ENGINE

4G6 SERIES

<1993 and subsequent>

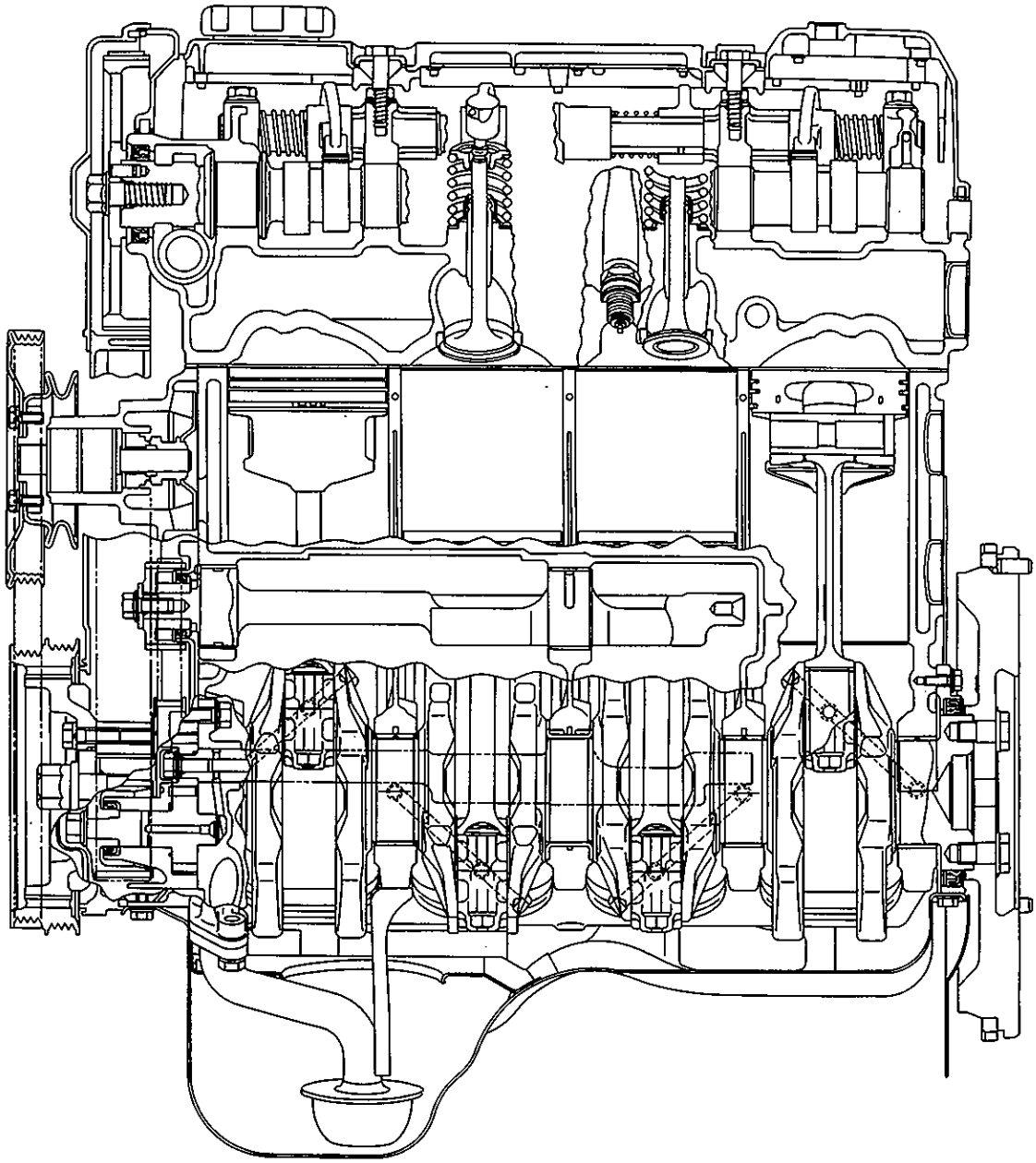
CONTENTS

REMARKS

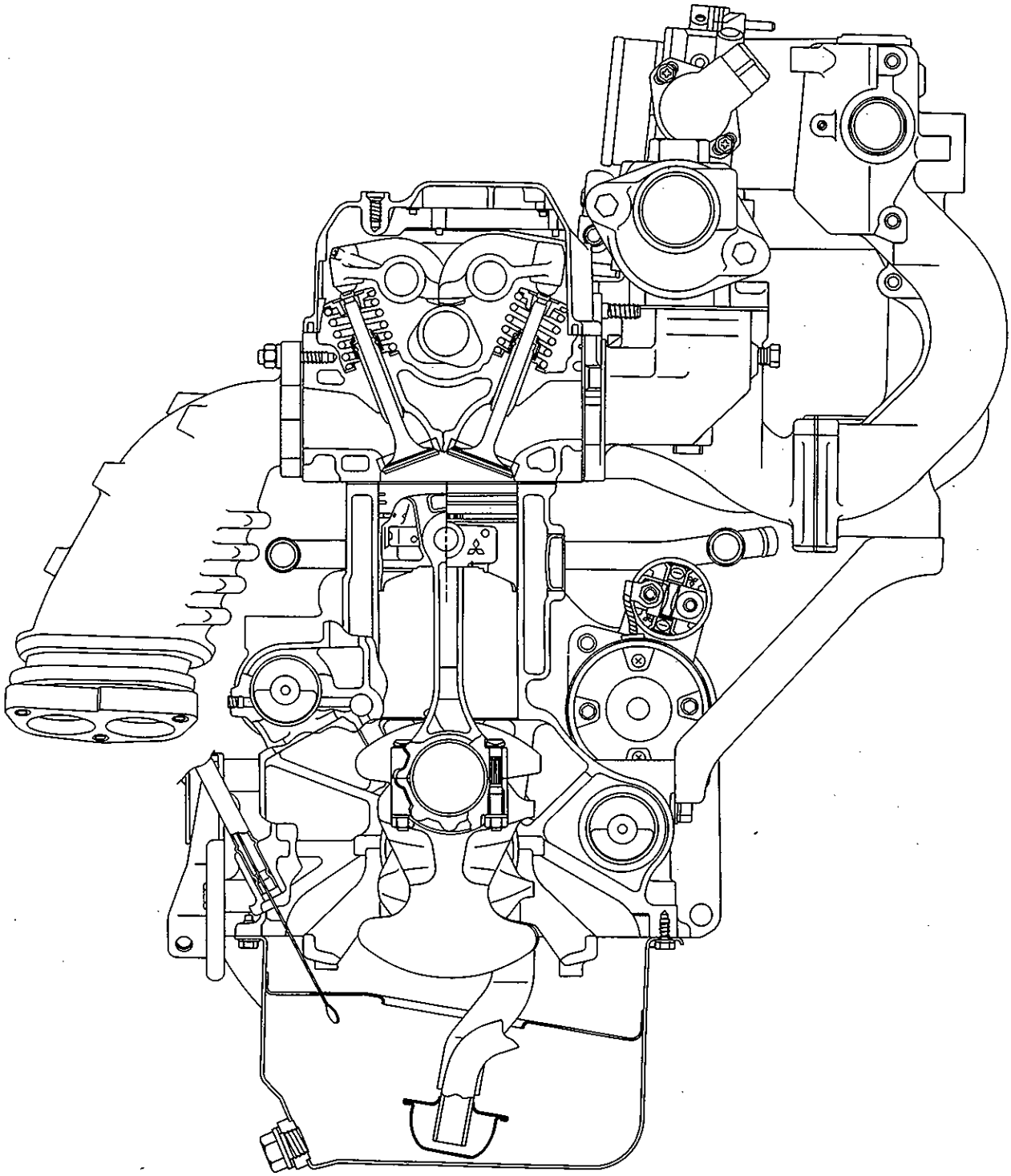
This manual covers the 4G6 engines of 1993 and subsequent year models. When using this manual, please note that all the pages are applicable to the above engines regardless of the indication in the headline of each page "4G6 ENGINE <1993>" and "4G6 ENGINE <1993–>".

GENERAL INFORMATION

SECTIONAL VIEW – 8-VALVE SINGLE CAMSHAFT ENGINE

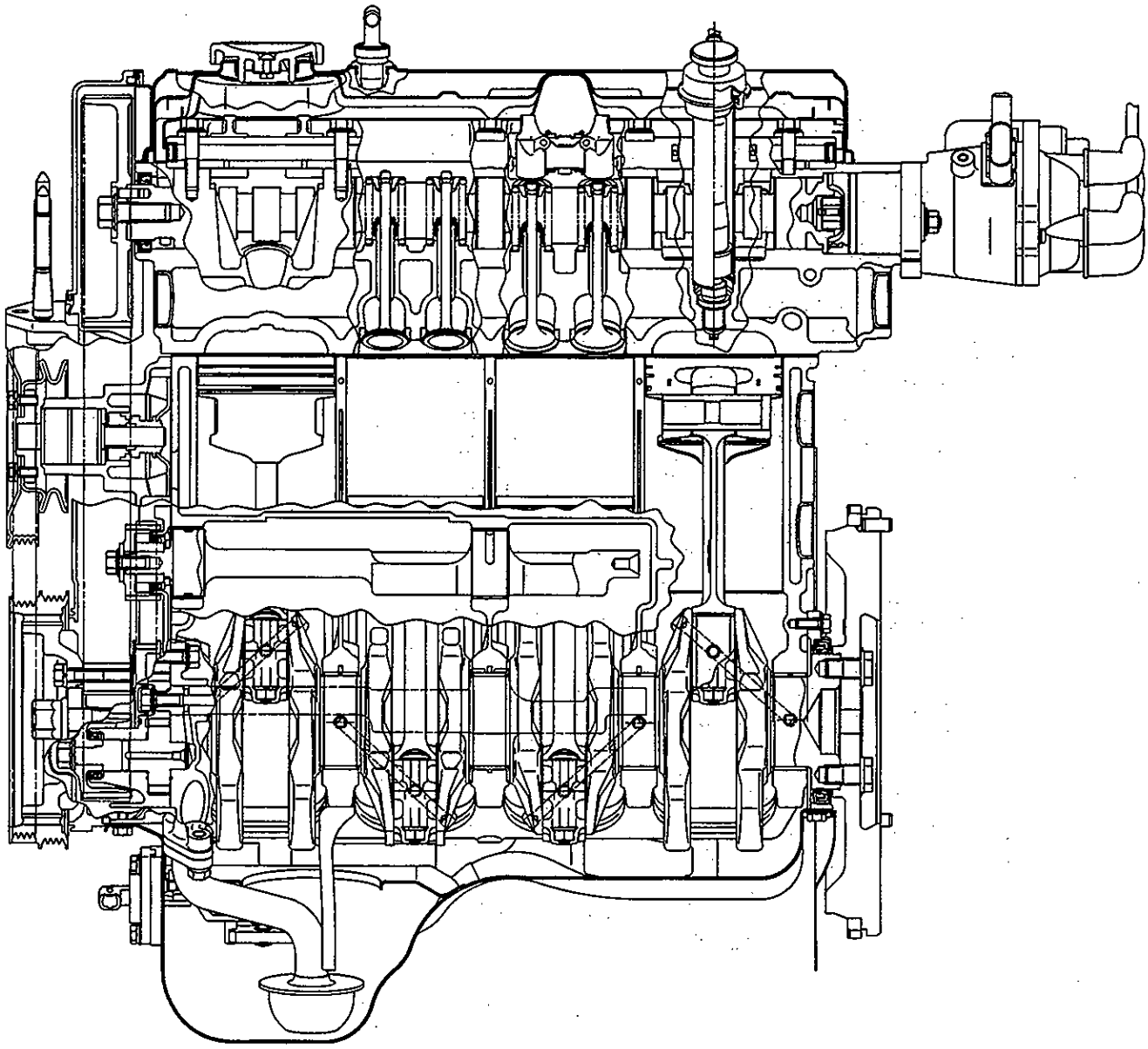


6EN0629

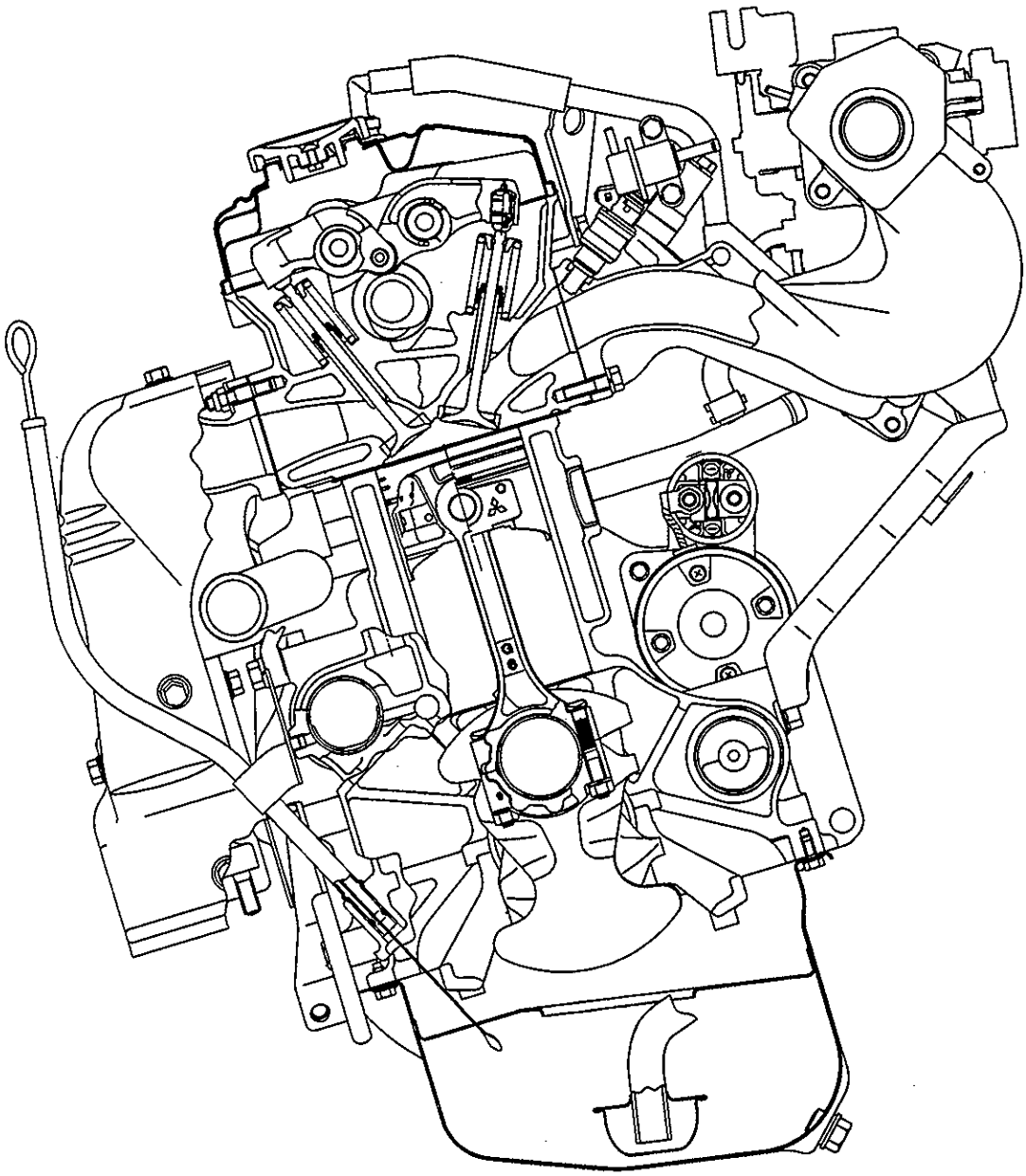


6EN0630

SECTIONAL VIEW – 16-VALVE SINGLE CAMSHAT ENGINE FOR FRONT WHEEL DRIVE VEHICLE



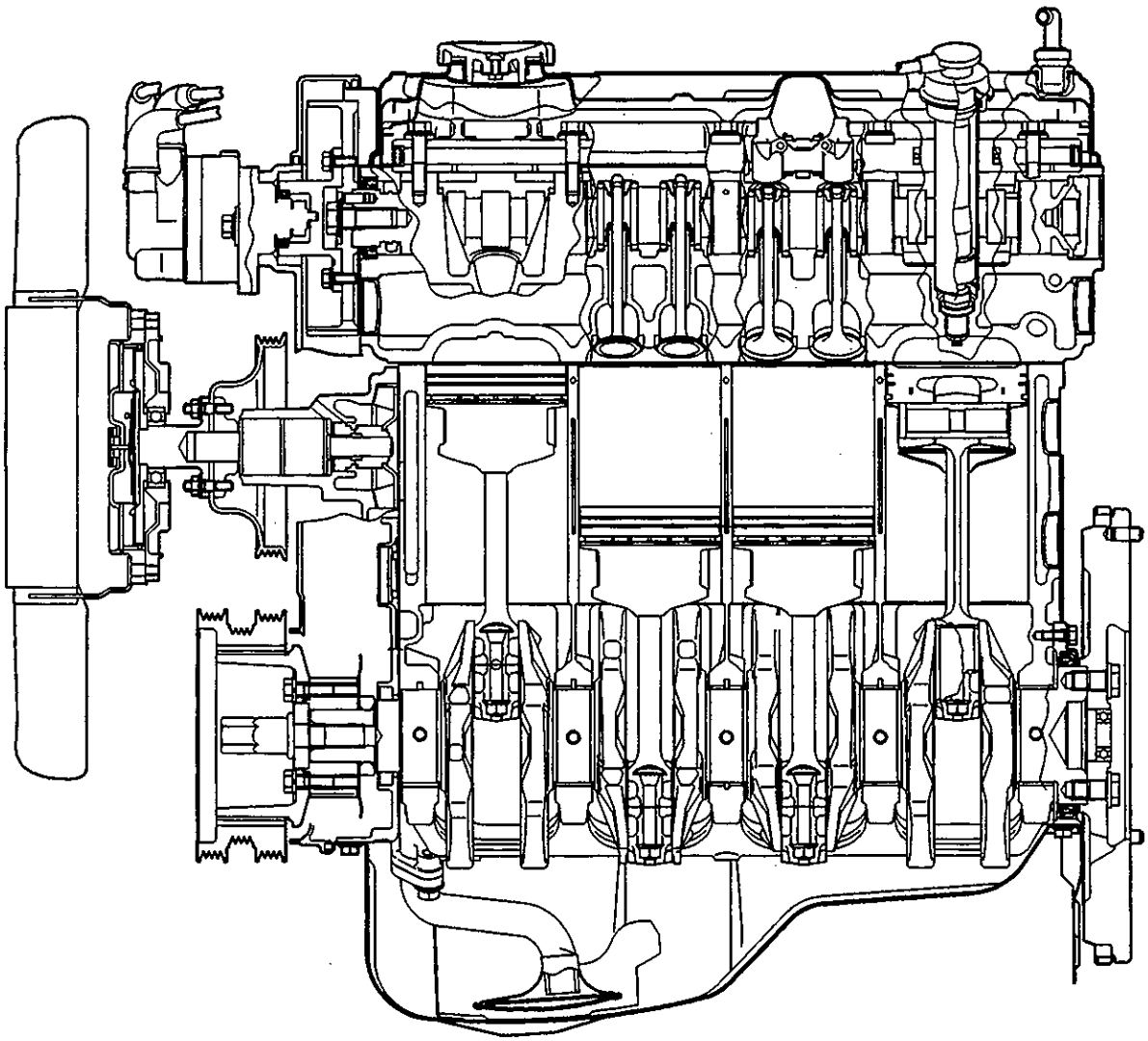
6EN0613



6EN0614

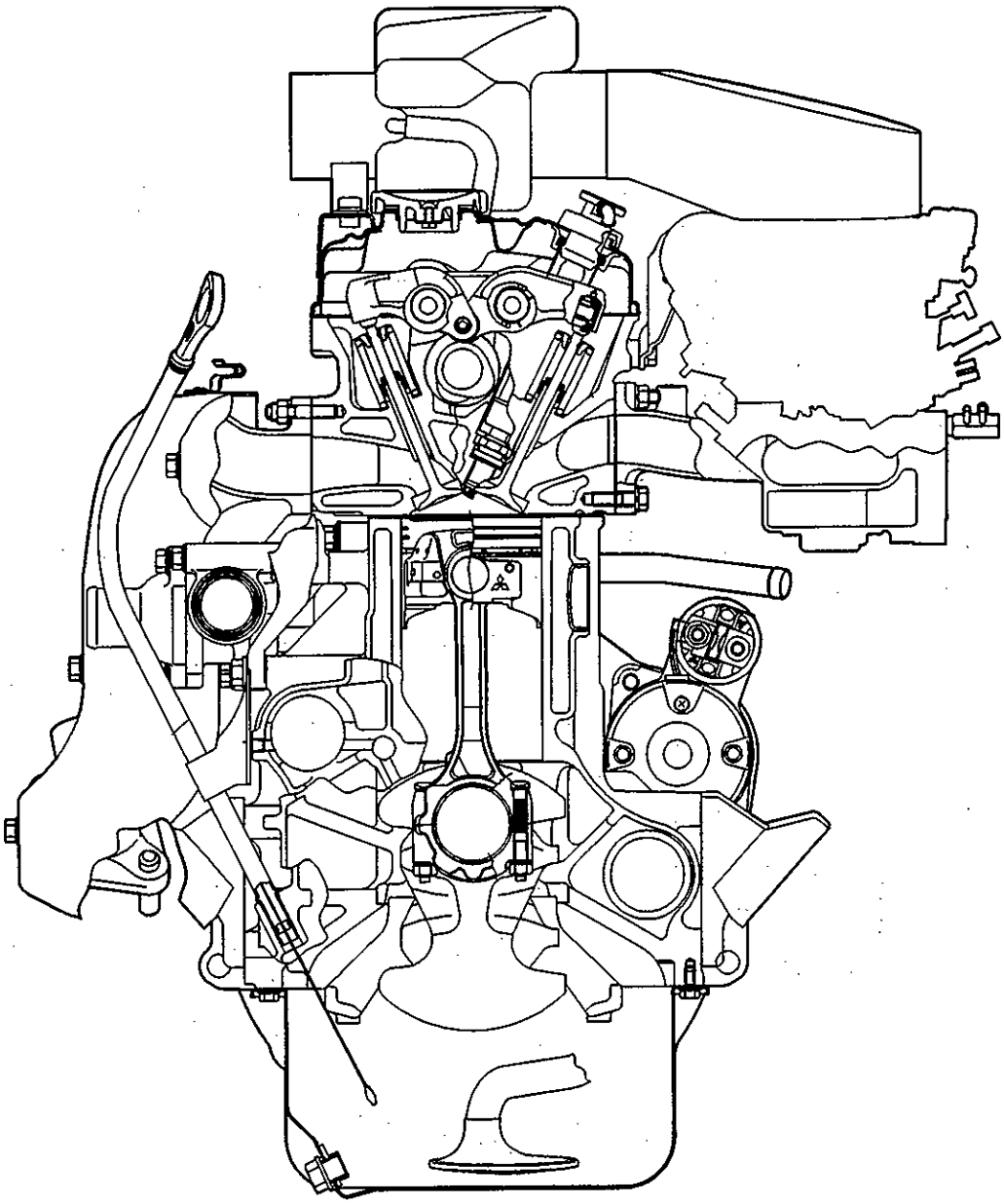
Added

SECTIONAL VIEW – 16-VALVE SINGLE CAMSHAT ENGINE FOR REAR WHEEL DRIVE VEHICLE



6EN1010

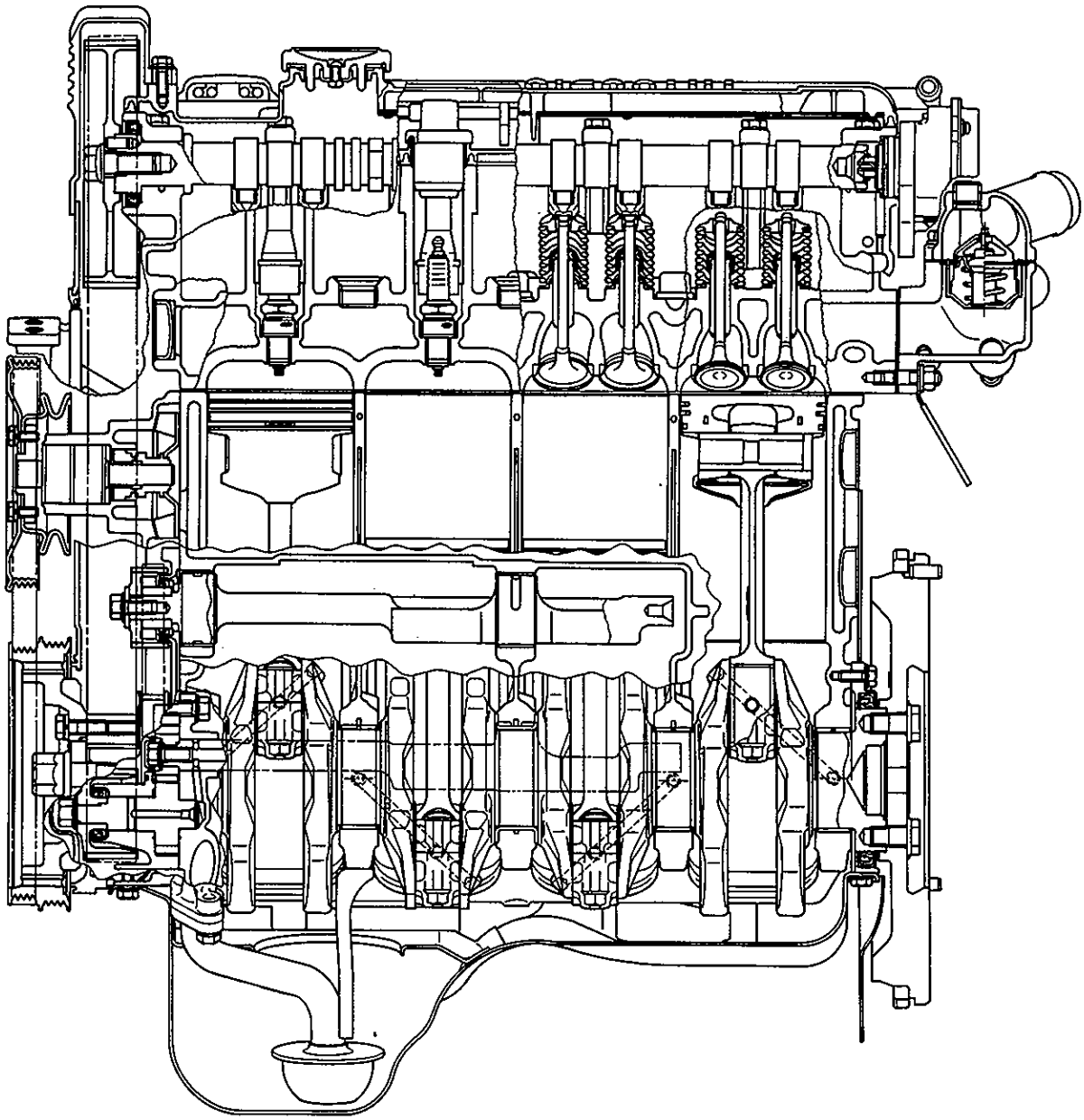
Added



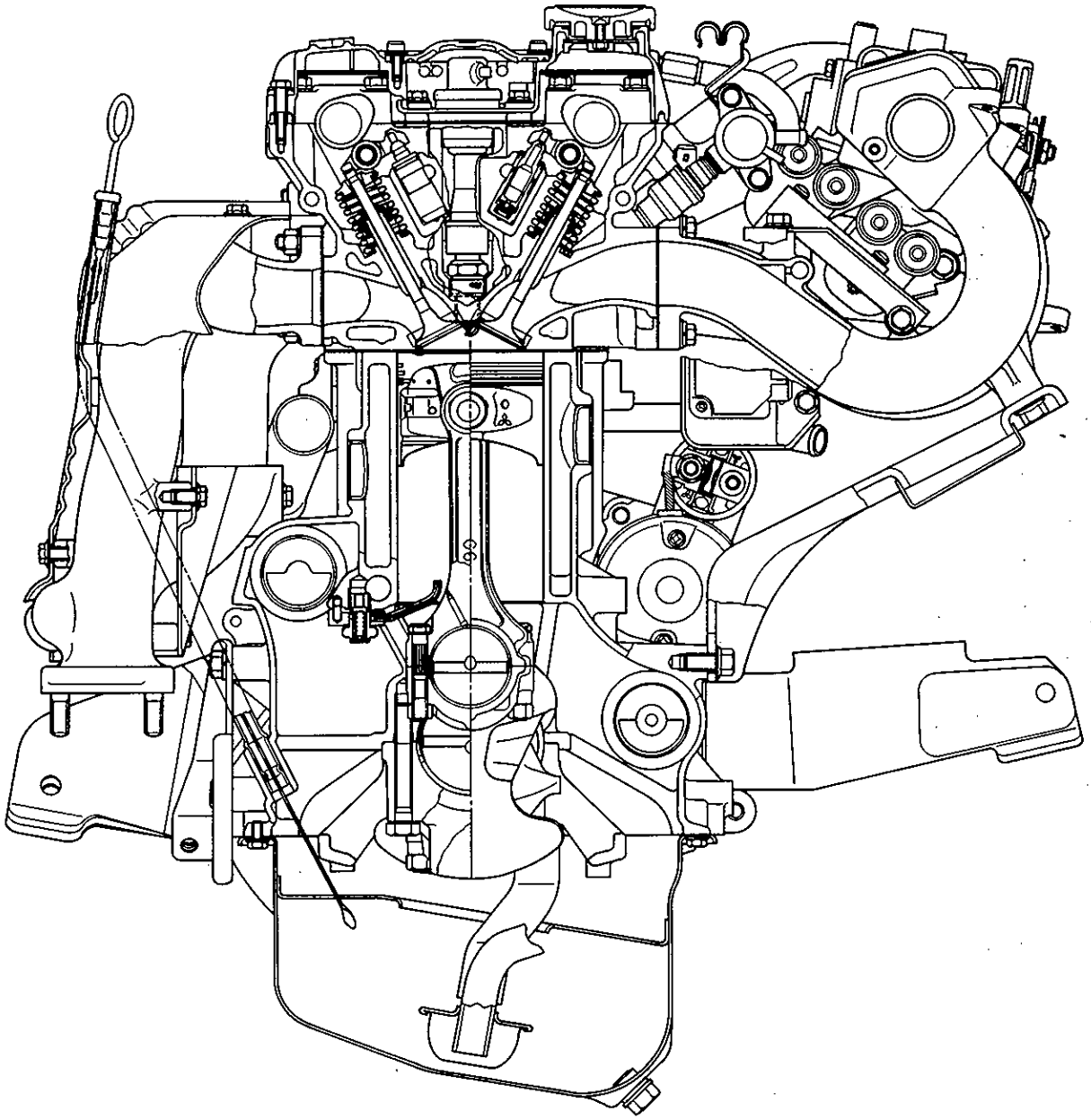
6EN1011

Added

SECTIONAL VIEW – DOUBLE CAMSHAFT ENGINE

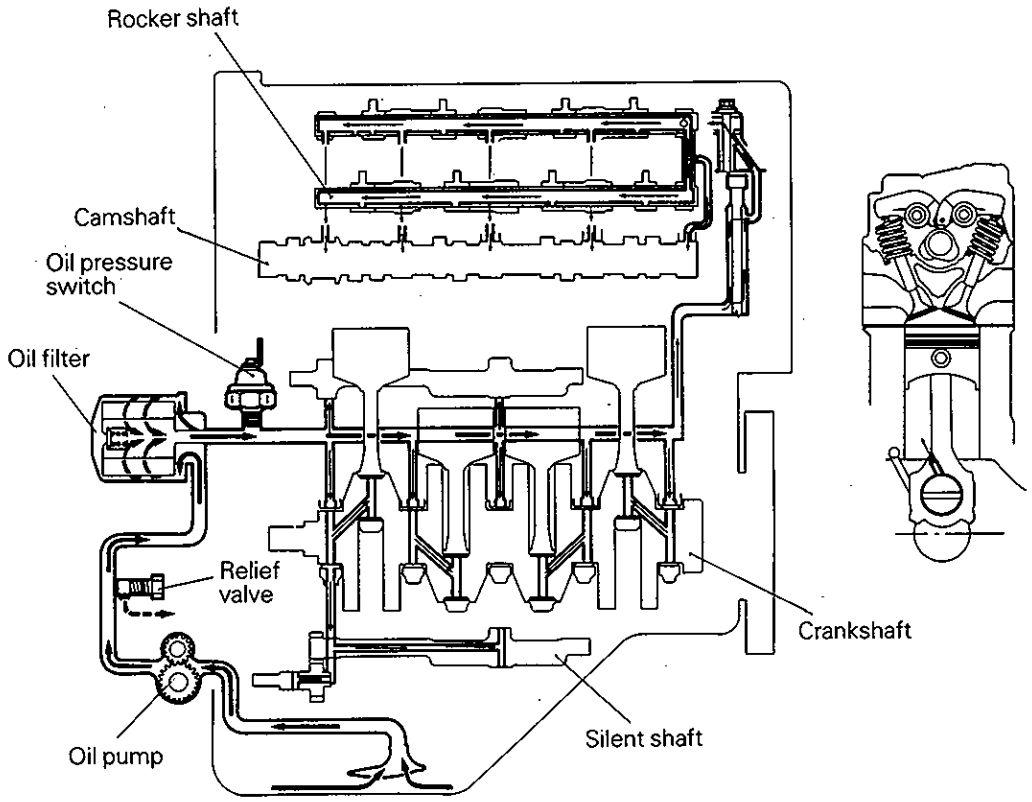


6EN0619



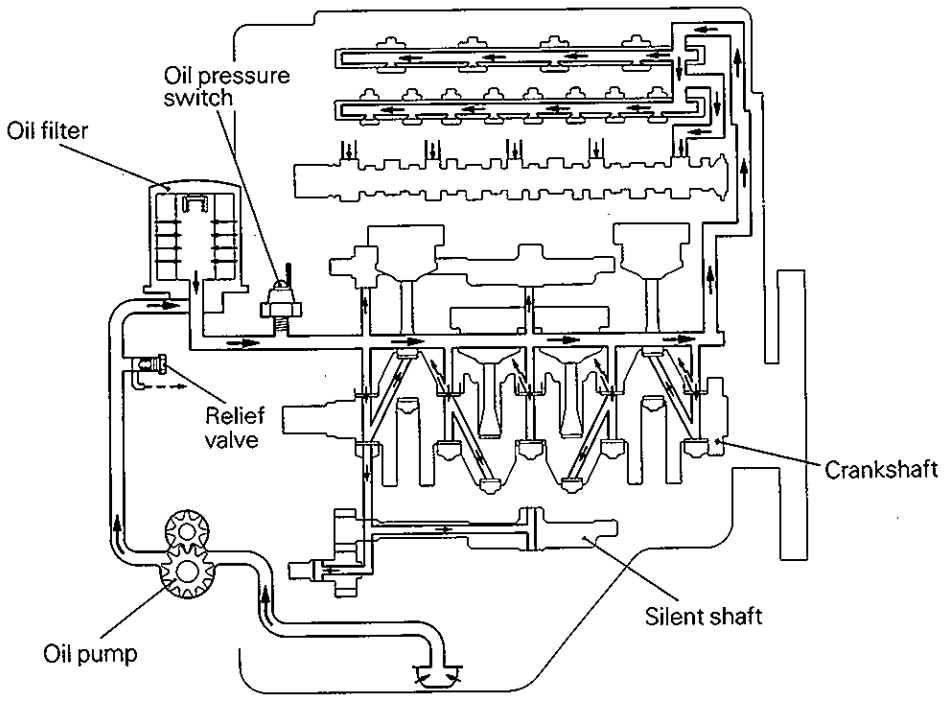
6EN0620

LUBRICATION SYSTEM – 8-VALVE SINGLE CAMSHAFT ENGINE



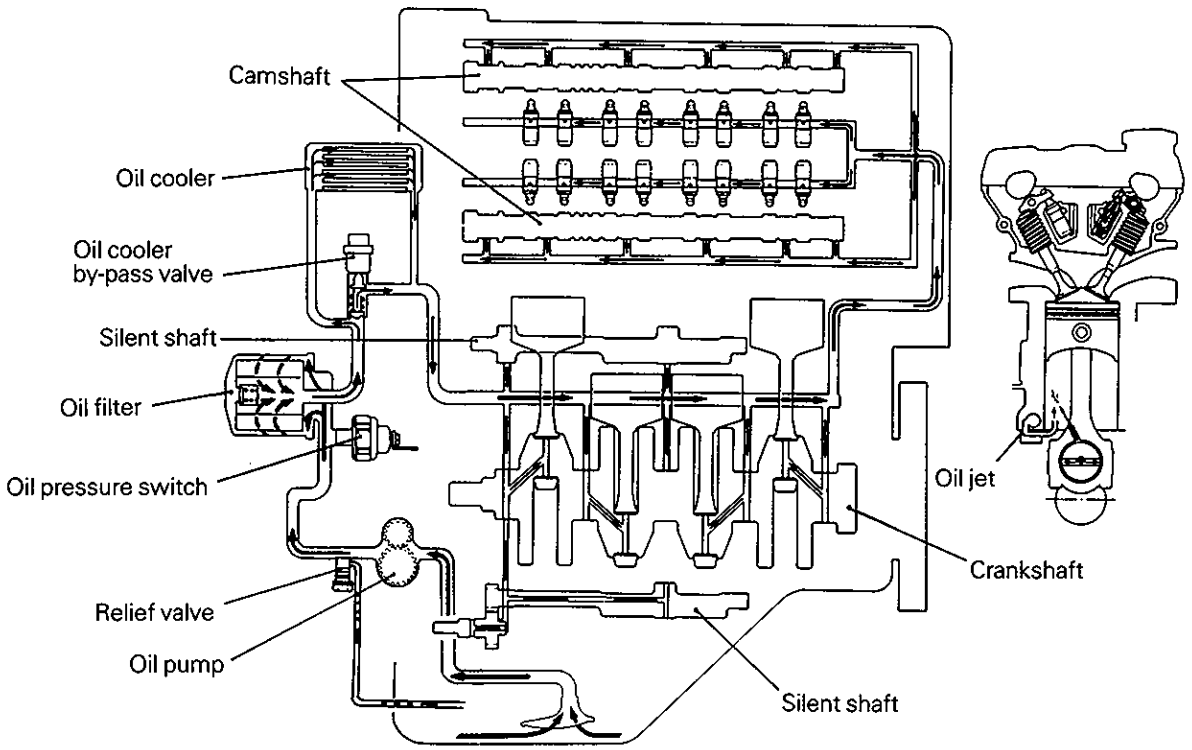
6LU0039

LUBRICATION SYSTEM – 16-VALVE SINGLE CAMSHAFT ENGINE



6EN0734

LUBRICATION SYSTEM – DOUBLE CAMSHAFT ENGINE



6LU0055

1. SPECIFICATIONS

GENERAL SPECIFICATIONS

4G63 8-VALVE SINGLE CAMSHAFT ENGINE

Description			Specifications
Type			In-line, overhead valve, single overhead camshaft
Number of cylinders			4
Combustion chamber			Pentroof type
Total displacement			1997 cm^3 (121.9 cu.in.)
Cylinder bore			85.0 mm (3.35 in.)
Piston stroke			88.0 mm (3.46 in.)
Compression ratio			8.5
Valve timing			
( ): camshaft identification			(1,A)
Intake valve	Open		19° BTDC
	Close		57° ABDC
Exhaust valve	Open		57° BBDC
	Close		19° ATDC
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

4G63 16-VALVE SINGLE CAMSHAFT ENGINE

Description			Specifications	
Type			In-line, overhead valve, single overhead camshaft	
Number of cylinders			4	
Combustion chamber			Pentroof type	
Total displacement			1997 cm^3 (121.9 cu.in.)	
Cylinder bore			85.0 mm (3.35 in.)	
Piston stroke			88.0 mm (3.46 in.)	
Compression ratio			10.5	
Valve timing				
( ): camshaft identification			(2)	(4)
Intake valve	Open		11° BTDC	16° BTDC
	Close		53° ABDC	44° ABDC
Exhaust valve	Open		63° BBDC	44° BBDC
	Close		21° ATDC	16° ATDC
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	

4G64 8-VALVE SINGLE CAMSHAFT ENGINE

Description			Specifications
Type			In-line, overhead valve, single overhead camshaft
Number of cylinders			4
Combustion chamber			Pentroof type
Total displacement			2350 cm^3 (143.4 cu.in.)
Cylinder bore			86.5 mm (3.41 in.)
Piston stroke			100.0 mm (3.94 in.)
Compression ratio			8.5
Valve timing			
( ): camshaft identification			(D)
Intake valve	Open		20° BTDC
	Close		64° ABDC
Exhaust valve	Open		64° BBDC
	Close		20° ATDC
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

4G64 16-VALVE SINGLE CAMSHAFT ENGINE

Description		Specifications			
Type		In-line, overhead valve, single overhead camshaft			
Number of cylinders		4			
Combustion chamber		Pentroof type			
Total displacement		2350 cm^3 (143.4 cu.in.)			
Cylinder bore		86.5 mm (3.41 in.)			
Piston stroke		100.0 mm (3.94 in.)			
Compression ratio		9.5			
Valve timing					
( ): camshaft identification		(1)	(5)	(B)	(C)
Intake valve	Open	18° BTDC	18° BTDC	16° BTDC	16° BTDC
	Close	58° ABDC	53° ABDC	61° ABDC	53° ABDC
Exhaust valve	Open	58° BBDC	50° BBDC	58° BBDC	50° BBDC
	Close	18° ATDC	18° ATDC	16° ATDC	16° ATDC
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			

4G63 DOUBLE CAMSHAFT ENGINE

Description			Specifications	
Type			In-line, overhead valve, double overhead camshaft	
Number of cylinders			4	
Combustion chamber			Pentroof type	
Total displacement			1997 cm^3 (121.9 cu.in.)	
Cylinder bore			85 mm (3.35 in.)	
Piston stroke			88 mm (3.46 in.)	
Compression ratio			10.5 <Up to 1995 model>, 10.0 <From 1996 model>	
Valve timing				
( ): camshaft identification			(G) <Up to 1995 model>, (L) (H) <From 1996 model>	
			<Up to 1995 model>	<From 1996 model>
Intake valve	Open		18° BTDC	21° BTDC
	Close		62° ABDC	51° ABDC
Exhaust valve	Open		63° BBDC	63° BBDC
	Close		21° ATDC	21° ATDC
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	

SERVICE SPECIFICATIONS

mm (in.)

	Standard	Limit
Cylinder head – 8-valve single camshaft engine		
Flatness of gasket surface	0.05 (0.0020)	0.2 (0.008)
Grinding limit		*0.2 (0.008)
* Total resurfacing depth of both cylinder head and cylinder block		
Flatness of manifold mounting surface	0.15 (0.0059)	0.3 (0.012)
Overall height	89.9 – 90.1 (3.539 – 3.547)	
Cylinder head bolt		
Nominal length		Max. 120.4 (4.74)
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05	13.05 – 13.07 (0.5138 – 0.5146)	
0.25	13.25 – 13.27 (0.5217 – 0.5224)	
0.50	13.50 – 13.52 (0.5315 – 0.5323)	
Oversize rework dimensions of intake valve seat ring hole		
0.30 4G63	44.30 – 44.33 (1.7441 – 1.7453)	
4G64	47.30 – 47.33 (1.8622 – 1.8634)	
0.60 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 4G63	38.30 – 38.33 (1.5079 – 1.5091)	
4G64	40.30 – 40.33 (1.5866 – 1.5878)	
0.60 4G63	38.60 – 38.63 (1.5197 – 1.5209)	
4G64	40.60 – 40.63 (1.5984 – 1.5996)	
Cylinder head – 16-valve single camshaft engine		
Flatness of gasket surface	0.05 (0.0020)	0.2 (0.008)
Grinding limit		*0.2 (0.008)
* Total resurfacing depth of both cylinder head and cylinder block		
Flatness of manifold mounting surface	0.15 (0.0059)	0.3 (0.012)
Overall height	119.9 – 120.1 (4.720 – 4.728)	
Cylinder head bolt		
Nominal length		Max. 99.4 (3.91)
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05	11.05 – 11.07 (0.435 – 0.436)	
0.25	11.25 – 11.27 (0.443 – 0.444)	
0.50	11.50 – 11.52 (0.453 – 0.454)	
Oversize rework dimensions of intake valve seat ring hole		
0.30	34.30 – 34.33 (1.350 – 1.351)	
0.60	34.60 – 34.63 (1.362 – 1.363)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.30	31.80 – 31.83 (1.2520 – 1.2531)	
0.60	32.10 – 32.13 (1.2638 – 1.2650)	

mm (in.)

	Standard	Limit
Cylinder head – Double camshaft engine		
Flatness of gasket surface	0.05 (0.0020)	0.2 (0.008)
Grinding limit		*0.2 (0.008)
* Total resurfacing depth of both cylinder head and cylinder block		
Flatness of manifold mounting surface	0.15 (0.0059)	0.3 (0.012)
Overall height	131.9 – 132.1 (5.193 – 5.201)	
Cylinder head bolt		
Nominal length		Max. 99.4 (3.91)
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05	12.05 – 12.07 (0.4744 – 0.4752)	
0.25	12.25 – 12.27 (0.4823 – 0.4831)	
0.50	12.50 – 12.52 (0.4921 – 0.4929)	
Oversize rework dimensions of intake valve seat ring hole		
0.30	35.30 – 35.33 (1.3898 – 1.3909)	
0.60	35.60 – 35.63 (1.4016 – 1.4028)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.30	33.30 – 33.33 (1.3110 – 1.3122)	
0.60	33.60 – 33.63 (1.3228 – 1.3240)	
Camshaft – 8-valve single camshaft engine		
Identification mark: 1		
Cam height – Intake	42.17 (1.6602)	41.67 (1.6405)
Cam height – Exhaust	42.23 (1.6626)	41.73 (1.6429)
Identification mark: A		
Cam height – Intake	42.08 (1.6567)	41.58 (1.6370)
Cam height – Exhaust	42.08 (1.6567)	41.58 (1.6370)
Identification mark: 3		
Cam height – Intake	42.40 (1.6693)	41.90 (1.6496)
Cam height – Exhaust	42.40 (1.6693)	41.90 (1.6496)
NOTE: The camshaft identification mark is stamped on the rear end of the camshaft.		
Fuel pump driving cam diameter	38 (1.50)	
Journal diameter	33.94 – 33.95 (1.3362 – 1.3366)	
Oil clearance	0.05 – 0.09 (0.0020 – 0.0035)	
Camshaft – 16-valve single camshaft engine		
Identification mark: 1, 2		
Cam height – Intake	37.39 (1.4720)	36.89 (1.4524)
Cam height – Exhaust	37.14 (1.4622)	36.64 (1.4425)
Identification mark: 4		
Cam height – Intake	37.20 (1.4646)	36.70 (1.4449)
Cam height – Exhaust	36.83 (1.4500)	36.33 (1.4303)
Identification mark: 5		
Cam height – Intake	37.39 (1.4720)	36.89 (1.4524)
Cam height – Exhaust	36.83 (1.4500)	36.33 (1.4303)

mm (in.)

		Standard	Limit
Camshaft – 16-valve single camshaft engine			
Identification mark: B			
Cam height	Intake	37.50 (1.4764)	37.00 (1.4567)
	Exhaust	37.30 (1.4685)	36.80 (1.4488)
Identification mark: C			
Cam height	Intake	37.50 (1.4764)	37.00 (1.4567)
	Exhaust	36.99 (1.4563)	36.49 (1.4366)
NOTE: The camshaft identification mark is stamped on the rear end of the camshaft.			
Journal diameter		44.93 – 44.94 (1.7689 – 1.7693)	
Oil clearance		0.05 – 0.09 (0.0020 – 0.0035)	
Camshaft – Double camshaft engine			
Identification mark: "G" <Up to 1995 model>, Intake "L" <From 1996 model>, Exhaust "H" <From 1996 model>			
Cam height <Up to 1995 model>	Intake	35.79 (1.4091)	35.29 (1.3894)
	Exhaust	35.49 (1.3972)	34.99 (1.3776)
<From 1996 model>	Intake	35.38 (1.3929)	34.88 (1.3732)
	Exhaust	34.91 (1.3744)	34.41 (1.3547)
NOTE: The camshaft identification mark is stamped on the rear end of the camshaft.			
Journal diameter		25.95 – 25.97 (1.0217 – 1.0224)	
Oil clearance		0.05 – 0.09 (0.0020 – 0.0035)	
Rocker arm – 8-valve single camshaft engine			
I.D.		18.91 – 18.93 (0.7445 – 0.7453)	
Rocker arm-to-shaft clearance		0.01 – 0.04 (0.0004 – 0.0016)	0.1 (0.004)
Rocker arm – 16-valve single camshaft engine			
I.D.		20.02 – 20.04 (0.7882 – 0.7890)	
Rocker arm-to-shaft clearance		0.02 – 0.05 (0.0008 – 0.0020)	0.1 (0.004)
Lash adjuster			
Leak down test		4 – 20 seconds/1 mm (0.04 in.)	
Remarks: Diesel fuel at 15 – 20°C (59 – 68°F)			
Rocker shaft – 8-valve single camshaft engine			
O.D.		18.89 – 18.90 (0.7437 – 0.7441)	
Overall length	Intake	385.5 (15.177)	
	Exhaust	372.5 (14.665)	
Rocker shaft – 16-valve single camshaft engine			
O.D.		19.99 – 20.00 (0.7870 – 0.7874)	
Overall length	Intake	417.25 (16.427)	
	Exhaust	417.25 (16.427)	
Valve – 8-valve single camshaft engine			
Overall length	Intake 4G63	109.76 (4.3213)	109.26 (4.3016)
	Intake 4G64	106.56 (4.1953)	106.06 (4.1756)
	Exhaust 4G63	108.66 (4.2779)	108.16 (4.2583)
	Exhaust 4G64	105.16 (4.1401)	104.66 (4.1204)
Stem diameter	Intake	7.96 – 7.98 (0.3134–0.3142)	
	Exhaust	7.93 – 7.95 (0.3122–0.3130)	
Face angle		45° – 45°30'	
Thickness of valve head (margin)	Intake	1.2 (0.047)	0.7 (0.028)
	Exhaust	2.0 (0.079)	1.5 (0.059)
Stem-to guide clearance	Intake	0.02 – 0.06 (0.0008 – 0.0024)	0.10 (0.004)
	Exhaust	0.05 – 0.09 (0.0020 – 0.0035)	0.15 (0.006)

mm (in.)

		Standard	Limit
Valve – 16-valve single camshaft engine			
Overall length	Intake	112.30 (4.4213)	111.80 (4.4016)
	Exhaust	114.11 (4.4925)	113.61 (4.4728)
Stem diameter	Intake	5.97 – 5.98 (0.2350 – 0.2354)	
	Exhaust	5.95 – 5.97 (0.2343 – 0.2350)	
Face angle		45° – 45°30′	
Thickness of valve head (margin)	Intake	1.0 (0.039)	0.5 (0.020)
	Exhaust	1.2 (0.047)	0.7 (0.028)
Stem-to guide clearance	Intake	0.02 – 0.05 (0.0008 – 0.0020)	0.10 (0.004)
	Exhaust	0.03 – 0.07 (0.0012 – 0.0028)	0.15 (0.006)
Valve – Double camshaft engine			
Overall length	Intake	109.50 (4.3110)	109.00 (4.2913)
	Exhaust	109.70 (4.3189)	109.20 (4.2992)
Stem diameter	Intake	6.57 – 6.58 (0.2587 – 0.2591)	
	Exhaust	6.53 – 6.55 (0.2571 – 0.2579)	
Face angle		45° – 45°30′	
Thickness of valve head (margin)	Intake	1.0 (0.039)	0.7 (0.028)
	Exhaust	1.5 (0.059)	1.0 (0.039)
Stem-to guide clearance	Intake	0.02 – 0.05 (0.0008 – 0.0020)	0.10 (0.004)
	Exhaust	0.05 – 0.09 (0.0020 – 0.0035)	0.15 (0.006)
Valve spring – 8-valve single camshaft engine			
Identification color: green			
Free height		47.5 (1.869)	46.5 (1.829)
Load/installed height N (kg, lbs.) / mm (in.)		276 (27.6, 61)/40.4 (1.591)	
Out-of-squareness		2° or less	Max. 4°
Identification color: white			
Free height		49.8 (1.961)	48.8 (1.921)
Load/installed height N (kg, lbs.) / mm (in.)		329 (32.9, 73)/40.4 (1.591)	
Out-of-squareness		2° or less	Max. 4°
Valve spring – 16-valve single camshaft engine			
Identification color: white			
Free height		51.0 (2.006)	50.0 (1.969)
Load/installed height N (kg, lbs.) / mm (in.)		272 (27.2, 60)/44.2 (1.74)	
Out-of-squareness		2° or less	Max. 4°
Valve spring – Double camshaft engine			
<Up to 1995 model>			
Identification color: blue			
Free height		48.3 (1.902)	47.3 (1.862)
Load/installed height N (kg, lbs.) / mm (in.)		300 (30, 66)/40 (1.57)	
Out-of-squareness		1.5° or less	Max. 4°

mm (in.)

		Standard	Limit
Valve spring – Double camshaft engine			
<From 1996 model>			
Identification color: pink			
Free height		47.0 (1.850)	46.0 (1.811)
Load / installed height N (kg, lbs.) / mm (in.)		240 (25, 54) / 40 (1.57)	
Out-of-squareness		1.5° or less	Max. 4°
Valve guide – 8-valve single camshaft engine			
Overall length	Intake	47 (1.85)	
	Exhaust	52 (2.05)	
I.D.		8.00 – 8.02 (0.3150 – 0.3157)	
O.D.		13.06 – 13.07 (0.5142 – 0.5146)	
Service size		0.05 (0.002), 0.25 (0.010), 0.50 (0.020) over size	
Press-in temperature		Room temperature	
Valve guide – 16-valve single camshaft engine			
Overall length	Intake	45.5 (1.791)	
	Exhaust	50.5 (1.988)	
I.D.		6.00 – 6.02 (0.2362 – 0.2370)	
O.D.		11.06 – 11.07 (0.4354 – 0.4358)	
Service size		0.05 (0.002), 0.25 (0.010), 0.50 (0.020) over size	
Press-in temperature		Room temperature	
Valve guide – Double camshaft engine			
Overall length	Intake	45.5 (1.791)	
	Exhaust	50.5 (1.988)	
I.D.		6.60 – 6.62 (0.2598 – 0.2606)	
O.D.		12.06 – 12.07 (0.4748 – 0.4752)	
Service size		0.05 (0.002), 0.25 (0.010), 0.50 (0.020) over size	
Press-in temperature		Room temperature	
Valve seat			
Seat angle		43°30′ – 44°	
Valve contact width		0.9 – 1.3 (0.035 – 0.051)	
Valve stem projection			
8-valve single camshaft engine		42.05 (1.6555)	42.55 (1.6752)
16-valve single camshaft engine		49.30 (1.9409)	49.80 (1.9606)
Double camshaft engine	Intake	49.20 (1.9370)	49.70 (1.9567)
	Exhaust	48.40 (1.9055)	48.90 (1.9252)
Service size		0.3 (0.012), 0.6 (0.024) 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 (0.7272 – 0.7276)	
	(rear)	40.95 – 40.97 (1.6122 – 1.6130)	
Oil clearance	Right (front)	0.03 – 0.06 (0.0012 – 0.0024)	
	(rear)	0.05 – 0.09 (0.0020 – 0.0036)	
	Left (front)	0.02 – 0.05 (0.0008 – 0.0020)	
	(rear)	0.05 – 0.09 (0.0020 – 0.0036)	

mm (in.)

		Standard	Limit
Piston – Single camshaft engine			
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 (0.0008 – 0.0016)	
Service size		0.25 (0.010), 0.50 (0.020), 0.75 (0.030), 1.00 (0.039) over size	
Piston – Double camshaft engine			
O.D.		84.97 – 85.00 (3.3453 – 3.3465)	
Piston to cylinder clearance		0.02 – 0.04 (0.0008 – 0.0016)	
Service size		0.50 (0.020), 1.00 (0.039) over size	
Piston ring – 8-valve single camshaft engine			
End gap	No. 1 ring	0.25 – 0.40 (0.0098 – 0.0157)	0.8 (0.031)
	No. 2 ring	0.45 – 0.60 (0.0177 – 0.0236)	0.8 (0.031)
	Oil ring	0.1 – 0.4 (0.0008 – 0.0157)	1.0 (0.039)
Ring-to-ring groove clearance	No. 1 ring		
	4G63	0.02 – 0.06 (0.0008 – 0.0024)	0.1 (0.004)
	4G64	0.03 – 0.07 (0.0012 – 0.0028)	0.1 (0.004)
	No. 2 ring		
	4G63	0.02 – 0.06 (0.0008 – 0.0024)	0.1 (0.004)
	4G64	0.03 – 0.07 (0.0012 – 0.0028)	0.1 (0.004)
Service size		0.25 (0.010), 0.50 (0.020), 0.75 (0.030), 1.00 (0.039) over size	
Piston ring – 16-valve single camshaft engine			
End gap	No. 1 ring	0.25 – 0.35 (0.0098 – 0.0138)	0.8 (0.031)
	No. 2 ring	0.45 – 0.55 (0.0177 – 0.0217)	0.8 (0.031)
	Oil ring	0.1 – 0.4 (0.0039 – 0.0157)	1.0 (0.039)
Ring-to-ring groove clearance	No. 1 ring		
	4G63	0.03 – 0.06 (0.0012 – 0.0024)	0.1 (0.004)
	4G64	0.03 – 0.07 (0.0012 – 0.0028)	0.1 (0.004)
	No. 2 ring		
	4G63	0.02 – 0.05 (0.0008 – 0.0020)	0.1 (0.004)
	4G64	0.03 – 0.07 (0.0012 – 0.0028)	0.1 (0.004)
Service size		0.25 (0.010), 0.50 (0.020), 0.75 (0.030), 1.00 (0.039) over size	
Piston ring – Double camshaft engine			
End gap	No. 1 ring <Up to 1995 model>	0.25 – 0.45 (0.0098 – 0.0177)	0.8 (0.031)
	<From 1996 model>	0.25 – 0.35 (0.0098 – 0.0138)	0.8 (0.031)
	No. 2 ring <Up to 1995 model>	0.45 – 0.60 (0.0177 – 0.0236)	0.8 (0.031)
	<From 1996 model>	0.40 – 0.55 (0.0157 – 0.0217)	0.8 (0.031)
	Oil ring <Up to 1995 model>	0.13 – 0.38 (0.0051 – 0.0150)	1.0 (0.039)
	<From 1996 model>	0.10 – 0.40 (0.0039 – 0.0157)	1.0 (0.039)
Ring-to-ring groove clearance	No. 1 ring	0.03 – 0.07 (0.0012 – 0.0028)	0.1 (0.004)
	No. 2 ring <Up to 1995 model>	0.03 – 0.07 (0.0012 – 0.0028)	0.1 (0.004)
	<From 1996 model>	0.02 – 0.06 (0.0008 – 0.0024)	0.1 (0.004)
Service size		0.50 (0.020), 1.00 (0.039) over size	
Piston pin			
O.D.		22.00 – 22.01 (0.8661 – 0.8665)	
Press-in load N (kg, lbs.)		7,500 – 17,500 (750 – 1,750, 1,653 – 3,858)	
Press-in temperature		Room temperature	

mm (in.)

		Standard	Limit
Connecting rod			
Big end center-to-small end center length		149.9 – 150.0 (5.902 – 5.906)	
Bend		0.05 (0.0020)	
Twist		0.1 (0.004)	
Big end side clearance		0.10 – 0.25 (0.0039 – 0.0098)	0.4 (0.016)
Crankshaft			
End play		0.05 – 0.18 (0.0020–0.0071)	0.25 (0.0098)
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		0.003 (0.0001)	
Concentricity of journal		0.003 (0.0001)	
Oil clearance of journal		0.02 – 0.04 (0.0008 – 0.0016)	0.1 (0.004)
Oil clearance of pin		0.02 – 0.05 (0.0008 – 0.0020)	0.1 (0.004)
Cylinder block			
Cylinder I.D.	4G63	85.00 – 85.03 (3.3465 – 3.3476)	
	4G64	86.50 – 86.53 (3.4055 – 3.4067)	
Flatness of gasket surface		0.05 (0.0020)	0.1 (0.004)
Grinding limit			*0.2 (0.008)
* Total resurfacing depth of both cylinder head and cylinder block			
Overall height	4G63	283.9 – 284.1 (11.177 – 11.185)	
	4G64	289.9 – 290.1 (11.413 – 11.421)	
Bearing cap bolt – Nominal length			Max. 71.1 (2.79)
Flywheel			
Runout			0.13 (0.0051)
Oil pump			
Side clearance			
Drive gear		0.08 – 0.14 (0.0031 – 0.0055)	
Driven gear		0.06 – 0.12 (0.0024 – 0.0047)	
Drive belt			
Deflection			
V-ribbed type belt	New belt	7.5 – 9.0 (0.30 – 0.35)	
	Used belt	8.0 (0.32)	
V type belt		7.0 – 10.0 (0.28 – 0.39)	
Tension			
V-ribbed type belt	New belt	500 – 700 N (50 – 70 kg, 110 – 154 lbs.)	
	Used belt	400 N (40 kg, 88 lbs.)	
Oil cooler by-pass valve			
Dimension (L)		34.5 (1.358) – normal temperature	
By-pass hole closing temperature		97 – 103°C (207 – 217°F) or more	
Auto tensioner			
Rod projection		12 (0.47)	1 (0.039)

NOTE
O.D.: Outer Diameter
I.D.: Inner Diameter
U.S.: Undersize Diameter

TORQUE SPECIFICATIONS

	Torque		
	Nm	kgm	ft.lbs.
Generator and ignition system			
Cooling fan	11	1.1	8
Fan clutch	11	1.1	8
Water pump pulley			
Flanged nut or bolt	11	1.1	8
Nut or bolt with spring washer	9	0.9	7
Generator mounting bolt	23	2.3	17
Generator brace bolt	24	2.4	17
Generator pivot nut	14	1.4	10
Crankshaft pulley bolt	25	2.5	18
Spark plug	25	2.5	18
Ignition coil bolt			
M6	14	1.4	10
M8	24	2.4	17
Distributor bracket	24	2.4	17
Camshaft sprocket spacer	10	1.0	7
Center cover bolt	3	0.3	2
Ignition power transistor bolt	11	1.1	8
Distributor nut or bolt			
8-valve engine	11	1.1	8
16-valve engine for front wheel drive vehicle	12	1.2	9
16-valve engine for rear wheel drive vehicle	13	1.3	9
Crankshaft position sensor nut	19	1.9	14
Timing belt			
Tensioner spring bolt	49	4.9	35
Tensioner pulley bolt	49	4.9	35
Tensioner arm bolt	22	2.2	16
Tensioner pulley bracket	49	4.9	35
Timing belt indicator	9	0.9	7
Idler pulley bolt	36	3.6	26
Oil pump sprocket nut	55	5.5	40
Crankshaft bolt	120	12.0	87
Tensioner "B" bolt	19	1.9	14
Silent shaft sprocket bolt	46	4.6	33
Camshaft sprocket bolt	90	9.0	65
Timing belt rear cover			
M8	14	1.4	10
M10	31	3.1	22
Crankshaft position sensor bolt	8.8	0.9	6.5
Camshaft position sensor bolt	8.8	0.9	6.5
Engine support bracket bolt	49	5.0	36

	Nm	Torque kgm	ft.lbs.
Fuel and emission control parts			
Carburetor			
8-valve single camshaft engine – conventional carburetor	12	1.2	9
8-valve single camshaft engine – electronic control carburetor	14	1.4	10
16-valve single camshaft engine	18	1.8	13
Fuel vapor separator	24	2.4	17
Fuel pump bolt	11	1.1	8
EGR valve bolt	22	2.2	16
Air pipe bracket			
M6	12	1.2	9
M8	14	1.4	10
Air reed valve bracket A			
M6	12	1.2	9
M8	14	1.4	10
Throttle body	12	1.2	9
EGR temperature sensor	11	1.1	8
Knock sensor	23	2.3	17
Injector and fuel rail	12	1.2	9
Fuel pressure regulator bolt	9	0.9	7
Fuel pressure regulator	40	4.0	29
Intake manifold			
Intake manifold bolt and nut			
8-valve single camshaft engine	18	1.8	13
16-valve single camshaft engine	20	2.0	14
Double camshaft engine M8	18	1.8	13
M10	36	3.6	26
Intake manifold stay bolt			
8-valve single camshaft engine	22	2.2	16
16-valve single camshaft engine for front wheel drive vehicle	31	3.1	22
16-valve single camshaft engine for rear wheel drive vehicle	14	1.4	10
Double camshaft engine	28	2.8	20
Intake manifold plenum bolt and nut	18	1.8	13
Intake manifold plenum stay bolt	18	1.8	13
Water inlet fitting bolt			
16-valve single camshaft engine for front wheel drive vehicle	13	1.3	9
Double camshaft engine <From 1996 model>	24	2.4	17
Water outlet fitting bolt			
8-valve single camshaft engine, double camshaft engine <Up to 1995 model>	19	1.9	14
16-valve single camshaft engine for front wheel drive vehicle, double camshaft engine <From 1996 model>	13	1.3	9
16-valve single camshaft engine for rear wheel drive vehicle	20	2.0	14
Engine coolant temperature gauge unit	11	1.1	8
Engine coolant temperature sensor	30	3	22
Thermostat case nut	18	1.8	13
Thermostat case bolt	19	1.9	14
Thermostat housing	24	2.4	17

	Nm	Torque kgm	ft.lbs.
Intake manifold			
Engine hanger			
8-valve single camshaft engine	18	1.8	13
16-valve single camshaft engine	19	1.9	14
Double camshaft engine	36	3.6	26
Heater pipe			
Carburetor	5	0.5	3.6
Fuel injection	13	1.3	9
Water hose bracket	13	1.3	9
Thermo switch	8	0.8	6
Exhaust manifold and water pump			
Oil level gauge guide bolt			
M8	14	1.4	10
Heat protector bolt			
16-valve single camshaft engine	13	1.3	9
Except 16-valve single camshaft engine			
M6	9	0.9	7
M8 – Engine with fuel injection	14	1.4	10
M8 – Engine with carburetor	30	3.0	22
Exhaust manifold nut			
8-valve single camshaft engine	18	1.8	13
16-valve single camshaft engine or double camshaft engine <Up to 1995 model> M8	28	2.8	20
M10	30	3.0	22
Double camshaft engine <From 1996 model> M8	29	3.0	22
M10	49	5.0	36
Cover	19	1.9	14
Radiator lower pipe	13	1.3	9
Thermo housing bracket	60	6.0	43
Thermo housing	24	2.4	17
Water by-pass fitting	24	2.4	17
Water inlet pipe bolt	14	1.4	10
Water pump bolt	14	1.4	10
Engine coolant temperature gauge unit	11	1.1	8
Thermo switch	8	0.8	6
Rocker arms and camshaft			
Rocker cover bolt – 8-valve single camshaft engine	6	0.6	4
Rocker cover bolt – 16-valve single camshaft engine	3.3	0.3	2
Bearing cap bolt – Single camshaft engine			
M8 x 25	24	2.4	17
M8 x 65	20	2	14
Bearing cap bolt – Double camshaft engine	20	2	14
Oil delivery body (valve body assembly)	11	1.1	8
Rocker arm and rocker shafts	32	3.2	23
Thrust case	14	1.4	10
Plate blot	12	1.2	8.7

	Torque		
	Nm	kgm	ft.lbs.
Cylinder head and valves			
Cylinder head bolt	20+90° turn +90° turn	2.0+90° turn +90° turn	14.5+90° turn +90° turn
Front case, silent shaft and oil pan			
Drain plug	40	4	29
Oil pan bolt	7	0.7	5
Oil screen bolt and nut	19	1.9	14
Check valve	33	3.3	24
Oil cooler bolt	43	4.3	31
Oil filter bracket bolt	19	1.9	14
Plug	24	2.4	17
Left silent shaft flange bolt	37	3.7	27
Front case bolt			
M8	24	2.4	17
M10	31	3.1	22
Oil pressure switch	10	1	7
Oil cooler by-pass valve	55	5.5	40
Relief plug	45	4.5	33
Oil pump cover bolt	17	1.7	12
Oil pump cover screw	10	1	7
Oil level sensor bolt	9	0.9	7
Baffle plate	9	0.9	7
Stiffener plate bolt	22	2.2	16
Piston and connecting rod			
Connecting rod cap nut	20+90° turn	2.0+90° turn	14.5+90° turn
Crankshaft, flywheel and drive plate			
Flywheel bolt	135	13.5	98
Drive plate bolt	135	13.5	98
Oil seal case bolt	11	1.1	8
Bearing cap bolt	25+90° turn	2.5+90° turn	18+90° turn
Oil jet	33	3.3	24
Cylinder block			
Left and right engine support bracket bolt	45	4.5	33
Front roll stopper bracket bolt	65	6.5	47
Rear roll stopper bracket bolt	120	12	87
Front engine support bracket bolt	60	6	43
Left engine support bracket bolt	36	3.6	26
Exhaust pipe support bracket bolt	36	3.6	26

NEW TIGHTENING METHOD – BY USE OF BOLTS TO BE TIGHTENED IN PLASTIC AREA

A new type of bolts, to be tightened in plastic area, is currently used in some parts of the engine. The tightening method for the bolts is different from the conventional one. Be sure to observe the method described in the text when tightening the bolts.
Service limits are provided for the bolts. Make sure that the service limits described in the text are strictly observed.

- Areas where the bolts are in use:
  (1) Cylinder head bolts
  (2) Main bearing cap bolts
  (3) Connecting rod cap bolts
- Tightening Method
  After tightening the bolts to the specified torque, tighten them another 90° or 180° (twice 90°). The tightening method varies on different areas. Observe the tightening method described in the text.

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
Engine support bracket bolt	3M ATD Part No. 8660 or equivalent	As required
Oil pan gasket	MITSUBISHI GENUINE PART MD970389 or equivalent	As required
Water outlet fitting	MITSUBISHI GENUINE PART MD970389 or equivalent	As required
Thermostat housing	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

FORM-IN-PLACE GASKET

The engine has several areas where the form-in-place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.
The FIPG used in the engine is a room temperature vulcanization (RTV) type and is supplied in a 100-gram tube (Part No. MD970389 or MD997110). Since the RTV hardens as it reacts with the moisture in the atmospheric air, it is normally used in the metallic flange areas. The FIPG, Part No. MD970389, can be used for sealing both engine oil and coolant, while Part No. 997110 can only be used for engine oil sealing.

Disassembly

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces. For removal of the oil pan, the special tool "Oil Pan Remover" (MD998727) is available. Be sure to use the special tool to remove the oil pan.

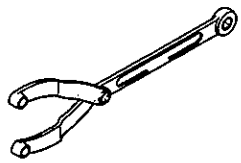
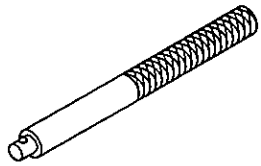
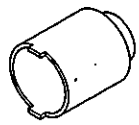
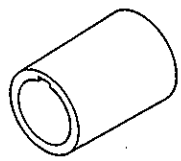
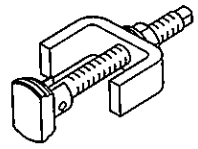
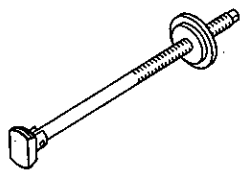
Surface Preparation

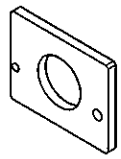
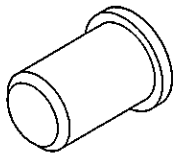
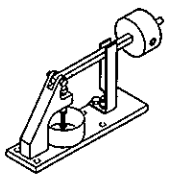
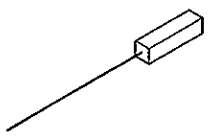
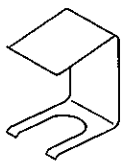
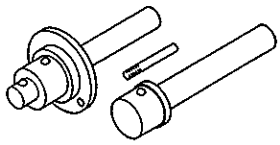
Thoroughly remove all substances desposited on the gasket application surfaces, using a gasket scraper or wire brush. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do not forget to remove the old sealant remaining in the bolt holes.

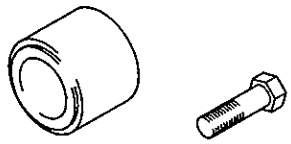
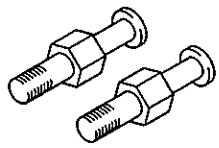
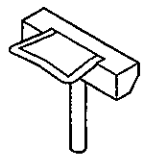
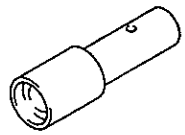
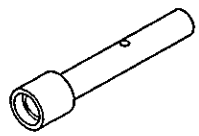
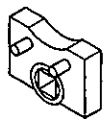
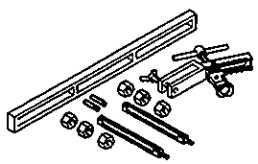
Form-In-Place Gasket Application

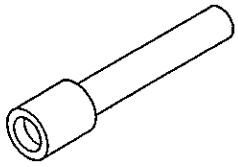
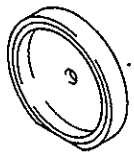
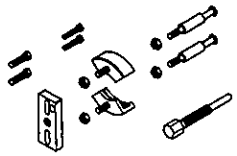
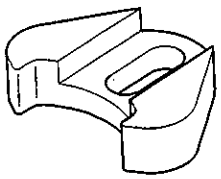
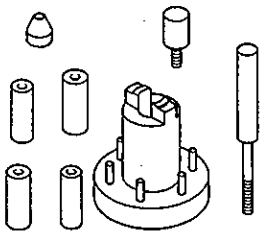
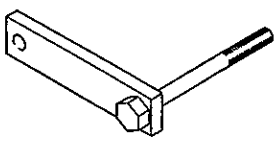
When assembling parts with the FIPG, you must observe some precautions, but the procedure is very simple as in the case of a conventional precut gasket.
Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only.
The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

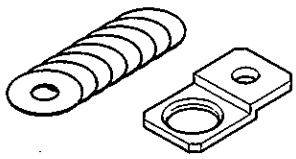
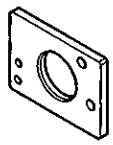
2. SPECIAL TOOLS

Tool	Number	Name	Use
	MB990685	Torque wrench	Adjustment of timing belt tension (16-valve single camshaft engine, double camshaft engine)
	MB990767	End yoke holder	Holding camshaft sprocket when loosening or torquing bolt
	MB990938	Handle	Installation of crankshaft rear oil seal (Use with MD998776)
	MD998162	Plug wrench	Removal and installation of front case cap plug
	MD998285	Crankshaft front oil seal guide	Guide for installation of crankshaft front oil seal (Use with MD998375) (Engine with silent shaft)
	MD998371	Silent shaft bearing puller	Removal of silent shaft front bearing (Engine with silent shaft)
	MD998372	Silent shaft bearing puller	Removal of silent shaft rear bearing (Engine with silent shaft)

Tool	Number	Name	Use
	MD998374	Silent shaft bearing installer stopper	Guide stopper for use in removal and installation of silent shaft rear bearing (Engine with silent shaft)
	MD998375	Crankshaft front oil seal installer	Installation of crankshaft front oil seal
	MD998440	Leak-down tester	Leak-down test of lash adjuster
	MD998441	Lash adjuster retainer	Air bleeding of lash adjuster (Single camshaft engine)
	MD998442	Air bleed wire	Air bleeding of lash adjuster
	MD998443	Lash adjuster holder	Retainer for holding lash adjuster in rocker arm at time of removal and installation of rocker arm and rocker shaft assembly (Single camshaft engine)
	MD998705	Silent shaft bearing installer	Installation of silent shaft front and rear bearings (Engine with silent shaft)

Tool	Number	Name	Use
	MD998713	Camshaft front oil seal installer	Installation of camshaft front oil seal Installation of circular packing
	MD998719	Pulley holding pins (2)	Holding camshaft sprocket when loosening or torquing bolt
	MD998727	Oil pan remover	Removal of the oil pan
	MD998729	Valve stem seal installer	Installation of valve stem seal (8-valve single camshaft engine)
	MD998737	Valve stem seal installer	Installation of valve stem seal (Double camshaft engine)
	MD998767	Socket wrench	Adjustment of timing belt tension (16-valve single camshaft engine, double camshaft engine)
	MD998772	Valve spring compressor	Compression of valve spring

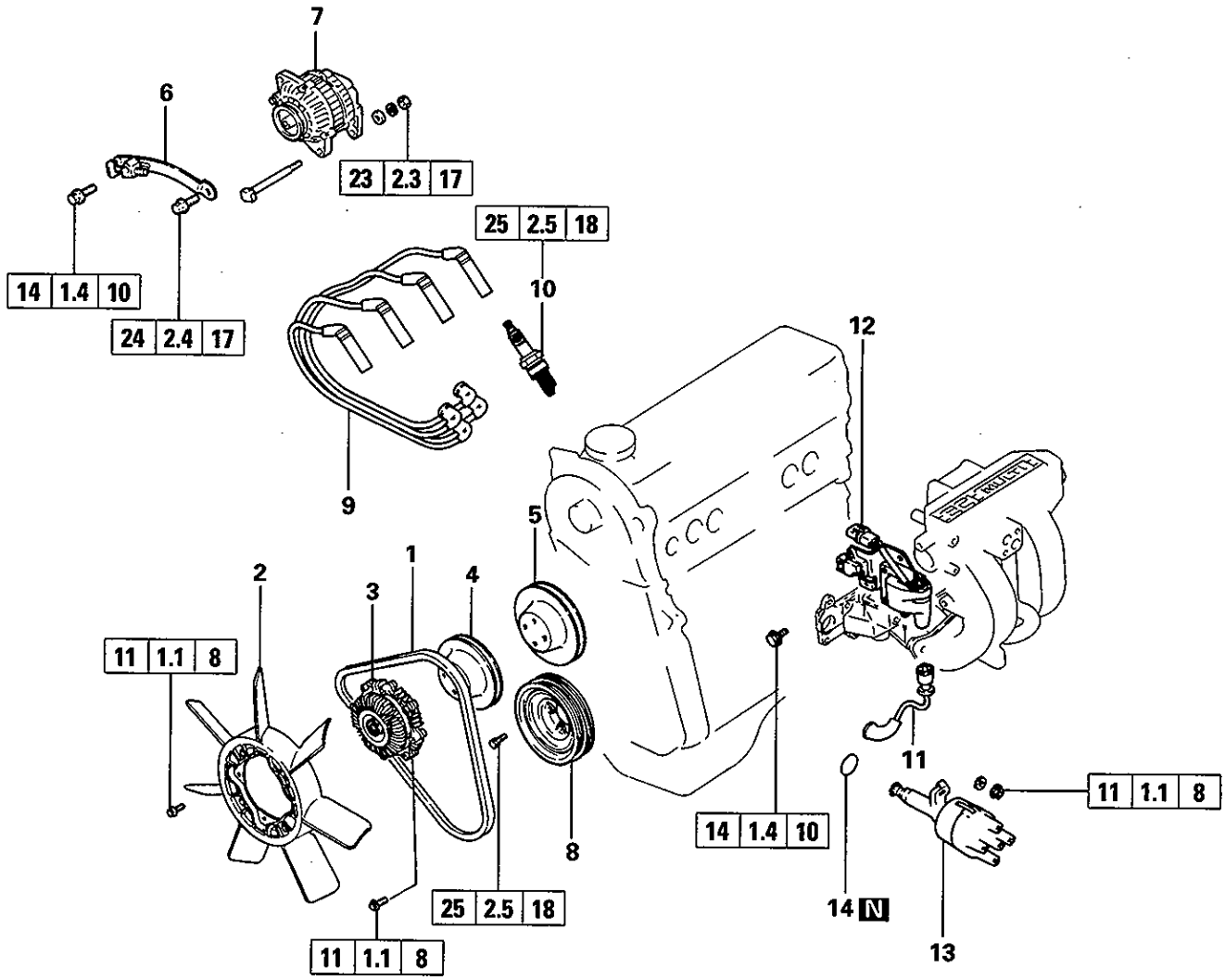
Tool	Number	Name	Use
	MD998774	Valve stem seal installer	Installation of valve stem seal (16-valve single camshaft engine)
	MD998776	Crankshaft rear oil seal installer	Installation of crankshaft rear oil seal (Use with MB990938)
	MD998778	Crankshaft sprocket puller	Removal of crankshaft sprocket
	MD998785	Sprocket stopper	Holding of silent shaft sprocket (Engine with silent shaft)
	MD998780	Piston pin setting tool	Removal and installation of piston pin
	MD998781	Flywheel stopper	Holding flywheel and drive plate

Tool	Number	Name	Use
	MD998783	Plug wrench retainer	Removal and installation of front case cap plug
	MB991603	Silent shaft bearing installer stopper	Guide stopper for removal and installation of silent shaft rear bearing (Engines with silent shafts)

NOTES

3. GENERATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION – 16 VALVE SINGLE CAMSHAFT ENGINE

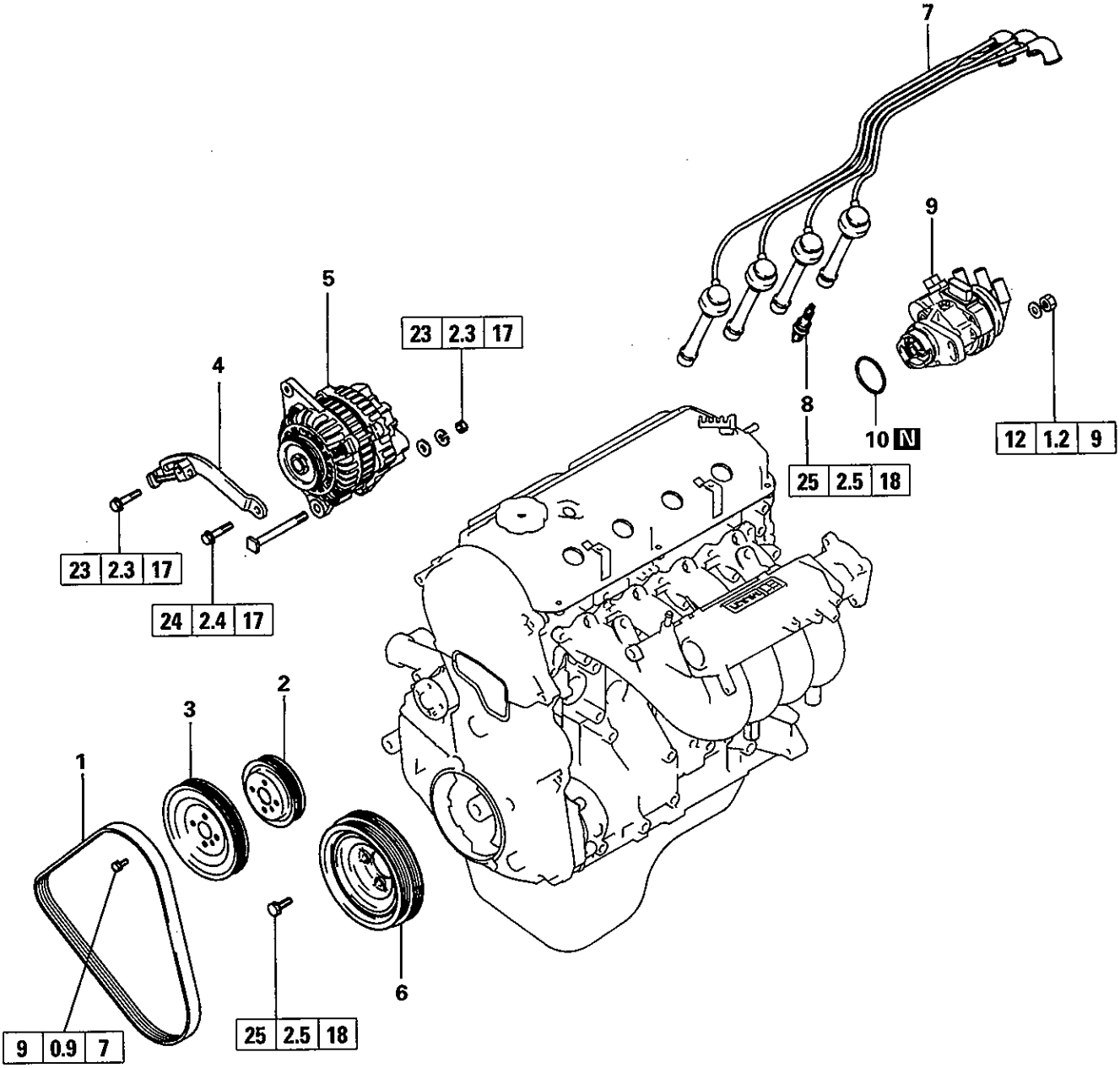


Removal steps

- ◆G◆ 1. Drive belt
- 2. Cooling fan
- 3. Fan clutch
- 4. Water pump pulley
- 5. Power steering pump pulley
- 6. Generator brace
- 7. Generator
- 8. Crankshaft pulley
- 9. Spark plug cable
- 10. Spark plug
- 11. High tension cable
- 12. Ignition coil and ignition power transistor — MPI
- ◆D◆ 13. Distributor
- 14. O-ring

6EN0654

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR FRONT WHEEL DRIVE VEHICLE

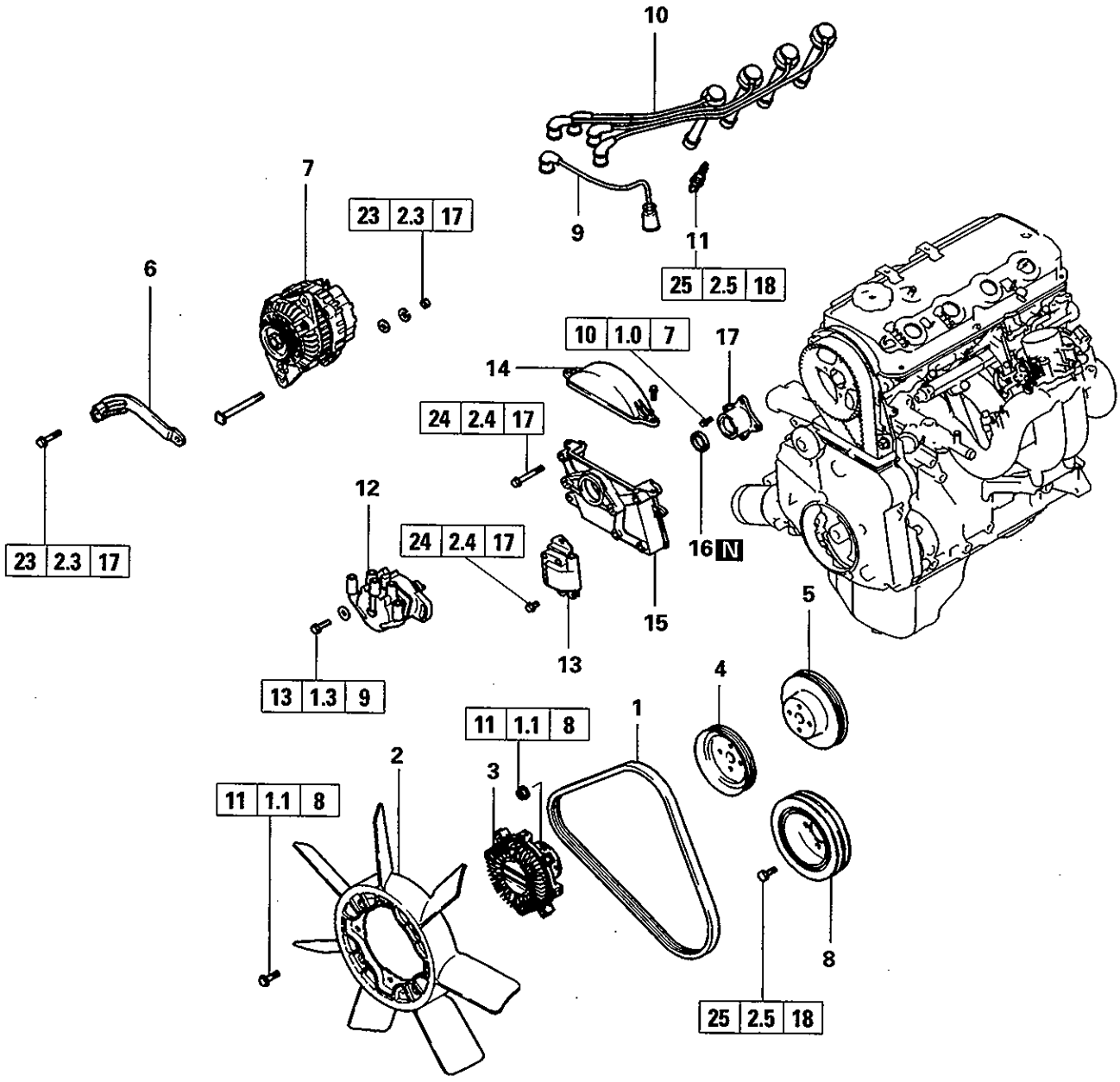


Removal steps

- ◆G◆ 1. Drive belt
- 2. Water pump pulley
- 3. Power steering pump pulley
- 4. Generator brace
- 5. Generator
- 6. Crankshaft pulley
- 7. Spark plug cable
- 8. Spark plug
- ◆D◆ 9. Distributor
- 10. O-ring

6EN0655

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR REAR WHEEL DRIVE VEHICLE

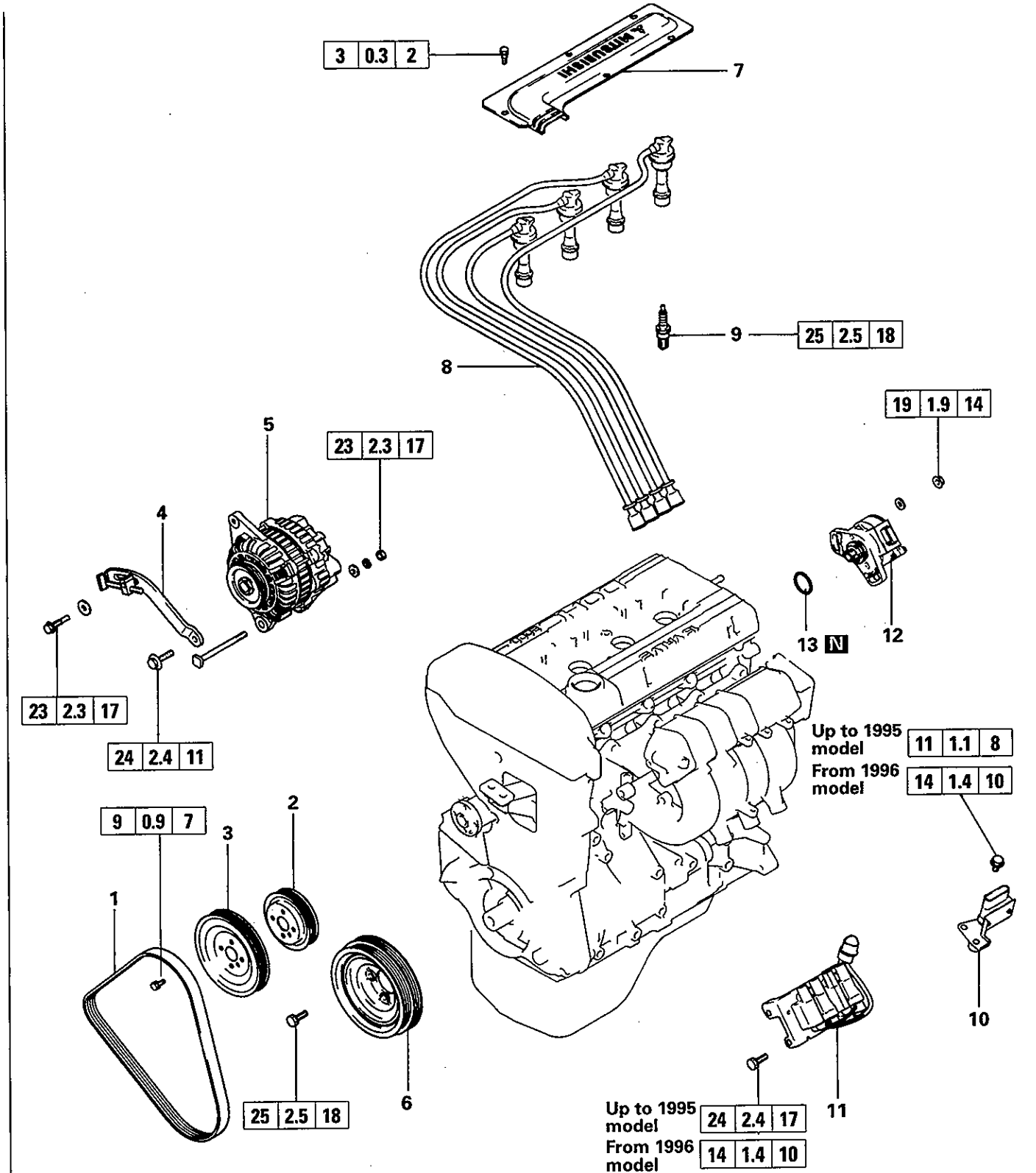


Removal steps

- ◆G◆ 1. Drive belt
- 2. Cooling fun
- 3. Fan clutch
- 4. Water pump pulley
- 5. Power steering pump pulley
- 6. Generator brace
- 7. Generator
- 8. Crankshaft pulley
- 9. High tension cable
- 10. Spark plug cable
- 11. Spark plug
- ◆E◆ 12. Distributor
- 13. Ignition coil
- 14. Timing belt front upper cover
- 15. Distributor braket
- ◆B◆ 16. Oil seal
- ◆A◆ 17. Camshaft sprocket spacer

6EN0964

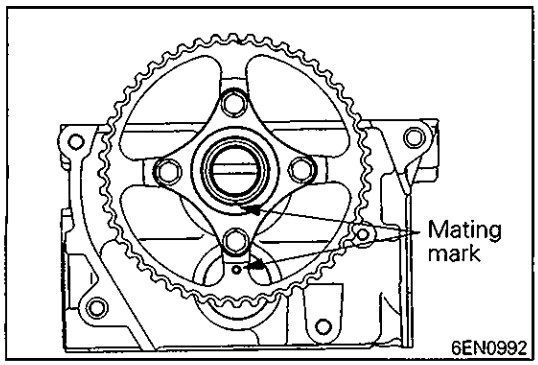
REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE



Removal steps

- ◆G◆ 1. Drive belt
- 2. Water pump pulley
- 3. Power steering pump pulley
- 4. Generator brace
- 5. Generator
- 6. Crankshaft pulley
- 7. Center cover
- 8. Spark plug cable
- 9. Spark plug
- 10. Ignition power transistor
- 11. Ignition coil
- ◆F◆ 12. Crankshaft position sensor } Up to 1995 model
- 13. O-ring } Up to 1995 model

6EN0656



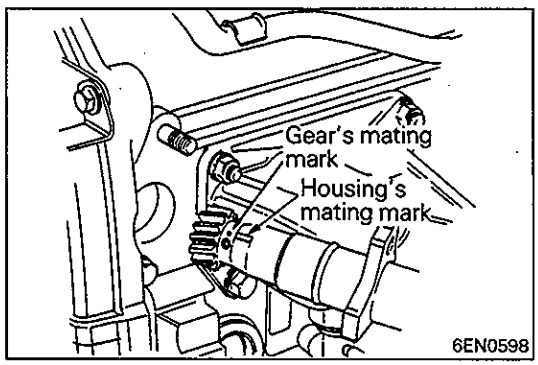
INSTALLATION SERVICE POINTS

◆A◆ CAMSHAFT SPROCKET SPACER INSTALLATION

(1) To install the spacer, align mating marks on camshaft sprocket and camshaft sprocket spacer as shown.

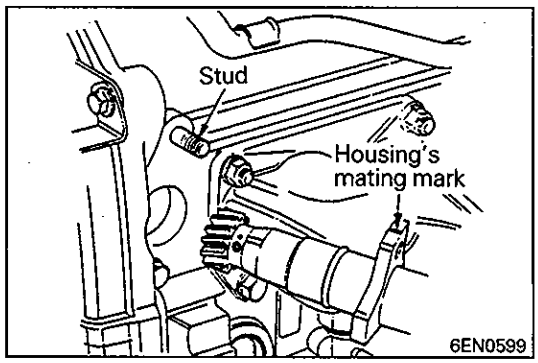
◆B◆ OIL SEAL INSTALLATION

(1) Lightly strike the oil seal into the camshaft sprocket spacer until it seats to its position securely.

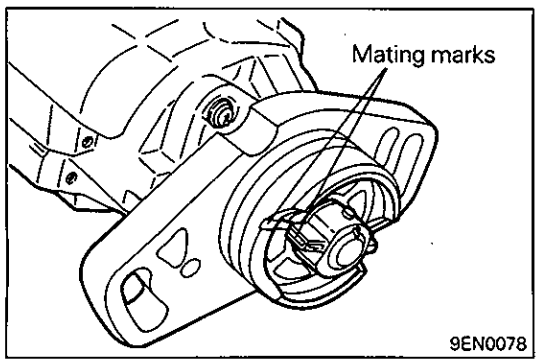


◆C◆ DISTRIBUTOR INSTALLATION

(1) Turn the crankshaft so that the No. 1 cylinder is at top dead center.
(2) Align the distributor housing and gear mating marks.

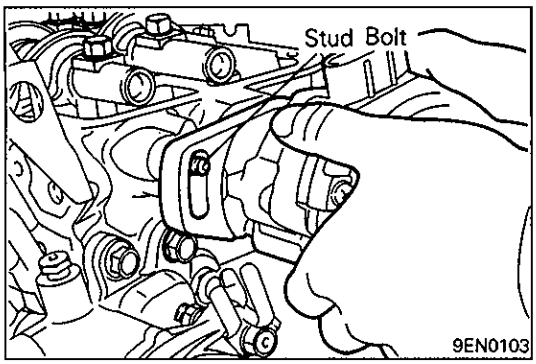


(3) Install the distributor to the engine while aligning the fine cut (groove or projection) of the distributor's installation flange with the center of the distributor installation stud.

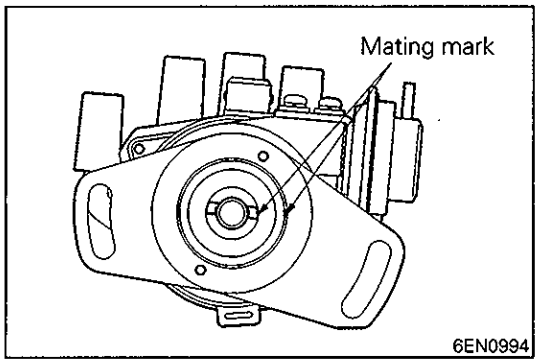


◆D◆ DISTRIBUTOR INSTALLATION

(1) Turn the crankshaft to bring No. 1 cylinder to the top dead center on the compression stroke.
(2) Align the mating mark on the distributor housing with that of the coupling key.

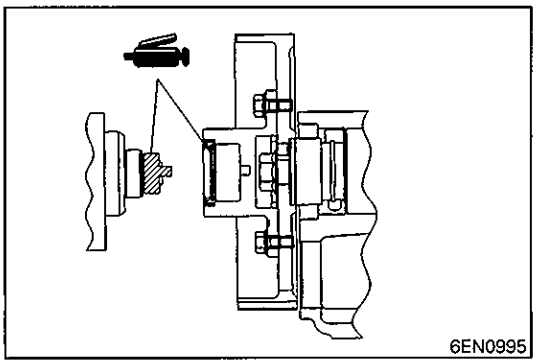


(3) Install the distributor assembly on the engine while aligning the stud bolt used for securing the distributor with the slot in the mouting flange of the distributor.



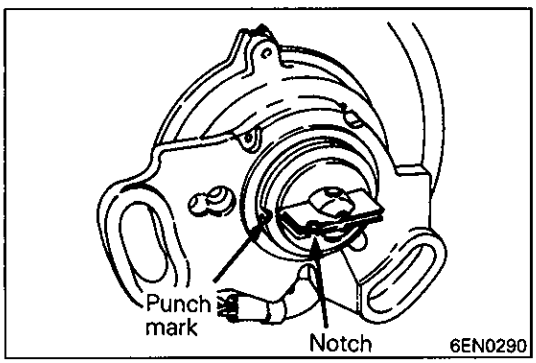
◗E◖ DISTRIBUTOR INSTALLATION

(1) Turn the crankshaft clockwise and set the No. 1 cylinder piston at the top dead center of the compression stroke.
(2) Align mating marks on the distributor housing and the coupling.



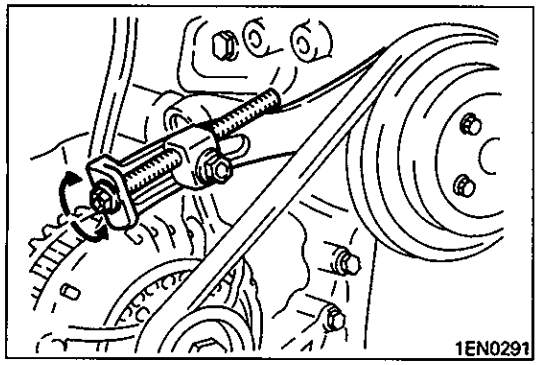
(3) Apply grease sparingly to the distributor coupling and the entire surface of the oil seal lip and install the distributor.

Specified grease: Multipurpose grease SAEJ310, NLGI No.3



◗F◖ CRANKSHAFT POSITION SENSOR INSTALLATION

(1) Turn the crankshaft so that the No. 1 cylinder is at the 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.

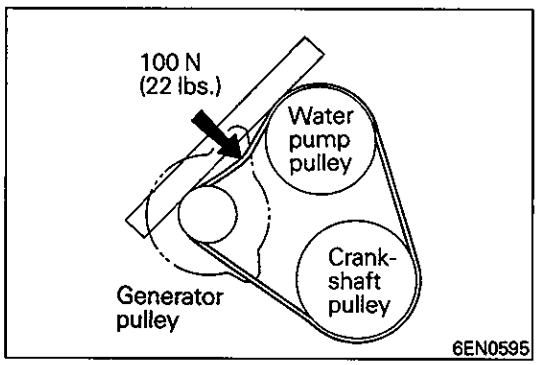


▶G◀ DRIVE BELT TENSION ADJUSTMENT

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.

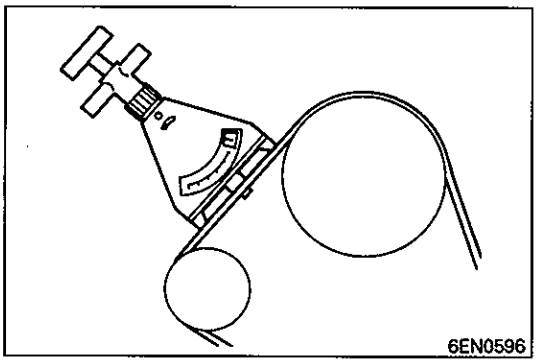
Standard value:
V-ribbed type belt
New belt
Front wheel drive vehicle
7.5 – 9.0 mm (0.30 – 0.35 in.)
Rear wheel drive vehicle
5.5 – 7.5 mm (0.22 – 0.30 in.)
Used belt 8.0 mm (0.32 in.)
V-type belt 7.0 – 10.0 mm (0.28 – 0.39 in.)



When using a tension gauge for V-ribbed belt:

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

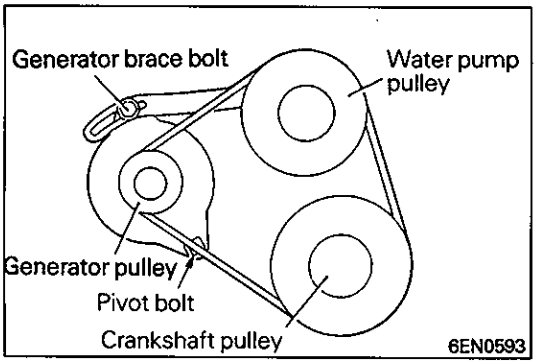
(1) Move the generator to adjust the belt deflection for the standard value.

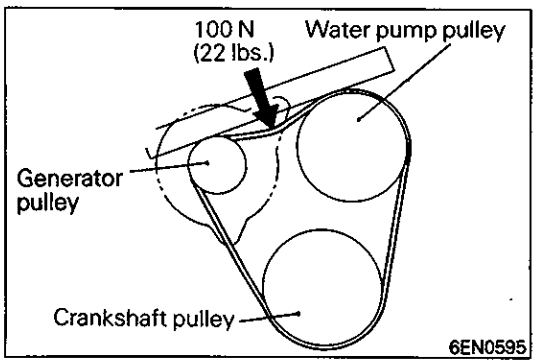
Standard value:
V-ribbed type belt
New belt 7.5 – 9.0 mm (0.30 – 0.35 in.)
Used belt 8.0 mm (0.32 in.)
V-type belt 7.0 – 10.0 mm (0.28 – 0.39 in.)

When using a tension gauge for V-ribbed belt:

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 pivot bolt to the specified torque.

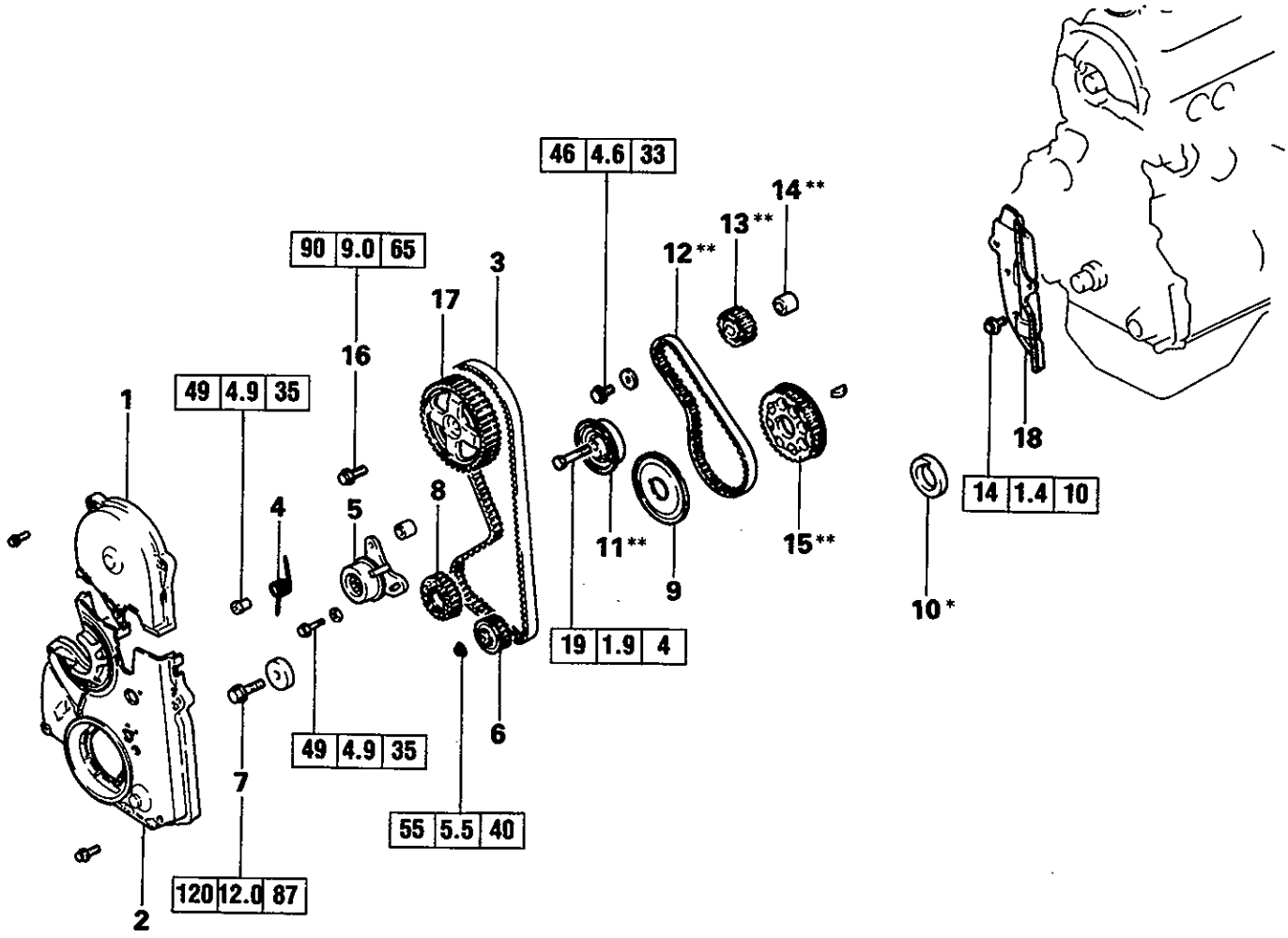




NOTES

4. TIMING BELT

REMOVAL AND INSTALLATION – 8-VALVE SINGLE CAMSHAFT ENGINE



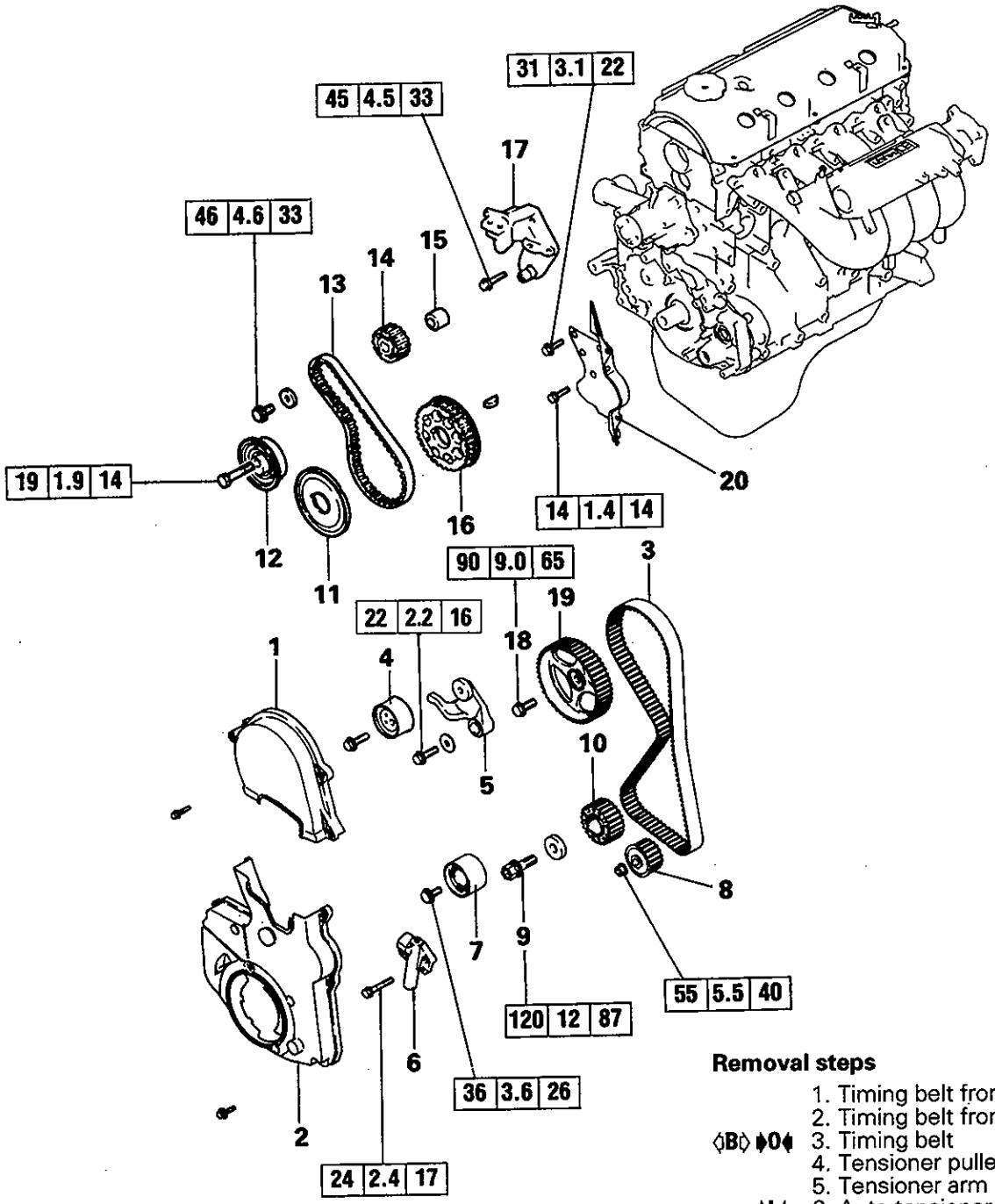
Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
◇A◇ ◆N◆ 3. Timing belt
◆K◆ 4. Tensioner spring
◆K◆ 5. Tensioner pulley
◇D◇ ◆J◆ 6. Oil pump sprocket
◇E◇ ◆I◆ 7. Crankshaft bolt
◇F◇ 8. Crankshaft sprocket
9. Flange
10. Spacer*
11. Tensioner "B"**
◇G◇ ◆H◆ 12. Timing belt "B"**
◇H◇ ◆G◆ 13. Silent shaft sprocket**
◆F◆ 14. Spacer**
◇I◇ 15. Crankshaft sprocket "B"**
◇J◇ ◆A◆ 16. Camshaft sprocket bolt
17. Camshaft sprocket
18. Timing belt rear cover

NOTE
*: Engine without silent shafts
**: Engine with silent shafts

6EN0763

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR FRONT WHEEL DRIVE VEHICLE

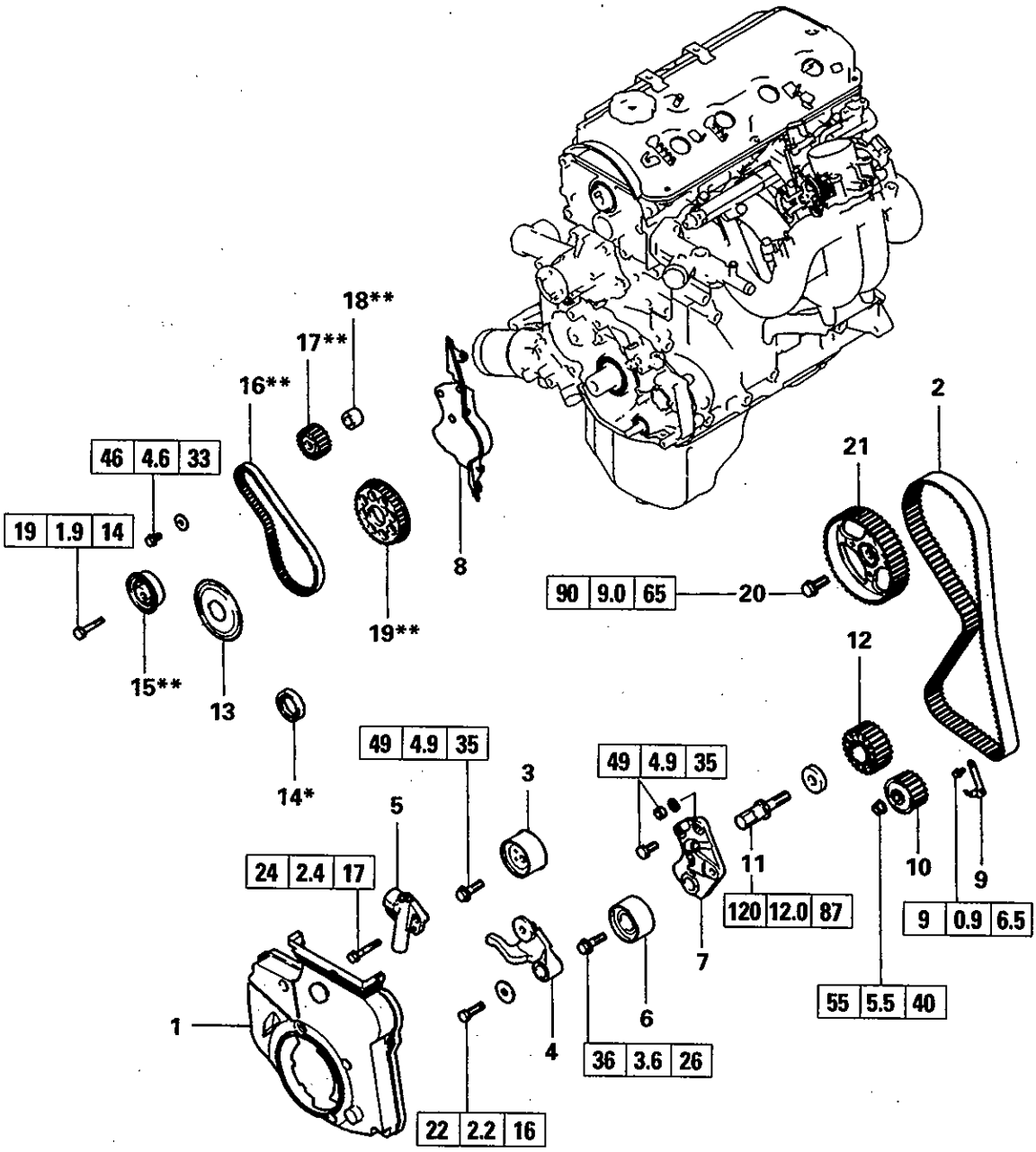


Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
◇B◇ ◆O◆ 3. Timing belt
4. Tensioner pulley
5. Tensioner arm
◆L◆ 6. Auto tensioner
7. Idler pulley
◇D◇ ◆J◆ 8. Oil pump sprocket
◇E◇ ◆I◆ 9. Crankshaft bolt
◇F◇ 10. Crankshaft sprocket
11. Flange
12. Tensioner "B"
◇G◇ ◆H◆ 13. Timing belt "B"
◇H◇ ◆G◆ 14. Silent shaft sprocket
◆F◆ 15. Spacer
◇I◇ 16. Crankshaft sprocket "B"
◆C◆ 17. Engine support bracket
◇J◇ ◆A◆ 18. Camshaft sprocket bolt
19. Camshaft sprocket
20. Timing belt rear cover

6EN0658

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR REAR WHEEL DRIVE VEHICLE

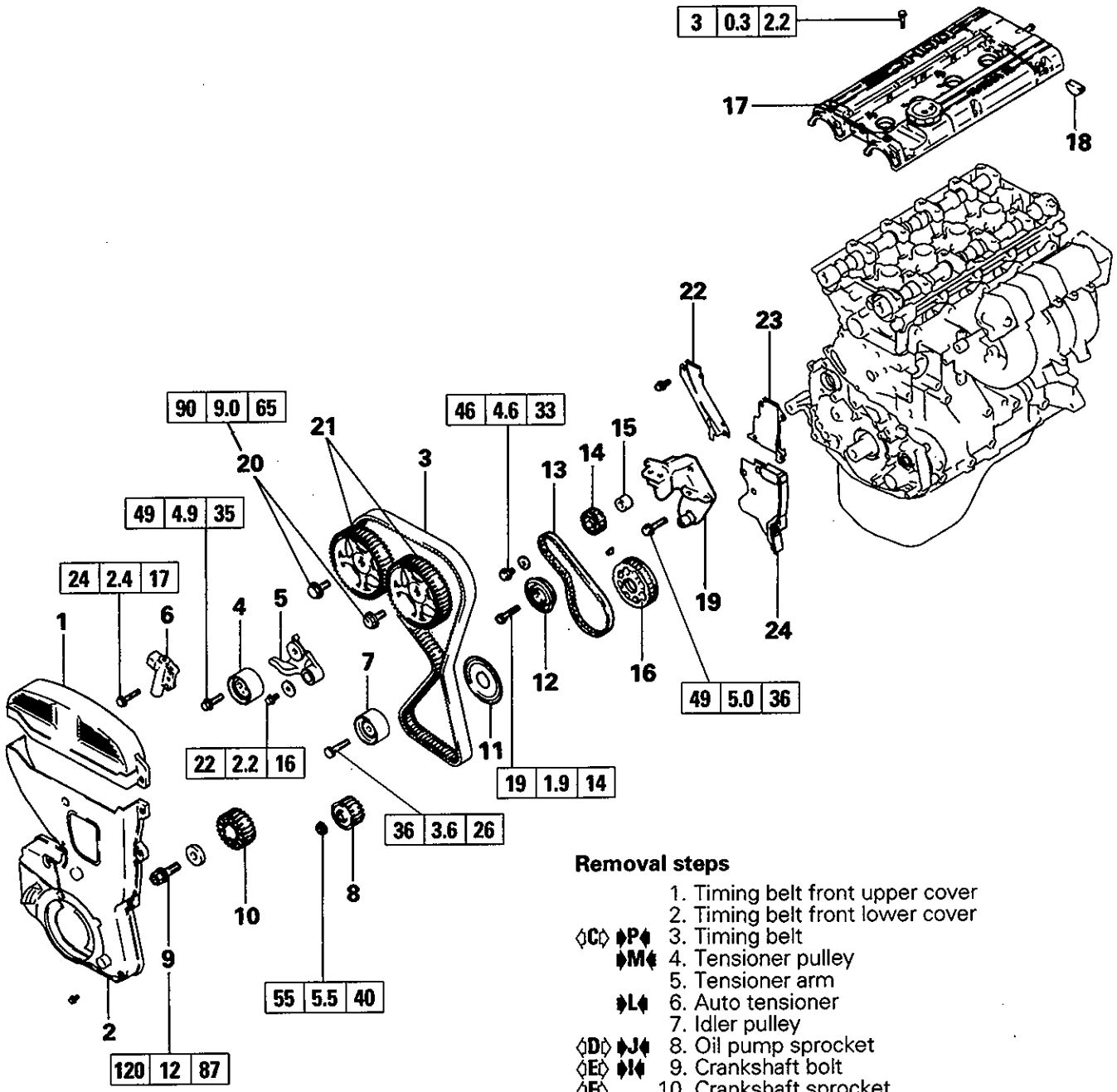


Removal steps

1. Timing belt front lower cover
◇B◇ ◆D◆ 2. Timing belt
3. Tensioner pulley
4. Tensioner arm
◆L◆ 5. Auto tensioner
6. Idler pulley
7. Tensioner pulley braket
8. Timing belt rear cover
9. Timing belt indicator
◇D◇ ◆J◆ 10. Oil pump sprocket
◇E◇ ◆I◆ 11. Crankshaft bolt
◇F◇ 12. Crankshaft sprocket
13. Flange
14. Spacer*
15. Tensioner "B"**
◇G◇ ◆H◆ 16. Timing belt "B"**
◇H◇ ◆G◆ 17. Silent shaft sprocket**
◆F◆ 18. Spacer**
◇I◇ 19. Crankshaft sprocket "B"**
◇J◇ ◆A◆ 20. Camshaft sprocket bolt
21. Camshaft sprocket

NOTE
*: Engine without silent shafts
**: Engine with silent shafts

REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE
<Up to 1995 model>

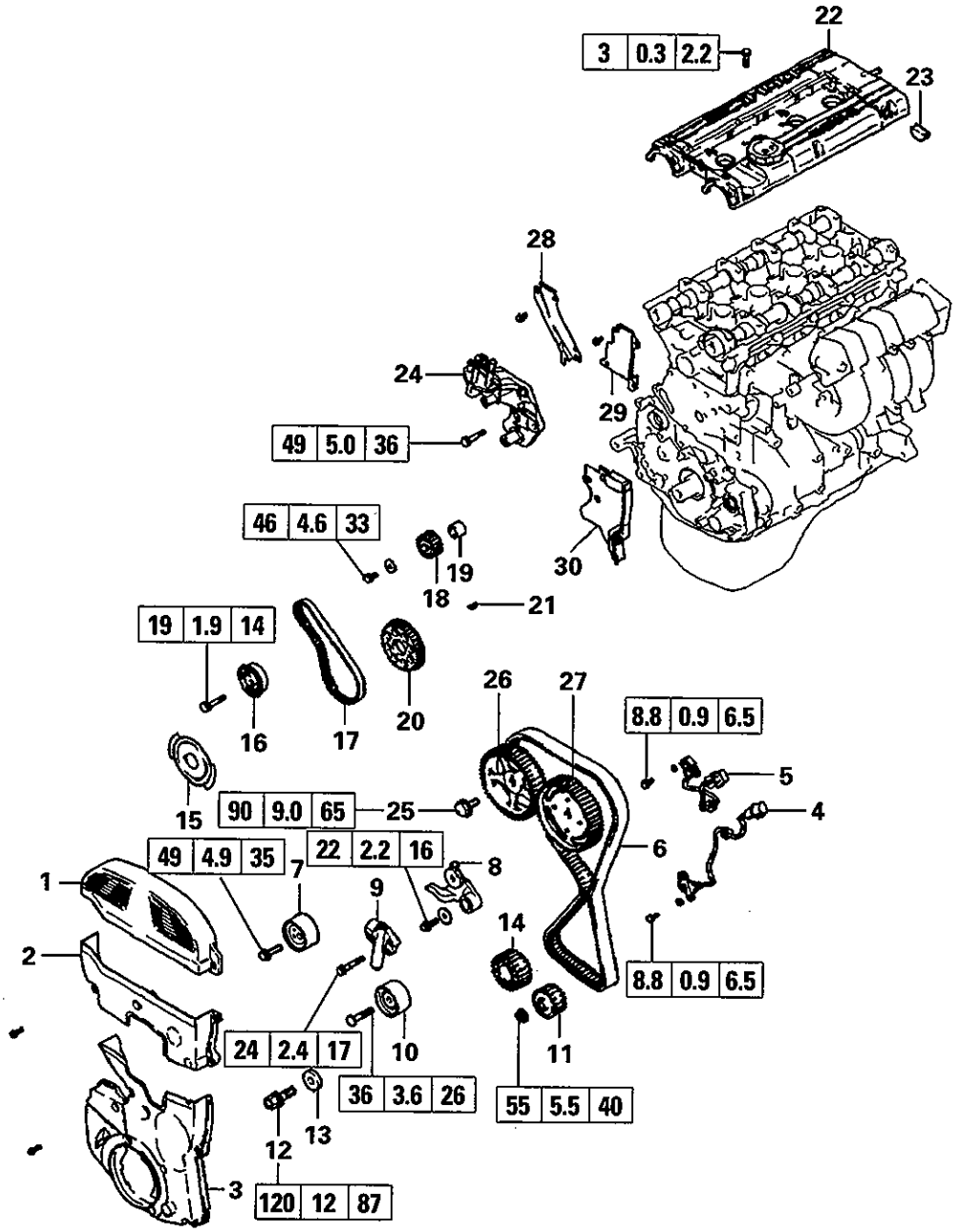


Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
◇C◇ ◆P◆ 3. Timing belt
◆M◆ 4. Tensioner pulley
5. Tensioner arm
◆L◆ 6. Auto tensioner
7. Idler pulley
◇D◇ ◆J◆ 8. Oil pump sprocket
◇E◇ ◆I◆ 9. Crankshaft bolt
◇F◇ 10. Crankshaft sprocket
11. Flange
12. Tensioner "B"
◇G◇ ◆H◆ 13. Timing belt "B"
◇H◇ ◆G◆ 14. Silent shaft sprocket
◆F◆ 15. Spacer
◇I◇ 16. Crankshaft sprocket "B"
◆E◆ 17. Rocker cover
◆D◆ 18. Semi-circular packing
◆C◆ 19. Engine support bracket
◇K◇ ◆B◆ 20. Camshaft sprocket bolt
21. Camshaft sprocket
22. Timing belt rear right cover
23. Timing belt rear left upper cover
24. Timing belt rear left lower cover

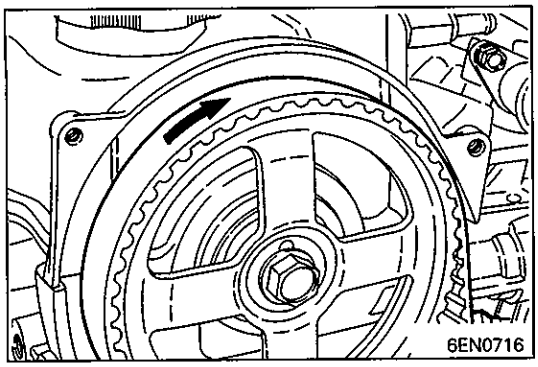
6EN0659

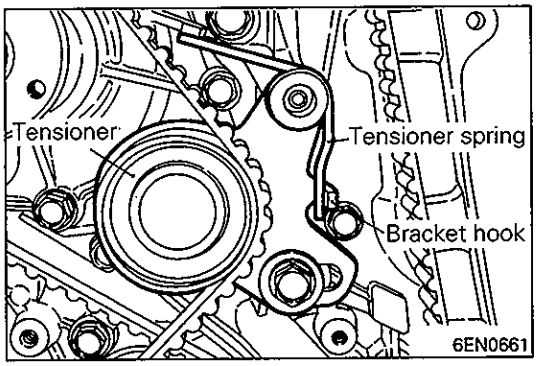
REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE <From 1996 model>



Removal steps

1. Timing belt front upper cover
2. Timing belt front center cover
3. Timing belt front lower cover
4. Crankshaft position sensor
5. Camshaft position sensor
◇C◇ ◆P◆ 6. Timing belt
7. Tensioner pulley
8. Tensioner arm
◆L◆ 9. Auto tensioner
10. Idler pulley
◇D◇ ◆J◆ 11. Oil pump sprocket
◇E◇ ◆I◆ 12. Crankshaft bolt
13. Special washar
◇F◇ 14. Crankshaft sprocket
15. Sensing blade
16. Tensioner "B"
◇G◇ ◆H◆ 17. Timing belt "B"
◇H◇ ◆G◆ 18. Silent shaft sprocket
◆F◆ 19. Spacer
◇I◇ 20. Crankshaft sprocket "B"
21. Key
◆E◆ 22. Rocker cover
◆D◆ 23. Semi-circular packing
◆C◆ 24. Engine support bracket
◇K◇ ◆B◆ 25. Camshaft sprocket bolt
26. Camshaft sprocket
27. Camshaft sprocket assembly
28. Timing belt rear right cover
29. Timing belt rear left upper cover
30. Timing belt rear left lower cover





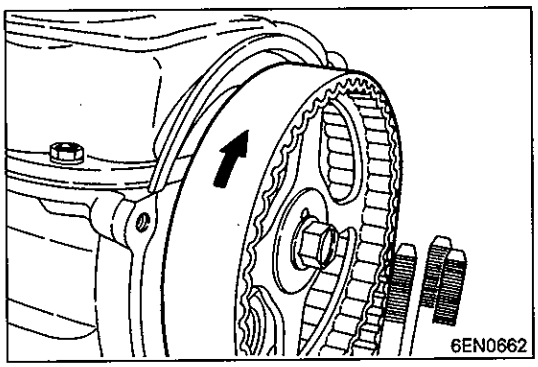
REMOVAL SERVICE POINTS

◇A◇ TIMING BELT REMOVAL – 8-VALVE SINGLE CAMSHAFT ENGINE

(1) Mark belt running direction for reinstallation.

NOTE
(1) Water or oil on the belt shorten 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 front case oil seals, camshaft oil seal and water pump for leaks.

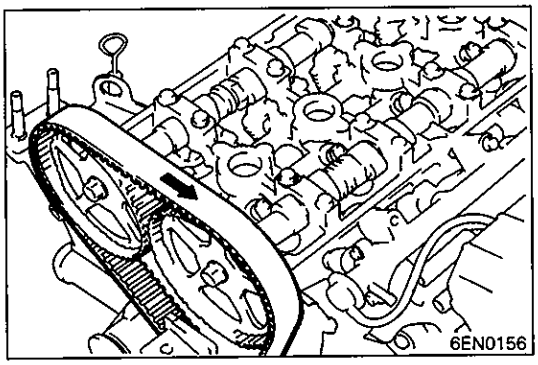
(2) Back off the tensioner spring mounting bolt three turns.
(3) Pinching the end of the tensioner spring on the tensioner side with pliers, unhook it from the bracket hook on the tensioner to free the tensioner spring.
(4) Loosen the tensioner mounting bolt and remove the timing belt.



◇B◇ TIMING BELT REMOVAL – 16-VALVE SINGLE CAMSHAFT ENGINE

(1) Mark belt running direction for reinstallation.

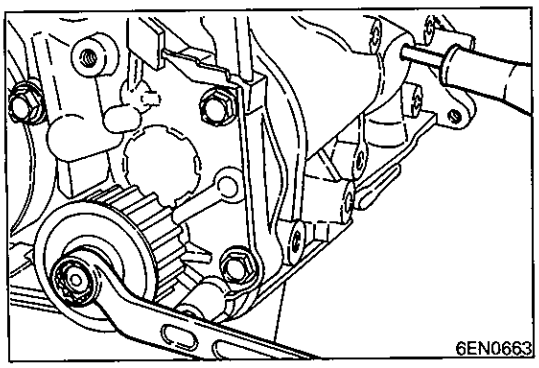
NOTE
(1) Water or oil on the belt shorten its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
(2) If there is oil or water on each part, check front case oil seals, camshaft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



◇C◇ TIMING BELT REMOVAL – DOUBLE CAMSHAFT ENGINE

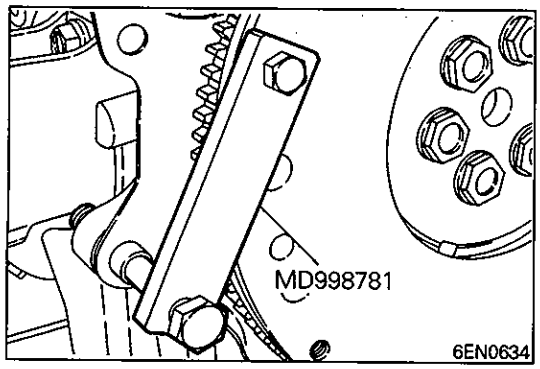
(1) Mark belt running direction for reinstallation.

NOTE
(1) Water or oil on the belt shorten 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 front case oil seals, camshaft oil seal and water pump for leaks.

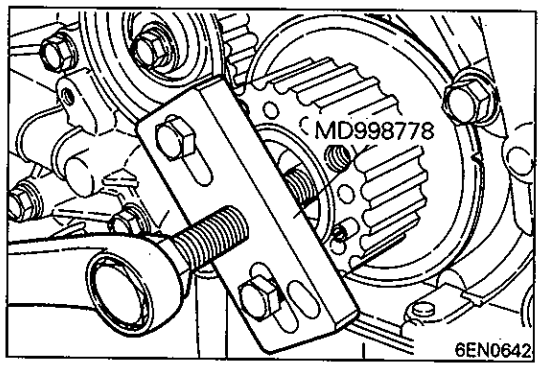


◇D◇ OIL PUMP SPROCKET REMOVAL – ENGINE WITH SILENT SHAFT

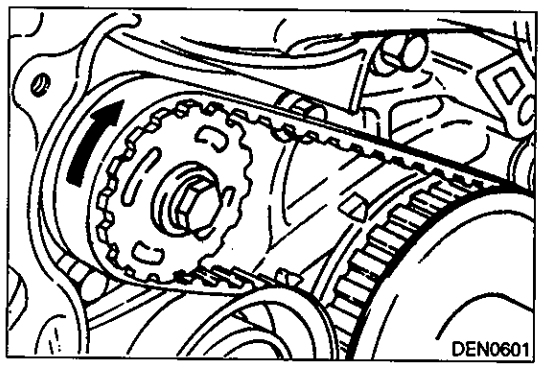
Added



◊E◊ CRANKSHAFT BOLT LOOSENING



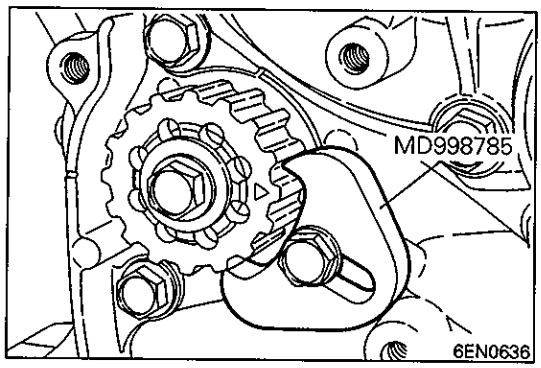
◊F◊ CRANKSHAFT SPROCKET REMOVAL



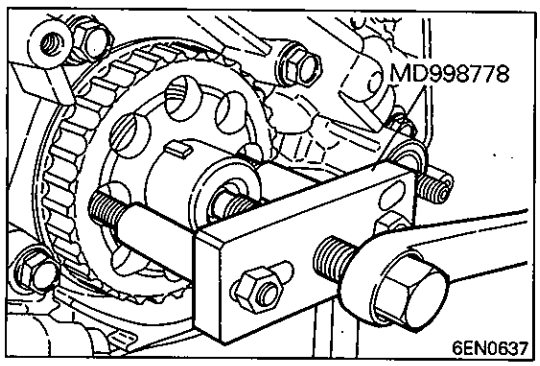
◊G◊ TIMING BELT "B" REMOVAL – ENGINE WITH SILENT SHAFT

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

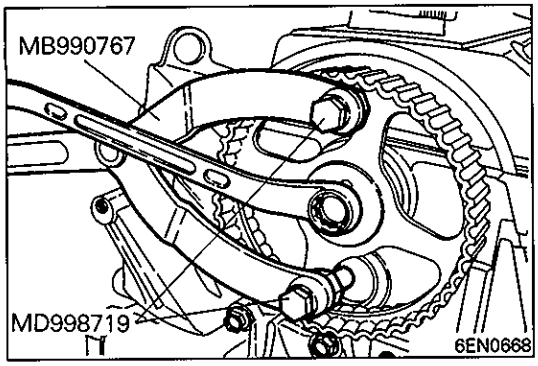
NOTE
(1) Water or oil on the belt shorten its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
(2) If there is oil or water on each part, check the front case oil seals, camshaft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



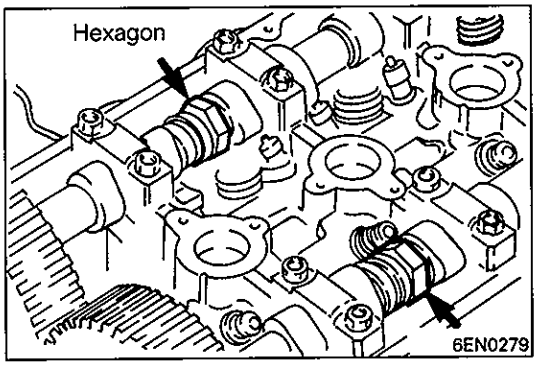
◊H◊ SILENT SHAFT SPROCKET REMOVAL – ENGINE WITH SILENT SHAFT



◊I◊ CRANKSHAFT SPROCKET "B" REMOVAL – ENGINE WITH SILENT SHAFT



⟨J⟩ CAMSHAFT SPROCKET BOLT LOOSENING – SINGLE CAMSHAFT ENGINE

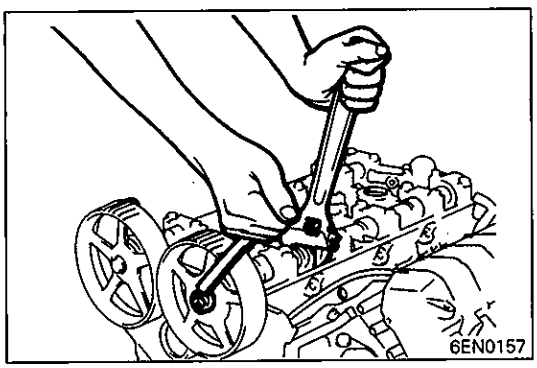


⟨K⟩ CAMSHAFT SPROCKET BOLT LOOSENING – DOUBLE CAMSHAFT ENGINE

(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.

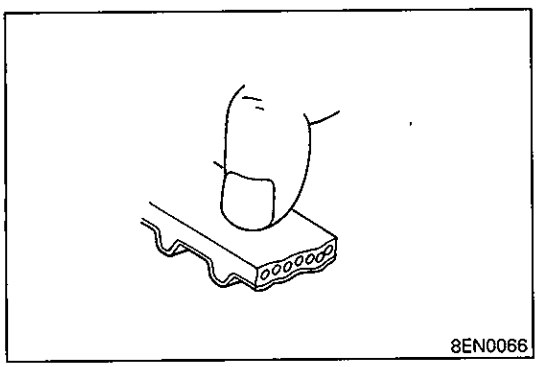


INSPECTION

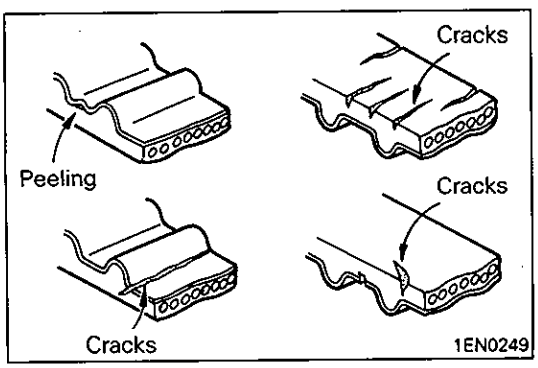
TIMING BELT

Replace belt if any of the following conditions exist.

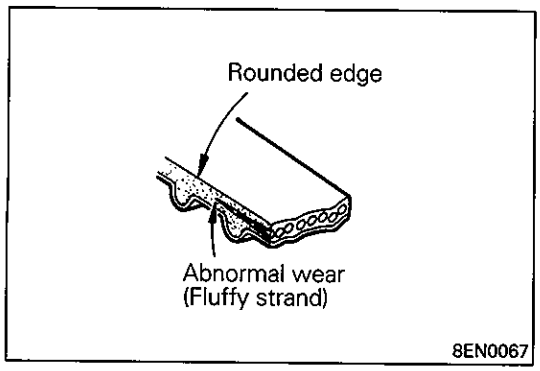
(1) Hardening of back rubber.
Back side is glossy without resilience and leaves no indent when pressed with fingernail.



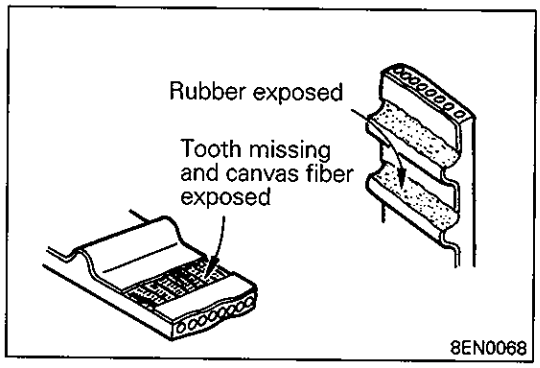
(2) Cracks on rubber back.
(3) Cracks or peeling of canvas.
(4) Cracks on tooth bottom.
(5) Cracks on belt sides.



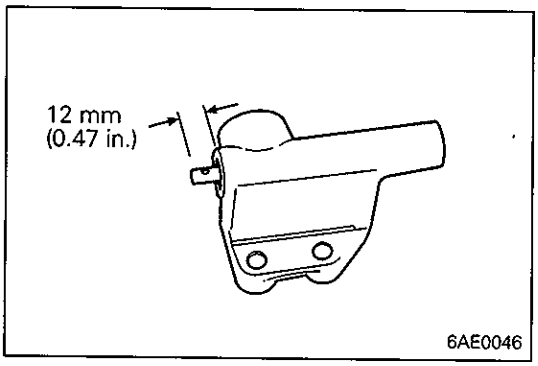
Added



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



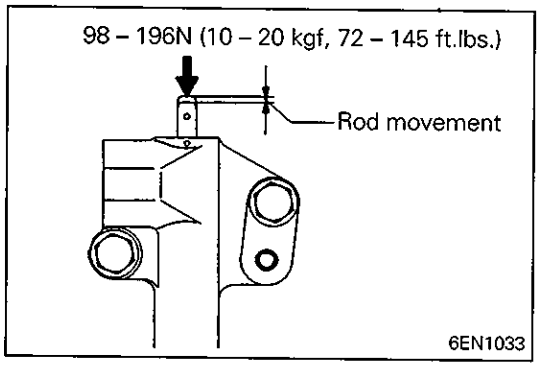
(7) Abnormal wear on teeth.
(8) Missing tooth.



AUTO TENSIONER

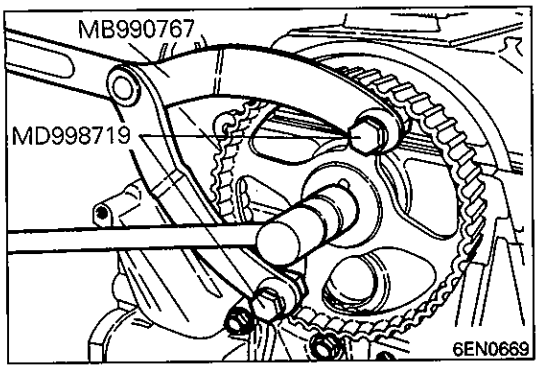
(1) Check the auto tensioner for possible oil leaks and replace if leaks are evident.
(2) Check the rod end for wear or damage and replace as necessary.
(3) Measure the rod protrusion. If it is out of specification, replace the auto tensioner.

Standard value: 12 mm (0.47 in.)



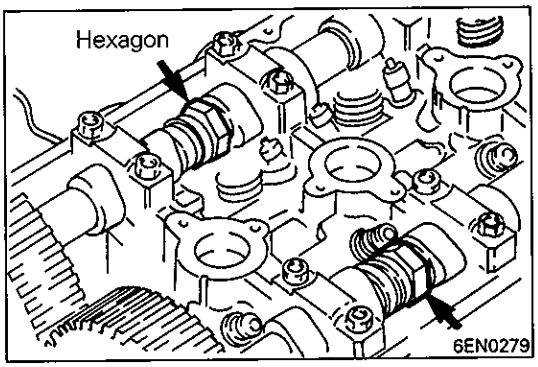
(4) Measure the distance over which the rod moves when the rod is depressed with a force of 98 to 196 N (10 to 20 kgf, 72 to 145 ft.lbs.).
If it is out of specifications, replace the auto tensioner.

Standard value: Within 1 mm (0.039 in.)



INSTALLATION SERVICE POINTS

◗A◖ CAMSHAFT SPROCKET TIGHTENING – SINGLE CAMSHAFT ENGINE

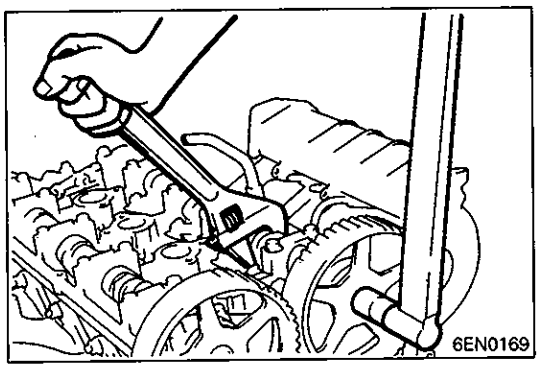


◗B◖ CAMSHAFT SPROCKET TIGHTENING – DOUBLE CAMSHAFT ENGINE

(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

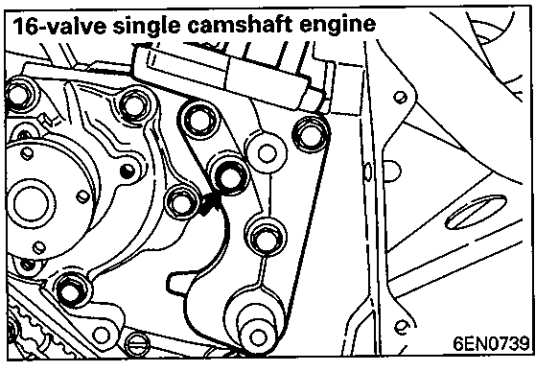
- **Locking the camshaft sprocket with a tool damages the sprocket.**

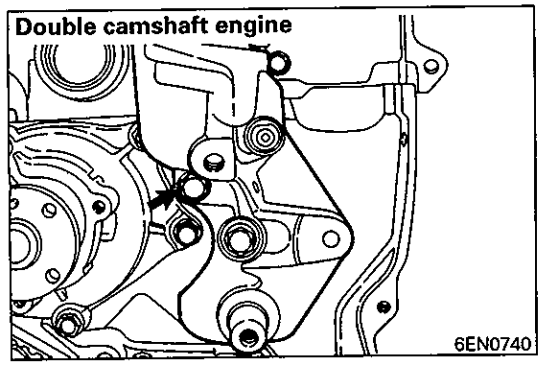


◗C◖ ENGINE SUPPORT BRACKET INSTALLATION

(1) Apply sealant to the bolt shown in the illustration before tightening it.

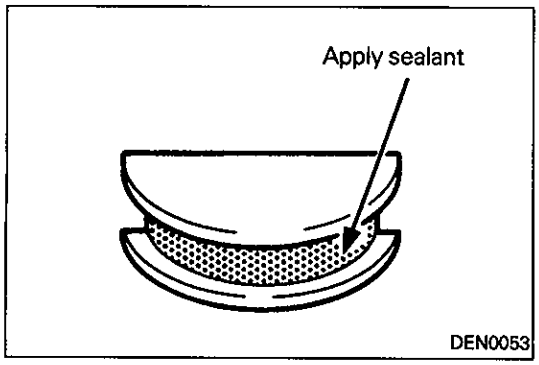
Specified sealant:
3M ATD Part No. 8660 or equivalent

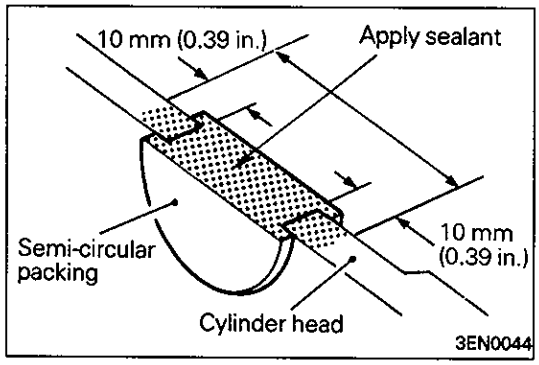




Added

326





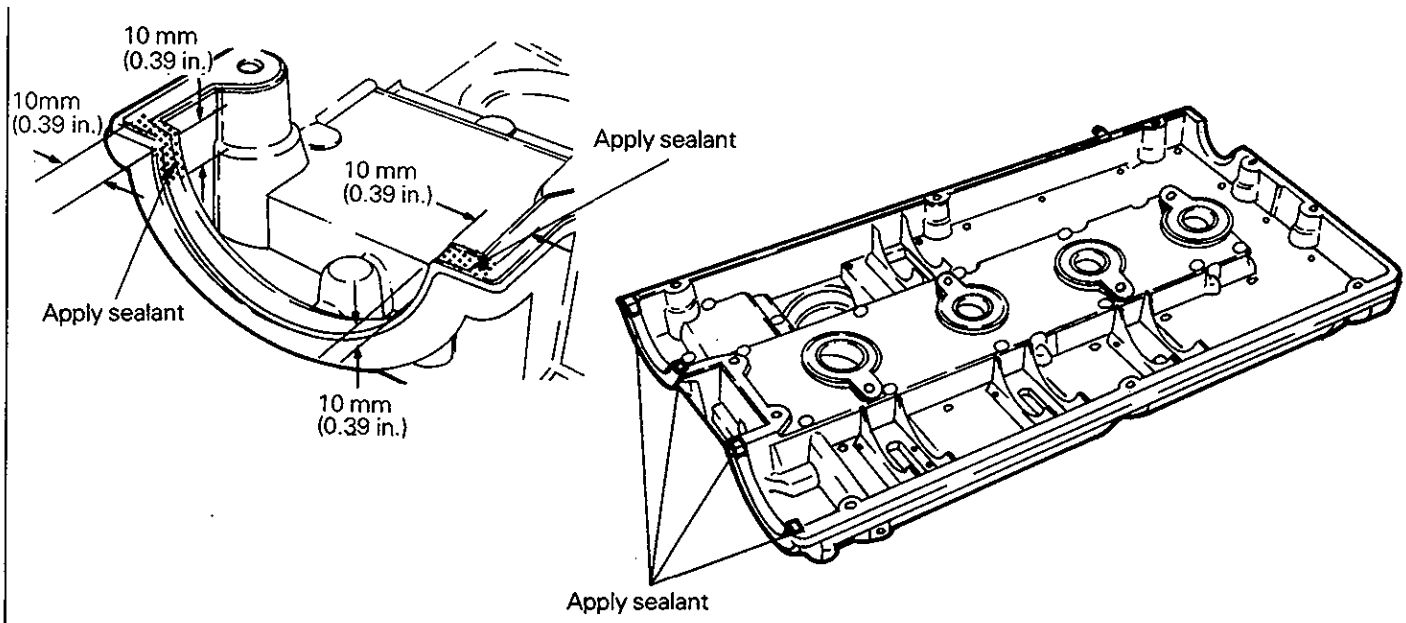
◆D◆ SEALANT APPLICATION ON SEMI-CIRCULAR PACKING – DOUBLE CAMSHAFT ENGINE

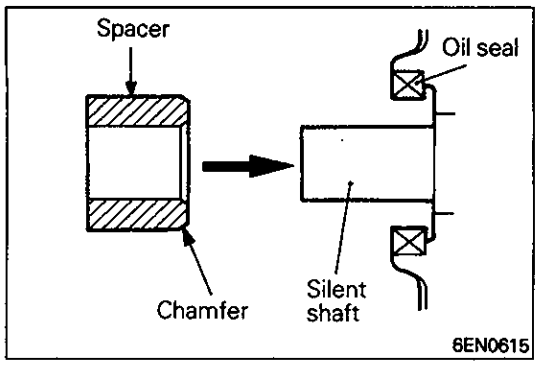
Specified sealant:
3M ATD Part No. 8660 or equivalent

◆E◆ SEALANT APPLICATION ON ROCKER COVER – DOUBLE CAMSHAFT ENGINE

Apply sealant to the areas indicated in the illustration.

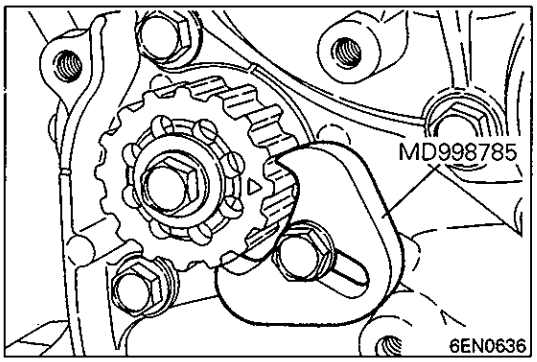
Specified sealant: 3M ATD Part No. 8660 or equivalent



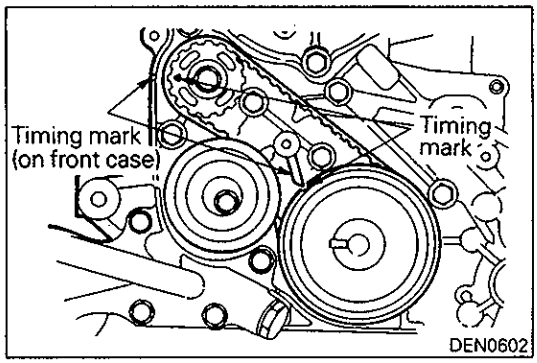


◆F◆ SPACER INSTALLATION – ENGINE WITH SILENT SHAFT

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

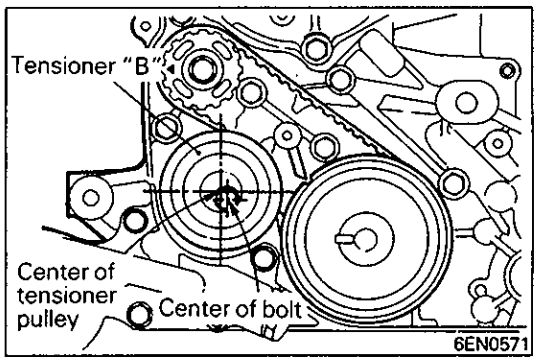


◆G◆ SILENT SHAFT SPROCKET INSTALLATION – ENGINE WITH SILENT SHAFT

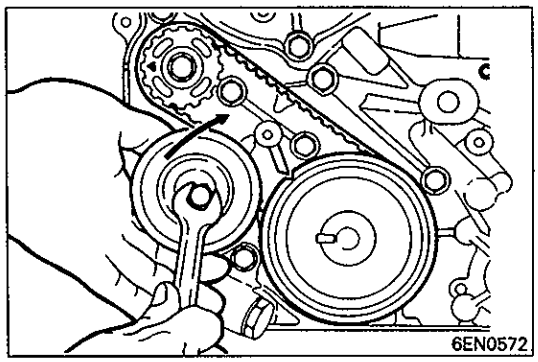


◆H◆ TIMING BELT "B" INSTALLATION – ENGINE WITH SILENT SHAFT

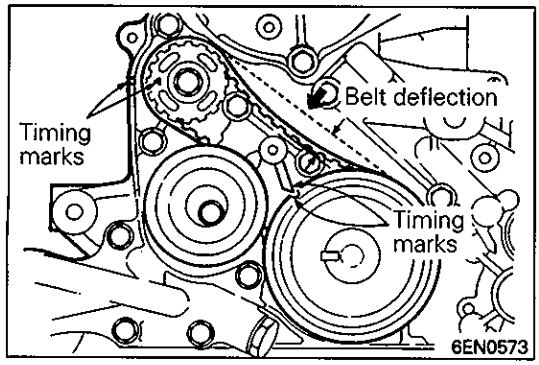
(1) Align the timing marks on the crankshaft sprocket "B" and silent shaft sprocket with the marks on the front case respectively.
(2) Install the timing belt "B" on the crankshaft sprocket "B" and silent shaft sprocket. There should be no slack on the tension side.



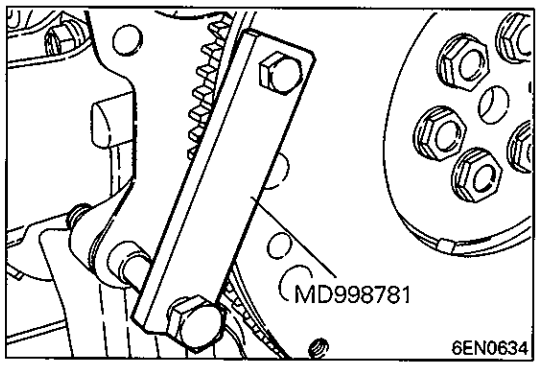
(3) Make sure that the relationship between the tensioner pulley center and the bolt center is as shown in the illustration.



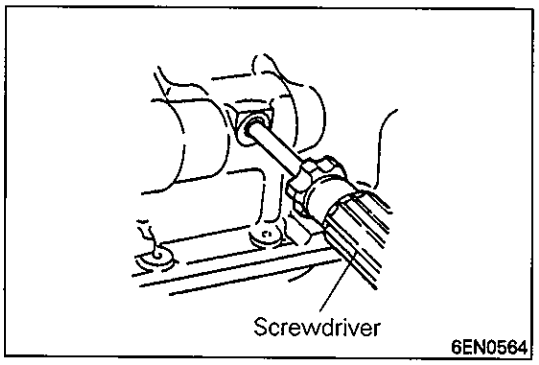
(4) Move the tensioner "B" in the direction of arrow while lifting with a finger to give a sufficient tension to the tension side of the timing belt. In this condition, tighten the bolt to secure tensioner "B". When the bolt is tightened, use care to prevent the shaft from turning together. If the shaft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



(5) Check to ensure that the timing marks on the sprockets and the front case are in alignment.
(6) Press with index finger the center of span on the tension side of timing belt "B". The bolt must deflect 5 – 7 mm (0.20 – 0.28 in.).

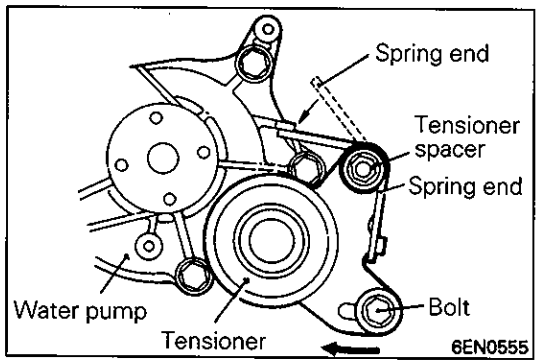


◆I◆ CRANKSHAFT BOLT TIGHTENING



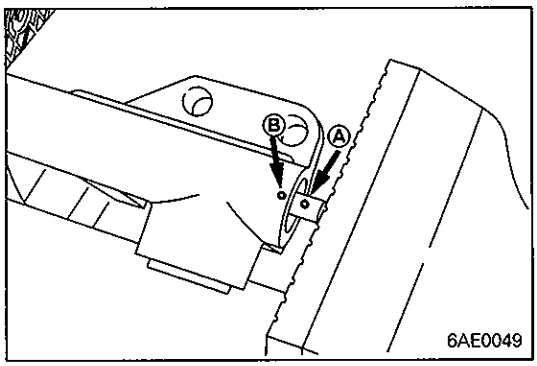
◆J◆ OIL PUMP SPROCKET INSTALLATION – ENGINE WITH SILENT SHAFT

(1) Insert a Phillips screwdriver [shank diameter 8 mm (0.31 in.) shaft] 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 nuts to the specified torque.



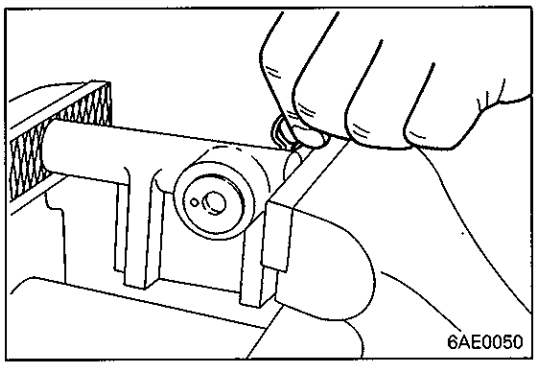
◆K◆ TENSIONER INSTALLATION – 8-VALVE SINGLE CAMSHAFT ENGINE

(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.



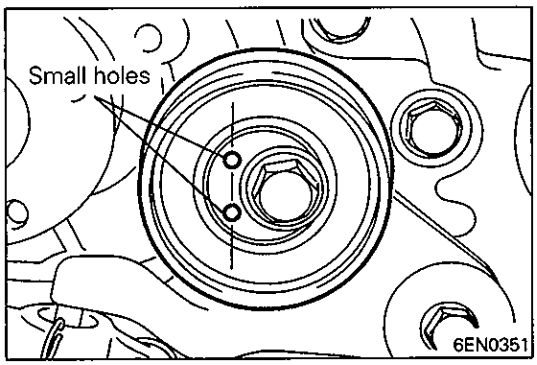
◆L◆ AUTO TENSIONER INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE AND DOUBLE CAMSHAFT ENGINE

(1) When the auto tensioner rod is left as extended, use the following procedure to set the rod.
   ① Place the auto tensioner straight in a vise so that it does not tilt.
   ② Push in the rod little by little with the vise until the set hole Ⓐ in the rod is aligned with the hole Ⓑ in the cylinder.



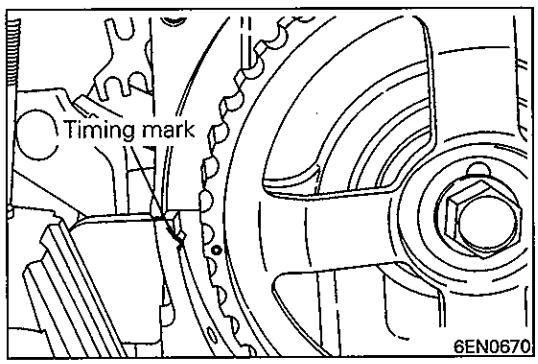
   ③ Insert a wire [1.44 mm (0.06 in.) in diameter] into the set holes.
   ④ Unclamp the auto tensioner from the vise.

(2) Install the auto tensioner.
Do not remove the wire until installation of the timing belt has been finished.



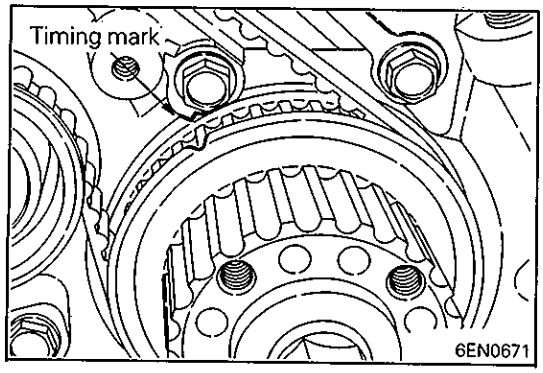
◆M◆ TENSIONER PULLEY INSTALLATION–DOUBLE CAMSHAFT ENGINE <Up to 1995 model>

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

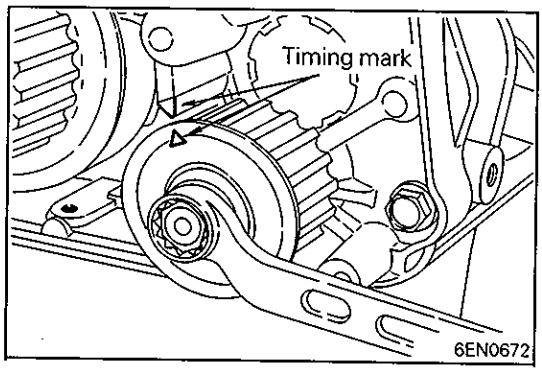


◆N◆ TIMING BELT INSTALLATION – 8-VALVE SINGLE CAMSHAFT ENGINE

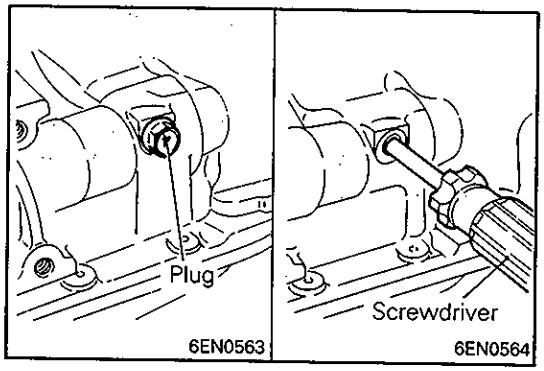
(1) Check that the timing belt tensioner and spring have been installed in position. (See ◆K◆)
(2) Align the timing mark on the camshaft sprocket with that on the cylinder head.



(3) Align the timing mark on the crankshaft sprocket with that on the front case.

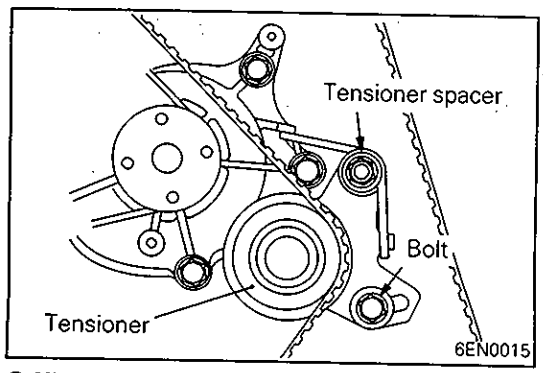


(4) Align the timing mark on the oil pump sprocket with its mating mark.



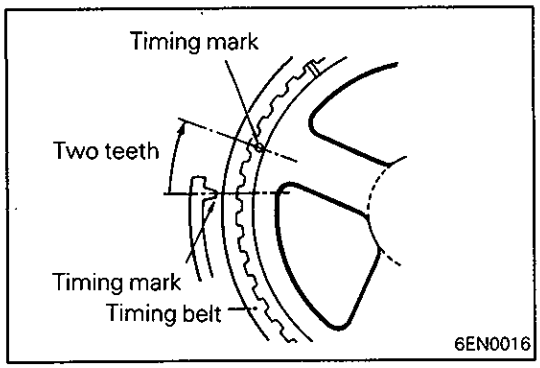
(5) Remove the plug on the cylinder block and insert a Phillips screwdriver [shank diameter 8 mm (0.31 in.)] through the hole (Engine with silent shafts).
If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (0.8 – 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.

(6) 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.

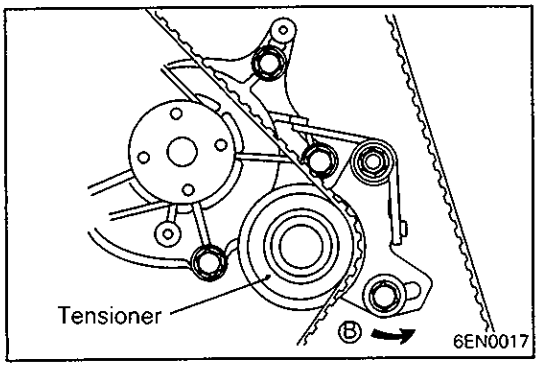


(7) Loosen the tensioner mounting bolt and tensioner spacer.

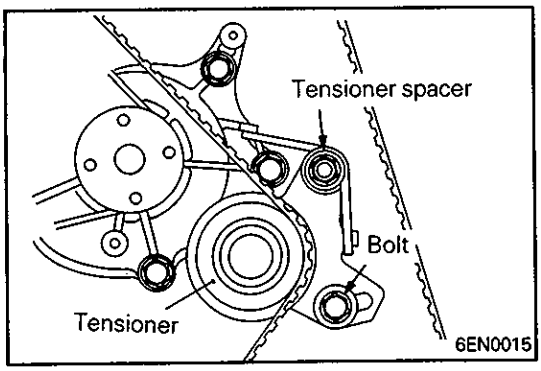
Added



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

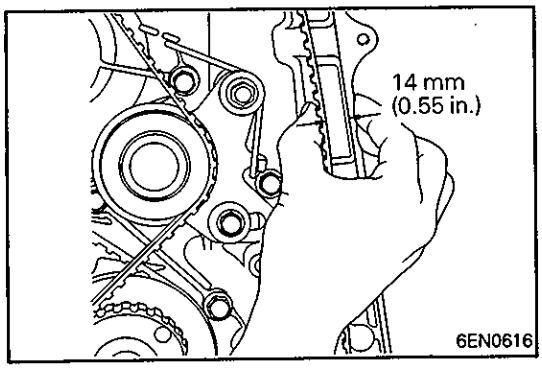


(9) Apply force to the tensioner in the direction shown by arrow Ⓑ to make the belt engage completely with each sprocket.



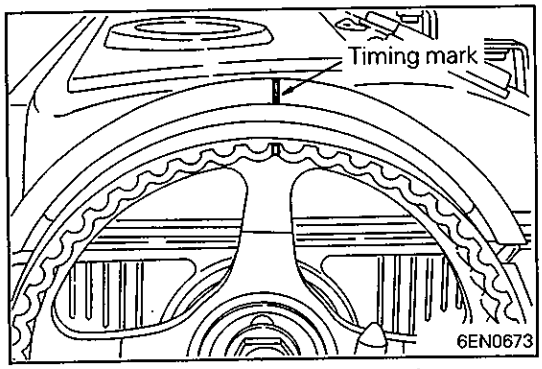
(10) Tighten the tensioner attaching bolt, then tighten the tensioner spacer.

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



(11) 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 meets the standard value.

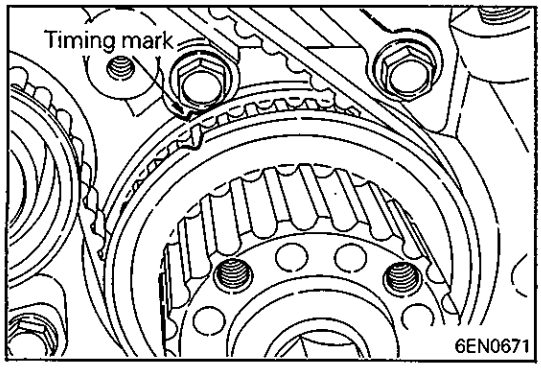
Standard value: 14 mm (0.55 in.)



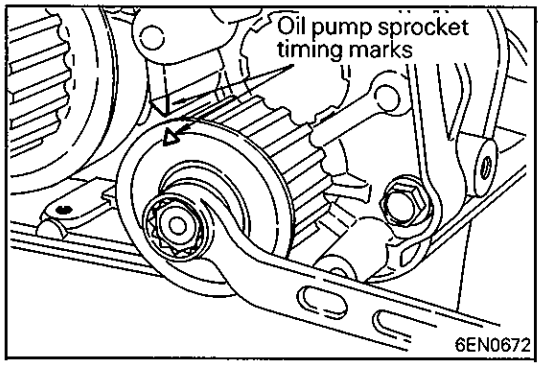
◆0◆ TIMING BELT INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE

(1) Check that the timing belt tensioner has been installed in position. (See ◆M◆)
(2) Align the timing mark on the camshaft sprocket with that on the cylinder head.

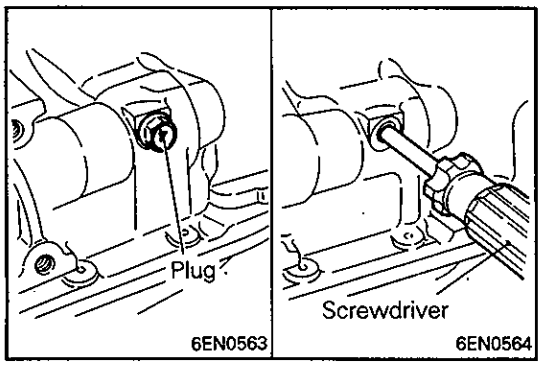
Added



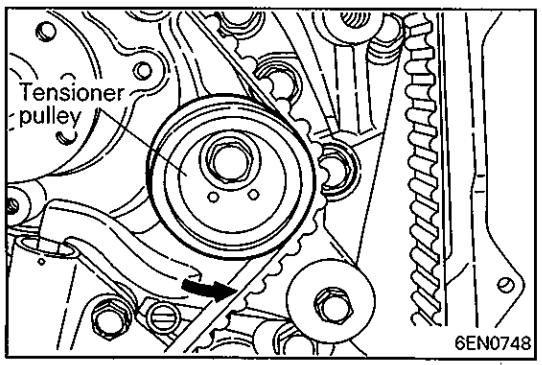
(3) Align the timing mark on the crankshaft sprocket with that on the front case.



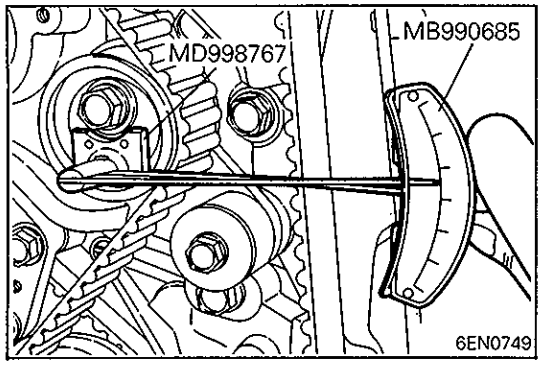
(4) Align the timing mark on the oil pump sprocket with its mating mark.



(5) Remove the plug on the cylinder block and insert a Phillips screwdriver [shank diameter 8 mm (0.31 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 (0.8 – 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.
(6) Connect the timing belt to the crankshaft sprocket, idler pulley, camshaft sprocket and tensioner pulley in that order.



(7) Lift up the tensioner pulley in the direction of arrow and tighten the center bolt.
(8) Check to see that all timing marks are lined up.
(9) Remove the screwdriver inserted in step (5) and fit the plug.
(10) Give the crankshaft a quarter counter-clockwise turn. Then, turn it clockwise until the timing marks are lined up again.

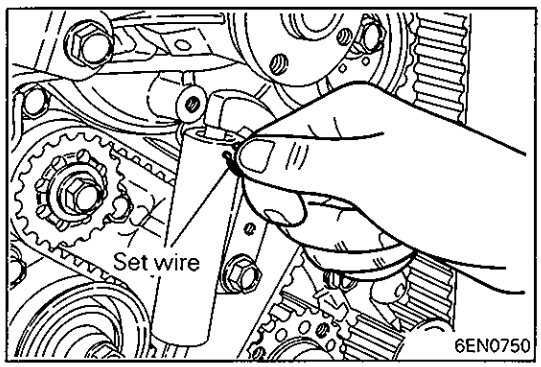


(11)Install the special tools, Socket Wrench and Torque Wrench, on the tensioner pulley, and loosen the tensioner pulley center bolt.

NOTE
If the special tool is not available, use a commercially available torque wrench that is capable of measuring 0 – 3 Nm (0 – 0.3 kgm, 0 – 2.2 ft.lbs.).

(12)Torque to 2.6 – 2.8 Nm (0.26 – 0.28 kgm, 1.88 – 2.03 ft.lbs.) with the torque wrench.

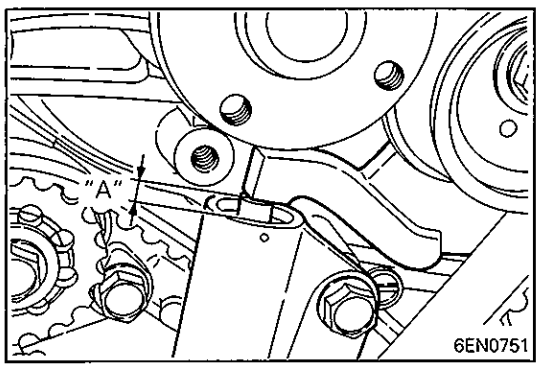
(13)Holding the tensioner pulley with the special tool and torque wrench, tighten the center bolt to the specification.



(14)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.

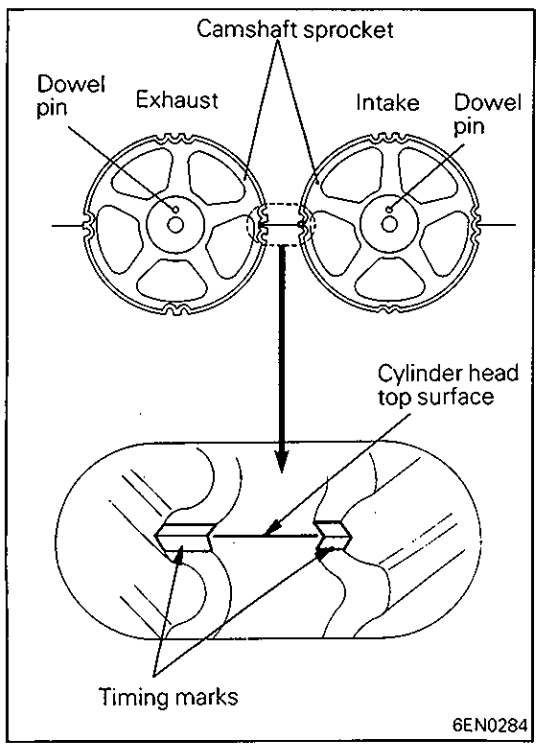
NOTE
If the wire does not move freely, repeat step (10) above until it moves freely.

(15)Remove the auto tensioner setting wire.



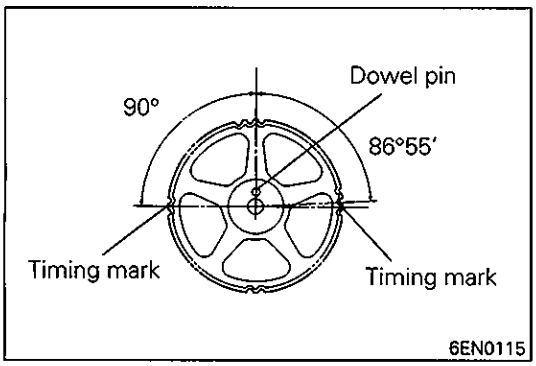
(16)Measure the distance "A" (between the tensioner arm and auto tensioner body).

Standard value: 3.8 – 4.5 mm (0.15 – 0.18 in.)

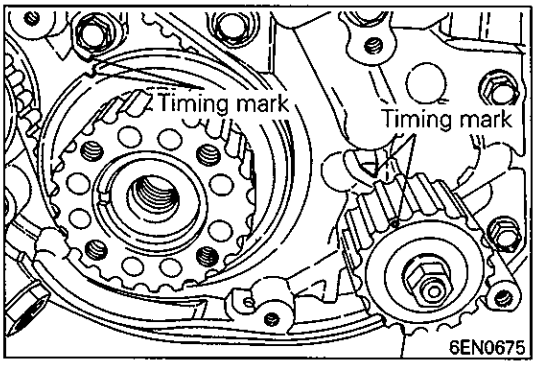


◗P◖ TIMING BELT INSTALLATION – DOUBLE CAMSHAFT ENGINE

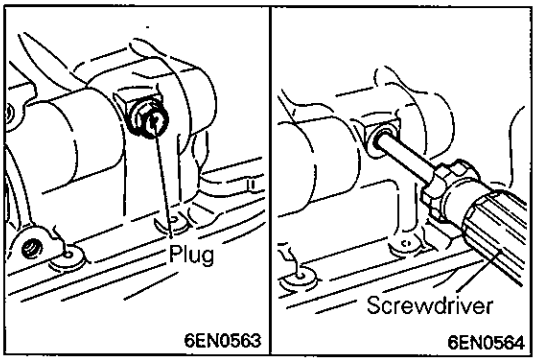
(1) Turn the two camshaft sprockets so that their dowel pins are located on top. Then, align the timing marks facing each other with the top surface of the cylinder head. When you let go of the exhaust camshaft sprocket, it will rotate one tooth in the counterclockwise direction. This should be taken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



NOTE
The same camshaft sprocket is used for the intake and exhaust camshafts and is provided with two timing marks. 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.

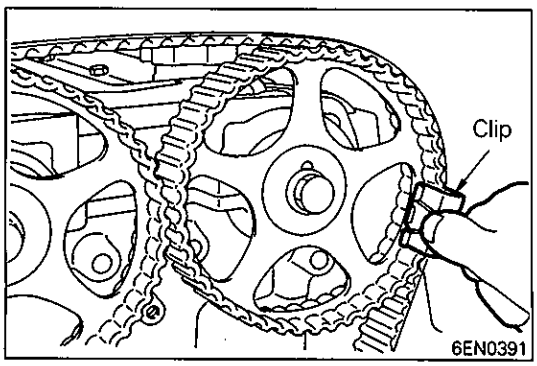


(2) Align the crankshaft sprocket timing marks.
(3) Align the oil pump sprocket timing marks.

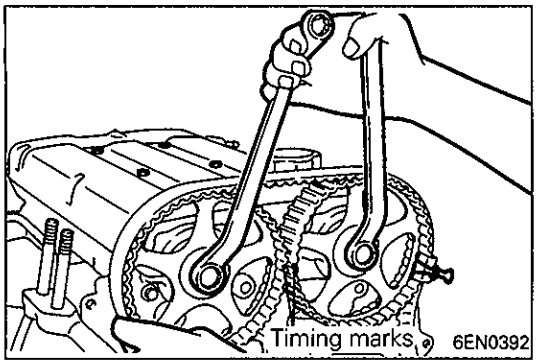


(4) Insert a Phillips screwdriver [shank diameter 8 mm (0.31 in.)] through the hole (Engine with silent shafts).
If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (0.8 – 1.0 in.), turn the oil pump sprocket one turn 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.

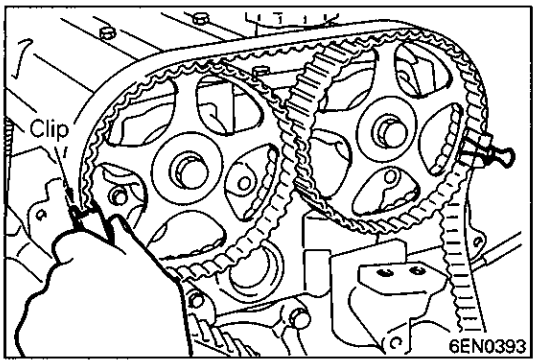
NOTE
Step (4) is performed to ensure that the oil pump sprocket is correctly positioned with reference to the silent shafts.



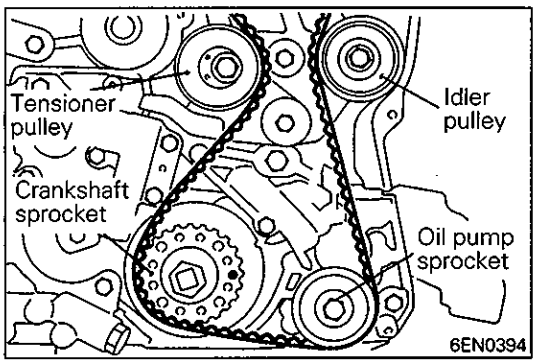
(5) Thread the timing belt over the intake side camshaft sprocket and fix it at indicated position by a clip.



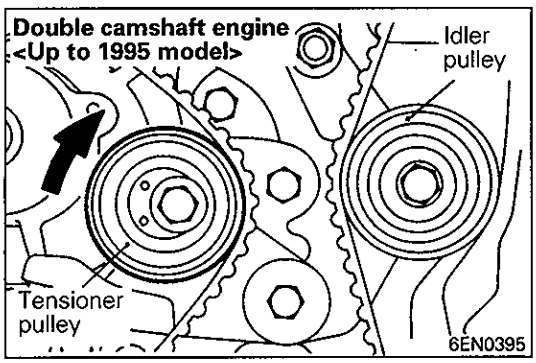
(6) Thread the timing belt over the exhaust side sprocket, aligning the timing marks with the cylinder head top surface using two wrenches.



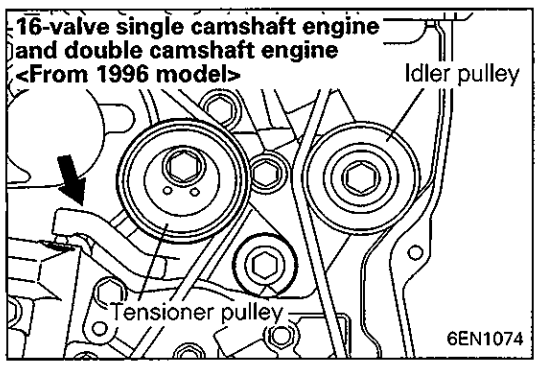
(7) Fix the belt at indicated position by a clip.

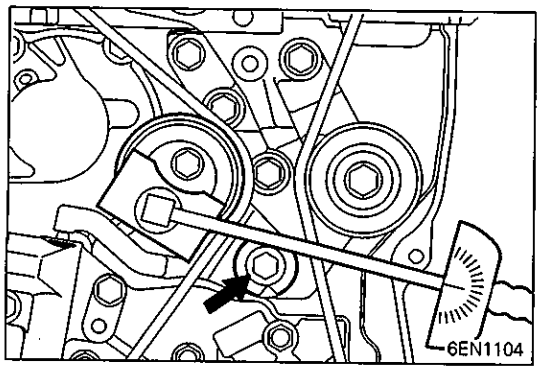


(8) Thread the timing belt over the idler pulley, the oil pump sprocket, the crankshaft sprocket and the tension pulley in the order shown.
(9) Remove the two clips.



(10) Lightly press the tensioner pulley to the timing belt, and tighten the center bolt temporarily.
(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.



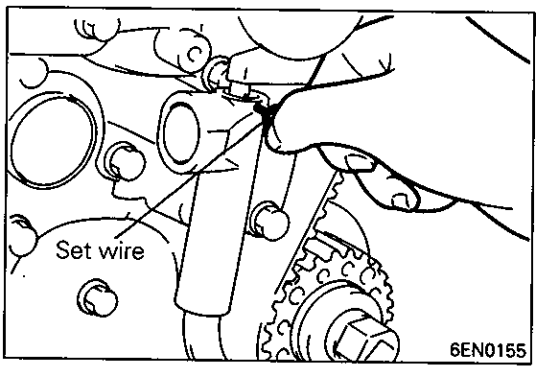


(14)Install the special tools, Socket Wrench and Torque Wrench, on the tensioner pulley, and loosen the tensioner pulley center bolt.

NOTE
If the special tool is not available, use a commercially available torque wrench that is capable of measuring 0 – 3 Nm (0 – 0.3 kgm, 0 – 2.2 ft.lbs.).

(15)Torque to 2.6 – 2.8 Nm (0.26 – 0.28 kgm, 1.88 – 2.03 ft.lbs.) with the torque wrench.

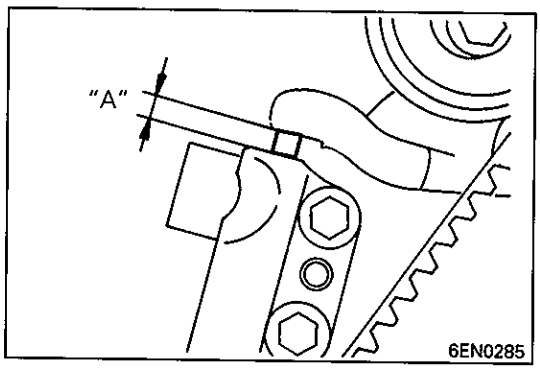
(16)Holding the tensioner pulley with the special tool and torque wrench, tighten the center bolt to specification.



(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.



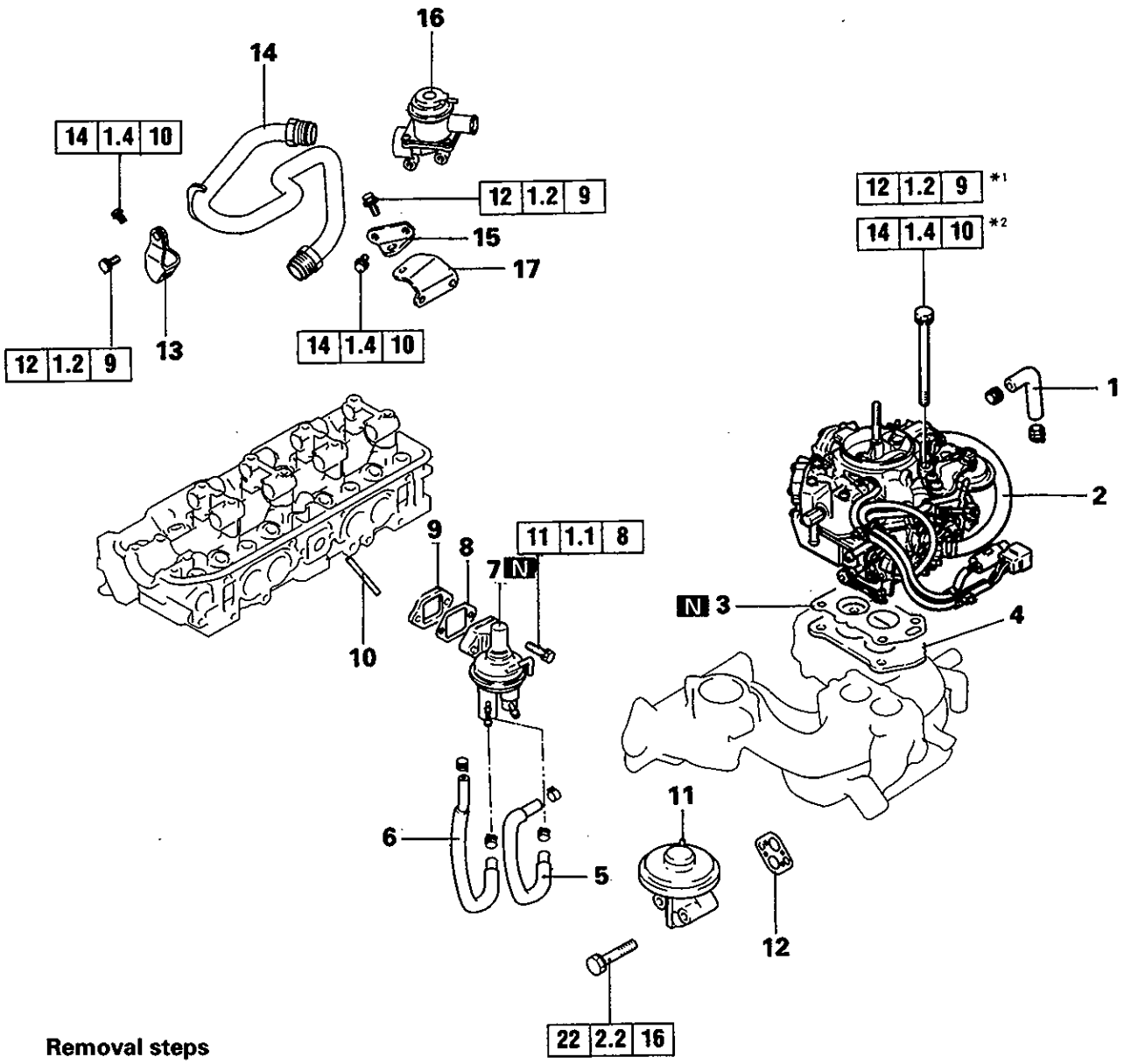
(19)Measure the distance "A" (between the tensioner arm and auto tensioner body).

Standard value: 3.8 – 4.5 mm (0.15 – 0.18 in.)

NOTES

5. FUEL AND EMISSION CONTROL PARTS

REMOVAL AND INSTALLATION – 4G63 8-VALVE ENGINE WITH CARBURETOR



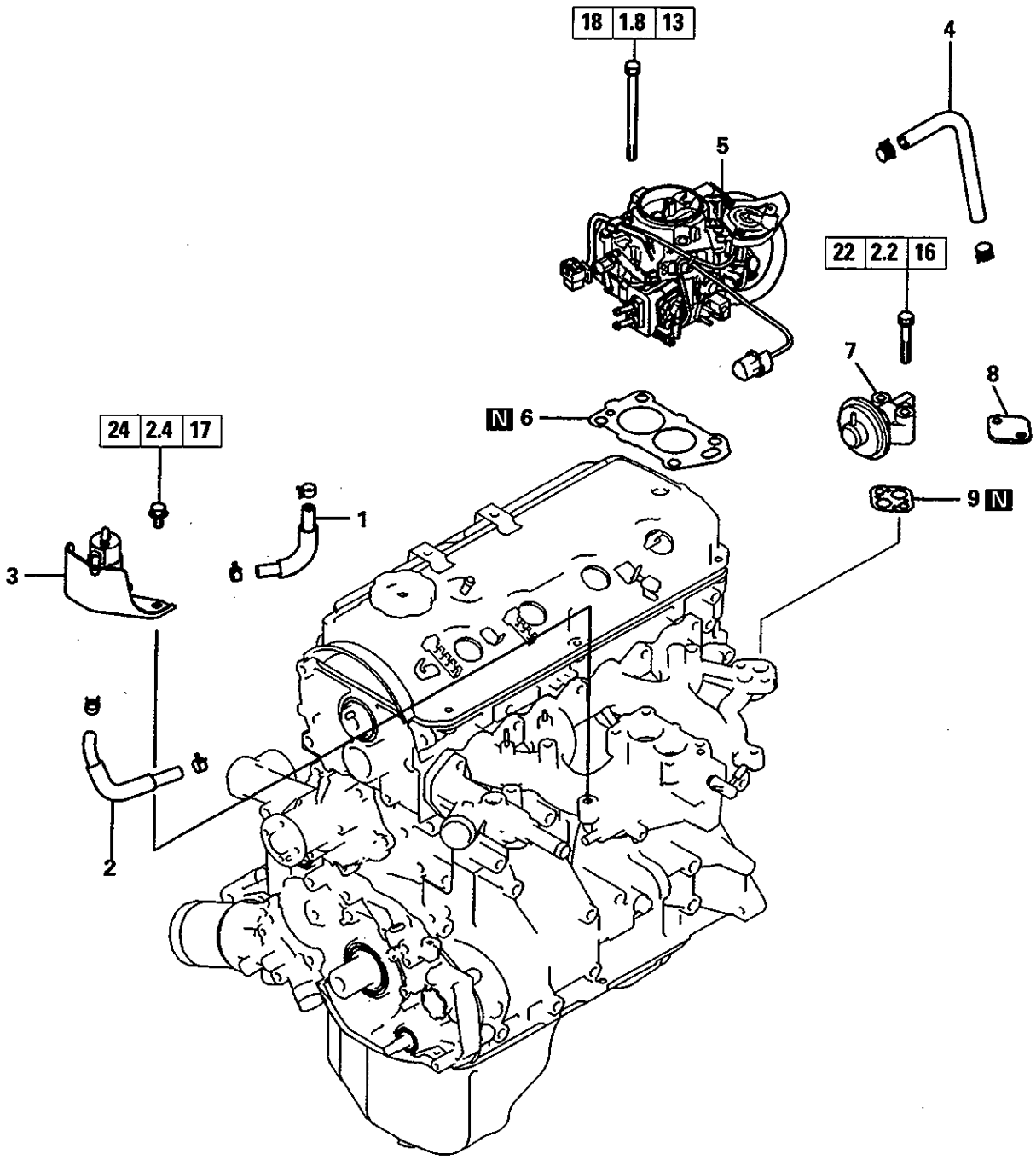
Removal steps

1. Water hose
2. Carburetor
3. ◆B◆ Gasket
4. 〈A〉 Cold mixture heater
5. Return hose
6. Outlet hose
7. 〈B〉 ◆A◆ Fuel pump
8. Gasket
9. Insulator
10. Push rod
11. EGR valve
12. Gasket
13. Air pipe bracket
14. Air pipe assembly
15. Air reed valve bracket A
16. Air reed valve
17. Air reed valve bracket B

NOTE
*1: Conventional carburator
*2: Electronic control carburator

6EN0781

REMOVAL AND INSTALLATION – 16-VALVE ENGINE WITH CARBURETOR



Removal steps

1. Fuel hose
2. Fuel hose
3. Fuel vapor separator
4. Water hose
5. Carburetor

◆B◆ 6. Gasket

7. EGR valve
8. Cover (Models without EGR valve)
9. Gasket

6EN1345

Intentionally blank

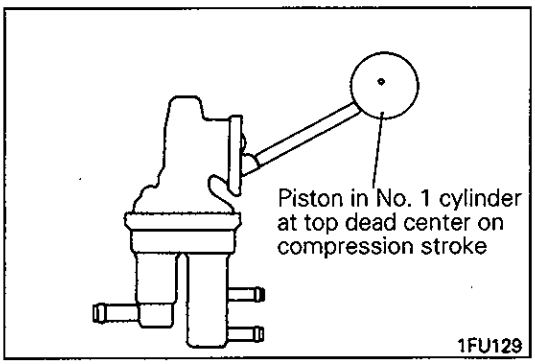
REMOVAL SERVICE POINTS

◇A◇ COLD MIXTURE HEATER REMOVAL

(1) Do not drop the cold mixture heater from a height of more than 30 cm (11.81 in.). Never use the dropped cold mixture heater.

◇B◇ FUEL PUMP REMOVAL

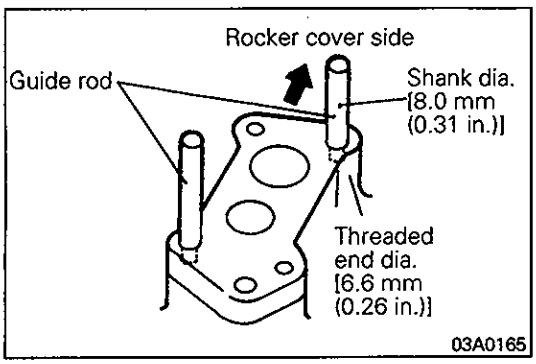
(1) Placing the piston in No. 1 cylinder at TDC on the compression stroke makes the fuel pump stroke lift the smallest, allowing easy removal of the pump.



INSTALLATION SERVICE POINTS

▶A◀ FUEL PUMP INSTALLATION

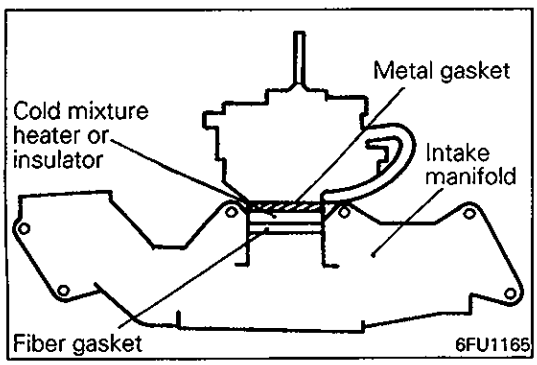
(1) Bring the piston in No. 1 cylinder to TDC on the compression stroke. This provides the smallest lift of the eccentric cam, allowing easy installation of the fuel pump.



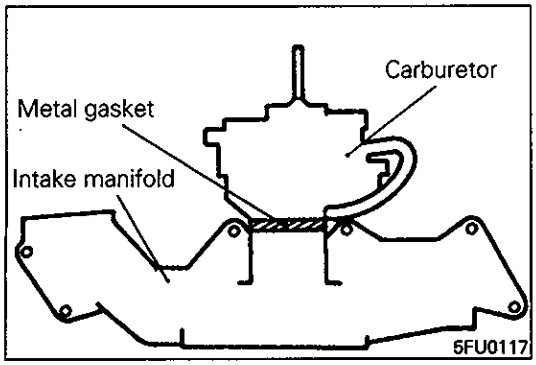
▶B◀ METAL GASKET INSTALLATION

(1) Using the threaded holes for mounting the carburetor on the intake manifold, stand two guide rods [threaded end dia.: 6.6 mm (0.26 in.), shank dia.: 8.0 mm (0.31 in.)] diagonally as illustrated.
(2) Set the carburetor gasket and the carburetor on the intake manifold along the guide rods.

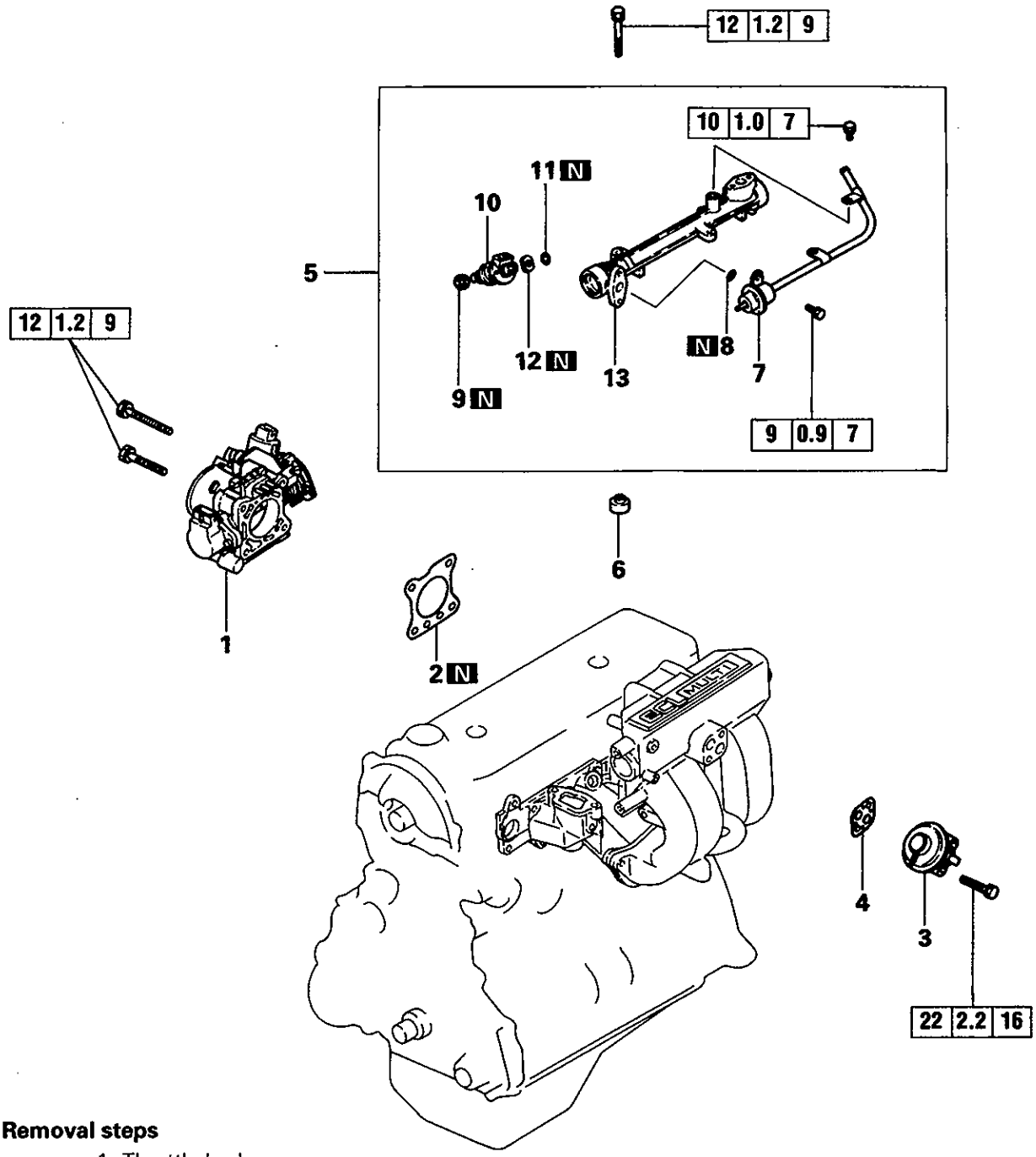
NOTE
After setting, do not move the carburetor.



(3) Insert the carburetor attaching bolts in the two vacant screw holes and tighten them finger-tight.
(4) Remove the guide rods, insert the carburetor attaching bolts in their place and tighten finger-tight.
(5) Tighten the four carburetor attaching bolts to the specified torque.


Carburetor
Metal gasket
Intake manifold
5FU0117

REMOVAL AND INSTALLATION – 8-VALVE SINGLE CAMSHAFT ENGINE for PAJERO / MONTERO, L200



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

◆C◆ 8. O-ring

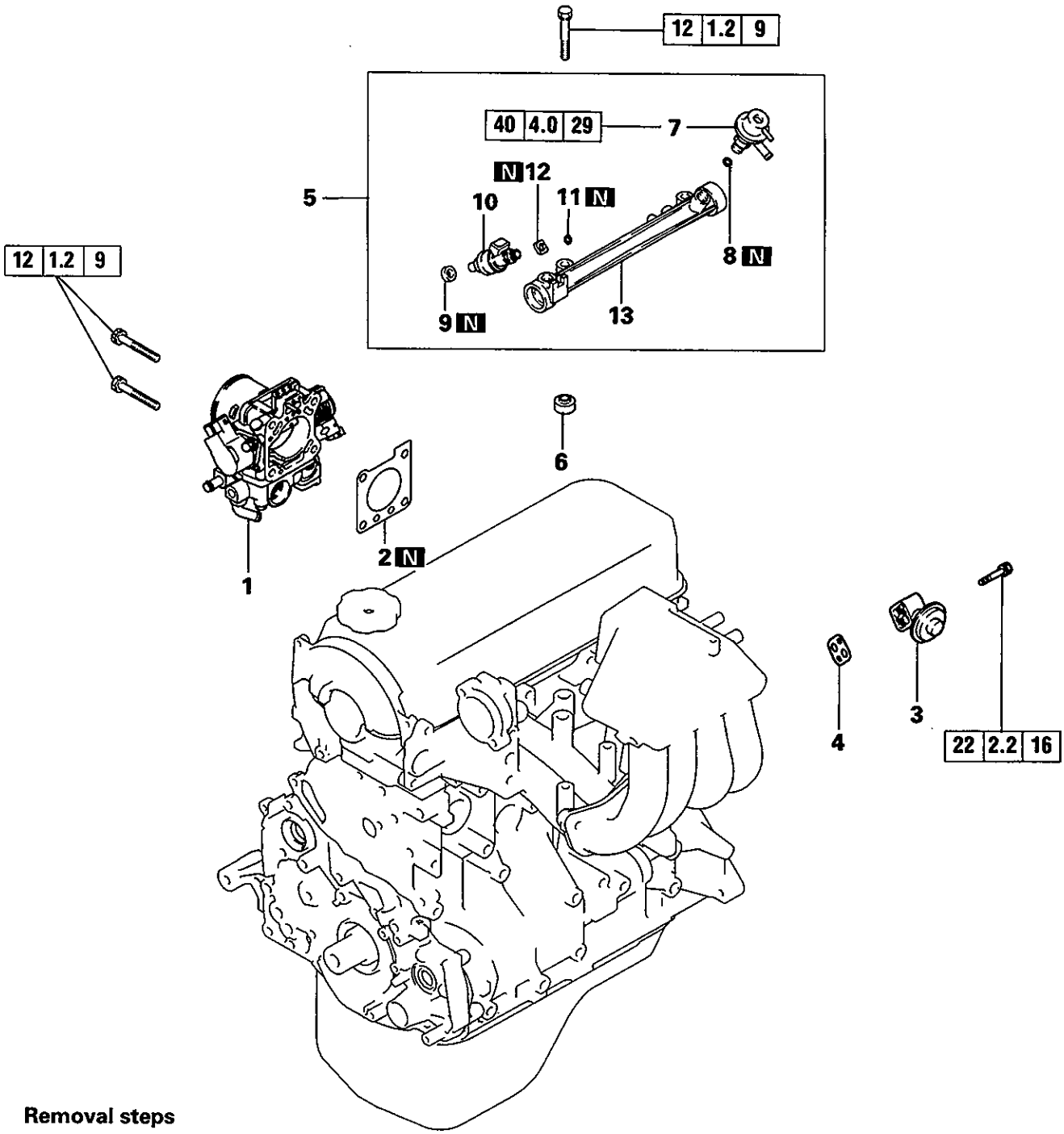
9. Insulator

◆B◆ 10. Injectors

11. O-ring
12. Grommet
13. Fuel rail

6EN0765

REMOVAL AND INSTALLATION – 8-VALVE SINGLE CAMSHAFT ENGINE for L300



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

◆C◆ 8. O-ring

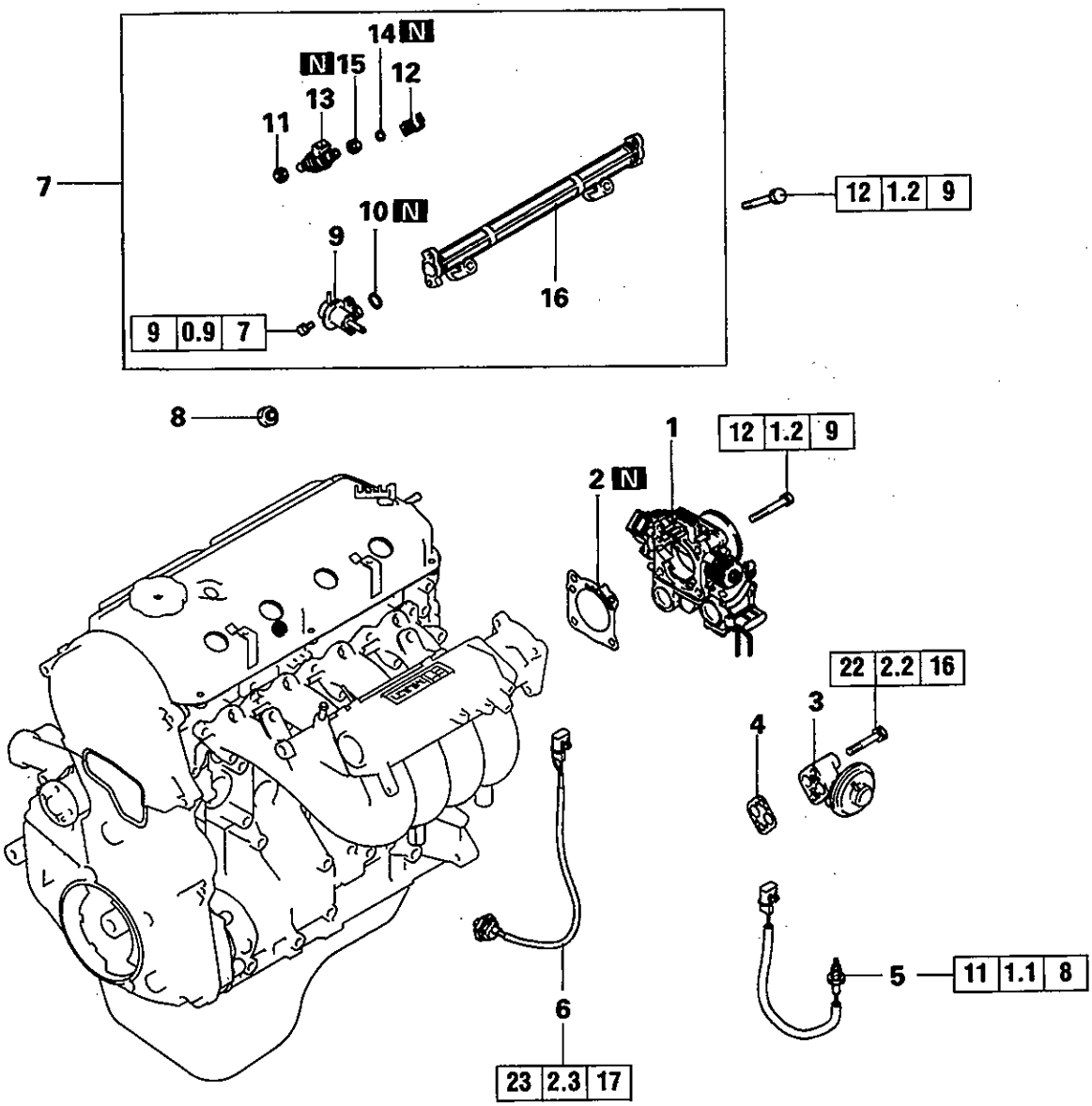
9. Insulator

◆B◆ 10. Injectors

11. O-ring
12. Grommet
13. Fuel rail

6EN0766

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR FRONT WHEEL DRIVE VEHICLE



Removal steps

1. Throttle body
2. Throttle body gasket
3. EGR valve
4. EGR valve gasket
5. EGR temperature sensor – For Sweden
6. Knock sensor
7. Injectors and fuel rail
8. Insulator
9. Fuel pressure regulator

◆C◆ 10. O-ring
11. Insulator

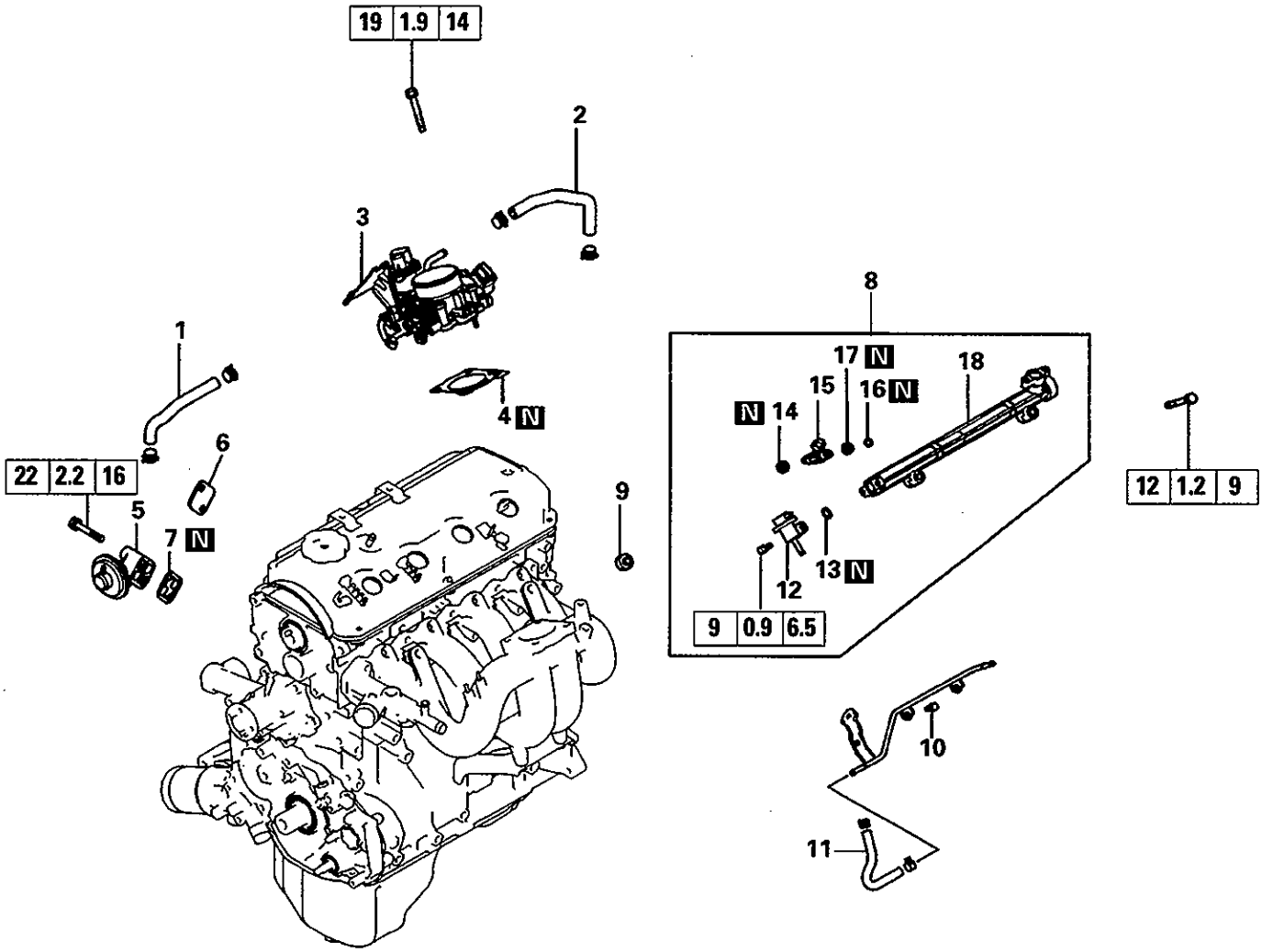
◆A◆ 12. Injector clip

◆B◆ 13. Injectors
14. O-ring
15. Grommet
16. Fuel rail

6EN0764

414

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR REAR WHEEL DRIVE VEHICLE



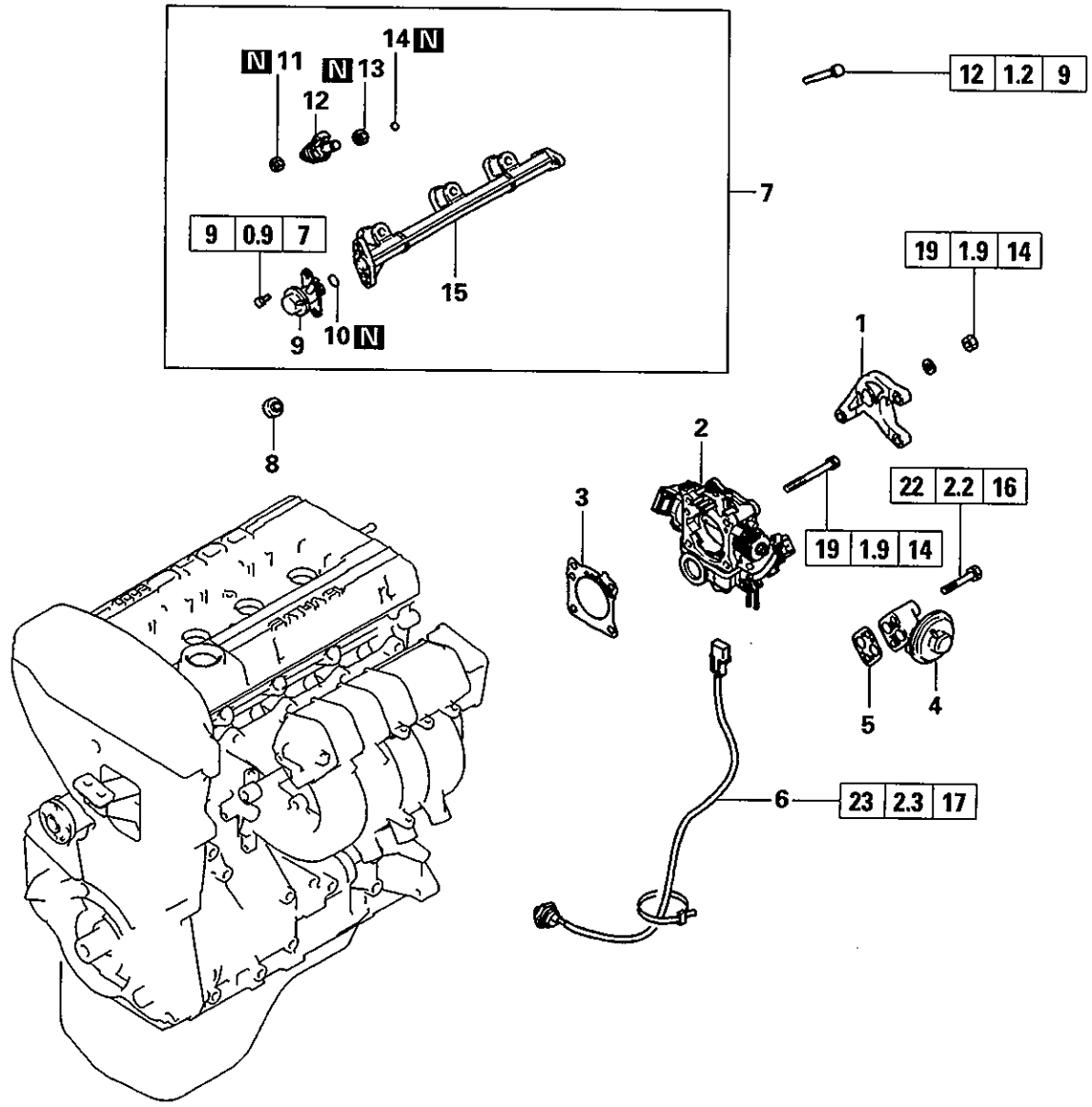
Removal steps

1. Water hose
2. Water hose
3. Throttle body
4. Gasket
5. EGR valve
6. Cover (Models without EGR valve)
7. Gasket
8. Injectors and fuel rail
9. Insulator
10. Fuel return pipe
11. Fuel hose
12. Fuel pressure regulator
13. ◆C◆ O-ring
14. Insulator
15. ◆A◆ Injector
16. O-ring
17. Grommet
18. Fuel rail

6EN1346

Intentionally blank

REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE

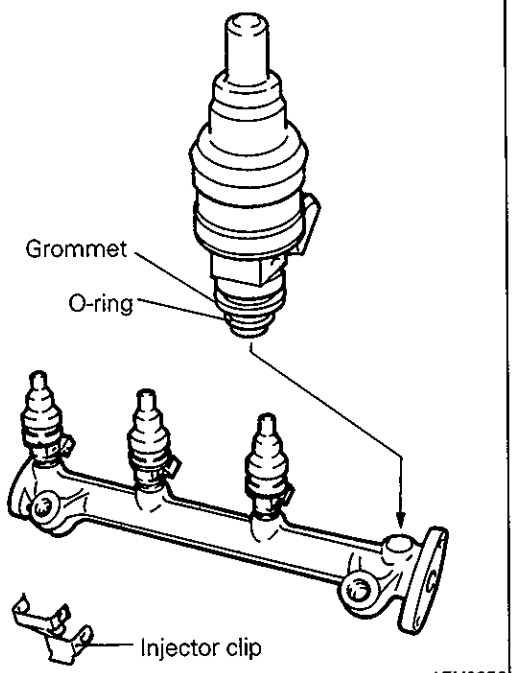


Removal steps

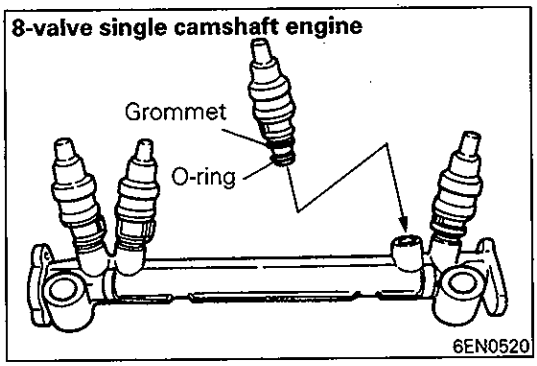
1. Throttle body stay <Up to 1995 model>
2. Throttle body
3. Throttle body gasket
4. EGR valve
5. EGR valve gasket
6. Knock sensor
7. Injectors and fuel rail
8. Insulator
◆C◆ 9. Fuel pressure regulator
10. O-ring
11. Insulator
◆B◆ 12. Injectors
13. O-ring
14. Grommet
15. Fuel rail

6EN1151

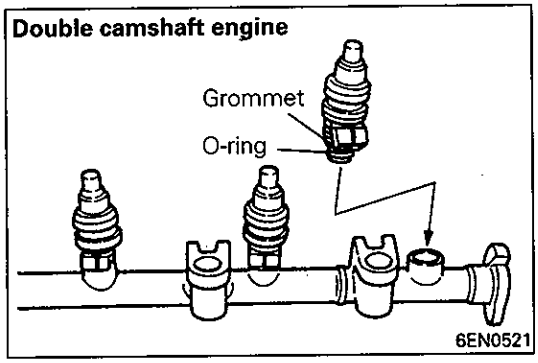
16-valve single camshaft engine



8-valve single camshaft engine



Double camshaft engine



INSTALLATION SERVICE POINTS

◆A◆ INJECTORS / INJECTOR CLIP INSTALLATION

(1) Before installing an injector, the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.
(2) Insert the injector top end into the fuel rail. Be carefull not to damage the O-ring during installation.
(3) Install the injector clip by sliding the open end onto the injector and onto the fuel rail.

◆B◆ INJECTOR INSTALLATION

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

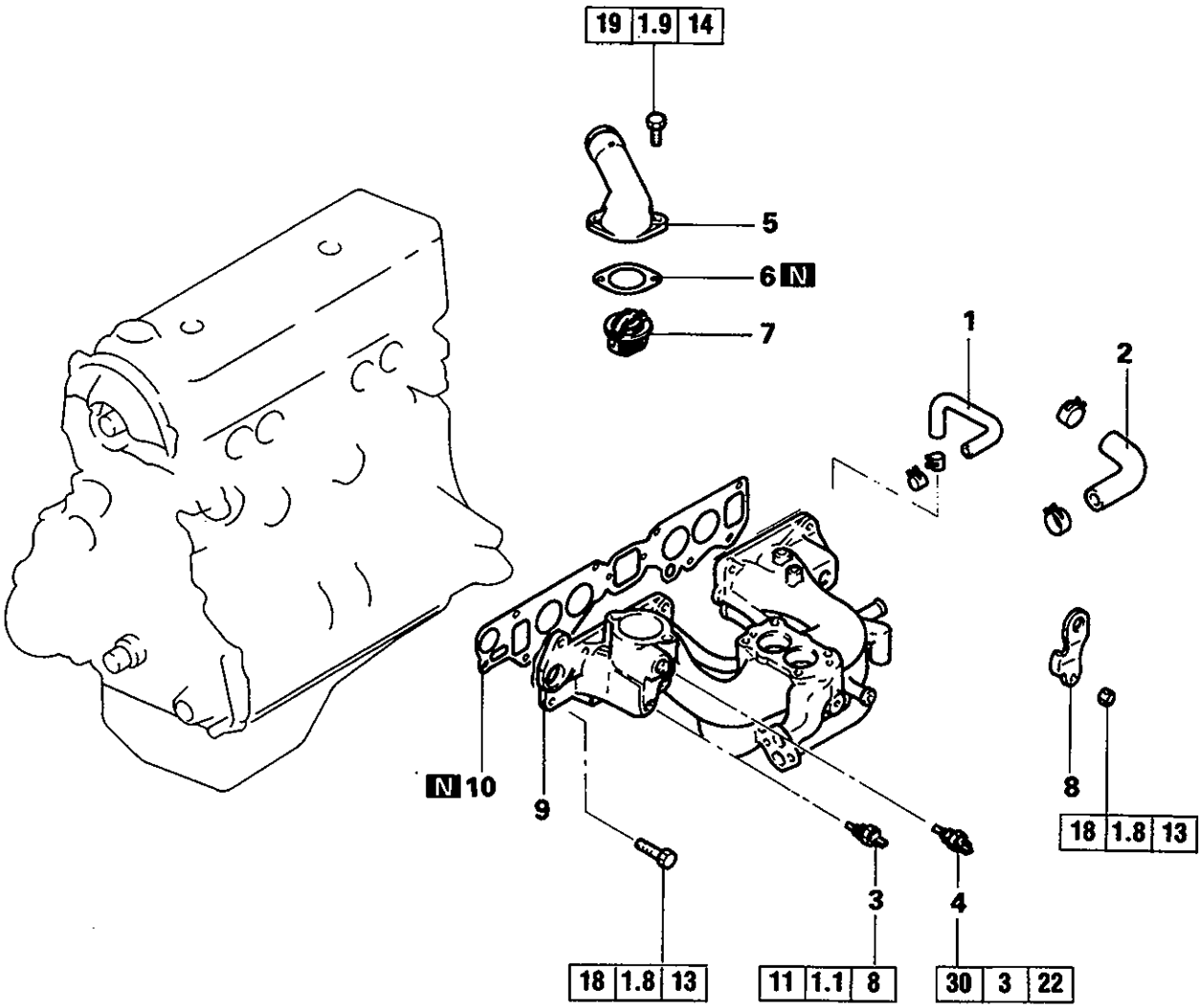
(2) Insert the injector top end into the fuel rail.
Be careful not to damage the O-ring during installation.

◆C◆ 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.

6. INTAKE MANIFOLD

REMOVAL AND INSTALLATION – 8-VALVE SINGLE CAMSHAFT ENGINE WITH CARBURETOR

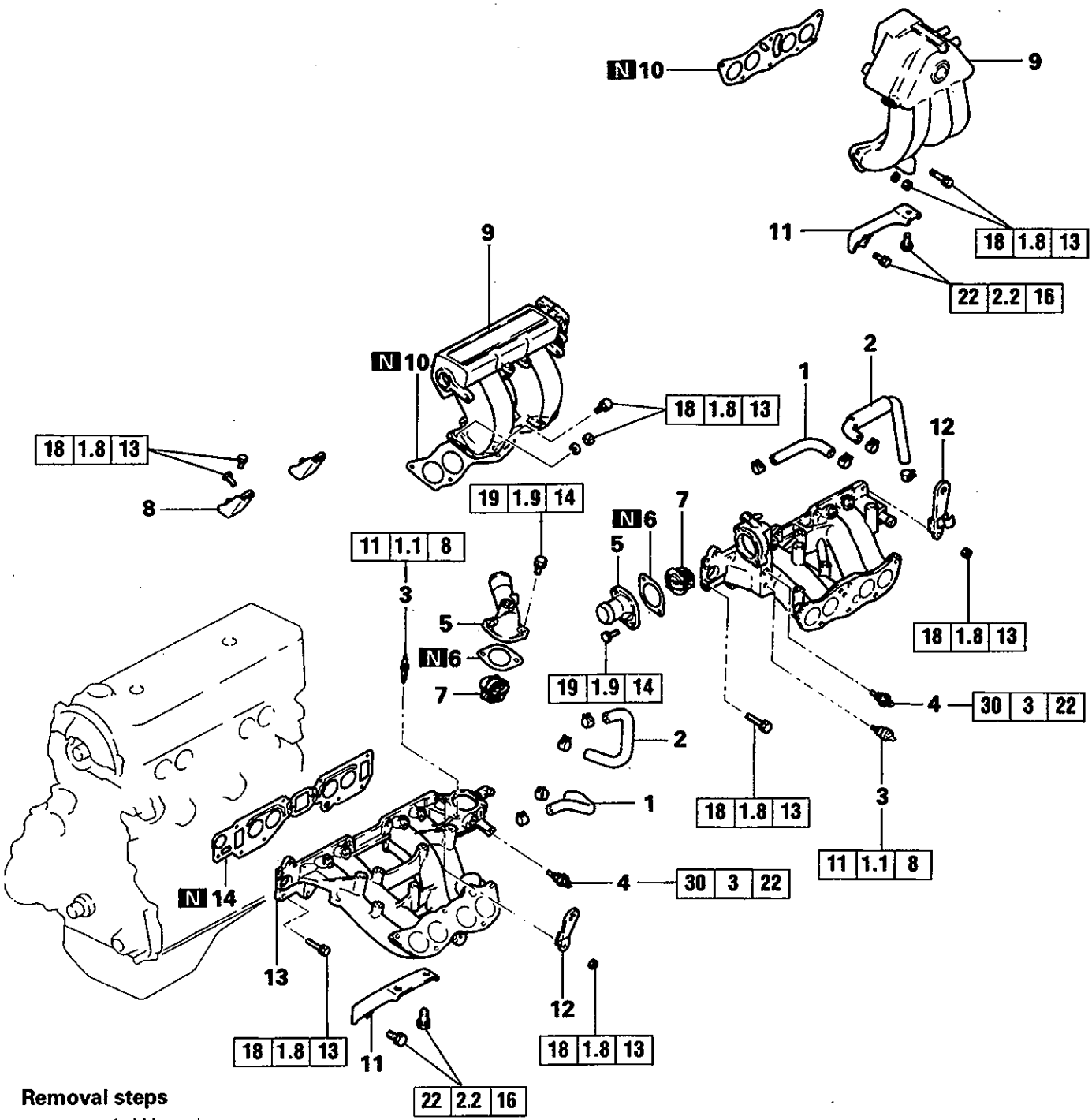


Removal steps

1. Water hose
2. Water by-pass hose
- ◆F◆ 3. Engine coolant temperature gauge unit
- ◆E◆ 4. Engine coolant temperature sensor (Electronic carburetor)
5. Water outlet fitting
- ◆B◆ 6. Gasket
7. Thermostat
8. Engine hanger
9. Intake manifold
10. Intake manifold gasket

6EN0767

REMOVAL AND INSTALLATION – 8-VALVE SINGLE CAMSHAFT ENGINE WITH FUEL INJECTION

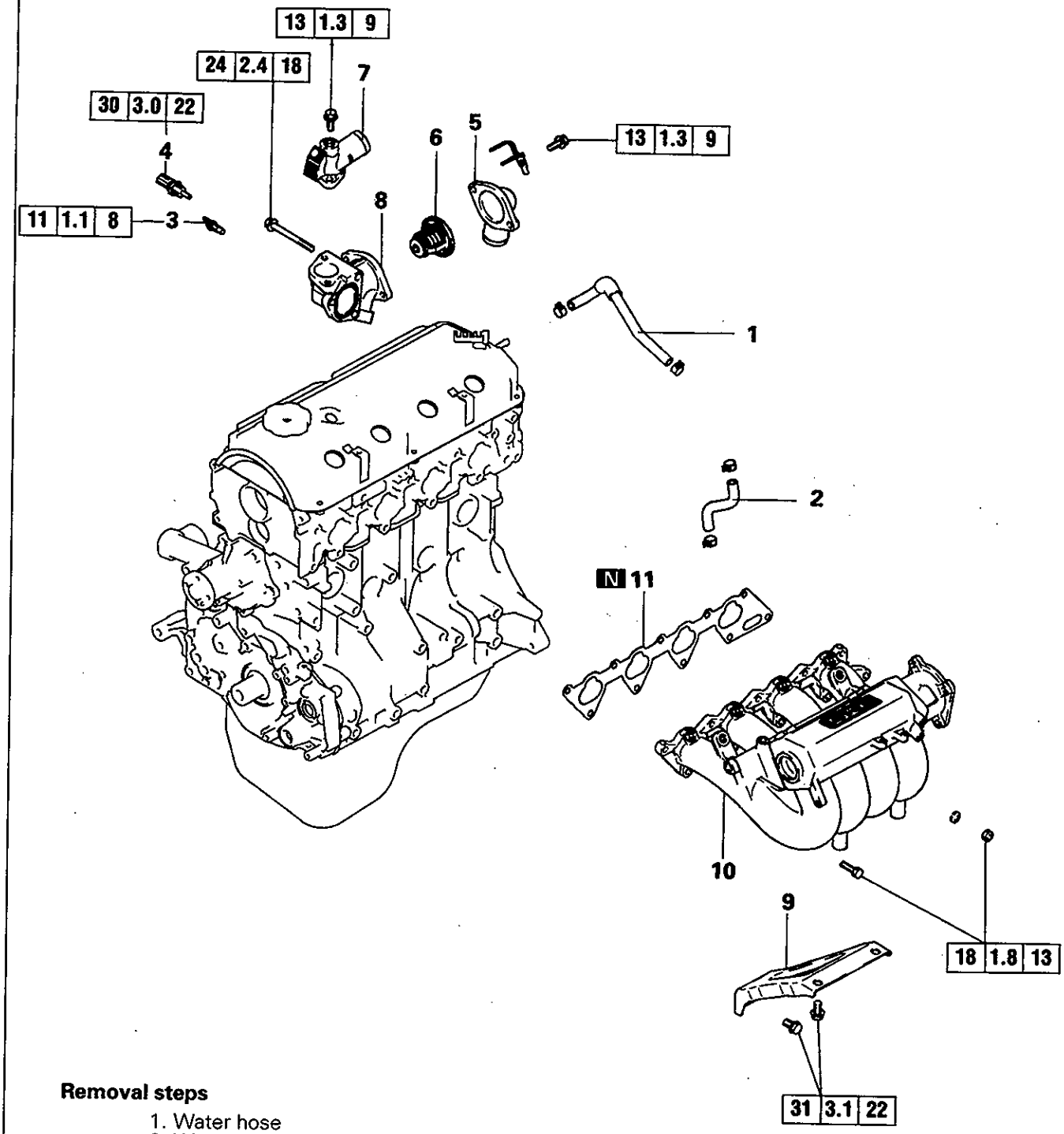


Removal steps

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

6EN0768

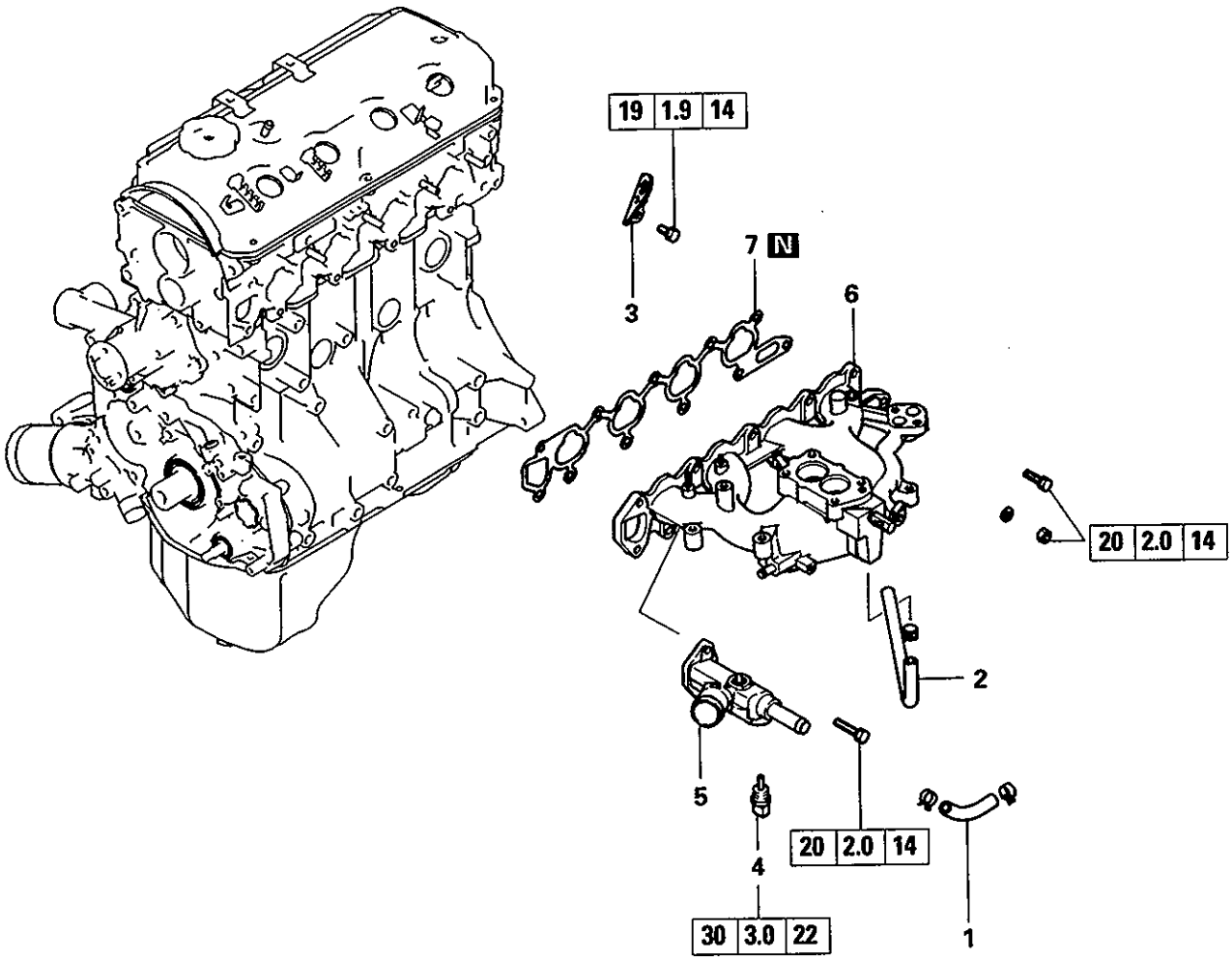
REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR FRONT WHEEL DRIVE VEHICLE



Removal steps

1. Water hose
2. Water hose
◆F◆ 3. Engine coolant temperature sensor
◆E◆ 4. Engine coolant temperature gauge unit
◆D◆ 5. Water inlet fitting
6. Thermostat
7. Water outlet fitting
◆C◆ 8. Thermostat housing
9. Intake manifold stay
10. Intake manifold
11. Intake manifold gasket

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR REAR WHEEL DRIVE VEHICLE WITH CARBURETOR (EXCEPT PAJERO/MONTERO)

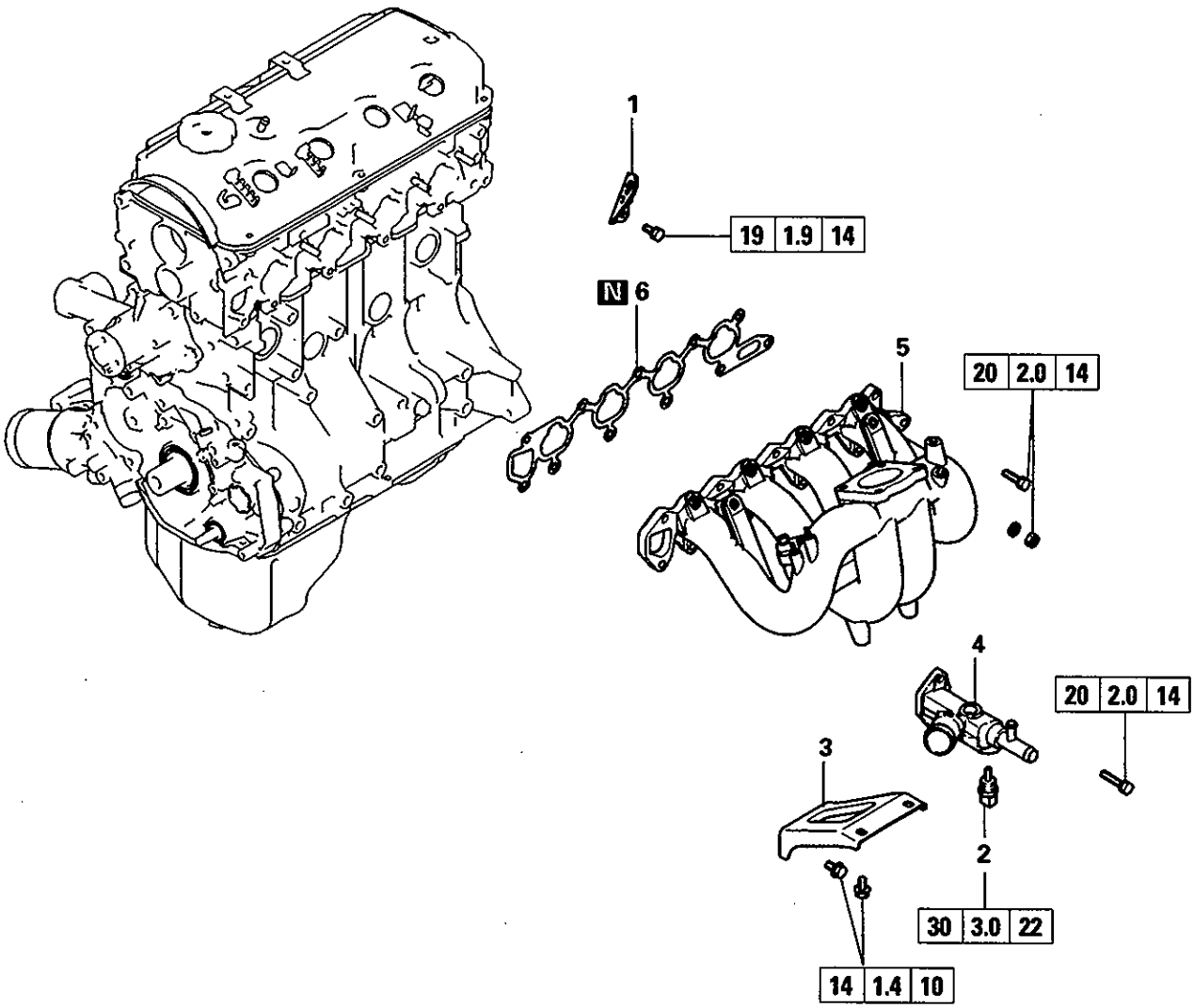


Removal steps

1. Water hose
2. Water hose
3. Engine hanger
- ◆E◆ 4. Engine coolant temperature sensor
- ◆D◆ 5. Water outlet fitting
6. Intake manifold
7. Gasket

6EN0968

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR REAR WHEEL DRIVE VEHICLE WITH FUEL INJECTION SYSTEM (EXCEPT PAJERO/MONTERO)

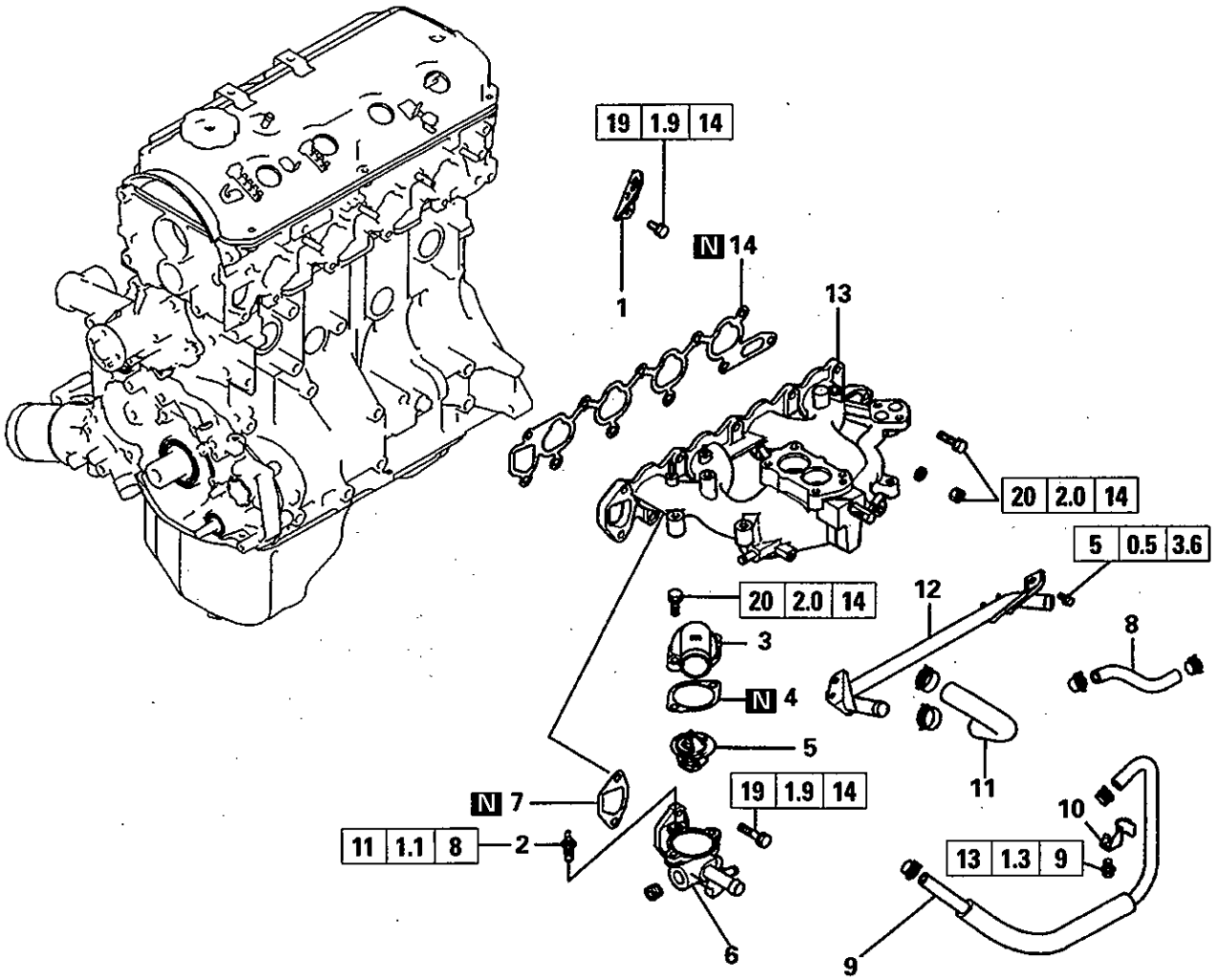


Removal steps

1. Engine hanger
◆E◆ 2. Engine coolant temperature sensor
3. Intake manifold stay
◆D◆ 4. Water outlet fitting
5. Intake manifold
6. Gasket

6EN0969

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR REAR WHEEL DRIVE VEHICLE WITH CARBURETOR (PAJERO/MONTERO)

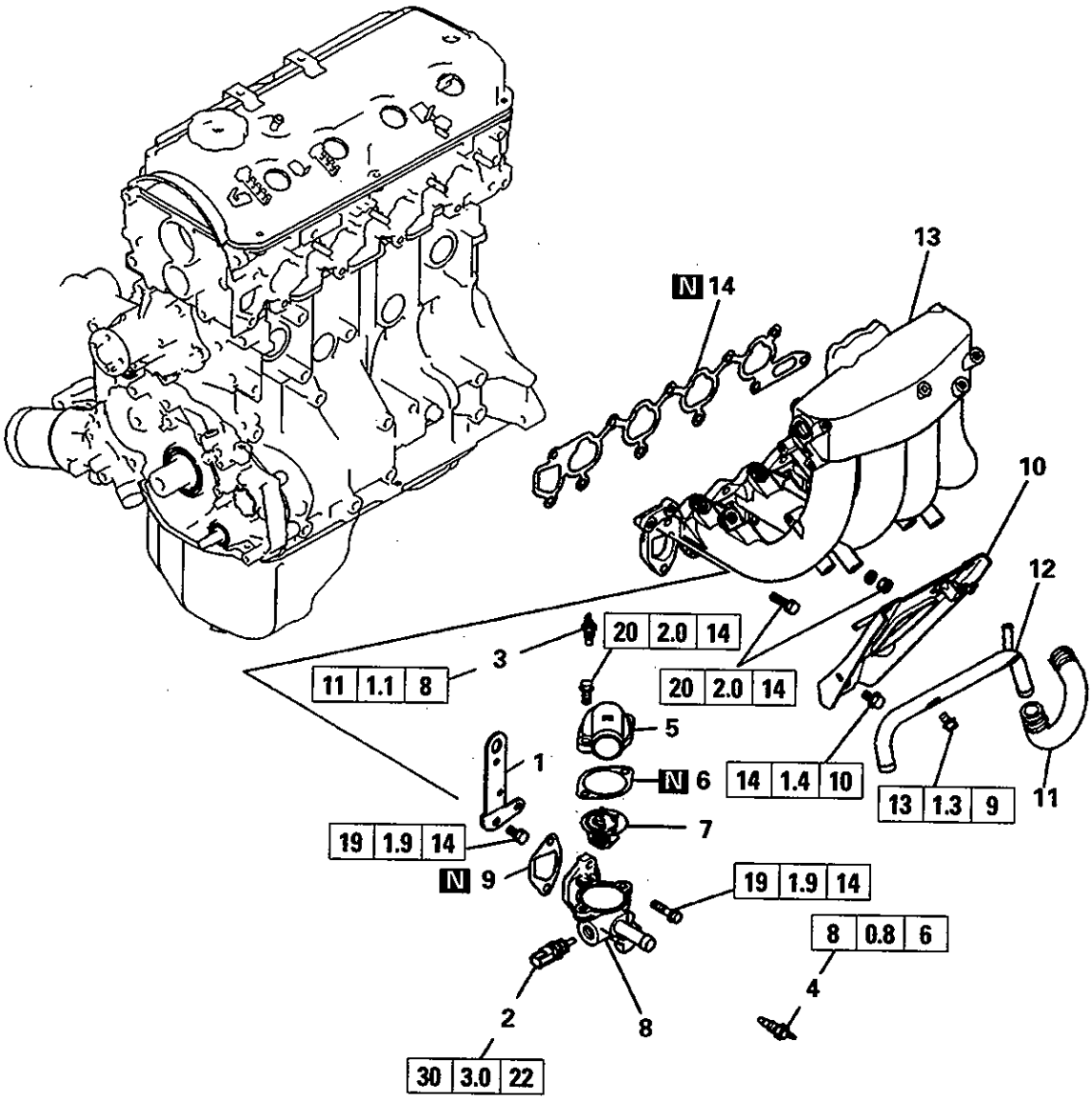


Removal steps

1. Engine hanger
◆F◆ 2. Engine coolant temperature gauge unit
3. Water outlet fitting
4. Gasket
5. Thermostat
6. Thermostat case
7. Gasket
8. Water hose
9. Water hose
10. Water hose bracket
11. Water hose
12. Heater pipe
13. Intake manifold
14. Gasket

6EN1347

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR REAR WHEEL DRIVE VEHICLE WITH FUEL INJECTION (PAJERO/MONTERO)

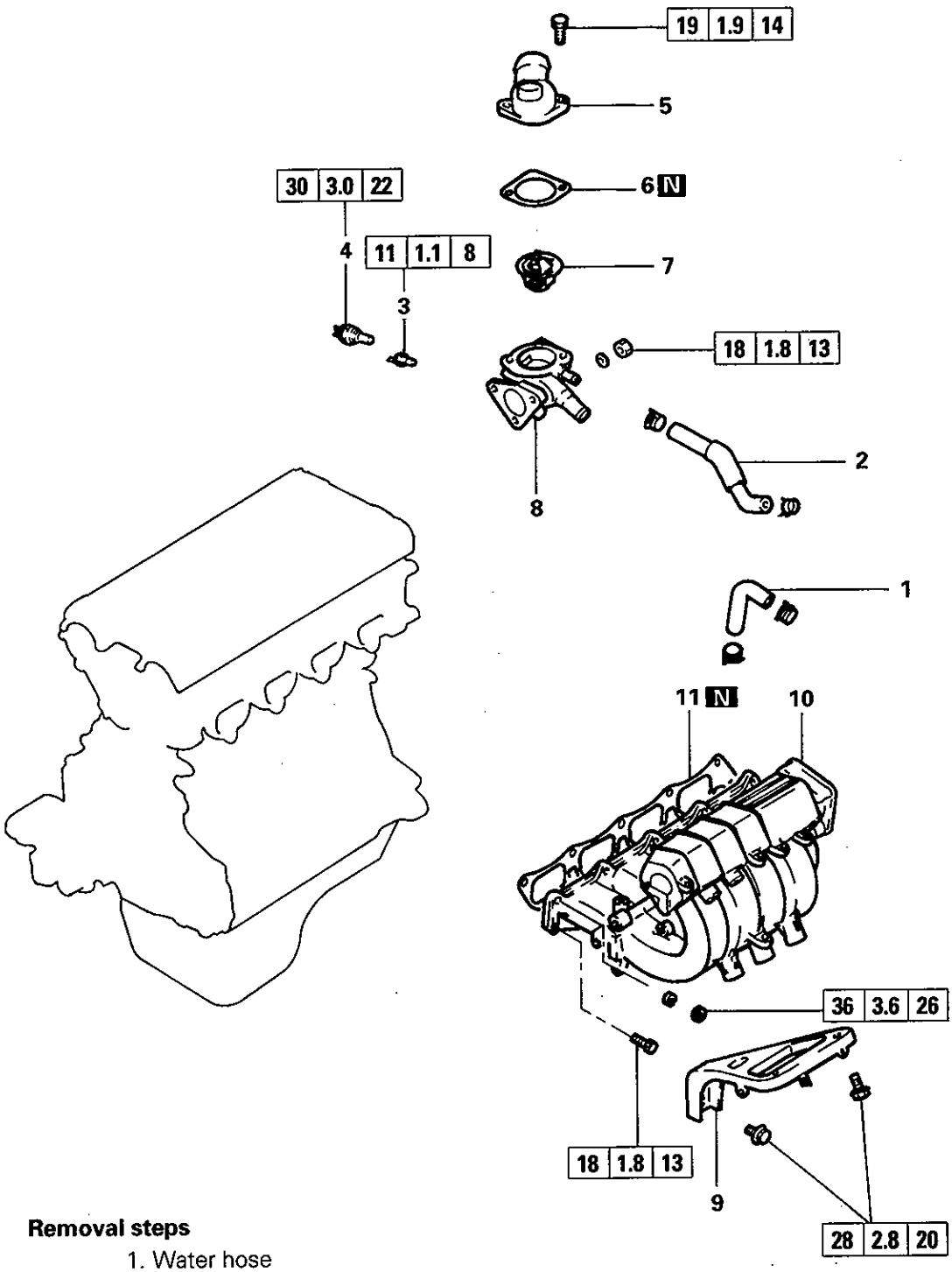


Removal steps

1. Engine hanger
◆E◆ 2. Coolant temperature sensor
◆F◆ 3. Coolant temperature gauge unit
◆G◆ 4. Thermo switch (A/T only)
5. Water outlet fitting
6. Gasket
7. Thermostat
8. Thermostat case
9. Gasket
10. Intake manifold stay
11. Water hose
12. Heater pipe
13. Intake manifold
14. Gasket

6EN1348

REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE
<Up to 1995 model>

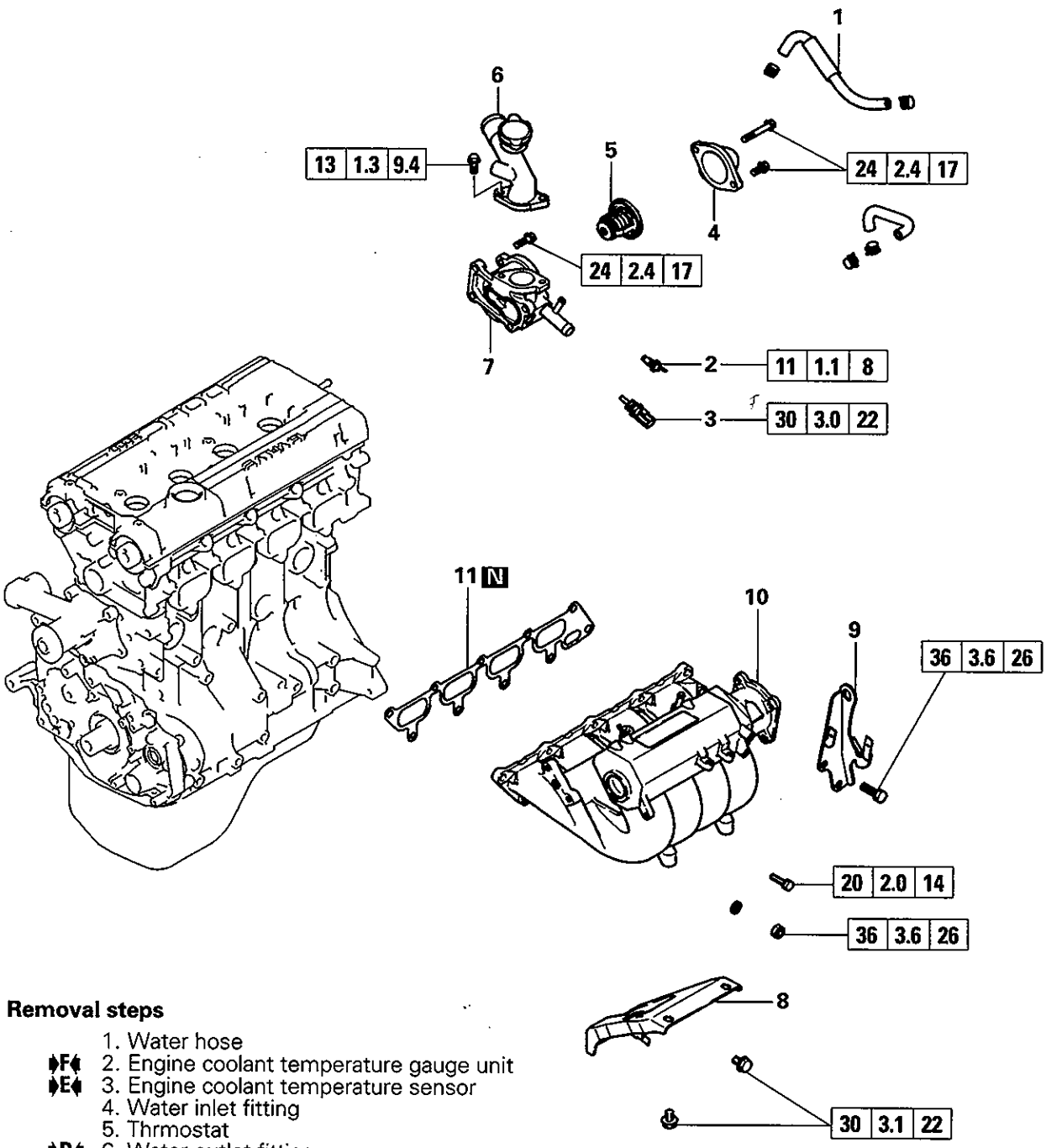


Removal steps

1. Water hose
2. Water hose
◆F◆ 3. Engine coolant temperature gauge unit
◆E◆ 4. Engine coolant temperature sensor
5. Water outlet fitting
◆B◆ 6. Gasket
7. Thermostat
◆C◆ 8. Thermostat housing
9. Intake manifold stay
◆A◆ 10. Intake manifold
11. Intake manifold gasket

6EN0769

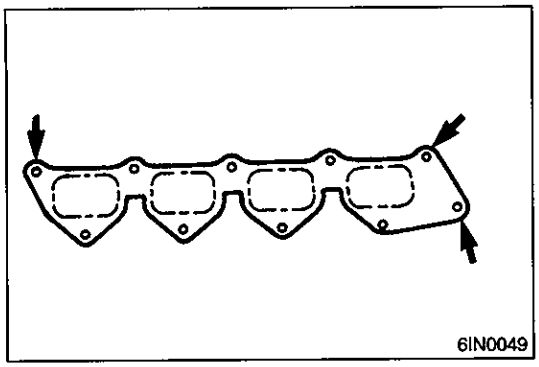
REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE <From 1996 model>



Removal steps

1. Water hose
- ◆F◆ 2. Engine coolant temperature gauge unit
- ◆E◆ 3. Engine coolant temperature sensor
4. Water inlet fitting
5. Thrmostat
- ◆D◆ 6. Water outlet fitting
- ◆C◆ 7. Thermostat housing
8. Intake manifold stay
9. Engine hanger
10. Intake manifold
11. Intake manifold gasket

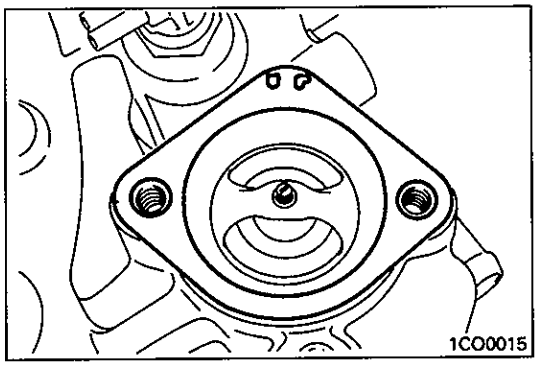
6EN1152



INSTALLATION SERVICE POINTS

◆A◆ INTAKE MANIFOLD INSTALLATION – DOUBLE CAMSHAFT ENGINE

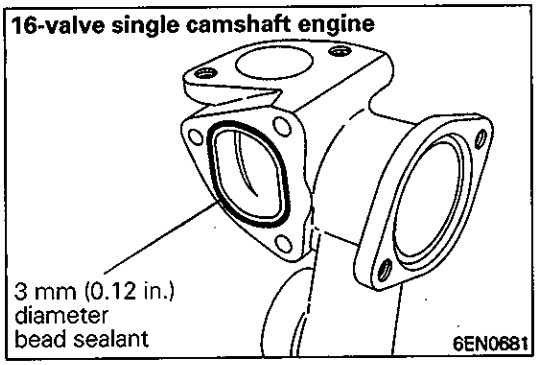
(1) Tighten the intake manifold bolts, noting that the bolts installed at the locations indicated in the illustration are tightened to a different torque.



◆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).

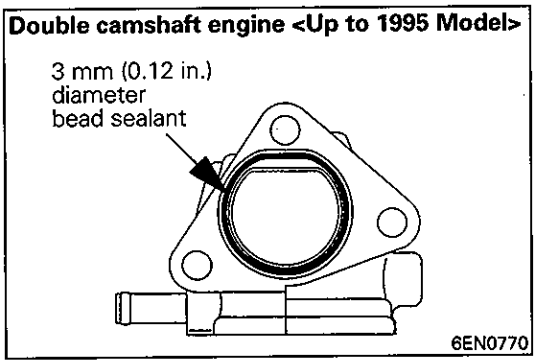
16-valve single camshaft engine



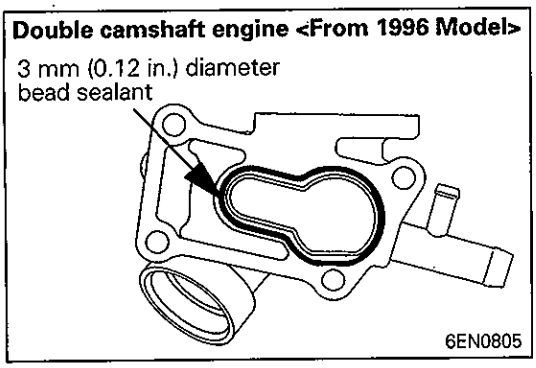
◆C◆ SEALANT APPLICATION TO THERMOSTAT HOUSING

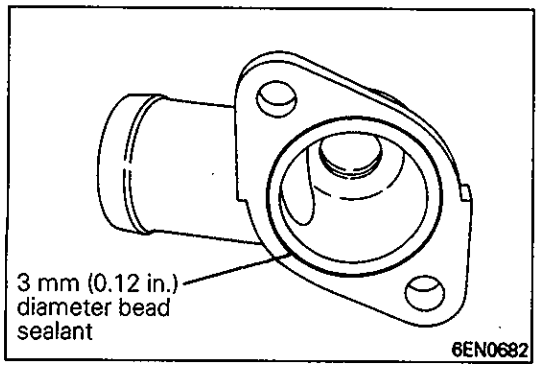
Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

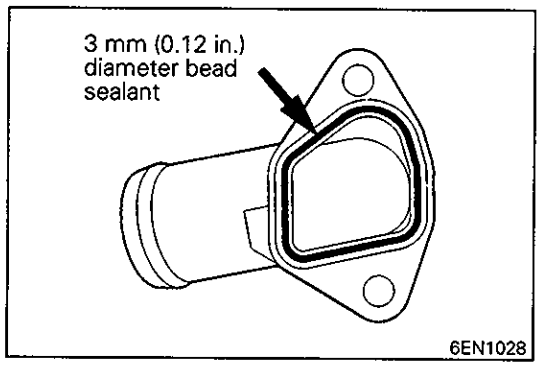
Double camshaft engine <Up to 1995 Model>



Double camshaft engine <From 1996 Model>

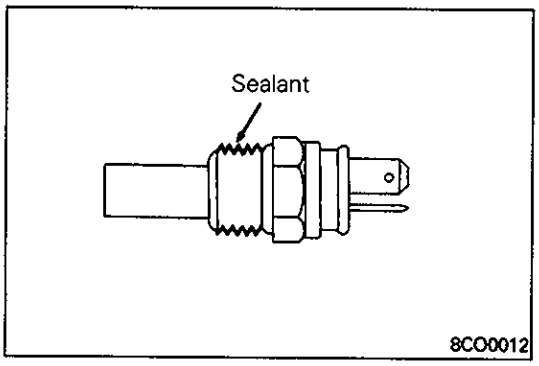






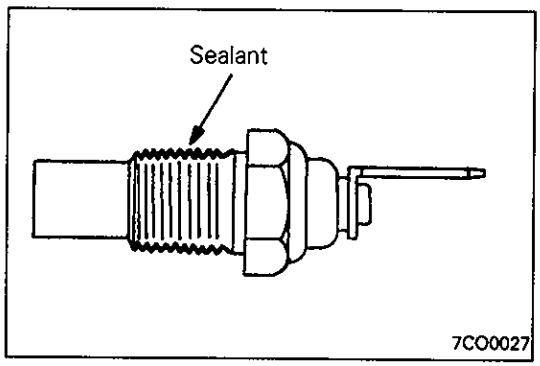
◆D◆ SEALANT APPLICATION TO WATER OUTLET FITTING

Specified sealant:
Mitsubisbi Genuine Part No. MD970389 or equivalent



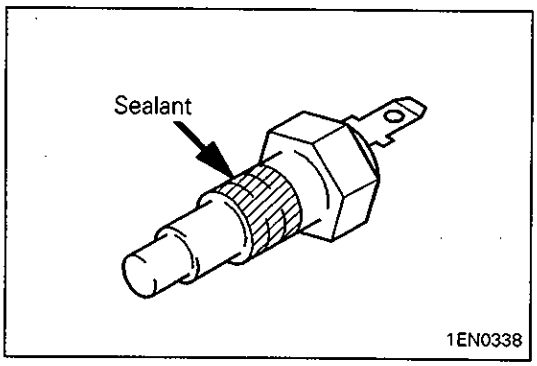
◆E◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR

Specified sealant:
3M Nut Locking Part No. 4171 or equivalent



◆F◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

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



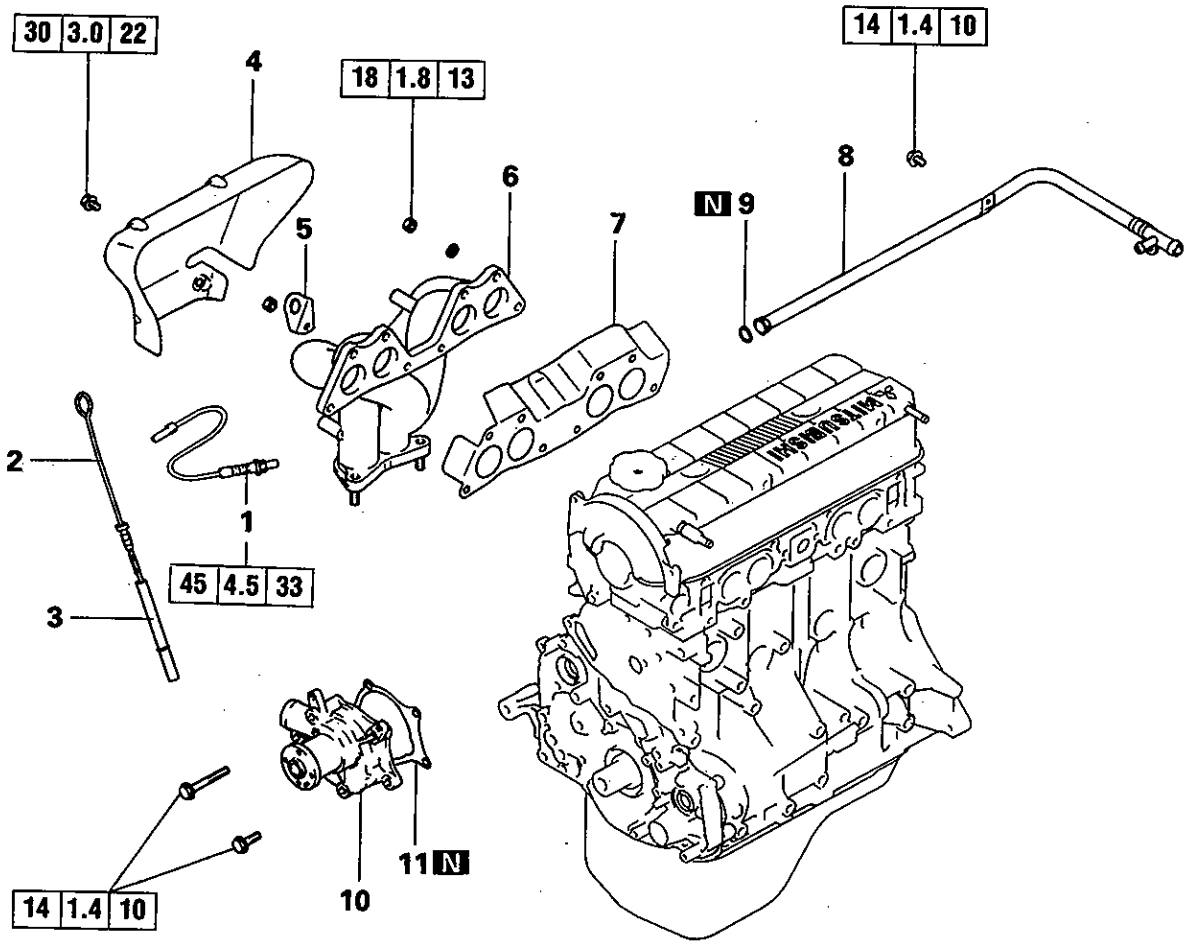
◆G◆ SEALANT APPLICATION TO THERMO SWITCH

Specified sealant:
3M Nut Locking Part No. 4171 or equivalent

NOTES

7. EXHAUST MANIFOLD AND WATER PUMP

REMOVAL AND INSTALLATION – 8-VALVE SINGLE CAMSHAFT ENGINE



Removal steps

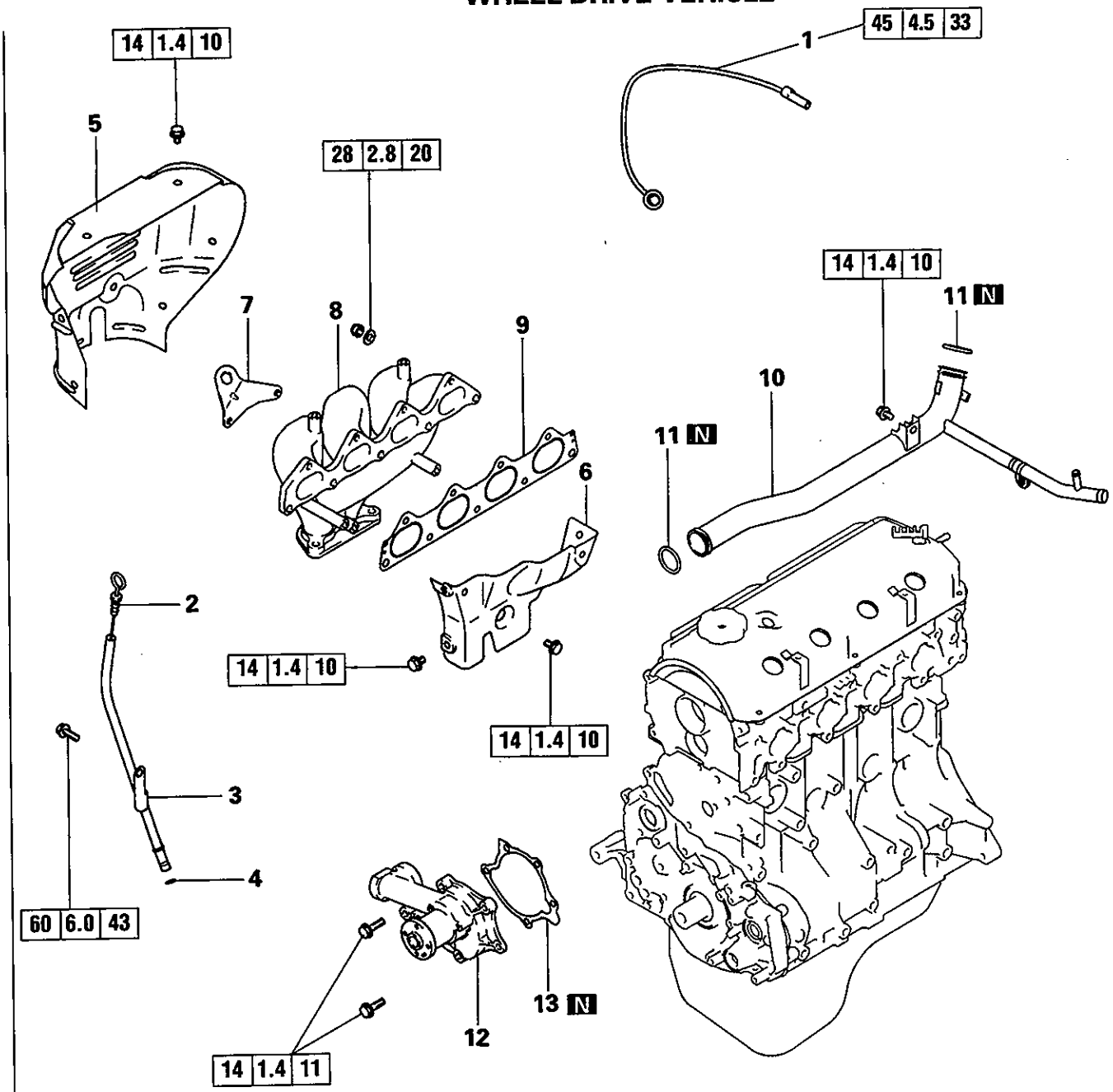
1. Oxygen sensor
2. Oil level gauge
3. Oil level gauge guide
4. Heat protector
5. Engine hanger
6. Exhaust manifold
7. Exhaust manifold gasket

◆A◆ 8. Water inlet pipe

◆A◆ 9. O-ring

10. Water pump
11. Water pump gasket

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR FRONT WHEEL DRIVE VEHICLE

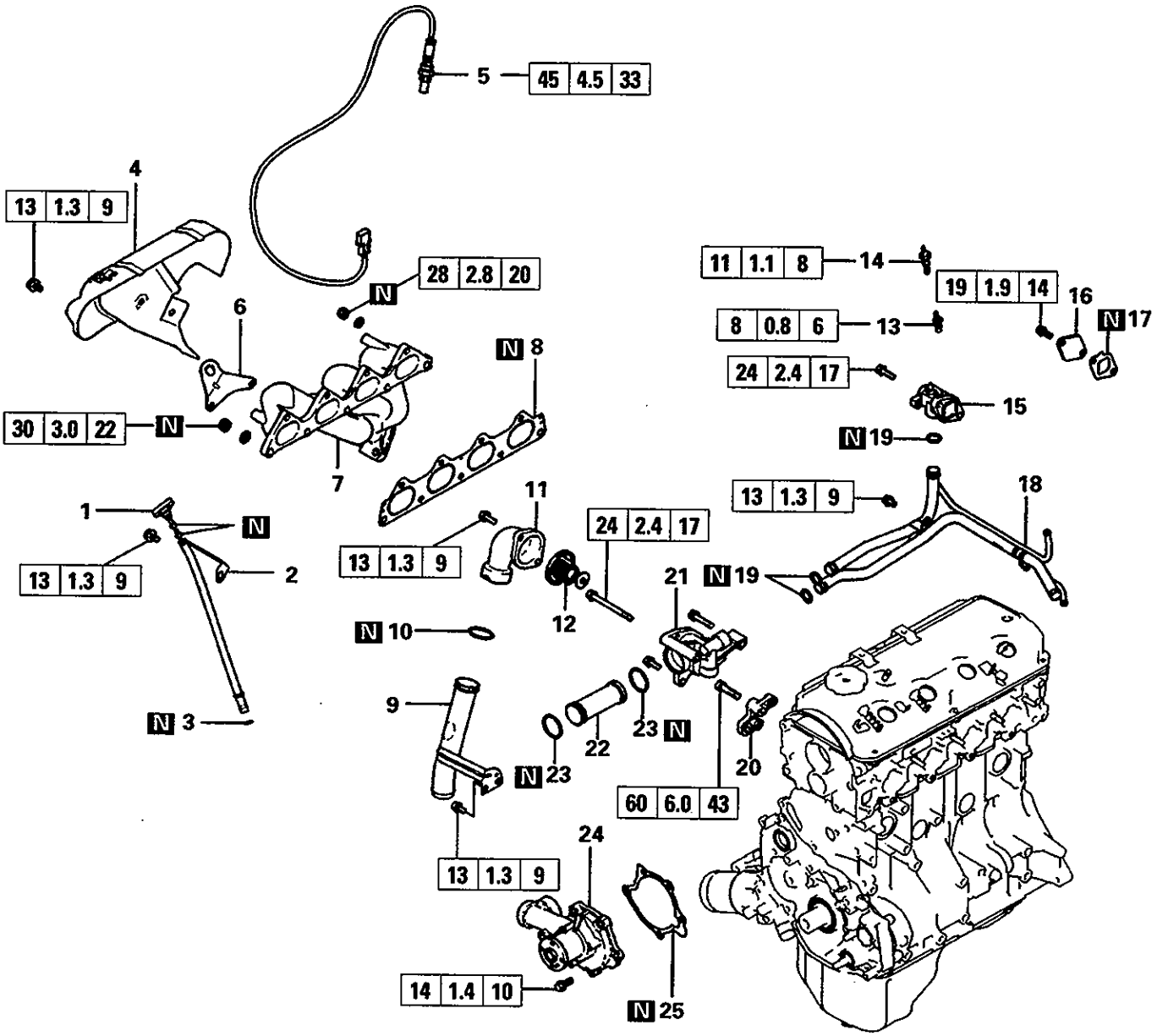


Removal steps

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

6EN0684

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE FOR REAR WHEEL DRIVE VEHICLE



Removal steps

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector
5. Oxygen sensor
6. Engine hanger
7. Exhaust manifold
8. Gasket
9. Radiator lower pipe
10. O-ring
11. Water inlet fitting
12. Thermostat
13. Thermo switch

(Except PAJERO/ MONTERO)

14. Engine coolant temperature gauge unit
- ◆B◆ 15. Water by-pass fitting

(Except PAJERO/ MONTERO)

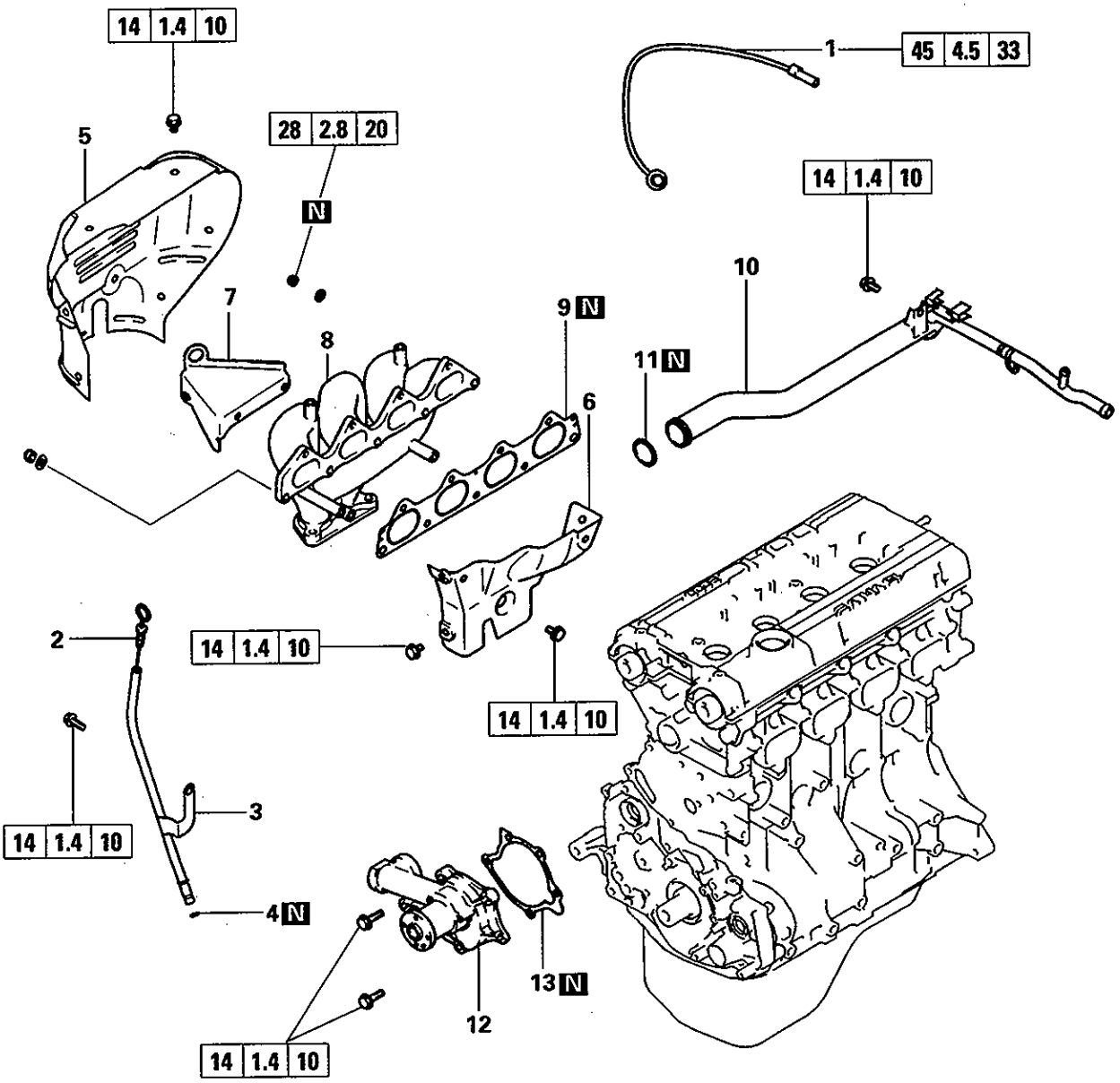
16. Cover
17. Gasket
- ◆A◆ 18. Water pipe assembly

19. O-ring
20. Thermostat housing bracket
21. Thermostat housing
22. Water inlet pipe
23. O-ring

(Except PAJERO/ MONTERO)

24. Water pump
25. Gasket

REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE <Up to 1995 model>



Removal steps

1. Oxygen sensor
2. Oil level gauge
3. Oil level gauge guide
4. O-ring
5. Heat protector "A"
6. Heat protector "B"
7. Engine hanger
8. Exhaust manifold
9. Exhaust manifold gasket

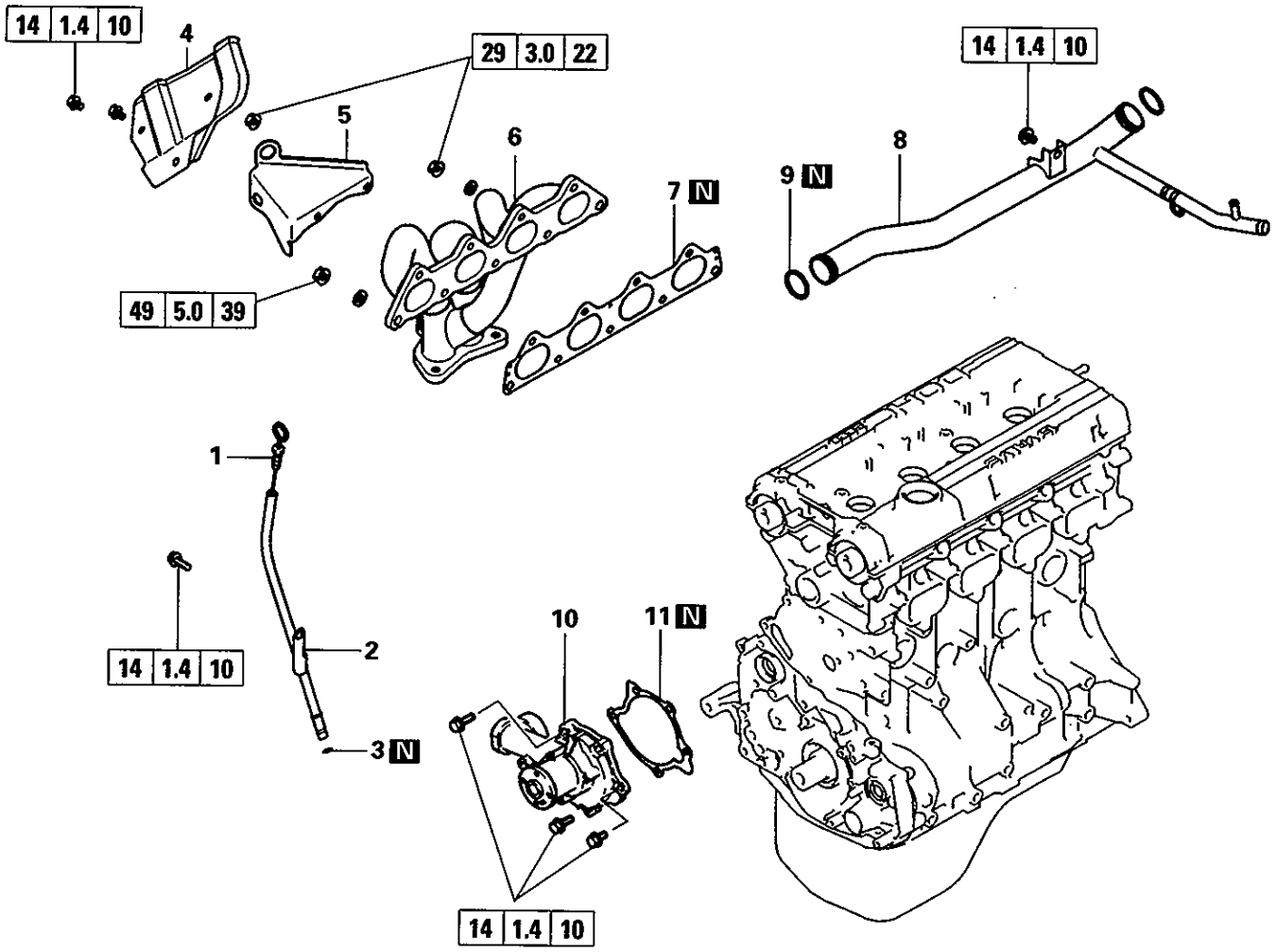
◆A◆ 10. Water inlet pipe

◆A◆ 11. O-ring

12. Water pump
13. Gasket

6EN0685

REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE <From 1996 model>



Removal steps

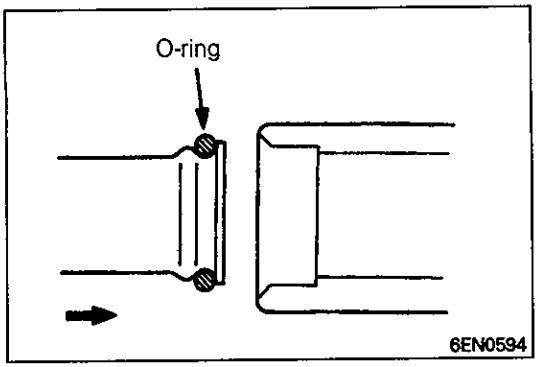
1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector
5. Engine hanger
6. Exhaust manifold
7. Exhaust manifold gasket

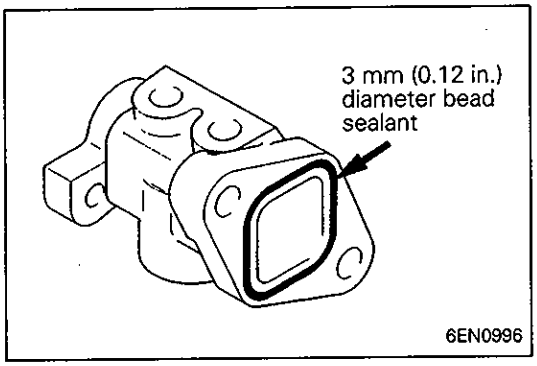
◆A◆ 8. Water inlet pipe

◆A◆ 9. O-ring

10. Water pump
11. Gasket

6EN1154





INSTALLATION SERVICE POINT

◗A◖ WATER PIPE/O-RING INSTALLATION

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

Caution

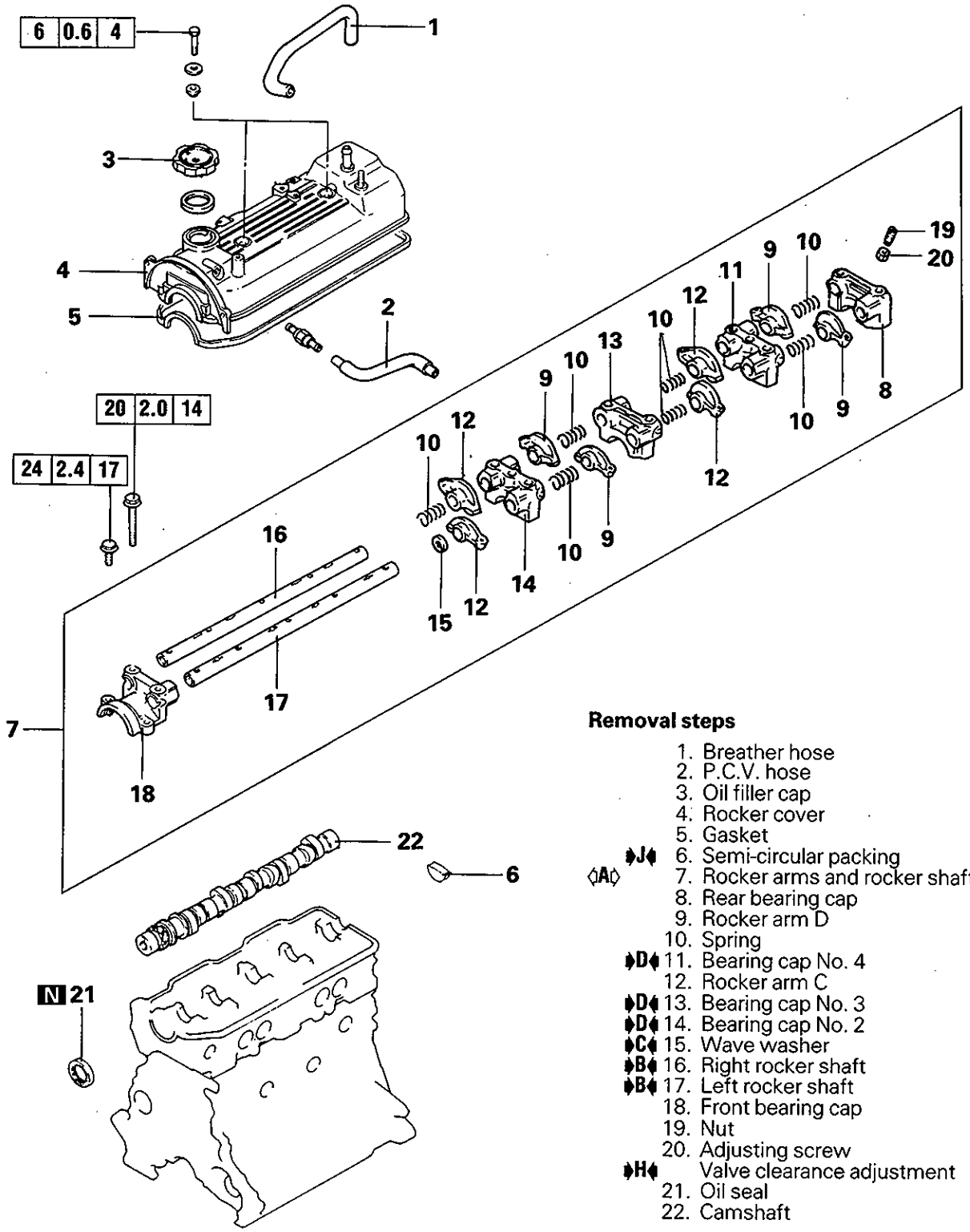
- **Keep the O-ring free of oil or grease.**

◗B◖ WATER BY-PASS FITTING INSTALLATION

Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

8. ROCKER ARMS AND CAMSHAFT

REMOVAL AND INSTALLATION – 4G63 8-VALVE SINGLE CAMSHAFT ENGINE



Removal steps

1. Breather hose
2. P.C.V. hose
3. Oil filler cap
4. Rocker cover
5. Gasket

◗J◖ 6. Semi-circular packing

◇A◇ 7. Rocker arms and rocker shafts

8. Rear bearing cap
9. Rocker arm D
10. Spring

◗D◖ 11. Bearing cap No. 4

12. Rocker arm C

◗D◖ 13. Bearing cap No. 3

◗D◖ 14. Bearing cap No. 2

◗C◖ 15. Wave washer

◗B◖ 16. Right rocker shaft

◗B◖ 17. Left rocker shaft

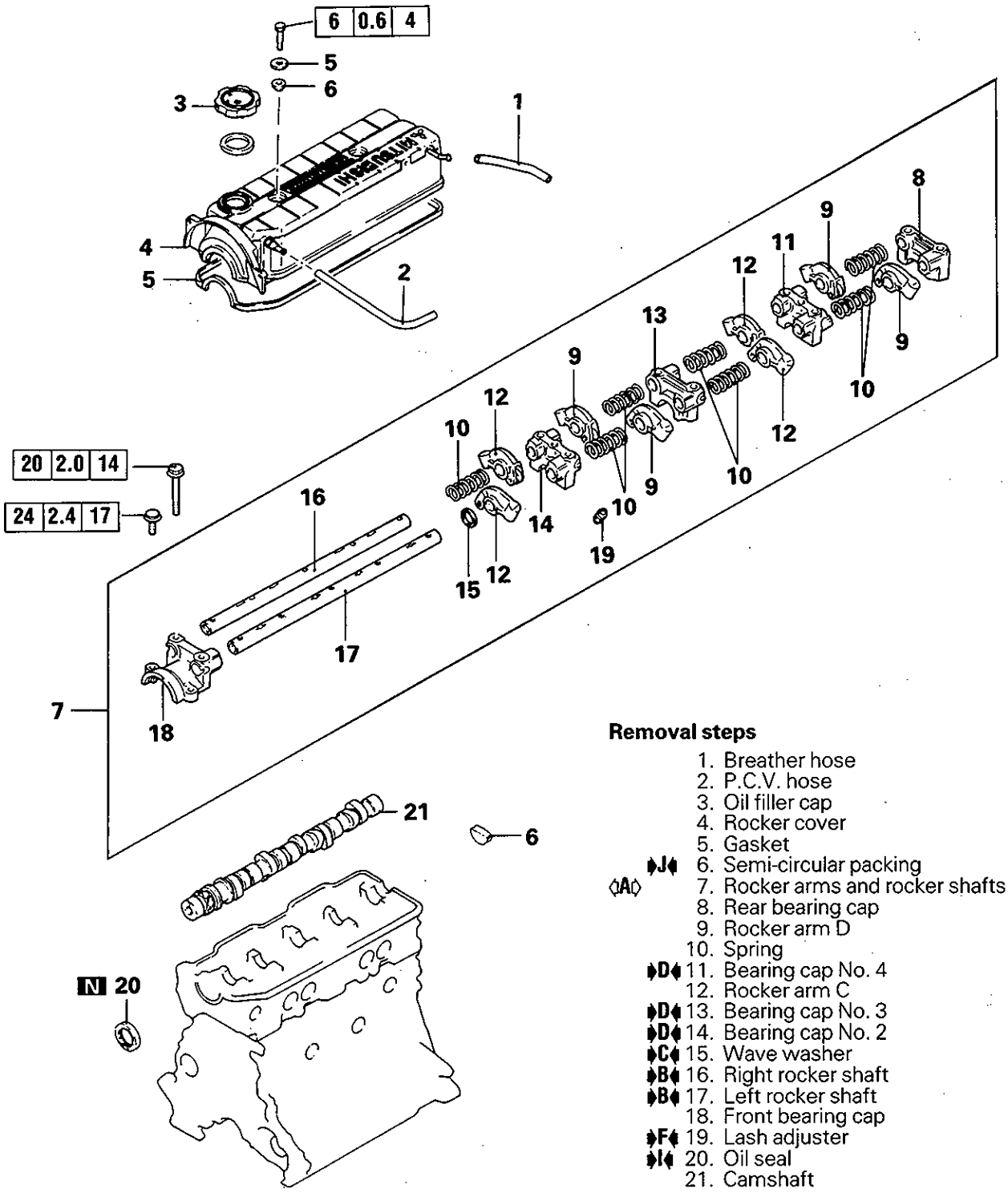
18. Front bearing cap
19. Nut
20. Adjusting screw

◗H◖ Valve clearance adjustment

21. Oil seal
22. Camshaft

6EN0771

REMOVAL AND INSTALLATION – 4G64 8-VALVE SINGLE CAMSHAFT ENGINE



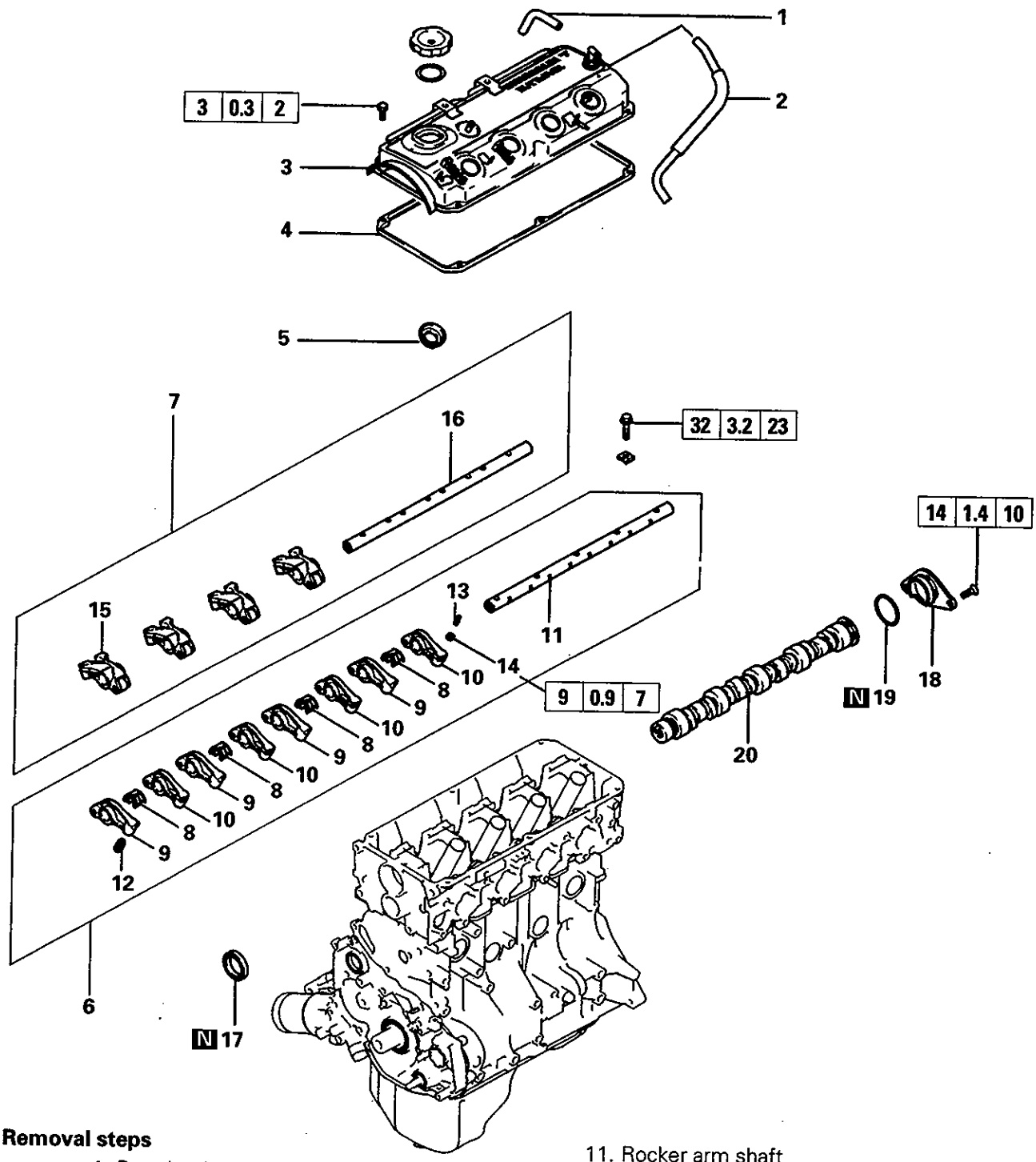
Removal steps

1. Breather hose
2. P.C.V. hose
3. Oil filler cap
4. Rocker cover
5. Gasket
◆J◆ 6. Semi-circular packing
〈A〉 7. Rocker arms and rocker shafts
8. Rear bearing cap
9. Rocker arm D
10. Spring
◆D◆ 11. Bearing cap No. 4
12. Rocker arm C
◆D◆ 13. Bearing cap No. 3
◆D◆ 14. Bearing cap No. 2
◆C◆ 15. Wave washer
◆B◆ 16. Right rocker shaft
◆B◆ 17. Left rocker shaft
18. Front bearing cap
◆F◆ 19. Lash adjuster
◆I◆ 20. Oil seal
21. Camshaft

6EN0523

Added

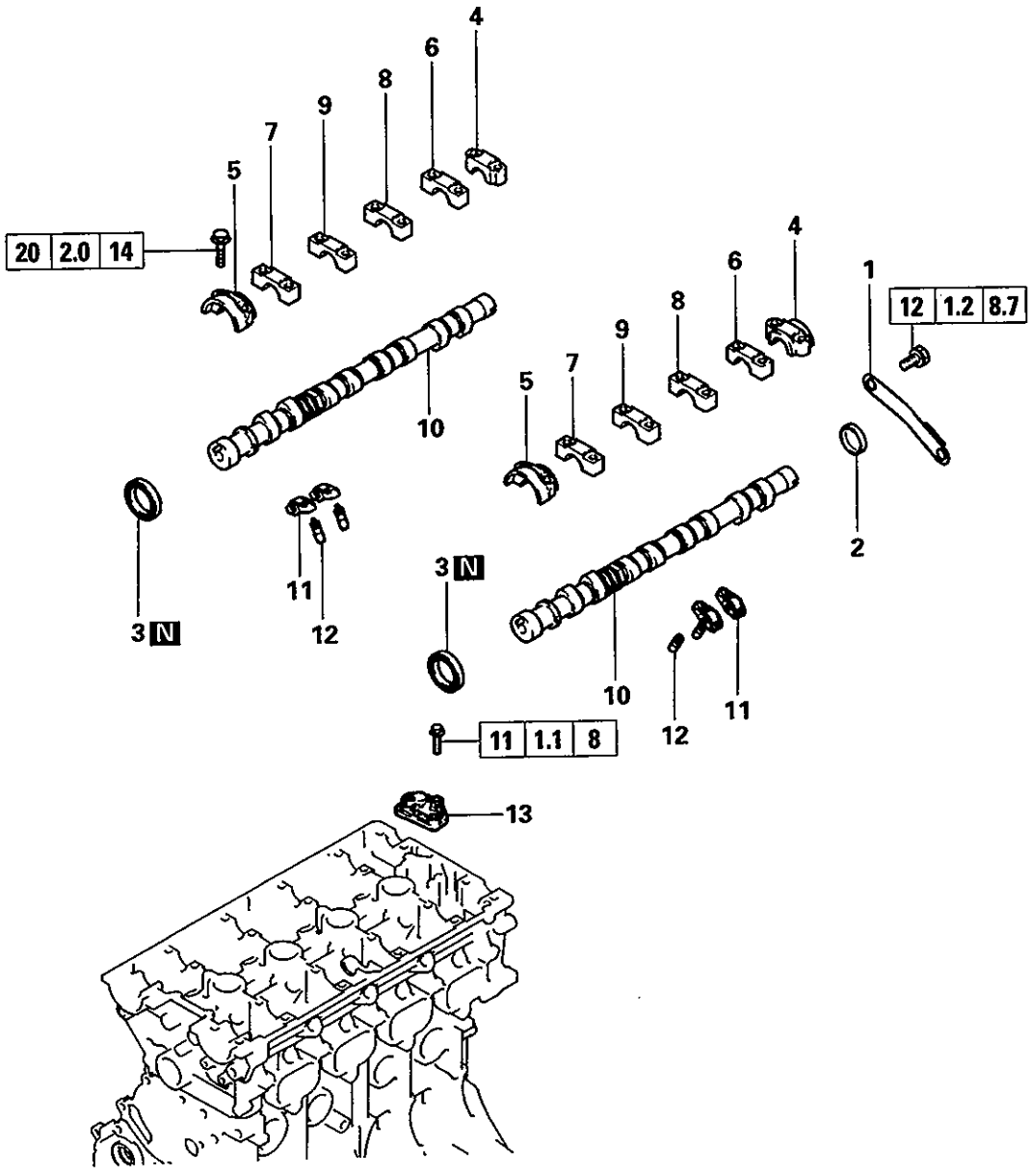
REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE



Removal steps

1. Breather hose
2. P.C.V. hose
3. Rocker cover
4. Rocker cover gasket
5. Oil seal
◇A◇ ◆G◆ 6. Rocker and rocker arm shaft
◇A◇ ◆G◆ 7. Rocker and rocker arm shaft
◆G◆ 8. Rocker shaft spring
9. Rocker arm A
10. Rocker arm B
11. Rocker arm shaft
◆F◆ 12. Lash adjuster (Except PAJERO/MONTERO)
13. Nut
14. Adjusting screw (PAJERO/MONTERO)
◆H◆ Valve clearance adjustment
15. Rocker arm C
16. Rocker arm shaft
◆I◆ 17. Oil seal
18. Thrust case
19. O-ring (Engines for rear wheel drive vehicle)
20. Camshaft

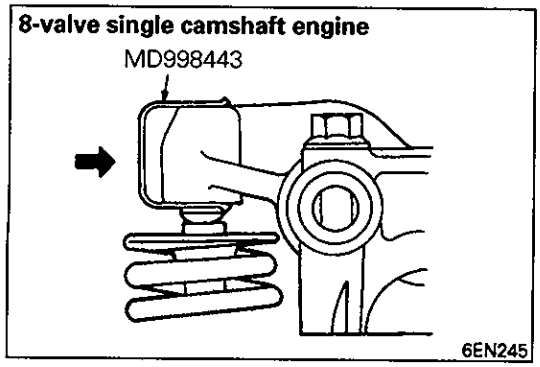
REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE

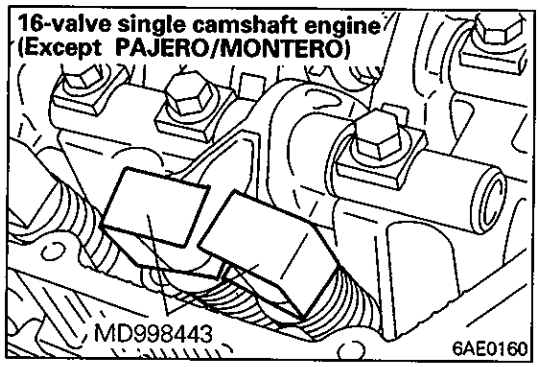


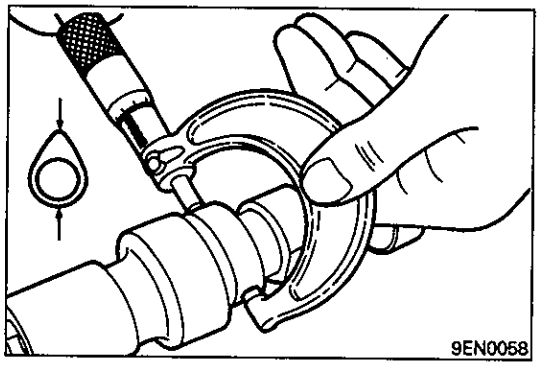
Removal steps

1. Plate } <From 1996 model>
2. Circular packing } <From 1996 model>
3. Bearing cap rear
4. Bearing cap front
5. Camshaft oil seal
6. Bearing cap No. 5
7. Bearing cap No. 2
8. Bearing cap No. 4
9. Bearing cap No. 3
10. Camshaft
11. Rocker arm
12. Lash adjuster
13. Oil delivery body

6EN1079







REMOVAL SERVICE POINT

〈A〉 ROCKER ARM AND ROCKER SHAFT REMOVAL

(1) Before removing rocker arms and shafts assembly, install the special tool as illustrated to prevent the adjusters from dropping.

INSPECTION

CAMSHAFT

(1) Measure the cam height

8-valve single camshaft engine

Unit: mm (in.)

Identification mark	Standard value	Limit
Intake		
1	42.17 (1.6602)	41.67 (1.6405)
A	42.08 (1.6567)	41.58 (1.6370)
3	42.40 (1.6693)	41.90 (1.6496)
Exhaust		
1	42.23 (1.6626)	41.73 (1.6429)
A	42.08 (1.6567)	41.58 (1.6370)
3	42.40 (1.6693)	41.90 (1.6496)

16-valve single camshaft engine

Unit: mm (in.)

Identification mark	Standard value	Limit
Intake		
1, 2	37.39 (1.4720)	36.89 (1.4524)
4	37.20 (1.4646)	36.70 (1.4449)
5	37.39 (1.4720)	36.89 (1.4524)
C	37.50 (1.4764)	37.00 (1.4567)
Exhaust		
1, 2	37.14 (1.4622)	36.64 (1.4425)
4	36.83 (1.4500)	36.33 (1.4303)
5	36.83 (1.4500)	36.33 (1.4303)
C	36.99 (1.4563)	36.49 (1.4366)

Double camshaft engine <Up to 1995 model>

Unit: mm (in.)

Identification mark	Standard value	Limit
Intake G	35.79 (1.4091)	35.29 (1.3894)
Exhaust G	35.49 (1.3972)	34.99 (1.3776)

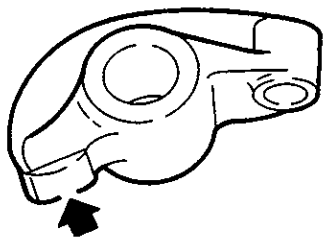
Double camshaft engine <From 1996 model>

Unit:mm (in.)

Identification mark	Standard value	Limit
Intake L	35.38 (1.3929)	34.88 (1.3732)
Exhaust H	34.91 (1.3744)	34.41 (1.3547)

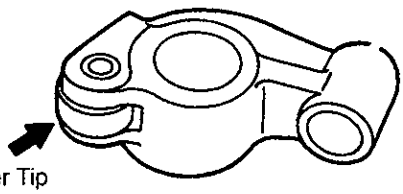
NOTE
The camshaft identification mark is stamped on the opposite end of the camshaft sprocket side.

8-valve single camshaft engine



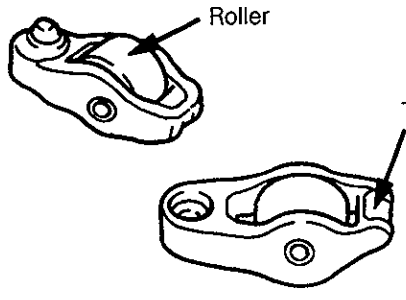
6EN0772

16-valve single camshaft engine



7EN0064

Double camshaft engine



6EN0185

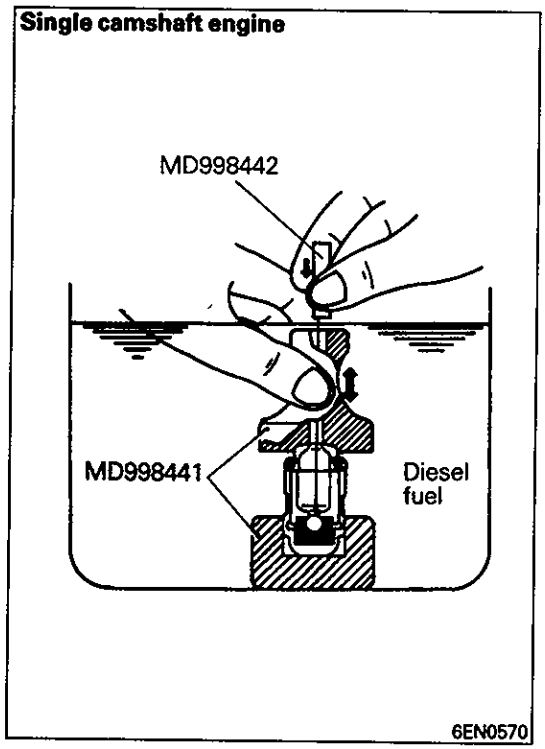
ROCKER ARM

(1) Check the roller or slipper surface. If any dents, damage or seizure is evident, replace the rocker arm.
(2) Check the roller for smooth rotation. 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

Caution

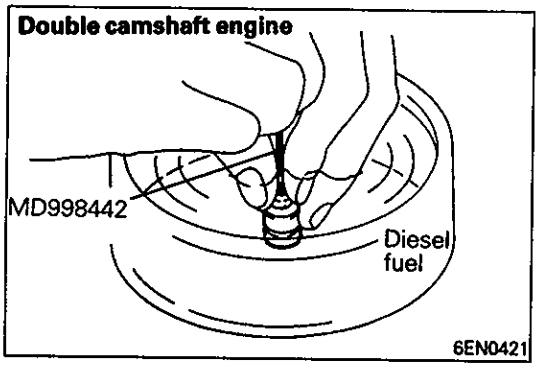
- **The lash adjuster is a precision part. Keep it free from dust and other foreign matter.**
- **Do not disassemble lash adjusters.**
- **When cleaning lash adjusters, use clean diesel fuel only.**

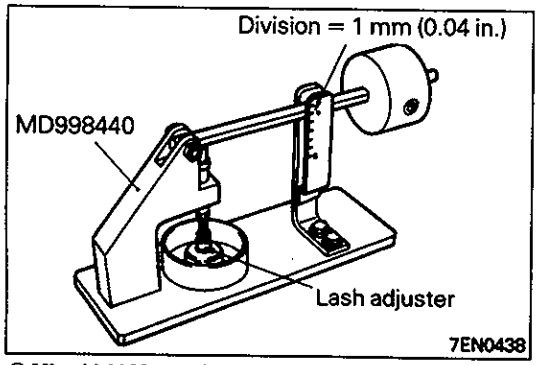


(1) Immerse the lash adjuster in clean diesel fuel.
(2) While lightly pushing down the inner steel ball using the special tool, Air Bleed Wire, move the plunger up and down four or five times to bleed air.
Use of the retainer (special tool) helps facilitate the air bleeding of the rocker arm mounted type lash adjuster.
(3) Remove the 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

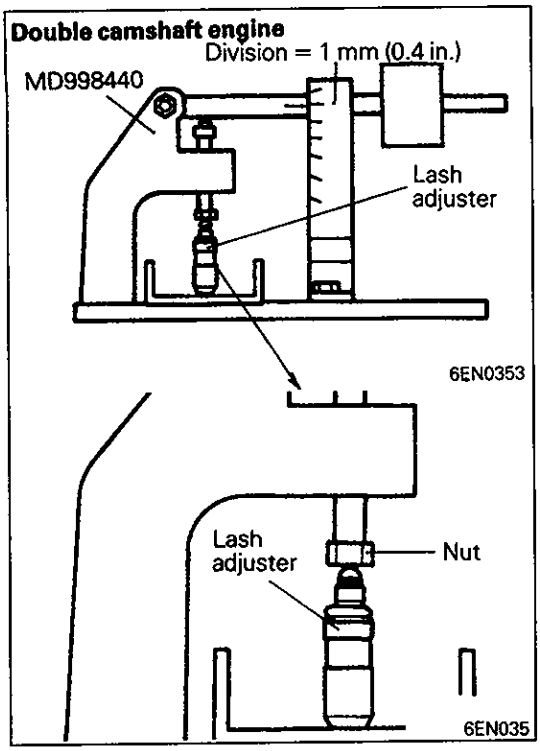
- **Upon completion of air bleeding, hold the lash adjuster upright to prevent inside diesel fuel from spilling.**

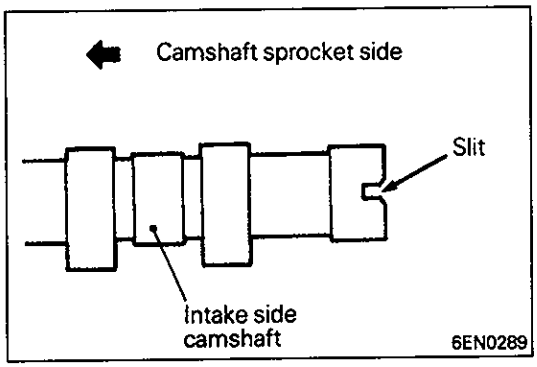




(4) After air bleeding, set the lash adjuster on the special tool (Leak down tester MD998440).
(5) After the plunger has gone down somewhat (0.2 – 0.5 mm), measure the time taken for it to go down 1 mm. Replace if the measured time is out of the specification.

Standard value: 4 – 20 seconds / 1 mm (0.04 in.)
[Diesel fuel at 15 – 20°C (59 – 68°F)]

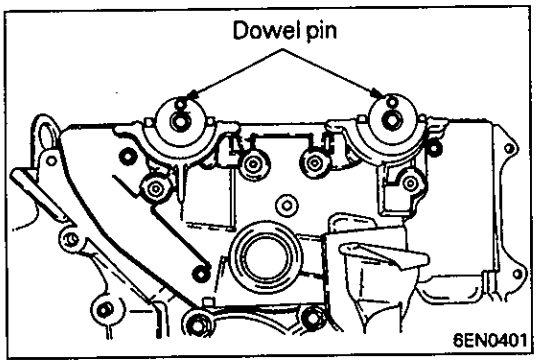




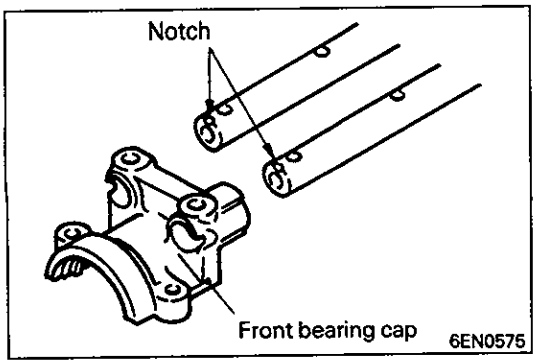
INSTALLATION SERVICE POINTS

◆A◆ CAMSHAFT INSTALLATION

(1) Apply engine oil to the journals and cams of the camshafts. 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.



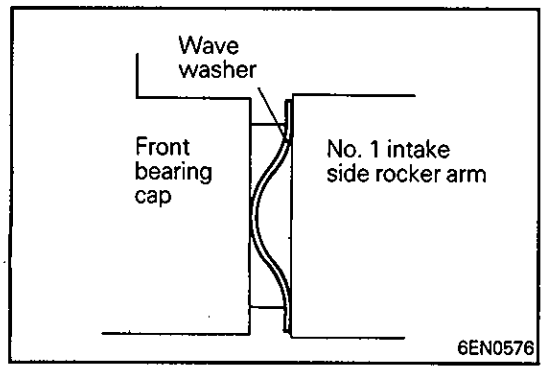
(2) Install the crankshaft sprocket B or spacer and flange to one end of the crankshaft, and turn the crankshaft until the timing marks are lined up, setting No. 1 cylinder to the TDC.
(3) Set the camshafts so that their dowel pins are positioned at top.



◆B◆ ROCKER SHAFT INSTALLATION

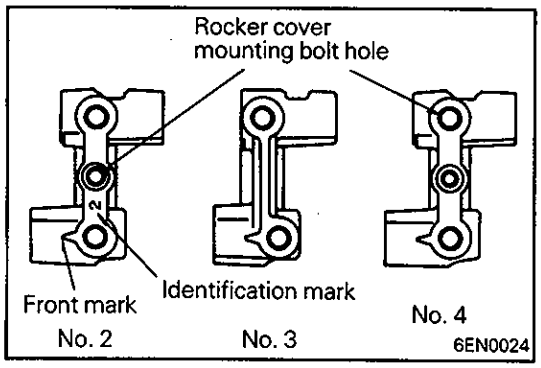
(1) Insert the rocker shafts into the front bearing cap so that the notches on the shafts face up, and insert the installation bolts without tightening them.

Added



◆C◆ WAVE WASHER INSTALLATION

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

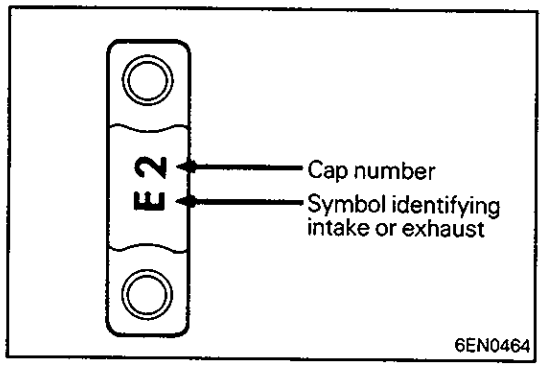


◆D◆ CAMSHAFT BEARING CAP IDENTIFICATION

(1) No. 3 bearing cap looks very similar to No. 2 and No. 4 bearing caps.
Use the identification marks shown at left for indentification.

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

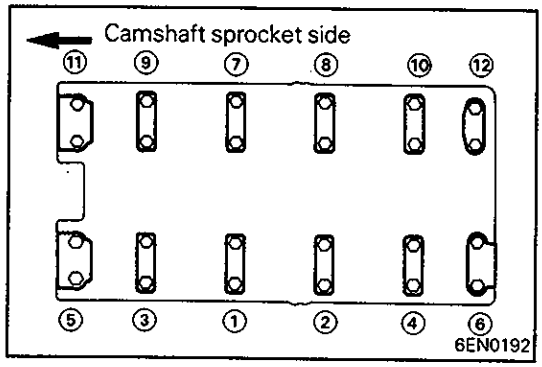
(2) Install the bearing caps with their front marks pointing to the camshaft sprocket side.



◆E◆ BEARING CAP INSTALLATION

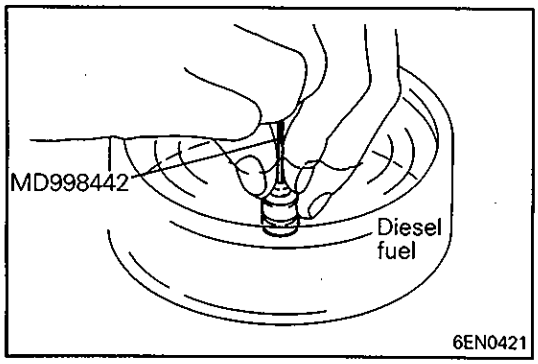
(1) According to the identification mark stamped on the top of each bearing cap, install the caps to the cylinder head. Only "L" or "R" is stamped on No. 1 bearing cap. Cap No. is stamped on No. 2 to No. 5 bearing caps. No. 6 bearing cap has no stamping.

I: For intake camshaft side
E: For exhaust camshaft side



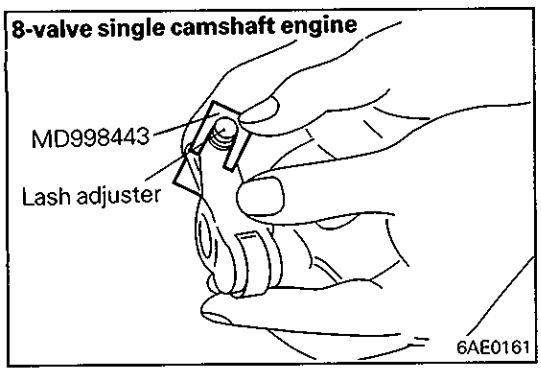
(2) Tighten the bearing caps in the order shown two to three times by torquing progressively.
Tighten to the specification in the final sequence.

(3) Check to ensure that the rocker arm is positioned correctly on the lash adjuster and valve stem end.

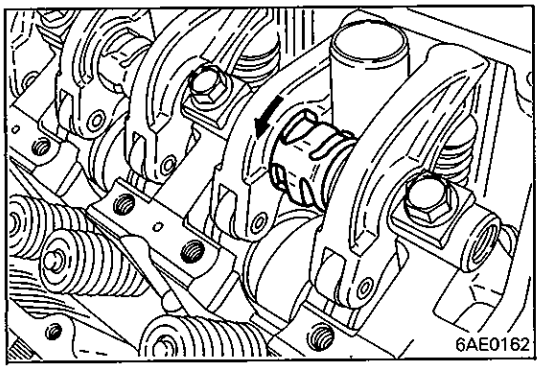


◆F◆ LASH ADJUSTER INSTALLATION

(1) Immerse the lash adjuster in clean diesel fuel.
(2) Using the special tool (air bleed 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.



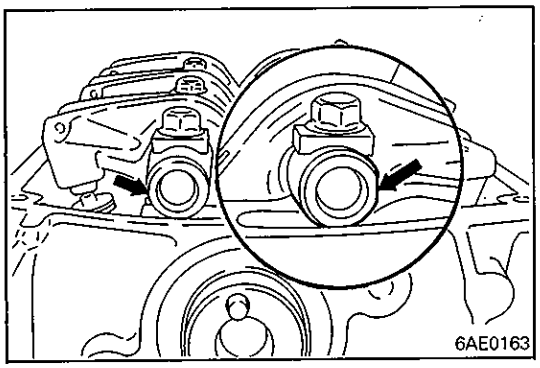
(3) Insert the lash adjuster to the rocker arm, being careful not to spill the diesel fuel. Then use the special tool to prevent the adjuster from falling while installing it.



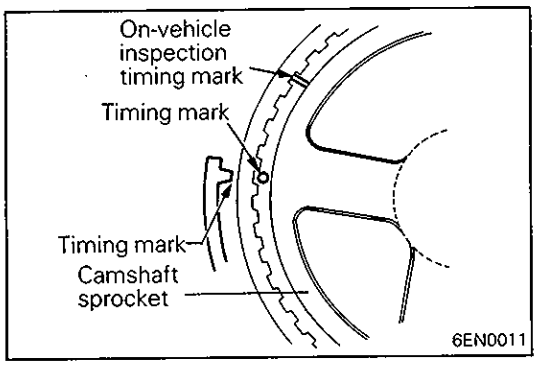
◆G◆ ROCKER SHAFT SPRING, ROCKER ARM AND ROCKER SHAFT INSTALLATION

(1) Temporarily tighten the rocker shaft on the inlet valve side with the bolt so that all rocker arms do not push the valves.
(2) Fit the rocker shaft spring from the above and position it so that it is right angles to the spark plug guide.

NOTE
Install the rocker shaft springs before installation of the exhaust side rocker arms and shaft.



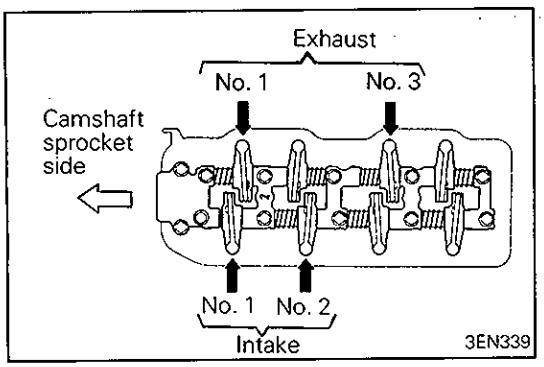
(3) Remove the special tool used to hold the lash adjuster.
(4) Make sure that the notch in the rocker shaft is directed as shown in the illustration.



◆H◆ VALVE CLEARANCE ADJUSTMENT

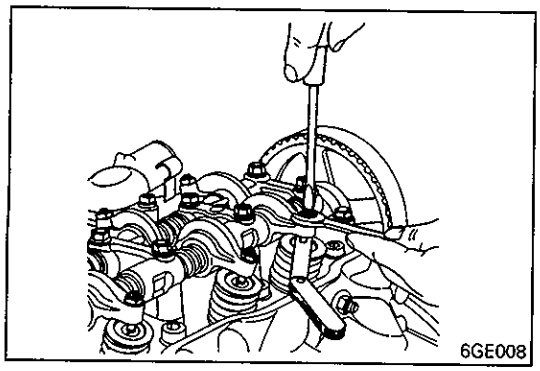
(1) Turn the crankshaft clockwise and align the timing mark on the camshaft sprocket with that on the cylinder head.

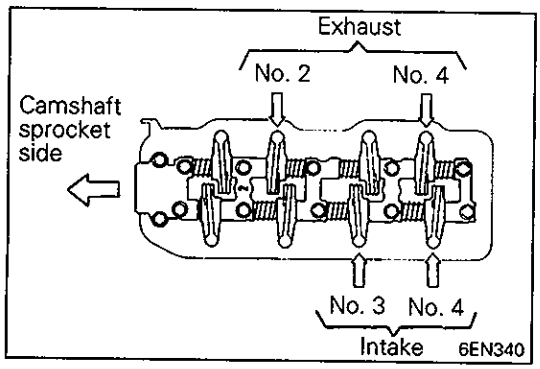
Caution
- **Do not mistake the timing mark for the on-vehicle inspection timing mark. (Front-engine front-wheel drive vehicle only)**



(2) Adjust the valve clearance at points shown in the illustration.

Added





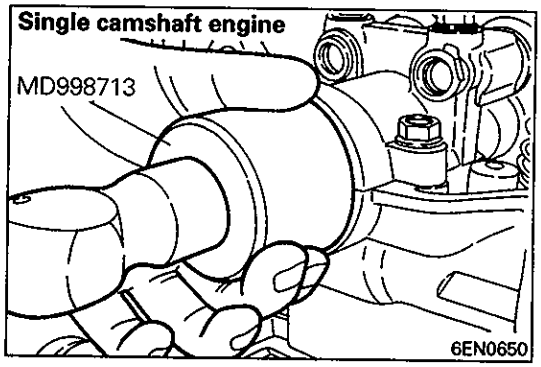
(3) Loosen the adjusting screw lock nut.
(4) Using a thickness gauge, adjust the valve clearance by turning the adjusting screw.

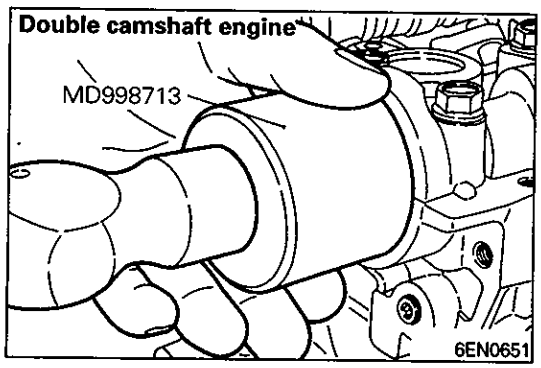
Standard value: on cold engine
<8-valve engine>
0.08 mm (0.0031 in.) ..... Intake
0.18 mm (0.0071 in.) ..... Exhaust
<16-valve engine>
0.10 mm (0.0039 in.) ..... Intake
0.20 mm (0.0079 in.) ..... Exhaust

(5) While holding the adjusting screw with a screwdriver, tighten the lock nut.
(6) Rotate clockwise the crankshaft one complete turn (360 degrees).
(7) Adjust the valve clearance at points shown in the illustration.
(8) Repeat steps (3) to (5) to adjust the valve clearance of remaining valves.

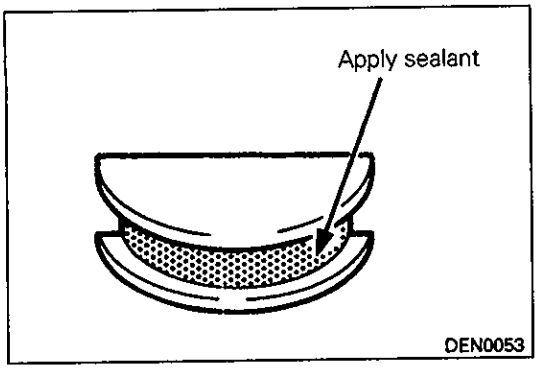
NOTE
With the engine mounted on vehicle, warm up the engine. Then, check for valve clearance on hot engine and adjust if necessary.

Standard value: on hot engine
<8-valve engine>
0.15 mm (0.0059 in.) ..... Intake
0.25 mm (0.0098 in.) ..... Exhaust
<16-valve engine>
0.20 mm (0.0079 in.) ..... Intake
0.30 mm (0.0118 in.) ..... Exhaust



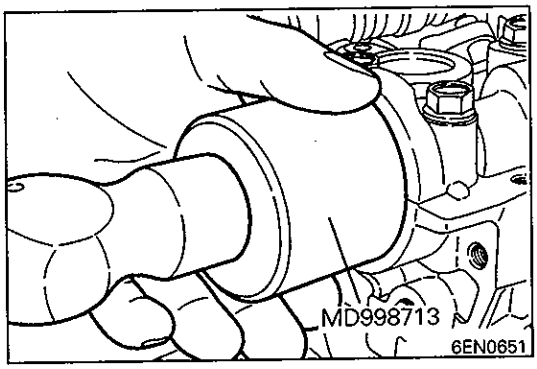


CAMSHAFT OIL SEAL INSTALLATION



◆J◆ SEMI-CIRCULAR PACKING INSTALLATION

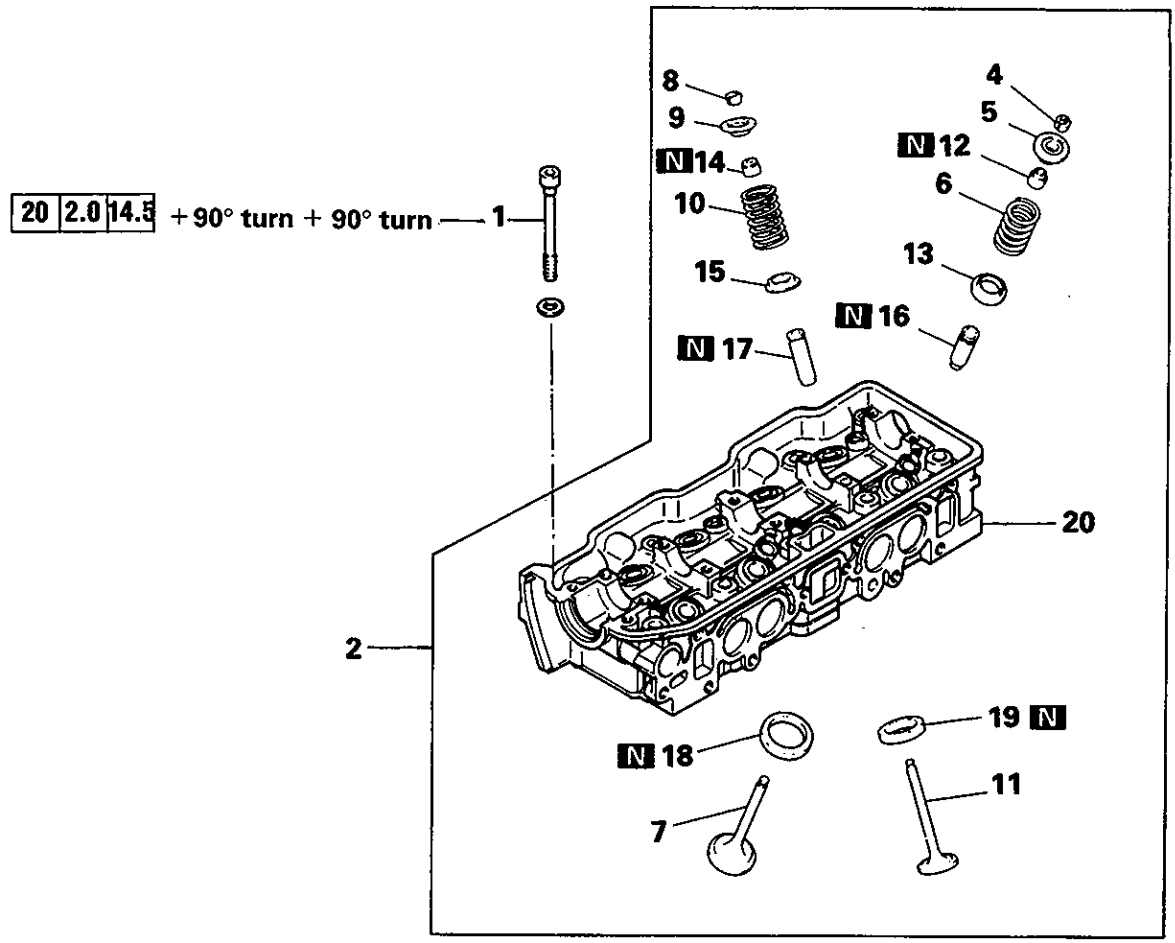
Specified sealant:
3M ATD Part No. 8660 or equivalent



◆K◆ CIRCULAR PACKING INSTALLATION

9. CYLINDER HEAD AND VALVES

REMOVAL AND INSTALLATION – 8-VALVE SINGLE CAMSHAFT ENGINE

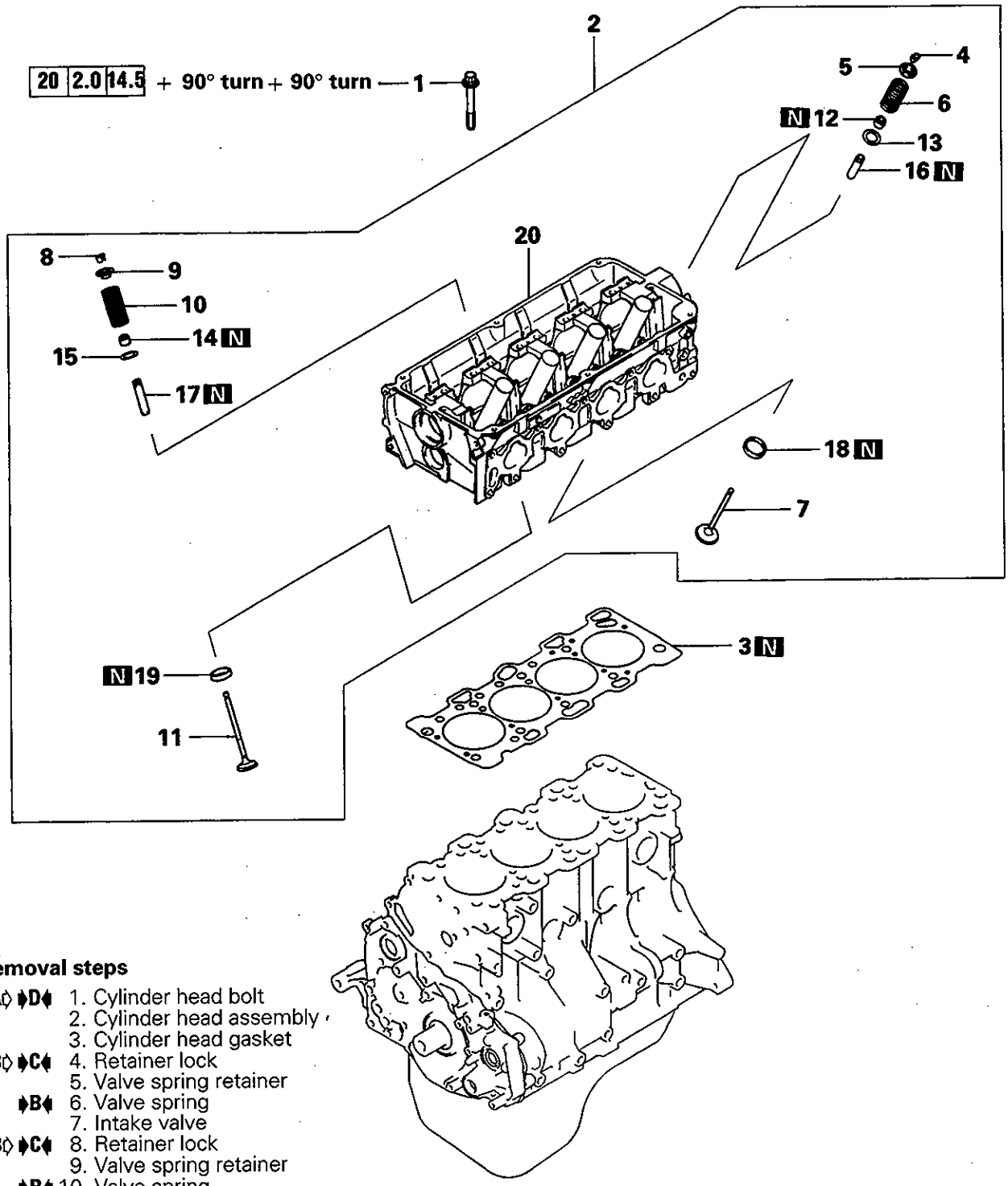


Removal steps

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

6EN0309

REMOVAL AND INSTALLATION – 16-VALVE SINGLE CAMSHAFT ENGINE



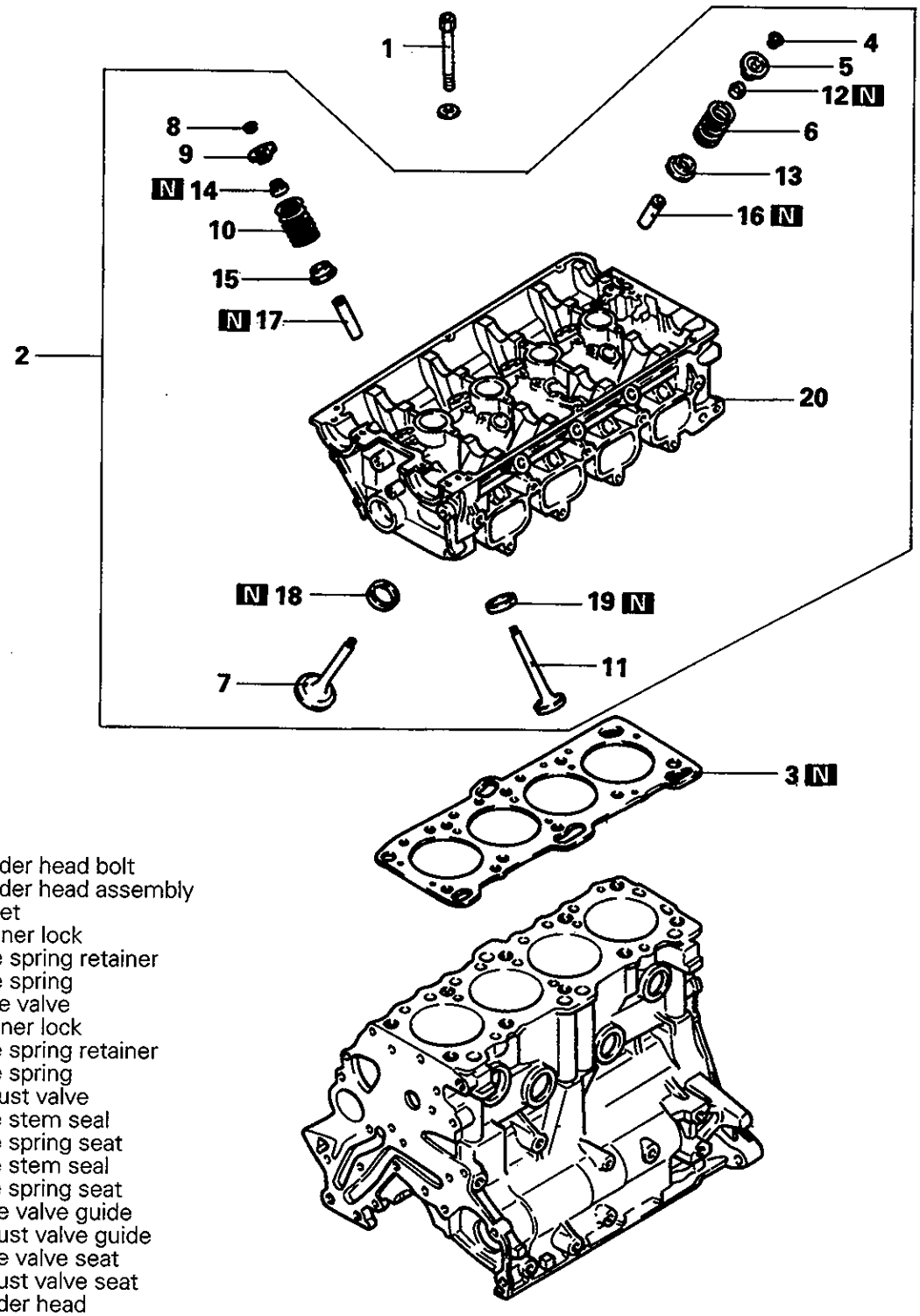
Removal steps

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

6EN0689

44

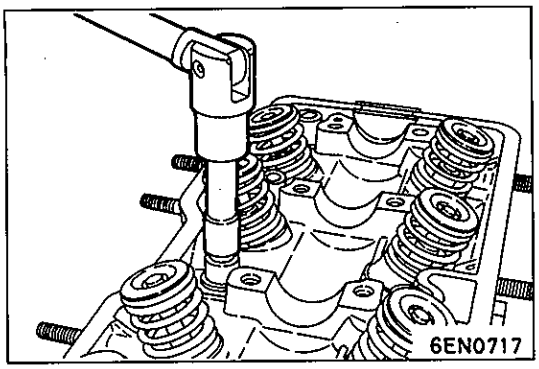
REMOVAL AND INSTALLATION – DOUBLE CAMSHAFT ENGINE

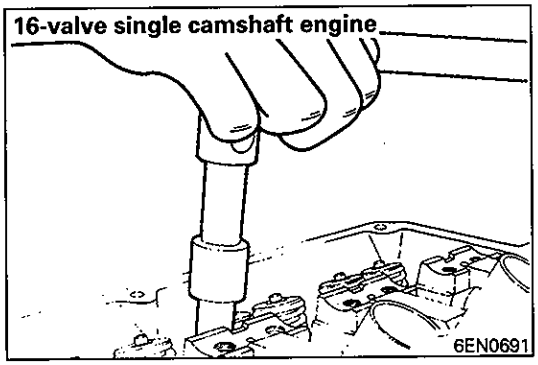


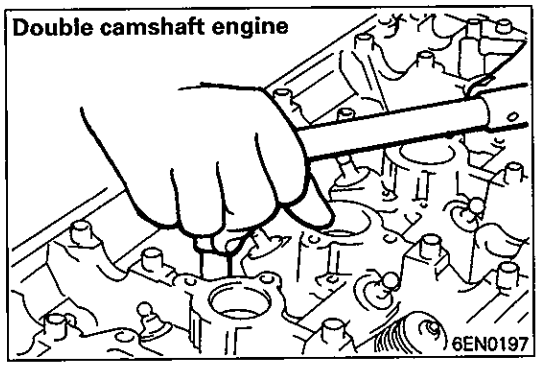
Removal steps

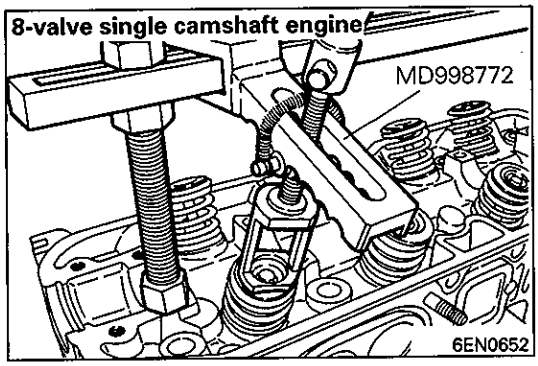
◇A◇ ◆E◆ 1. Cylinder head bolt
2. Cylinder head assembly
◆D◆ 3. Gasket
◇B◇ ◆C◆ 4. Retainer lock
5. Valve spring retainer
◆B◆ 6. Valve spring
7. Intake valve
◇B◇ ◆C◆ 8. Retainer lock
9. Valve spring retainer
◆B◆ 10. Valve spring
11. Exhaust valve
◇C◇ ◆A◆ 12. Valve stem seal
13. Valve spring seat
◇C◇ ◆A◆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

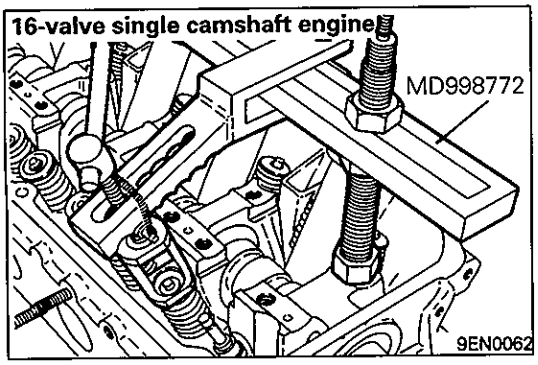
6EN0196











REMOVAL SERVICE POINTS

PRECAUTION FOR REMOVED PARTS

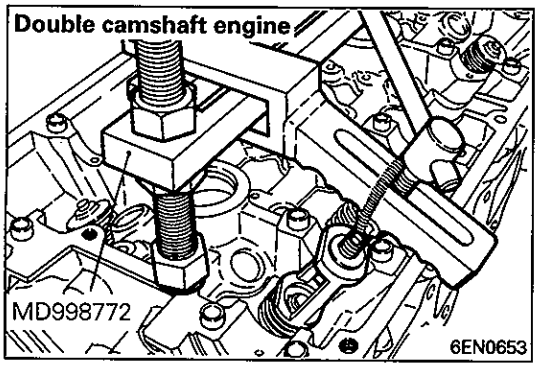
(1) Keep removed parts in order according to the cylinder number and intake/exhaust.

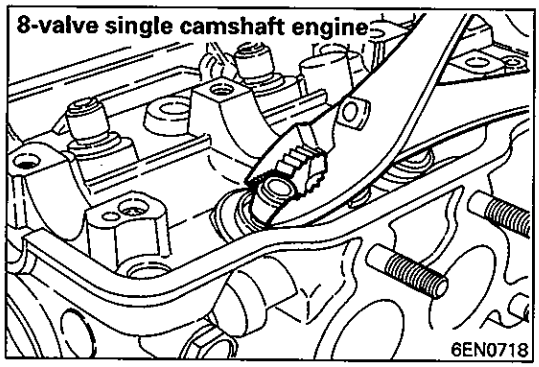
⟨A⟩ CYLINDER HEAD BOLT REMOVAL

(1) Using a 12mm – 12 points socket wrench, loosen the cylinder head bolts.
Loosen evenly, little by little.

⟨B⟩ RETAINER LOCK REMOVAL

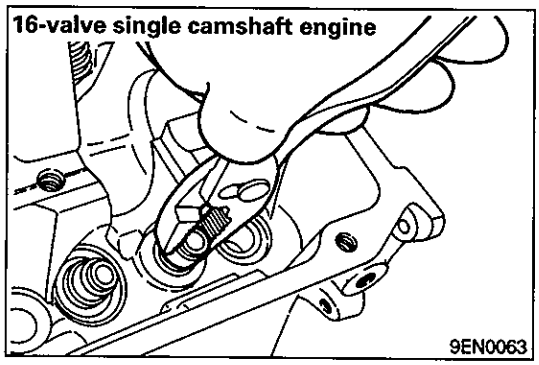
(1) Store removed valves, springs and other parts, tagged to indicate their cylinder No. and location for reassembly.

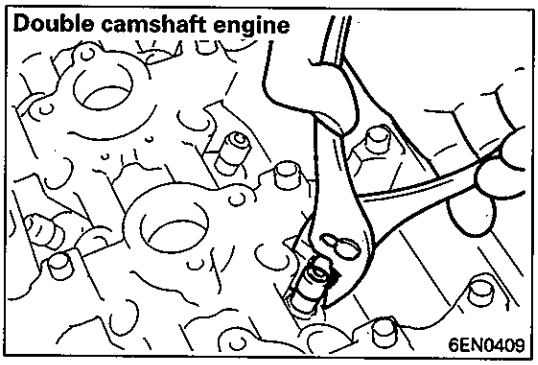


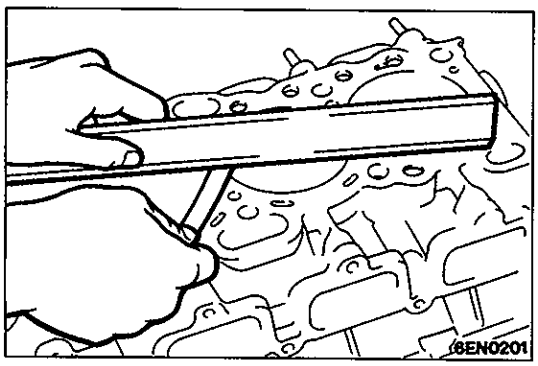


◇C◇ VALVE STEM SEAL REMOVAL

(1) Do not reuse removed valve stem seal.







INSPECTION

CYLINDER HEAD

(1) Check the cylinder head gasket surface for flatness by using a straightedge and thickness gauge.

Standard value: 0.05 mm (0.0020 in.)
Limit: 0.2 mm (0.008 in.)

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

Grinding limit: *0.2 mm (0.008 in.)

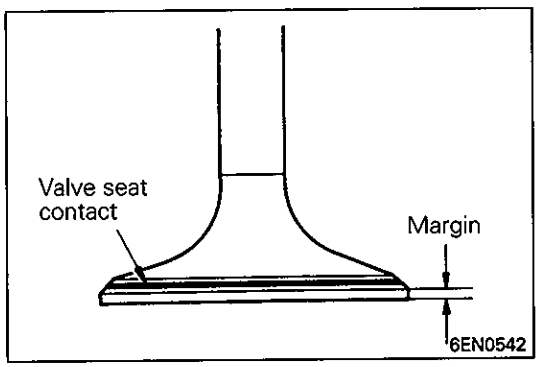
* Total resurfacing depth of both cylinder head and cylinder block.

Cylinder head height (Specification when new):

8-valve single camshaft engine
89.9 – 90.1 mm (3.539 – 3.547 in.)

16-valve single camshaft engine:
119.9 – 120.1 mm (4.720 – 4.728 in.)

Double camshaft engine:
131.9 – 132.1 mm (5.193 – 5.201 in.)



VALVE

(1) Check the valve face for correct contact. If incorrect, reface using a valve refacer. Valve seat contact should be maintained uniform at the center of valve face.

(2) If the margin exceeds the service limit, replace the valve.

Standard value:

8-valve single camshaft engine
Intake 1.2 mm (0.047 in.)
Exhaust 2.0 mm (0.079 in.)

16-valve single camshaft engine
Intake 1.0 mm (0.039 in.)
Exhaust 1.2 mm (0.047 in.)

Double camshaft engine
Intake 1.0 mm (0.039 in.)
Exhaust 1.5 mm (0.059 in.)

Limit:

8-valve single camshaft engine
Intake 0.7 mm (0.028 in.)
Exhaust 1.5 mm (0.059 in.)

16-valve single camshaft engine
Intake 0.5 mm (0.020 in.)
Exhaust 0.7 mm (0.028 in.)

Double camshaft engine
Intake 0.5 mm (0.020 in.)
Exhaust 1.0 mm (0.039 in.)

(3) Measure the overall length of the valve and, if it is outside the limit, replace the valve.

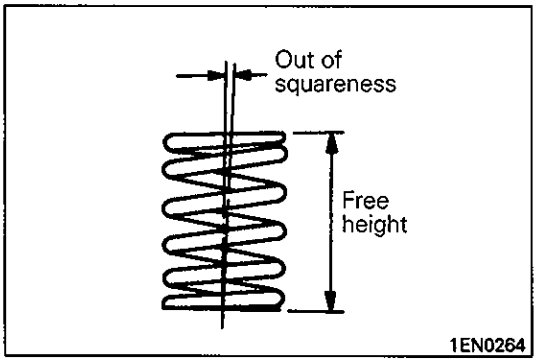
Standard value:

4G63 8-valve single camshaft engine
Intake 109.76 mm (4.3213 in.)
Exhaust 108.66 mm (4.2779 in.)

4G64 8-valve single camshaft engine
Intake 106.56 mm (4.1953 in.)
Exhaust 105.16 mm (4.1401 in.)
16-valve single camshaft engine
Intake 112.30 mm (4.4213 in.)
Exhaust 114.11 mm (4.4925 in.)
Double camshaft engine
Intake 109.50 mm (4.3110 in.)
Exhaust 109.70 mm (4.3189 in.)

Limit:

4G63 8-valve single camshaft engine
Intake 109.26 mm (4.3016 in.)
Exhaust 108.16 mm (4.2583 in.)
4G64 8-valve single camshaft engine
Intake 106.06 mm (4.1756 in.)
Exhaust 104.66 mm (4.1204 in.)
16-valve single camshaft engine
Intake 111.80 mm (4.4016 in.)
Exhaust 113.61 mm (4.4728 in.)
Double camshaft engine
Intake 109.00 mm (4.2913 in.)
Exhaust 109.20 mm (4.2992 in.)



VALVE SPRING

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

8-valve single camshaft engine

Identification color: Green
Standard value: 47.5 mm (1.869 in.)
Limit: 46.5 mm (1.829 in.)

Identification color: White
Standard value: 49.8 mm (1.961 in.)
Limit: 48.8 mm (1.921 in.)

16-valve single camshaft engine

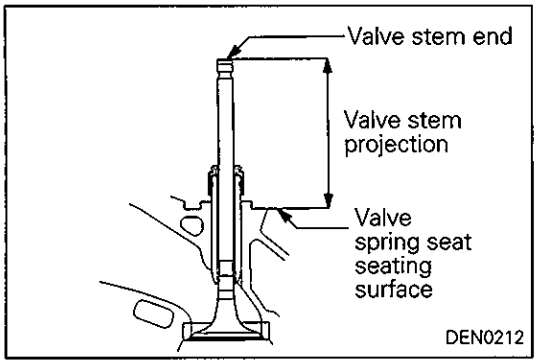
Identification color: White
Standard value: 51.0 mm (2.006 in.)
Limit: 50.0 mm (1.969 in.)

Double camshaft engine <Up to 1995 model>

Identification color: Blue
Standard value: 48.3 mm (1.902 in.)
Limit: 47.3 mm (1.862 in.)
Double camshaft engine <From 1996 model>
Identification color: Pink
Standard value: 47.0 mm (1.850 in.)
Limit: 46.0 mm (1.811 in.)

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

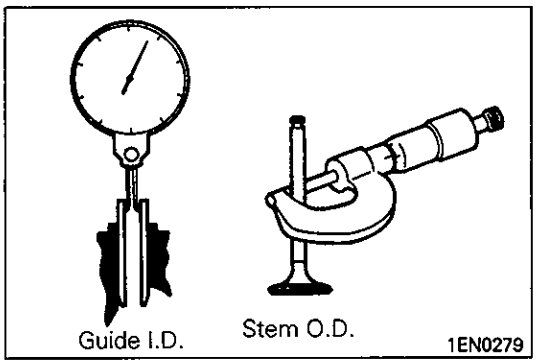
Standard value:
Single camshaft engine 2° or less
Double camshaft engine 1.5 or less
Limit: Max. 4°



VALVE SEAT

(1) Assemble the valve. With the valve pushed against the valve seat, measure valve projection from the valve stem end to the valve spring seat seating surface.
If the limit is exceeded, replace the valve seat.

Standard value:
8-valve single camshaft engine
42.05 mm (1.6555 in.)
16-valve single camshaft engine
49.30 mm (1.9409 in.)
Double camshaft engine
Intake 49.20 mm (1.9370 in.)
Exhaust 48.40 mm (1.9055 in.)
Limit:
8-valve single camshaft engine
42.55 mm (1.6752 in.)
16-valve single camshaft engine
49.80 mm (1.9606 in.)
Double camshaft engine
Intake 49.70 mm (1.9567 in.)
Exhaust 48.90 mm (1.9252 in.)



VALVE GUIDE

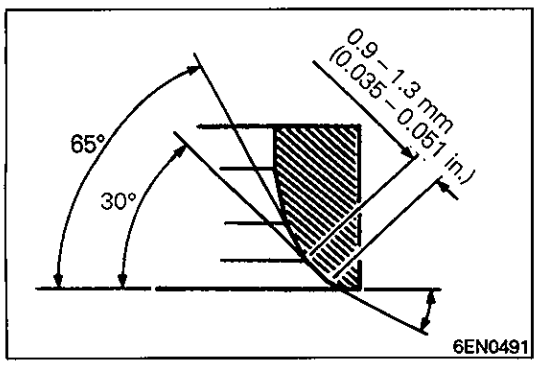
(1) Measure the clearance between the valve guide and valve stem. If the limit is exceeded, replace the valve guide or valve, or both.

Standard value:

8-valve single camshaft engine	
Intake	**0.02 – 0.06 mm (0.0008 – 0.0024 in.)**
Exhaust	**0.05 – 0.09 mm (0.0020 – 0.0035 in.)**
16-valve single camshaft engine	
Intake	**0.02 – 0.05 mm (0.0008 – 0.0020 in.)**
Exhaust	**0.03 – 0.07 mm (0.0012 – 0.0028 in.)**
Double camshaft engine	
Intake	**0.02 – 0.05 mm (0.0008 – 0.0020 in.)**
Exhaust	**0.05 – 0.09 mm (0.0020 – 0.0035 in.)**

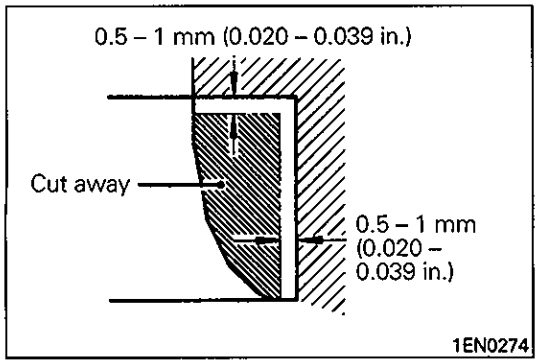
Limit:

Intake	**0.10 mm (0.004 in.)**
Exhaust	**0.15 mm (0.006 in.)**



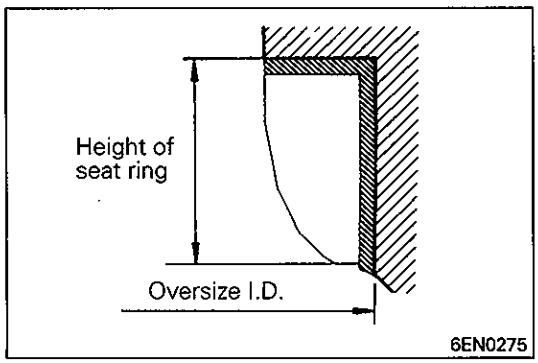
VALVE SEAT RECONDITIONING PROCEDURE

(1) When correcting the valve seat, measure clearance between the valve guide and the valve, and replace either the valve guide or the valve, or both of them, if necessary.
(2) Connect the valve seat width and seat angle to specification.
(3) After correction, apply lapping compound to lap the valve and the valve seat. After this, confirm the valve projection.
Refer to "VALVE SEAT INSPECTION."



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.

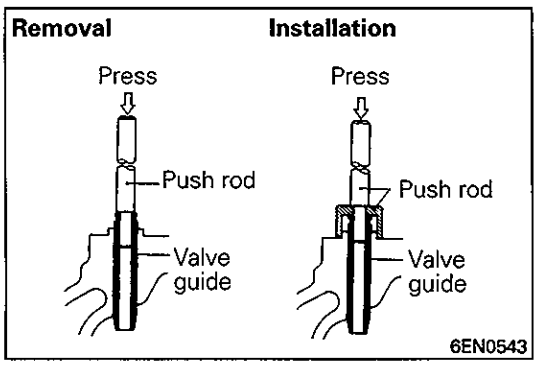


(2) Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

Seat ring hole diameter: See "Service Specifications" on page 11B-1-4.

(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 the cylinder head gasket surface.

(2) Rebore the valve guide hole to the new oversize valve guide outside diameter.

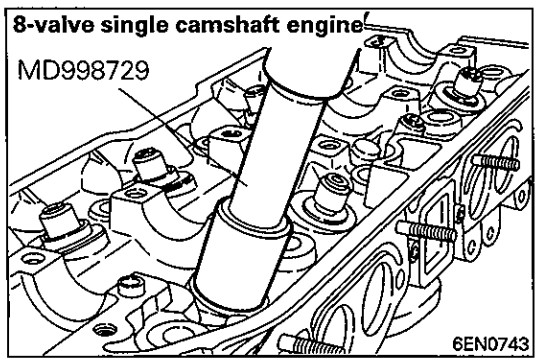
Valve guide hole diameter: See "Service Specifications" on page 11B-1-4.

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.

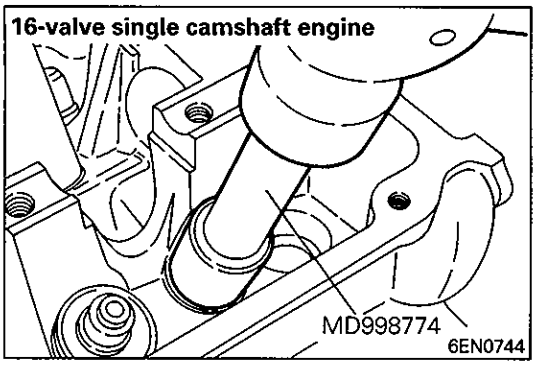


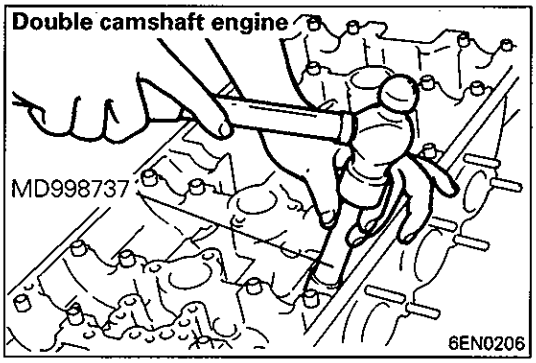
INSTALLATION SERVICE POINTS

◆A◆ VALVE STEM SEAL INSTALLATION

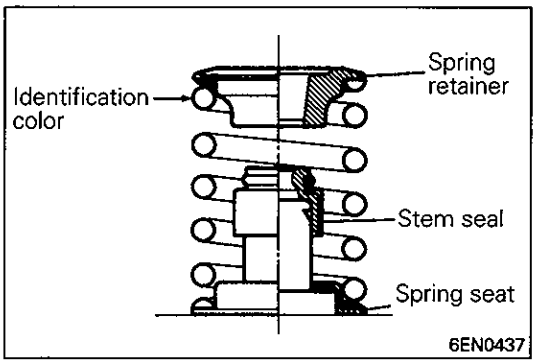
(1) Install the valve spring seat.

(2) The special tool must be used to install the valve stem seal. Improper installation could result in oil leaking past the valve guide.



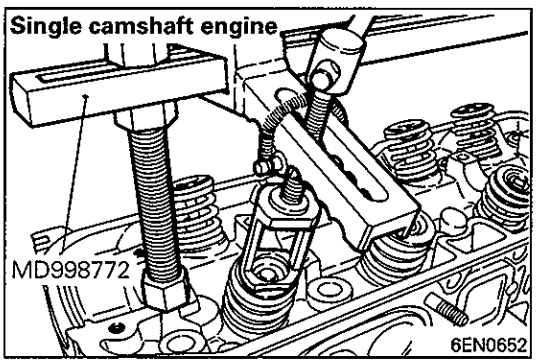


Caution
- **Do not reuse removed valve stem seal.**



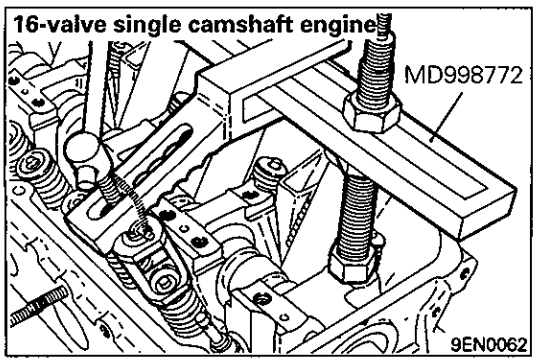
◗B◖ VALVE SPRING INSTALLATION

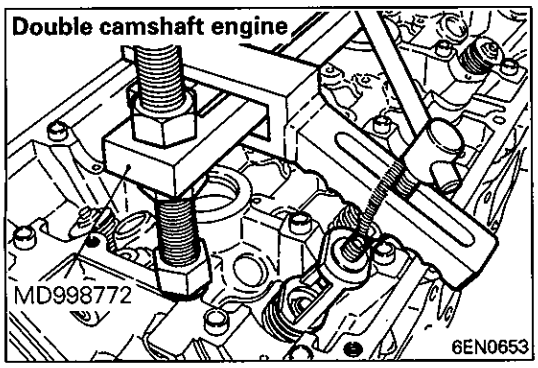
(1) Direct the valve spring end with identification color toward the spring retainer.

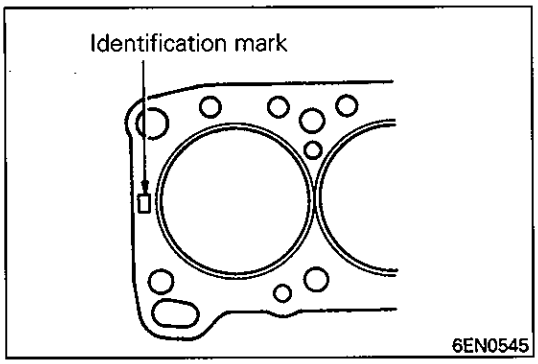


◗C◖ RETAINER LOCK INSTALLATION

(1) The valve spring, if excessively compressed, causes the bottom end of the retainer to be in contact with, and damage, the stem seal.







◗D◖ CYLINDER HEAD GASKET IDENTIFICATION

Identification mark:

8-valve single camshaft engine

63	**4G63**
64C	**4G64**

16-valve single camshaft engine

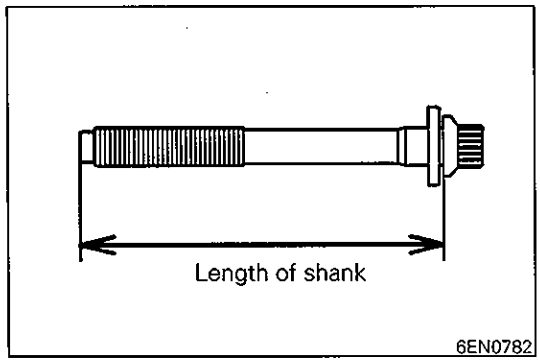
4G63K	**4G63**
4G64K	**4G64**

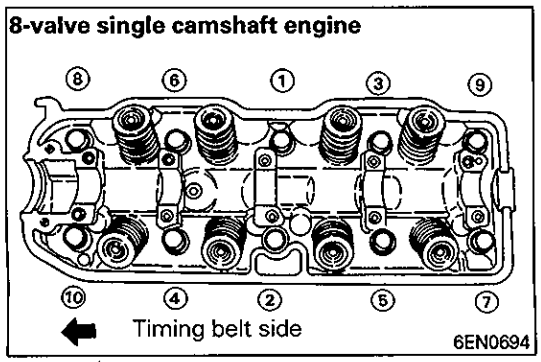
Double camshaft engine

4G63K

Caution

- **Do not apply sealant to cylinder head gasket.**





◗E◖ CYLINDER HEAD BOLT INSTALLATION

(1) When installing the cylinder head bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolt.

Limit:

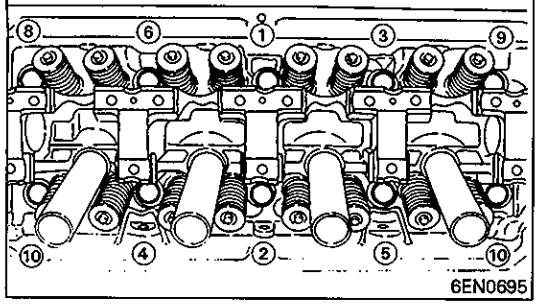
8-valve single camshaft engine
Max. 120.4 mm (4.74 in.)

16-valve single camshaft engine
Max. 99.4 mm (3.91 in.)

Double camshaft engine **Max. 99.4 mm (3.91 in.)**

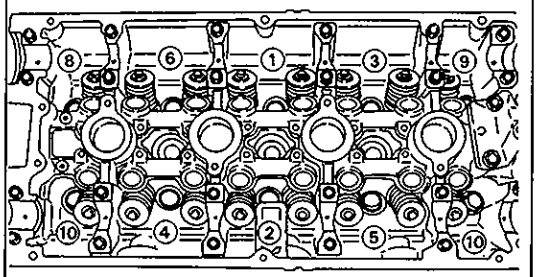
(2) Apply engine oil to the bolt threads and washers.
(3) According to the tightening sequence, tighten the bolts to 78 Nm (80 kgm, 58 ft.lbs.) using a 12mm – 12 points socket wrench.
(4) Loosen the bolts completely.
(5) Retighten the loosened bolts to 20 Nm (2.0 kgm, 14.5 ft.lbs.) in the specified tightening sequence.
(6) Make paint marks on the bolt heads and cylinder head.
(7) Give a 90° turn to the bolts in the specified tightening sequence.

16-valve single camshaft engine



6EN0695

Double camshaft engine



6EN0696

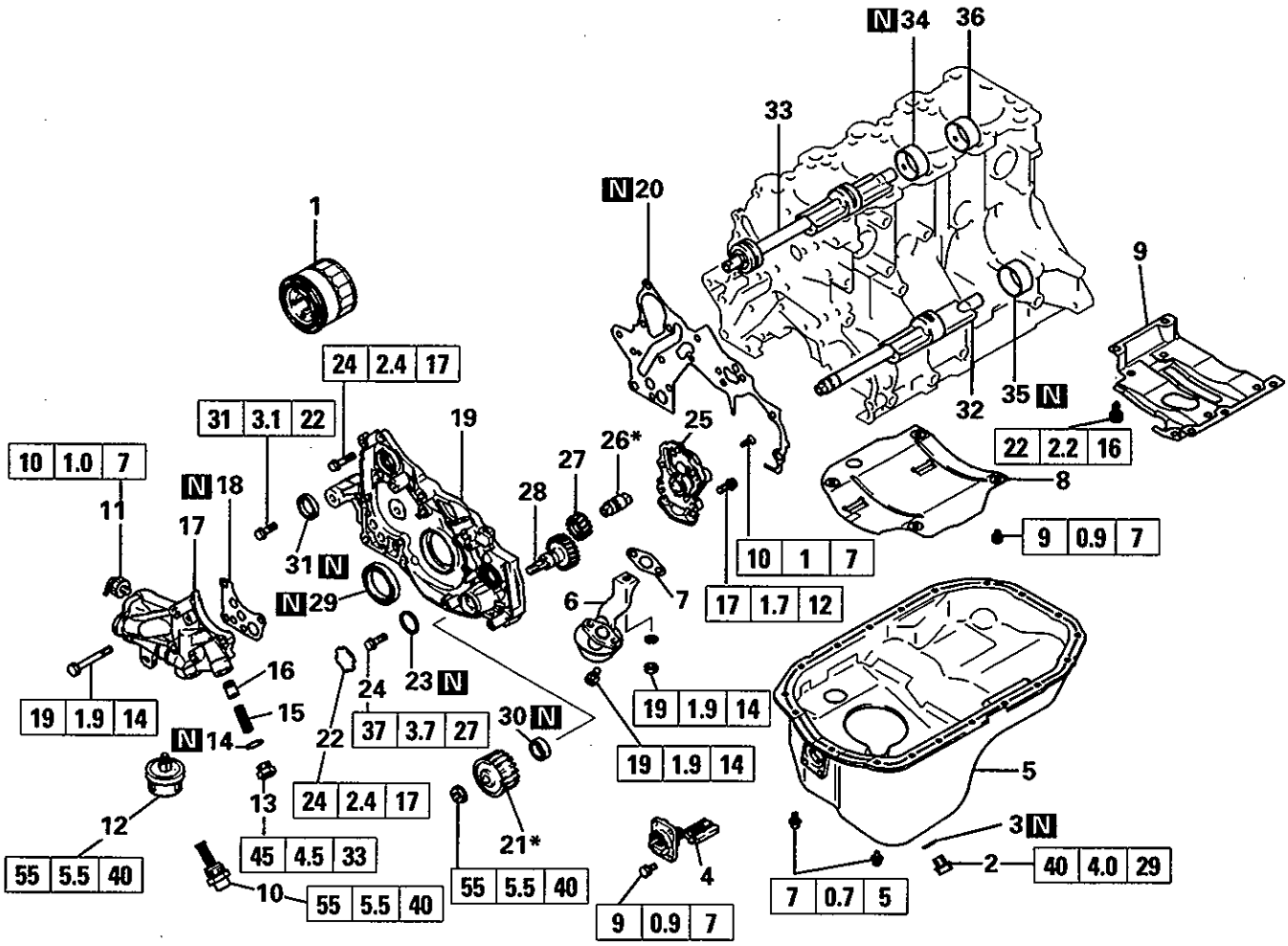
(8) Give another 90° turn to the bolts and make sure that the paint mark on the head of each bolt and that on the cylinder head are on the same straight line.

Caution

- **If the bolt is turned less than 90°, proper fastening performance may not be expected. When tightening the bolt, therefore, be careful to give a sufficient turn to it.**
- **If the bolt is overtightened, loosen the bolt completely and then retighten it by repeating the tightening procedure from step (1).**

10. FRONT CASE, SILENT SHAFT AND OIL PAN

REMOVAL AND INSTALLATION

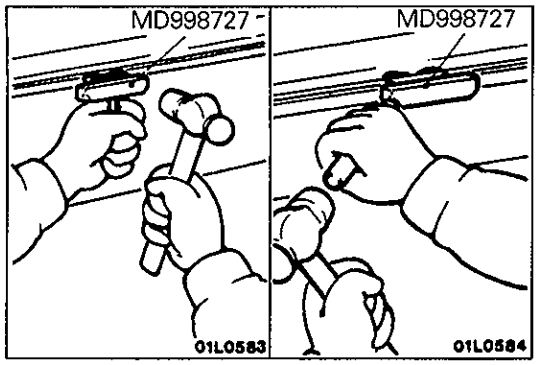


Removal steps

1. Oil filter
2. Drain plug
3. Drain plug gasket
4. Oil level sensor
◇A◇ ◆N◆ 5. Oil pan
6. Oil screen
7. Oil screen gasket
8. Buffle plate <Double camshaft engine – from 1996 model>
9. Stiffener plate
10. Oil cooler by-pass valve <Double camshaft engine – up to 1995 model>
◆M◆ 11. Oil pressure switch
◆L◆ 12. Oil pressure gauge unit
13. Relief plug
14. Gasket
15. Relief spring
16. Relief plunger
17. Oil filter bracket
18. Oil filter bracket gasket
◆I◆ 19. Front case
20. Front case gasket
◆H◆ 21. Oil pump sprocket*
◇B◇ ◆K◆ 22. Plug
23. O-ring
◇C◇ ◆J◆ 24. Flange bolt
25. Oil pump cover
26. Oil pump shaft*
◆G◆ 27. Oil pump driven gear
◆G◆ 28. Oil pump drive gear
◆F◆ 29. Crankshaft front oil seal
◆E◆ 30. Oil pump oil seal
◆D◆ 31. Silent shaft oil seal
32. Silent shaft, left
33. Silent shaft, right
◇E◇ ◆C◆ 34. Silent shaft, front bearing
◇F◇ ◆B◆ 35. Silent shaft, rear bearing, left
◇F◇ ◆A◆ 36. Silent shaft, rear bearing, right

NOTE
*: Engine without silent shafts

6EN1351

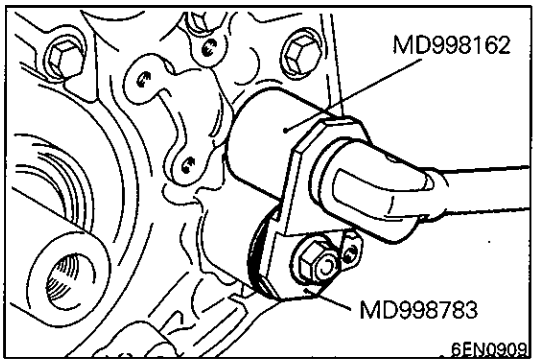


REMOVAL SERVICE POINTS

◇A◇ OIL PAN REMOVAL

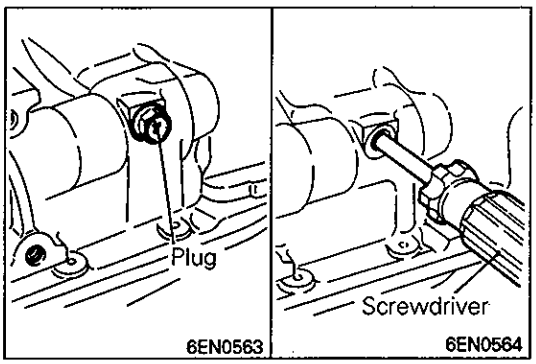
(1) Remove the all oil pan bolts.
(2) Drive in the special tool between the cylinder block and oil pan.

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



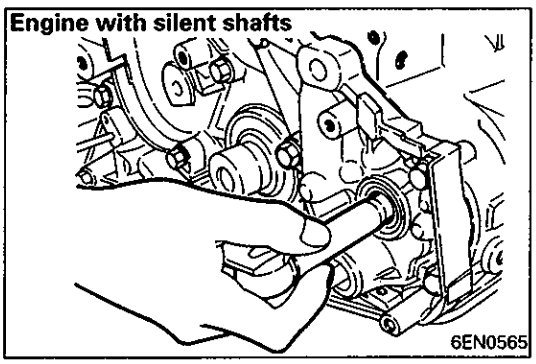
◇B◇ PLUG REMOVAL

(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.

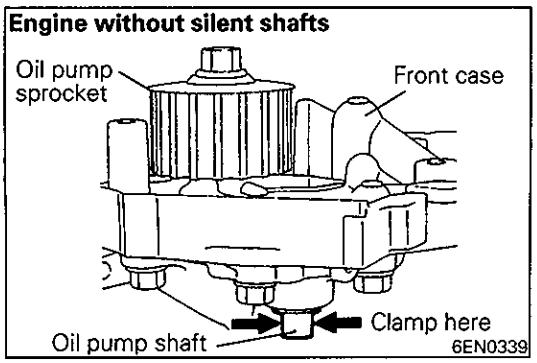


◇C◇ FLANGE BOLT REMOVAL (ENGINE WITH SILENT SHAFTS)

(1) Remove the plug on the side of the cylinder block.
(2) Insert a Phillips screwdriver [shank diameter 8 mm (0.32 in.)] into the plug hole to lock the silent shaft.

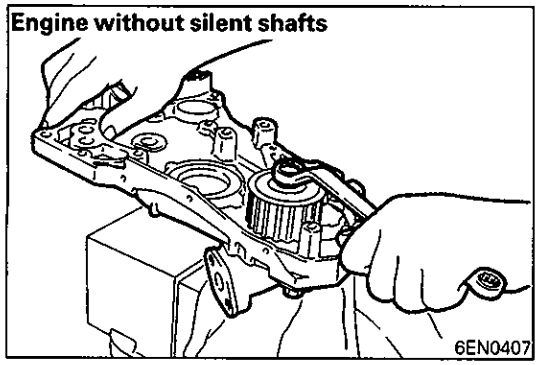


(3) Loosen the flange bolt.

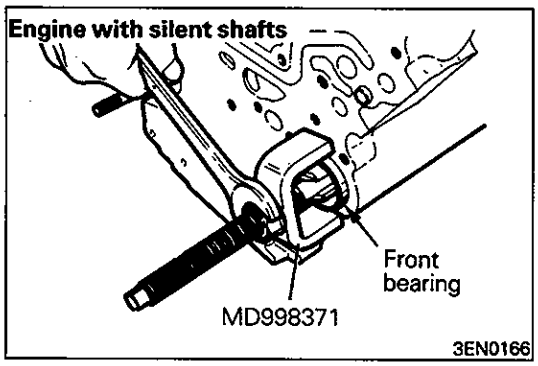


◇D◇ FLANGE NUT REMOVAL (ENGINE WITHOUT SILENT SHAFTS)

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



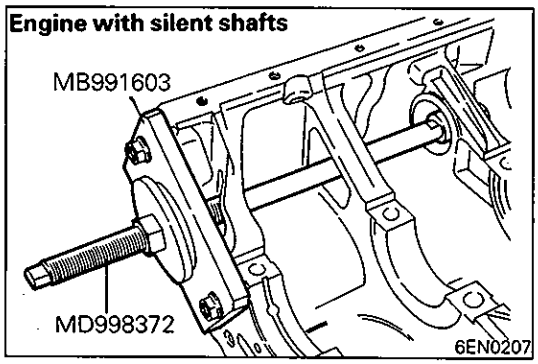
(2) Remove the oil pump sprocket nut.



◇E◇ SILENT SHAFT FRONT BEARING REMOVAL (ENGINE WITH SILENT SHAFTS)

(1) Using the special tool, remove the right silent shaft 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◇ REAR BEARING REMOVAL (ENGINE WITH SILENT SHAFTS)

(1) Using the special tool, remove the rear bearings from the cylinder block.
(2) To remove the left rear bearing, install the special tool, Silent Shaft Bearing Installer Stopper, to the front of the cylinder block, then remove the bearing using the special tool, Silent Shaft Bearing Puller.

INSPECTION

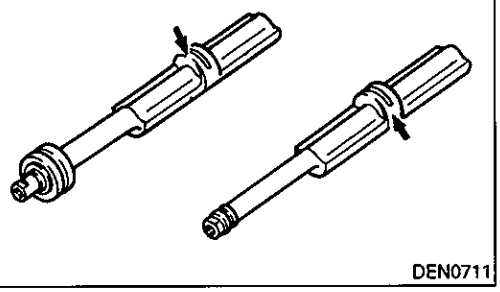
FRONT CASE

(1) Check the oil holes for clogging and clean if necessary.
(2) Check the 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.

Engine with silent shafts



DEN0711

SILENT SHAFT (ENGINE WITH SILENT SHAFTS)

(1) Check the oil holes for clogging.
(2) Check the journal for seizure, damage and contact with bearing. If there is anything wrong with the journal, replace the 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.

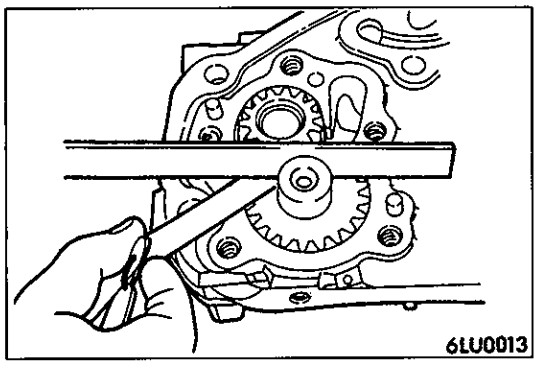
Standard value:

Front

0.03 – 0.06 mm (0.0012 – 0.0024 in.) ..... Right
0.02 – 0.05 mm (0.0008 – 0.0020 in.) ..... Left

Rear

0.05 – 0.09 mm (0.0020 – 0.0036 in.) ..... Right
0.05 – 0.09 mm (0.0020 – 0.0036 in.) ..... Left



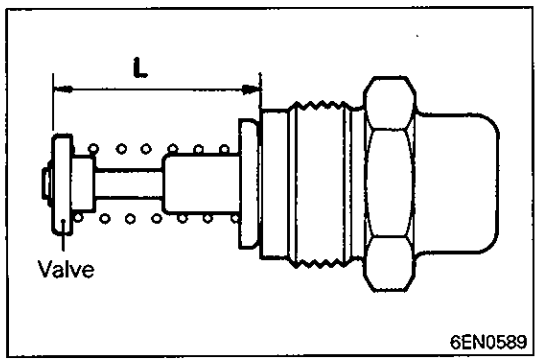
6LU0013

OIL PUMP

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

Standard value:

0.08 – 0.14 mm (0.0031 – 0.0055 in.) ..... Drive gear
0.06 – 0.12 mm (0.0024 – 0.0047 in.) ... Driven gear



6EN0589

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

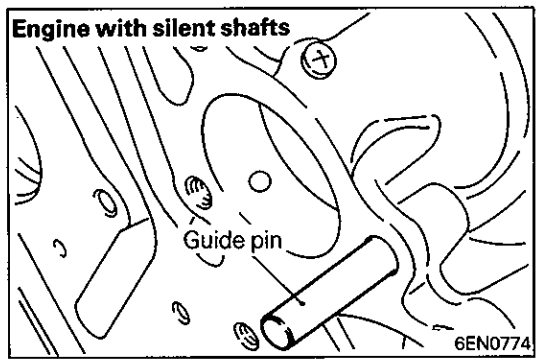
(1) Make sure that the valve moves smoothly.
(2) Ensure that the dimension (L) measures the standard value under normal temperature and humidity.

Standard value (L): 34.5 (1.358 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

Engine with silent shafts

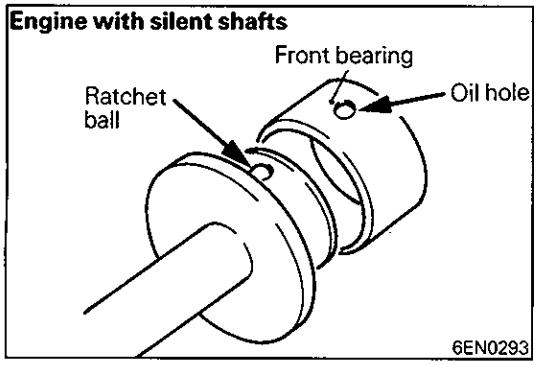


6EN0774

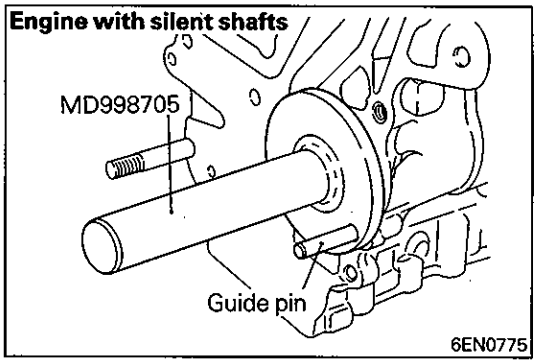
INSTALLATION SERVICE POINTS

▶A◀ RIGHT SILENT SHAFT REAR BEARING INSTALLATION (ENGINE WITH SILENT SHAFTS)

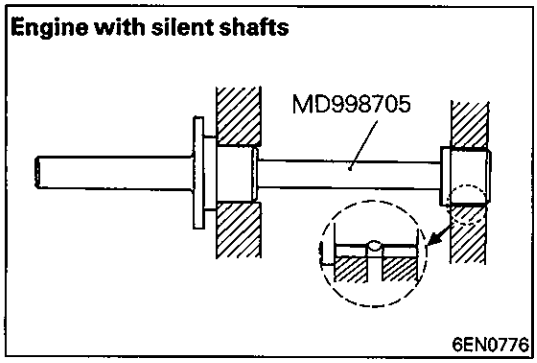
(1) Install the guide pin of the special tool in the threaded hole of the cylinder block as shown.

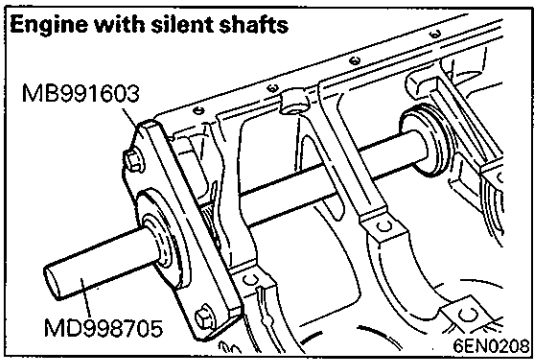


(2) Align the ratchet ball of the special tool with the oil hole in the rear bearing to install the bearing on the special tool.
(3) Apply engine oil to the outside circumference of the bearing and the bearing hole in the cylinder block.



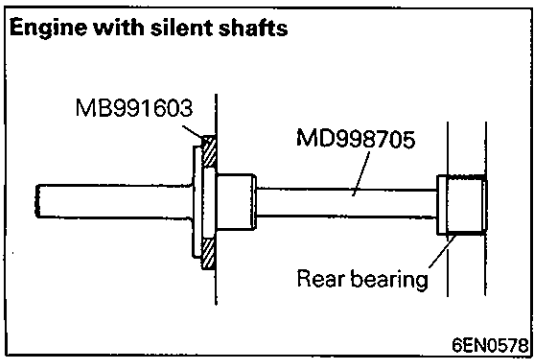
(4) Insert the installer so that it is in alignment with the guide pin, and install the bearing in position.





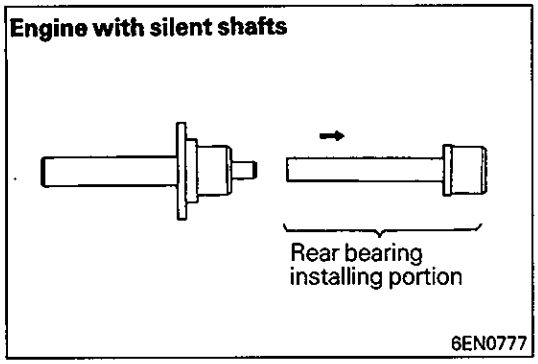
◗B◖ LEFT SILENT SHAFT REAR BEARING INSTALLATION (ENGINE WITH SILENT SHAFTS)

(1) Install the special tool (MD998374) to the cylinder block.
(2) Apply engine oil to the rear bearing outer circumference and bearing hole in the cylinder block.



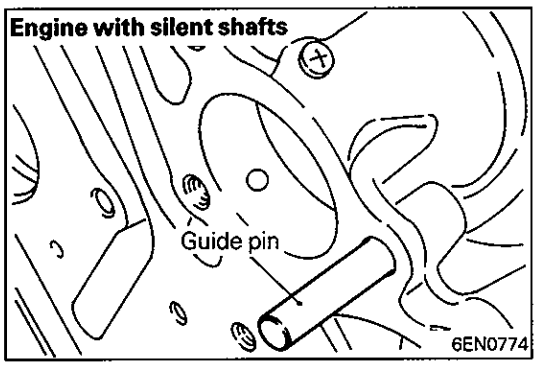
(3) Using the special tool, install the rear bearing.

NOTE
The left rear bearing has no oil hole.



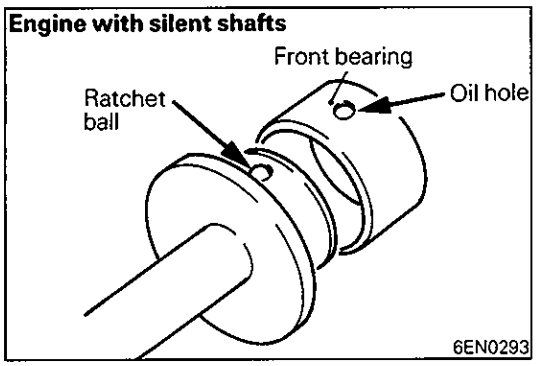
◆C◆ SILENT SHAFT FRONT BEARING INSTALLATION (ENGINE WITH SILENT SHAFTS)

(1) Remove the rear bearing installing portion from the special tool.

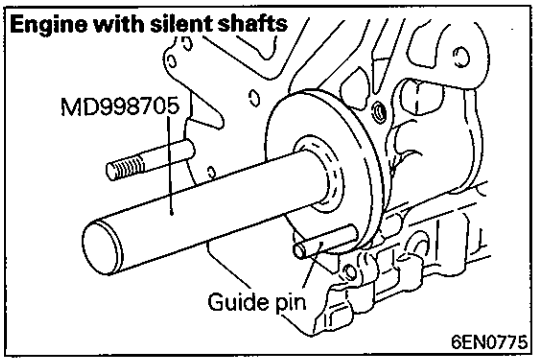


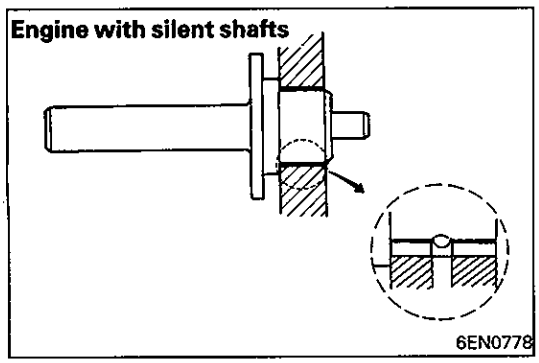
(2) Install the guide pin of the special tool in the threaded hole of the cylinder block.

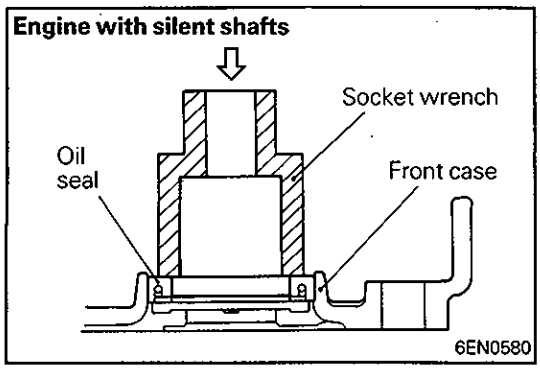
(3) Align the ratchet ball of the special tool with the oil hole in the front bearing to install the bearing on the special tool.
(4) Apply engine oil to the outside circumference of the bearing and the bearing hole in the cylinder block.



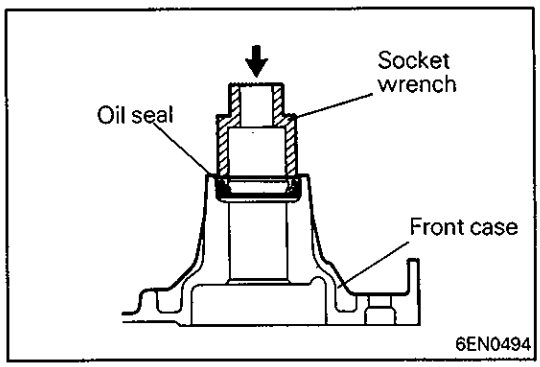
(5) Insert the installer so that it is in alignment with the guide pin, and install the bearing in position.



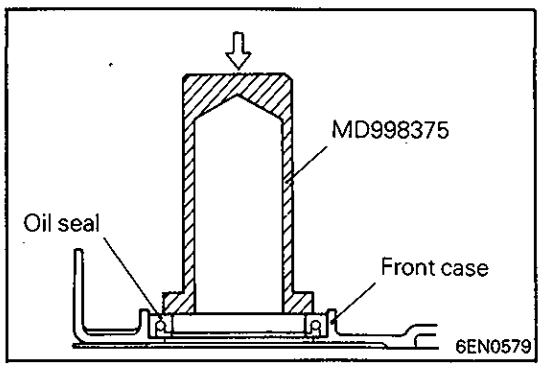




◗D◖ SILENT SHAFT OIL SEAL (ENGINE WITH SILENT SHAFTS)

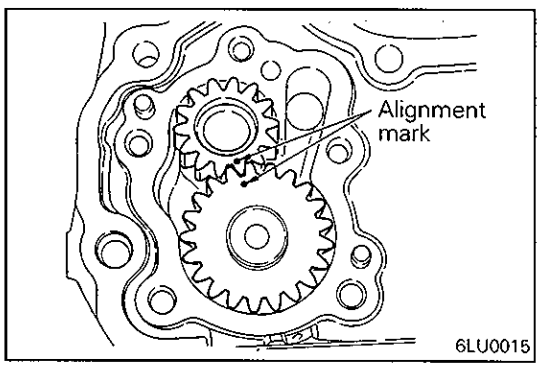


◗E◖ OIL PUMP OIL SEAL INSTALLATION



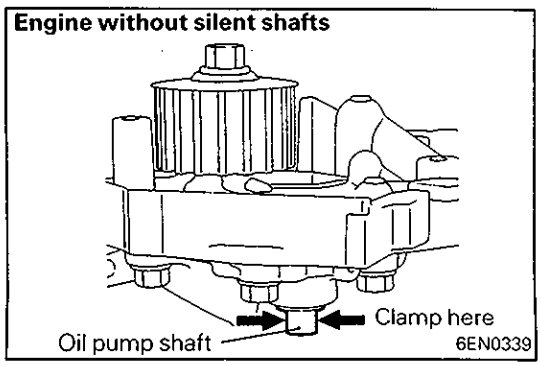
◗F◖ CRANKSHAFT FRONT OIL SEAL INSTALLATION

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



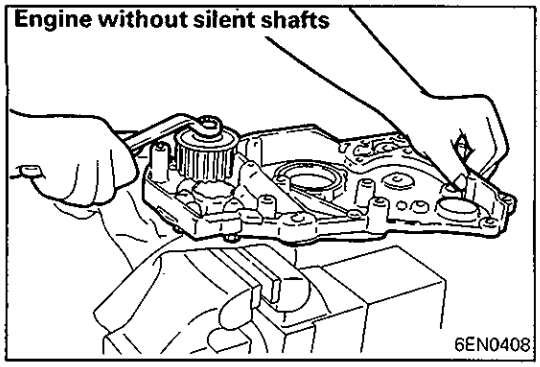
◗G◖ OIL PUMP DRIVEN GEAR / OIL PUMP DRIVE GEAR INSTALLATION

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

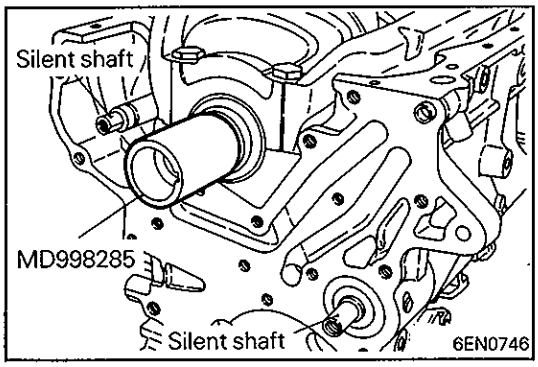


◗H◖ FLANGE NUT INSTALLATION (ENGINE WITHOUT SILENT SHAFTS)

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

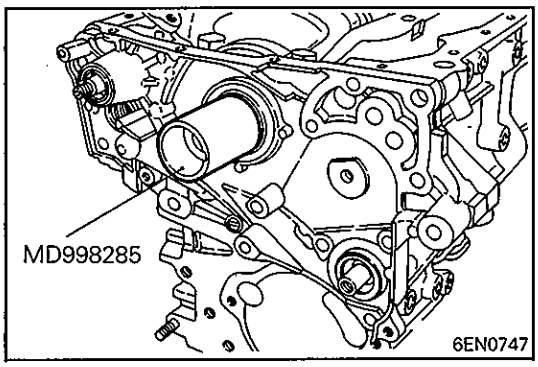


(2) Tighten the oil pump sprocket nut to the specified torque.

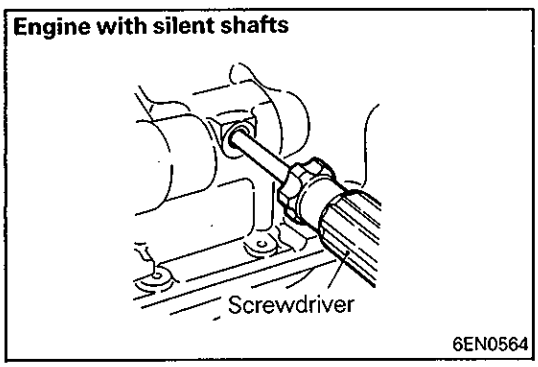


◆I◆ FRONT CASE INSTALLATION

(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.

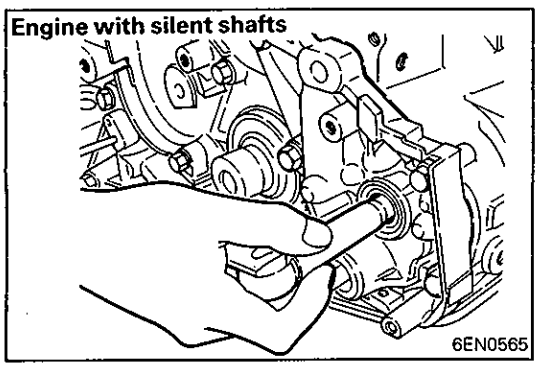


(2) Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).

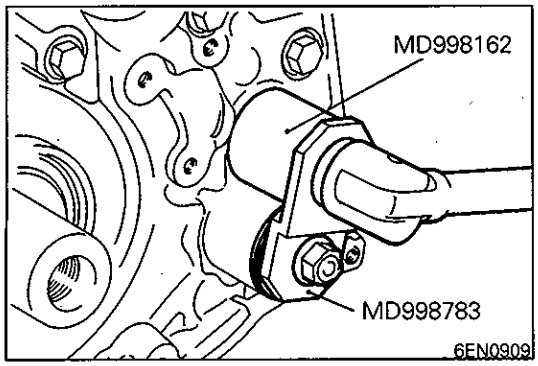


◆J◆ FLANGE BOLT INSTALLATION (ENGINE WITH SILENT SHAFTS)

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

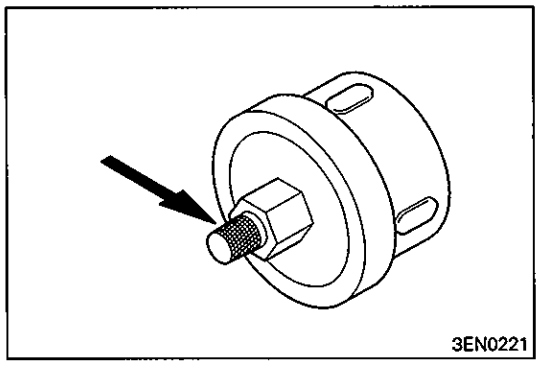


(2) Secure the oil pump driven gear onto the left silent shaft by tightening the flange bolt to the specified torque.



◆K◆ PLUG INSTALLATION

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

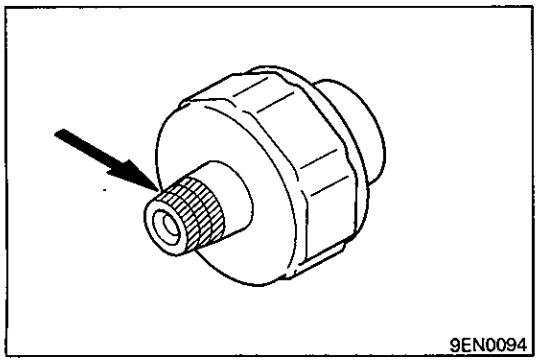


◆L◆ SEALANT APPLICATION TO OIL PRESSURE GAUGE UNIT

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

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

Caution
- **Keep the end of threaded portion clear of sealant.**
- **Avoid an overtightening.**



◆M◆ 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

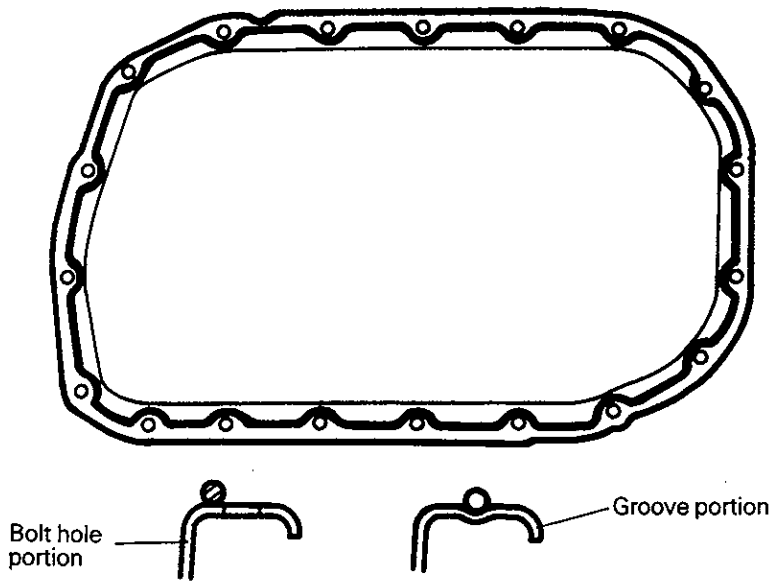
Caution
- **Keep the end of threaded portion clear of sealant.**
- **Avoid an overtightening.**

◆N◆ OIL PAN INSTALLATION

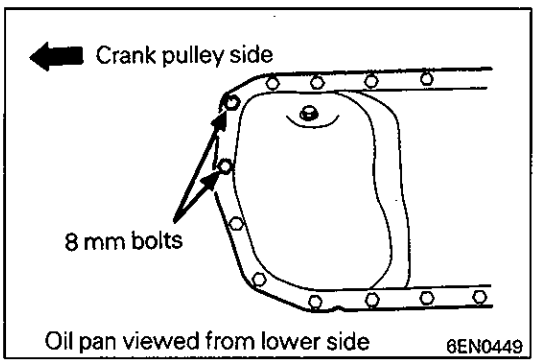
(1) Clean both mating surface of the oil pan and cylinder block.
(2) Apply a 4 mm (0.16 in.) wide bead of sealant to the entire circumference of the oil pan flange.

Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

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



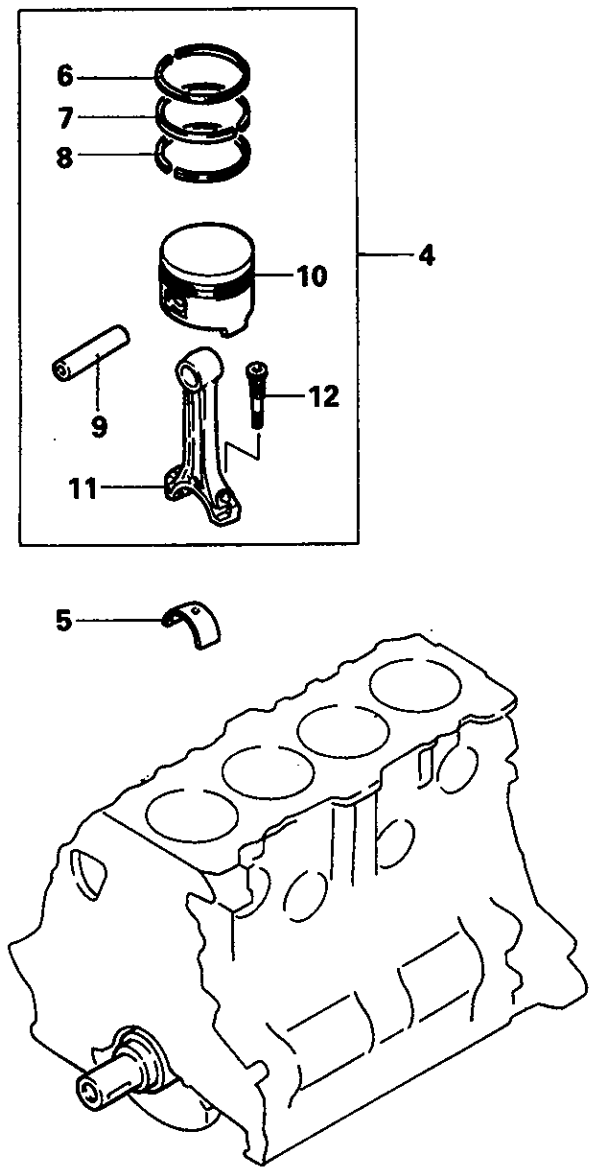
6EN0213



(4) Note the difference in bolt lengths at the location shown.

11. PISTON AND CONNECTING ROD

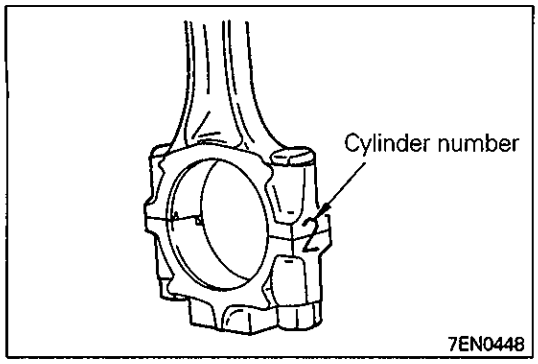
REMOVAL AND INSTALLATION



Removal steps

- ◗G◖ 1. Nut
- ◇A◇ ◗F◖ 2. Connecting rod cap
- ◗E◖ 3. Connecting rod bearing
- ◗D◖ 4. Piston and connecting rod assembly
- ◗E◖ 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

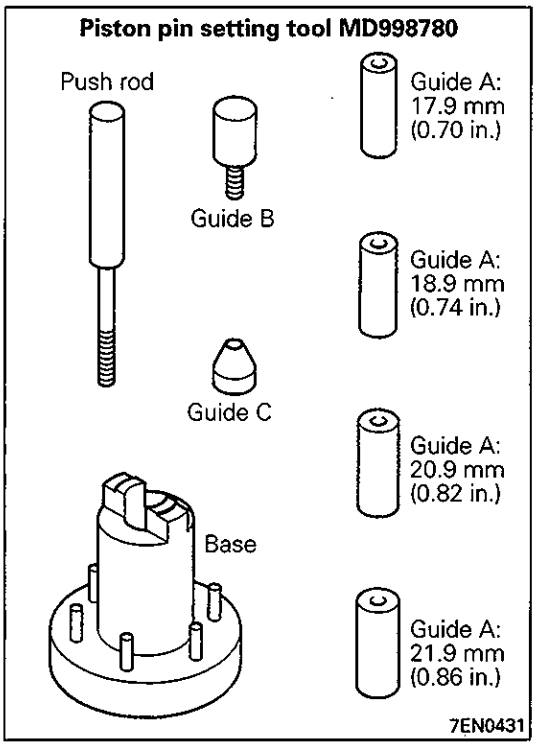
6EN0526



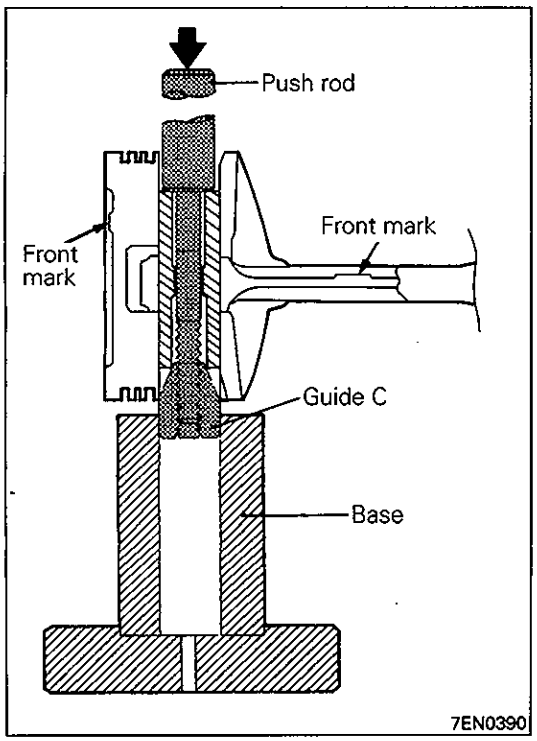
REMOVAL SERVICE POINTS

◇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.



◇B◇ PISTON PIN REMOVAL



(1) Insert the special tool, Push Rod, into the piston from the side on which the front mark is stamped in the piston head, and attach the guide C to the push rod end.
(2) Place the piston and connecting rod assembly on the special tool, Piston Pin Setting Base, with the front mark facing upward.
(3) Using a press, remove the piston pin.

NOTE
Keep the disassembled pistons, piston pins and connecting rods in order according to the cylinder number.

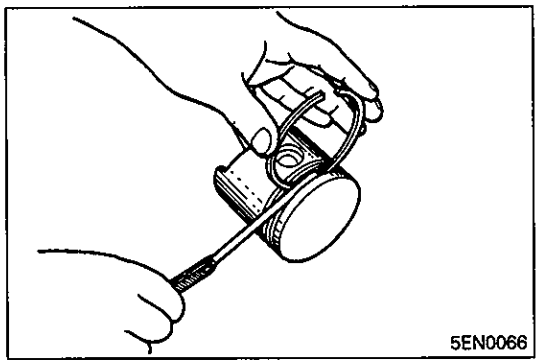
INSPECTION

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.



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:

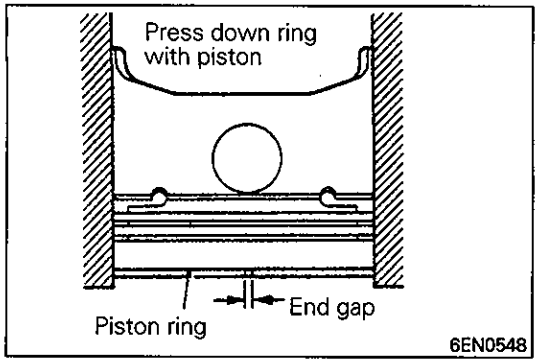
No.1

4G63 8-valve single camshaft engine
0.02 – 0.06 mm (0.0008 – 0.0024 in.)
4G64 single camshaft engine and double camshaft engine
0.03 – 0.07 mm (0.0012 – 0.0028 in.)
4G63 16-valve single camshaft engine
0.03 – 0.06 mm (0.0012 – 0.0024 in.)

No.2

4G63 8-valve single camshaft engine and 4G63 double camshaft engine <From 1996 model>
0.02 – 0.06 mm (0.0008 – 0.0024 in.)
4G64 single camshaft engine and 4G63 double camshaft engine <Up to 1995 model>
0.03 – 0.07 mm (0.0012 – 0.0028 in.)
4G63 16-valve single camshaft engine
0.02 – 0.05 mm (0.0008 – 0.0020 in.)

Limit: 0.1 mm (0.004 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

8-valve single camshaft engine
0.25 – 0.40 mm (0.0098 – 0.0157 in.)
16-valve single camshaft engine and 4G63 double camshaft engine <From 1996 model>
0.25 – 0.35 mm (0.0098 – 0.0138 in.)
4G63 Double camshaft engine <Up to 1995 model>
0.25 – 0.45 mm (0.0098 – 0.0177 in.)

No.2

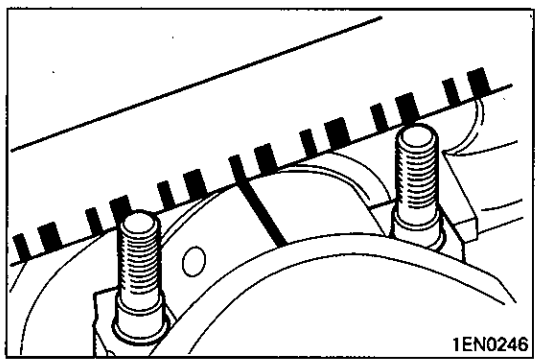
8-valve single camshaft engine and 4G63 double camshaft engine <Up to 1995 model>
0.45 – 0.60 mm (0.0177 – 0.0236 in.)
16-valve single camshaft engine
0.45 – 0.55 mm (0.0177 – 0.0217 in.)
4G63 Double camshaft engine <From 1996 model>
0.40 – 0.55 mm (0.0157 – 0.0217 in.)

Oil

Single camshaft engine and double camshaft engine <From 1996 model>
0.10 – 0.40 mm (0.0039 – 0.0157 in.)
Double camshaft engine <Up to 1995 model>
0.13 – 0.38 mm (0.0051 – 0.0150 in.)

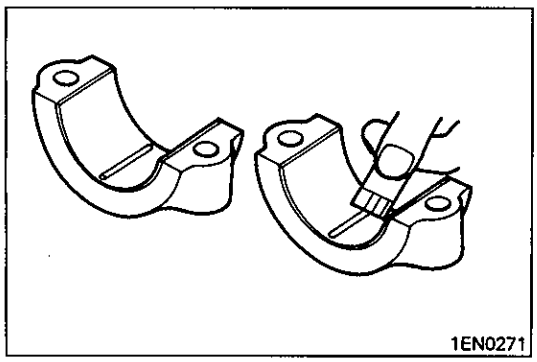
Limit:

No. 1, No. 2	**0.8 mm (0.031 in.)**
Oil	**1.0 mm (0.039 in.)**



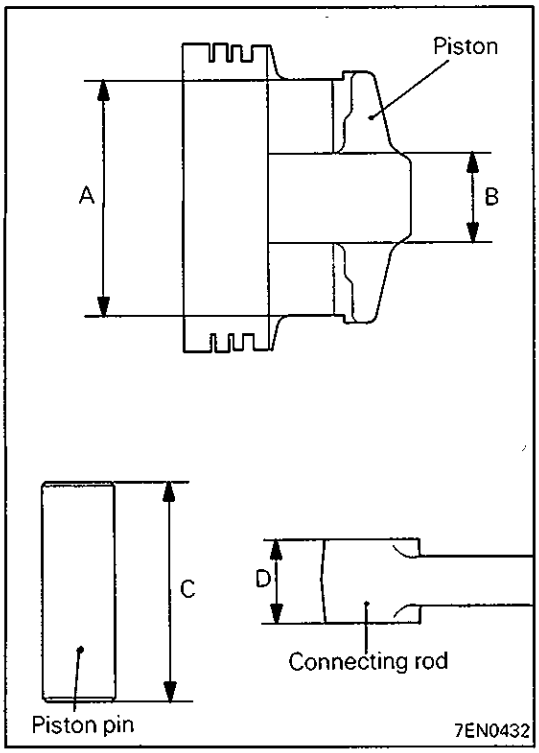
CRANKSHAFT PIN OIL CLEARANCE (PLASTIC GAUGE METHOD)

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



(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 the scale printed on the plastic gauge package.

Standard value: 0.02 – 0.05 mm (0.0008 – 0.0020 in.)
Limit: 0.1 mm (0.004 in.)



INSTALLATION SERVICE POINTS

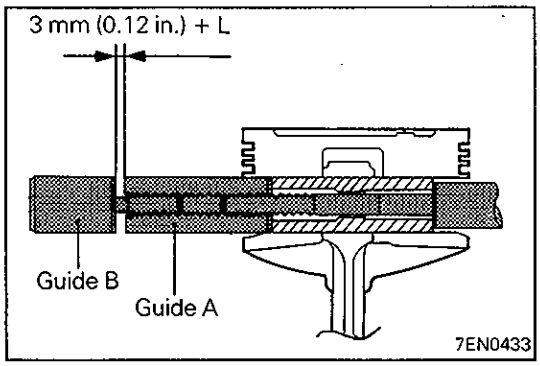
◆A◆ PISTON PIN INSTALLATION

(1) Measure the following dimensions of the piston, piston pin and connecting rod.
A: Piston pin insertion hole length
B: Distance between piston bosses
C: Piston pin length
D: Connecting rod small end width

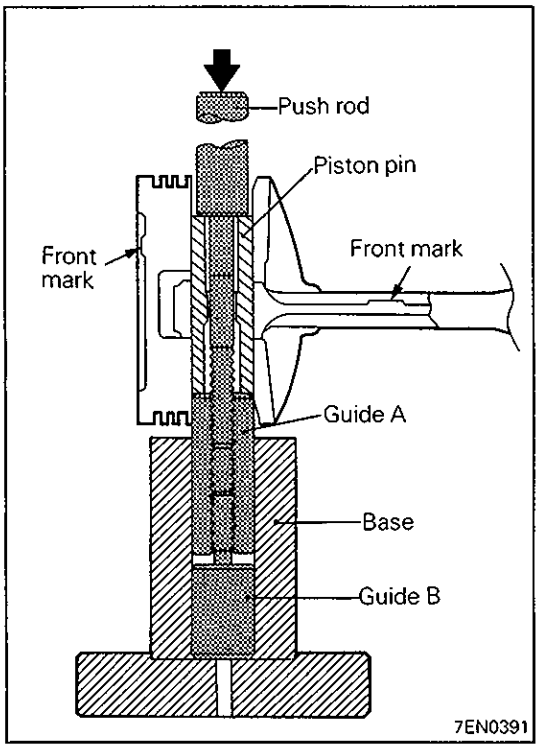
(2) Obtain dimension L (to be used later) from the above measurements by using by following formula.

$$L = \frac{(A - C) - (B - D)}{2}$$

(3) Insert the special tool, Push Rod, into the piston pin and attach the guide A to the push rod end.
(4) Assemble the connecting rod in the piston with their front marks facing the same direction.
(5) Apply engine oil to the entire periphery of the piston pin.
(6) Insert the piston pin, push rod and guide A assembly having assembled in step (3) from the guide A side into the piston pin hole on the front marked side.

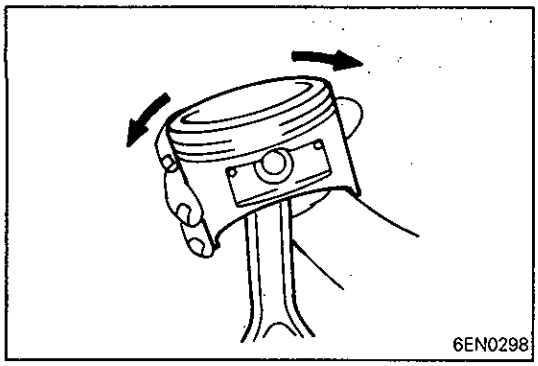


(7) Screw the guide B into the guide A until the gap between both guides amounts to the value L obtained in step (2) plus 3 mm (0.12 in).

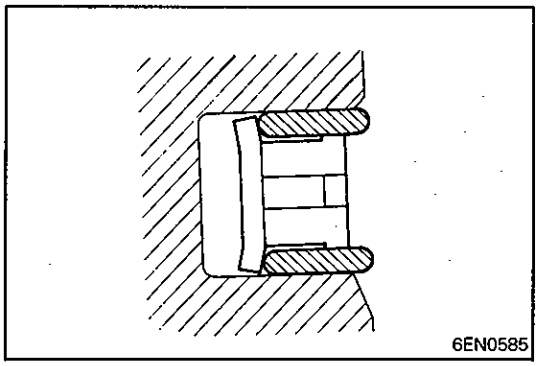


(8) Place the piston and connecting rod assembly onto the piston setting base with the front marks directed upward.
(9) Press-fit the piston pin using a press.
If the press-fitting force required is less than the standard value, replace the piston and piston pin set or/and the connecting rod.

Standard value:
7,500 – 17,500N (750 – 1,750 kg, 1,653 – 3,858 lbs.)


6EN0298

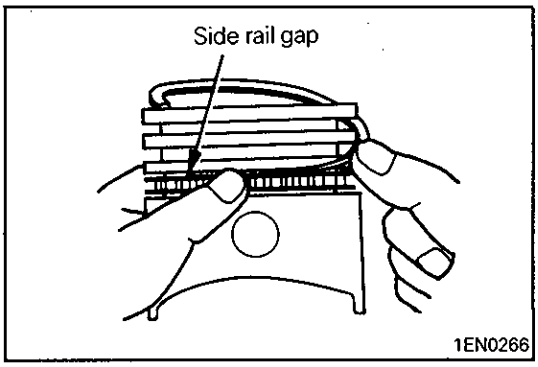
(10)Check that the piston moves smoothly.


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.

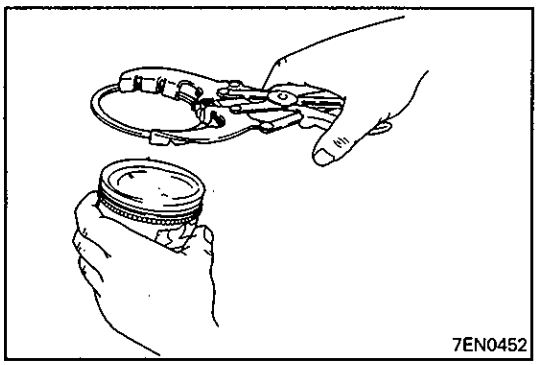


1EN0266

(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 any piston ring expander when installing side rails.**

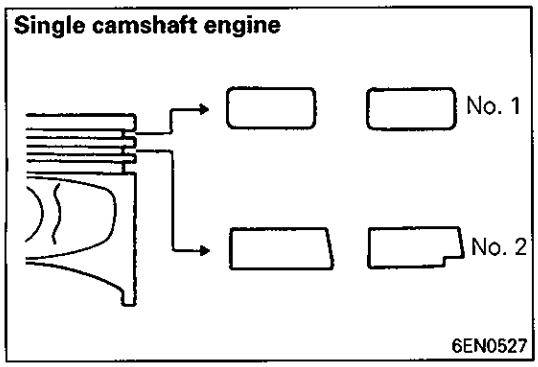
(3) Install the lower side rail in the same procedure as described in step (2).
(4) Make sure that the side rails move smoothly in either direction.

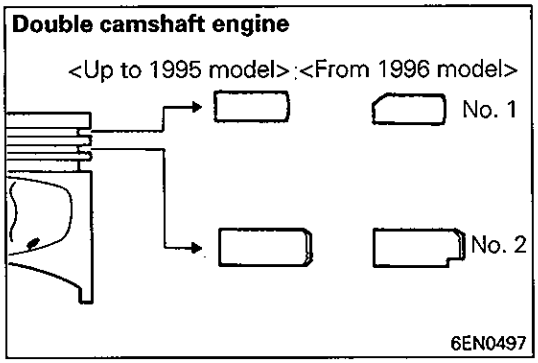

7EN0452

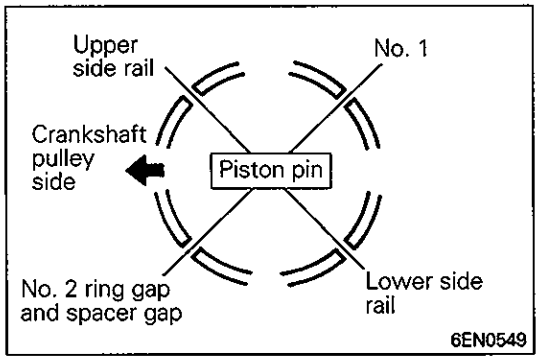
◗C◖ PISTON RING NO. 2 / PISTON RING NO. 1 INSTALLATION

(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).

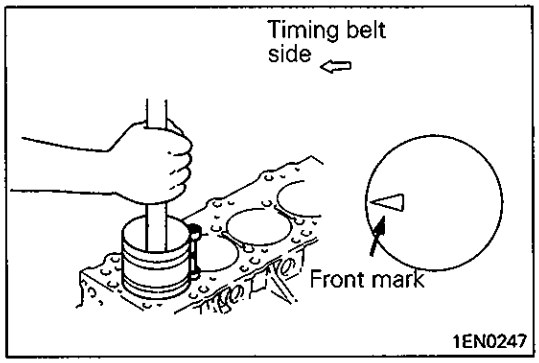




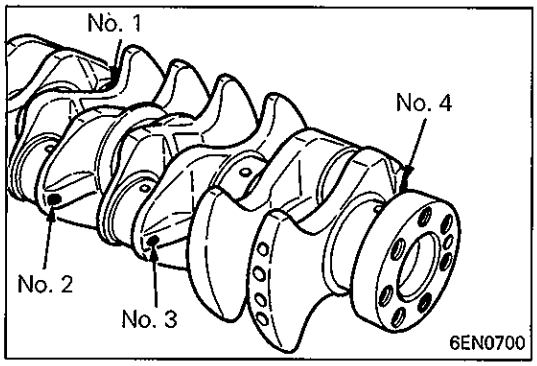


◆D◆ PISTON AND CONNECTING ROD INSTALLATION

(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 illustration.



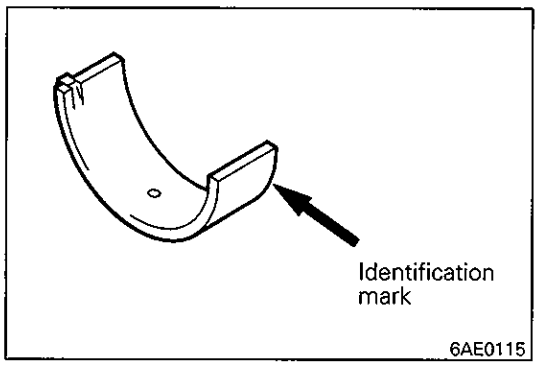
(3) Rotate the crankshaft so that the crank pin is on the center of the cylinder bore.
(4) Use suitable thread protectors on the connecting rod bolts before inserting the piston and connecting rod assembly into the cylinder block.
Care must be taken not to nick the crank pin.
(5) Using a suitable piston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



◗E◖ CONNECTING ROD BEARING INSTALLATION

When the bearing needs replacing, select and install a proper bearing by the following procedure.

(1) Measure the crankshaft pin diameter and confirm its classification from the following table. In the case of a crankshaft supplied as a service part, identification colors of its pins are painted at the positions shown in the illustration.



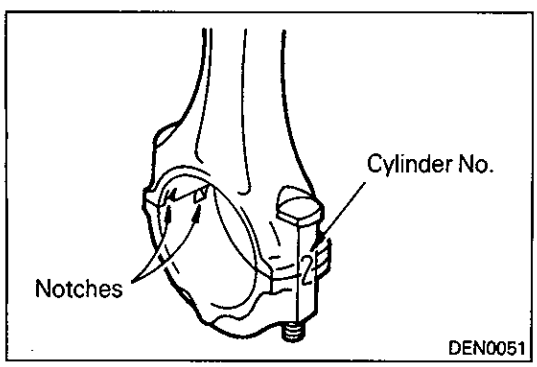
(2) The connecting rod bearing identification mark is stamped at the position shown in the illustration.

Crankshaft pin				Connecting rod bearing	
Classification	Identification color		O.D. mm (in.)	Identification mark	Thickness mm (in.)
	Production part	Service part			
1	None	Yellow	44.995 – 45.000 (1.7715 – 1.7717)	1	1.478 – 1.491 (0.0582 – 0.0587)
2	None	None	44.985 – 44.995 (1.7711 – 1.7715)	2	1.491 – 1.495 (0.0587 – 0.0589)
3	None	White	44.980 – 44.985 (1.7709 – 1.7711)	3	1.495 – 1.499 (0.0589 – 0.0590)

Connecting rod I.D.: 48.000 – 48.015 mm (1.8900 – 1.8904 in.)

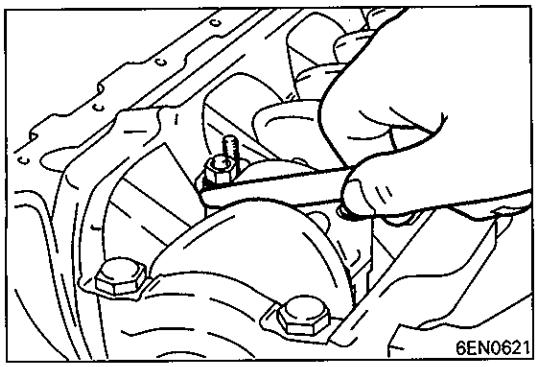
(3) Select a proper bearing from the above table on the basis of the identification data confirmed under Items (1) and (2).

[Example]
If the measured value of a crankshaft pin outer diameter is between 44.995 and 45.000 mm (1.7715 and 1.7717 in.), the pin is classified as "1" in the table.
In case the crankshaft is also replaced by a spare part, check the identification colors of the pins painted on the new crankshaft. If the color is yellow, for example, the pin is classified as "1".
In the above cases, select the connecting rod bearing having identification mark "1".



◗F◖ 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 connecting rod big end side clearance meets the specification.

Standard value: 0.10 – 0.25 mm (0.0039 – 0.0098 in.)
Limit: 0.4 mm (0.016 in.)

◆G◆ CONNECTING ROD CAP NUT INSTALLATION

NOTE
Installation of the connecting rod nut should be performed with the cylinder head or the spark plug removed.

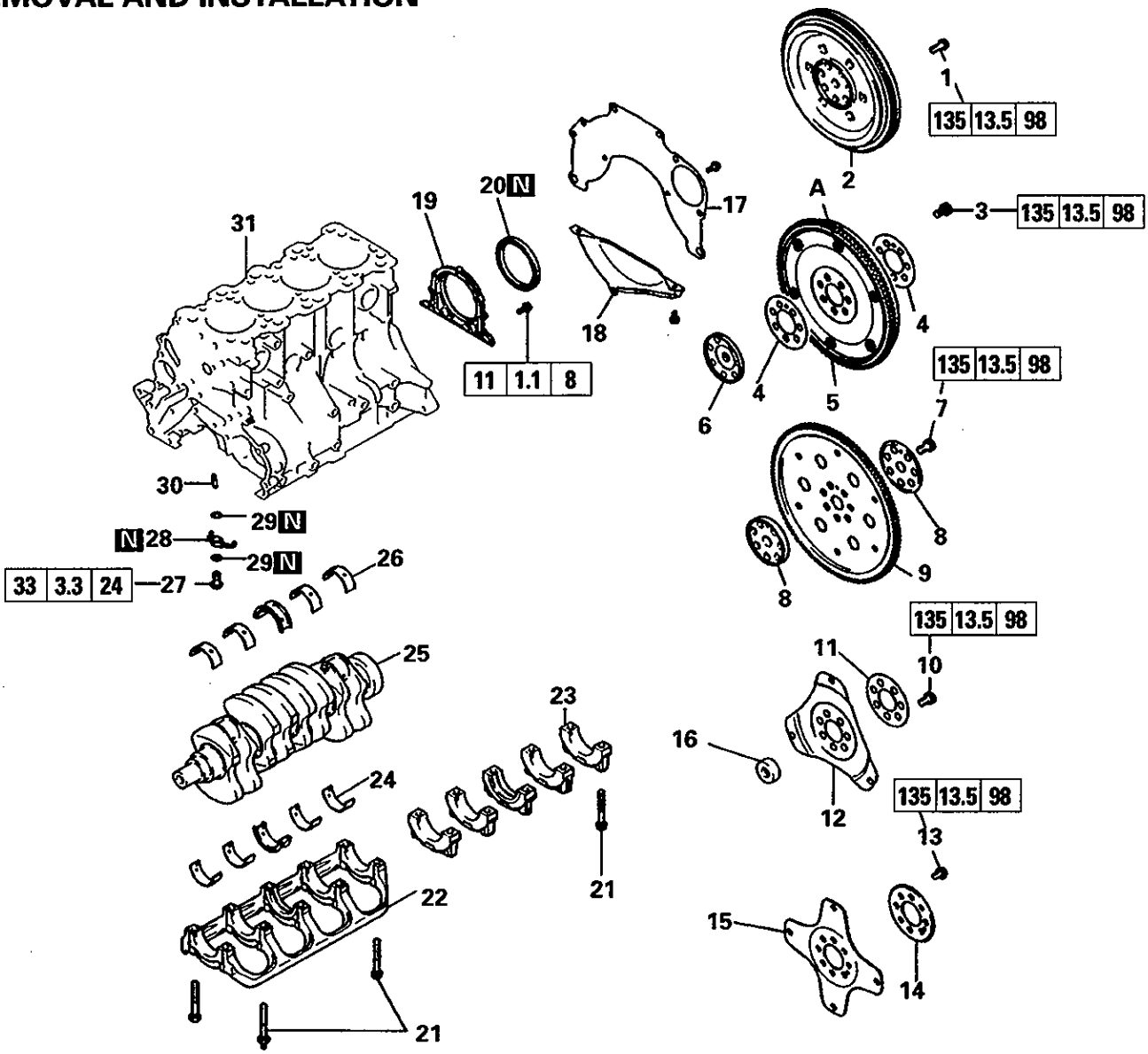
(1) Since the connecting rod bolts and nuts are torqued using the plastic area tightening method, the bolts should be examined BEFORE reuse. If the bolt threads are "necked down", the bolt should be replaced.
Necking can be checked by running a nut with fingers to the full length of the bolt threads. If the nut does not run down smoothly, the bolt should be replaced.
(2) Before installation of each nut, apply engine oil to the threaded portion and bearing surface of the nut.
(3) Loosely tighten each nut to the bolt.
(4) Then tighten the nuts alternately to a torque of 20 Nm (2.0 kgm, 14.5 ft.lbs.) to install the cap properly.
(5) Make a paint mark on the head of each nut.
(6) Make a paint mark on the bolt end at the position 90° to 100° from the paint mark made on the nut in the direction of tightening the nut.
(7) Give a 90° to 100° turn to the nut and make sure that the paint mark on the nut and that on the bolt are in alignment.

Caution
- **If the nut is turned less than 90°, proper fastening performance may not be expected. When tightening the nut, therefore, be careful to give a sufficient turn to it.**
- **If the nut is overtightened (exceeding 100°), loosen the nut completely and then retighten it by repeating the tightening procedure from step (1).**

NOTES

12. CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION



Removal steps

- 1. Flywheel bolt
- 2. Flywheel
- 3. Flywheel bolt
- 4. Adapter plate
- 5. Flexible flywheel
- 6. Crankshaft adapter
- 7. Drive plate bolt
- 8. Adapter plate
- 9. Drive plate
- 10. Drive plate bolt
- 11. Adapter plate
- 12. Drive plate
- 13. Drive plate bolt
- 14. Adapter plate
- 15. Drive plate

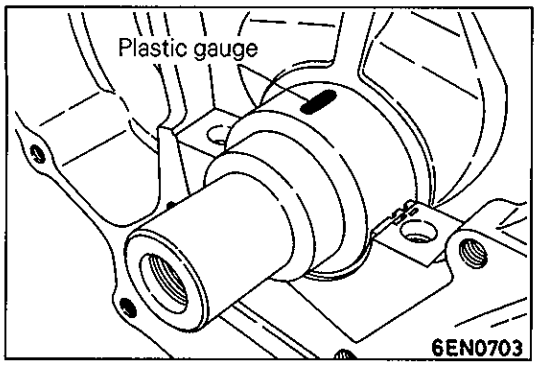
(1–3: Engines combined with M/T (Except 4G64 engine for L400 for Europe); 4–6: Engines combined with M/T (4G64 engine for L400 for Europe); 7–9: 8-valve single camshaft engines combined with A/T; 10–12: 16-valve single camshaft engines combined with A/T; 13–15: Double camshaft engines combined with A/T)

- 16. Crankshaft bushing – Engines combined with A/T
- 17. Rear plate
- 18. Bell housing cover
- ◆D◆ 19. Oil seal case
- ◆C◆ 20. Oil seal
- ◆B◆ 21. Bearing cap bolt
- ◆B◆ 22. Bearing cap – 4G64 8-valve single camshaft engine, 16-valve single camshaft engine, double camshaft engine
- ◆B◆ 23. Bearing cap – 4G63 8-valve single camshaft engine
- ◆A◆ 24. Crankshaft bearing (lower)
- 25. Crankshaft
- ◆A◆ 26. Crankshaft bearing (upper)
- 27. Check valve*
- 28. Oil jet*
- 29. Gasket*
- 30. Oil jet**
- 31. Cylinder block

NOTE
*: Double camshaft engine <Up to 1995 model>
**: Double camshaft engine <From 1996 model>

Caution
On the flexible wheel equipped engines, do not remove any of the bolts "A" of the flywheel shown in the illustration. The balance of the flexible flywheel is adjusted in an assembled condition. Removing the bolt, therefore, can cause the flexible flywheel to be out of balance, giving damage to the flywheel.

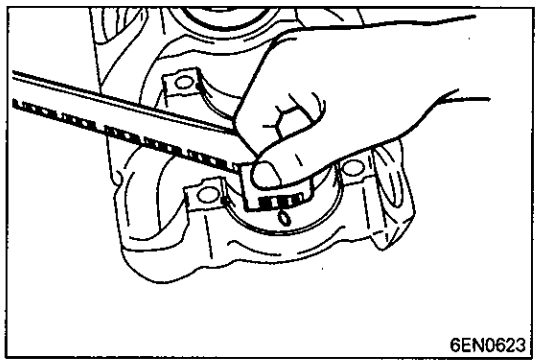
6EN1281



INSPECTION

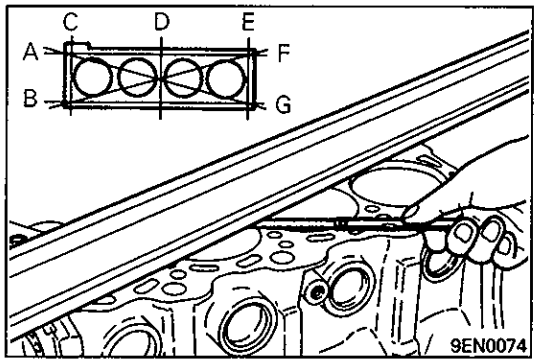
CRANKSHAFT OIL CLEARANCE (PLASTIC GAUGE METHOD)

(1) Remove oil from the crankshaft journal and crankshaft bearing.
(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 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 – 0.04 mm (0.0008 – 0.0016 in.)
Limit: 0.1 mm (0.004 in.)



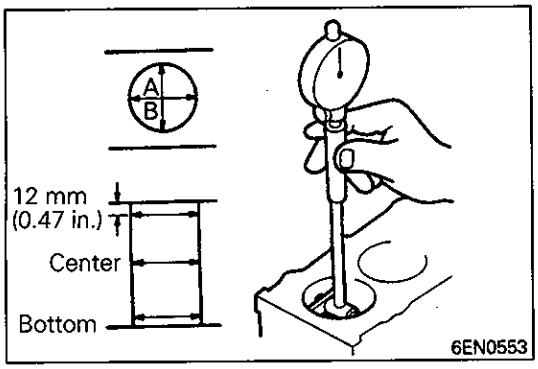
CYLINDER BLOCK

(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.

Standard value: 0.05 mm (0.0020 in.)
Limit: 0.1 mm (0.004 in.)

(3) If the distortion is excessive, correct within the allowable limit or replace.

Grinding limit: 0.2 mm (0.008 in.)
The total thickness of the stock allowed to be removed from the cylinder block and the mating cylinder head is 0.2 mm (0.008 in.) at maximum.
Cylinder block height (when new):
4G63 283.9 – 284.1 mm (11.177 – 11.185 in.)
4G64 289.9 – 290.1 mm (11.413 – 11.421 in.)



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

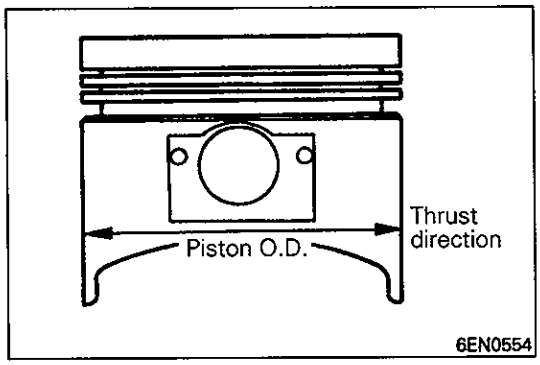
Standard value:
Cylinder I.D.
4G63
85.00 – 85.03 mm (3.3465 – 3.3476 in.)
4G64
86.50 – 86.53 mm (3.4055 – 3.4067 in.)
Cylindricity 0.01 mm (0.0004 in.)

CYLINDER BORING

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

Piston size identification

Size	Identification mark
0.50 mm (0.02 in.) O.S.	0.50
1.00 mm (0.04 in.) O.S.	1.00



NOTE
Size mark is stamped on the piston top.

(2) Measure the outside diameter of a piston to be used. Measure it in the 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 (0.0008 in.) (honing margin)

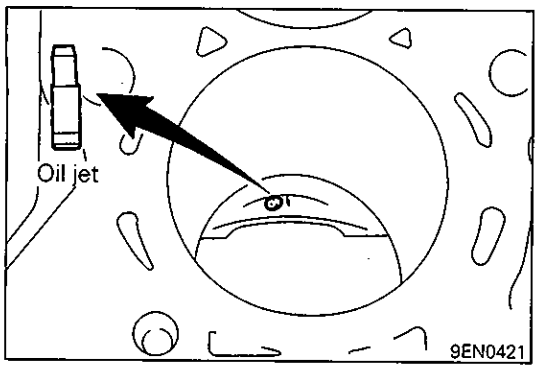
(4) Bore all cylinders to the calculated boring finish dimension.

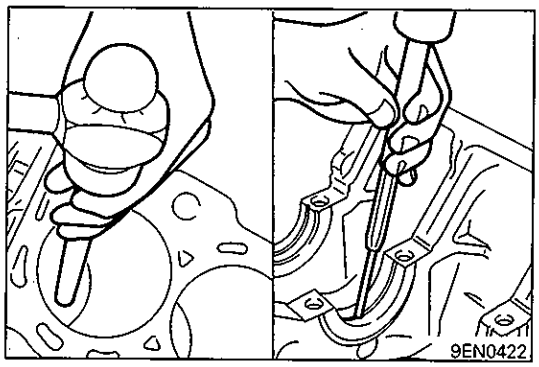
Caution
- **To prevent distortion that may result from temperature rise during boring, bore cylinders, working from No. 2 to No. 4 to No. 1 to No. 3.**

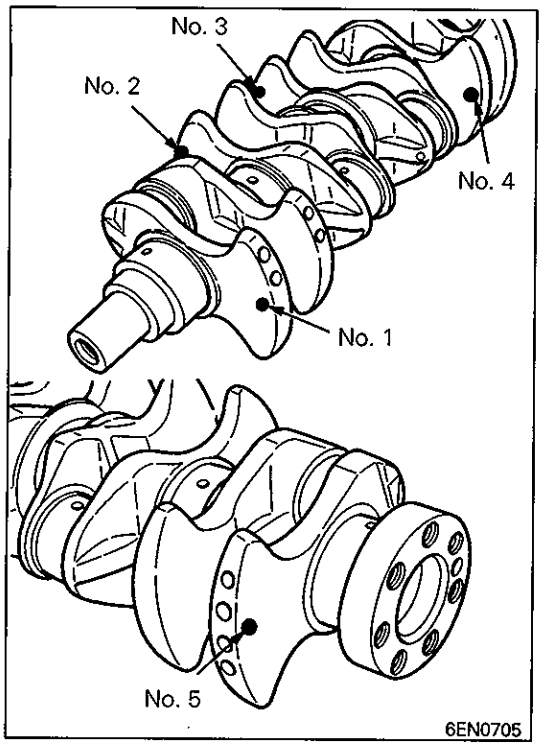
(5) Hone to the final finish dimension (piston O.D. + clearance between piston O.D. and cylinder).
(6) Check the clearance between the piston and cylinder.

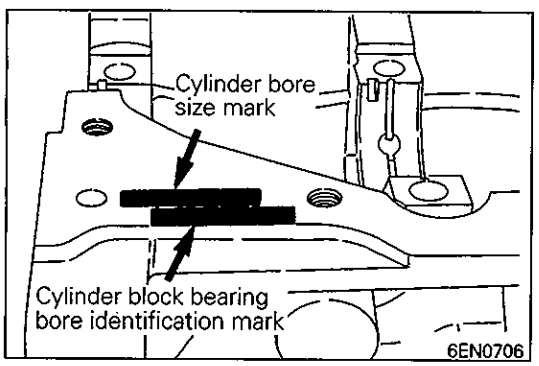
Clearance between piston and cylinder:
0.02 – 0.04 mm (0.0008 – 0.0016 in.)

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









OIL JET REPLACEMENT PROCEDURE (DOUBLE CAMSHAFT ENGINE – FROM 1996 MODEL)

(1) Use a suitable length of metal rod to drive the oil jet out.

Caution
- **Use utmost care not to cause damage to the cylinder wall.**
- **Do not reuse the removed oil jet.**

(2) Use a pin punch 4.5 mm in diameter to install the oil jet through the crankshaft journal until it bottoms.

INSTALLATION SERVICE POINTS

◆A◆ CRANKSHAFT BEARING INSTALLATION

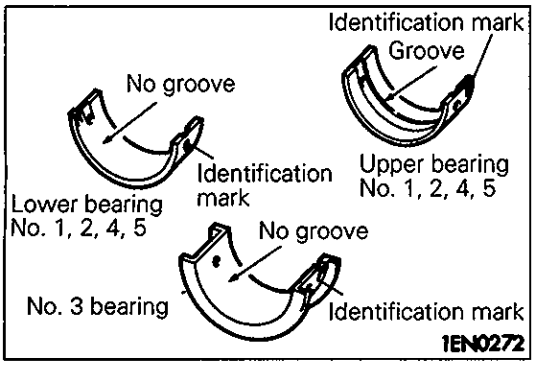
When the bearing needs replacing, select and install a proper bearing by the following procedure.

(1) Measure the crankshaft journal diameter and confirm its classification from the following table. In the case of a crankshaft supplied as a service part, identification colors of its journals are painted at the positions shown in the illustration.

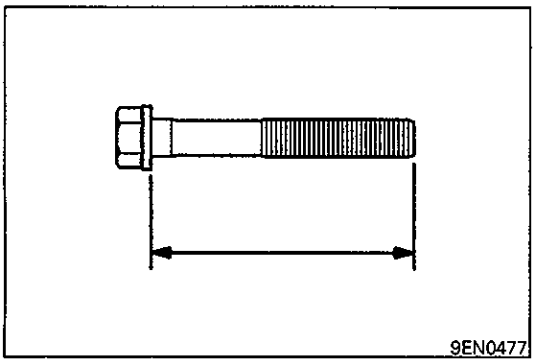
(2) The cylinder block bearing bore diameter identification marks are stamped at the position shown in the illustration from front to rear beginning at No. 1.

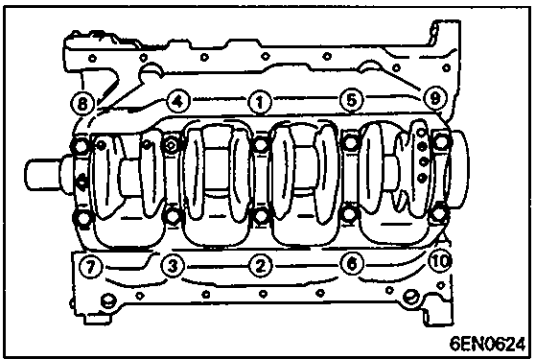
Combination of crankshaft journal diameter and cylinder block bearing bore diameter					Bearing identification mark (for service part)
Crankshaft journal				Cylinder block bearing bore diameter identification mark	
Classification	Identification color		O.D. mm (in.)		
	Production part	Service part			
1	None	Yellow	57.000 – 57.006 (2.2441 – 2.2443)	0	1
				1	2
				2	3
2	None	None	57.006 – 57.012 (2.2441 – 2.2445)	0	2
				1	3
				2	4
3	None	White	57.012 – 57.018 (2.2446 – 2.2448)	0	3
				1	4
				2	5

(3) Select a proper bearing from the above table on the basis of the identification data confirmed under Items (1) and (2).



[Example]
(1) If the measured value of a crankshaft journal outer diameter is between 57.000 and 57.006 mm (2.2441 and 2.2443 in.), the journal is classified as "1" in the table.
In case the crankshaft is also replaced by a spare part, check the identification colors of the journals painted on the new crankshaft. If the color is yellow, for example, the journal is classified as "1".
(2) Next, check the cylinder block bearing hole identification mark stamped on the cylinder block. If it is "0", read the "Bearing identification mark" column to find the identification mark of the bearing to be used. In this case, it is "1".
(3) Install the bearings having an oil groove to the cylinder block.
(4) Install the bearings having no oil groove to the bearing caps.





◆B◆ BEARING CAP / BEARING CAP BOLT INSTALLATION

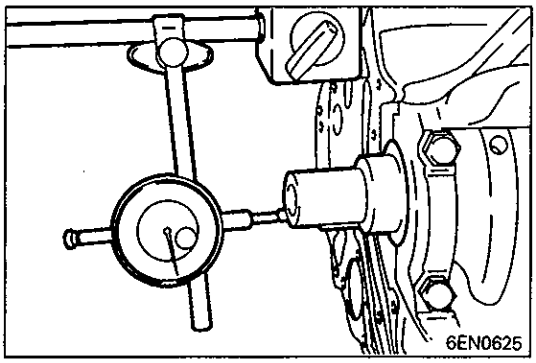
(1) Install the bearing caps so that their arrows are directed to the timing belt side.
(2) Before installing the bearing cap bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolt.

Limit (A): 71.1 mm (2.79 in.)

(3) Apply engine oil to the threaded portion and bearing surface of the bolt.
(4) Tighten the bolts to 25 Nm (2.5 kgm, 18 ft.lbs.) in the specified tightening sequence.

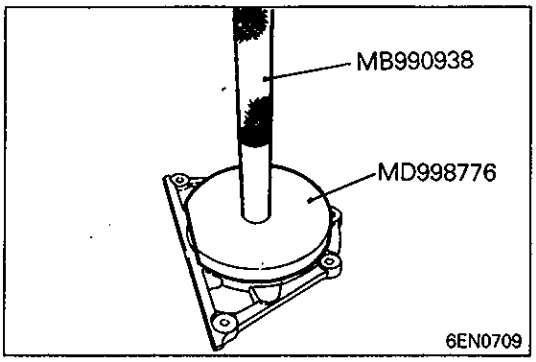
(5) Make a paint mark on the head of each bolt.
(6) Make a paint mark on the bearing cap at the position 90° to 100° from the paint mark made on the bolt in the direction of tightening the bolt.
(7) According to the specified tightening sequence, give a 90° to 100° turn to each bolt and make sure that the paint mark on the bolt and that on the cap are in alignment.

Caution
- **If the bolt is turned less than 90°, proper fastening performance may not be expected. When tightening the bolt, therefore, be careful to give a sufficient turn to it.**
- **If the bolt is overtightened (exceeding 100°), loosen the bolt completely and then retighten it by repeating the tightening procedure from step (1).**

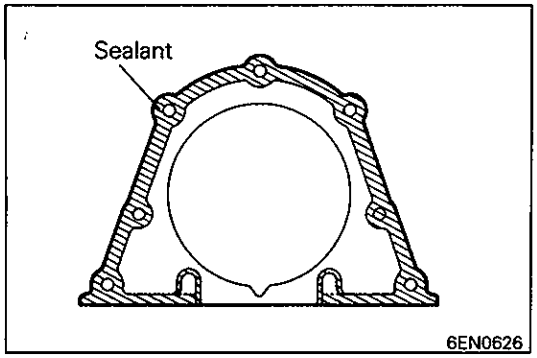


(8) After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace the crankshaft bearings.

Standard value: 0.05 – 0.25 mm (0.0020 – 0.0098 in.)
Limit: 0.4 mm (0.016 in.)



◆C◆ OIL SEAL INSTALLATION

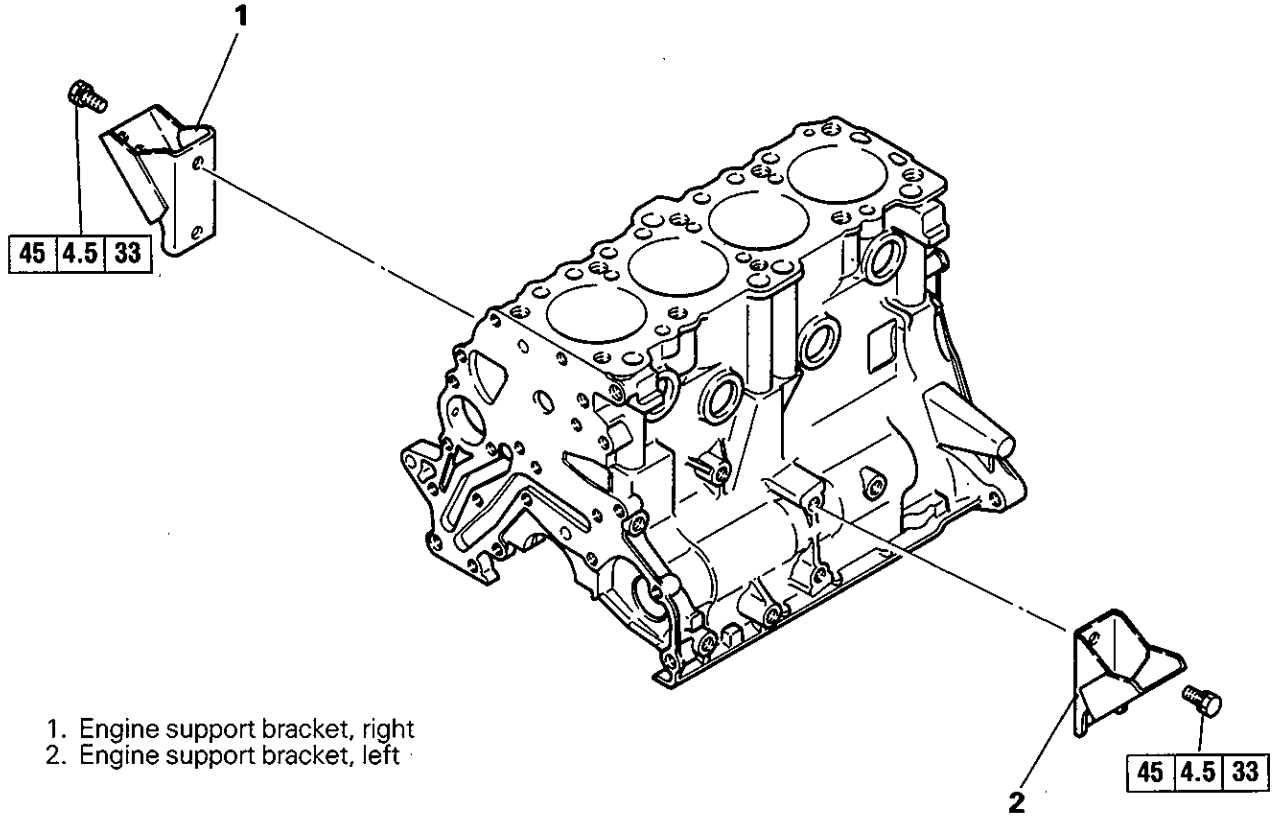


◆D◆ SEALANT APPLICATION TO OIL SEAL CASE

Specified sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

13. ENGINE MOUNT BRACKETS

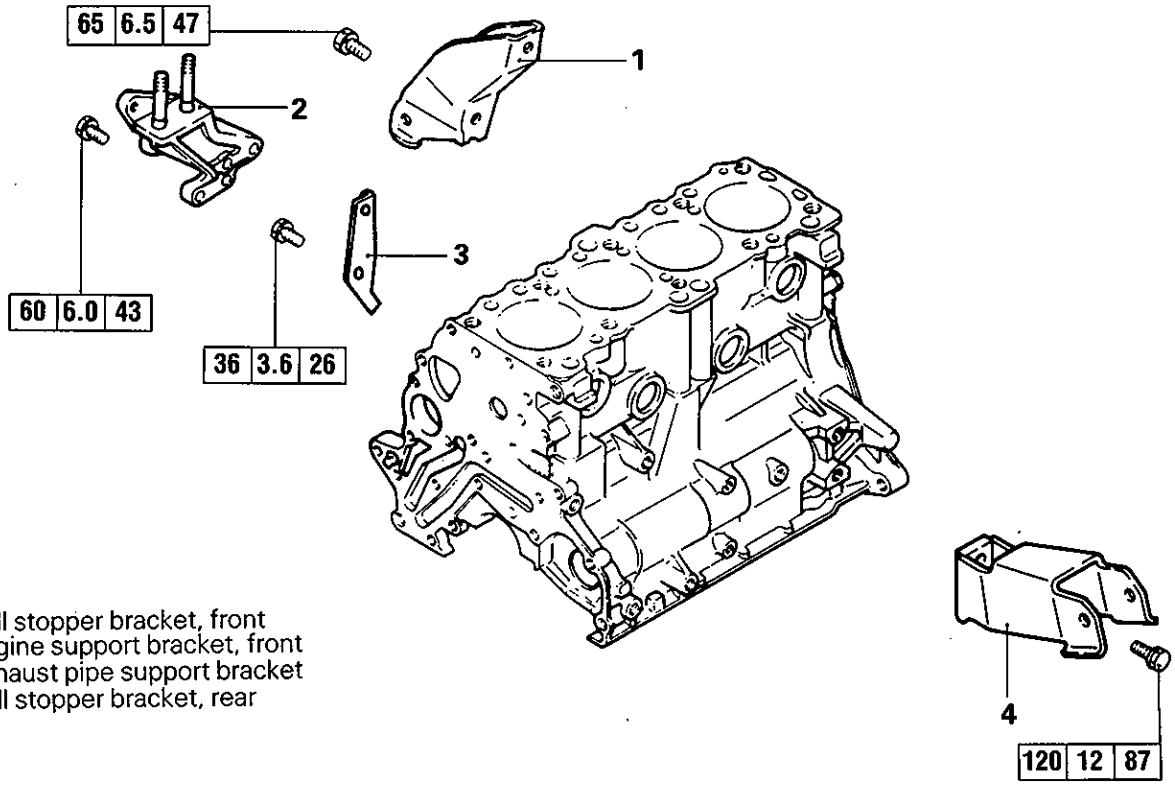
REAR WHEEL DRIVE AND FOUR WHEEL DRIVE



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

6EN0583

FRONT WHEEL DRIVE AND FOUR WHEEL DRIVE



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

6EN0722

NOTES

Service Bulletins

Click on the applicable bookmark to select the Service Bulletin.

SERVICE BULLETIN

MITSUBISHI MOTORS

TECHNICAL SERVICE PLANNING
INTERNATIONAL CAR ADMINISTRATION OFFICE. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	NO. : MSB-01E11-501	
	DATE : 2001-3-20	<MODEL> <M/Y> (EC)GALANT(E50-80,EA0) 93-10 (EC)ECLIPSE(D20,30) (EC)SPACE RUNNER(N10,20,60) (EC)SPACE WAGON(N30,40,80,90) (EC)L200(K00T,K30T,K60,70) (EC)L300(P00) (EC)L400(PA0～PD0) (EC)PAJERO/MONTERO(V10-40)
SUBJECT : CORRECTION TO CRANKSHAFT BEARING INSTALLATION PROCEDURES		
GROUP : ENGINE	DRAFTNO. : 00EN622018	
CORRECTION	INTERNATIONAL CAR ADMINISTRATION OFFICE	T. MASAKI - MANAGER TECHNICAL SERVICE PLANNING

1. Description:

Correction has been made to the installation procedures for the 4G6 engine crankshaft bearings.

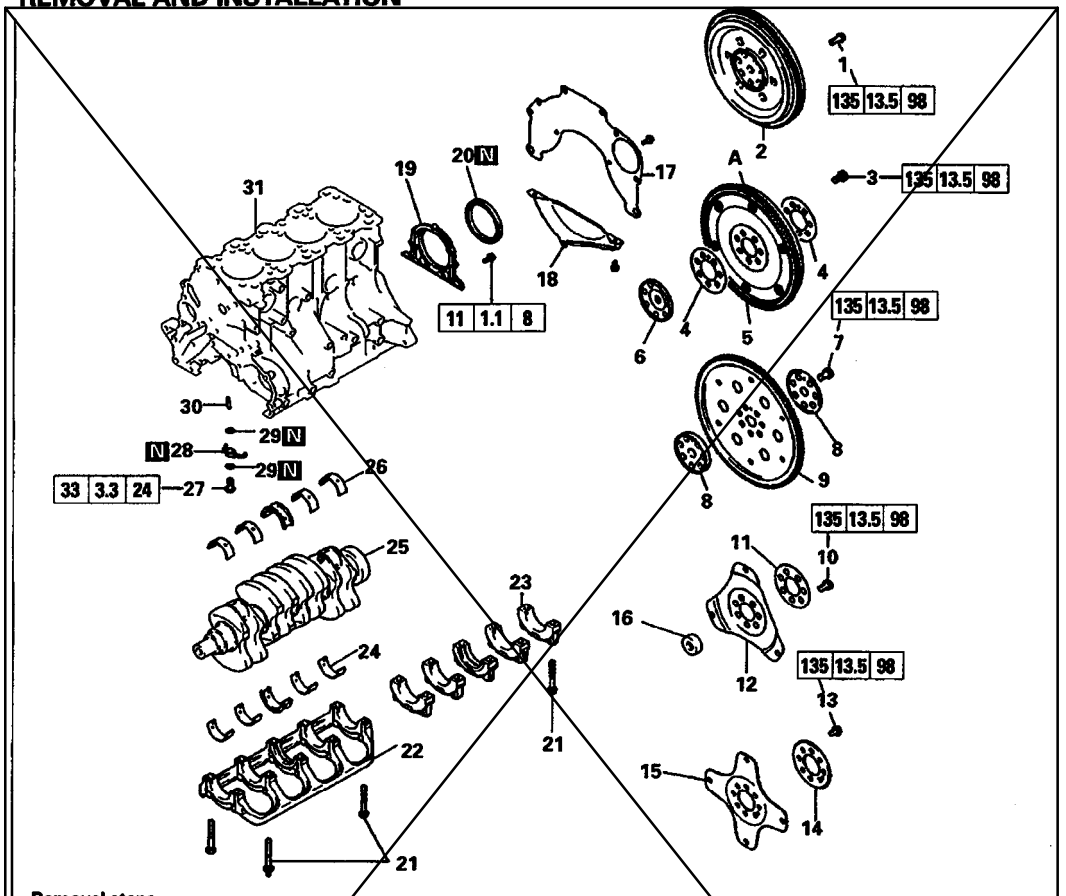
2. Applicable Manuals:

Manual	Pub. No.	Page
ENGINE 4G6 (E-W) Workshop Manual	PWEE9616 (English)	11A-12-1 11A-12-1a 11A-12-3 11A-12-4
	PWES9617 (Spanish)	
	PWEF9618 (French)	
	PWEG9619 (German)	
	PWED9620 (Dutch)	
	PWEW9621 (Swedish)	
ENGINE 4G6 (W-E) Workshop Manual	PWEE9037 (English)	11B-12-1 11B-12-4 11B-12-5
	PWES9038 (Spanish)	
	PWEF9039 (French)	
	PWEG9040 (German)	
	PWED9041 (Dutch)	
	PWEW9042 (Swedish)	

12. CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION

<Incorrect>



Removal steps

1. Flywheel bolt
2. Flywheel
3. Flywheel bolt
4. Adapter plate
5. Flexible flywheel
6. Crankshaft adapter
7. Drive plate bolt
8. Adapter plate
9. Drive plate
10. Drive plate bolt
11. Adapter plate
12. Drive plate
13. Drive plate bolt
14. Adapter plate
15. Drive plate
16. Crankshaft bushing
17. Rear plate
18. Bell housing cover

Engines combined with M/T (Except 4G64 engine for L400 for Europe)
Engines combined with M/T (4G64 engine for L400 for Europe)
8-valve single camshaft engines combined with A/T
16-valve single camshaft engines combined with A/T
Double camshaft engines combined with A/T
– Engines combined with A/T

◆D◆ 19. Oil seal case
◆C◆ 20. Oil seal
◆B◆ 21. Bearing cap bolt
◆B◆ 22. Bearing cap – 4G64 8-valve single camshaft engine, 16-valve single camshaft engine, double camshaft engine
◆B◆ 23. Bearing cap – 4G63 8-valve single camshaft engine
◆A◆ 24. Crankshaft bearing (lower)
25. Crankshaft
◆A◆ 26. Crankshaft bearing (upper)
27. Check valve*
28. Oil jet*
29. Gasket*
30. Oil jet**
31. Cylinder block

NOTE
*: Double camshaft engine <Up to 1995 model>
**: Double camshaft engine <From 1996 model>

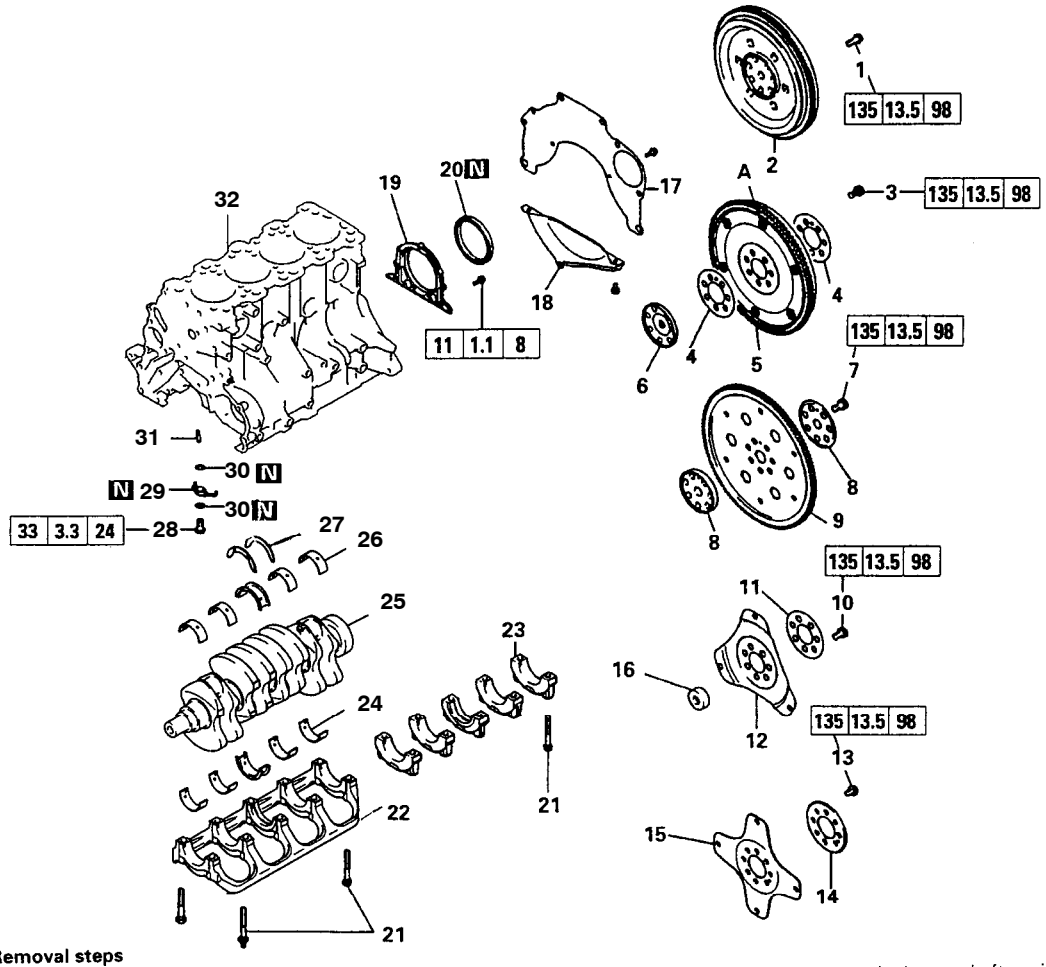
Caution
On the flexible wheel equipped engines, do not remove any of the bolts "A" of the flywheel shown in the illustration. The balance of the flexible flywheel is adjusted in an assembled condition. Removing the bolt, therefore, can cause the flexible flywheel to be out of balance, giving damage to the flywheel.

6EN1281

 PWEE9037-D Revised

Corrected to following page

<Correct>



Removal steps

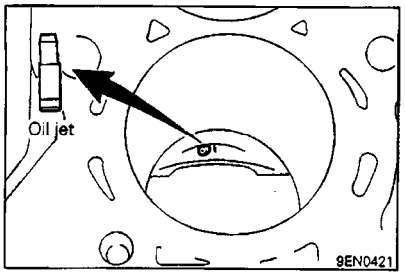
1. Flywheel bolt
2. Flywheel
3. Flywheel bolt
4. Adapter plate
5. Flexible flywheel
6. Crankshaft adapter
7. Drive plate bolt
8. Adapter plate
9. Drive plate
10. Drive plate bolt
11. Adapter plate
12. Drive plate
13. Drive plate bolt
14. Adapter plate
15. Drive plate

Engines combined with M/T (Except 4G64 engine for L400 for Europe)
Engines combined with M/T (4G64 engine for L400 for Europe)
8-valve single camshaft engines combined with A/T
16-valve single camshaft engines combined with A/T
Double camshaft engines combined with A/T

16. Crankshaft bushing – Engines combined with A/T
17. Rear plate
18. Bell housing cover
◆D◆ 19. Oil seal case
◆C◆ 20. Oil seal
◆B◆ 21. Bearing cap bolt
◆B◆ 22. Bearing cap – 4G64 8-valve single camshaft engine, 16-valve single camshaft engine, double camshaft engine
◆B◆ 23. Bearing cap – 4G63 8-valve single camshaft engine
◆A◆ 24. Crankshaft bearing (lower)
25. Crankshaft
◆A◆ 26. Crankshaft bearing (upper)
27. Crankshaft thrust bearing - Except thrust bearing-integrated type
28. Check valve*
29. Oil jet*
30. Gasket*
31. Oil jet**
32. Cylinder block

NOTE
*: Double camshaft engine <Up to 1995 model>
**: Double camshaft engine <From 1996 model>

Caution
On the flexible wheel equipped engines, do not remove any of the bolts "A" of the flywheel shown in the illustration. The balance of the flexible flywheel is adjusted in an assembled condition. Removing the bolt, therefore, can cause the flexible flywheel to be out of balance, giving damage to the flywheel.

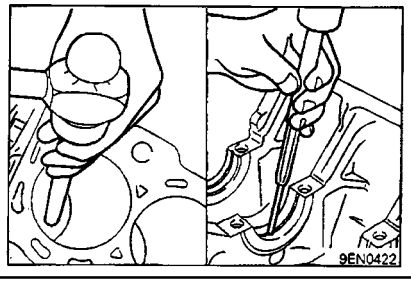


OIL JET REPLACEMENT PROCEDURE (DOUBLE CAMSHAFT ENGINE – FROM 1996 MODEL)

(1) Use a suitable length of metal rod to drive the oil jet out.

Caution
- **Use utmost care not to cause damage to the cylinder wall.**
- **Do not reuse the removed oil jet.**

(2) Use a pin punch 4.5 mm in diameter to install the oil jet through the crankshaft journal until it bottoms.



Corrected to the following two pages

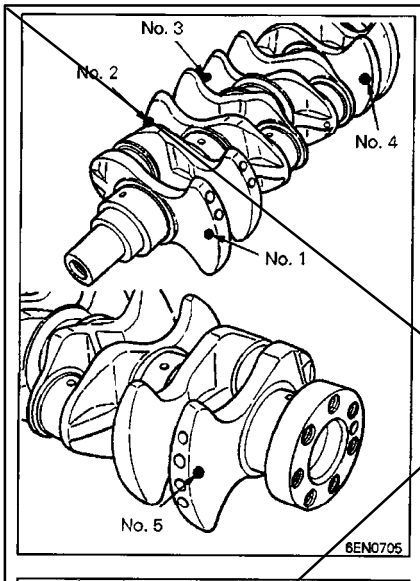
<Incorrect>

INSTALLATION SERVICE POINTS

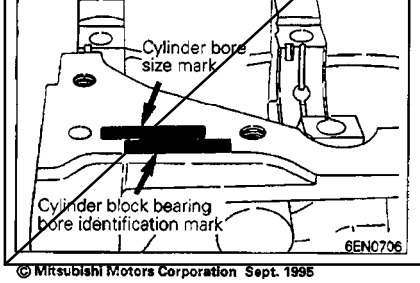
▶A◀ CRANKSHAFT BEARING INSTALLATION

When the bearing needs replacing, select and install a proper bearing by the following procedure.

(1) Measure the crankshaft journal diameter and confirm its classification from the following table. In the case of a crankshaft supplied as a service part, identification colors of its journals are painted at the positions shown in the illustration.



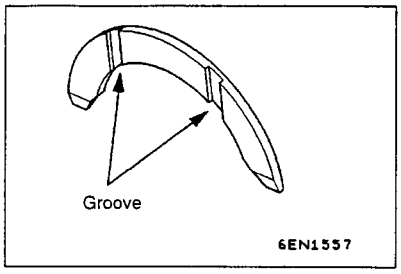
(2) The cylinder block bearing bore diameter identification marks are stamped at the position shown in the illustration from front to rear beginning at No. 1.



Combination of crankshaft journal diameter and cylinder block bearing bore diameter					Bearing identification mark (for service part)
Crankshaft journal				Cylinder block bearing bore diameter identification mark	
Classification	Identification color		O.D. mm (in.)		
	Production part	Service part			
1	None	Yellow	57.000 – 57.006 (2.2441 – 2.2443)	0	1
				1	2
				2	3
2	None	None	57.006 – 57.012 (2.2441 – 2.2445)	0	2
				1	3
				2	4
3	None	White	57.012 – 57.018 (2.2446 – 2.2448)	0	3
				1	4
				2	5

(3) Select a proper bearing from the above table on the basis of the identification data confirmed under Items (1) and (2).

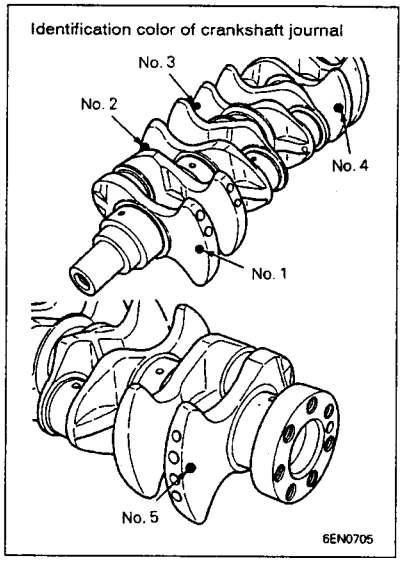
<Correct>



INSTALLATION SERVICE POINTS

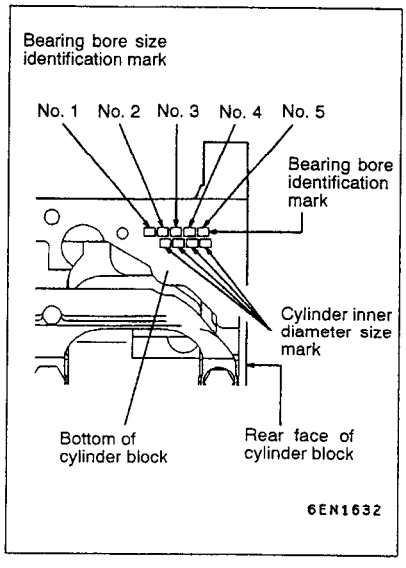
▶B◀ CRANKSHAFT THRUST BEARING INSTALLATION

(1) Install the two thrust bearing in the number 3 bearing bore in the cylinder block. For easier installation, apply engine oil to the bearings; this will help hold them in position.
(2) The thrust bearings must be installed with their groove side toward the crankshaft web.



▶C◀ CRANKSHAFT BEARING INSTALLATION

(1) From the following table, select a bearing whose size is appropriate for the crankshaft journal outside diameter.



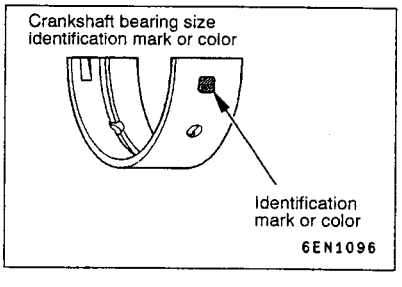
<Correct>

Type 1 (Engine with thrust bearing that is integral with No.3 bearing)

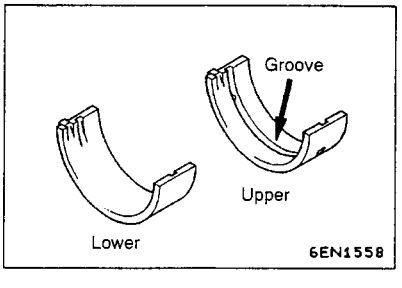
Crankshaft journal outside diameter		Cylinder block bearing bore	Crankshaft bearing
Identification r color	Size mm	Identification mark	Identification mark or color
Yellow	56.994 ~ 57.000	0	1 or Green
		1	2 or Yellow
		2	3 or None
None	56.988 ~ 56.994	0	2 or Yellow
		1	3 or None
		2	4 or Blue
White	56.982 ~ 56.988	0	3 or None
		1	4 or Blue
		2	5 or Red

Type 2 (Engine with thrust bearing that is separate from No.3 bearing)

Crankshaft journal outside diameter		Cylinder block bearing bore	Crankshaft bearing for No.1,2,4,5	Crankshaft bearing for No.3
Identification r color	Size mm	Identification mark	Identification mark or color	Identification mark or color
Yellow	56.994 ~ 57.000	0	1 or Green	0 or Black
		1	2 or Yellow	1 or Green
		2	3 or None	2 or Yellow
None	56.988 ~ 56.994	0	2 or Yellow	1 or Green
		1	3 or None	2 or Yellow
		2	4 or Blue	3 or None
White	56.982 ~ 56.988	0	3 or None	2 or Yellow
		1	4 or Blue	3 or None
		2	5 or Red	4 or Blue



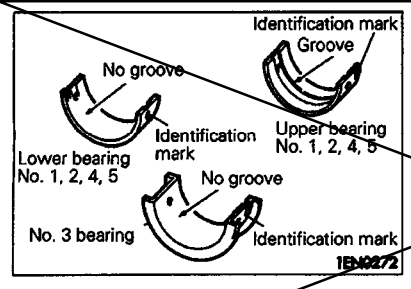
For example, if the crankshaft journal outside diameter ID color is "yellow" and cylinder block bearing bore ID mark is "1", select a bearing whose ID mark is "2" or ID color is "yellow" for number 1, 2, 4 and 5, and a bearing whose ID mark is "1" or ID color is "green" for number 3.
If there is no ID color paint on the crankshaft, measure the journal outside diameter and select a bearing appropriate for the measured value.



(2) Install the bearings having an oil groove to the cylinder block.

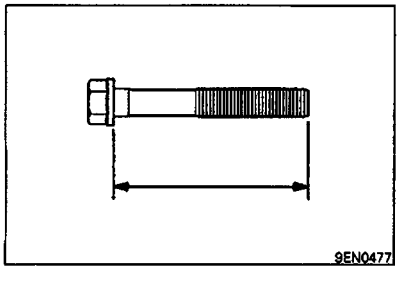
NOTE
The No.3 bearing that is integral with the thrust bearing has no grooves.

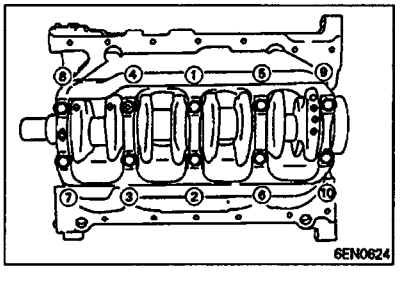
(3) Install the bearings having no oil groove to the bearing cap.



[Example]
(1) If the measured value of a crankshaft journal outer diameter is between 57.000 and 57.006 mm (2.2441 and 2.2443 in.), the journal is classified as "1" in the table.
In case the crankshaft is also replaced by a spare part, check the identification colors of the journals painted on the new crankshaft. If the color is yellow, for example, the journal is classified as "1".
(2) Next, check the cylinder block bearing hole identification mark stamped on the cylinder block. If it is "0", read the "Bearing identification mark" column to find the identification mark of the bearing to be used. In this case, it is "1".
(3) Install the bearings having an oil groove to the cylinder block.
(4) Install the bearings having no oil groove to the bearing caps.

<Deleted>





◆B◆ BEARING CAP / BEARING CAP BOLT INSTALLATION

(1) Install the bearing caps so that their arrows are directed to the timing belt side.
(2) Before installing the bearing cap bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolt.
Limit (A): 71.1 mm (2.79 in.)
(3) Apply engine oil to the threaded portion and bearing surface of the bolt.
(4) Tighten the bolts to 25 Nm (2.5 kgm, 18 ft.lbs.) in the specified tightening sequence.