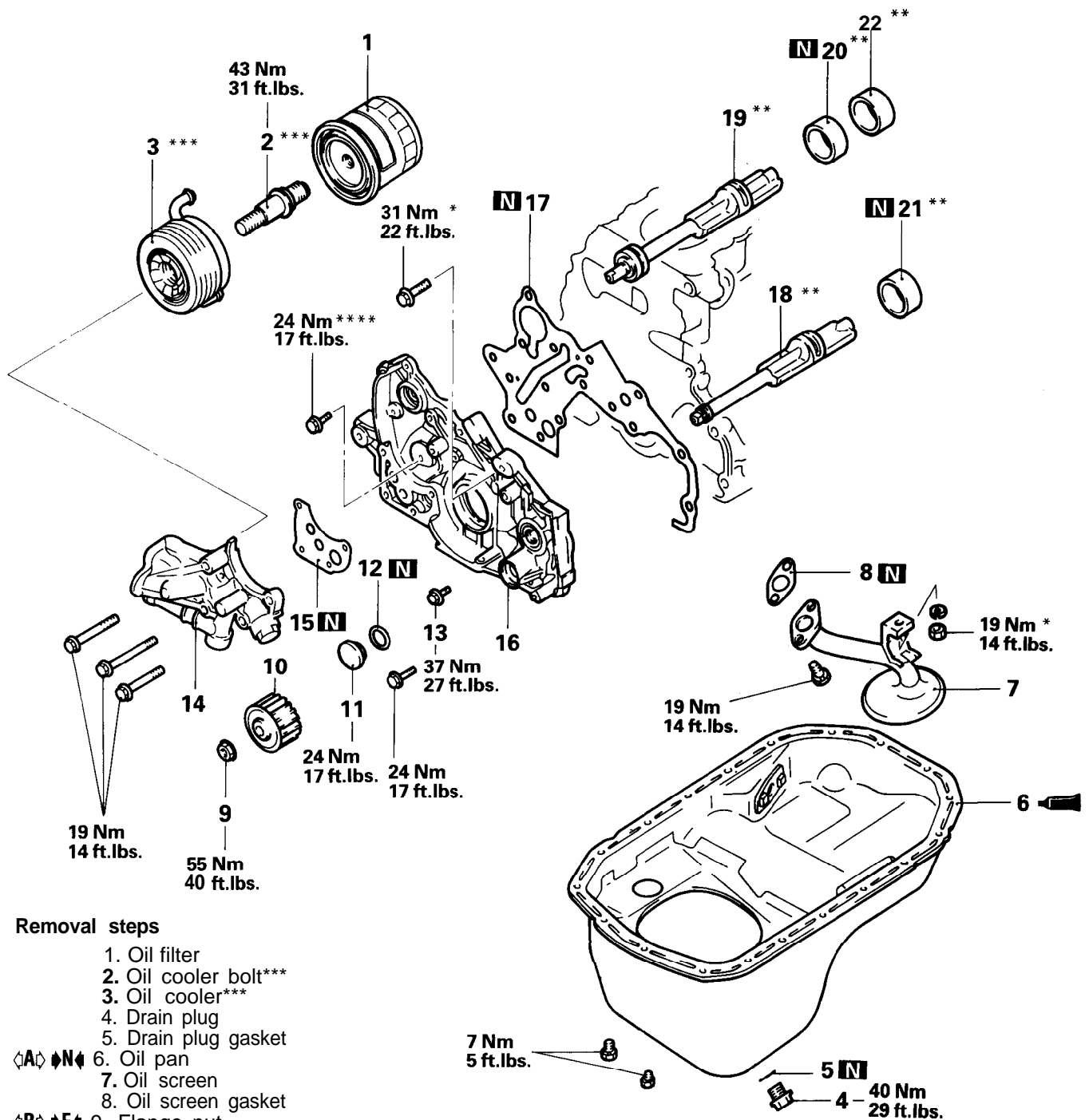
▶E▶ CYLINDER HEAD BOLT INSTALLATION

- (1) Tighten the cylinder head bolts in the sequence shown. Each bolt should be tightened in two to three steps, torquing progressively. Tighten to the specified torque in the final sequence.



FRONT CASE, SILENT SHAFT AND OIL PAN

REMOVAL AND INSTALLATION

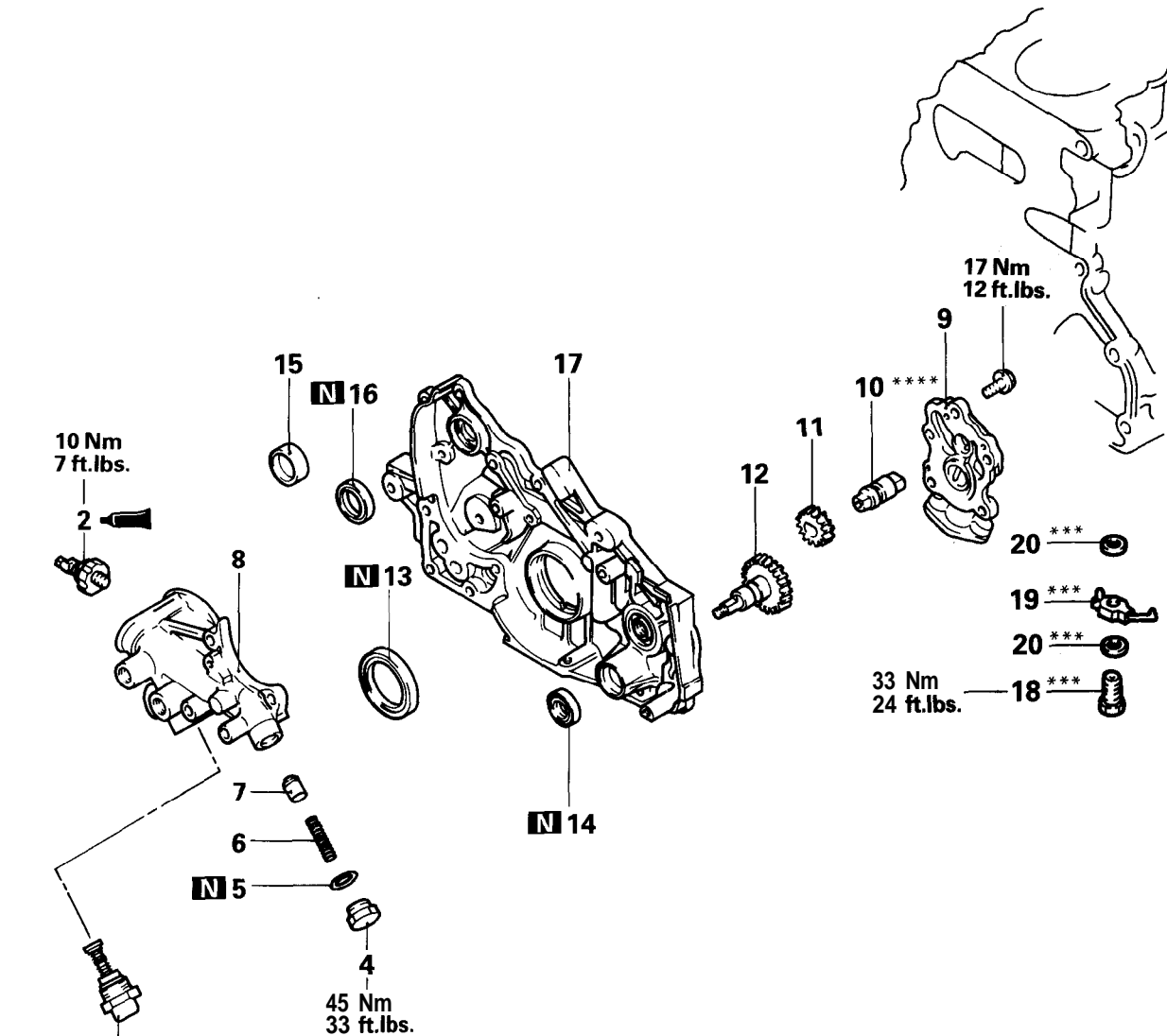


Removal steps

1. Oil filter
2. Oil cooler bolt***
3. Oil cooler***
4. Drain plug
5. Drain plug gasket
- ◊A◊ ◊N◊ 6. Oil pan
7. Oil screen
8. Oil screen gasket
- ◊B◊ ◊E◊ 9. Flange nut
10. Oil pump sprocket**
- ◊C◊ ◊M◊ 11. Plug
12. O-ring
- ◊D◊ ◊L◊ 13. Flange bolt
14. Oil filter bracket
15. Oil filter bracket gasket
- ◊K◊ 16. Front case
17. Front case gasket
18. Silent shaft, left**
19. Silent shaft, right**
- ◊E◊ ◊J◊ 20. Silent shaft, front bearing**
- ◊F◊ ◊I◊ 21. Silent shaft, rear bearing, left**
- ◊G◊ ◊H◊ 22. Silent shaft, rear bearing, right**

NOTE

- * : DOHC
- ** : Engine with silent shafts
- *** : Engine with turbocharger
- **** : Engine without silent shafts
- ***** : Engine with air-cooling type oil cooler



***** 55 Nm
40 ft.lbs.

55 Nm
40 ft.lbs.

45 Nm
33 ft.lbs.

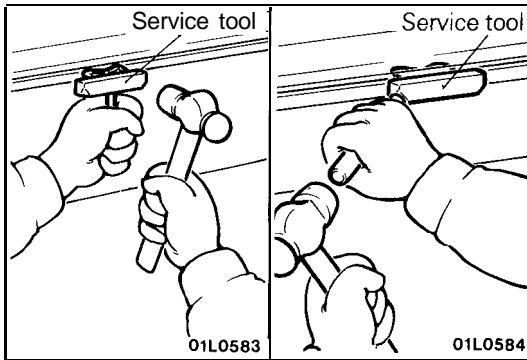
17 Nm
12 ft.lbs.

33 Nm
24 ft.lbs.

- 1. Oil cooler by-pass valve*****
- ◆G◆ 2. Oil pressure switch
- ◆F◆ 3. Oil pressure gauge unit
- 4. Relief plug
- 5. Gasket
- 6. Relief spring
- 7. Relief plunger
- 8. Oil filter bracket
- 9. Oil pump cover
- 10. Oil pump shaft*****
- ◆D◆ 11. Oil pump driven gear
- ◆D◆ 12. Oil pump drive gear
- ◆C◆ 13. Crankshaft front oil seal
- ◆B◆ 14. Oil pump oil seal
- 15. Plug*****
- ◆A◆ 16. Silent shaft oil seal**
- 17. Front case
- 18. Check valve
- 19. Oil jet
- 20. Gasket

NOTE

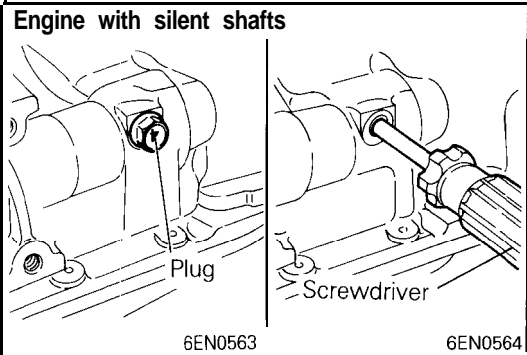
- * : DOHC
- ** : Engine with silent shafts
- *** : Engine with turbocharger
- **** : Engine without silent shafts
- ***** : Engine with air-cooling type oil cooler

**REMOVAL SERVICE POINTS****◊A◊ OIL PAN REMOVAL**

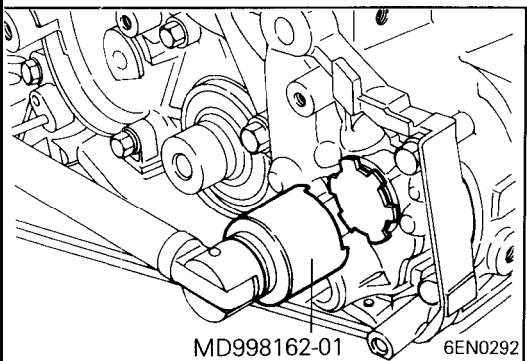
- (1) Remove the all oil pan bolts.
- (2) Drive in the service tool between the cylinder block and oil pan.

NOTE

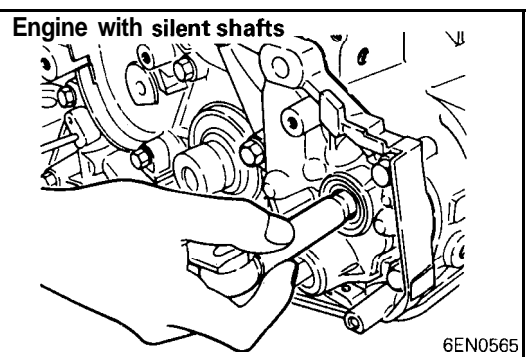
Never use a screwdriver or chisel, instead of the service tool, as a deformed oil pan flange will result in oil leakage.

**◊B◊ FLANGE NUT REMOVAL
(ENGINE WITH SILENT SHAFTS)**

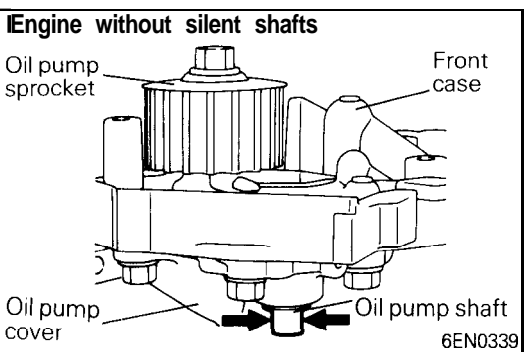
- (1) Remove the plug on the side of the cylinder block.
- (2) Insert a Phillips screwdriver [shank diameter 8 mm (.32 in.)] into the plug hole to lock the silent shaft.
- (3) Loosen the oil pump sprocket flange nut.

**◊C◊ PLUG REMOVAL**

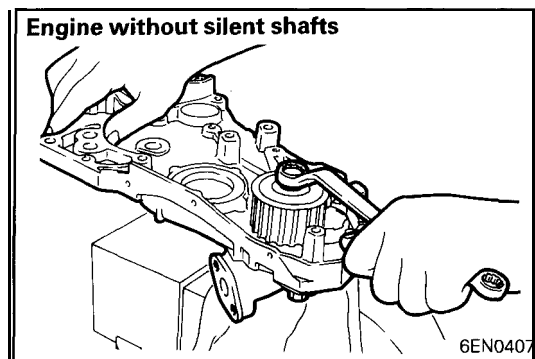
- (1) If the plug is too tight, hit the plug head with a hammer two to three times, and the plug will be easily loosened.

**◊D◊ FLANGE BOLT REMOVAL
(ENGINE WITH SILENT SHAFTS)**

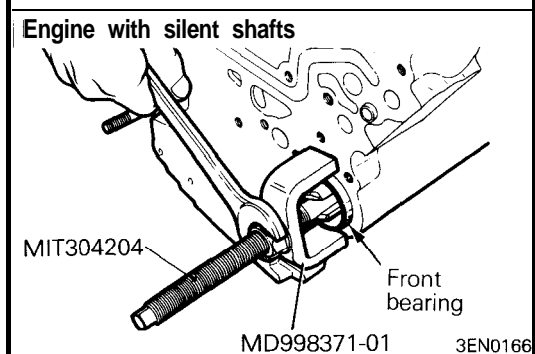
- (1) Referring to ◊B◊ (2), lock the silent shaft.
- (2) Loosen the flange bolt.

**◊D◊ FLANGE NUT REMOVAL
(ENGINE WITHOUT SILENT SHAFTS)**

- (1) Clamp the oil pump shaft end in a vise.



(2) Remove the oil pump sprocket nut.

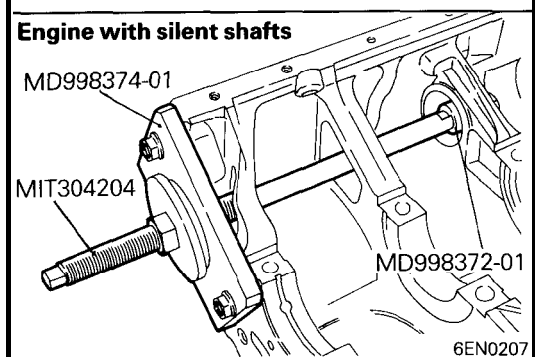


◁E▷ **SILENT SHAFT FRONT BEARING REMOVAL
(ENGINE WITH SILENT SHAFTS)**

Using the special tool, remove the silent shaft front bearing from the cylinder block.

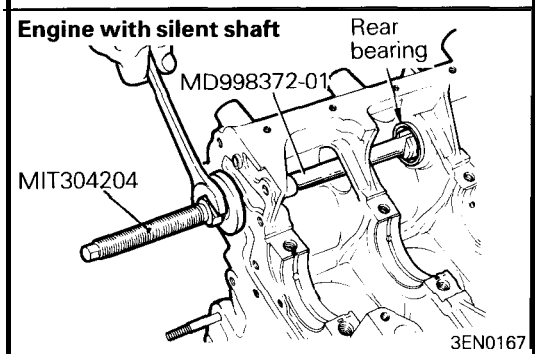
NOTE

Be sure to remove the front bearing first.
If it has not been removed, the Rear Bearing Puller cannot be used.



◁F▷ **LEFT SILENT SHAFT REAR BEARING REMOVAL
(ENGINE WITH SILENT SHAFTS)**

Using the special tool, remove the left silent shaft rear bearing from the cylinder block.



◁G▷ **REAR BEARING REMOVAL
(ENGINE WITH SILENT SHAFTS)**

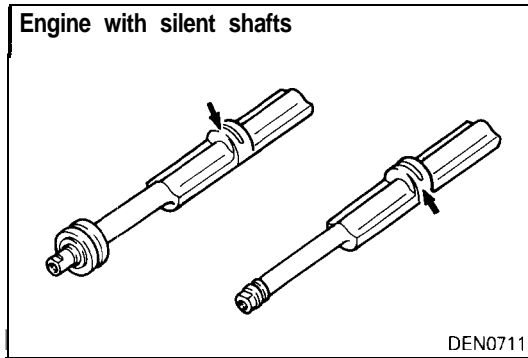
Using the special tool, remove the right silent shaft rear bearing from the cylinder block.

**INSPECTION
FRONT CASE**

- (1) Check oil holes for clogging and clean if necessary.
- (2) Check left silent shaft front bearing section for wear, damage and seizure. If there is anything wrong with the section, replace the front case.
- (3) Check the front case for cracks and other damage. Replace cracked or damaged front case.

OIL SEAL

- (1) Check the oil seal lip for wear and damage. Replace the oil seal if necessary.
- (2) Check the oil seal lip for deterioration. Replace the oil seal if necessary.

**SILENT SHAFT (ENGINE WITH SILENT SHAFTS)**

- (1) Check oil holes for clogging.
- (2) Check journal for seizure, damage and contact with bearing. If there is anything wrong with the journal, replace silent shaft, bearing or front case assembly.
- (3) Check the silent shaft oil clearance. If the clearance is excessively due to wear, replace the silent shaft bearing, silent shaft or front case assembly.

Standard value:**Front**

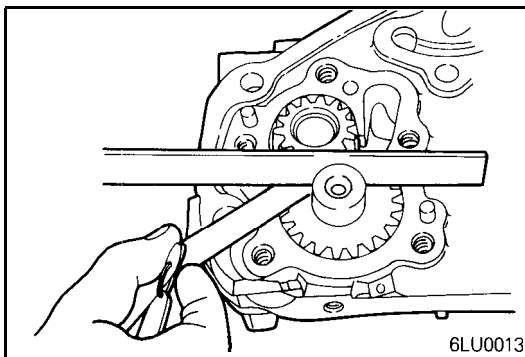
Right 0.03 – 0.06 mm (.0012 – .0024 in.)

Left 0.02 – 0.05 mm (.0008 – .0020 in.)

Rear

Right 0.05 – 0.09 mm (.0020 – .0036 in.)

Left 0.05 – 0.09 mm (.0020 – .0036 in.)

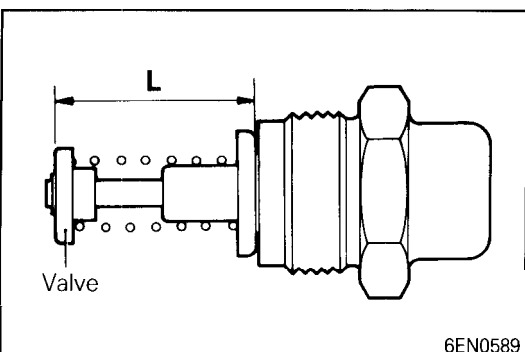
**OIL PUMP**

- (1) Assemble the oil pump gears in the front case and rotate them to ensure smooth rotation with no looseness.
- (2) Ensure that there is no ridge wear on the gear contact surface of the front case and the oil pump cover.
- (3) Check the side clearance

Standard value:

Drive gear 0.08 – 0.14 mm (.0031 – .0055 in.)

Driven gear 0.06 – 0.12 mm (.0024 – .0047 in.)

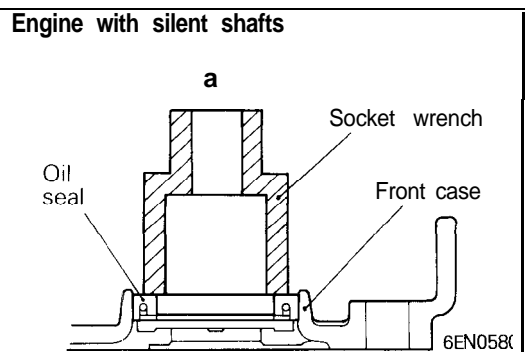
**OIL COOLER BYPASS VALVE
(ENGINE WITH AIR COOLING TYPE OIL COOLER)**

- (1) Make sure that the valve moves smoothly.
- (2) Ensure that the dimension (L) measures the standard value under normal temperature and humidity.

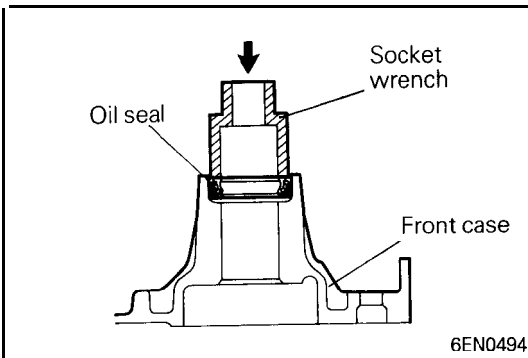
Standard value (L): 34.5 (.358 in.)

- (3) The dimension must be the standard value when measured after the valve has been dipped in 100°C (212°F) oil.

Standard value (L): 40 mm (1.57 in.) or more

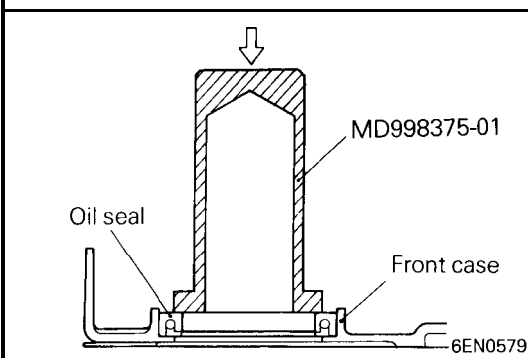
**INSTALLATION SERVICE POINTS****◆◆ SILENT SHAFT OIL SEAL INSTALLATION
(ENGINE WITH SILENT SHAFTS)**

◆B◆ OIL PUMP OIL SEAL INSTALLATION



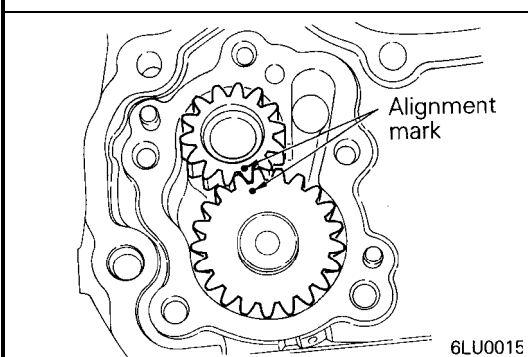
◆C◆ CRANKSHAFT FRONT OIL SEAL INSTALLATION

- (1) Using the special tool, install the crankshaft front oil seal into the front case.



◆D◆ OIL PUMP DRIVEN GEAR / OIL PUMP DRIVE GEAR INSTALLATION

- (1) Apply engine oil amply to the gears and line up the alignment marks.

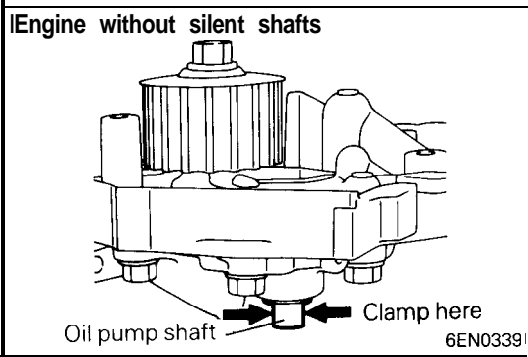


◆E◆ FLANGE NUT INSTALLATION (ENGINE WITHOUT SILENT SHAFTS)

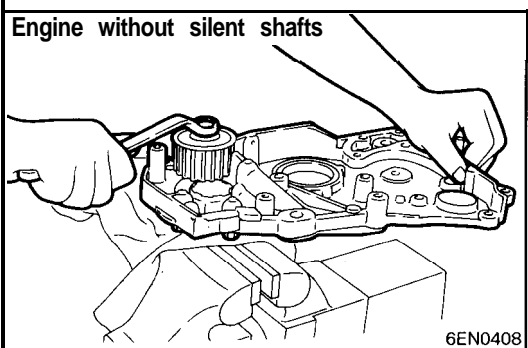
Caution

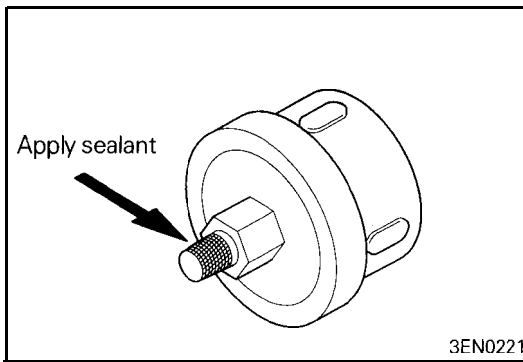
Before installing the flange nut, apply an appropriate amount of oil to the seating surface.

- (1) Clamp the oil pump shaft end in a vise.



- (2) Tighten the oil pump sprocket nut to the specified torque.





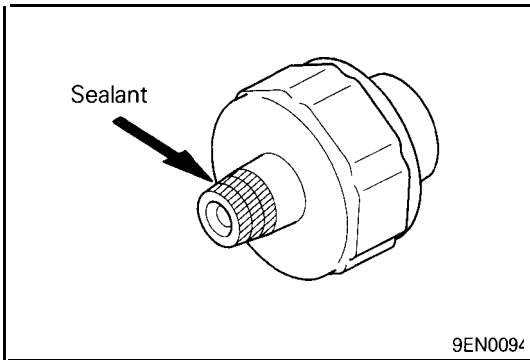
◆F◆ SEALANT APPLICATION TO OIL PRESSURE GAUGE UNIT

- (1) Coat the threads of the oil pressure gauge unit with sealant and install the unit using the special tool.

Specified sealant: 3M ATD Part No. 8660 or equivalent

Caution

1. Keep the end of threaded portion clear of sealant.
2. Avoid an **overtightening**.



◆G◆ SEALANT APPLICATION TO OIL PRESSURE SWITCH

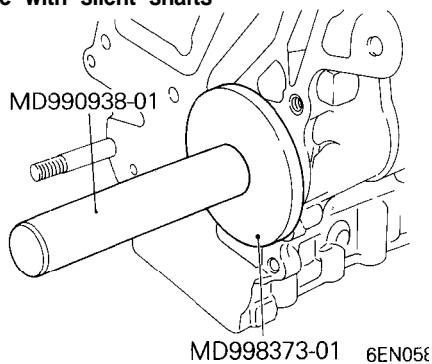
- (1) Coat the threads of the oil pressure switch with sealant and install the switch using the special tool.

Specified sealant: 3M ATD Part No.8660 or equivalent

Caution

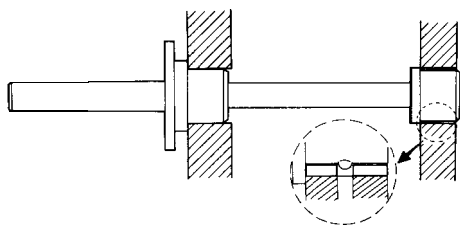
1. Keep the end of threaded portion clear of sealant.
2. Avoid an **overtightening**.

Engine with silent shafts



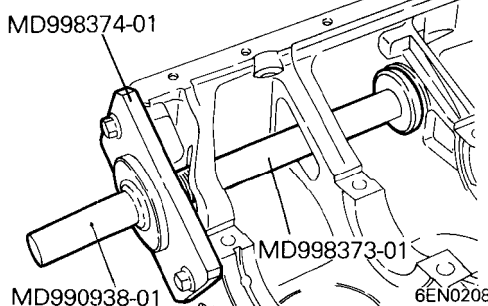
◆H◆ RIGHT SILENT SHAFT REAR BEARING INSTALLATION (ENGINE WITH SILENT SHAFTS)

- (1) Apply engine oil to the outer surface of the bearing.
- (2) Using special tools, install the right rear bearing. Make sure that the oil hole of the bearing is aligned with the oil hole of the cylinder block.



6EN058

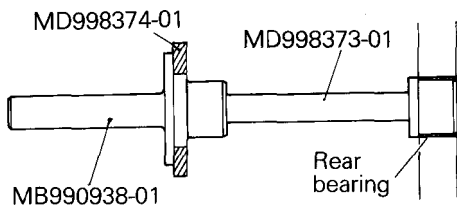
Engine with silent shafts



◆I◆ LEFT SILENT SHAFT REAR BEARING INSTALLATION (ENGINE WITH SILENT SHAFTS)

- (1) Install the special tool (Guide Plate) to the cylinder block.
- (2) Apply engine oil to the rear bearing outer circumference and bearing hole in the cylinder block.

Engine with silent shafts



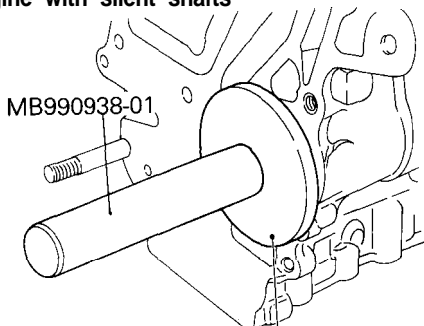
6EN0578

- (3) Using the special tool, install the rear bearing.

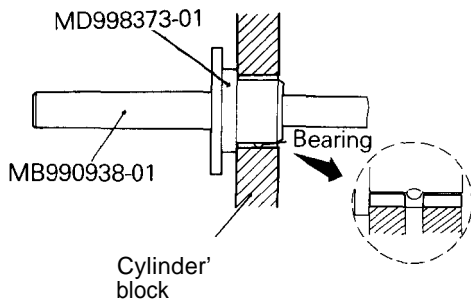
NOTE

The left rear bearing has no oil holes.

Engine with silent shafts



MD998373-01 6EN0586

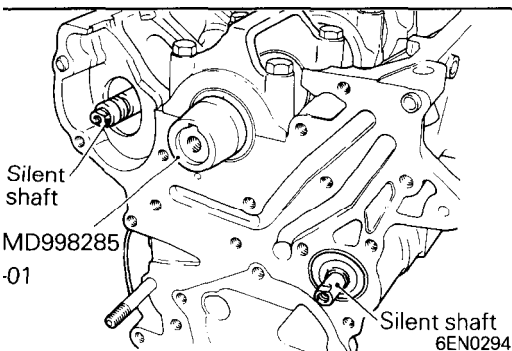


6EN0588



SILENT SHAFT FRONT BEARING INSTALLATION (ENGINE WITH SILENT SHAFTS)

- (1) Using the special tools, install the front bearing.

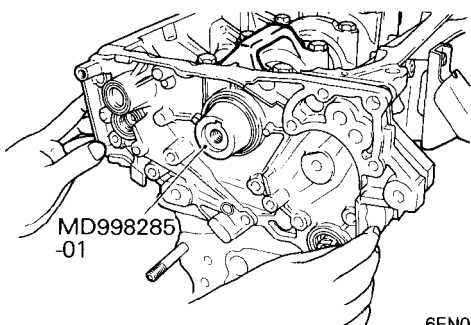


6EN0294



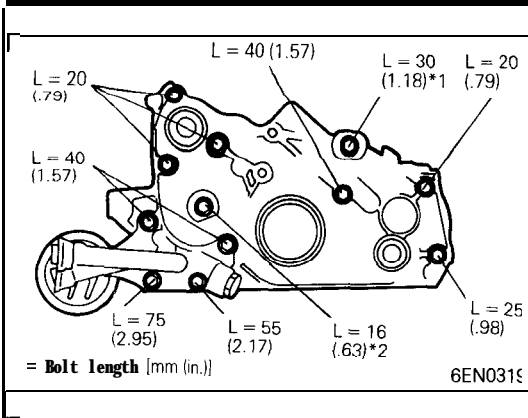
FRONT CASE INSTALLATION

- (1) Set the special tool on the front end of the crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.



6EN0262

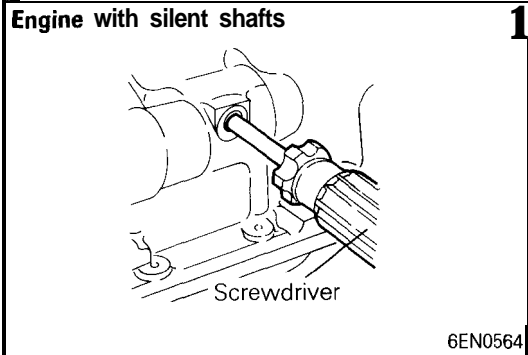
- (2) Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).



- (3) Mount the oil filter bracket with oil filter bracket gasket. Then, install the four bolts with washers.
- (4) Tighten the bolts to the specification.

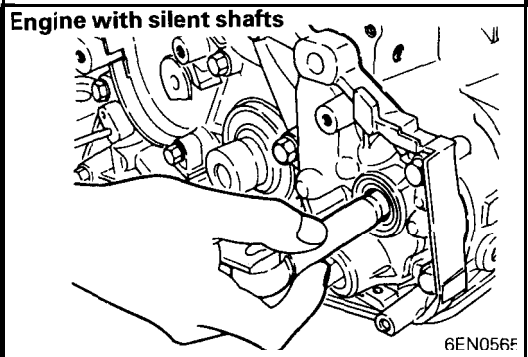
NOTE

- (1) The bolt marked with *1 in the illustration differs in tightening torque.
- (2) The bolt marked with *2 in the illustration is for engine without silent shafts only.

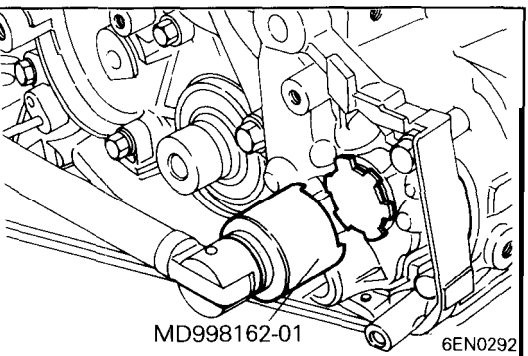


◆L◆ FLANGE BOLT INSTALLATION (ENGINE WITH SILENT SHAFTS)

- (1) Insert a Phillips screwdriver into the hole on the left side of the cylinder block to lock the silent shaft.

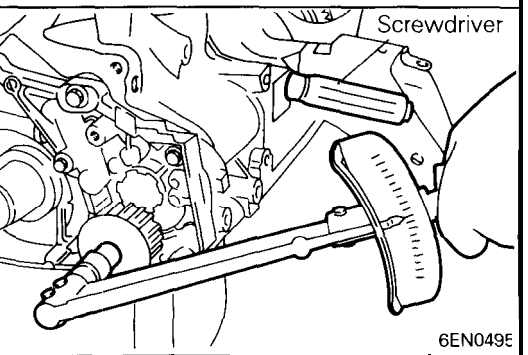


- (2) Secure the oil pump driven gear on the left silent shaft by tightening the flange bolt to the specified torque.



◆M◆ PLUG INSTALLATION

- (1) Install a new O-ring in the groove of the front case.
- (2) Using the special tool, install the plug and tighten to the specified torque.



◆E◆ FLANGE NUT INSTALLATION (ENGINE WITH SILENT SHAFTS)

- (1) Referring to ◆J◆ (1), lock the silent shaft.
- (2) Tighten the flange nut to the specified torque.

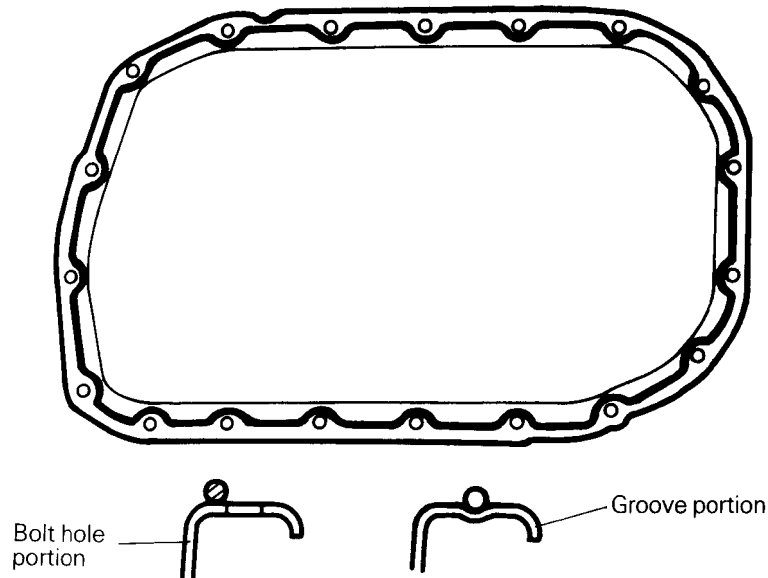
◆N◆ OIL PAN INSTALLATION

- (1) Clean both mating surface of the oil pan and the cylinder block.
- (2) Apply a 4 mm (.16 in.) wide bead of sealant to the entire circumference of the oil pan flange.

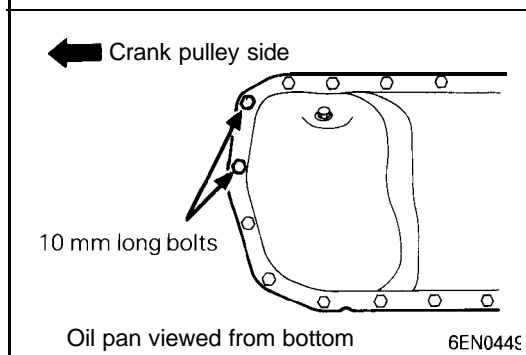
Specified sealant:

MITSUBISHI GENUINE PART No. MD970389 or equivalent

- (3) The oil pan should be installed in 15 minutes after the application of sealant.



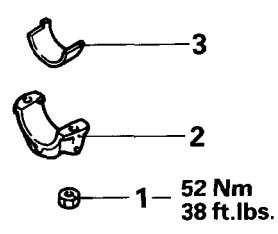
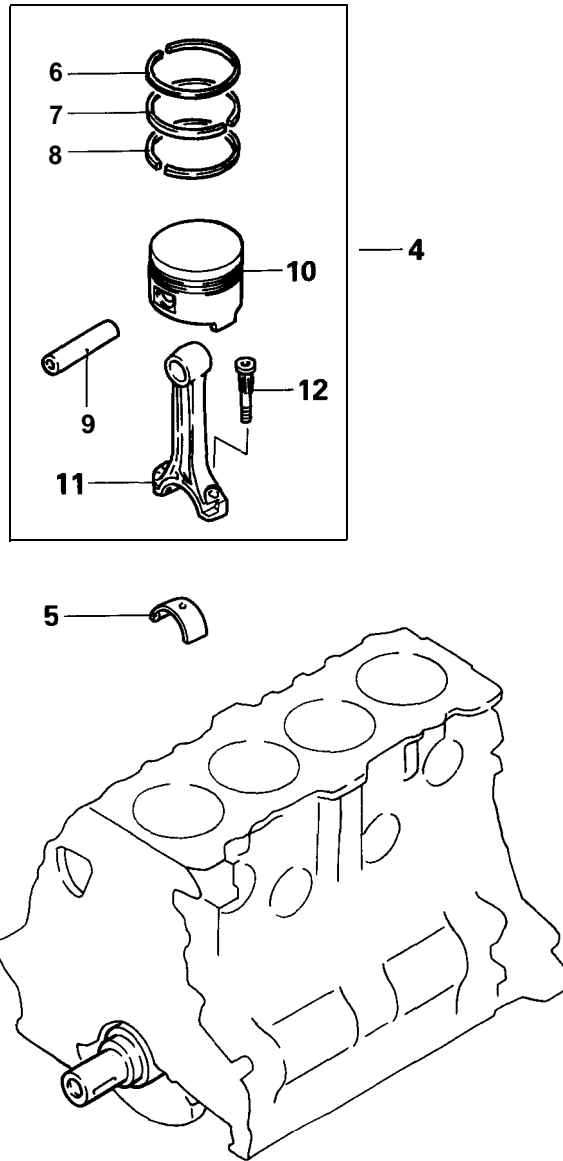
6FN0213



- (4) Note that the bolts at the location shown are different in length from the others.

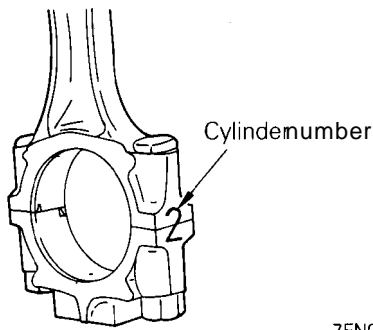
PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION



Removal steps

1. Nut
- ↙A↘ ↗E↖ 2. Connecting rod cap
3. Connecting rod bearing
- ↗D↖ 4. Piston and connecting rod assembly
5. Connecting rod bearing
- ↗C↖ 6. Piston ring No. 1
- ↗C↖ 7. Piston ring No. 2
- ↗B↖ 8. Oil ring
- ↙B↘ ↗A↖ 9. Piston pin
10. Piston
11. Connecting rod
12. Bolt



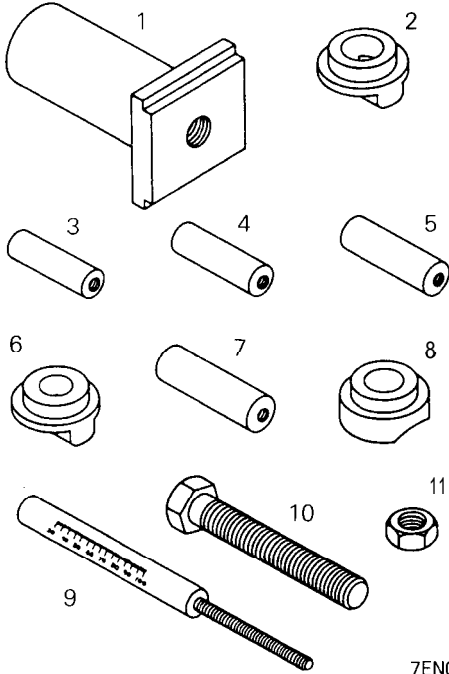
7EN0448

REMOVAL SERVICE POINTS

◁A▷ CONNECTING ROD CAP REMOVAL

- (1) Mark the cylinder number on the side of the connecting rod big end for correct reassembly.
- (2) Keep the removed connecting rods, caps, and bearings in order according to the cylinder number.

Piston pin setting tool MIT216941

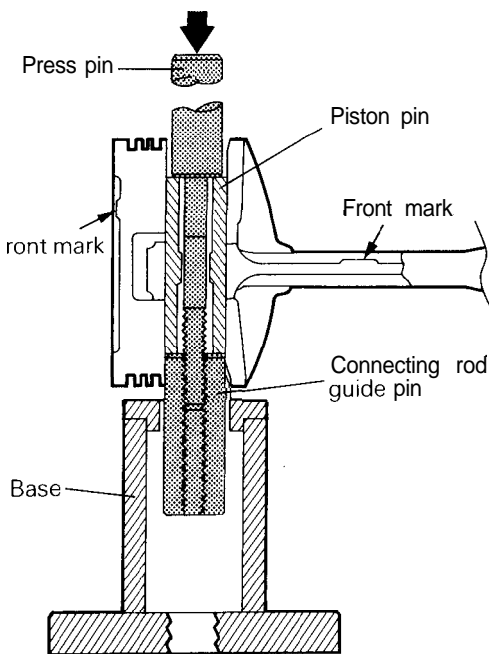


7EN0425

◁B▷ PISTON PIN REMOVAL

Item No.	Part No.	Description
1	MIT310134	Base
2	MIT310136	Piston Support
3	MIT310137	Connecting Rod Guide Pin
4	MIT310138	Connecting Rod Guide Pin
5	MIT310139	Connecting Rod Guide Pin
6	MIT310140	Piston Support
7	MIT310141	Connecting Rod Guide Pin
8	MIT310142	Piston Support
9	MIT48143	Press Pin
10	2 16943	Stop Screw
11	10396	Nut

- (1) Remove the stop screw from the base.
- (2) Select the correct piston support for your application (See above). Fit the piston support onto the base. Place the base on press support blocks.



7EN0426

- (3) Insert the press pin through the piston pin hole. Select the correct connecting rod guide pin (See above). Thread the guide pin onto the threaded portion of the press pin.
- (4) Position the piston assembly on the piston support in the press. With the press pin up as shown in the illustration, insert the guide pin through the hole in the piston and through the hole in the piston support.
- (5) Press the piston pin out of the assembly.

IMPORTANT: To avoid piston damage,

1. The piston support must seat squarely against the piston.
2. Verify that the piston pin will slide through the hole in the piston support.

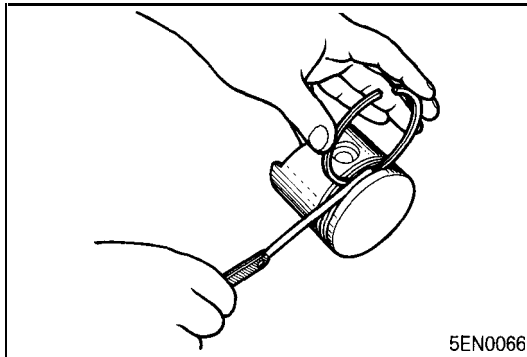
- (6) Remove the piston pin from the press pin.

INSPECTION**PISTON**

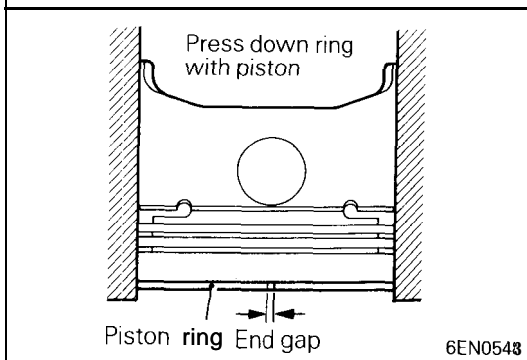
- (1) Replace the piston if scratches or seizure is evident on its surfaces (especially the thrust surface). Replace the piston if it is cracked.

PISTON PIN

- (1) Insert the piston pin into the piston pin hole with a thumb. You should feel a slight resistance. Replace the piston pin if it can be easily inserted or there is an excessive play.
- (2) The piston and piston pin must be replaced as an assembly.



5EN0066



Piston ring End gap

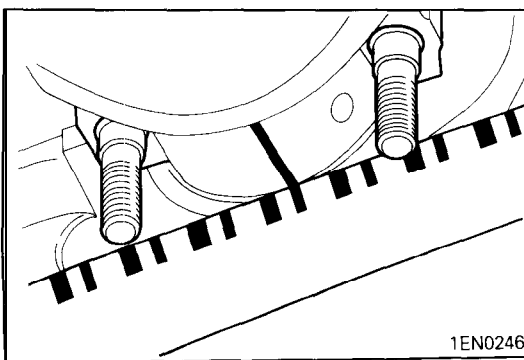
6EN0543

PISTON RING

- (1) Check the piston ring for damage, excessive wear, and breakage and replace if defects are evident. If the piston has been replaced with a new one, the piston rings must also be replaced with new ones.
- (2) Check for the clearance between the piston ring and ring groove. If the limit is exceeded, replace the ring or piston, or both.

Standard value:**No.1** 0.03 – 0.07 mm (.0012 – .0028 in.)**No.2 SOHC** 0.02 – 0.06 mm (.0008 – .0024 in.)**No. 2 DOHC** 0.03 – 0.07 mm (.0012 – .0028 in.)**Limit: 0.1 mm (.004 in.)**

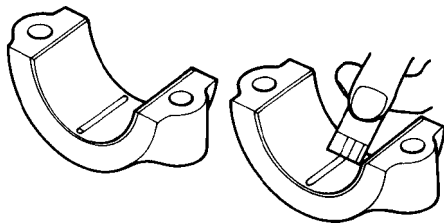
- (3) Install the piston ring into the cylinder bore. Force it down with a piston, its crown being in contact with the ring, to correctly position it at right angles to the cylinder wall. Then, measure the end gap with a feeler gauge. If the ring gap is excessive, replace the piston ring.

Standard value:**No. 1** 0.25 – 0.40 mm (.0098 – .0157 in.)**No. 2** 0.35 – 0.50 mm
(.0138 – .0197 in.) **4G61**0.20 – 0.35 mm
(.0079 – .0138 in.) **4G63 – SOHC**0.45 – 0.60 mm
(.0177 – .0236 in.) **4G63 – DOHC**0.20 – 0.40 mm
(.0079 – .0157 in.) **4G64****Oil** 0.20 – 0.70 mm (.0079 – .0276 in.)**Limit:****No. 1, No. 2** 0.8 mm (.031 in.)**Oil** 1.0 mm (.039 in.)

1EN0246

**CRANKSHAFT PIN OIL CLEARANCE
(PLASTIC GAUGE METHOD)**

- (1) Remove oil from crankshaft pin and connecting rod bearing.
- (2) Cut the plastic gauge to the same length as the width of bearing and place it on crankshaft pin in parallel with its axis.



1 EN027

- (3) Install the connecting rod cap carefully and tighten the bolts to the specified torque.
- (4) Carefully remove the connecting rod cap.
- (5) Measure the width of the plastic gauge at its widest part by using a scale printed on the plastic gauge package.

Standard value: 0.02 – 0.05 mm (.0008 – .0020 in.)
Limit: 0.1 mm (.004 in.)

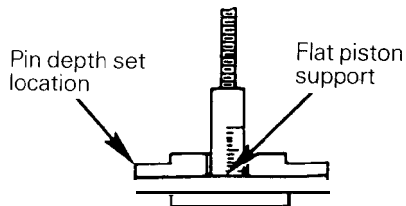
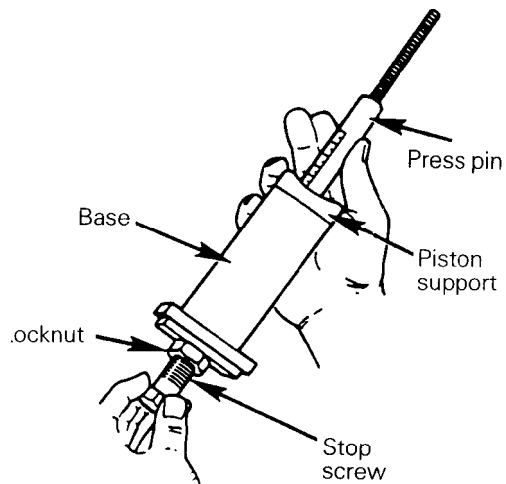
INSTALLATION SERVICE POINTS

◆A◆ PISTON PIN INSTALLATION

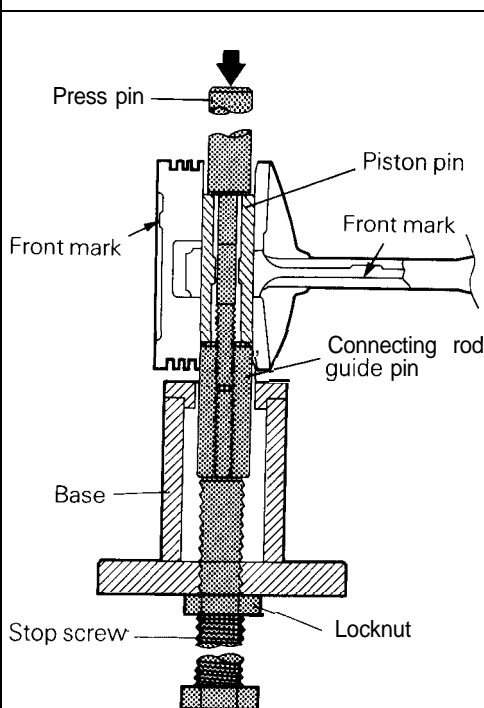
- (1) Thread the stop screw and lock nut assembly into the base. Fit the correct piston support on the top of the base. Insert the press pin, threaded end up, into the hole in the piston support until the press pin touches the stop screw.
- (2) Using the graduations on the press pin, adjust the stop screw to the depth shown below.

Depth:

SOHC and 4G61 DOHC 56 mm (2.20 in.)
4G63 DOHC 55 mm (2.17 in.)



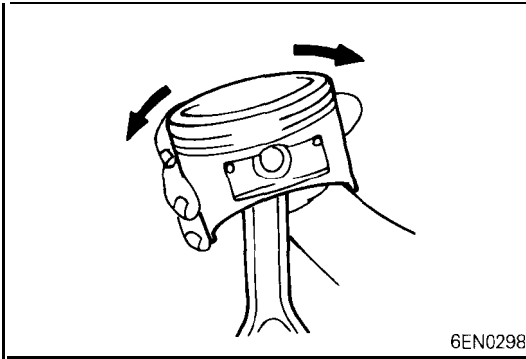
7EN0428



7EN0429

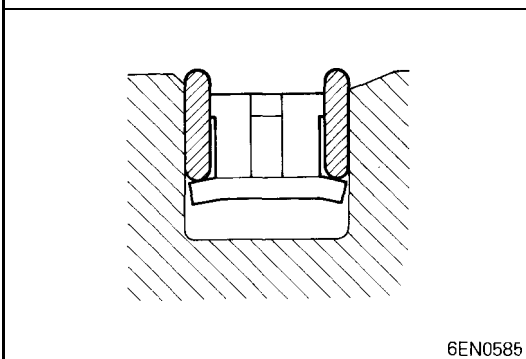
- (3) Place the base on press support blocks.
- (4) Slide the piston pin over the threaded end of the press pin, and thread the correct guide pin up against it.
- (5) Coat the piston pin with oil, and with the connecting rod held in position, slide the guide pin through the piston and connecting rod.
- (6) Press the piston pin through the connecting rod until the guide pin contacts the stop screw.
- (7) Remove the piston assembly from the base. Remove the guide pin and press pin from the assembly.

IMPORTANT: Due to production tolerance variations, it is necessary to visually inspect the piston pin depth after installation to verify that the piston pin is centered. Adjust if necessary.



6EN0298

(8) Check that the piston moves smoothly.



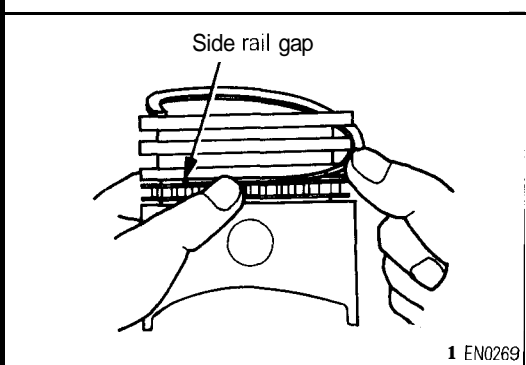
6EN0585

▶B◀ OIL RING INSTALLATION

(1) Fit the oil ring spacer into the piston ring groove.

NOTE

The side rails and spacer may be installed in either direction.



1 EN0269

(2) Install the upper side rail.

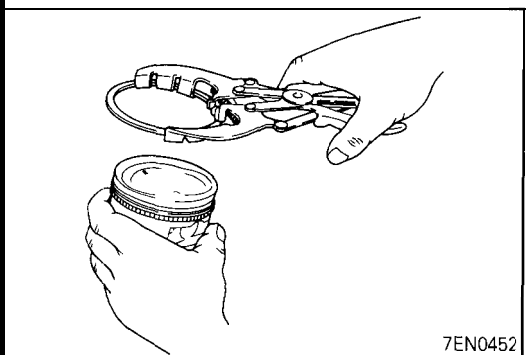
To install the side rail, first fit one end of the rail into the piston groove, then press the remaining portion into position by finger. See illustration.

Caution

Do not use piston ring expander when installing side rail.

(3) Install the lower side rail in the same procedure as described in step (2).

(4) Make sure that the side rails move smoothly in either direction.



7EN0452

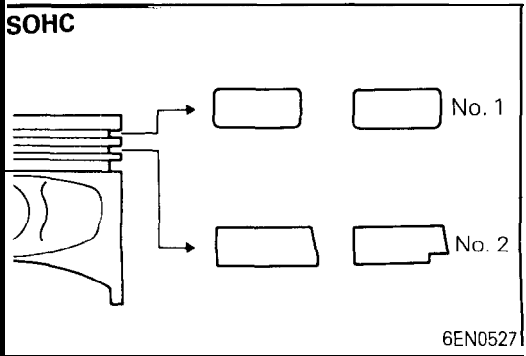
▶C◀ PISTON RING NO. 2 / PISTON RING NO. 1 INSTALLATION

(1) Using a piston ring expander, fit No. 2 and then No. 1 piston ring into position.

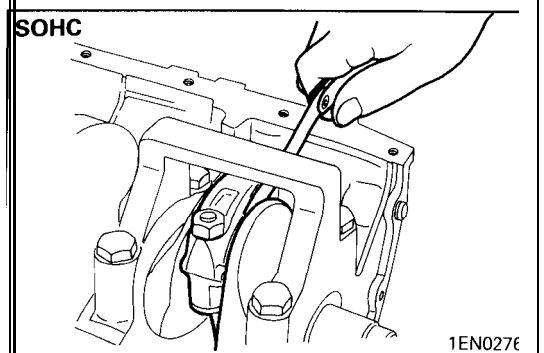
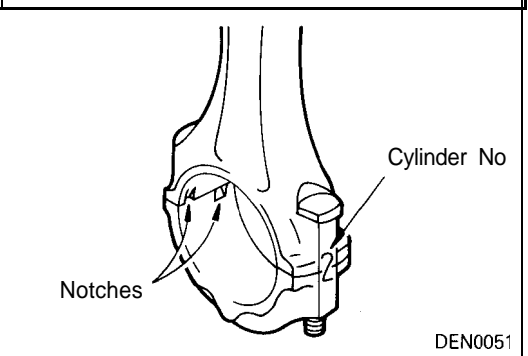
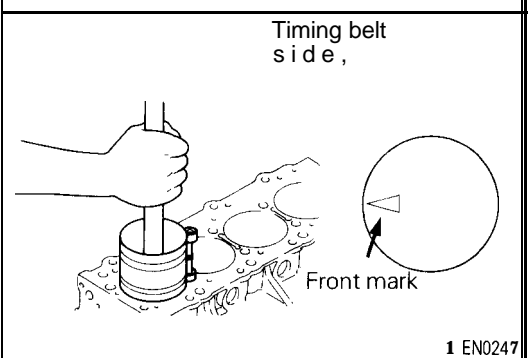
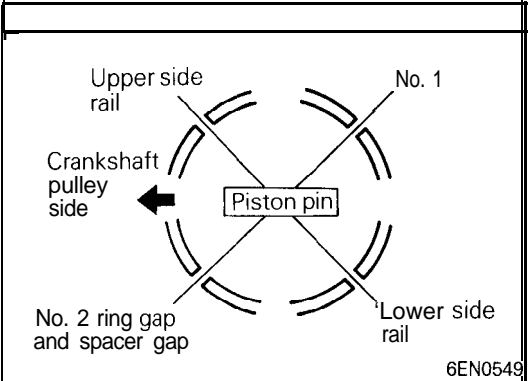
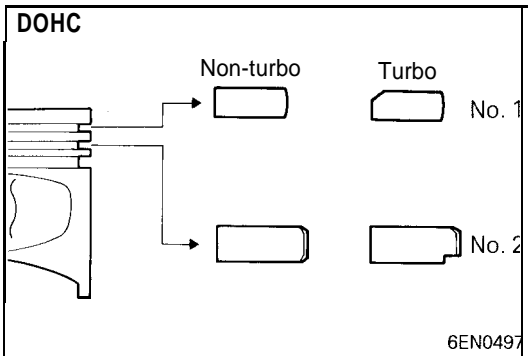
NOTE

(1) Note the difference in shape between No. 1 and No. 2 piston rings.

(2) Install piston rings No. 1 and No. 2 with their side having marks facing up (on the piston crown side).



6EN0527



◆D◆ PISTON AND CONNECTING ROD INSTALLATION

- (1) Liberally coat engine oil on the circumference of the piston, piston ring, and oil ring.
- (2) Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the figure.

- (3) Rotate the crankshaft so that the crank pin is on the center of the cylinder bore.
- (4) Use suitable thread protectors on the connecting rod bolts before inserting the piston and connecting rod assembly into the cylinder block.
Care must be taken not to nick the crank pin.
- (5) Using a suitable piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.

◆E◆ CONNECTING ROD CAP INSTALLATION

- (1) Verifying the mark made during disassembly, install the bearing cap to the connecting rod. If the connecting rod is new with no index mark, make sure that the bearing locking notches come on the same side as shown.

- (2) Make sure that the connecting rod big end side clearance meets the specification.

Standard value: 0.10 – 0.25 mm (.0039 – .0098 in.)

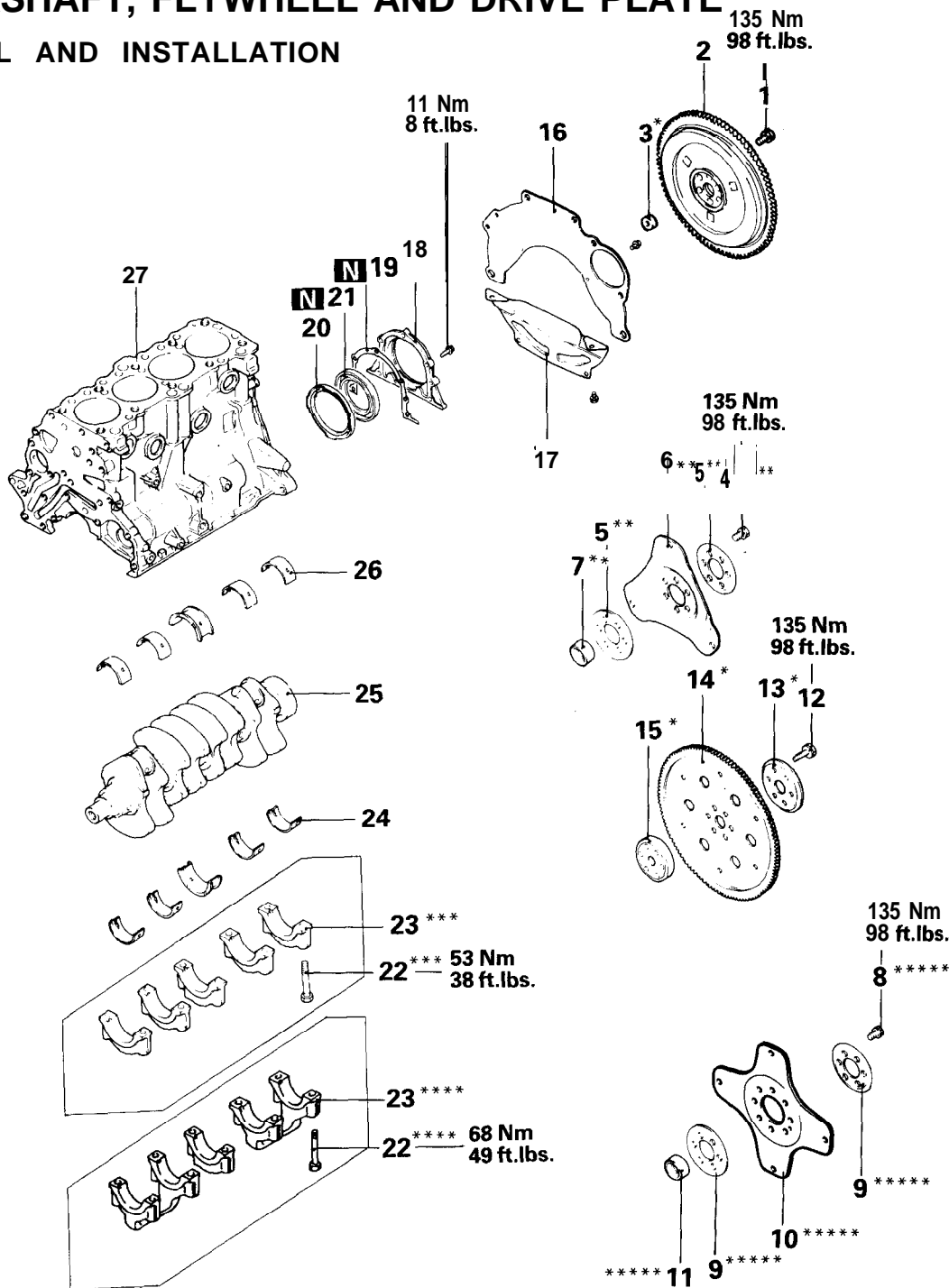
Limit: 0.4 mm (.016 in.)



5
A

CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION

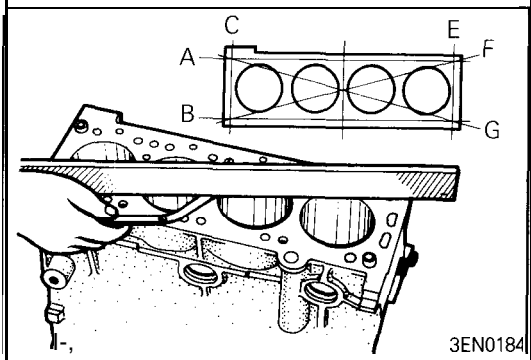
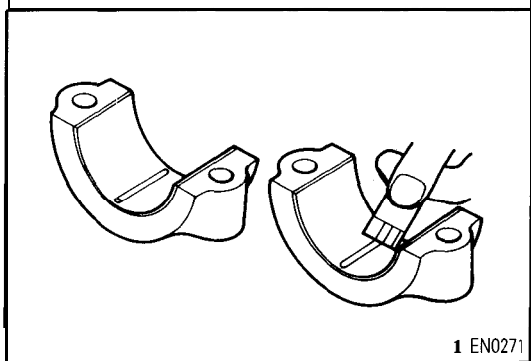
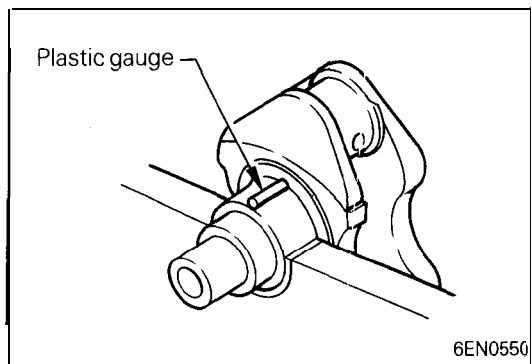


Removal steps

- | | |
|-------------------------|------------------------------------|
| 1. Flywheel bolt | 14. Drive plate* |
| 2. Flywheel | 15. Crankshaft adapter* |
| 3. Ball bearing* | 16. Rear plate |
| 4. Drive plate bolt** | 17. Bell housing cover |
| 5. Adapter plate** | 18. Oil seal case |
| 6. Drive plate** | 19. Gasket |
| 7. Crankshaft bushing** | ▶D▶ 20. Oil separator |
| 8. Drive plate bolt | ▶C▶ 21. Oil seal |
| 9. Adapter plate | 22. Bearing cap bolt |
| 10. Drive plate | ▶B▶ 23. Bearing cap |
| 11. Crankshaft bushing | ▶A▶ 24. Crankshaft bearing (lower) |
| 12. Drive plate bolt* | 25. Crankshaft |
| 13. Adapter plate* | ▶A▶ 26. Crankshaft bearing (upper) |
| | 27. Cylinder block |

NOTE

- * : Rear wheel drive
- ** : Front wheel drive
- *** : SOHC
- **** : DOHC
- ***** : DOHC Turbo for ECLIPSE



INSPECTION

CRANKSHAFT OIL CLEARANCE (PLASTIC GAUGE METHOD)

- (1) Remove oil from the crankshaft journals and crankshaft bearings.
- (2) Install the crankshaft.
- (3) Cut the plastic gauge to the same length as the width of the bearing and place it on the journal in parallel with its axis.
- (4) Install the crankshaft bearing cap carefully and tighten the bolts to the specified torque.
- (5) Carefully remove the crankshaft bearing cap.
- (6) Measure the width of the plastic gauge at its widest part by using a scale printed on the plastic gauge package.

Standard value: 0.02 – 0.05 mm (.0008 – .0020 in.)

Limit: 0.1 mm (.004 in.)

CYLINDER BLOCK

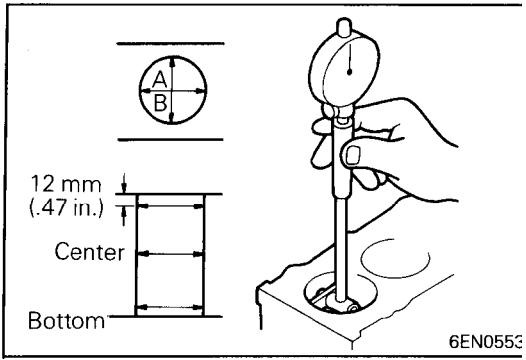
- (1) Visually check for scratches, rust, and corrosion. Use also a flaw detecting agent for the check. If defects are evident, correct, or replace.
- (2) Using a straightedge and feeler gauge, check the block top surface for warpage. Make sure that the surface is free from gasket chips and other foreign matter.
- (3) If the distortion is excessive, correct within the allowable limit or replace.

Grinding limit: 0.2 mm (.008 in.)

The total resurfacing depth of both cylinder block and mating cylinder head is 0.2 mm (.008 in.) at maximum.

Cylinder block height (when new):

4G61	274.9 – 275.1 mm (10.823 – 10.831 in.)
4G63	283.9 – 284.1 mm (11.177 – 11.185 in.)
4G64	289.9 – 290.1 mm (11.413 – 11.421 in.)



- (4) Check cylinder walls for scratches and seizure. If defects are evident, correct (rebores to an oversize) or replace.
- (5) Using a cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct the cylinder to an oversize and replace the piston and piston rings. Measure at the points shown in illustration.

Standard value:

Cylinder I.D.

4G61

82.30 – 82.33 mm (3.2402 – 3.2413 in.)

4G63

85.00 – 85.03 mm (3.3465 – 3.3476 in.)

4G64

86.50 – 86.53 mm (3.4055 – 3.4067 in.)

Cylindricity 0.01 mm (.0004 in.)

BORING CYLINDER

- (1) Oversize pistons to be used should be determined on the basis of the largest bore cylinder.

Piston size identification

Size	Identification mark
0.25 mm (.01 in.) O.S.	0.25
0.50 mm (.02 in.) O.S.	0.50
0.75 mm (.03 in.) O.S.	0.75
1.00 mm (.04 in.) O.S.	1.00

NOTE

Size mark is stamped on the piston top.

- (2) Measure outside diameter of piston to be used. Measure it in thrust direction as shown.
- (3) Based on the measured piston O.D. calculate the boring finish dimension.

Boring finish dimension = Piston O.D. + (clearance between piston O.D. and cylinder) – 0.02 mm (.0008 in.) (honing margin)

- (4) Bore all cylinders to the calculated boring finish dimension.

Caution

To prevent distortion that may result from temperature rise during honing, bore cylinders, working from No. 2 to No. 4 to No. 1 to No. 3.

- (5)hone to final finish dimension (piston O.D. + clearance between piston O.D. and cylinder).
- (6) Check the clearance between piston and cylinder.

Clearance between piston and cylinder:

4G63 SOHC

0.01 – 0.03 mm (.0004 – .0012 in.)

4G63 DOHC T/C

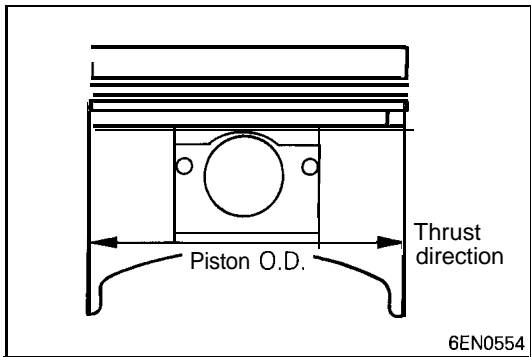
0.03 – 0.05 mm (.0012 – .0020 in.)

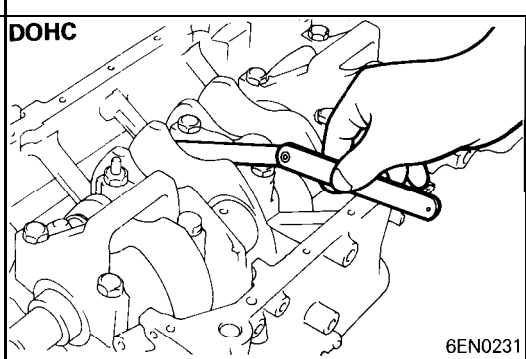
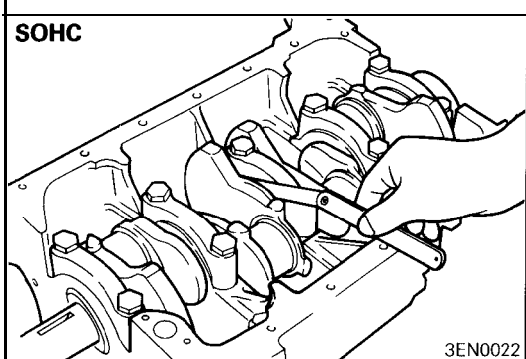
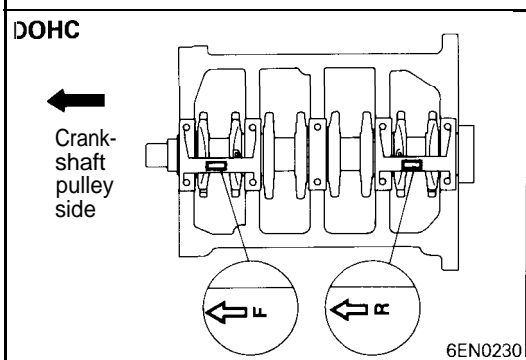
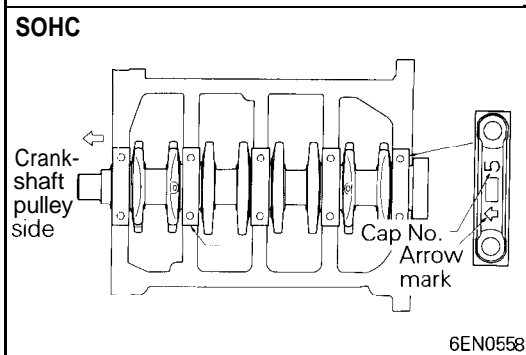
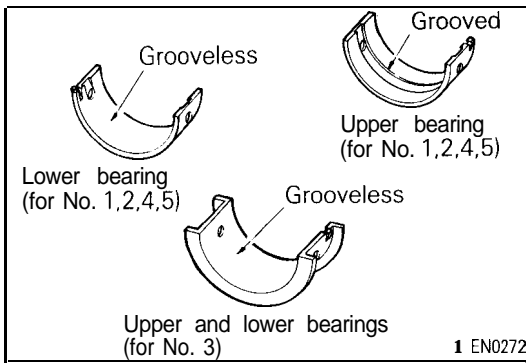
4G61, 4G63 DOHC, 4G64

0.02 – 0.04 mm (.0008 – .0016 in.)

NOTE

When boring cylinders, finish all of four cylinders to the same oversize. Do not bore only one cylinder to an oversize.





INSTALLATION SERVICE POINTS

◆A◆ CRANKSHAFT BEARING IDENTIFICATION

- (1) The upper bearings (on the cylinder block side) for Nos. 1, 2, 4 and 5 journals are provided with oil groove.
- (2) The lower bearings (on the cap side) for Nos. 1, 2, 4 and 5 journals are not provided with oil groove.
- (3) No.3 bearings are flanged and provided with no groove. Common bearings are used on the cap side and cylinder block side.

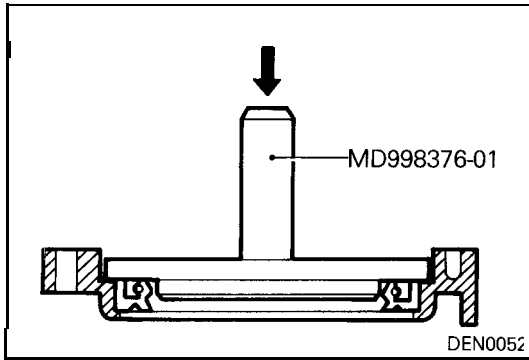
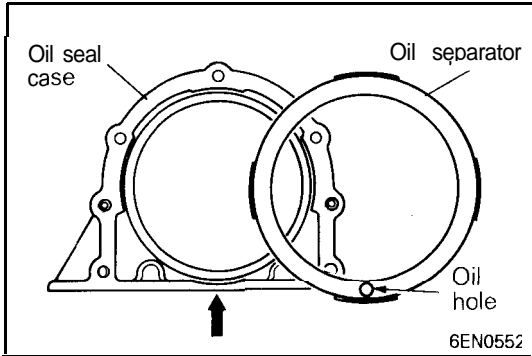
◆B◆ BEARING CAP INSTALLATION

- (1) Check the bearing cap for the identification mark before it is installed.

- (2) After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

Standard value: 0.05 – 0.18 mm (.0020 – .0071 in.)

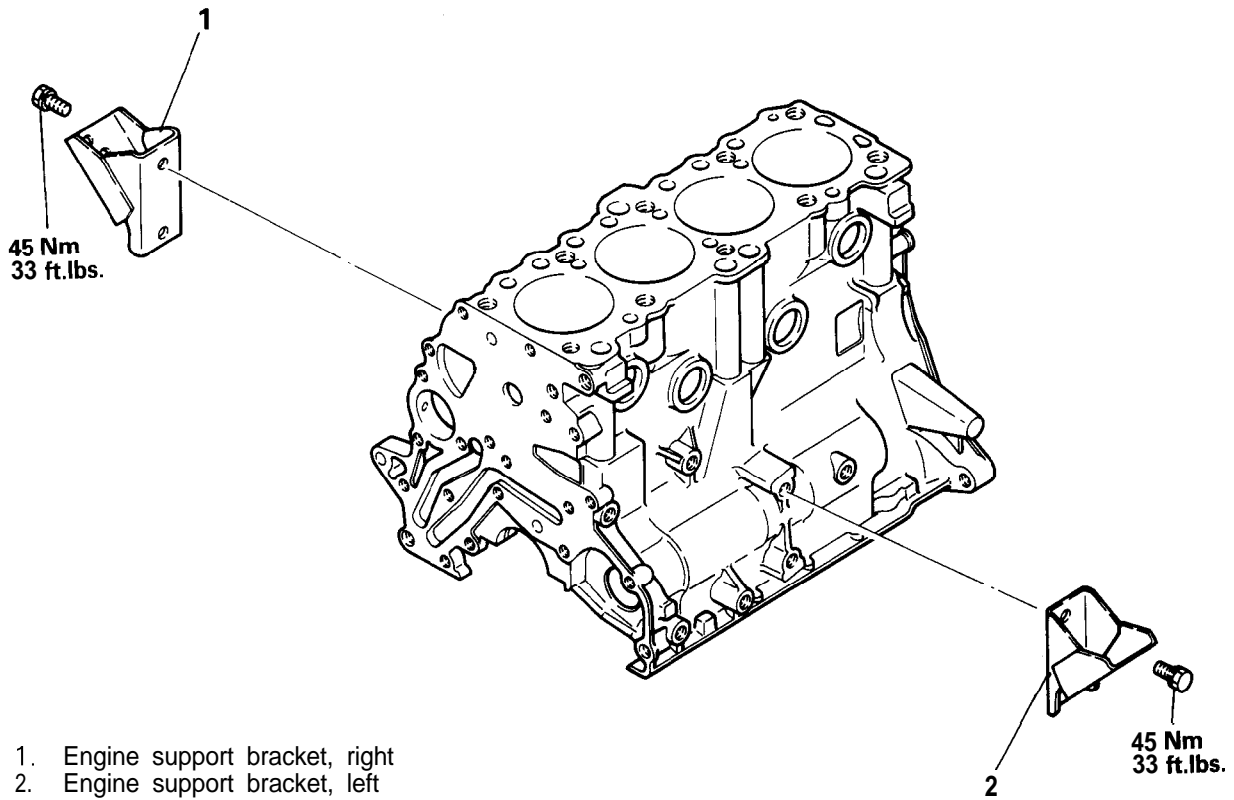
Limit: 0.25 mm (.0098 in.)

**◆C◆ OIL SEAL INSTALLATION****◆D◆ OIL SEPARATOR INSTALLATION**

- (1) Force the oil separator into the oil seal case so that the oil hole in the separator is directed downward (arrow in illustration).

BRACKET

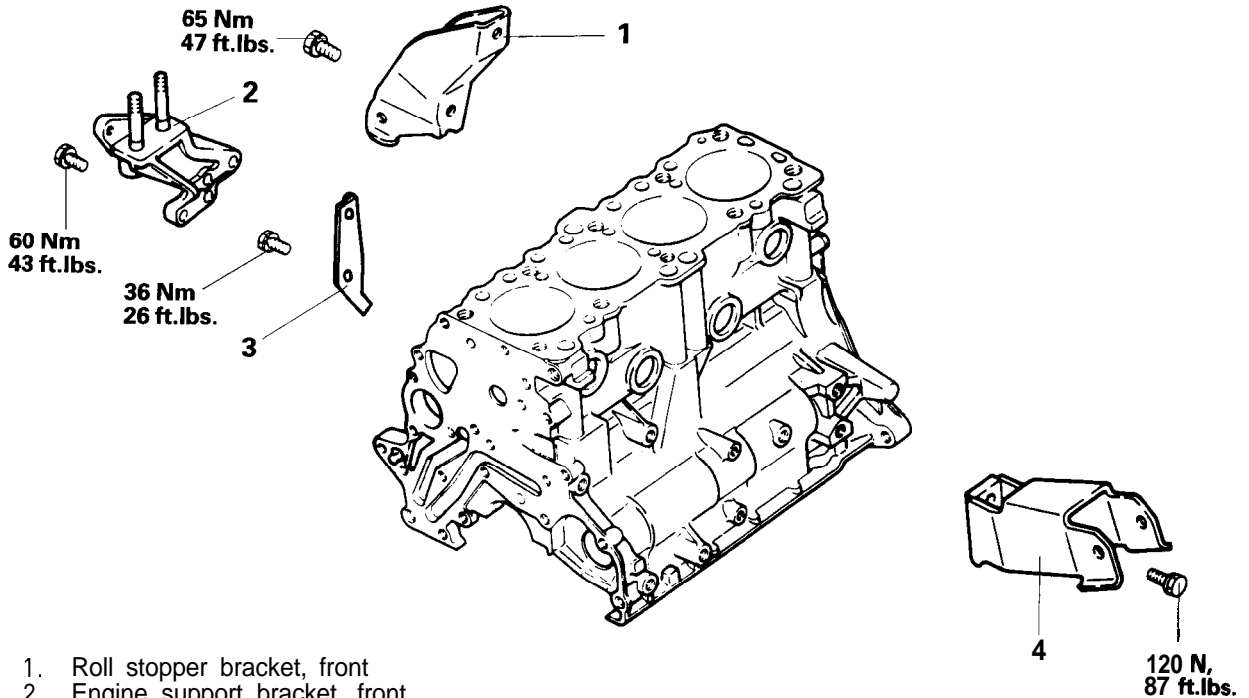
Rear wheel drive and four wheel drive



1. Engine support bracket, right
2. Engine support bracket, left

6EN350

Front wheel drive and all wheel drive



1. Roll stopper bracket, front
2. Engine support bracket, front
3. Exhaust pipe support bracket
4. Roll stopper bracket, rear

6EN0722

NOTES