

MITSUBISHI MINICAB BRAVO

Full Mechanical Service Edition

Specifications
General Maintenance
Engine Overhaul 3G83 DOHC-SOHC
Fuel System
Cooling System
Emission Controls
Transmission Maintenance
Driveline
Suspension
Brake System
Steering System
Heater

2WD-4WD
1990-1998

James Danko

Mitsubishi

MINICAB & BRAVO
English Mechanical Service Manual

Full Mechanical Version

Truck & Van

3G83 660cc Gasoline Engines

2WD & 4WD

V-U41T

V-U42T

V-U41TP

V-U42TP

V-U41V

V-U42V

V-U43V

V-U44V

MT-AT Vehicles

1990-1998

James Danko

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Credits: I would like to thank Yoshiro for all his computer technology to make these books happen. His computer graphics and technology is simply the best. www.yoshiro.com

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Introduction

Due to the high request for English version manuals on Japanese mini trucks & Vans, we are publishing wide variety information to provide the mini truck community with the ability to maintain their vehicles.

Japanese mini trucks & vans are produced only for the Japanese market. Therefore, all original manuals are only available in Japanese. Translations of the original Japanese to English have been translated by the author. During the process of translating from Japanese to English mistakes in the original Japanese text were found. The best possible English translations have been added by the author in these cases.

Service manuals are not sold to the public in Japan, as in many countries. You must be a new car dealer to receive them. We have a few hundred in stock. We do not sell manuals from our own library. We have started publishing them in English (Translated) and our own original versions.

This book or manual is for the professional mechanic. It is written in Factory Service Manual perspective. It is full of diagrams and schematics that are easily understood by a professional mechanic. Complete diagrams of all major parts, including body. You will have the same information as the Mitsubishi Factory technicians have. This book is written by a mechanic, for mechanics.

We have manuals for all Japanese manufactures. It's a time consuming process, please check our web page frequently as we post more information.

Note: Part numbers are often changed by the manufactures over time. When ordering parts always include your Japanese VIN (Vehicle Identification Number). Your supplier will be able to easily reference any part number changes when you include your VIN.

For more information please visit our home page at www.yokohamamotors.com

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2. Vehicle VIN Decoding (VIN)
3. Jacking Locations

Vehicle Code Identification: Body Type: ENG-TRANS Combinations

TRUCK

Series	Vehicle Code	Type	Engine Series	Transmission
V-U41T	CFSV	TS	3G83 SOHC 4 VALVE	R4 M11 (2WD-4M/T)
	HFSV	TS		
	CFDV	TD		
	HFDV	TD		R3 AS1 (2WD-3AT)
	HKDV			
	HFDV6			
	SFS	TU	3G83 2 VALVE	R4 M11 (2WD-4M/T)
	HFS	TU		
	HFDV 4	MIGHTY	3G83 SOHC 4 VALVE	V4 M11 PT/4WD-4M/T
	HNJV	TL		
	HFDV5	SUPER CUSTOM		
	HKDV5			
	HFDV7			
HFDV5	SUPER CUSTOM			
HFDV7				
V-U42T	HFSV	TS	3G83 SOHC 4 VALVE	R4 M11 (2WD-4M/T)
	HFDV	TD		
	HFDV6	TD		
	HFDV4	MIGHTY		V4 M11 PT/4WD-4M/T
	HNJV	TL		
	HFDV5	SUPER CUSTOM		
	HFDV7			
V-U42T	HFSV	TS	3G83 SOHC 4 VALVE	R4 M11 (2WD-4M/T)
	HFDV	TD		
	HFDV6	TD		
	HFDV4	MIGHTY		V4 M11 PT/4WD-4M/T
	HNJV	TL		
	HFDV5	SUPER CUSTOM		
	HFDV7			

MINICAB DUMP TRUCK

Series	Vehicle Code	Type	Engine Series	Transmission
V-U41T	HFDV	DUMP	3G83	R4 M11 (2WD-4M/T)
V-U42T	HFDV9		4 VALVE	V4 M11 PT/4WD-4M/T

MINICAB PANEL VAN (TRUCK FRAME)

Series	Vehicle Code	Type	Engine Series	Transmission
V-U41TP	FSV	PANEL VAN	3G83	R4 M11 (2WD-4M/T)
	LFSV		4 VALVE	

Vehicle Code Identification: Body Type: ENG-TRANS Combinations

MINICAB VAN

Series	Vehicle Code	Type	Engine Series	Transmission
V-U41	LFSV	CS	3G83 4 VALVE	R4 M11 (2WD-4M/T)
	LFSVC	CS 2-SEAT		
	GLFSVC	CS 2-SEAT		
	HLFSVC	CS 2-SEAT HIGH ROOF		
	JLFSVC	CS 2-SEAT HIGH ROOF		
	LFDV	CD		R3 AS1 (2WD-3AT)
	HLFDV	CD		
	HLKDV	CD		
	HLNJV	CL HIGH ROOF		R5 M11 (2WD-5M/T)
	HLKJV	CD		R3 AS1 (2WD-3AT)
V-U42	LFDV	CD	3G83 4 VALVE	V4 M11 PT/4WD-4M/T
	HLFDV	CD HIGH ROOF		
	HLNJV	CL HIGH ROOF		V5 M11 PT/4WD-5M/T

BRAVO VAN

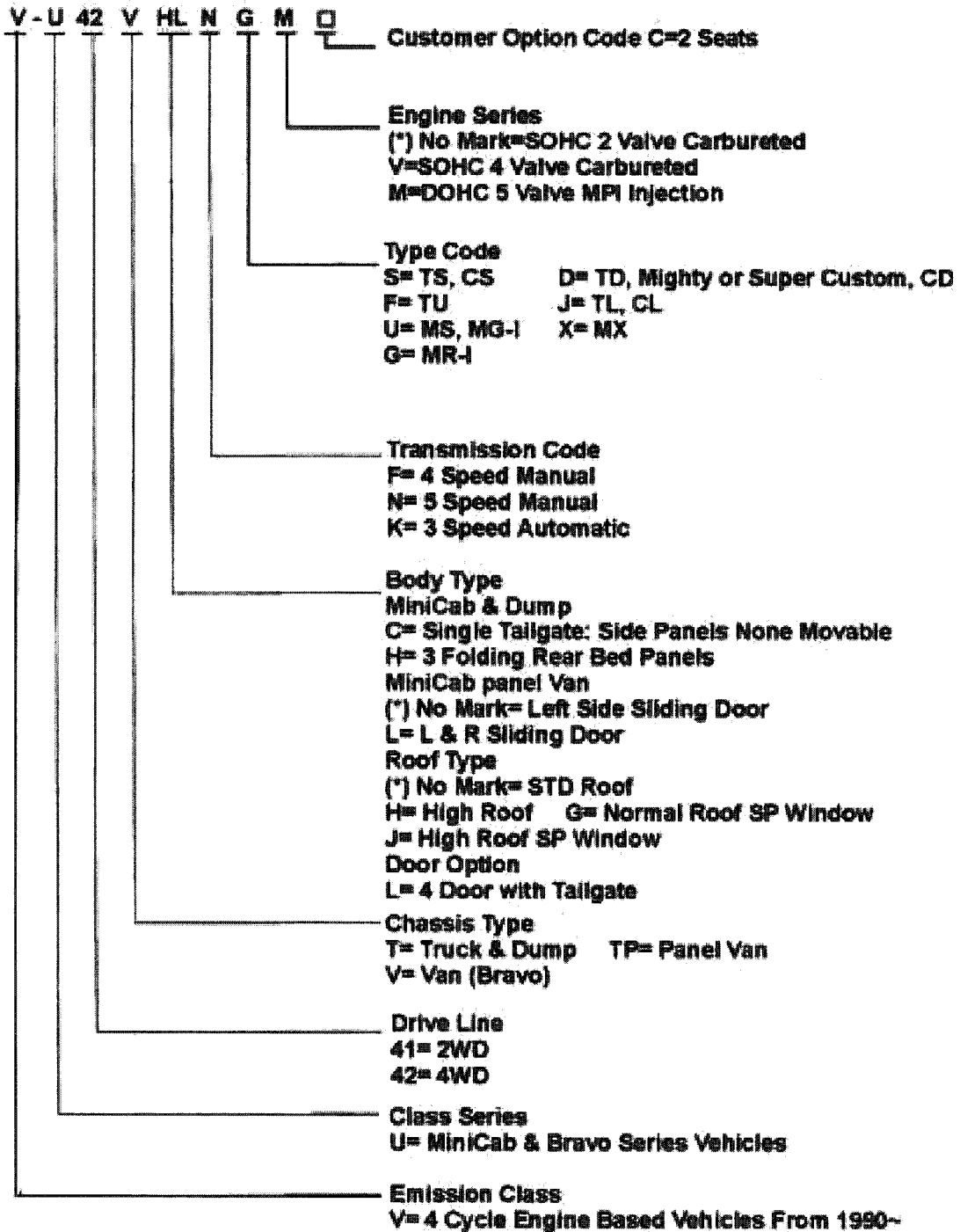
Series	Vehicle Code	Type	Engine Series	Transmission
V-U41V	HLNUV	MS H-ROOF	3G83 4 VALVE	R5 M11 2WD-5M/T
	HLNXV	MX H-ROOF		
	HLKXV			R3 AS1 (2WD-3AT)
	HLNXV2	MX SUPER AERO ROOF	3G83 DOHC- MPI	R5 M11 2WD-5M/T
	HLKXV2			R3 AS1 (2WD-3AT)
	HLNUM	MG-I H-ROOF		R5 M11 2WD-5M/T
	HLKUM			R3 AS1 (2WD-3AT)
	HLNUM2	MG-I SUPER AERO ROOF		R5 M11 2WD-5M/T
	HLKUM2			R3 AS1 (2WD-3AT)
	HLNGM2	MR-I SUPER AERO ROOF		R5 M11 2WD-5M/T

Vehicle Code Identification: Body Type: ENG-TRANS Combinations

BRAVO VAN

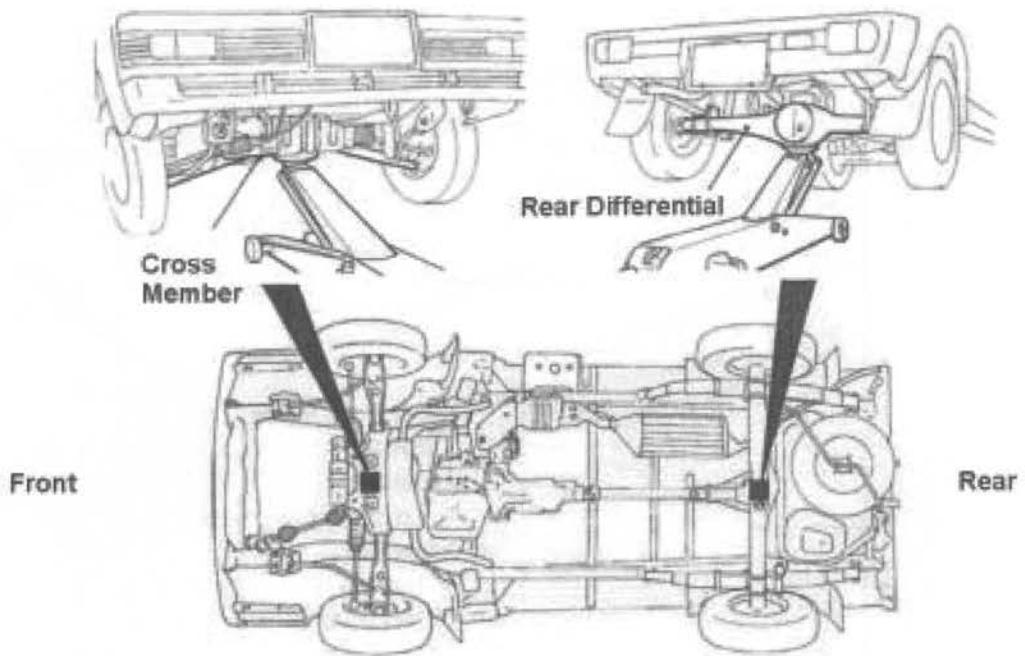
Series	Vehicle Code	Type	Engine Series	Transmission
V-U42V	HLNUV	MS H-ROOF	3G83 4VALVE	V5 M11 FULL TIME 4WD-5M/T
	HLNXV	MX H-ROOF		VAS1 FULL TIME 4WD- 3A/T
	HLKXV			V5 M11 FULL TIME 4WD-5M/T
	HLNXV2	MX SUPER AERO ROOF		VAS1 FULL TIME 4WD- 3A/T
	HLKXV2		V5 M11 FULL TIME 4WD-5M/T	
	HLNUM	MG-I H-ROOF	3G83 DOHC- MPI	V5 M11 FULL TIME 4WD-5M/T
	HLKUM			VAS1 FULL TIME 4WD- 3A/T
	HLNUM2	MG-I SUPER AERO ROOF		V5 M11 FULL TIME 4WD-5M/T
	HLKUM2			VAS1 FULL TIME 4WD- 3A/T
	HLNGM2	MR-I SUPER AERO ROOF	V5 M11 FULL TIME 4WD-5M/T	

VIN Decoding Chart

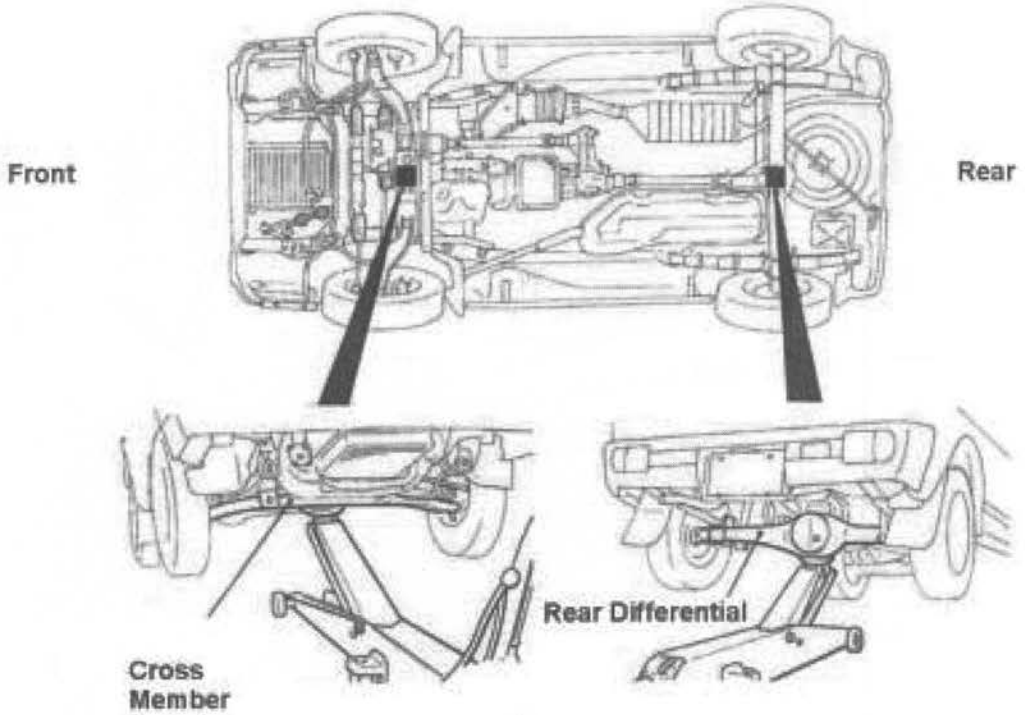


Jacking Positions

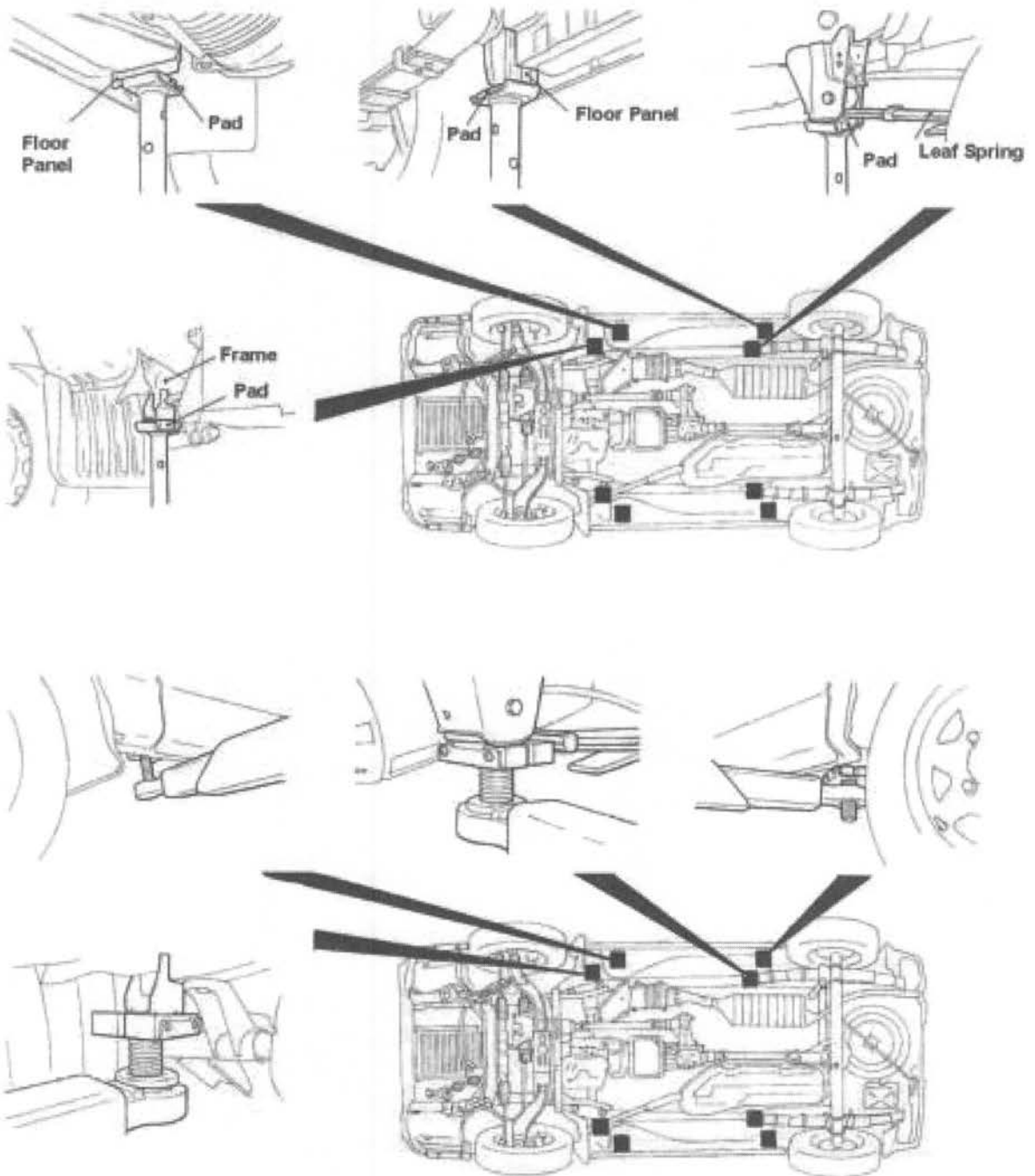
2WD



4WD



Jacking Positions



Chapter 2

General Engine Maintenance

4. Engine Settings & Adjustment Specifications SOHC-DOHC
5. Tools
6. V Belts: Alternator-Power Steering-A/C
7. Valve Clearance SOHC
8. Idle and Timing Settings SOHC
9. CO₂ & HC SOHC
10. Fast Idle & AC Idle SOHC
11. Throttle Position SOHC
12. Cylinder Compression SOHC
13. Intake Manifold Pressure SOHC
14. Timing Belt Inspection SOHC
15. Idle Settings DOHC
16. Timing- CO₂ & HC DOHC
17. Fast Idle Settings DOHC
18. Engine Compression DOHC
19. Intake Manifold Pressure-DOHC
20. Timing Belt Inspection DOHC

Engine Settings & Adjustment Specifications

V-Belts Flex Limitation

Description		Limit	Engine: Notes
Alternator V-Belt (mm)	New Belt	7.5-9.00mm	SOHC
	Old Belt	11mm	Non-PWR Steering
Alternator V-Belt(mm)	New Belt	8.0-10.00mm	SOHC-DOHC
	Old Belt	10.5	PWR Steering
PWR Steering Belt(mm)	New Belt	13.00-16.5mm	All
AC Belt	New Belt	10.00-11.00mm	All
	Old Belt	12.00mm	All







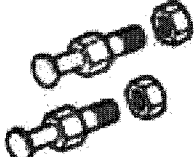



Valve Clearance

Valve Clearance(mm)	Hot	Intake	0.20mm	SOHC
		Exhaust	0.30mm	SOHC
	Cold	Intake	0.14mm	SOHC 2 Valve
		Exhaust	0.24mm	SOHC 2 Valve
		Intake	0.07mm	SOHC 4 Valve
		Exhaust	0.17mm	SOHC 4 Valve

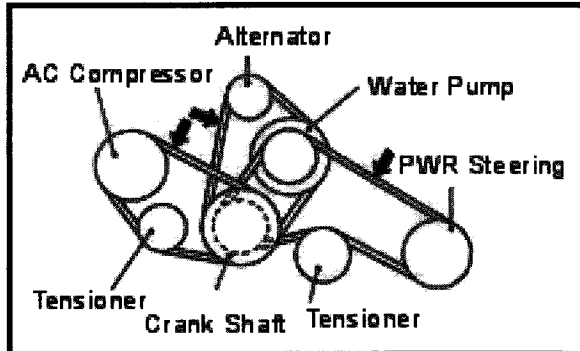
Idle & CO2

Idle RPM	900+-50RPM	SOHC M/T, DOHC
	1000+-50	SOHC AT
Timing Setting	BTDC 6+-2°	SOHC 2 Valve
	BTDC 5+-2°	SOHC/DOHC 4 Valve
CO%	1.0+-0.5	SOHC
	Below 0.6	DOHC
HC ppm	Below 800	SOHC
	Below 200	DOHC
Fast Idle Setting	1500+-50 RPM A/C	SOHC
	1300+-50 RPM Non-A/C	SOHC
	Computer Set	DOHC MPI Vehicles
Compression 400RPM	12.5 kg/cm2	SOHC 2 Valve
	13.0 kg/cm2	SOHC-DOHC 4 Valve
Intake Manifold mmHG	450	SOHC 2 Valve
	470	SOHC-DOHC 4 Valve

Tools

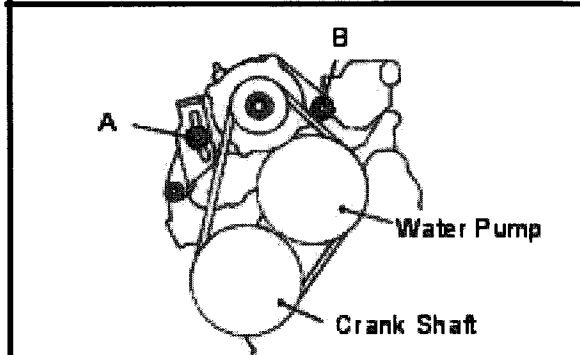
Tool	Part #	Use	SOHC	DOHC
	MD991397	Camshaft Oil Seal	O	X
	MD998713	Camshaft Oil Seal	X	O
	MB991395	Crank Shaft Front Oil Seal	O	O
	MD998376	Crank Shaft Rear Oil Seal	O	O
	MD998747	Sprocket Holder	O	O
	MB990767	Camshaft Holder	O	O
	MD998719	Pulley Holder	O	O
	MD998608	Flywheel Retainer	O	O
	MD998442	Air Bleeder	X	O
	MB991412	Cylinder Head Bolt Socket	O 4 Valve	O

V-Belt System

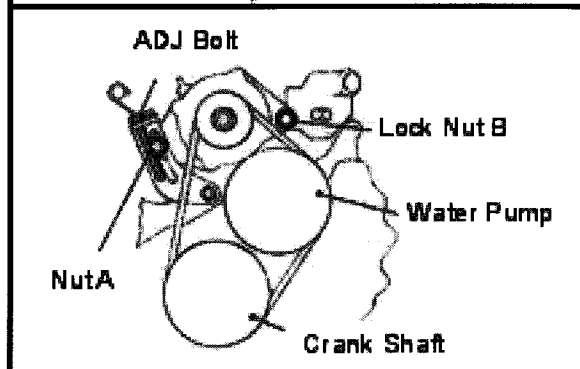


V-Belt Configuration & Routing

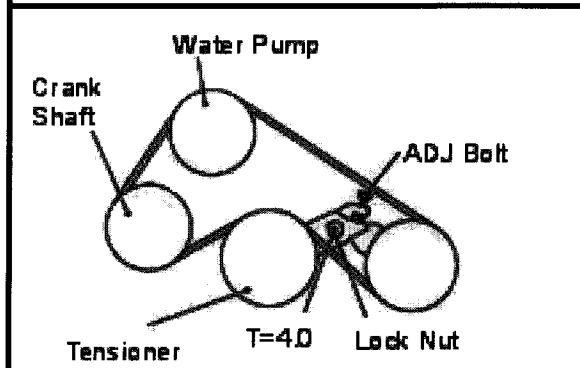
1. Full Option Vehicle: A/C & Power Steering



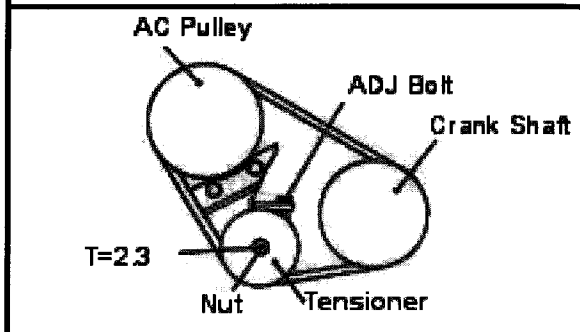
2. Standard Non-Option Configuration



3. A/C Equipped Alternator Pulley Lock Nut Configuration



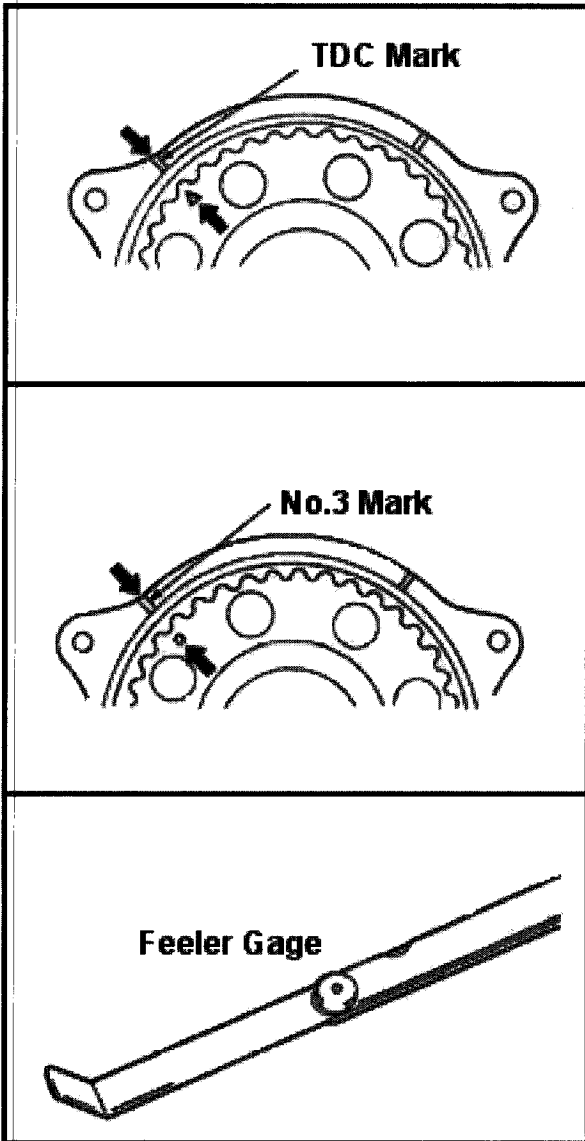
4. Power Steering Belt Configuration and Adjustment Tension Bolts



5. A/C Belt Configuration and Adjustment Bolt Location

Note: Torque (T=) Metric Conversion kg/cm²

Valve Clearance SOHC



Note: Best Temperature to set valves 80-90°C

1. Remove Valve Cover
2. Remove Timing Belt Cover
3. Turn Engine over to TDC position

Note: TDC Mark is a Triangle \triangle

4. Use the chart below and set valves accordingly in order. Always start with TDC No.1 compression first.

5. Rotate Engine to No.3 compression TDC. Check gear for circle mark (o)

6. Set valves required in the chart below using a proper feeler gage.

7. Run engine and check settings hot to verify settings.

8. Install covers

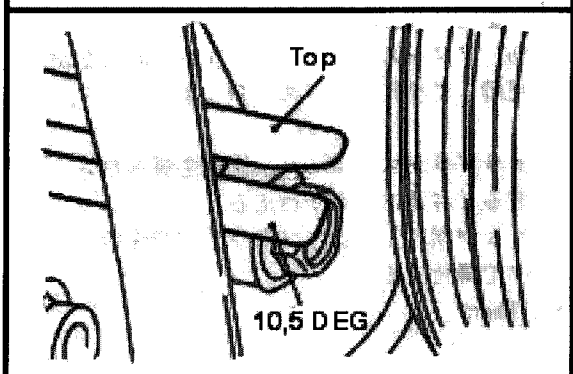
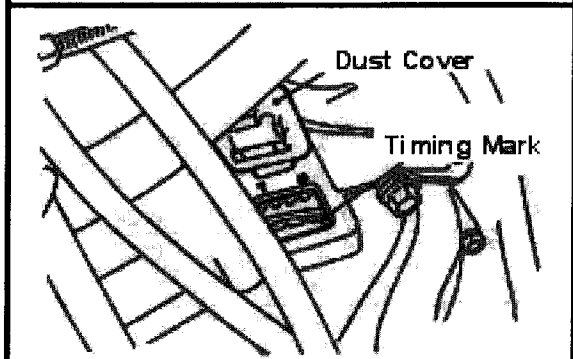
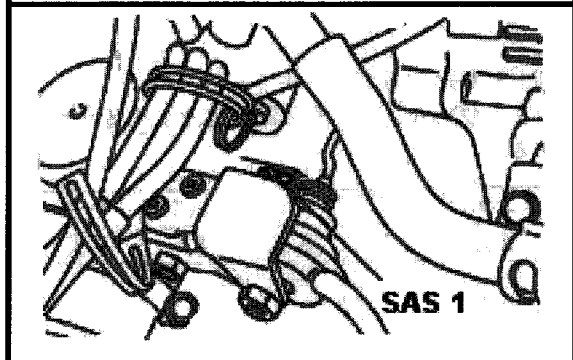
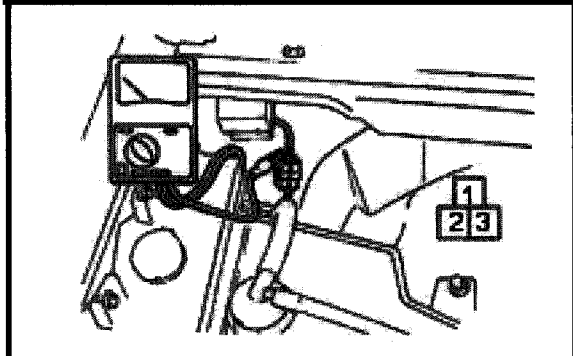
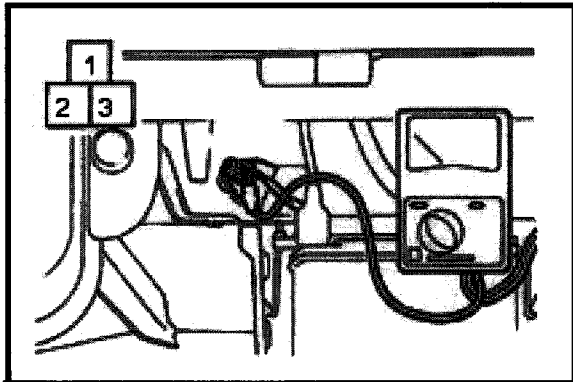
Adjustment Position Chart

Stroke	No.1 Cylinder		No.2 Cylinder		No.3 Cylinder	
	IN	EX	IN	EX	IN	EX
No.1 TDC	○	○	○			○
No.3 TDC				○	○	

Measurement Chart (mm)

Engine Type	Valve Type	Hot	Cold
2 Valve Engine	Intake	0.20mm	0.14mm
	Exhaust	0.30mm	0.24mm
4 Valve Engine	Intake	0.20mm	0.07mm
	Exhaust	0.30mm	0.17mm

Idle and Timing Settings SOHC



Idle RPM Confirmation

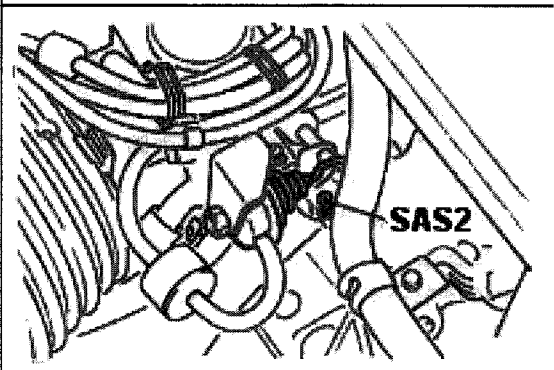
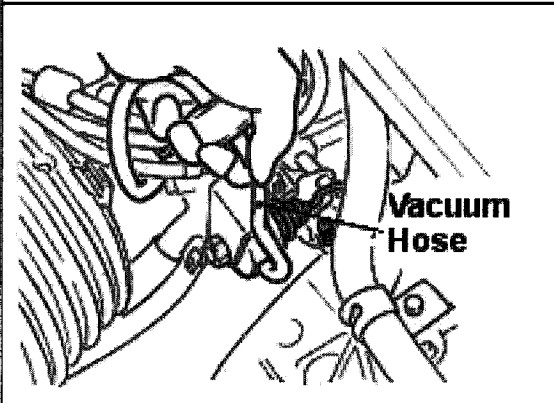
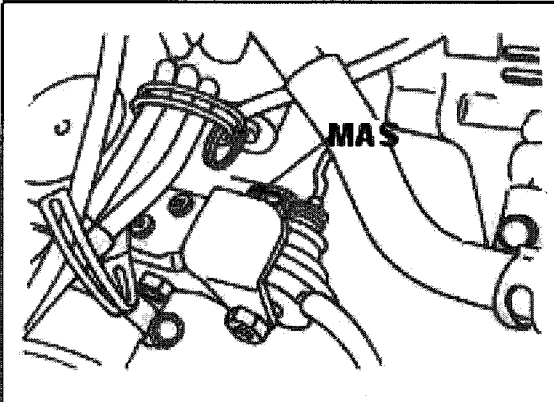
1. Warm Engine to 80-90°C
2. Transmission Neutral (MT) and side brake applied. (AT) in Park Side Brake applied.
3. Locate coil harness connection as shown.
4. Use a paper clip and slide into connector as shown. Slide into pin1 & or pin 3. Pin 2 is positive. Do not disconnect the plug, the vehicle will not run.
5. Attach tachometer
6. Start the vehicle and verify RPM.
 - MT: 900+-50RPM
 - AT: 1000+-50RPPM
7. To adjust idle speed use SAS 1 idle speed adjustment screw as shown in the diagram on the left.

Timing Settings

1. Warm Engine to 80-90°C
2. Remove rubber timing mark cover
3. The scale is marked "T" to 10°
4. Attach timing light
5. Loosen distributor base bolt
6. Idle vehicle and set timing to specifications
 1. BTDC 6+-2° (2 Valve)
 2. BTDC 5+-2° (4 Valve)
7. Tighten distributor bolt after setting timing

Note: Vehicles equipped with a front case marking system as shown on the left use the following guide. The Top equals TDC and the lower bar indicates bottom=10° & inner side equals 5°

CO2- HC & Fast Idle Settings SOHC



CO2-HC Level Testing

1. Warm Engine to 80-90°C
2. Verify Idle speed and timing settings are correct.
3. Verify air cleaner is clean. Replace air filter before test if found to be soiled.
4. Place test lead into tail pipe
5. Adjust MAS screw as required
6. Between adjustments raise RPM to 2000-3000 RPM for minimum 15 seconds

Note: See Specifications chart for limits

Fast Idle Circuit Level 1 Test

1. Warm Engine to 80-90°C
2. Verify Idle speed and timing settings are correct.
3. Attach Tachometer and verify idle
4. As shown in the diagram on the left pinch the inlet vacuum hose between your fingers.
5. The engine RPM should increase to 1500+-50 RPM

Note: If idle does not increase replace actuator

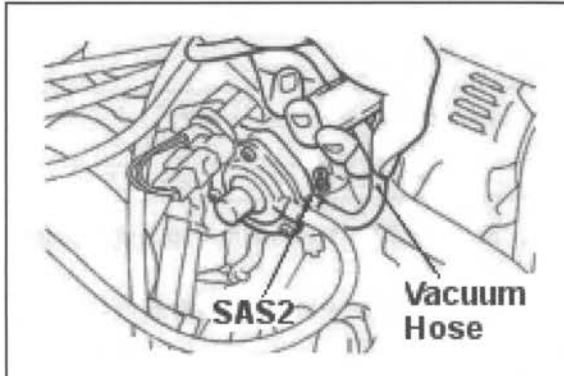
6. To increase or decrease fast idle turn the SAS2 screw to set speed.

Air Conditioned Vehicles

1. Place vehicle in Neutral (MT) or Park for (AT). Engage parking brake.
2. Warm Engine to 80-90°C
3. Attach tachometer: Do not use dash mounted tachometer if equipped.
4. Engage AC Switch and Fan Switch to Full (High) Position
5. Idle shall automatically increase to 1300+-50 RPM.
6. Adjust SAS2 screw as necessary

Note: If idle does not increase replace actuator valve and re-test

CO2- HC & Fast Idle Settings SOHC



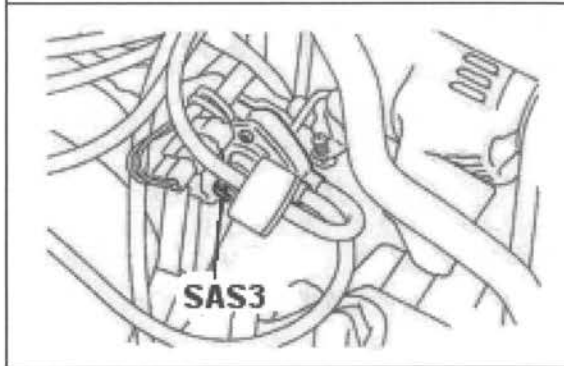
Secondary Vacuum Actuator

Note: Power Steering equipped vehicles turn wheels all the way to Left to easily access vacuum hose.

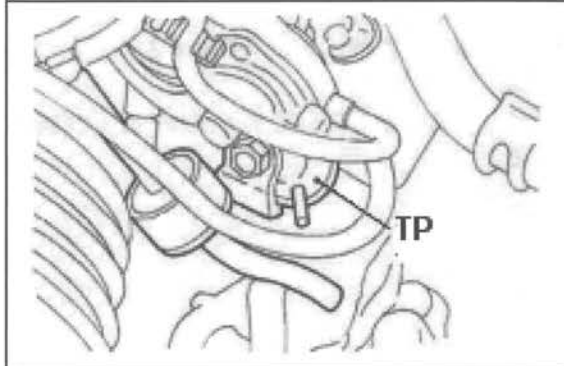
1. AC vehicles: Engage AC (Including freezer trucks). Place fan switch on full position (High Mode).
2. Attach tachometer
3. Vehicle engine speed shall rise to 1500+-50 RPM.

Note: Replace actuator if no increase in RPM.

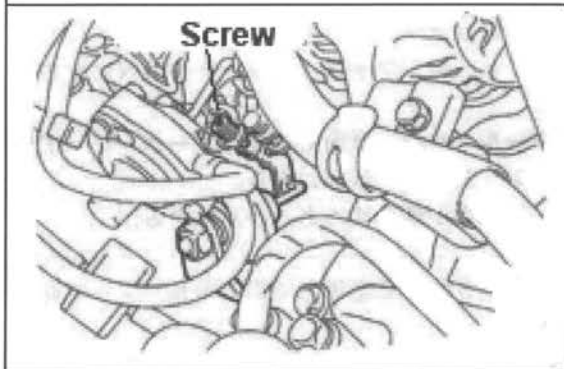
4. Adjust SAS2 screw to set speed
1. Non-AC Vehicles: Pinch vacuum hose with fingers as shown.
2. Set speed to 1300+-50RPM



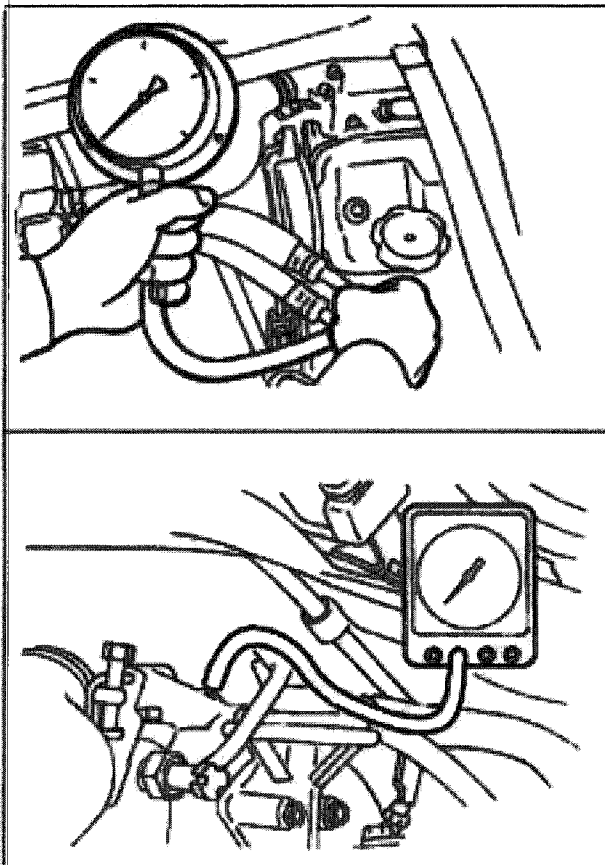
Throttle Positioner



1. Warm Engine to 80-90°C
2. Attach tachometer
3. Remove hose as shown
4. Engine speed shall increase to 2100+-50 RPM.
5. Use adjustment screw as shown on bottom left diagram and set to 2100+-50 RPM
6. Re-attach hose. System shall re-balance to correct idle within 1.0 to 4.5 seconds. If beyond 4.5 seconds replace actuator.



Cylinder Compression & Intake Manifold Pressure SOHC



Cylinder Pressure Inspection

1. Warm Engine to 80-90°C
2. Stop engine
3. Disconnect coil connection plug
4. Remove Spark Plug Number #1
5. Attach compression gage
6. Rotate engine by using the starter. Turn over speed approximately 400RPM
 - 12.5kg/cm² (2 Valve)
 - 13.0kg/cm² (4 Valve)
 - 1.0kg/cm² Balance Limit Between Cylinders
7. Inspect Remaining Cylinders

Note: See Overhaul Section of this Book for Internal Engine Repairs

Intake Manifold Pressure Test

1. Warm Engine to 80-90°C
2. Attach Vacuum gage as shown on the left.

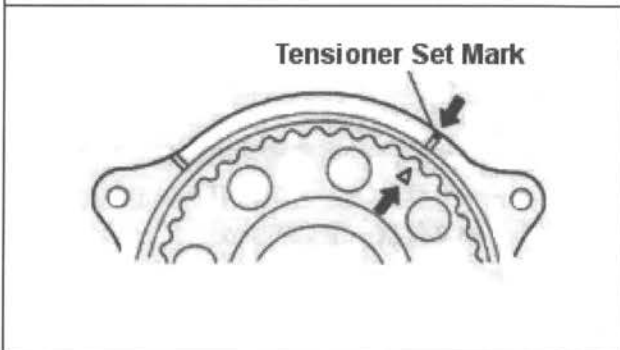
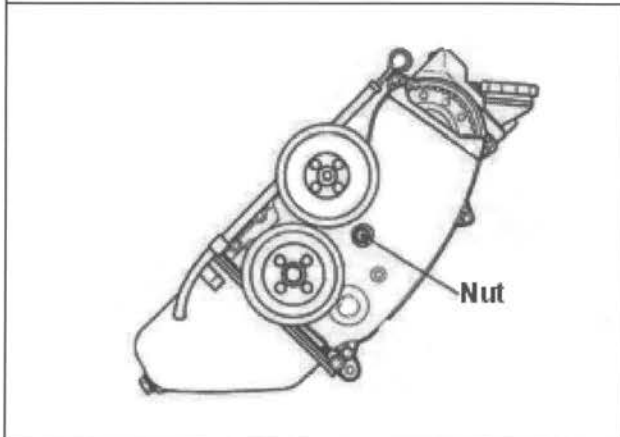
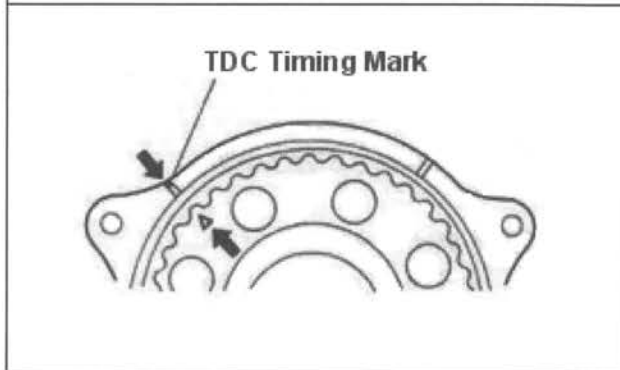
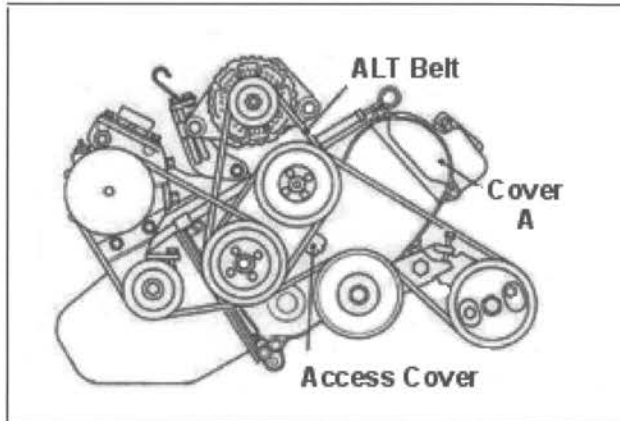
3. Allow engine to idle 2-3 minutes

Limit: 450mmHG (2 Valve)

470mmHG (4 Valve)

Note: If vacuum does not read within the limits check valve clearance and re-test. If clearance is within proper range inspect valve guides. See overhaul section of this book for specifications and replacement procedures.

Timing Belt Inspection SOHC



Timing Belt Inspection

Note: For replacement procedure see timing belt section in the Engine Overhaul Chapter.

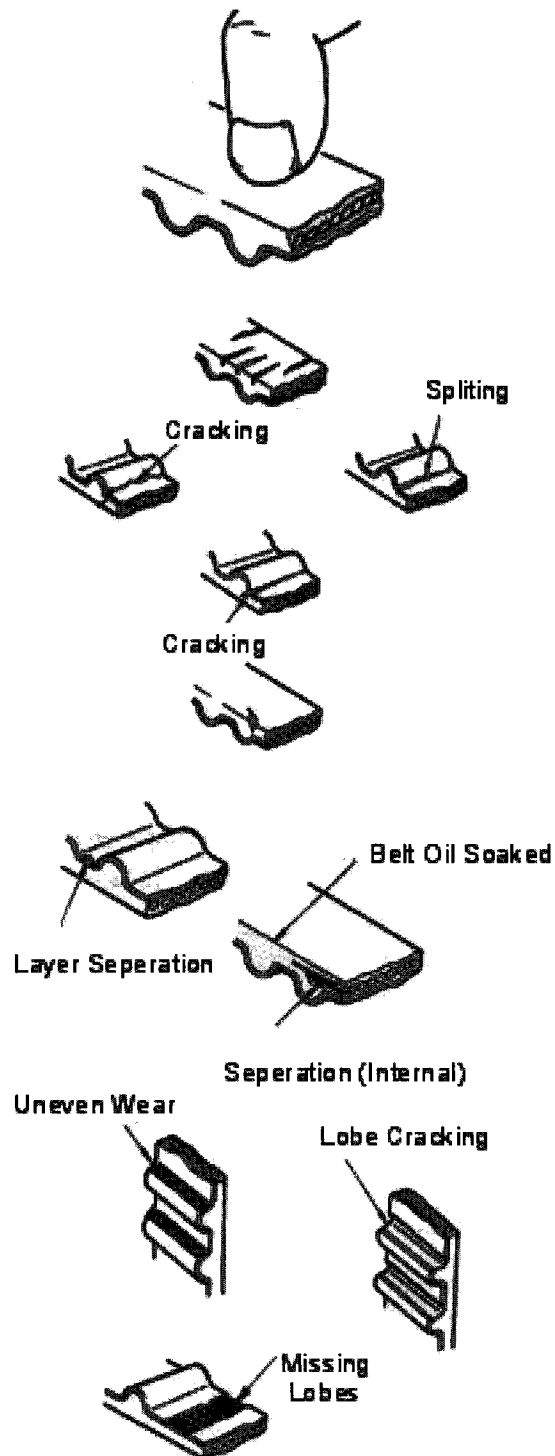
1. Loosen Alternator Belt
2. Remove Oil Level Gage (Dip Stick)
3. Remove Timing Belt Cover "A".
4. Remove Access Cover
5. Turn over Engine to TDC #1 Position

Note: Always turn Engine over in the Right Direction (Clockwise).

6. Loosen Tensioner Nut 1-2 Turns

7. Turn over Engine Slowly and Inspect Belt.
8. If defects are detected replace belt. (See Overhaul Chapter)
9. Rotate Engine to Tensioner Set Mark as Shown on the Left. Tighten Lock Nut.
10. Assemble Components in Reverse Order.

Timing Belt Inspection SOHC

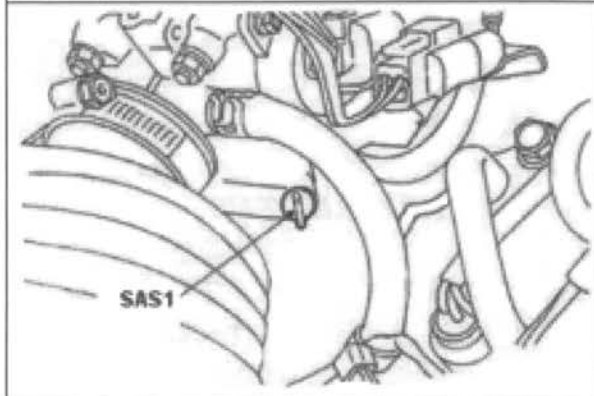
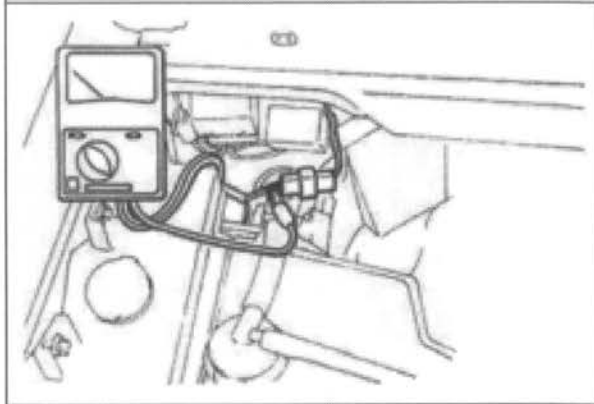
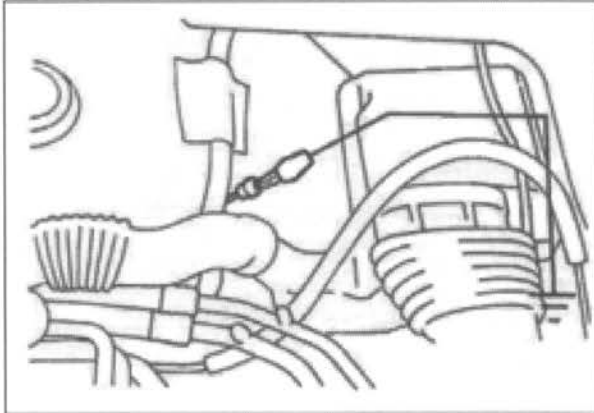


Note: Replace Belts that Show any of the Above Physical Damage

Note: Replace all Belts 80,000 Kilometers

Note* If Water Pump Fails Below 80,000 Kilometers Change Timing Belt

Idle Settings DOHC



Idle Setting

1. Warm Engine to 80-90°C
2. Transmission Neutral (MT) and side brake applied. (AT) in Park Side Brake applied.
3. Locate coil harness connection as shown (Female). This serves as a ground.
4. Locate noise filter #2 Pin and slide in a paper clip as shown.
5. Attach tachometer
6. Start the vehicle and verify RPM.

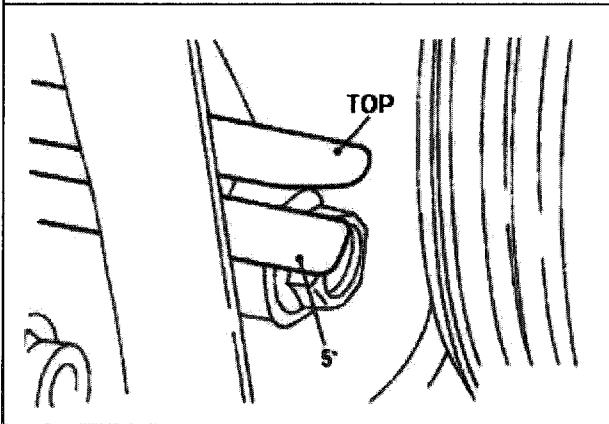
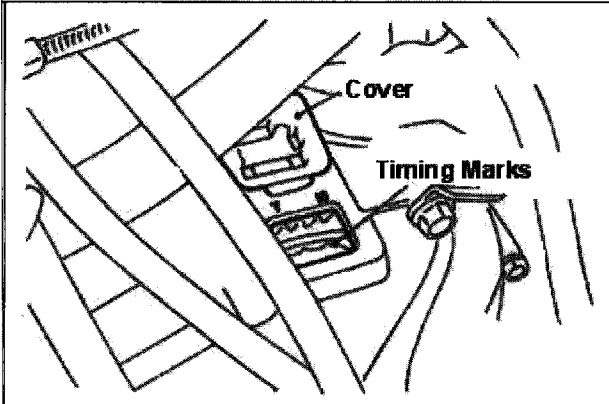
Idle Speed Setting: 900+/-50 RPM

7. Set Idle Seed by Adjusting SAS2

Note: Before testing RPM confirm Air Filter is clean and free from Debris. Verify spark plugs are properly gaped and in good working order.

Note: If Idle is erratic verify Distributor Cap & Rotor are clean and free of carbon deposits. Bad spark plugs and dirty distributor caps can affect idle RPM. Adjust RPM manually only after verifying related components are in proper working order.

Timing & Fast Idle Settings



Timing Settings

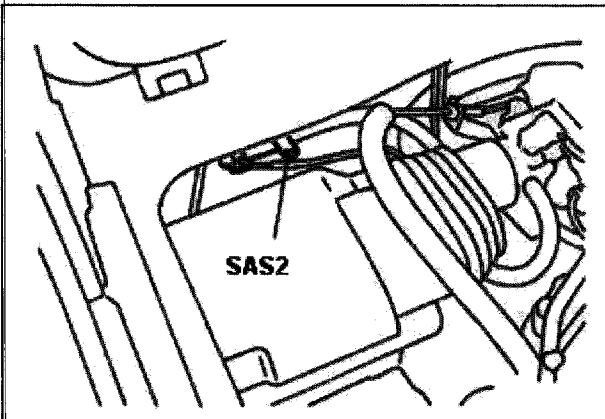
1. Warm Engine to 80-90°C
2. Verify RPM Settings
3. Remove rubber timing mark cover
4. The scale is marked "T" to 10°
5. Attach timing light
6. Loosen distributor base bolt
7. Idle vehicle and set timing to specifications
 1. BTDC 5+-2
8. Tighten distributor bolt after setting timing

Note: Vehicles equipped with a front case marking system as shown on the left use the following guide. The Top equals TDC and the lower bar indicates bottom=10° & inner side equals 5°

CO2-HC Test

1. Warm Engine to 80-90°C
2. Connect to ECI-MULTI System Tester
3. Adjust CO: Below 0.6%
4. Adjust HC: Below 200PPM

See Fuel System for more information.

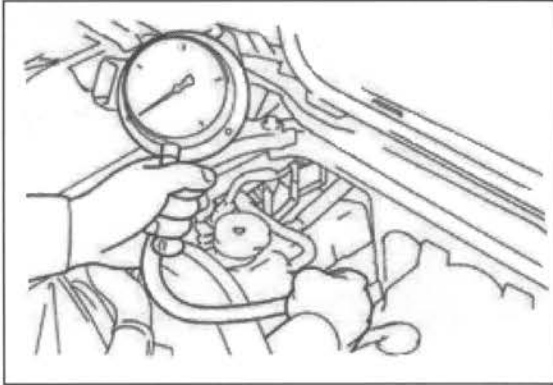


Fast Idle Settings

1. Warm Engine to 80-90°C
2. Put vehicle in "Park" (AT) or "Neutral" (MT) with side brake applied.
3. Verify RPM Settings
4. Engage AC and Fan Switch to "HIGH" position.
5. Engine shall increase to 1300+-50 RPM
6. Fast Idle is Adjusted by SAS2

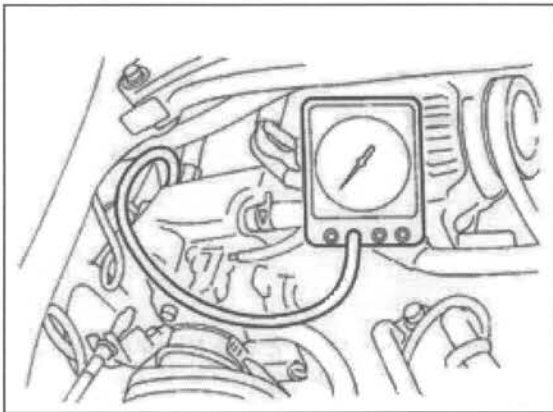
Note: Always verify Air Cleaner is Clean and Ignition System Components are in proper working Specifications before Adjusting Fast Idle.

Engine Compression-Intake Manifold Pressure-Timing Belt DOHC



Engine Compression Test

1. Warm Engine to 80-90°C
2. Stop engine
3. Disconnect coil connection plug
4. Remove Spark Plug Number #1
5. Attach compression gage
6. Rotate engine by using the starter. Turn over speed approximately 400RPM
 - 13.0kg/cm²
 - 1.0kg/cm² Balance Limit Between Cylinders
7. Inspect Remaining Cylinders. See Overhaul Section for Internal Repairs

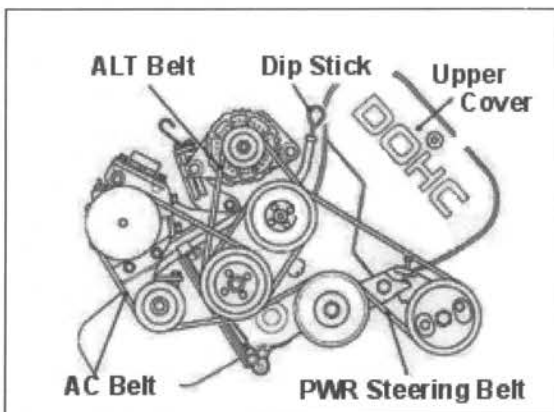


Intake Manifold Pressure Test

4. Warm Engine to 80-90°C
5. Attach Vacuum gage as shown on the left.
6. Allow engine to idle 2-3 minutes

Limit: 470mmHG

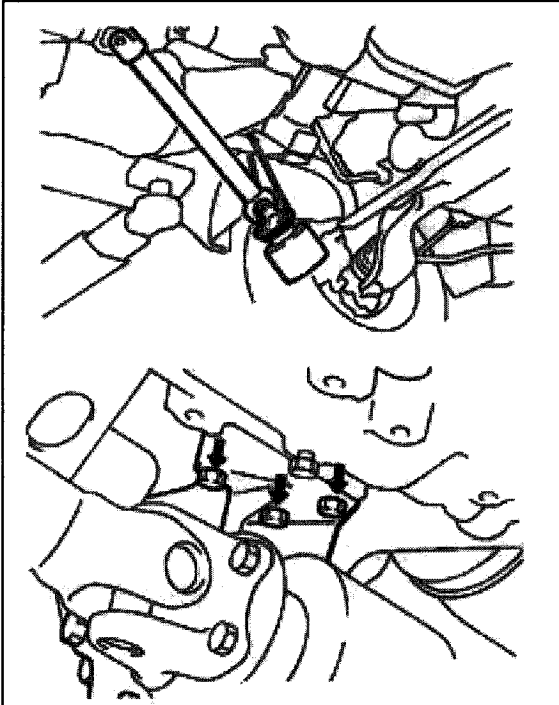
Note: If vacuum does not read within the limits check valve clearance and re-test. If clearance is within proper range inspect valve guides. See overhaul section of this book for specifications and replacement procedures.



Timing Belt Inspection

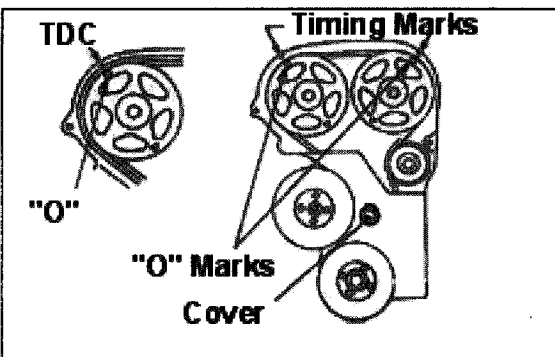
1. Remove Oil Dip Stick
2. Remove AC Belt
3. Remove Power Steering Belt
4. Remove Alternator Belt

Timing Belt Inspection DOHC



5. Disconnect front HCU on 4WD vehicles as shown on the left.

6. With the hoses remaining attached, remove power steering pump. Do not disconnect hoses. Tie to the side.

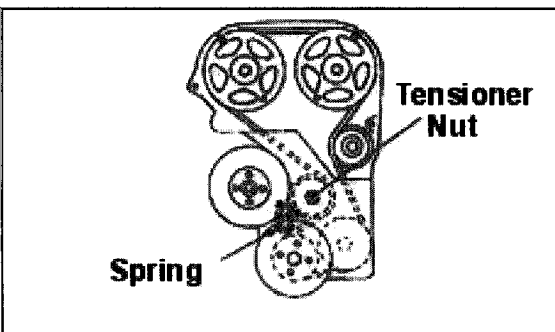


7. Remove Timing Belt Upper Cover.

8. Remove Access Cover as shown on the Left.

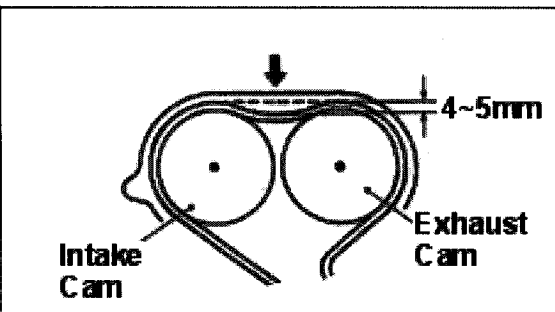
9. Turn engine over towards the right direction (Clockwise) and line up alignment marks as shown. Alignment marks are indicated by "O".

Note: If Timing Marks do not line up as indicated, the belt has "Jumped" the sprocket and must be replaced. See Overhaul Section for Replacement.



10. Loosen Tensioner Nut Two (2) Turns.

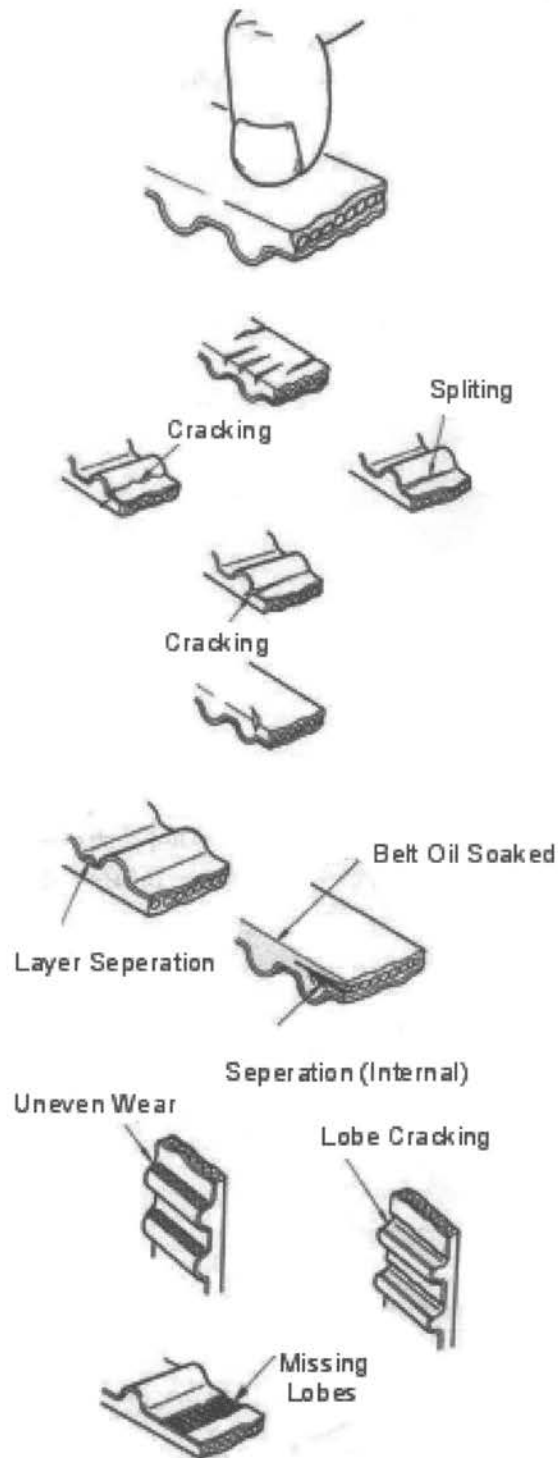
11. Rotate Engine Two (2) Rotations to TDC Position. Inspect Belt for Defects.



12. Tighten Tensioner until there is Belt Play of 4 to 5mm is set as shown on left. If no defects are detected reassemble in Reverse order. If defects are detected proceed to Timing Belt Replacement Section.

Note: Change Belt Every 80,000 Kilometers and or During Water Pump Replacement.

Timing Belt Inspection DOHC



Note: Replace Belts that Show any of the Above Physical Damage

Note: Replace all Belts 80,000 Kilometers

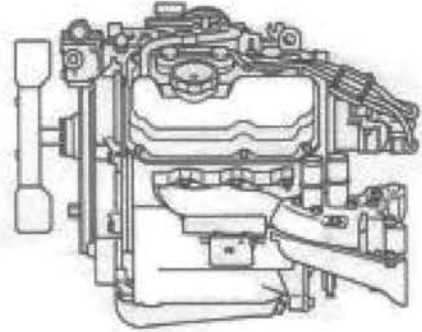
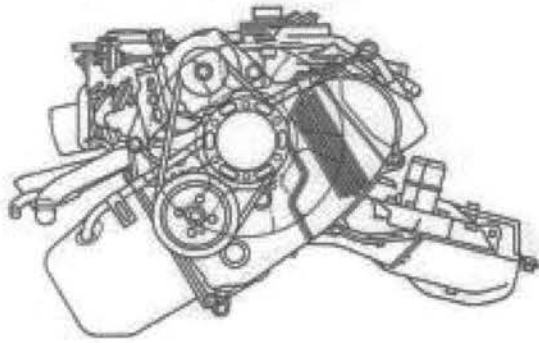
Note: If Water Pump Fails Below 80,000 Kilometers Change Timing Belt

Chapter 3

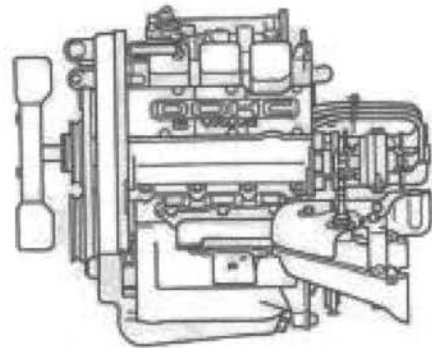
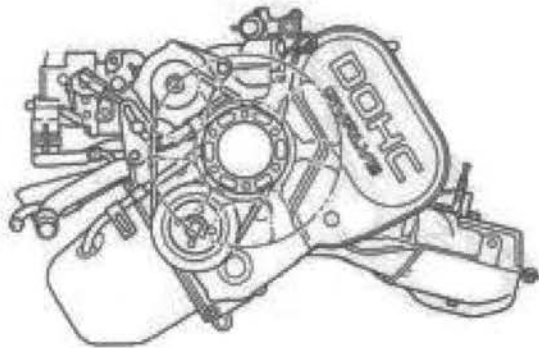
Engine Overhaul & Repair

21. Specialty Tools
22. Engine Specifications & Details
23. Timing Belt Replacement SOHC (2 & 4 Valve)
24. Timing Belt Replacement DOHC
25. Cylinder Head Gasket Replacement SOHC
26. Cylinder Head Gasket Replacement DOHC
27. Engine & Transmission Removal SOHC
28. Engine & Transmission Removal DOHC
29. Valve Train & Camshaft SOHC 4 Valve
30. Valve Train & Camshaft SOHC 2 Valve
31. Valve Train & Camshaft DOHC 5 Valve
32. Cylinder Head & Valves SOHC 4 Valve
33. Front Case-Counterbalance Shaft-Oil Pan (All) Components
34. Piston & Connecting Rods (ALL)
35. Piston -Piston Ring-Piston Pin-Connecting Rod
36. Crankshaft-Flywheel-Flex Plate
37. Cylinder Block Assembly
38. Lubrication System-Oil Filter-Oil Pressure Switch-Oil Pump
39. Oil Pump

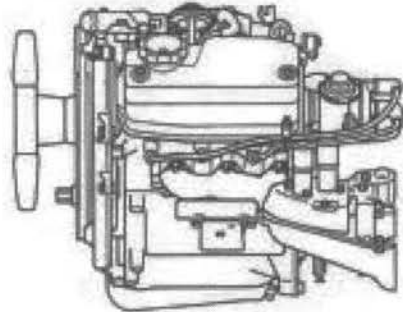
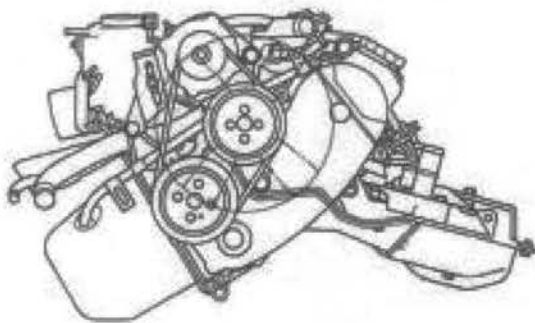
SOHC 4 Valve



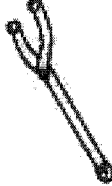









DOHC 5 Valve










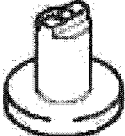
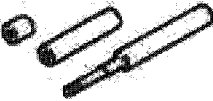
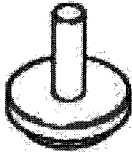
SOHC 2 Valve



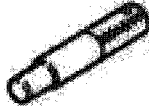
Specialty Tools

 <p style="text-align: center;">MB990767</p>	<p style="text-align: center;">Yoke End Holder</p>
 <p style="text-align: center;">MD996719</p>	<p style="text-align: center;">Pulley Holder</p>
 <p style="text-align: center;">MD996608</p>	<p style="text-align: center;">Flywheel Stopper Attachment</p>
 <p style="text-align: center;">MD996442</p>	<p style="text-align: center;">Air Bleeder 5 Valve Engine</p>
 <p style="text-align: center;">MD996440</p>	<p style="text-align: center;">Leak Down Tester</p>
 <p style="text-align: center;">MD996713</p>	<p style="text-align: center;">Camshaft Oil Seal Installer 5 Valve</p>
 <p style="text-align: center;">MB991397</p>	<p style="text-align: center;">Camshaft Oil Seal Installer SOHC 2 & 4 Valve</p>
 <p style="text-align: center;">MB991412</p>	<p style="text-align: center;">Cylinder Head Bolt Attachment 5 & 4 Valve</p>
 <p style="text-align: center;">MD996735</p>	<p style="text-align: center;">Valve Spring Compressor 4 & 5 Valve</p>
 <p style="text-align: center;">MD996597</p>	<p style="text-align: center;">Valve Spring Compressor 2 Valve</p>

Specialty Tools

	<p>MD999801</p>	<p>Valve Stem Seal Installer 4 & 5 Valve</p>
	<p>MD998302</p>	<p>Valve Stem Seal Installer 2 Valve</p>
	<p>MD998727</p>	<p>Oil Pan Separator</p>
	<p>MD999593</p>	<p>Balance Shaft Bearing Remover</p>
	<p>MD999592</p>	<p>Balance Shaft Rear Bearing Installer</p>
	<p>MD999591</p>	<p>Balance Shaft Front Bearing Installer</p>
	<p>MB991395</p>	<p>Crankshaft Front Oil Seal Installer</p>
	<p>MD999583</p>	<p>Piston Pin Setting Base</p>
	<p>MD999584</p>	<p>Push Rod & Guide Pin Set</p>
	<p>MD998376</p>	<p>Crankshaft Rear Seal Installer</p>

Specialty Tools

 <p>MD999571</p>	<p>Drive Plate Center Guide</p>
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Engine Specifications & Details

Item				DOHC 5 valve	
				Standard	Limit
Cylinder Head	Bottom Strain			0.05	0.2
	Bottom Grinding Limit*				0.2
	Overall Height			87.95~88.05	
	Valve Guide		0.05OS	10.550~10.568	
	Hole Diameter		0.25OS	10.750~10.768	
			0.50OS	11.000~11.018	
	Valve Seat Ring Hole Diameter		Intake 0.3OS	21.300~21.321	
			0.6OS	21.600~21.621	
			Exhaust 0.3OS	23.800~23.821	
0.6OS			24.100~24.121		
Camshaft	Cam Height		Intake A	34.64	34.14
			B	32.69	32.19
			Exhaust	33.93	33.43
	Journal Diameter		No.1	37.940~37.955	
			Except No.1	39.440~39.455	
Oil Clearance			0.045~0.085		
Valve	Overall Length		Intake	102.3	
			Exhaust	100.5	
	Stem Diameter		Intake	4.965~4.980	
			Exhaust	5.450~5.470	
				45°~45°30'	
	Margin		Intake	0.95	0.5
			Exhaust	1.25	0.7
	Guide Gap		Intake	0.020	0.10
Exhaust			0.030~0.062	0.12	
Valve Spring	Free Height		Intake	41.5	40.5
			Exhaust	43.0	42.0
	Loading Height		Intake	34.55(at	
			Exhaust	37.10(at17.2kg)	
Squareness			2°	4°	
Valve Guide	Entire Length		Intake	49.0	
			Exhaust	52.5	
	Internal Diameter		Intake	5.000~5.012	
			Exhaust	5.500~5.512	
Valve Seat	Seat Side Angle			30°/44°/65°	
	Attached Width			0.9~1.3	
	Sunk				0.2

Engine Specifications & Details

Cylinder Head SOHC

ITEM			SOHC 4 valve		SOHC 2valve		
			Standard	Limit	Standard	Limit	
Cylinder	Bottom Strain		0.05	0.2	0.05	0.2	
	Bottom Grinding Limit			0.2		0.2	
	Overall Height		108.9~109.1		108.9~109.1		
	Valve Guide Hole Diameter		0.05OS	12.050~12.068		10.550~10.568	
			0.25OS	12.250~12.268		10.750~10.768	
			0.50OS	12.500~15.518		11.000~11.018	
	Valve Seat	Intake	0.3OS	31.300~31.325		26.300~26.321	
			0.6OS	31.600~31.625		26.600~26.621	
	Ring Hole	Exhaust	0.3OS	29.300~29.321		23.300~23.321	
0.6OS			29.600~29.621		23.600~23.621		
Camshaft	Camshaft Height		Intake	34.96~35.19	34.46	34.12~34.32	33.62
			Exhaust	35.03~35.29	34.53	34.57~34.77	34.07
	Journal Diameter		40.940~40.955		40.940~40.955		
	Oil Clearance		0.045~0.085		0.045~0.085		
	End Play		0.06~0.14	0.3	—		
Rocker Arm	Oil Clearance		0.012~0.043	0.1	0.012~0.043	0.1	
	Valve Clearance (Cold)		Intake	0.14		0.07	
			Exhaust	0.24		0.17	
Rocker Shaft	External Diameter		16.985~16.998		16.985~16.998		
	Entire Diameter		232.0		250.4		
Valve	Entire Diameter		Intake	100.6		100.27	
			Exhaust	100.8		105.76	
	Stem Diameter		Intake	6.565~6.580		4.965~4.980	
			Exhaust	6.530~6.550		4.950~4.970	
	Face Angle		45°~45°30'		45°~45°30'		
	Margin		Intake	1.0	0.5	0.95	0.5
			Exhaust	1.3	0.8	1.25	0.8
Guide Gap		Intake	0.020~0.050	0.10	0.020~0.047	0.09	
		Exhaust	0.050~0.085	0.15	0.030~0.062	0.10	
Valve Spring	Free Height		Intake	46.3	45.3	40.8	40.0
			Exhaust	↑	↑	↑	↑
	Loading Height		Intake	37.7		35.7(at18kg)	
			Exhaust	↑		↑	
Squareness		2°	4°	2°	4°		
Valve Guide	Entire Diameter		Intake	44.0		45.0	
			Exhaust	49.5		56.0	
	Internal Diameter		Intake	6.600~6.615		5.000~5.012	
			Exhaust	↑		↑	
Valve Seat	Seat Side Angle		30°/44°/65°		30°/44°/65°		
	Attached Width		0.9~1.3		0.9~1.3		
	Sunk			0.2		0.2	

Engine Specifications & Details
DOHC-SOHC Common Block Related Specifications

Item			Standard	Limit
Counter Balance Shaft	Journal Diameter	Front	19.987~20.000	
		Rear	43.984~44.000	
	Oil Clearance	Front	0.035~0.068	
		Rear	0.035~0.071	
Piston	External Diameter		64.97~65.00	
	Piston Clearance		0.02~0.04	
	Ring Groove Width	No.1	1.22~1.24	
		No.2	1.21~1.23	
Oil		2.815~2.835		
Piston Ring	Miter Gap	No.1	0.15~0.30	0.8
		No.2	0.35~0.50	0.8
		Oil	0.20~0.70	1.0
	Gap Ring Groove	No.1	0.03~0.07	0.12
		No.2	0.02~0.06	0.10
Piston Pin	External Diameter		16.001~16.007	
	Installation Press Pressure		500~1500	
	Installation Press Temperature		Room	
Connecting Rod	Between Centers Width		101.95~102.05	
	Parallelism of Large and Small End		0.05	
	Twist		0.1	
	Large End Thrust Gap		0.10~0.25	
Crankshaft	End Play		0.10~0.25	
	Journal Diameter		39.98~40.00	
	Pin Diameter		35.98~36.00	
	Journal · Pin Cylindricity		0.005	
	Journal · Pin Concentricity		0.015	
	Oil Clearance	Journal	0.021~0.045	
Pin		0.022~0.052		
Cylinder Block	Cylinder Internal Diameter		65.00~65.03	
	Cylinder Cylindricity		0.01	
	Upper Surface Strain		0.05	
	Upper Surface Ground Limit			
	Entire Height		210.9~211.1	
Flywheel	Warpage			0.13

Engine Specifications & Details

Parts	Screw Size · Spec	Tightening Torque(kgfm)		
		D5	S4	S2
Timing Belt Cover	M6x1.0 Bolt	1.0~1.2	1.0~1.2	1.0~1.2
Crankshaft Pulley	M6x1.0 -8T	1.2~1.5	1.2~1.5	1.2~1.5
Crankshaft Sprocket	M10x1.25-7T PW + F	9.0~10	9.0~10	9.0~10
Camshaft Sprocket	M12x1.25 F Bolt	9.0	9.0	9.0
Timing Belt Tensioner	M8 x 1.25-4T PW + F	2.6	2.6	2.6
Oil Pump Sprocket	M8 x 1.25-6T F Nut	5.0~5.7	5.0~5.7	5.0~5.7
Timing Belt Idler	M8 x 1.25-4T F Bolt	2.6	-	-
Camshaft Housing	M6 x 1.0-8T F Hexagon	1.2~1.4	-	-
	M6 x 1.0-8T Nut	1.2~1.4	-	-
Distributor Bracket	M6 x 1.0-7T F Bolt	1.0~1.2	-	-
Camshaft Housing Cover	M6 x 1.0 Machine	0.9	-	-
Rocker Cover	M6 x 1.0-7T SW,PW	-	0.30-0.35	-
	M6 x 1.0-7T Bolt	-	-	0.5
Camshaft Thrust Plate	M6 x 1.0-7T F Bolt	-	-	1.0~1.2
Valve Clearance Adjust	M6 x 0.75 Nut	-	0.9	0.9
Rocker Arm Shaft	M8 x 1.25-8T PW + F	-	2.9~3.5	2.9~3.5
Cylinder Head	M10 x 1.25 PW + Hexagon	6.0~7.0	6.0~7.0	-
	M10 x 1.25 PW + F	-	-	6.0~7.0
Oil Pump Cover	M6 x 1.0-7T SW Bolt	0.9	0.9	0.9
Oil Pump Driven Gear	M8 x 1.25 F Bolt	3.4~4.0	3.4~4.0	3.4~4.0
Front Case	M6 x 1.0 - 7T	0.9	0.9	0.9
Oil Drain Plug	M14 x 1.5	4.0	4.0	4.0
Oil Pan	M6 x 1.0 - 7T F Bolt	1.0~1.2	1.0~1.2	1.0~1.2
Connecting Rod Cap	M7 x 1.0 Nut	2.5~2.8	2.5~2.8	2.5~2.8
Flywheel	M10 x 1.25 F Bolt	7.0~8.0	7.0~8.0	7.0~8.0
Drive Plate	M10 x 1.25 F Bolt	6.7~7.7	6.7~7.7	6.7~7.7
Main Bearing Cap · Beam	M10 x 1.25- 10T Bolt	5.0~6.0	5.0~6.0	-
Main Bearing Cap	M10 x 1.25-10T Bolt	-	-	5.0~6.0
Rear Oil Seal Case	M6 x 1.0-7T F Bolt	1.0~1.2	1.0~1.2	1.0~1.2
Rear Cover	M6 x 1.0-7T F Bolt	1.0~1.2	1.0~1.2	1.0~1.2
Rear Plate	M6 x 1.0-7T F Bolt	1.0~1.2	1.0~1.2	1.0~1.2
Bell Housing Cover	M6 x 1.0-7T F Bolt	1.0~1.2	1.0~1.2	1.0~1.2
Engine Support Bracket	M10 x 1.25-7T SW Bolt	4.5	4.5	4.5

Engine Specifications & Details

Series	Engine Type	Displacement	Spec				Transmission	
			MPI	A/C	P/S	Cold Area	M/T	A/T
U41V	3G83-1-	657cc	•		•		•	
U42V	3G83-1-		•		•	•	•	
	3G83-1-		•	•	•		•	
	3G83-1-		•	•	•	•	•	
	3G83-1-		•		•			•
	3G83-1-		•		•	•		•
	3G83-1-		•	•	•			•
	3G83-1-		•	•	•	•		•

Note: Cold Area Option= Heavy Duty Starter & Battery System

Series	Engine Type	Displacement	Spec				Transmission		
			Cab	A/C Truck	P/S	Cold Area	M/T	A/T	
U41T	3G83-2-00	657cc	•				•		
U42T	3G83-2-01		•			•	•		
	3G83-2-02		•		•		•		
	3G83-2-03		•		•	•	•		
	3G83-2-04		•	•			•		
	3G83-2-05		•	•		•	•		
	3G83-2-06		•	•	•		•		
	3G83-2-07		•	•	•	•	•		
	3G83-2-10		•					•	
	3G83-2-11		•			•		•	
	3G83-2-12		•			•		•	
	3G83-2-13		•			•	•		•
	3G83-2-14		•	•					•
	3G83-2-15		•	•		•			•
	3G83-2-16		•	•		•			•
	3G83-2-17		•	•		•	•		•
U41V	3G83-2-20		•				•		
	3G83-2-21		•			•	•		
	3G83-2-22		•		•		•		
	3G83-2-23		•		•	•	•		
	3G83-2-24		•	•			•		
	3G83-2-25		•	•		•	•		
	3G83-2-26		•	•	•		•		
	3G83-2-27		•	•	•	•	•		
	3G83-2-30		•					•	
	3G83-2-31		•			•		•	
	3G83-2-32		•			•		•	
	3G83-2-33		•			•	•		•
	3G83-2-34		•	•					•
	3G83-2-35		•	•		•			•
	3G83-2-36		•	•		•			•
	3G83-2-37		•	•	•	•			•

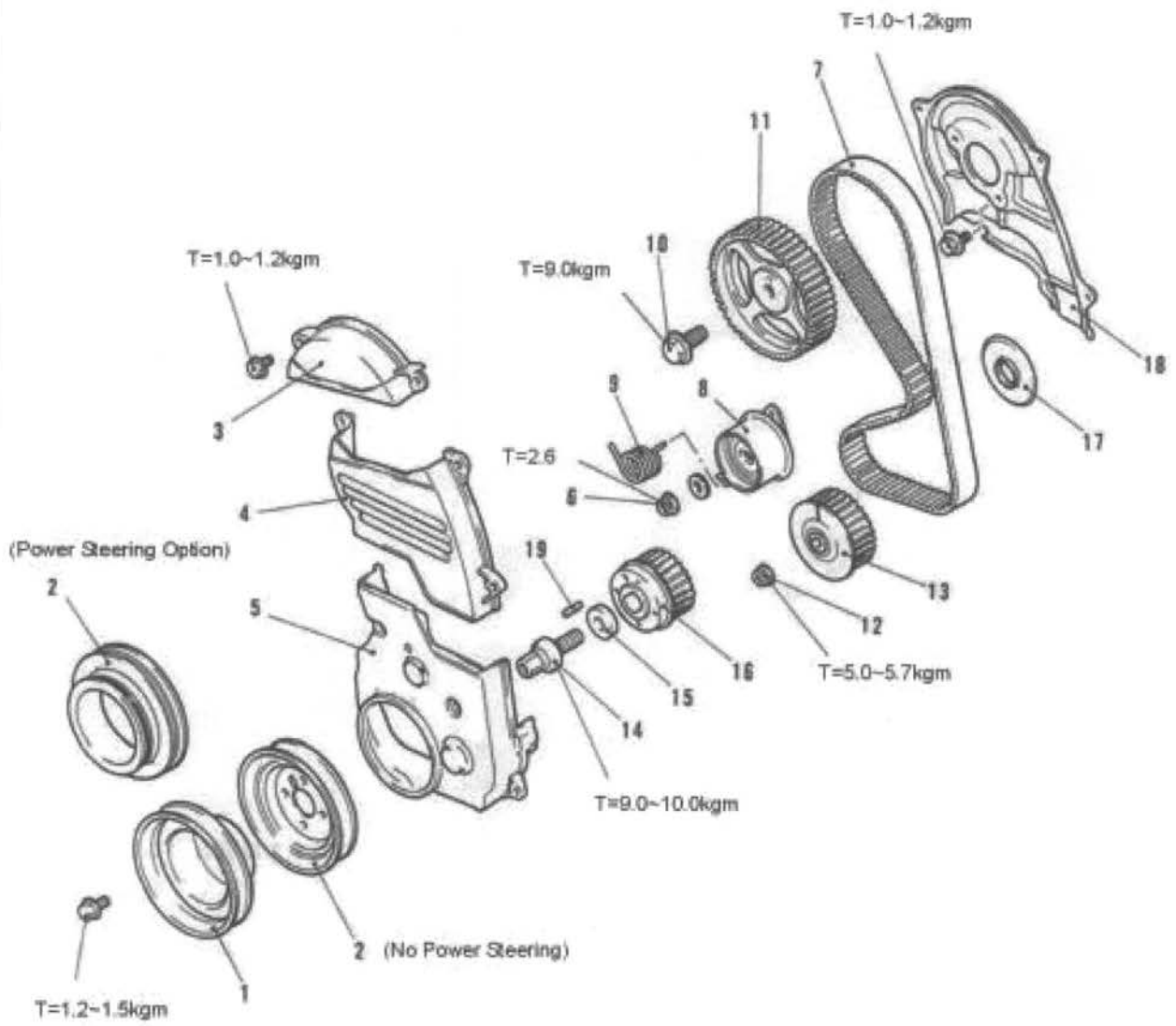
Engine Specifications & Details

Series	Engine Type	Displacement	Spec			Transmission	
			Cab	A/C	Cold Area	M/T	A/T
U41G	3G83-0-	657cc	●			●	
	3G83-0-		●			●	

Common Bolt Torques Reference

Bolt Diameter	Pitch	Torque kgm				
		Bolt, Stud, Nut (with Spring, Washer)			Flange Bolt, Flange Nut	
		Head Mark 4	Head Mark 7	Head Mark 10	Head Mark 4	Head Mark 7
M5	0.8	-	0.4~0.6	-	-	0.5~0.7
M6	1.0	-	0.7~1.1	1.0~1.3	-	0.8~1.2
M8	1.25	0.9~1.4	1.7~2.6	2.5~3.5	1.0~1.5	1.9~2.8
M10	1.25	1.9~2.8	3.5~5.5	5.0~7.0	2.1~3.1	3.9~6.0
M12	1.25	3.4~5.0	7.0~9.5	9.5~12.0	3.8~5.5	8.0~11.0
M14	1.5	6.0~8.5	12~16	10.0~19.0	-	-

Timing Belt Replacement SOHC Components



Timing Belt Replacement SOHC

Standard Replacement

1. Remove V Belts & A/C Pulley if Equipped
2. Remove Crankshaft Pulley (All Models)
3. Remove Timing Belt Cover (1)
4. Remove Timing Belt cover (4)
5. Remove Timing Belt Cover (5)
6. Remove Timing Belt Tensioner Nut
7. Remove Timing Belt Remove
8. Timing Belt Tensioner Unit
9. Remove Spring
10. Remove Crankshaft Sprocket Bolt (If Further Engine Disassembly Required)

Note: Replace Oil Pump if Over 100,000 Kilometers at Same Time as Timing Belt. See Engine Lubrication Section for more Details

11. Remove Sprocket
12. Remove Oil Pump Sprocket (F) Nut
13. Remove Oil Pump Sprocket
14. Remove Crankshaft Bolt
15. Remove Sprocket Washer
16. Remove Sprocket
17. Remove Flange
18. Remove Timing Belt Rear Cover
19. Remove Spring Pin

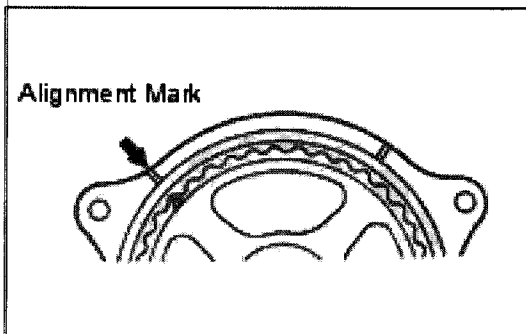
Note: Inspect all Parts

Timing Belt Replacement SOHC

Inspection & Replacement

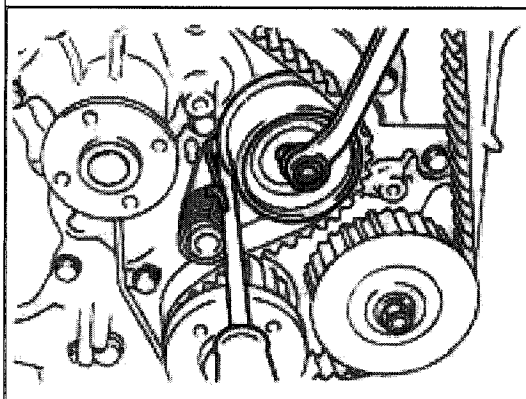
Note: When Removing Timing Belt or Assembling Keep Belt Grease & Oil Free. If Old Belt was Oily Replace any and all Leaking Gaskets Before Replacement

Note: Follow Instructions on Previous page to Remove Covers & Pulleys.



1. Turn Engine Clockwise Until the Camshaft Sprocket Triangle Mark Aligns with the Mark as Shown on the Left. This is the Number 1 Cylinder TDC Point.

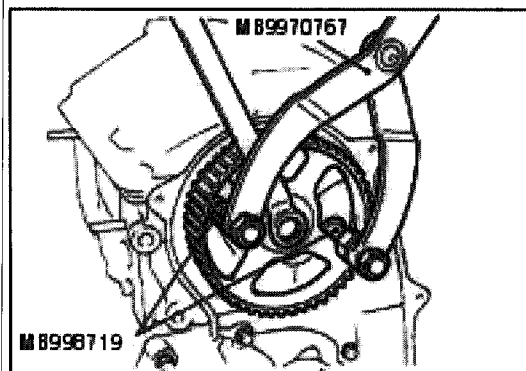
2. Loosen Timing Belt Tensioner Nut.



3. Use a Straight (-) Screwdriver & Loosen Spring as Shown on the Left.

Note: Be Careful Not to damage Water Pump Case

Note: Replace Water Pump with Timing Belt if over 60,000 Kilometers

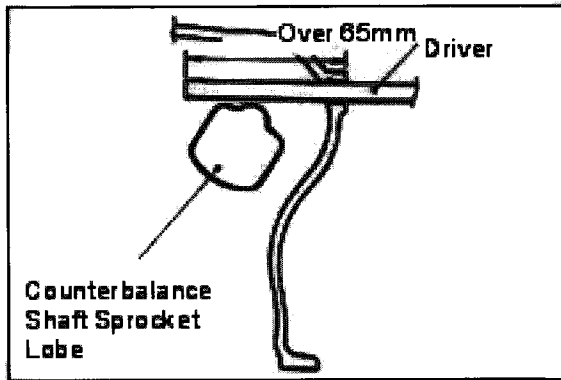


4. Remove Timing Belt

5. Remove & Replace Camshaft Sprocket if Defects are Detected. Use Required Tools as Shown

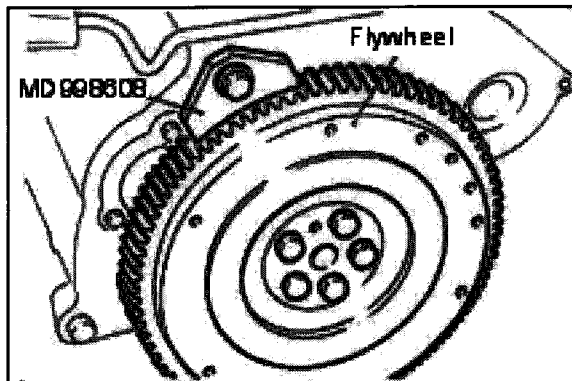
Timing Belt Replacement SOHC

Inspection & Replacement



Note: If the Oil Pump Sprocket is Removed the Counterbalance Shaft needs to be Held in Position.

1. Remove Oil Plug to the Side of the Block.
2. Slide through the Orifice a 8mm Thick Rounded (-) Screwdriver. The Length of the Driver Must be Over 65mm in Length.
3. Remove Oil Pump "F" Nut
4. Remove Sprocket



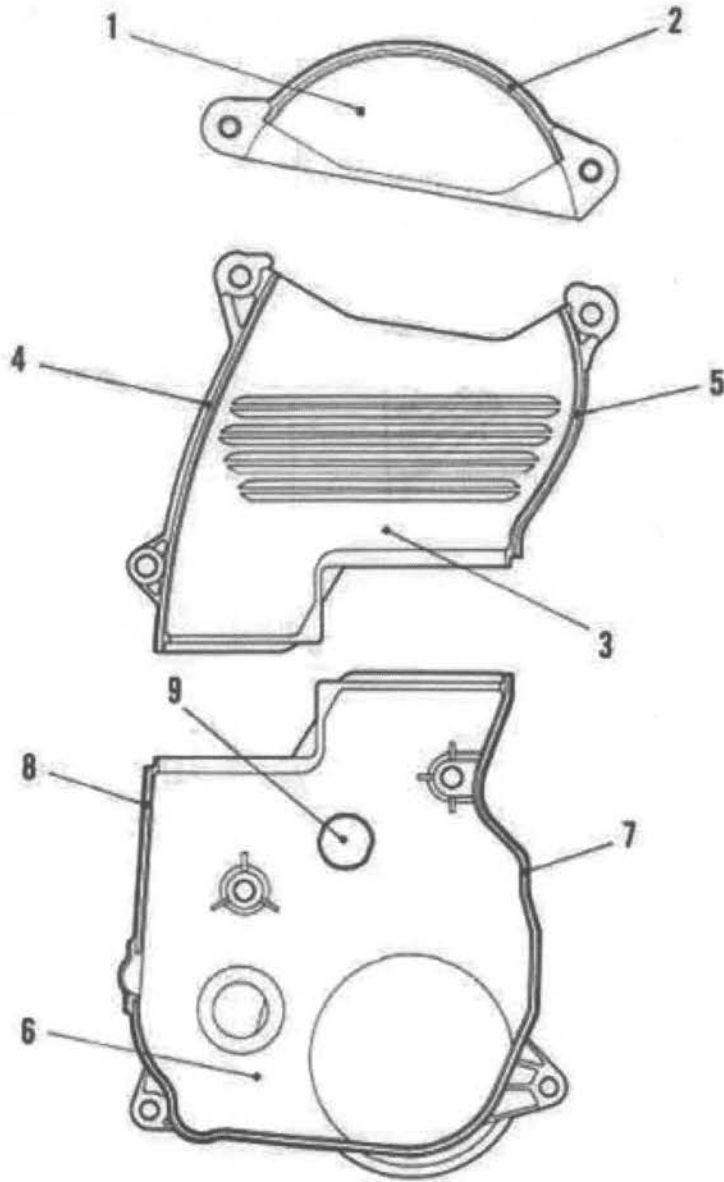
Crankshaft Bolt Removal

1. Place Flywheel Retaining Unit as Shown on the Left.
2. Remove Crankshaft Bolt

Timing Belt Replacement SOHC

Inspection & Replacement

Timing Cover Gasket & Cover Placement

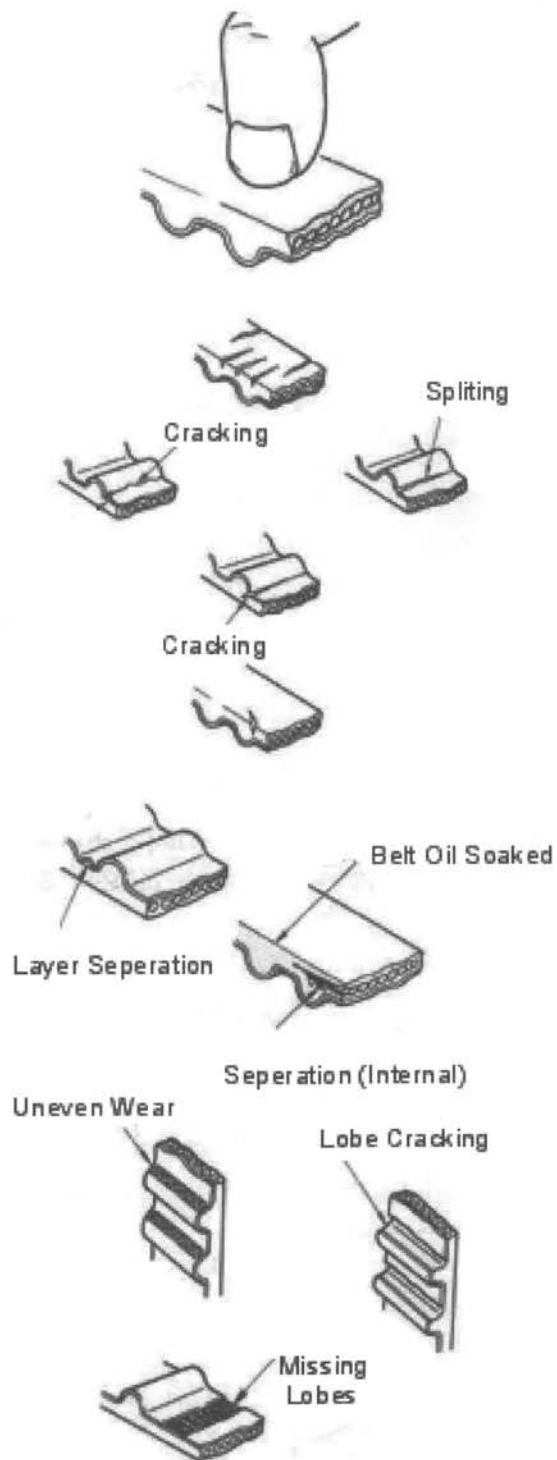


1. Timing Belt Cover A
2. Timing Belt Cover Gasket D
3. Timing Belt Cover B
4. Timing Belt Cover Gasket C
5. Timing Belt Cover Gasket E
6. Timing Belt Cover C
7. Timing Belt Cover Gasket A
8. Timing Belt Cover Gasket B
9. Access Cover

Timing Belt Replacement SOHC

Inspection & Replacement

Timing belt Inspection



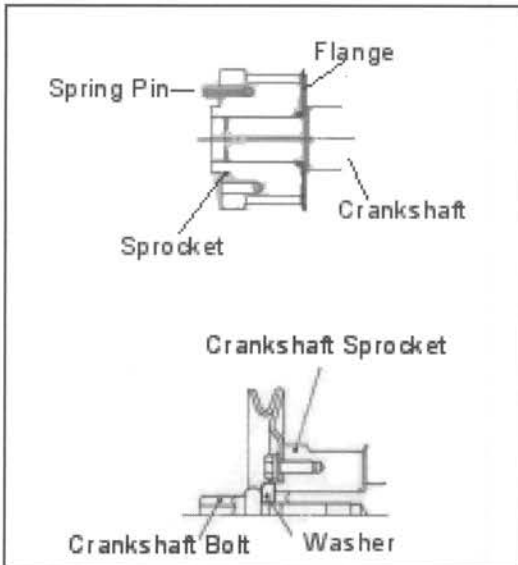
Note: Replace Belts that Show any of the Above Physical Damage

Note: Replace all Belts 100,000 Kilometers

Note* If Water Pump Fails Below 80,000 Kilometers Change Timing Belt

Timing Belt Replacement SOHC

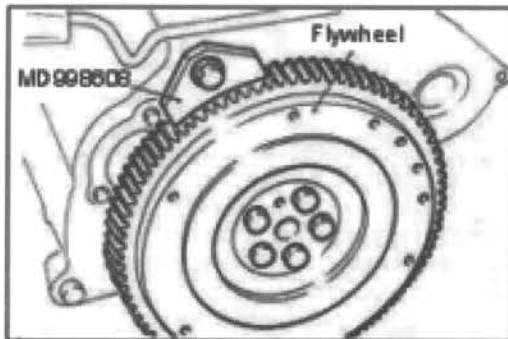
Installation



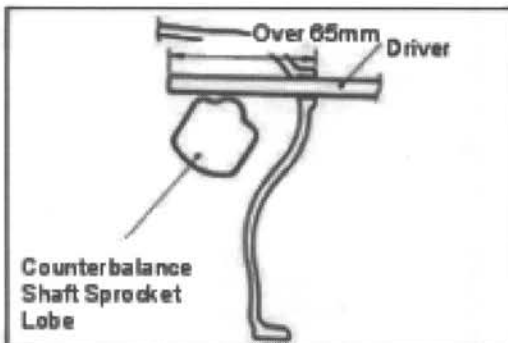
Spring Pin

1. Install Spring Pin as Shown in the Left Diagram

2. Install Crankshaft Sprocket and Washer



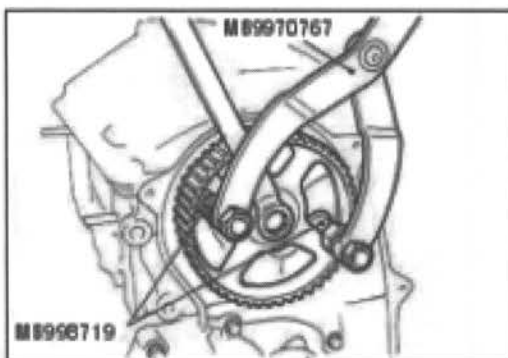
3. Attach Flywheel Retainer and Install Crankshaft Bolt. Torque: T=10.0 kgm



4. Slide through the Orifice a 8mm Thick Rounded (-) Screwdriver. The Length of the Driver Must be Over 65mm in Length.

5. Install Oil Pump Sprocket

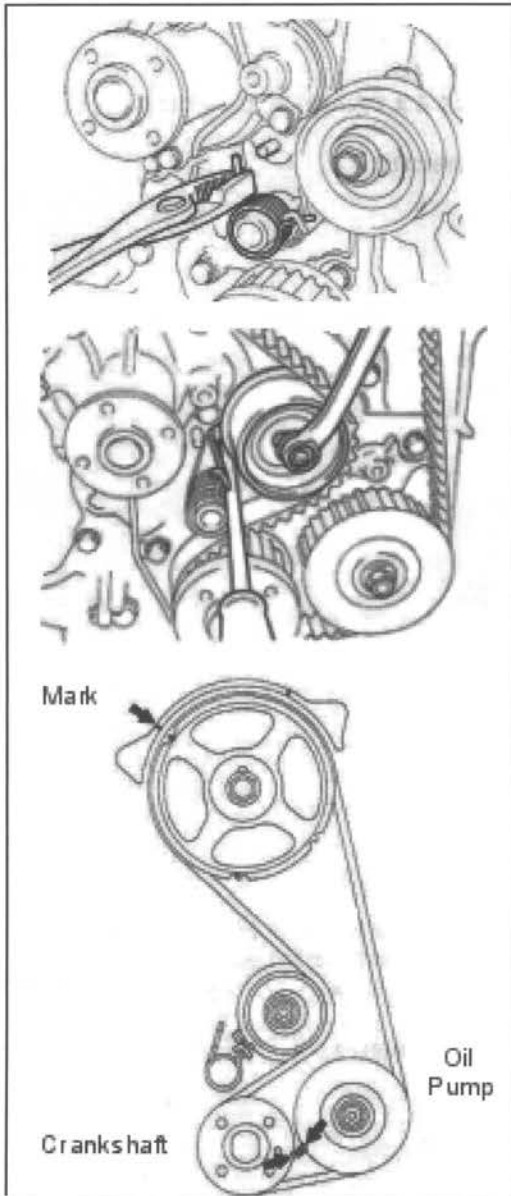
6. Install Oil Pump "F" Nut



7. Attach Camshaft Sprocket. Use Tools as Shown

Timing Belt Replacement SOHC

Installation



Tensioner Spring

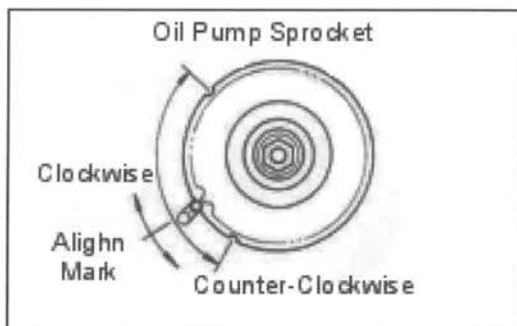
1. Use a Pair of Pliers and Install Tensioner Spring as Shown on the left.

Note: Take Caution Not to Damage Water Pump During Installation.

2. Place Belt Over Pulleys.
3. Use a Screwdriver as Shown to Move the Tensioner and Tighten Nut. Do Not Fully Tighten Belt Until Proper Positioning Has been Assured.

4. Check All Alignment Marks

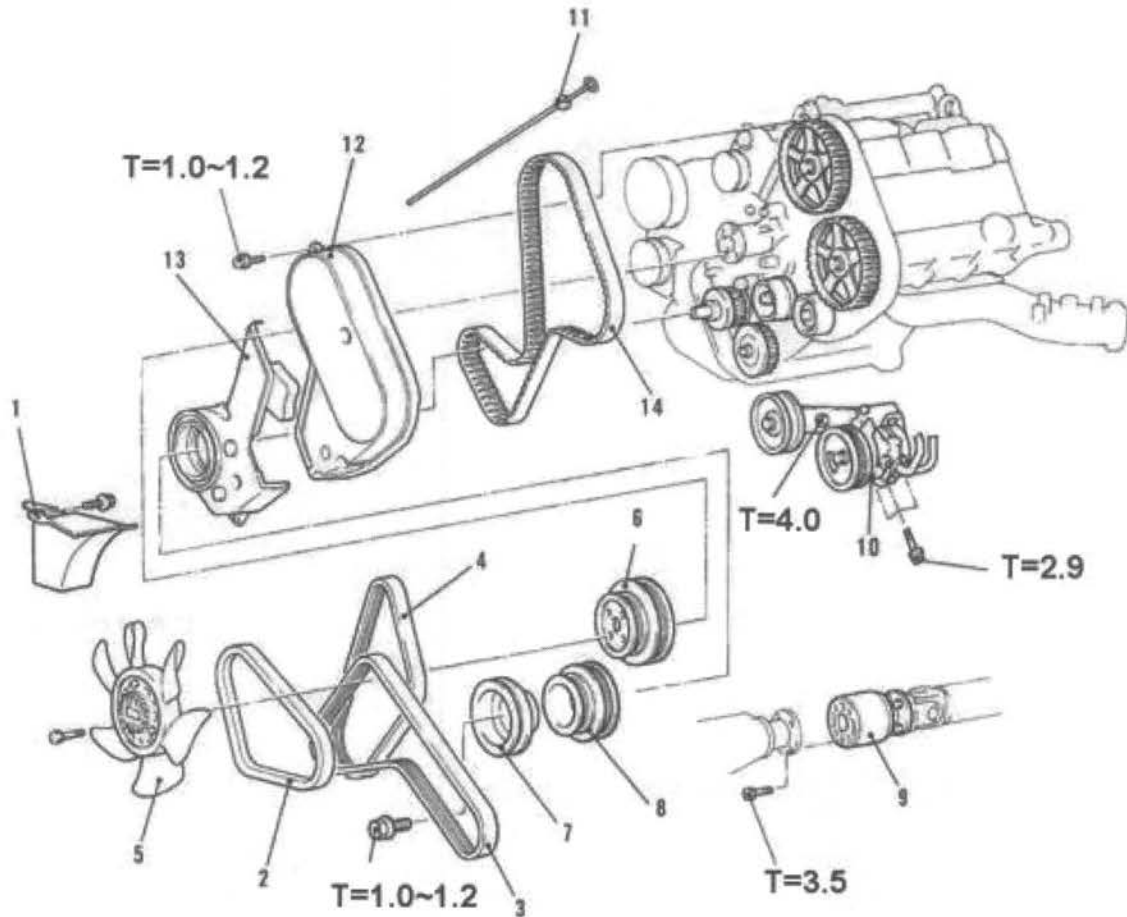
Tighten Tensioner Nut: T=2.6



Oil Pump Sprocket Alignment

Note: Use the Diagram on the Left for Oil Pump Sprocket Alignment

Timing Belt Replacement DOHC



Component List

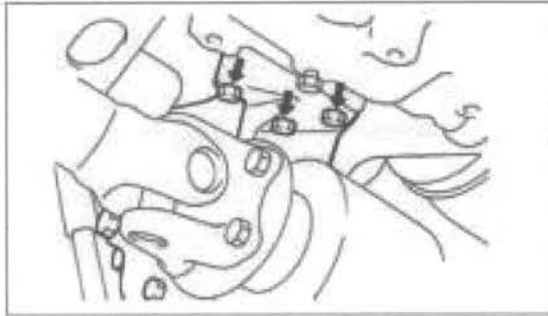
1. Shroud A	2. AC Belt	3. PWR ST Belt	4. ALT Belt	5. Fan
6. WP Pulley	7. AC Pulley	8. Crank Pulley	9. HCU Unit	10. PowerSteering Pump
11. Dip Stick	12. Upper Cover	13. Lower Cover	14. Timing Belt	



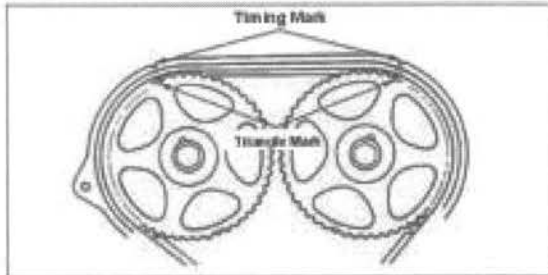
Timing Belt Replacement

1. Remove HCU Coupling. As shown in the Left Diagram, Mark Pre-Removal Position for Re-Installation Location.
2. Place HCU End in a Plastic Bag for Protection.

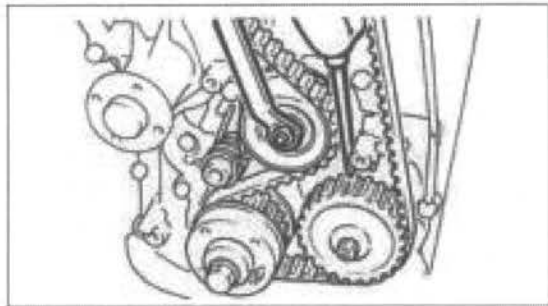
Timing Belt Replacement DOHC



3. Remove the three (3) Retaining Bolts Attached to the Power Steering Oil Pump. Do not separate Hoses. Move Pump Unit to the Side.



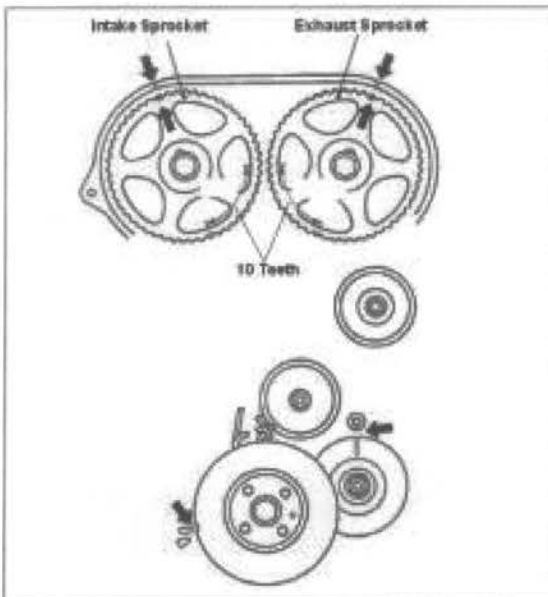
4. Remove all Accessory Belts
5. Remove Upper & Lower Covers
6. Rotate Engine Clockwise to the TDC Position as shown on the Left. Both Intake & Exhaust Sprockets have "Triangle" Marks that line up with the Timing Marks as Shown.



7. Loosen Tensioner Bolt.
8. Remove Timing Belt

Note: If vehicle has over 100,000 Replace Belt & Tensioner as a Set.

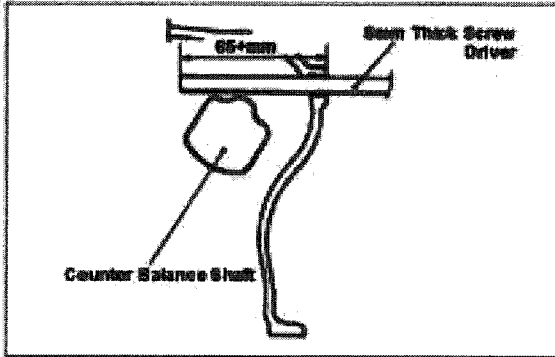
Note: Clean All Parts before Reassembly



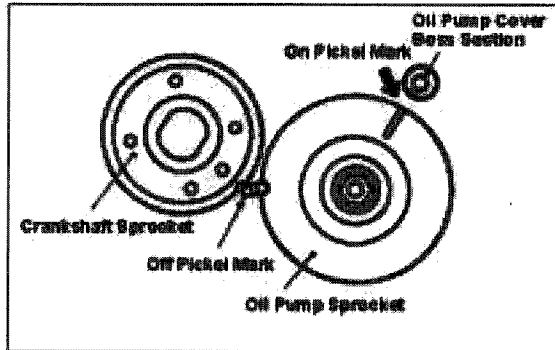
Timing Belt Installation

1. Use the Diagram on the Left to Show Sprocket and Pulley Alignment
2. The Intake & Exhaust Sprockets will Have the "Triangle" Mark pointed to the Timing Marks. Counting Ten (10) Teeth from the Center of the Sprockets to the Circular "O" Marks with Indicate TDC.
3. Align Crankshaft Pulley to "TOP" Mark

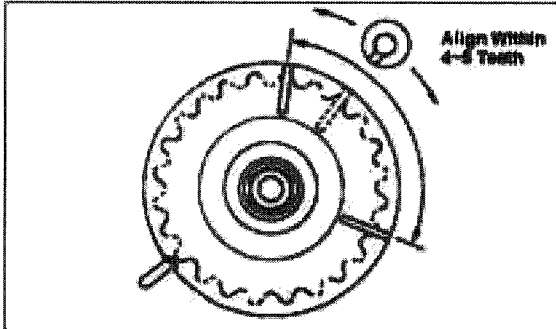
Timing Belt Replacement DOHC



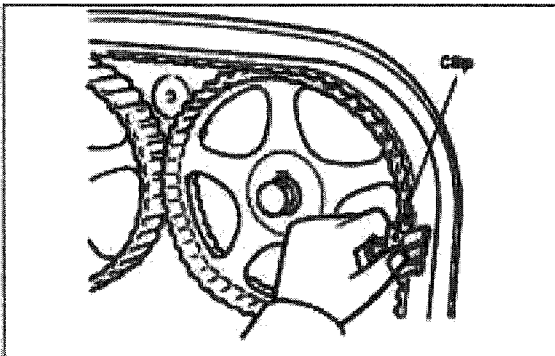
- To prevent the Oil Pump from moving while setting alignment slide a 8mm thick screw driver through the side hole as shown on the left. The screw driver will prevent the Counter Balance Shaft from moving. Minimum Shaft length 65mm.



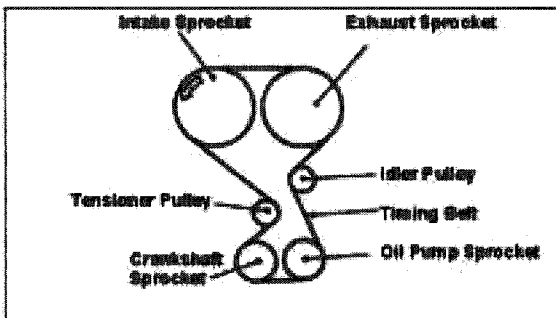
- Using the Diagram on the left align the Pickle Marks as shown



- Use the close-up Diagram on the left showing the Oil Pump Sprocket. The Alignment Marks must be within 4 to 5 Gear Teeth as shown.

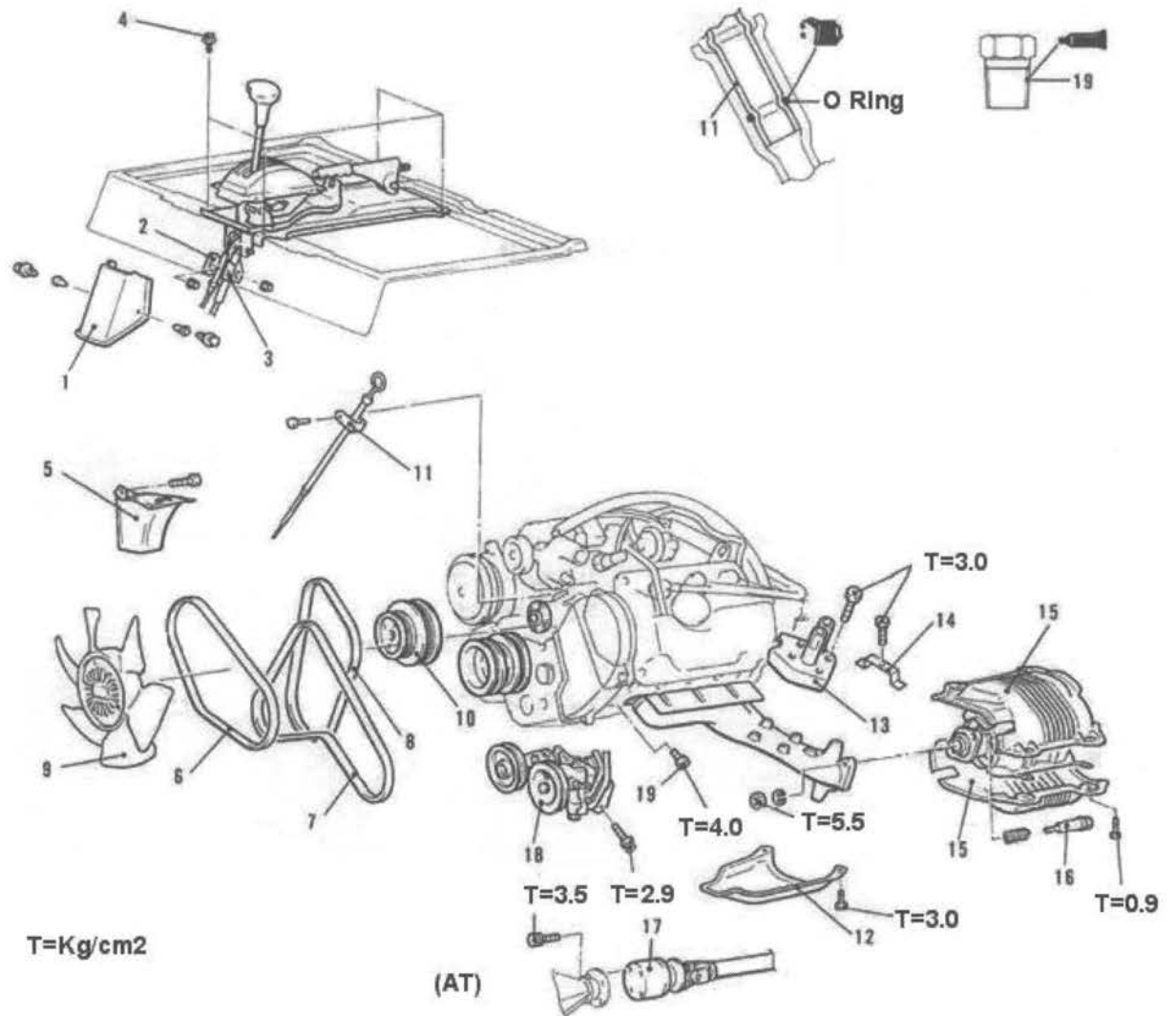


- Install Timing Belt. Use a large Book Binding Paper Clip as shown to prevent movement.



- Set Tensioner. Belt Play between the Intake & Exhaust Sprockets no more than 4 to 5mm.
- Remove Clip. Rotate Engine One Full Rotation to Verify TDC points align.
- Assemble Components in Reverse Order.

Cylinder Head Gasket Replacement SOHC

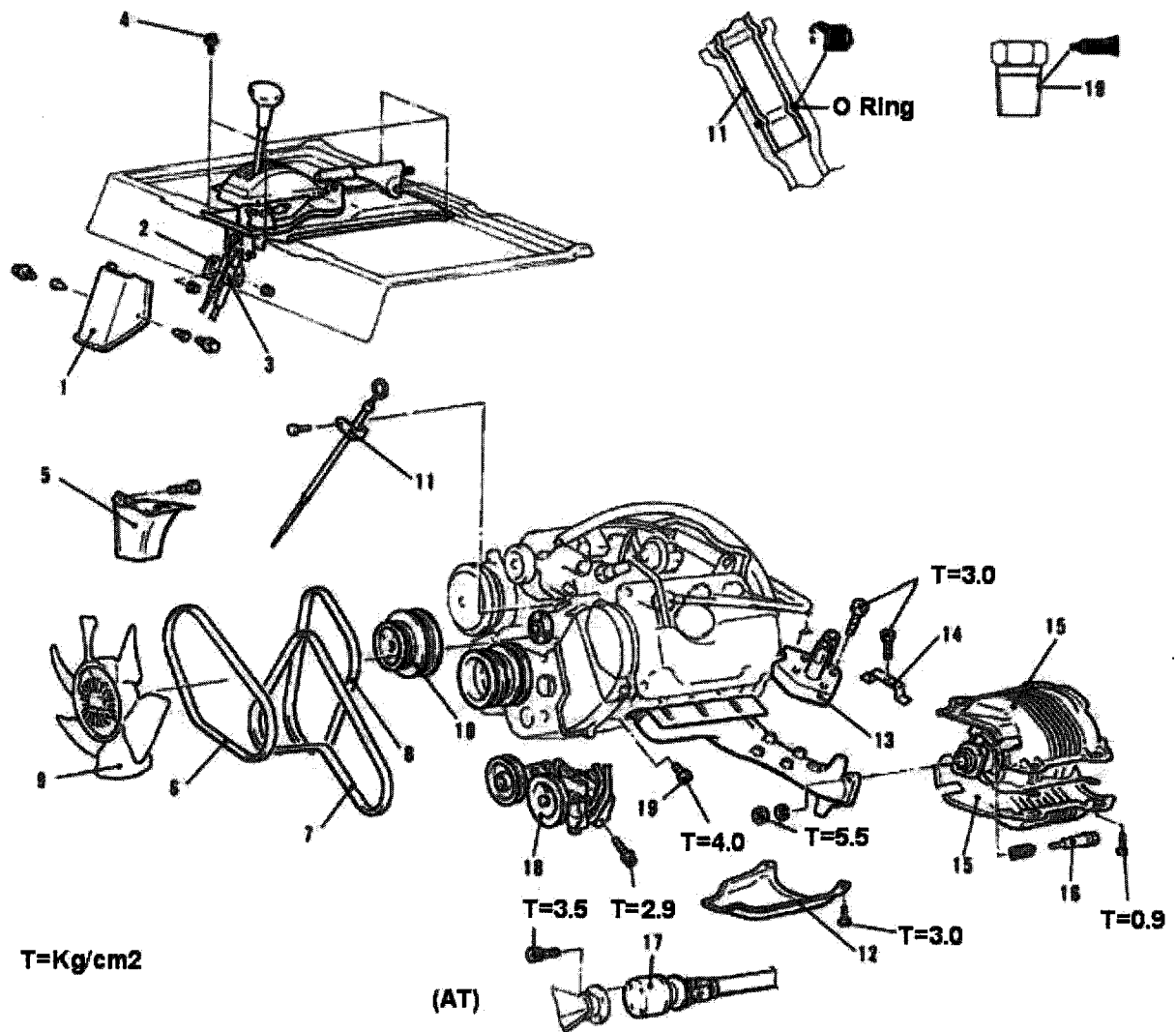


Cylinder Head Gasket Removal Order

Remove or Disconnect the Following Items

1. (AT Vehicles) Remove Cable Cover Note: IGN Lock Models remove Trans Lock Rod
2. (AT Vehicles) Disconnect Key Interlock Cable
3. (AT Vehicles) Disconnect Shift Lock Cable
4. Remove Center Shift Cover Panel
5. Remove Shroud "A"
6. (AC Vehicles) Remove AC Belt
7. (Power Steering Vehicles) Remove PS Belt
8. Remove Alternator Belt
9. Remove Cooling Fan
10. Remove Water Pump Pulley

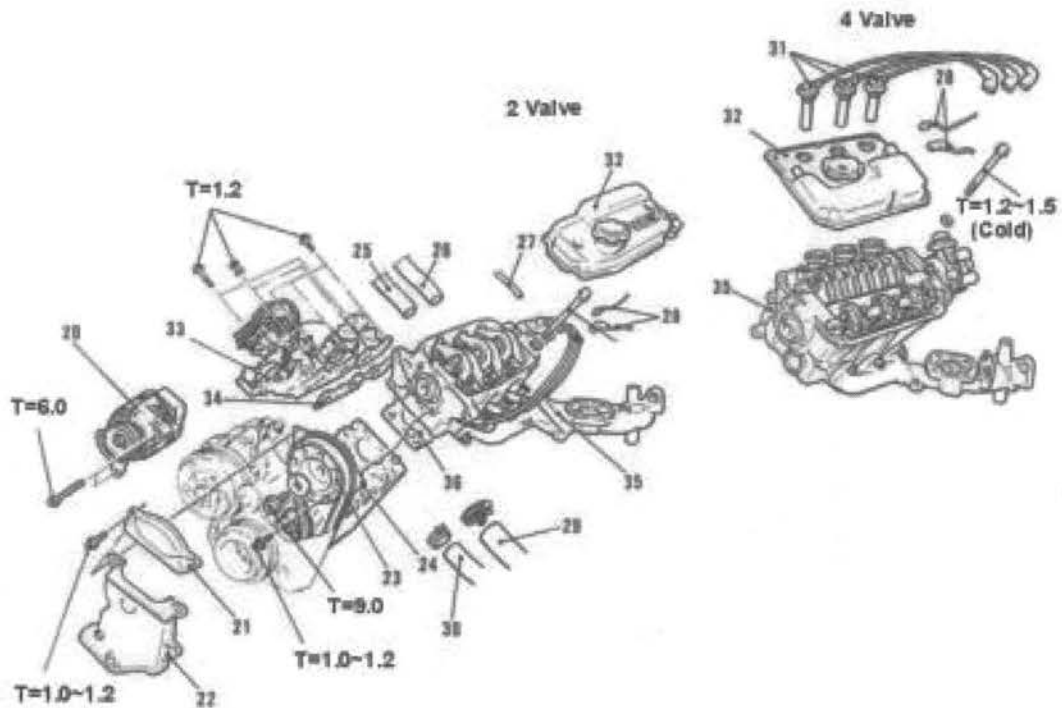
Cylinder Head Gasket Replacement SOHC



Cylinder Head Gasket Removal Order

11. Remove Oil Dip Stick Guide (Dip Stick Tube)
12. Remove Exhaust Manifold Cover
13. Remove Heat Cowl
14. Remove Exhaust Manifold Cover Bracket
15. Remove Converter Cover
16. Remove Exhaust Manifold & Catalytic Converter Assemblies
17. Remove HCU Unit & Cover with a Protective Bag
18. Remove Power Steering Oil Pump Assembly
19. Remove Drain Plug and Drain Oil

Cylinder Head Gasket Replacement SOHC



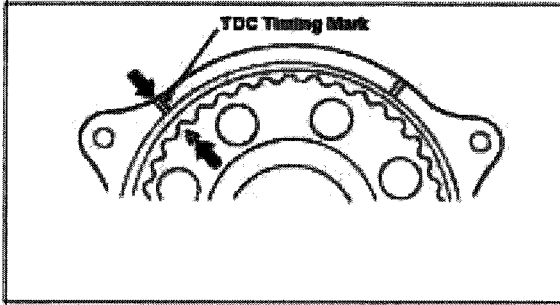
20. Remove Alternator
21. Remove Timing Belt Cover A
22. Remove Timing Belt Cover B
23. Remove Camshaft Sprocket
24. Remove Timing Belt Lower Cover
25. Disconnect Ventilation Hose
26. Disconnect Breather Hose
27. Disconnect Vacuum Hose
28. Disconnect Spark Plug Wires
29. Remove Radiator Upper Hose
30. Disconnect Heater Hose
31. Remove Spark Plug Wires (4 Valve)
32. Remove Rocker Cover (Valve Cover)
33. Remove Intake Manifold
34. Remove Intake Manifold Gasket
35. Remove Cylinder Head Assembly and Exhaust Manifold
36. Remove Cylinder Head Gasket

Installation in Reverse Order

Note: Never Reuse Gaskets

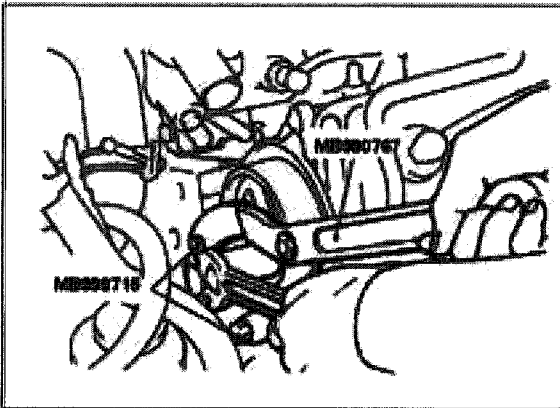
Note: For Timing Belt Installation Details See Timing Belt Section of this Manual

Cylinder Head Gasket Replacement SOHC Installation Points



Timing Belt Alignment

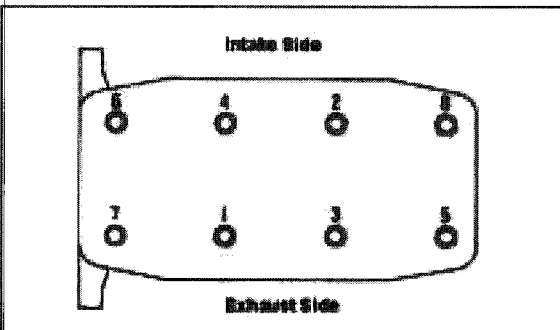
Note: Always Align TDC Before Installing Timing Belt to TDC. Rotate Engine Clockwise Two Times to Verify Setting Before Installing Other Components. See Timing Belt Section for More Details.



Camshaft Sprocket Installation Points

Always Use Proper Tools During Camshaft Sprocket Installation.

Use Tool: MB990767 To Hold Camshaft Sprocket in Place and Prevent Rotation.



Cylinder Head Torque Sequence

Note: Always Use New Gaskets

Note: Always Torque Engine (Cold)

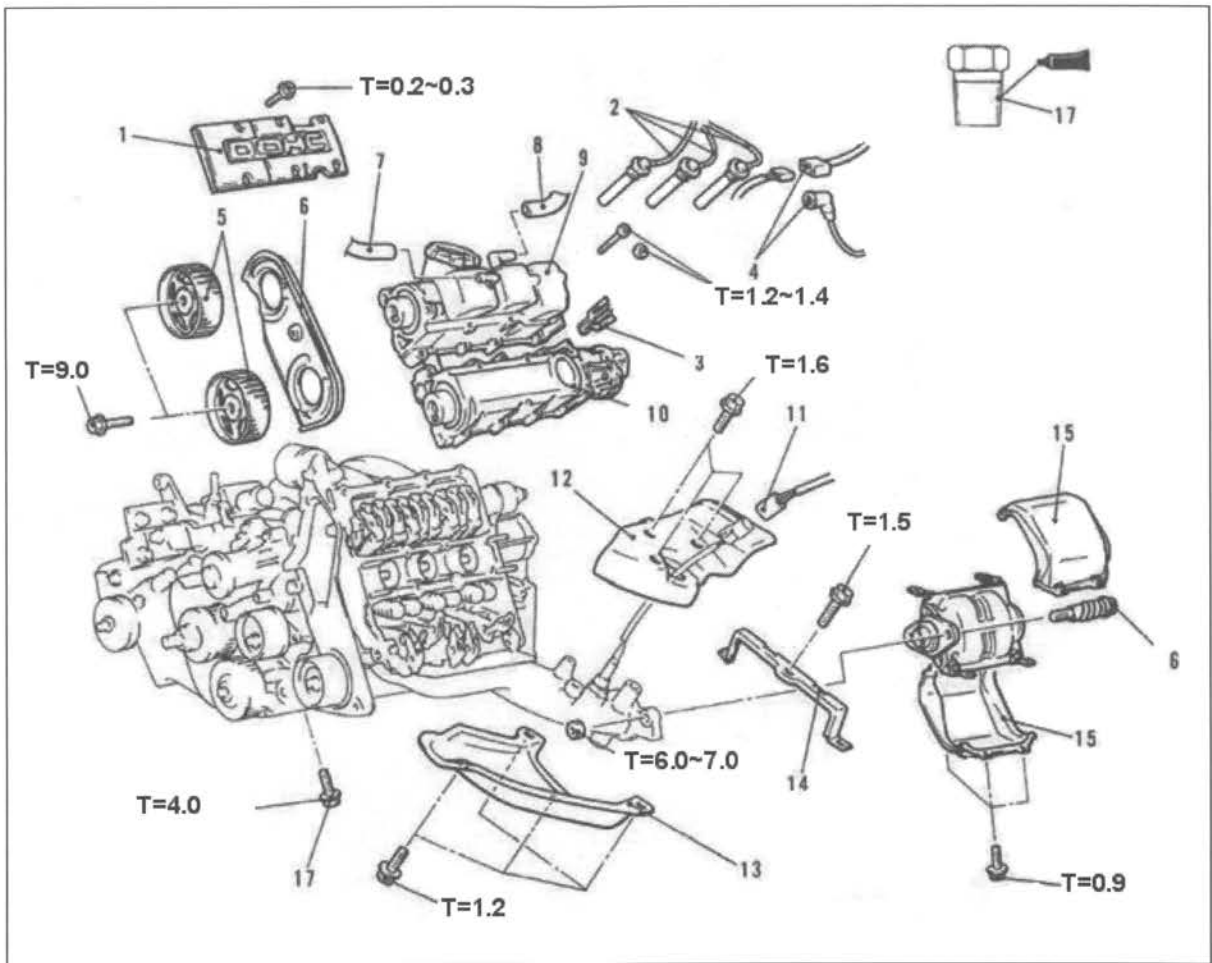
Note: Torque in Three Stage Settings

Note: 4 Valve Engines use Tool #MB991412 Head Bolt Socket Wrench

Note: See Previous Pages for All torque Settings

Note* See Other Chapters of this Manual for Individual Component Replacement Items

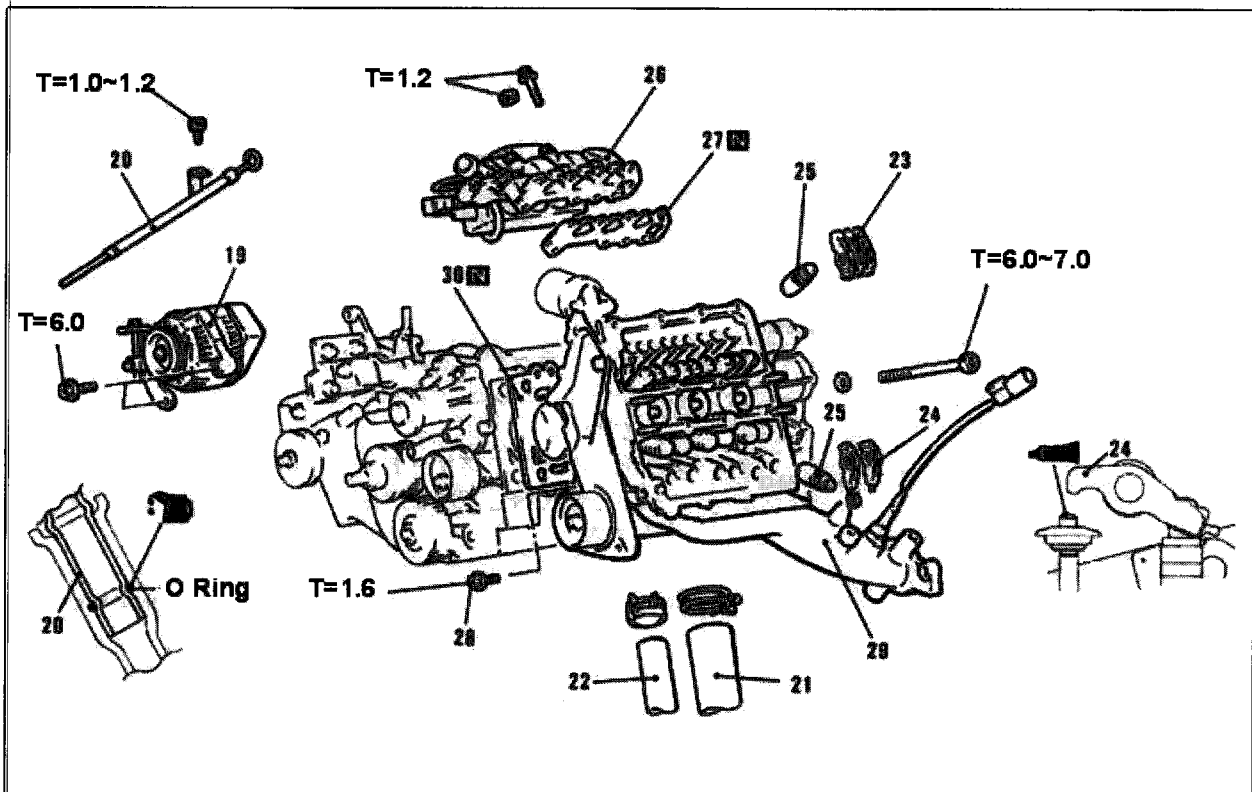
Cylinder Head Gasket Replacement DOHC



Cylinder Head Gasket Removal Order

1. Remove Center Cover
2. Remove Spark Plug Wires
3. Remove Cable Clamp
4. Remove Coil Wire & Connector
5. Remove Camshaft Sprocket
6. Remove Timing Belt Rear Upper Cover
7. Disconnect Ventilation Hose
8. Disconnect Breather Hose
9. Remove Right Side Camshaft Housing
10. Remove Left Side Camshaft Housing
11. Disconnect O2 Sensor Connector
12. Remove Heat Cowl
13. Remove Exhaust Manifold Cover
14. Remove and Discard Exhaust Manifold Gasket
15. Remove Protector
16. Remove Catalytic Converter Assembly
17. Remove Drain Plug

Cylinder Head Gasket Replacement DOHC



18. *Manual Delete Number Sequence*
19. Remove Alternator
20. Remove Dip Stick Guide Tube
21. Remove Radiator Upper Hose
22. Disconnect Heater Hose
23. Remove Intake Rocker Arms
24. Remove Exhaust Rocker Arms
25. Remove Auto-Lash Adjuster (Hydraulic Lifters)
26. Remove Intake Manifold & Cylinder Head Assembly
27. Remove and Discard Manifold Gasket
28. Remove Timing Belt Lower Cover
29. Separate Cylinder Head and Exhaust Manifold Assembly
30. Remove Cylinder Head Gasket and Discard

Note: Thoroughly Clean and Inspect all Parts before Reassembly

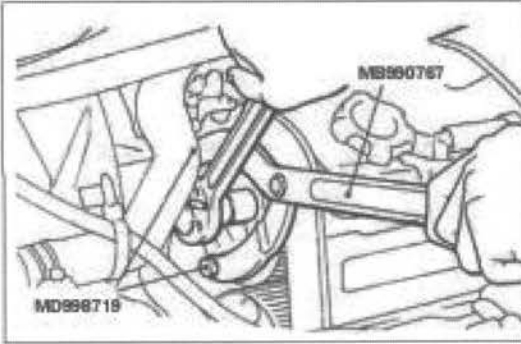
Note: Do Not Reuse Gaskets

Installation is in Reverse Order: See Related Sections of this Manual for Individual Component Replacement Procedures.

Note: All Torque Values are shown in the Respective Diagrams

Cylinder Head Gasket Replacement DOHC

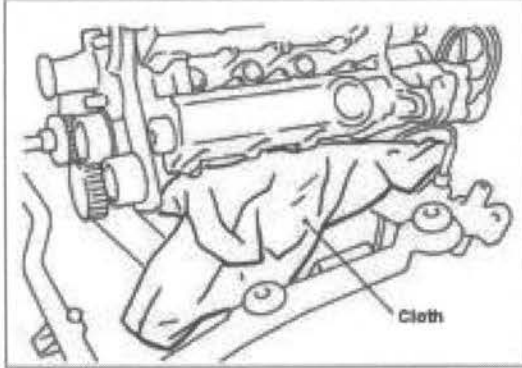
Installation Points



Camshaft Sprocket Torque Setting

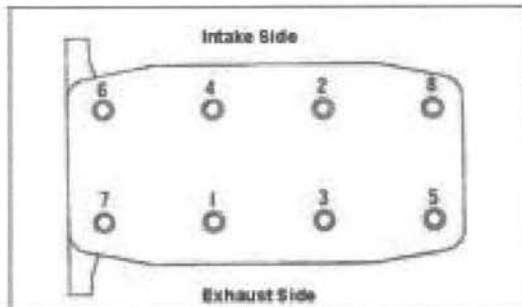
Use Tool MB990767 to Hold Sprocket in Position during Assembly

Note: Always Align TDC Before Installing Timing Belt to TDC. Rotate Engine Clockwise Two Times to Verify Setting Before Installing Other Components. See Timing Belt Section for More Details.



Left Side Rocker Housing Cover

Due to the Low Position Place a Clean Cloth over Exhaust Manifold to Prevent Oil Leaking onto the Manifold. Caution: Spilled Oil can Cause a Fire.



Cylinder Head Torque Sequence

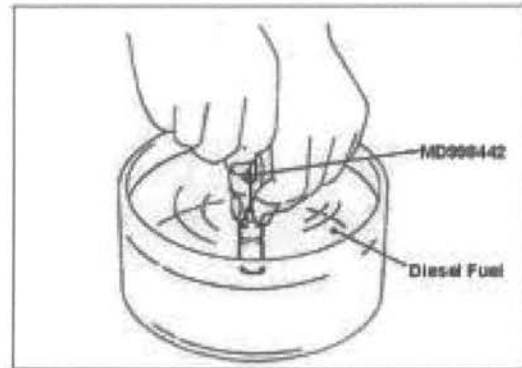
T=6.0-7.0

Note: Always Use New Gaskets

Note: Always Torque Engine (Cold)

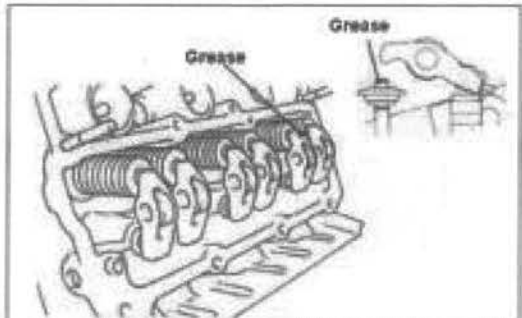
Note: Torque in Three Stage Settings

Note: Use Tool #MB991412 Head Bolt Socket Wrench



Clean Auto-Lash Adjusters in Clean Diesel Fuel using Tool #MD998442. After Cleaning Soak in Fresh Engine Oil SAE 30W for Minimum 10 Minutes before Installation.

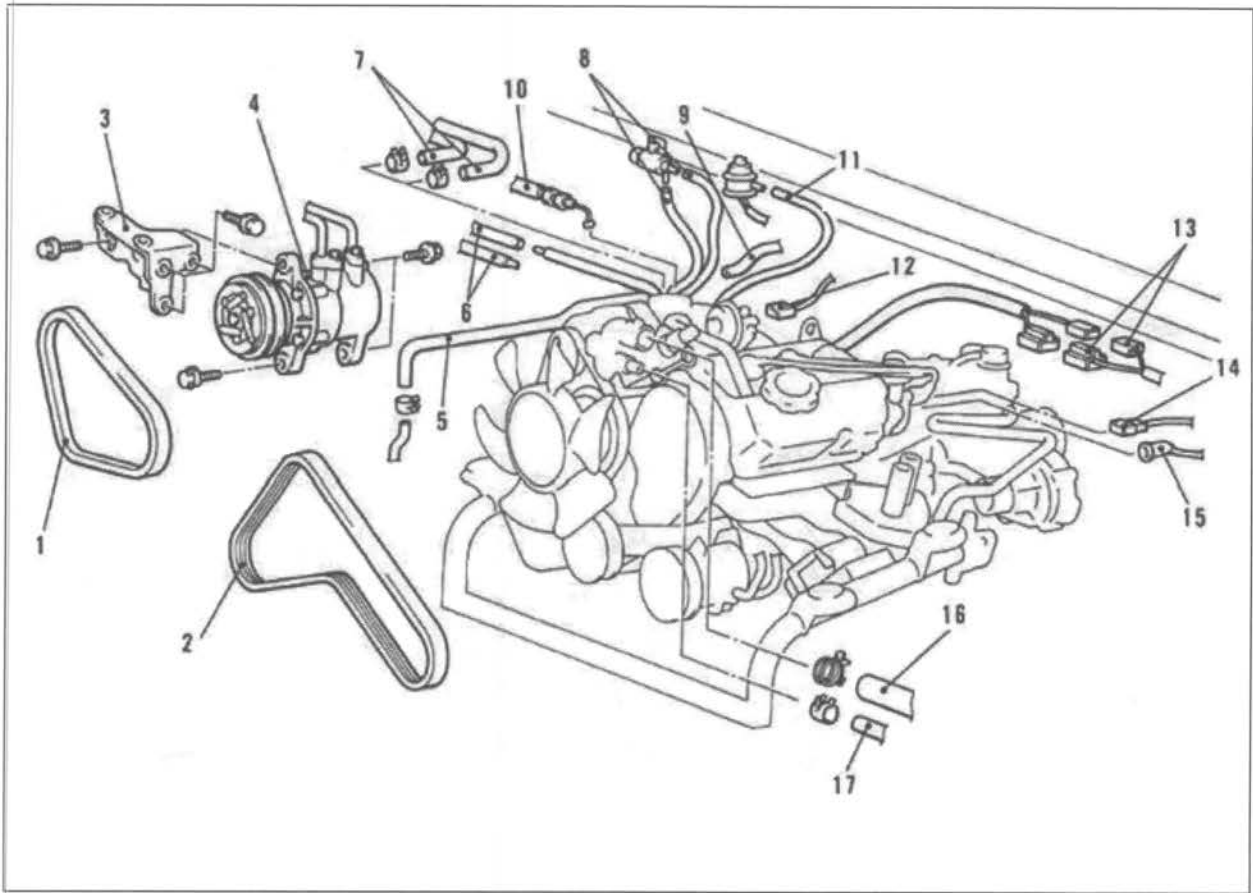
Grease Rocker Arm Tips & Valve Tips before Installation.



Note: After Complete Installation Run Engine Minimum 10 Minutes between Idle & 3000 RPM. Check Engine and then Test Drive. Change Oil After 100-250 Kilometers.

Note* See Other Sections for More Details on Individual Component Installation.

Engine & Transmission Removal SOHC

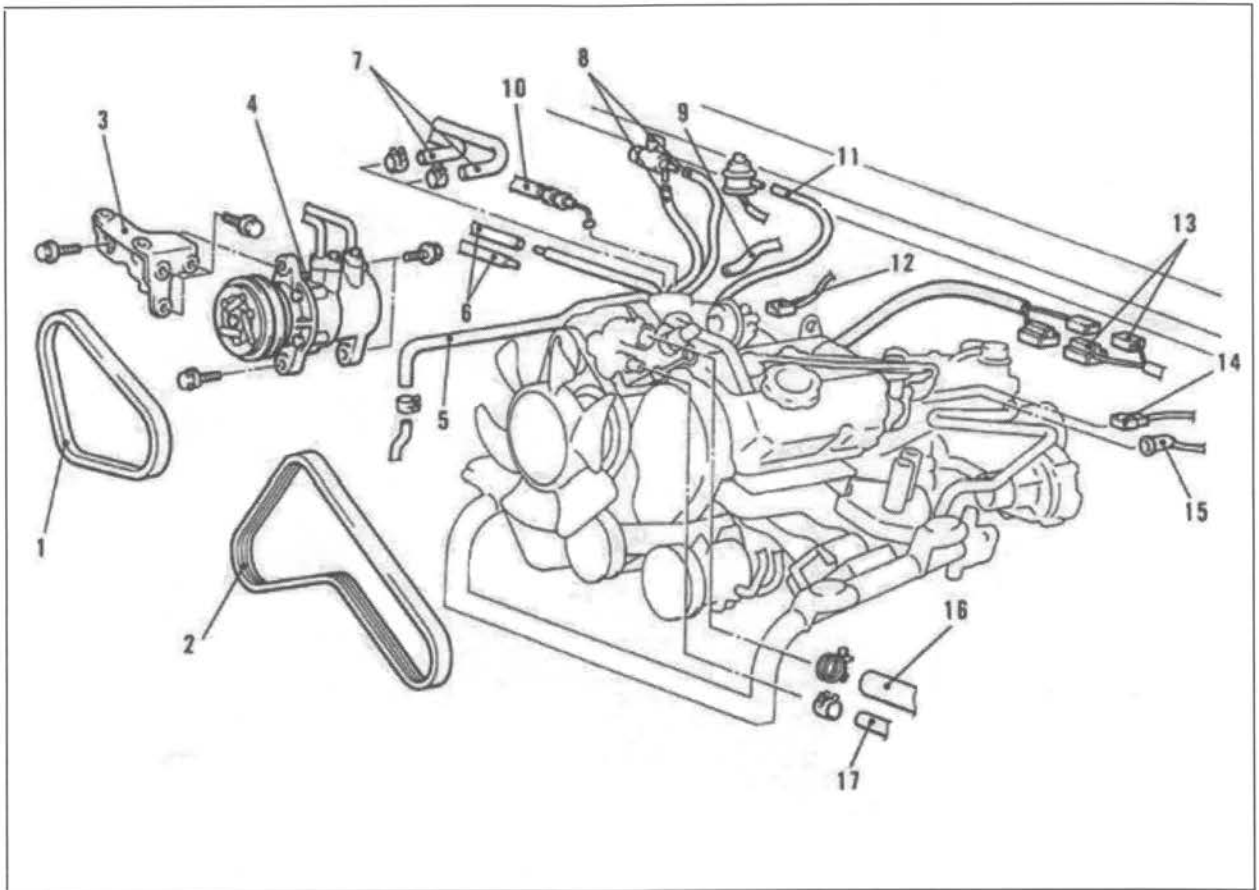


Engine Removal Component Order

Note: Disconnect Negative (-) Battery Cable, Drain Coolant before Proceeding.

1. (AC Vehicle) AC Belt
2. (PS Vehicle) Power Steering Belt
3. (AC Vehicle) Compressor Upper Bracket
4. (AC Vehicle) Remove AC Compressor: Do not Disconnect Lines
5. Disconnect Brake Booster Vacuum Hose
6. Disconnect Vapor Hoses
7. Disconnect Fuel Hose and Plug
8. (AC Vehicle) Disconnect AC Fast Idle Vacuum Hose
9. Disconnect Vacuum Hose (PT 4WD Vehicle)
10. Disconnect Accelerator Cable
11. Disconnect Vacuum Switch Hose
12. Disconnect PWR Steering Idle-Up Connector
13. Disconnect Engine Harness Connections
14. Disconnect Distributor Connector
15. Remove Coil Wire

Engine & Transmission Removal SOHC



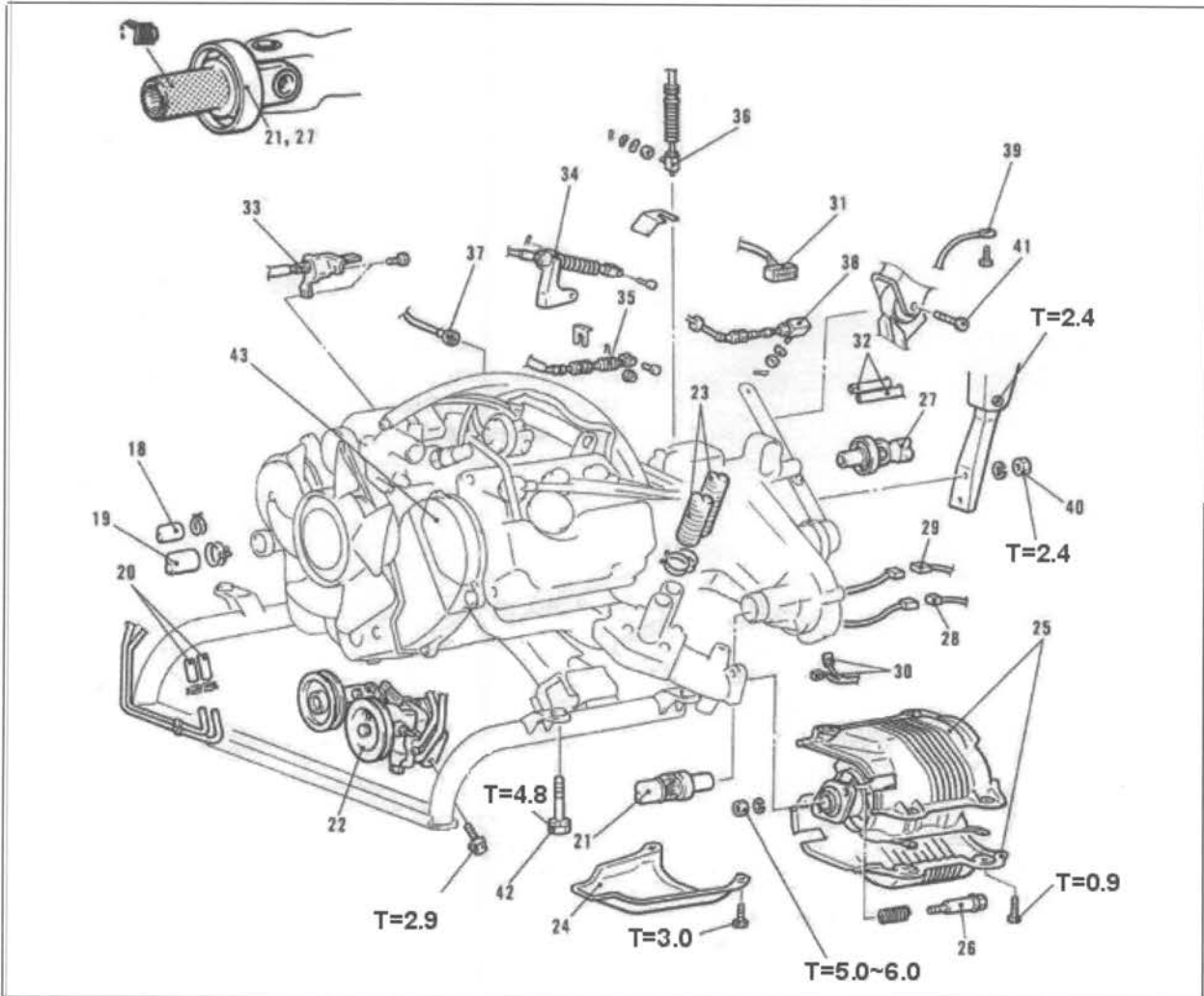
16. Remove Radiator Upper Hose

17. Remove Heater Hose

Note: Do not Reuse Engine Coolant

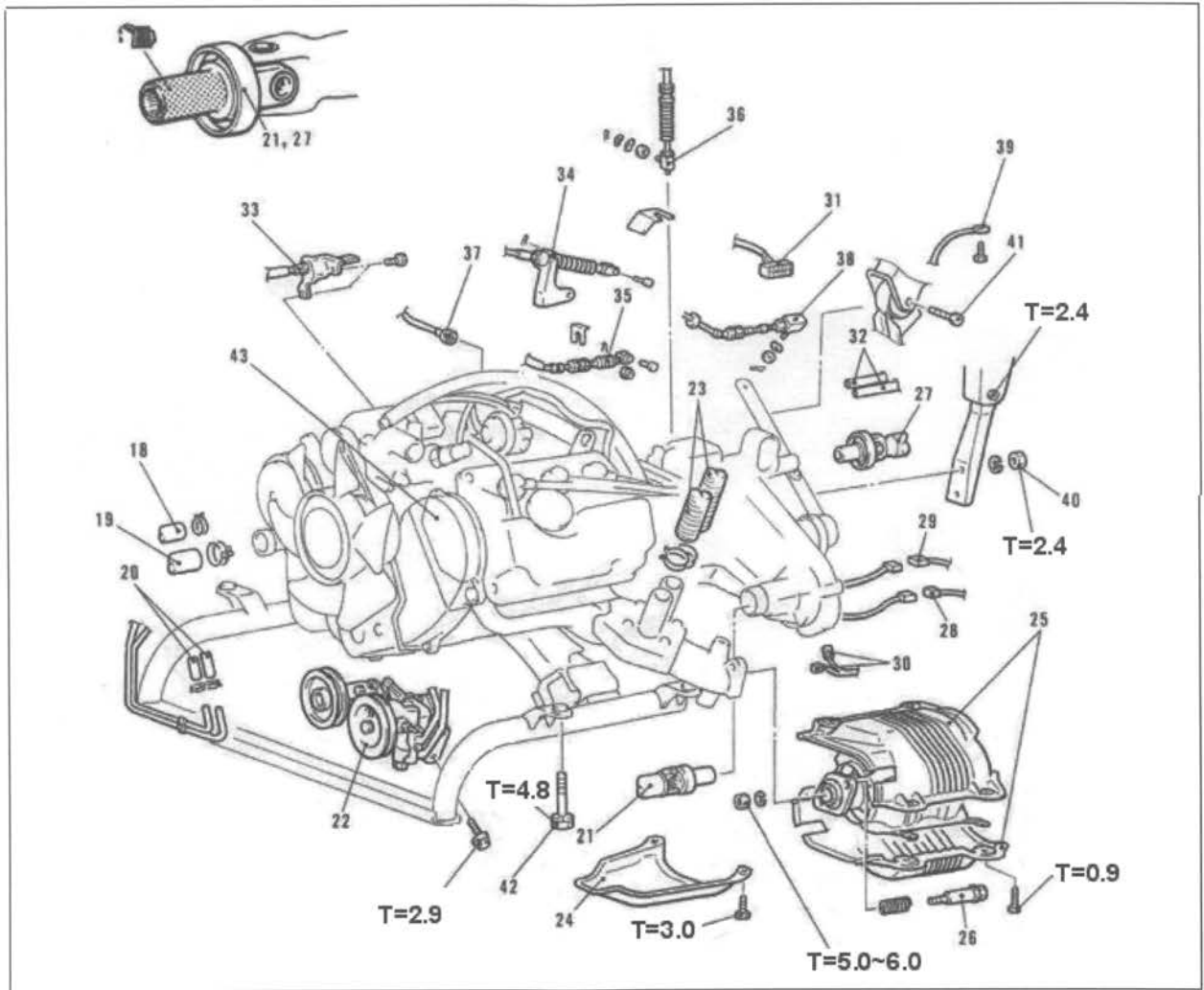
(Continued on next page)

Engine & Transmission Removal SOHC



18. Disconnect Heater Hose
19. Remove Lower Radiator Hose
20. (AT Vehicle) Disconnect Oil Cooler Hose
21. 4WD Remove Front Drive Shaft: Mark Bolt Positions
22. Remove PWR Steering Pump
23. Remove Hot Air Duct
24. Remove Exhaust Manifold Cover
25. Remove Catalytic Converter Cover
26. Remove Exhaust Manifold and Catalytic Converter Assemblies
27. Remove Rear Drive Shaft and Plug Transmission Shaft End: Mark Bolt Positions
28. Disconnect Back-Up Switch Connector
29. Disconnect Transfer Case Switch Connector (4WD)
30. Disconnect Starter Connections
31. Disconnect Inhibitor Connection
32. (Part Time 4WD) Disconnect Vacuum Actuator Hose

Engine & Transmission Removal SOHC



33. Disconnect Clutch Cable
34. Disconnect Select Cable (MT)
35. Disconnect Shift Cable (MT)
36. Disconnect Control Cable (AT)
37. Disconnect Speedometer Cable
38. Disconnect Transfer Control Cable
39. Disconnect Ground (-) Cable
40. Place Jacks in Place and Remove Transfer Mount Nut
41. Remove Rear Mount Attachment Bolt
42. Remove Cross Member Bolts
43. Remove Engine

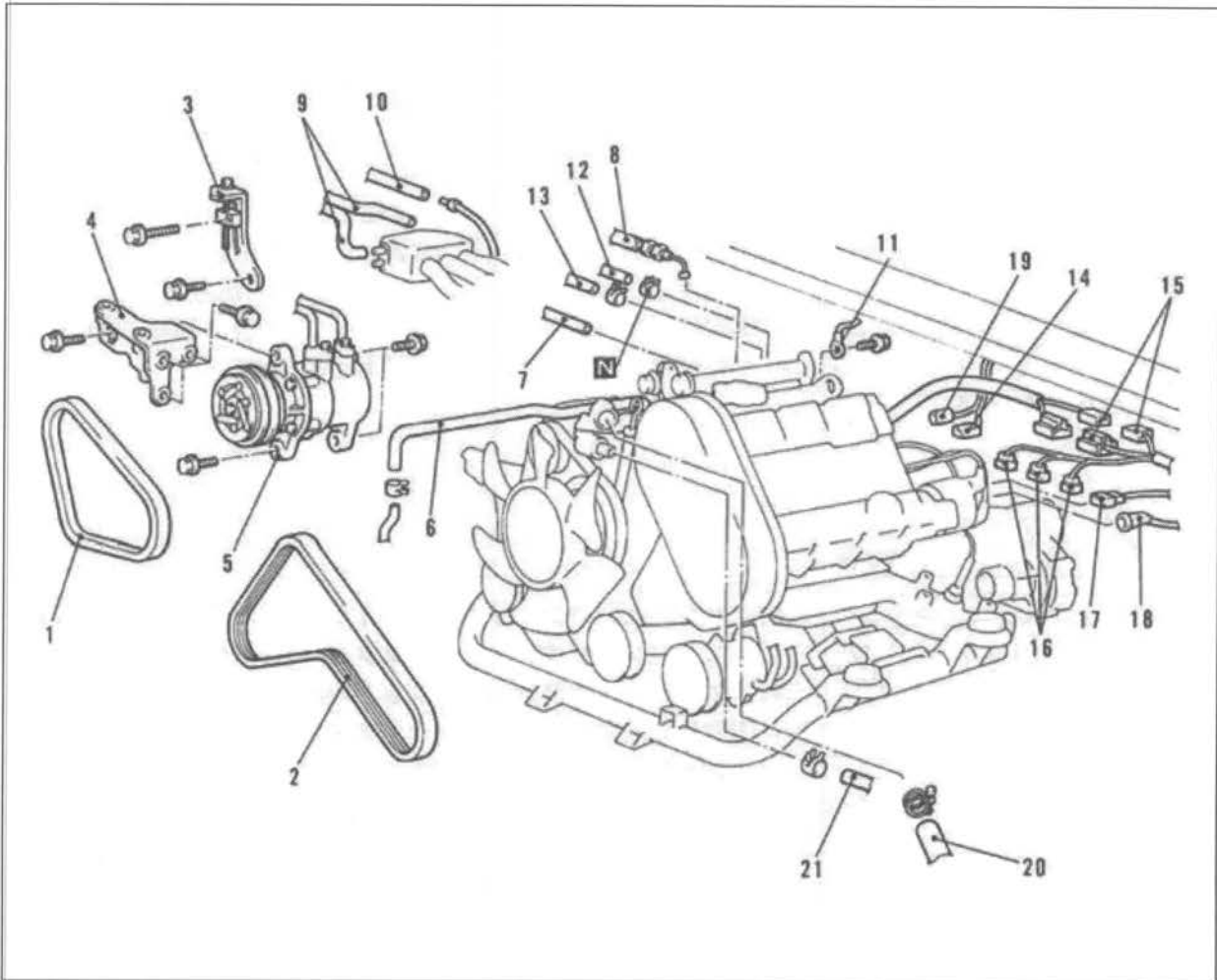
Note: When Lowering Engine Take Care Not to Damage Surrounding Parts or Electrical Connections.

Note: Installation in Reverse Order

Note: Always Use New Engine Oil & Coolant During Installation

Note: See Individual Component Sections for Details and Adjustments

Engine & Transmission Removal DOHC



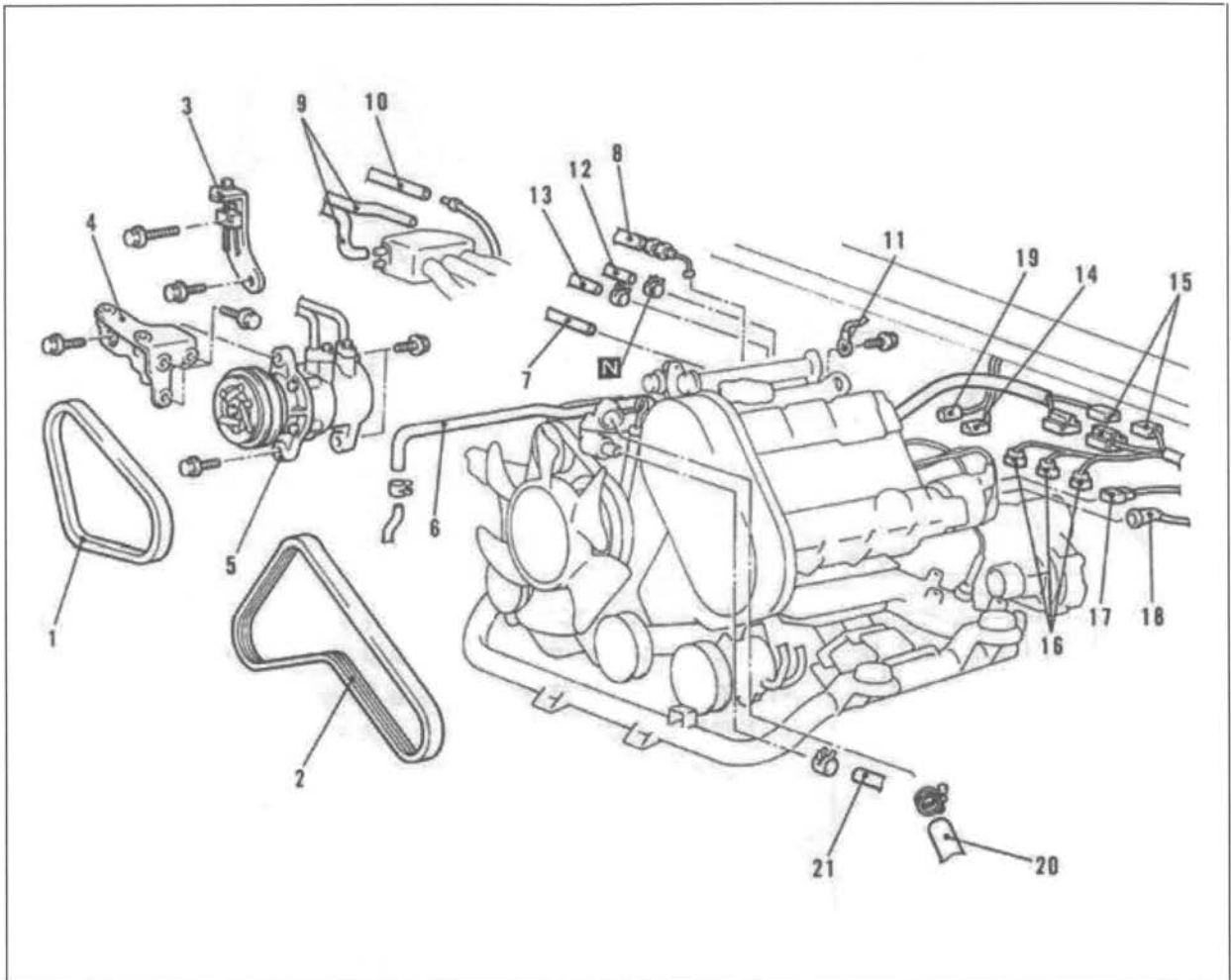
Engine Removal Component Order

Note: Disconnect Negative (-) Battery Cable, Drain Coolant before Proceeding.

Note: Prepare Proper Engine Jacks

1. Remove AC Belt (AC Vehicle)
2. Remove PS Belt (PWR Steering Vehicle)
3. Remove Alternator Brace
4. Remove AC Compressor Upper Bracket (AC Vehicle)
5. Remove AC Compressor: Do not disconnect AC Hoses
6. Disconnect Brake Booster Vacuum Hose
7. Disconnect Boost Sensor Vacuum Hose
8. Disconnect Accelerator Cable
9. Disconnect AC Fast Idle Vacuum Hose
10. Disconnect Vapor Hose
11. Disconnect Ground (-) Cable
12. Disconnect and Plug Main Fuel Hose
13. Disconnect and Plug Return Fuel Hose

Engine & Transmission Removal DOHC

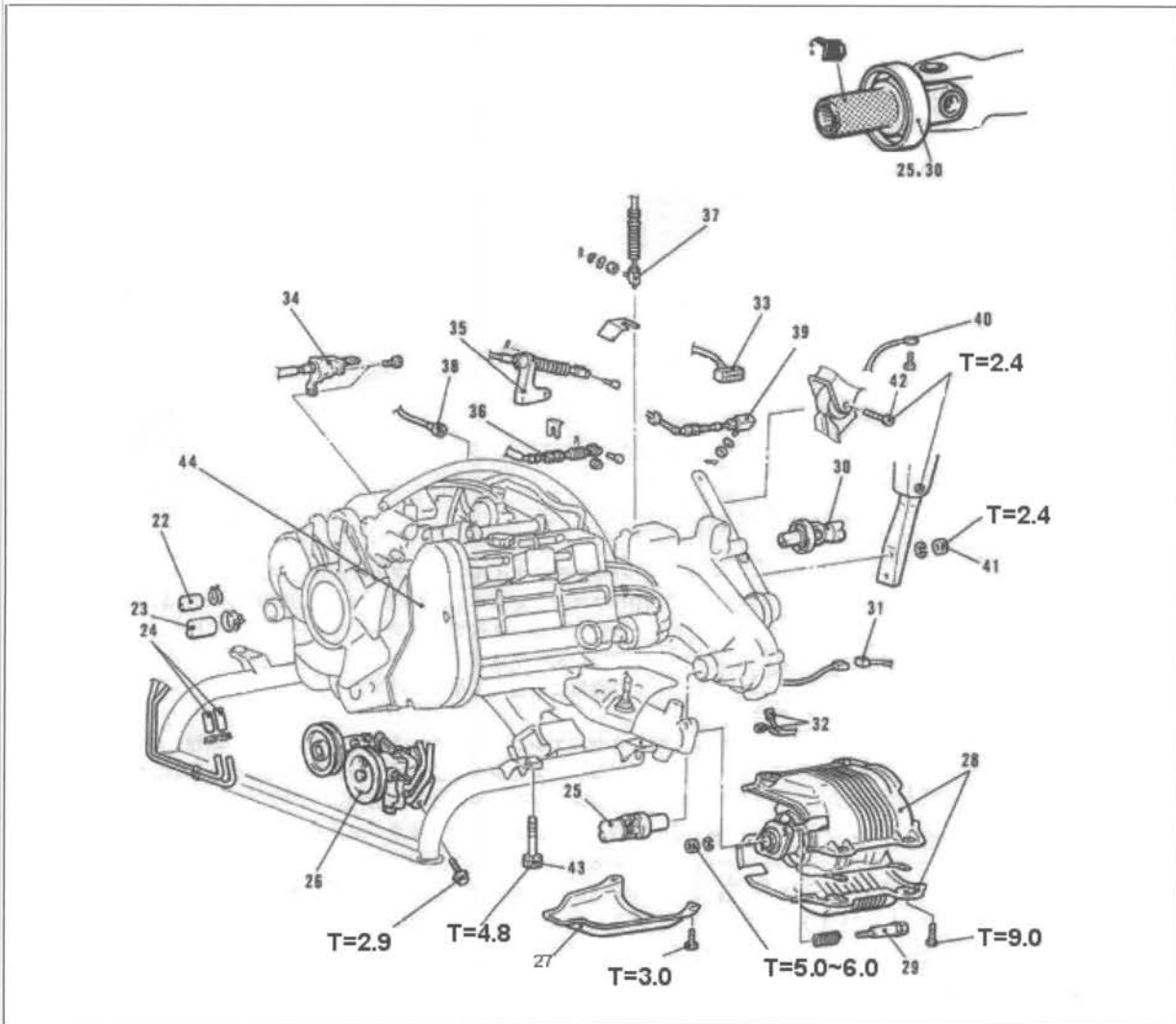


14. Disconnect Solenoid Valve Connector
15. Disconnect Engine Harness Connector
16. Disconnect Injector Connector
17. Disconnect Distributor Connector
18. Remove Coil Wire
19. Disconnect O2 Sensor Connector
20. Remove Radiator Upper Hose
21. Disconnect Heater Hose

Note: Never Reuse Engine Coolant or Engine Oil

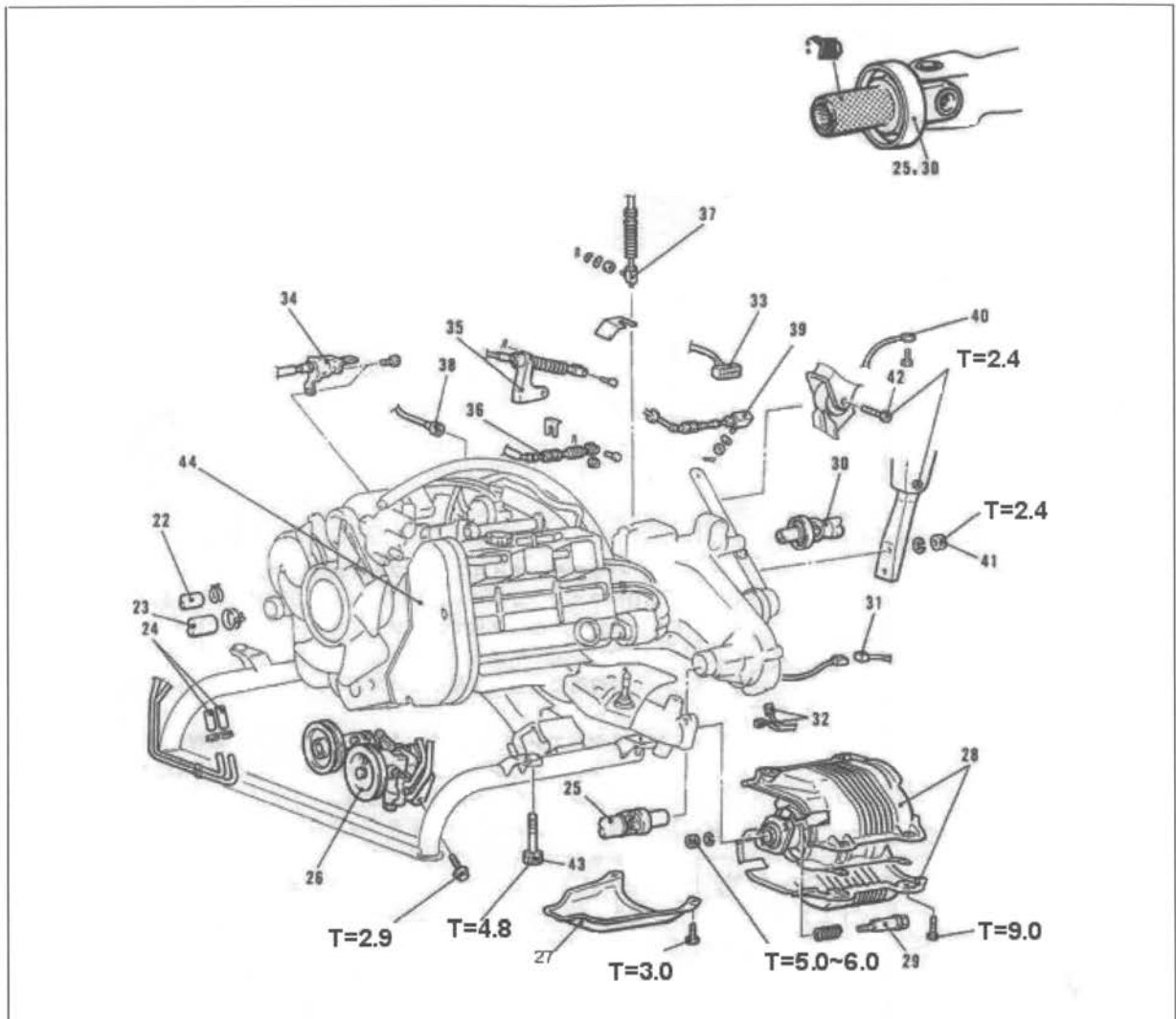
(Continued on Following Page)

Engine & Transmission Removal DOHC



22. Disconnect Heater Hose
23. Remove Lower Radiator Hose
24. Disconnect A/T Cooler Hose (AT Vehicle)
25. Remove Front Drive Shaft: Mark Bolt Position for Reassembly (4WD)
26. Remove PWR Steering Pump
27. Remove Exhaust Manifold Cover
28. Remove Converter Cover
29. Remove Catalytic Converter and Exhaust Manifold
30. Remove Rear Drive Shaft: Mark Bolt Position for Reassembly
31. Disconnect Back-Up Lamp Connector
32. Disconnect Starter Wire Harness
33. Disconnect Inhibitor Connector
34. Disconnect Clutch Cable (MT)
35. Disconnect Select Cable (MT)
36. Disconnect Shift Cable (MT)

Engine & Transmission Removal DOHC



37. Disconnect Control Cable (AT)
38. Disconnect Speedometer Cable
39. Disconnect Transfer Case Control Cable (4WD)
40. Disconnect Ground Cable (-)
41. Place Jacks in Place. Remove Transfer Mount Bolt
42. Remove Rear Mount Bolt
43. Remove Cross Member Bolts
44. Remove Engine Unit

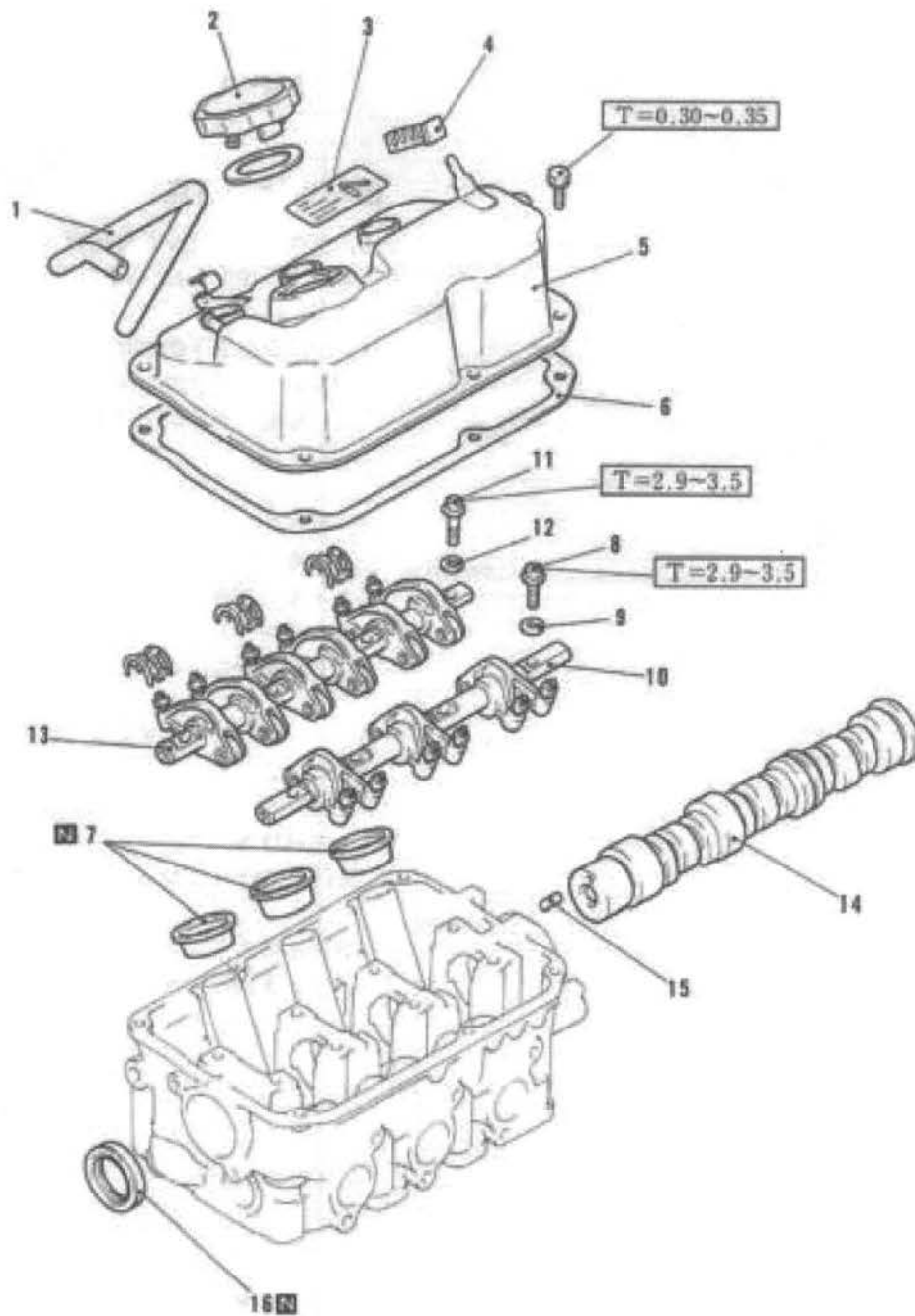
Note: When Lowering Engine Take Care Not to Damage Surrounding Parts or Electrical Connections.

Note: Installation in Reverse Order

Note: Always Use New Engine Oil & Coolant during Installation

Note: See Individual Component Sections for Details and Adjustments

Valve Train & Camshaft SOHC 4 Valve



Valve Train & Camshaft SOHC 4 Valve Components

1. PVC Hose
2. Oil Filler Cap
3. Caution Label
4. Cable Clamp
5. Rocker Cover
6. Rocker Cover Gasket
7. Spark Plug Guide Oil Seal
8. Special Exhaust Bolt
9. Washer
10. Rocker Arm Shaft Assembly: Exhausts
11. Special Intake Bolt
12. Washer
13. Rocker Arm Shaft Assembly: Intake
14. Camshaft
15. Dowell Pin
16. Camshaft Oil Seal

Note: Gaskets Can Not be Reused

Valve Train & Camshaft SOHC 4 Valve

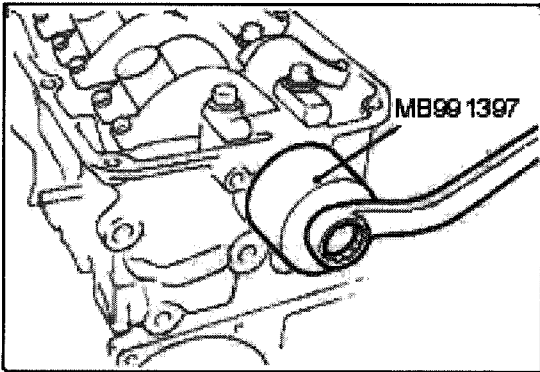
Camshaft Specification Limits

Lobe Height

Intake: 34.12mm-34.32mm

Exhaust: 34.57mm-34.77mm

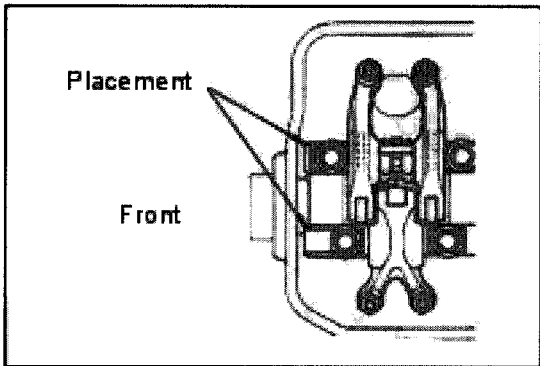
Note: Out of Range Replace Camshaft.



Inspection Points

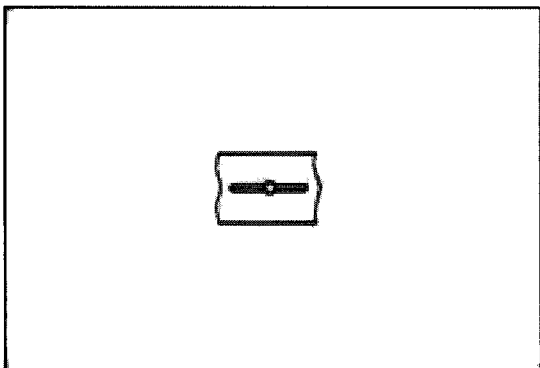
Note* If Engine Experiences Loss of High End Power and Valve Lash is Correct Remove Camshaft and Inspect Lobe Height. Engines Over 100,000 Kilometers should Replace Camshaft if Engine has been Disassembled.

Use tool MB991397 to Replace Leaking Oil seal. Seal Must be Replaced if Camshaft has been Removed.



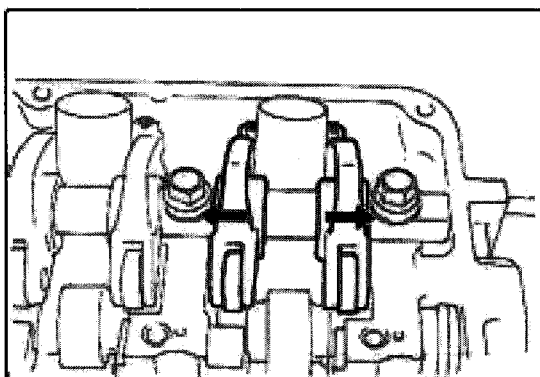
Inspect Valve Train Components for Proper Positioning. Valve Train Noise Can be Attributed to Miss-Alignment in High Mileage Engines.

Inspect Alignment & Re-Torque Components to Specifications. Always Readjust Valve Clearance after any Adjustments



Rail Positioning & Condition

Inspect Track Rails for Damage. Elongated Bolt Holes Require Unit to be Replaced.

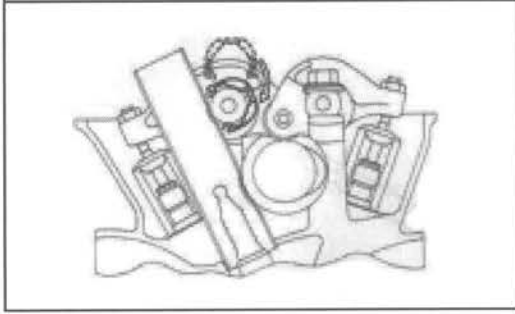


Special Bolt Inspection

Inspect Special Bolts and Rail Area. These Bolts Must be Replaced with Factory Specific Units. If Elongated Holes are Located During Disassembly Replace Entire Unit Including New Special Bolts.

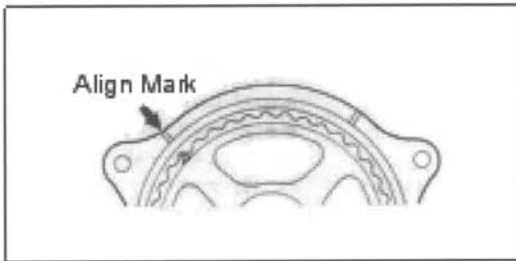
See Parts Catalogue for Engine Specific P/N

Valve Train & Camshaft SOHC 4 Valve



Rocker Shaft Spring Clip

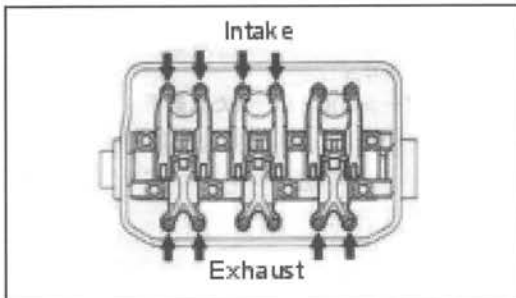
Use the Diagram on the Left as a Guide. Take Caution Not to Drop The Clip. Clips Should be Replaced on Engines over 60,000 Kilometers



Valve Clearance Settings

Note: Set Valves with at Ambient Temperature.

1. Rotate Engine to TDC Position (Triangle Mark)

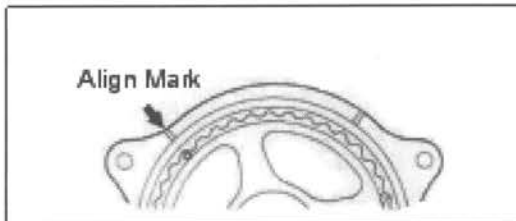


Clearance specifications: All Models

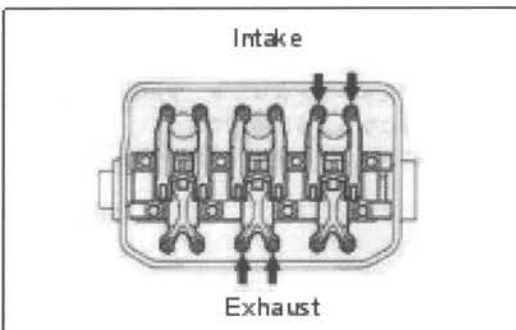
Intake: 0.07mm (Cold)

Exhaust: 0.17mm (Cold)

2. Set Valves as Show on the Left. Loosen Adjustment Screw and Set as Required



3. Rotate Engine to No.3 Cylinder TDC Circle Mark (o)



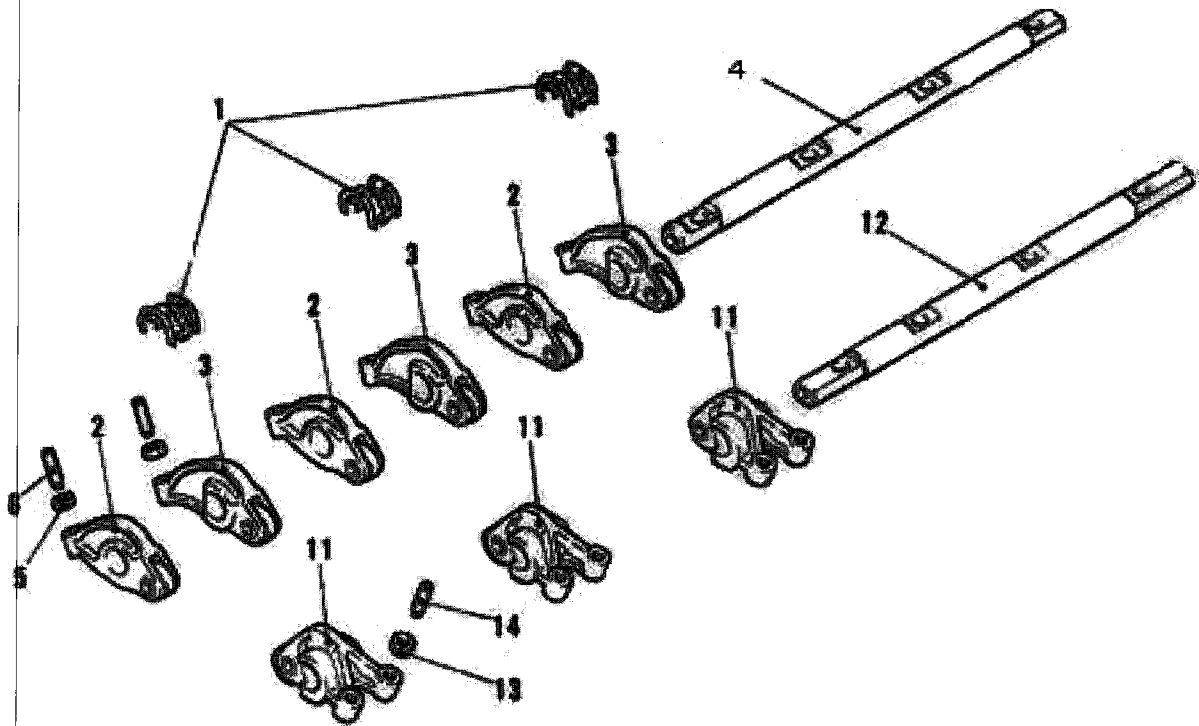
4. Set Remaining Valves

Note: Run Engine to Operating Temperature. Recheck Valve lash to "Hot" Specifications

Limits: Intake= 0.20mm (Hot)

Exhaust= 0.30mm (Hot)

Valve Train & Camshaft SOHC 4 Valve Components



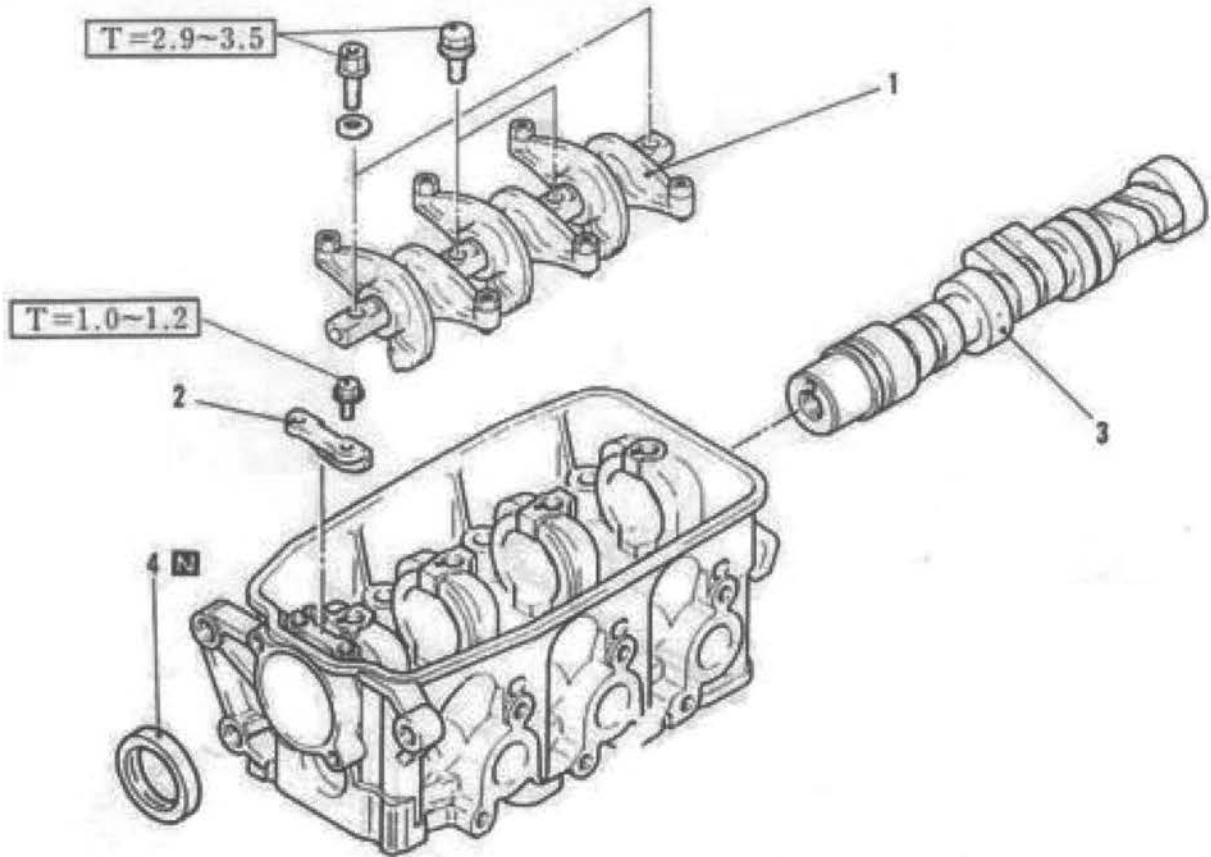
1. Rocker Shaft Springs
2. Rocker Arm A
3. Rocker Arm B
4. Rocker Shaft: Intake
5. Nut
6. Adjusting Screw
11. Rocker Arm C
12. Rocker Shaft: Exhaust
13. Nut
14. Adjusting Screw

Valve Train & Camshaft SOHC 2 Valve

Clearance specifications: All Models

Intake: 0.07mm (Cold)

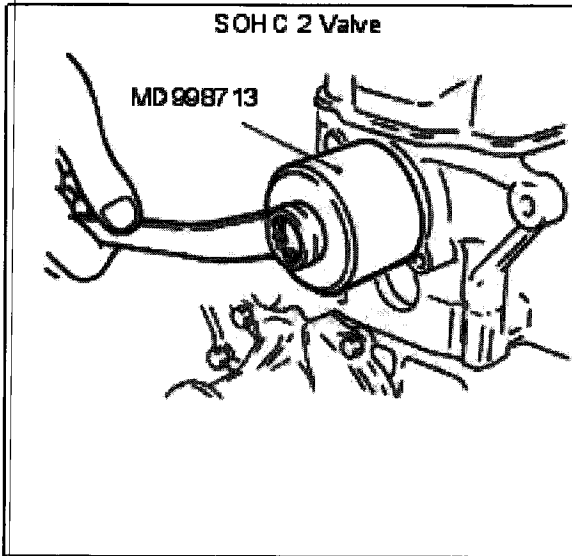
Exhaust: 0.17mm (Cold)



1. Rocker Arm and Rocker Arm Shaft Assembly
2. Camshaft Thrust Plate
3. Camshaft
4. Camshaft Oil Seal

Note: For Further Details on this Cylinder Head See Pre-1991 Service Manual or Service Parts Manual

Valve Train & Camshaft SOHC 2 Valve



SOHC 2 Valve Oil Seal Replacement

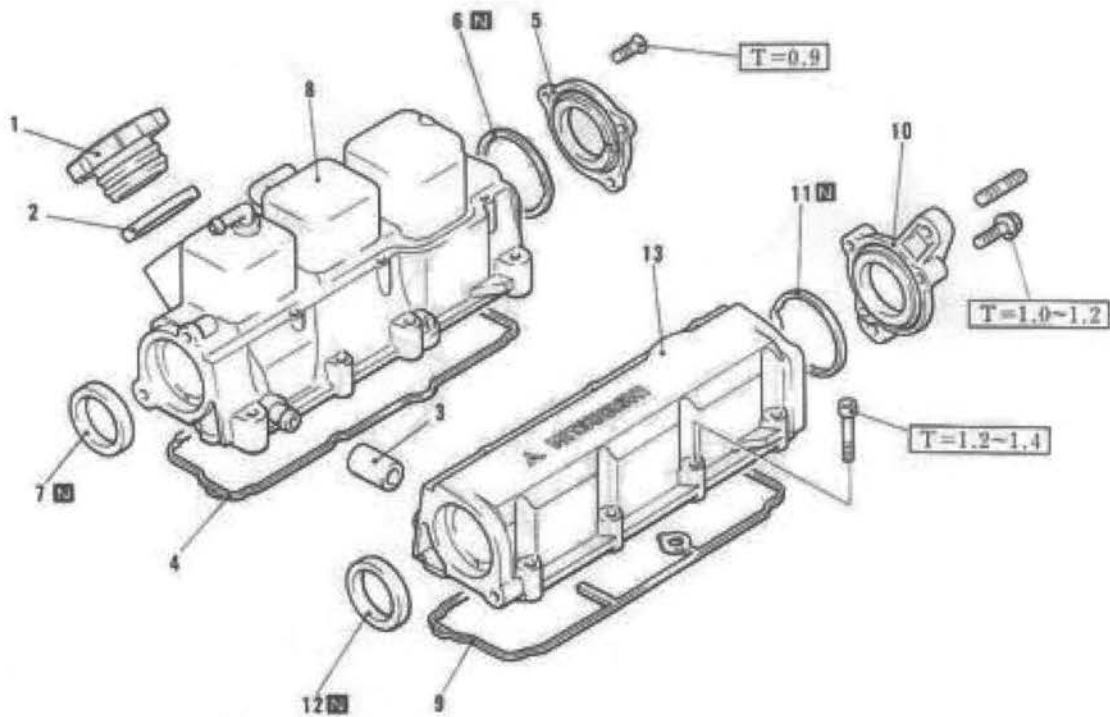
Use Tool MD998713 as Shown on the Left

Note: Never Reuse Seals

Note: See Pre-1991 Service Manual for Final Service Updates.

Note* Use Parts Catalogue for Engine Specific Cylinder Head Components

Valve Train & Camshaft DOHC 5 Valve

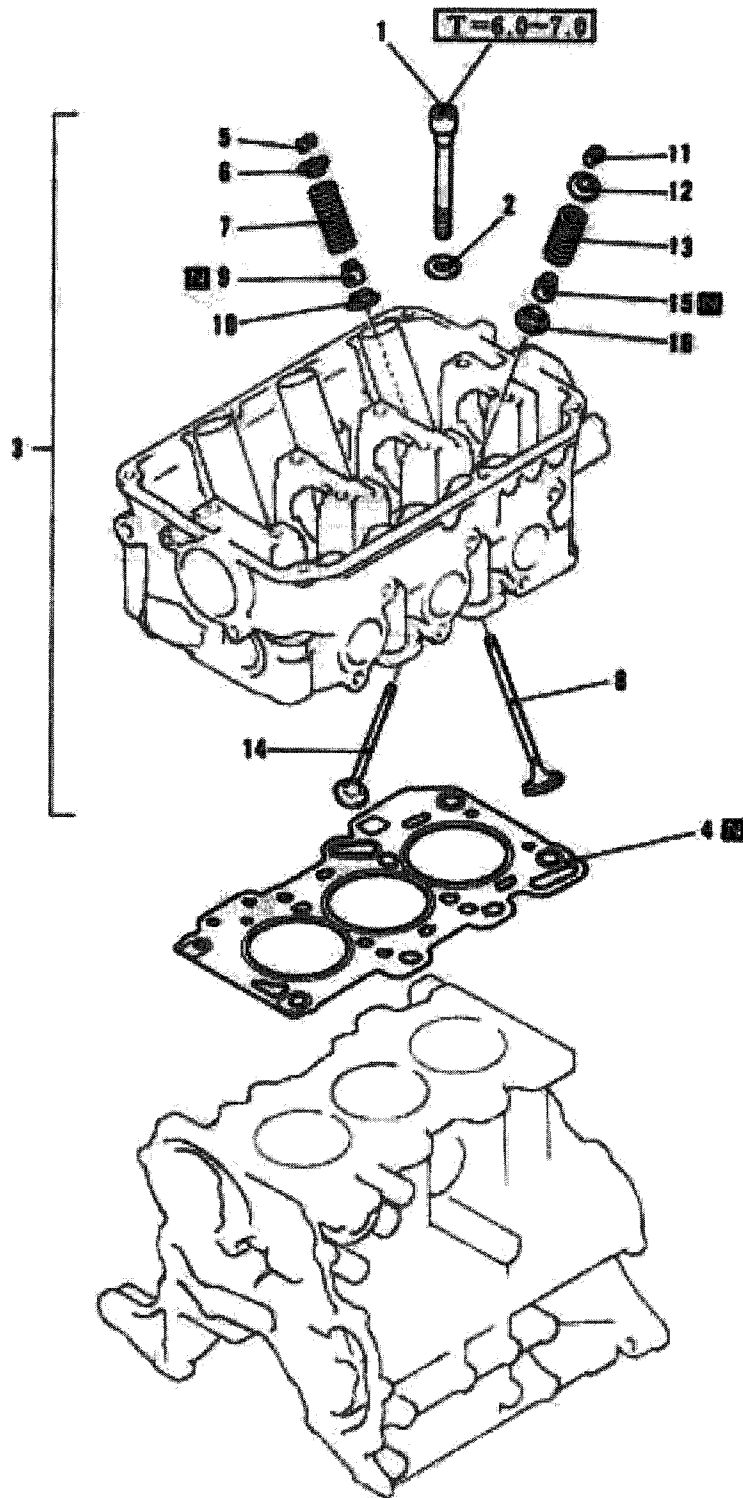


Removal: Details See Engine Cylinder Head Removal DOHC

1. Remove Oil Filler Cap
2. Gasket
3. Remove Blow-By Hose
4. Gasket
5. Camshaft Housing Cover
6. Gasket
7. Camshaft Oil Seal
8. Camshaft Housing: Right
9. Gasket
10. Distributor Bracket
11. Gasket
12. Camshaft Oil Seal
13. Camshaft Housing: Left

Note: DOHC Components are Not Adjustable: See Cylinder Head Gasket Section

Cylinder Head & Valves SOHC 4 Valve



Cylinder Head & Valves SOHC 4 Valve Removal & Overhaul

Note: Use Previous Diagram as a Guide (Camshaft Removed)

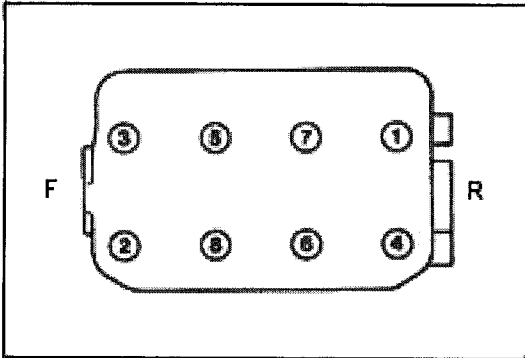
Note: See the Following Pages for Details & Required Tools

Removal

1. Remove Cylinder Head Bolts
2. Remove Washers: Do Not Reuse
3. Remove Cylinder Head Assembly
4. Remove and Discard Head Gasket
5. Remove Valve keepers: Use Spring Compressor as Shown in the Following Pages of this Section. Keep all Relative Parts Per Valve Together
6. Remove Valve Spring Retainer
7. Remove Valve Spring
8. Intake Valve
9. Valve Stem
10. Valve Spring Seat: Replace if Over 100,000 kilometers
11. Valve Spring Keepers
12. Valve Spring Retainer
13. Valve Spring
14. Exhaust Valve
15. Valve Stem Seal
16. Valve Spring Seat: Replace if Over 100,000 kilometers
17. Clean & Inspect Cylinder Head

Note* See Following Pages for Assembly

Cylinder Head & Valves SOHC 4 Valve



Inspection & Specification

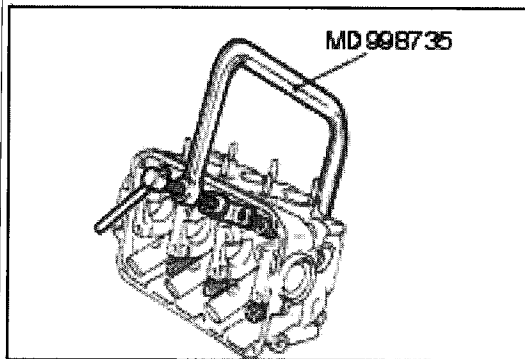
Cylinder Head Bolt Pattern & Torque Sequence

Torque: 6.0-7.0 kgm

Valve Spring Removal

Use Tool MD998735 (Spring Compressor) to Remove Valve Stem Keeper

Note: Use Extreme Caution-Springs Under Extreme Pressure. Wear Safety Goggles During Spring Removal

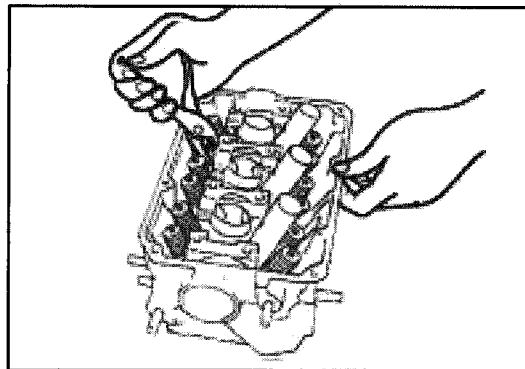


Valve Stem removal

Use Pliers to Pull out Valve Guides. Pull Straight Out & Do Not Wiggle During Removal.

Note* Valve Guides Can Not be Reused

See Parts Catalogue for Standard & Oversize Replacements



Valve Spring Height

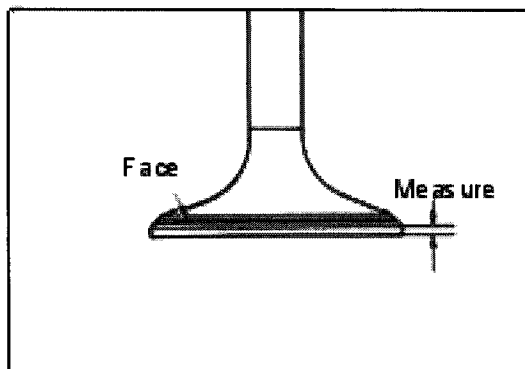
Free Travel Height Limit: 40.8mm

Spring Straightness Limit: Below 2 Degrees

Intake & Exhaust valve Inspection

Measure Limits: Intake 0.95mm

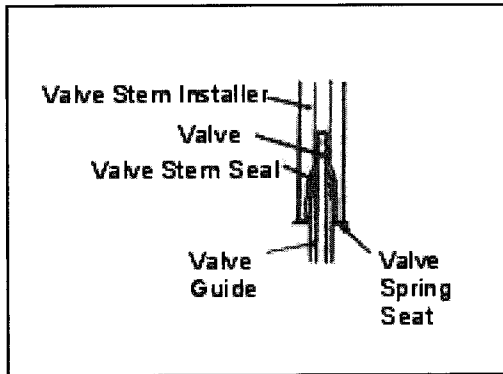
Exhaust 1.25mm



Note: Valve Face Can Not be Resurfaced if Damaged. New Units Must be Installed

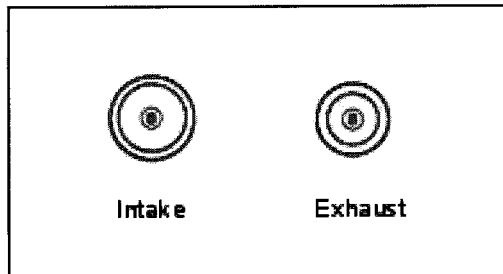
Note: Valves With Over 120,000 Should be Replaced

Cylinder Head & Valves SOHC 4 Valve

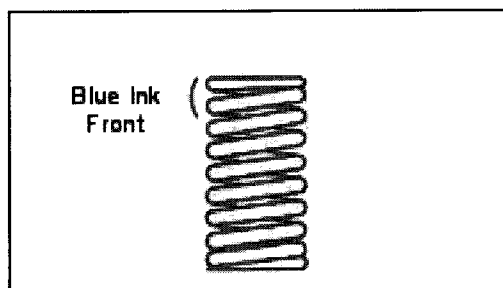


Valve Stem Seal Replacement

1. Place Valve Spring Seat
2. Slide Valve into Place
3. Coat New Seal With Oil and Place
4. Use Tool MB999601 & Install Seal as Shown



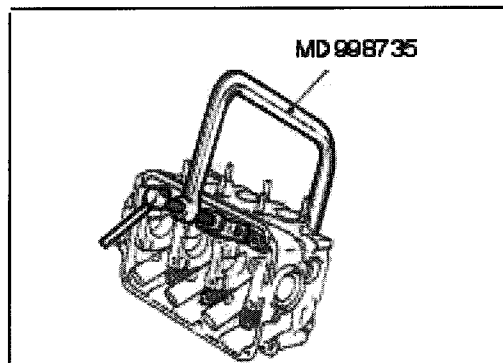
Inlet & Exhaust Valve Size Comparison



Install Valve Springs

Standard Springs are Color Coded Blue: Face Forward

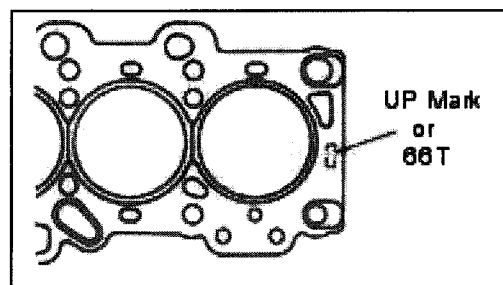
Note: Oversize Springs Use Different Color Code. Check Parts Catalogue for Information



Install Valve Keeps

Use Spring Compressor MD998735 and Install Valve Spring Keepers

Note* Use Caution and Wear Proper Safety Goggles when Compressing Springs



Cylinder Head Installation

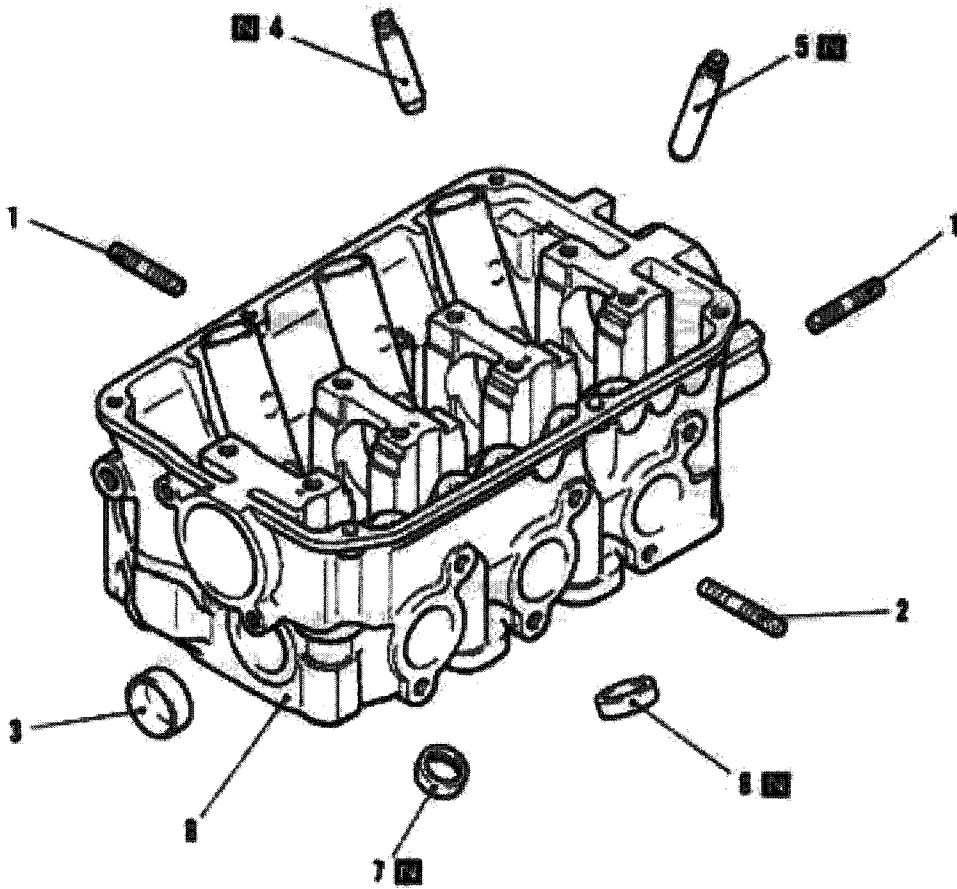
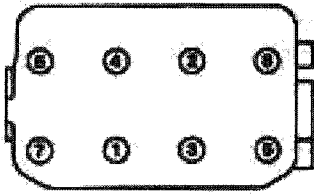
Install Cylinder Head Gasket as Shown.

Note: Two Marks are Possible: Both = Face UP

1. Marked "UP"
2. Marked "66T"

Cylinder Head & Valves SOHC 4 Valve

Torque Sequence



Cylinder Head & Valves SOHC 4 Valve Components & Details

1. Stud
2. Stud
3. Plug
4. Intake Valve Guide
5. Exhaust Valve Guide
6. Intake Valve Seat
7. Exhaust Valve Seat
8. Cylinder Head

Note: Check Parts Catalogue for Product Updates & Replacement Sizes

Cylinder Head Deck Height

Cylinder Head Deck Warpage Limit: 0.05mm

Manifold Side Deck Warpage Limit: 0.15mm

Cylinder Head Height: 108.9-109.1mm

Valve Seat Specifications

Intake Valve Seat

0.3OS....26.300-26.321mm

0.6OS....26.600-26.621mm

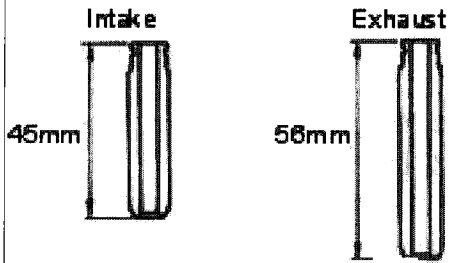
Exhaust Valve Seat

0.3OS....23.300-23.321mm

0.6OS....23.600-23.621mm

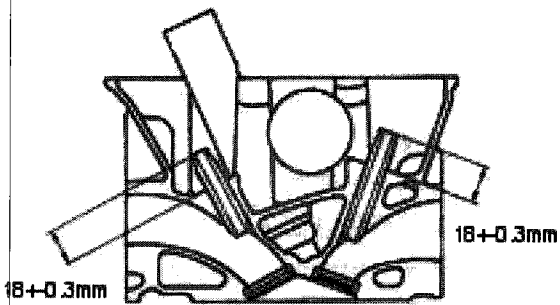
Cylinder Head & Valves SOHC 4 Valve

Components & Details



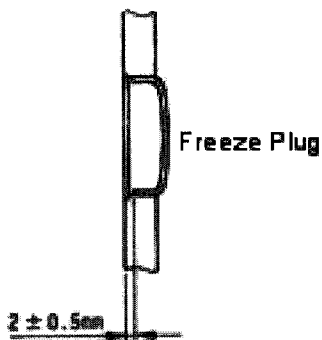
Valve Guide Oversize Bore
0.05OS....10.550-10.568mm
0.25OS....10.750-10.768mm
0.50OS....11.000-11.018mm

Note: All Guides Must be Replaced as Set



Valve Guide Height Intake & Exhaust

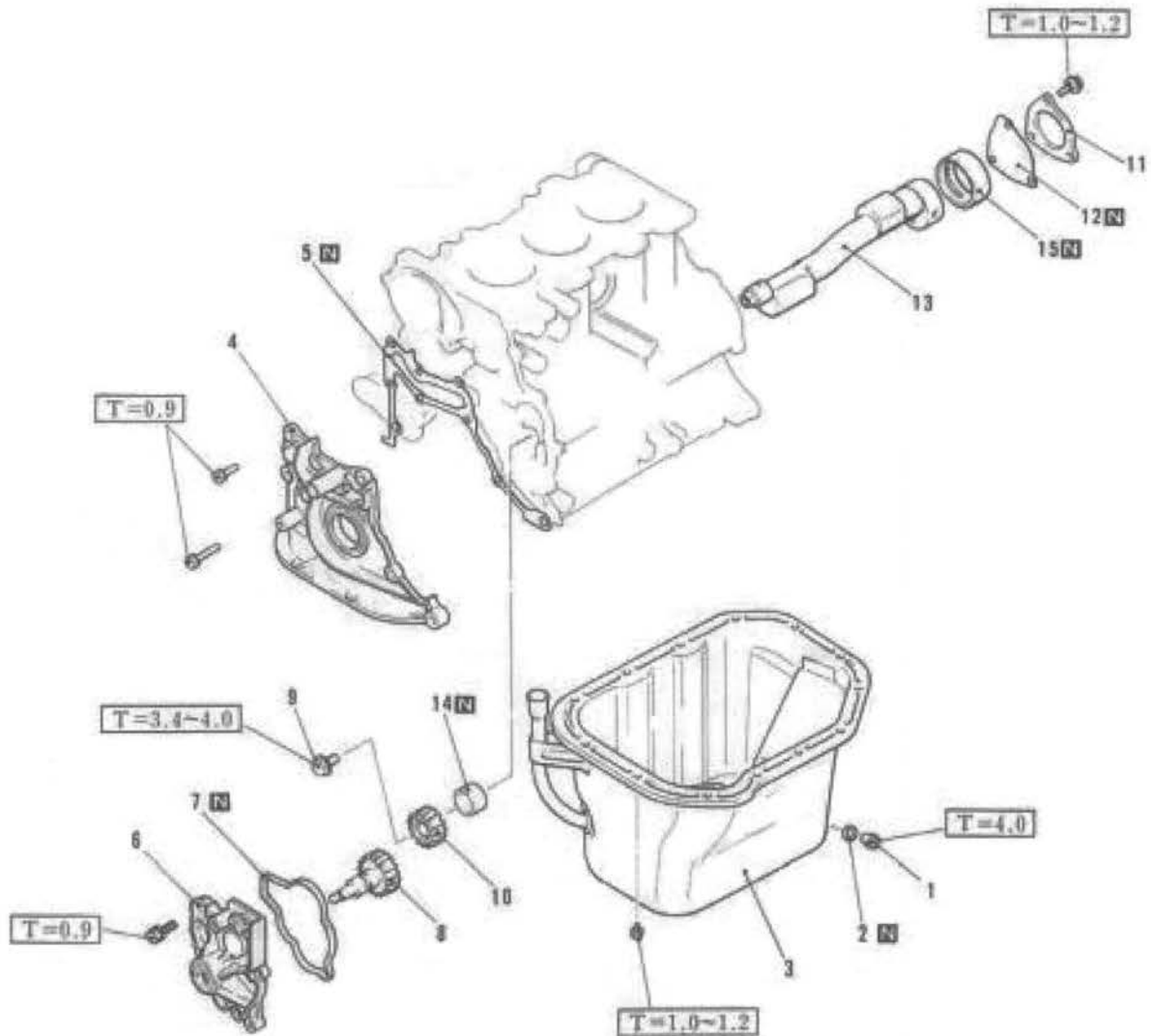
Deck Height: 18+0.3mm



Cylinder Head Freeze Plug

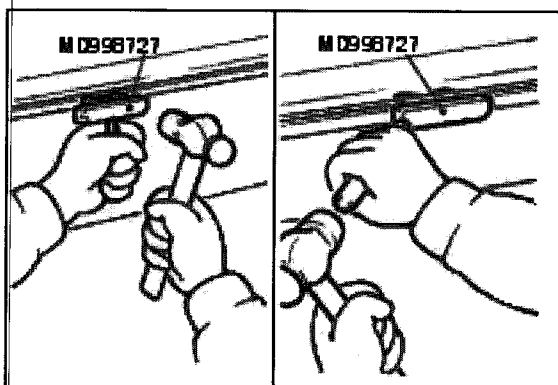
Install Freeze Plug to 2+0.5mm
Use Threabond Sealant: #1102

Front Case-Counterbalance Shaft-Oil Pan (All) Components



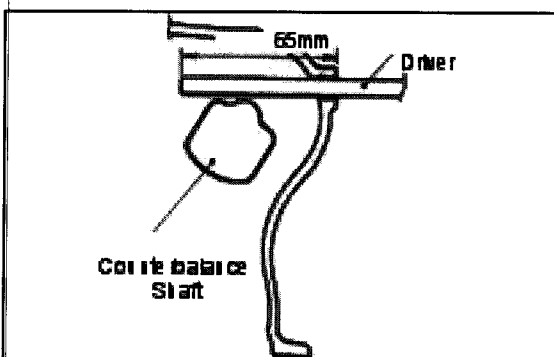
1. Oil Drain Plug
2. Oil Drain Plug Gasket
3. Oil Pan
4. Front Case Assembly
5. Front Case Gasket
6. Oil Pump Cover
7. Oil Pump Cover Gasket
8. Oil Pump Drive Gear
9. F Bolt
10. Oil Pump Driven Gear
11. Rear Cover
12. Rear Cover Gasket
13. Counterbalance Shaft
14. Shaft Front Bearing
15. Shaft Rear Bearing

Front Case-Counterbalance Shaft-Oil Pan



Oil Pan Removal

1. Drain Oil
2. Remove Bolts
3. Use Tool MD998727 and Separate Oil Pan



F Bolt Removal

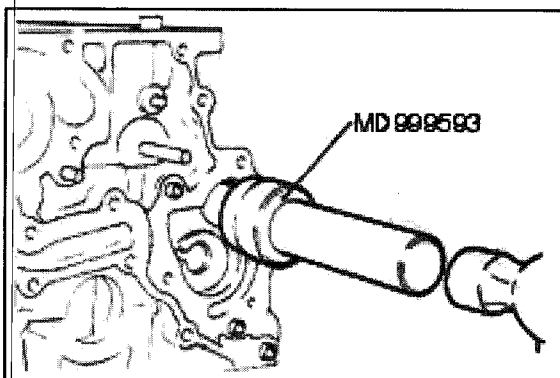
1. Remove Block Plug
2. Slide in 8mm Round (-) Driver. Minimum Size: 65mm Length. This Prevents the Counterbalance Shaft from Moving Position During Maintenance.
3. Remove F Bolt Gear Retainer

Front

Counterbalance Shaft Bearing Replacement

1. Remove Counterbalance Shaft
2. Drive Out Old Bearing Using Tool #MD999593.

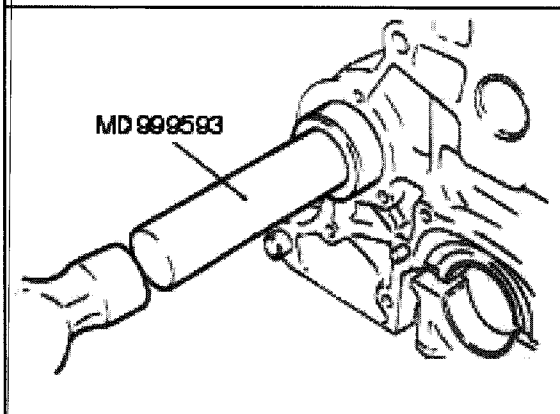
Note: Bearing Will be Removed from Inside off Block. Take Caution Not to Damage or Scratch Internal Parts



Rear

Counterbalance Shaft Bearing Replacement

1. Use Tool MD999593 and Remove Bearing in as Shown

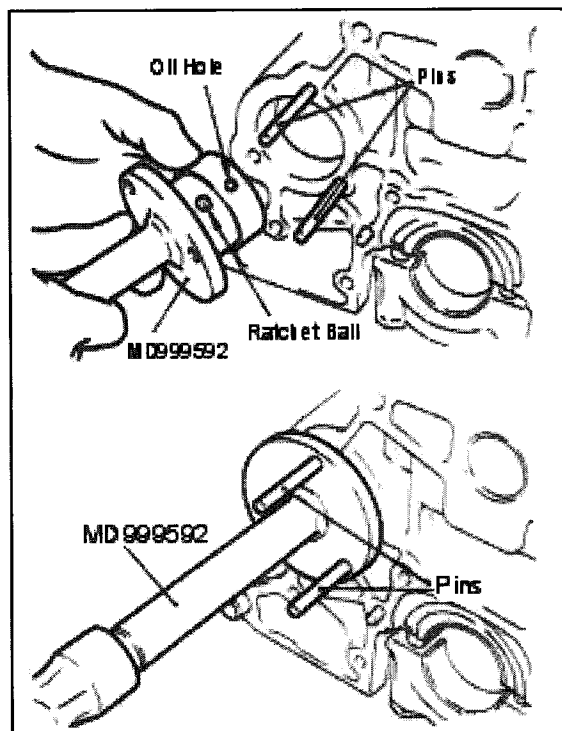


Bearing Clearance Specifications

Front: 0.035-0.068mm

Rear: 0.035-0.071mm

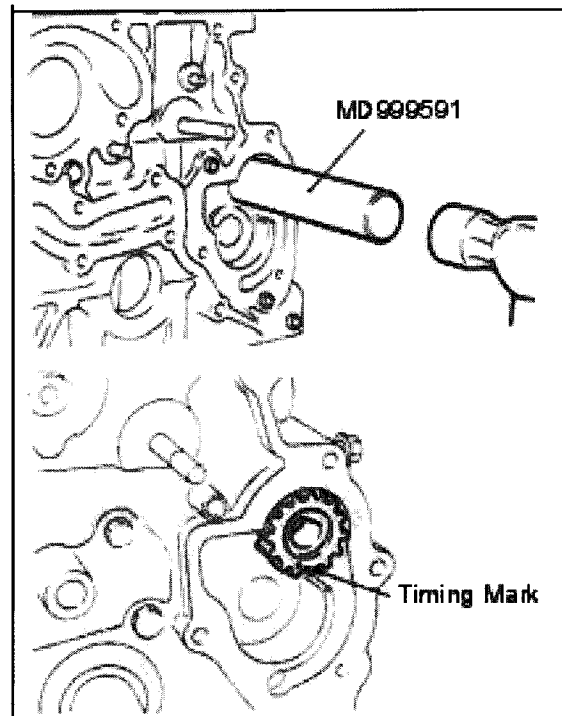
Front Case-Counterbalance Shaft-Oil Pan



Rear

Counterbalance Shaft Rear Bearing Installation

1. Install Two Guide Pins as Shown
2. Use Tool MD999592 and Line Up Oil Hole of Bearing and Slide over Tool Unto Ratchet Ball Clicks into Proper Place
3. Slide Unit as Shown Over The Two Guide Pins.
4. Use a Hammer and Tap Slowly into Place Until the Tool Lines With the Block Face
5. Pull Back Tool and Ratcheting Ball will Release automatically
6. Remove Guide Pins & Inspect New Bearing
7. Grease Bearing



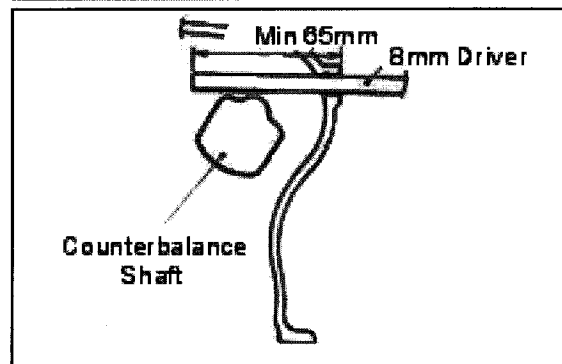
Front

Counterbalance Shaft Front Bearing Installation

1. Use Tool MD999591 and Drive in New Bearing
2. Remove Tool
3. Grease Bearing

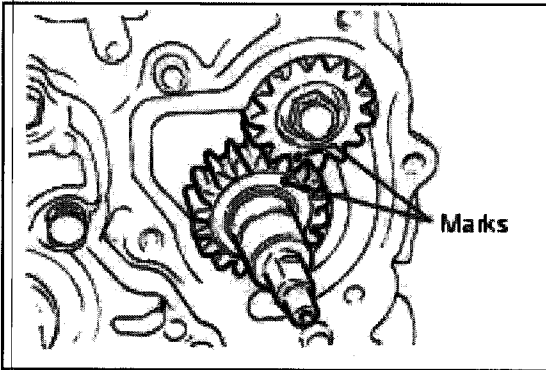
Oil Pump Drive Gear

1. Install Counterbalance Shaft
2. Check for Free Spin
3. Slide on Oil Pump Drive Gear



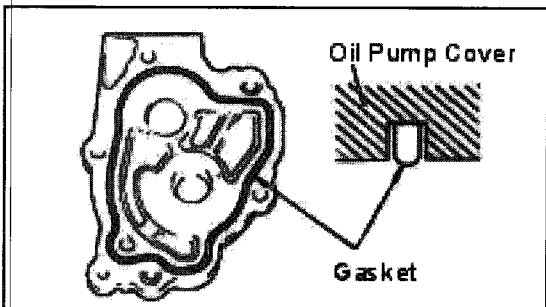
4. Slide in Round Driver Through Block Side Plug Orifice to Refrain Shaft Movement
5. Install F Bolt

Front Case-Counterbalance Shaft-Oil Pan



Oil Pump Drive Gear Alignment

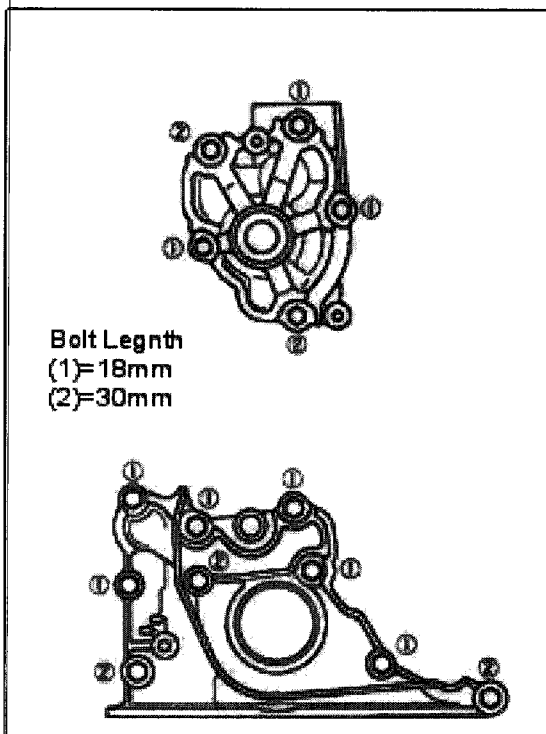
1. Install Drive gears and Align Marks as Shown in the Diagram.
2. Coat with Engine Oil



Oil Pump Cover Gasket

1. Install Oil Pump Cover Gasket in Track as Shown

Note: Never Reuse Old Gaskets



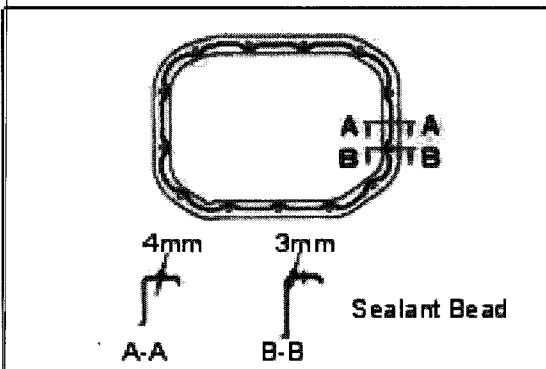
Oil Pump Cover Attachment

Note: Use the Diagram on the Left for Bolt Length Guide

- (1)=18mm
(2)=30mm

1. Attach Cover

Note: Take Caution Not to Damage New Crankshaft Seal. Make Sure Lip is in the Correct Position. See Following Page for Installation of Seal.



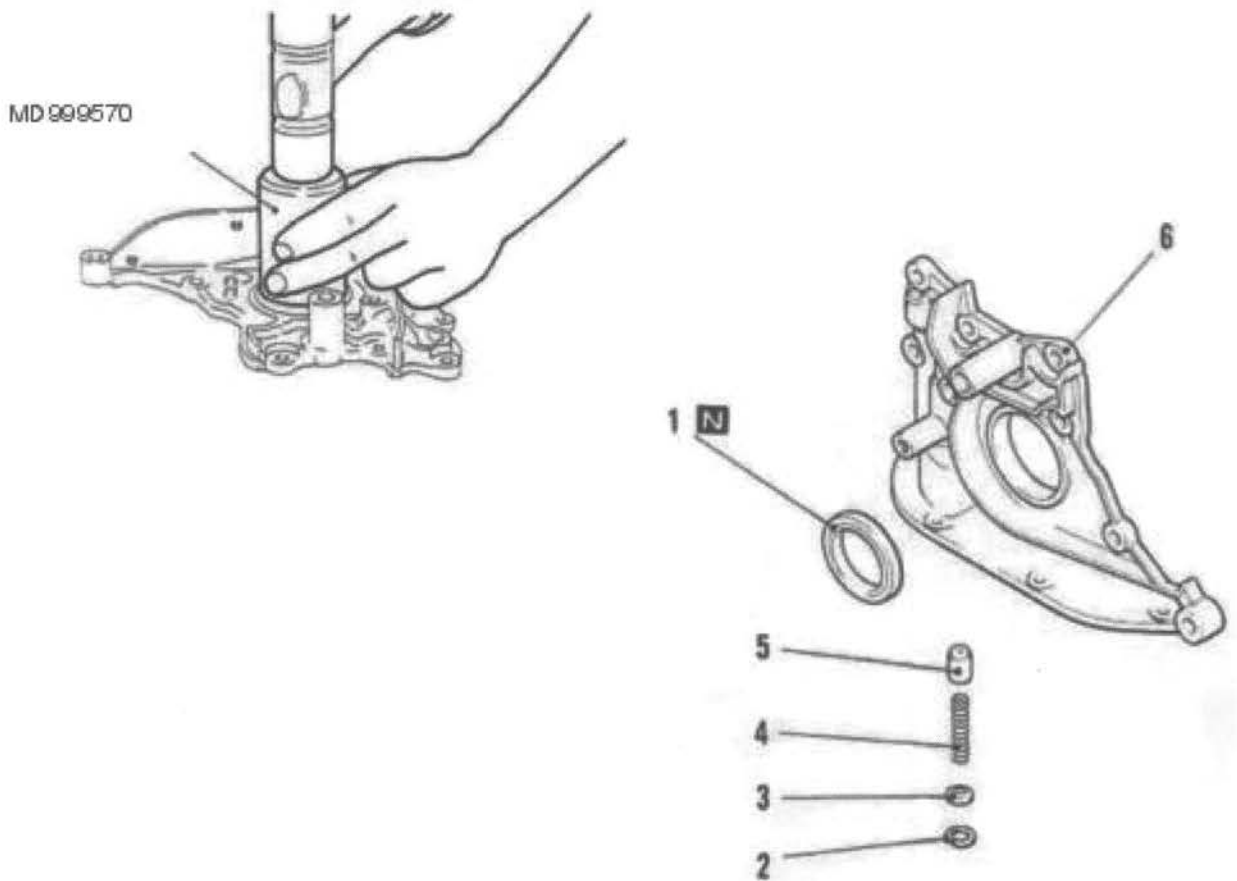
Oil Pan Gasket

Note: After Applying Sealant Allow 5 Minutes to Cure before Attachment

Apply Sealant as Shown. Use Threebond #1207 or Similar Product

Note: Wait 30min before Adding Oil

Front Case-Counterbalance Shaft-Oil Pan



Front Case Components

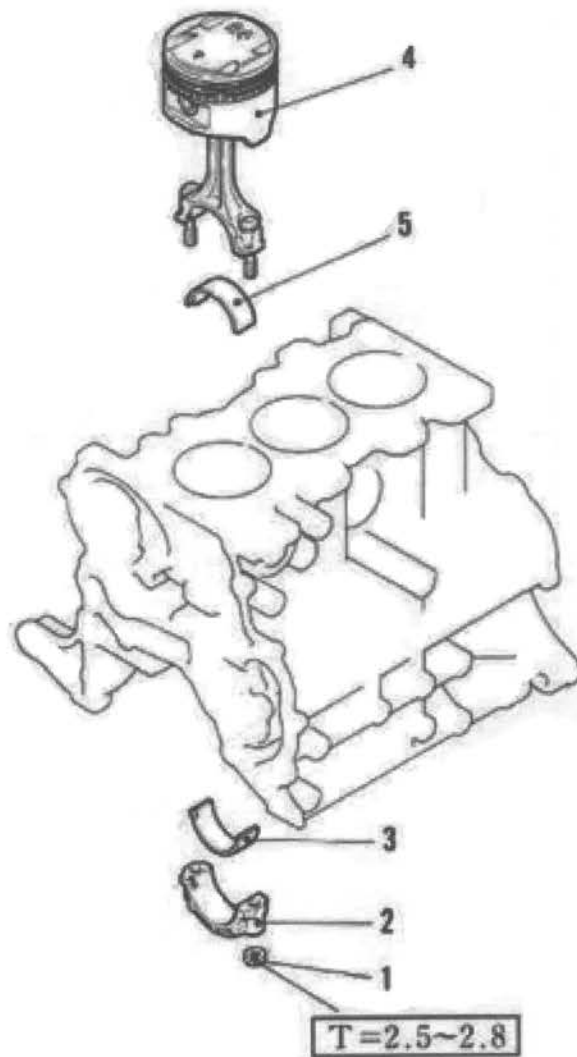
1. Front Oil Seal
2. Snap Ring
3. Spring Retainer
4. Relief Spring
5. Relief Plunger
6. Front Case

Front Case Oil Seal

1. Remove Old Seal
2. Use Tool MD999570 to Install New Seal
3. Grease Rubber Lip Before Installing on Engine

Notes:

Piston & Connecting Rods (ALL)



Components

1. Retaining Nut
2. Connecting Rod Cap
3. Connecting Rod Lower Bearing
4. Piston & Connecting Rod assembly
5. Connecting Rod Upper Bearing

Connecting Rod Bearing Clearance

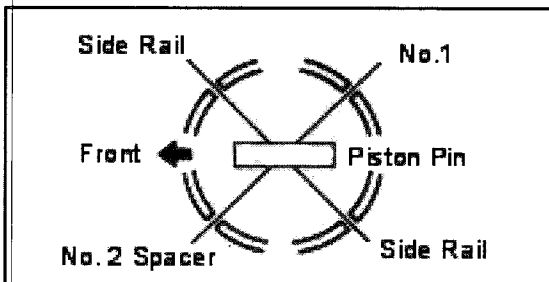
Limit Clearance: 0.022-0.052mm

Replace: 0.1mm

Note: Replace All Bearings if Over 80,000 Kilometers

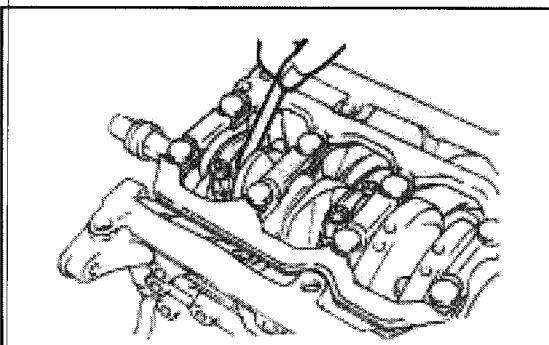
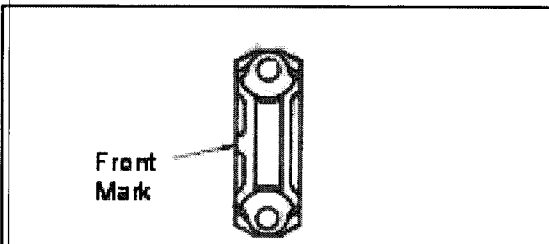
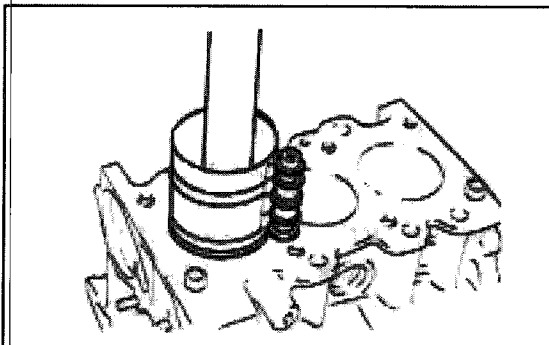
Piston & Connecting Rods

Note: See Following Pages for Piston and Ring Rebuilding Specifications



Piston & Connecting Rod Installation

1. Well Oil Piston & Rings Before Installation
2. Compress Rings With Appropriate Ring Compression Tool
3. Tap Piston Assembly Down into Block with a Wooden Hammer Handle.
4. Confirm Connecting Rod Caps are Facing Forward to the Front of the Engine.
5. Confirm Connecting Rod Side Clearance Using a Feeler Gage.

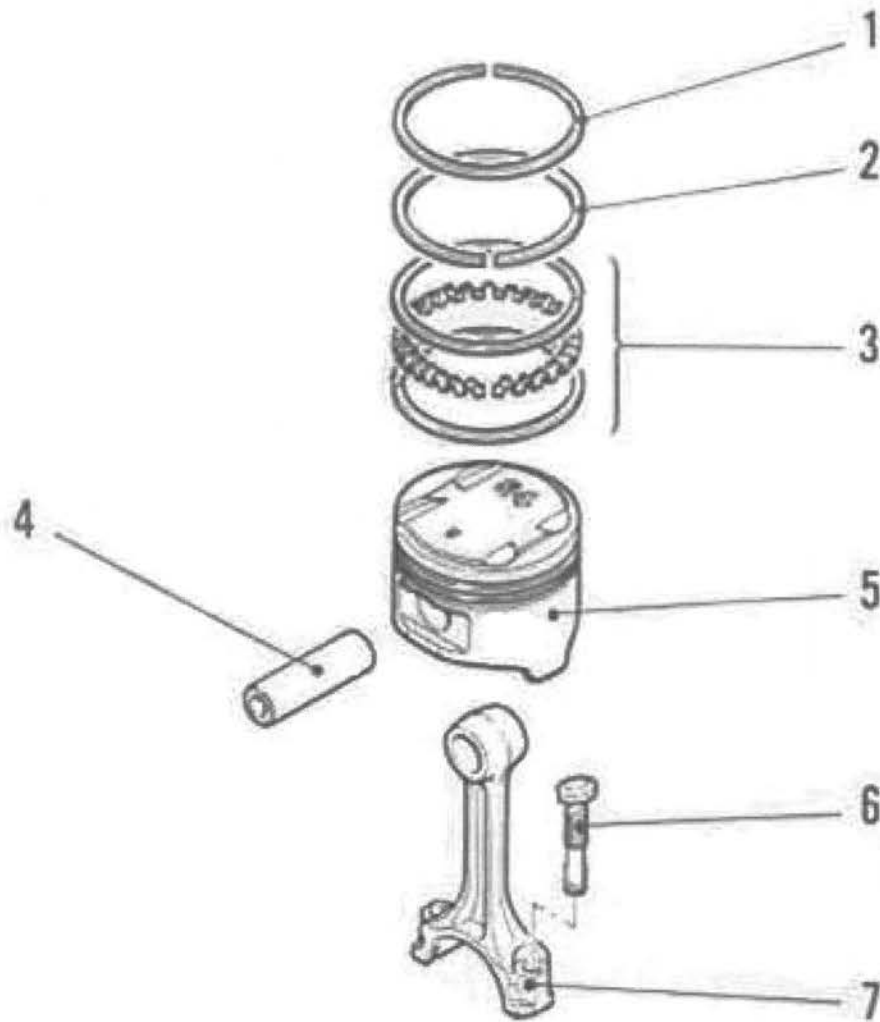


Limit: 0.10mm-0.25mm

Over: 0.4mm

Note: Check Parts Catalogue for Product Sizes and Updates

Piston & Connecting Rods

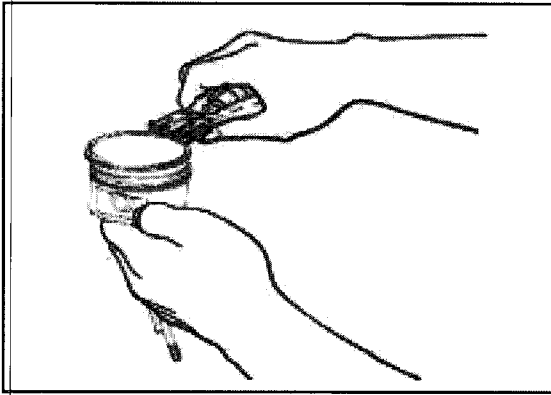


Piston Components

1. Piston Ring No.1
2. Piston Ring No.2
3. Oil Ring Set
4. Piston Pin
5. Piston
6. Connecting Rod Bolt
7. Connecting Rod

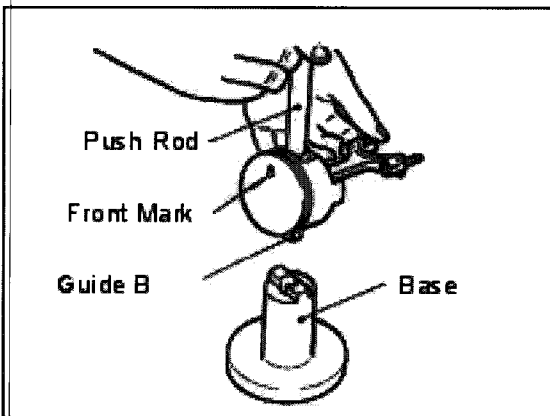
Note: Check Parts Catalogue for Over-Size (OS) Pistons

Piston -Piston Ring-Piston Pin-Connecting Rod



1. Use Piton Ring Expander & Remove Piston Ring 1 & 2 (Compression Rings).
2. Remove Oil Rings

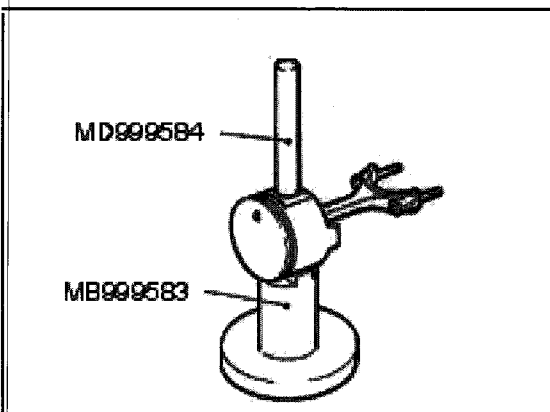
Note: Replace Rings if Over 80,000 Kilometers



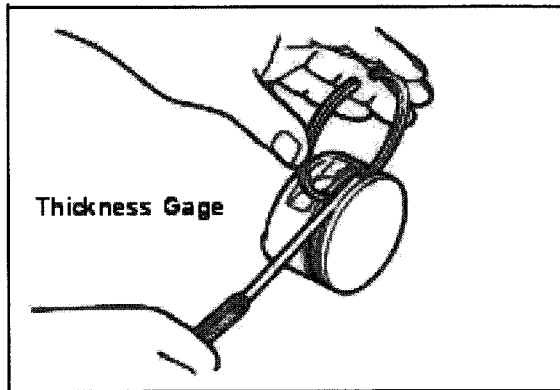
Piston Pin Removal

Use Tool Set MB999584 & Base MB999583 to Extract Piston Pins

1. Place Piston as Shown
2. Remove Pin



Piston -Piston Ring-Piston Pin-Connecting Rod



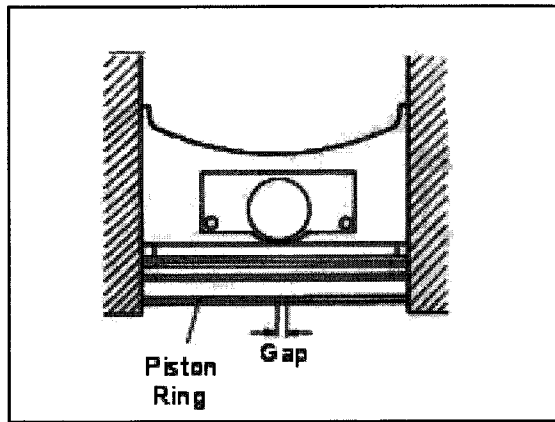
Ring Side Clearance

Note: If New Pistons are Used New Rings Must be Installed

Side Clearance (Compression Rings)

Piston Ring #1: 0.03-0.07mm

Piston Ring #2: 0.02-0.06mm



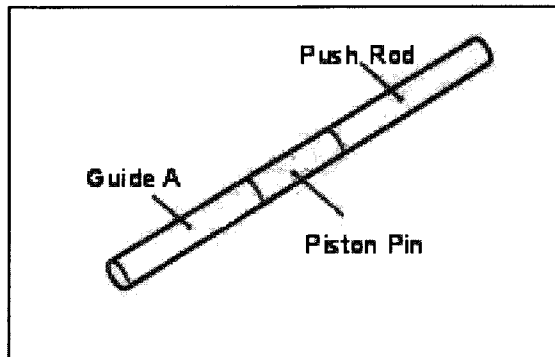
Piston Ring Gap

Clearance Limit:

Piston Ring No.1: 0.15-0.30mm

Piston Ring No.2: 0.35-0.50mm

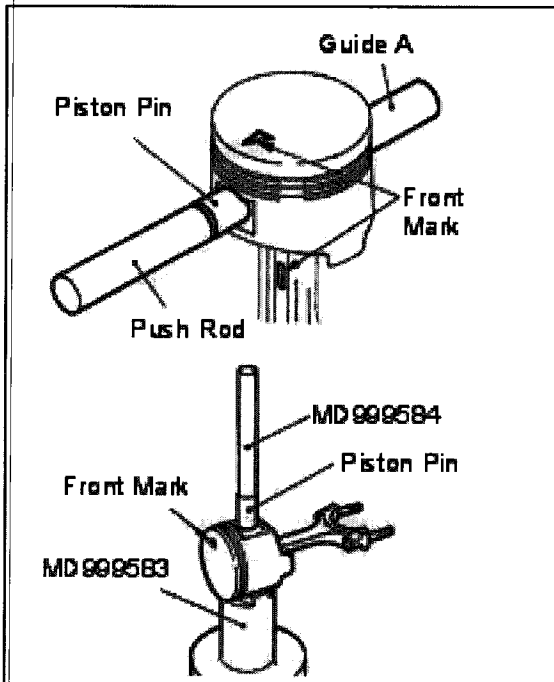
Oil Ring: 0.2-0.7mm



Piston Pin Installation

Tools will be Used as Following to Install Piston Pins

Piston -Piston Ring-Piston Pin-Connecting Rod



Piston Pin Installation

1. Prepare Piston as Show on the Left

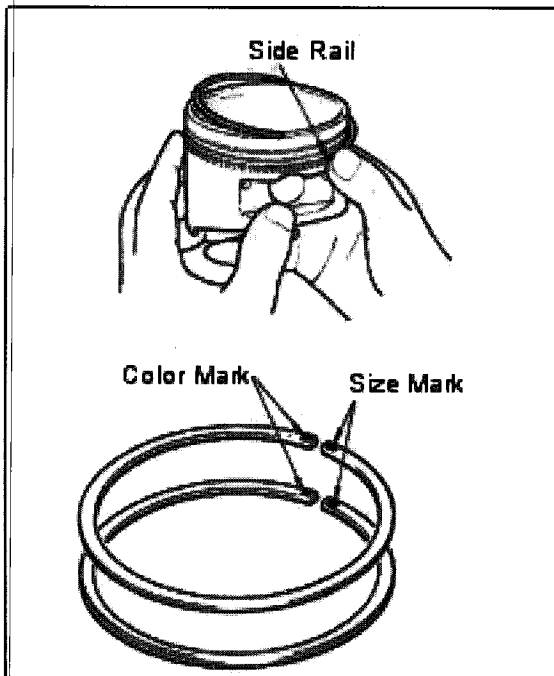
Note: Confirm All Front Marks are Facing Forward before Installation

2. Place Piston as Shown on Base Tool #MD999583
3. Use Press to Install Pin

Installation Press Pressure: 500-1500kg

Oil Ring Installation

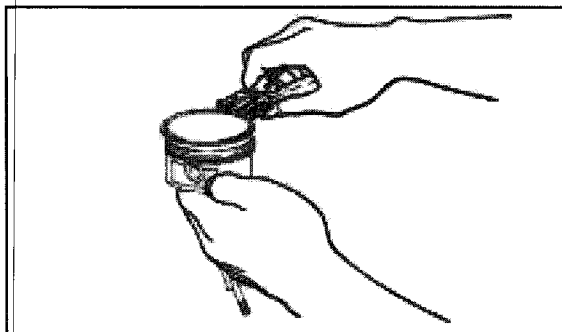
1. Place Install Oil Ring Spacer
2. Install Upper Oil Ring Rail
3. Install Lower Oil Ring Rail



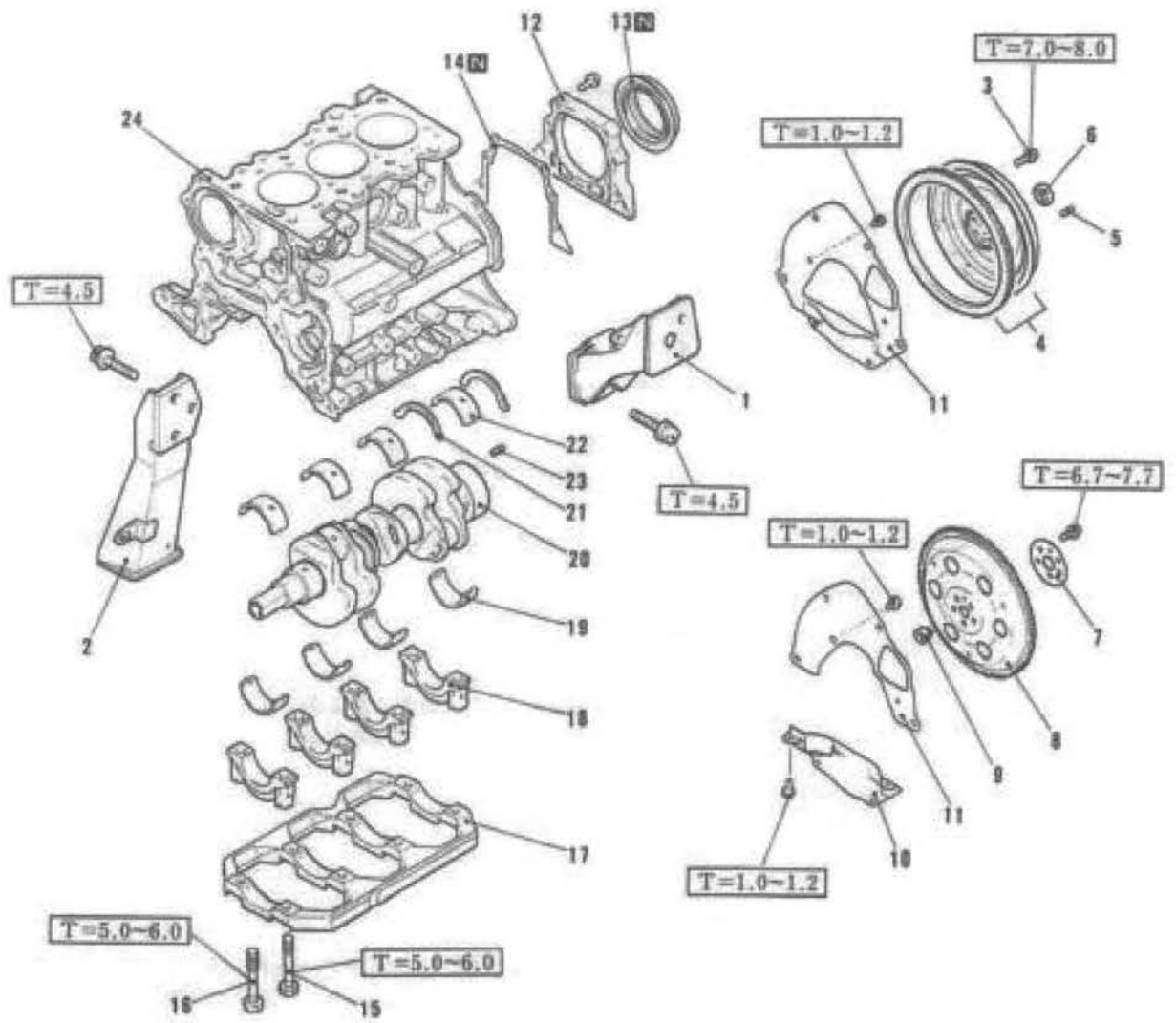
Size	Color Code
STD	None
0.25mm OS	Blue 2 Strips
0.50mmOS	Red 1 Stripe
0.75mmOS	Red 2 Stripes
1.00mmOS	Yellow 1 Stripe

Compression Rings No.1 & No.2

Size	No.1	No.2	Mark
STD			None
0.25mmOS	1R	2R	25
0.50mmOS			50
0.75mmOS			75
1.00mmOS			100



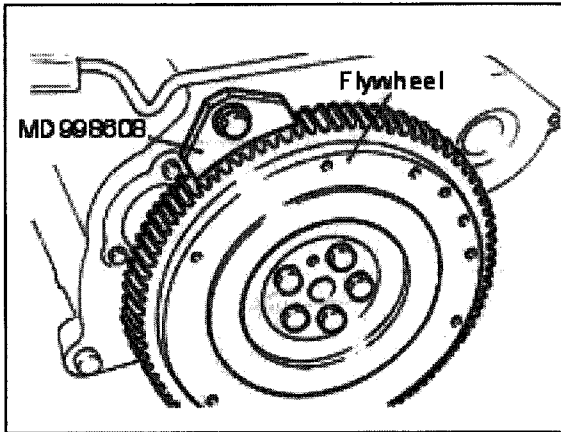
Crankshaft-Flywheel-Flex Plate



Crankshaft-Flywheel-Flex Plate Components

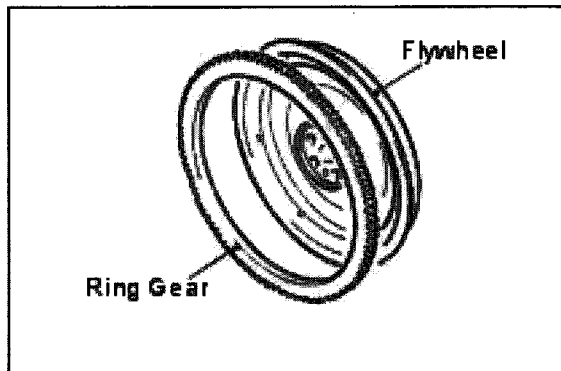
1. Engine Mount Bracket: Left
2. Engine Mount Bracket: Right
3. Bolt
4. Flywheel Assembly: Manual transmission
5. Dowel Pins (8): Manual Transmission
6. Pilot Bearing (Ball Type)
7. Adapter Plate: Automatic Transmission
8. Flex Plate: Automatic transmission
9. Crankshaft Bushing: Automatic transmission
10. Bell Housing Cover: Automatic transmission
11. Rear Plate
12. Oil Seal Case
13. Oil Seal
14. Gasket
15. Bearing Cap bolts [S4] [D5]
16. Bearing Cap Bolt [S2]
17. Beam [S4] [D5]
18. Bearing Cap
19. Crankshaft Lower Bearing
20. Crankshaft
21. Crankshaft Thrust Bearing
22. Crankshaft Upper Bearing
23. Dowel Pins (6)
24. Cylinder Block Assembly

Crankshaft-Flywheel-Flex Plate



Flywheel-Flex plate Inspection & Removal

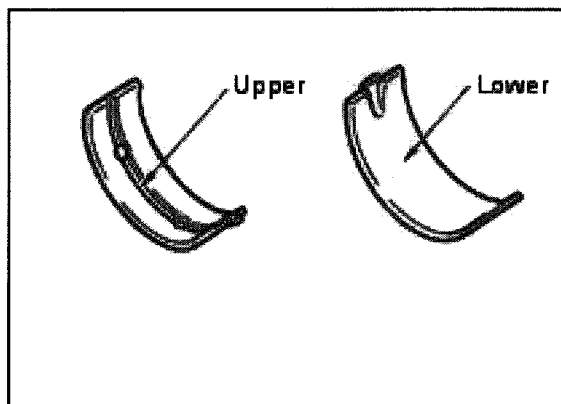
1. Use Flywheel Blocking Tool #MD998608 and Secure Flywheel from Movement
2. Remove Attachment Bolts
3. Remove Flywheel
4. Inspect Flywheel for Broken or Missing teeth.
5. Replace Ring Gear if Teeth are Damaged



Note: Check Parts Catalogue for Ring Gear Sizes Per Application. Replace Flywheel Unit as an Assembly if Balancing Equipment is Not Available

Crankshaft Oil Seal Clearance

Limit: 0.021-0.045mm



Crankshaft Bearings

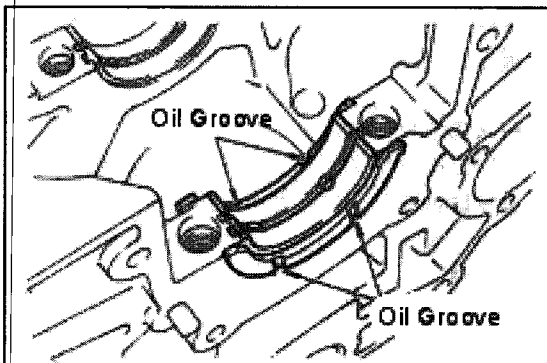
Note: Bearing Should Always be Replaced

1. Grooved Bearing is Upper Bearing & Smooth Faced Bearing is Lower Bearing.
2. Coat With Assembly Grease before Installation

Note: See Parts Catalogue for Oversize Bearing Availability

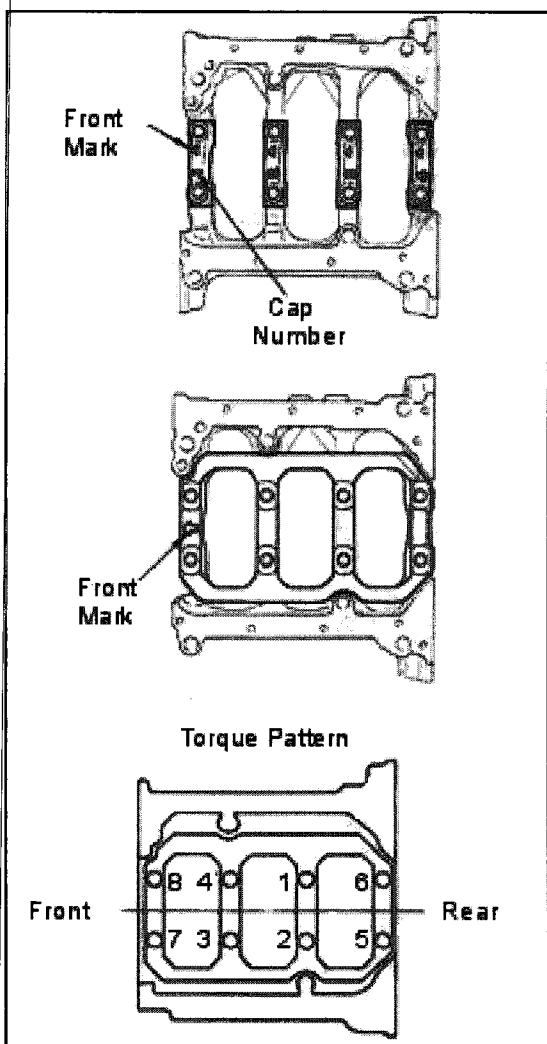
Note: Never Reuse Crankshaft Bearings

Crankshaft-Flywheel-Flex Plate



Crankshaft Thrust Bearing

1. Install thrust Bearing as Shown. Coat with Grease and Engine Oil Before Placing Crankshaft.
2. After All Bearings Installed Place Crankshaft. Coat Crankshaft with plenty of 30W engine Oil.



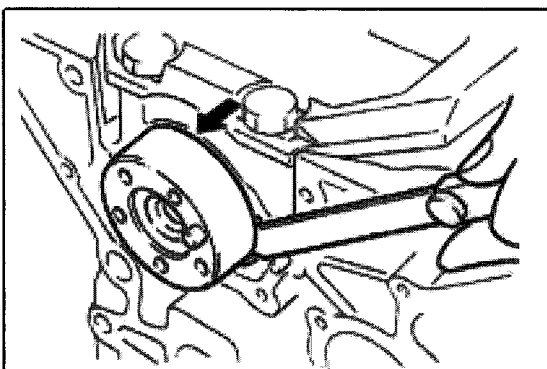
Bearing Caps

1. Place Cap in Order from Front 1-2-3-4
2. Check Crankshaft Free Spin

Note: If Crankshaft Does Not Spin freely Remove caps & Investigate Cause

3. Place Support Beam in Place
4. Snug Caps & Check Crankshaft Free Spin

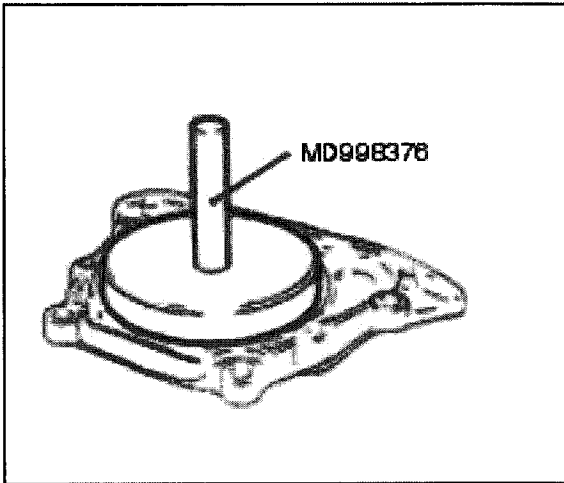
5. Torque Support Beam to Specification
T=6.0 kgm



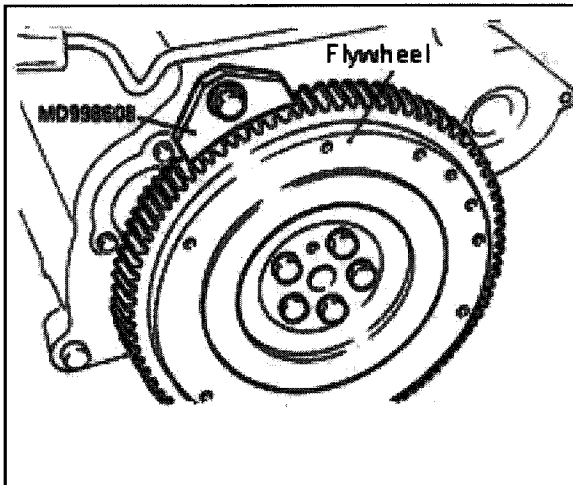
6. Crankshaft End Play
Limit: 0.05-0.25mm

Crankshaft-Flywheel-Flex Plate

Oil Seal Replacement



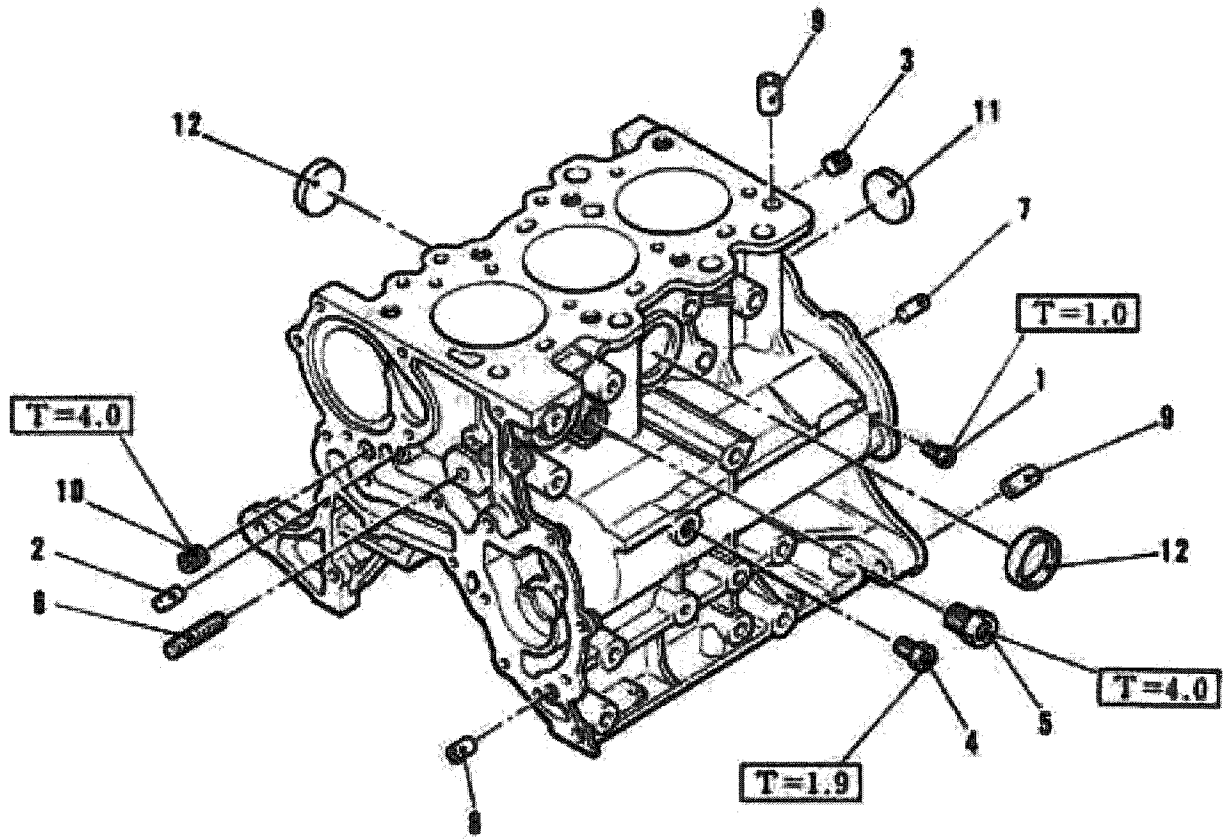
7. Remove Oil Seal & Discard
8. Clean Area & Use Tool MD998376 to Install New Seal
9. Install Rear Oil Seal Case



10. Install Flywheel [MT] or Flex Plate [AT]
11. Remove Retaining Tool MD998608 and Check Engine Free Rotation

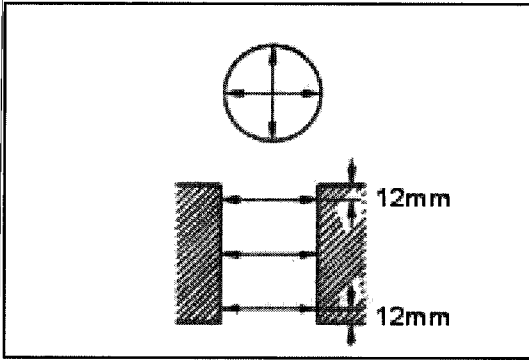
Notes:

Cylinder Block Assembly Components



1. Tapered Plug (1/16)
2. Dowel Pin
3. Plug
4. Tapered Plug (1/8)
5. Water Drain Plug
6. Stud (8x50-7T)
7. Dowel Pin (6)
8. Knock Bushing (6x9)
9. Knock Bushing (10x16)
10. Tapered Plug (PT-1/4)
11. Freeze Plug (35mm)
12. Freeze Plug (30mm)
13. Cylinder Block

Cylinder Block Assembly



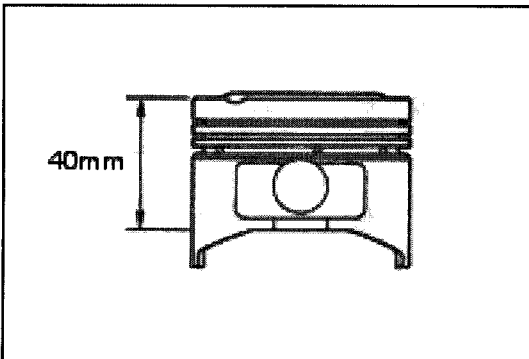
Cylinder Block

Note: Thoroughly Clean Block before Inspection or Maintenance

1. Use a Straight Edge to Inspect Block Deck Straightness. Check by Using "X" Pattern or Cross Pattern.

Surface Warpage Limit: 0.05mm

Over: 1.00mm Resurface Deck



Cylinder Bore

Bore Distortion Limit: 0.01mm

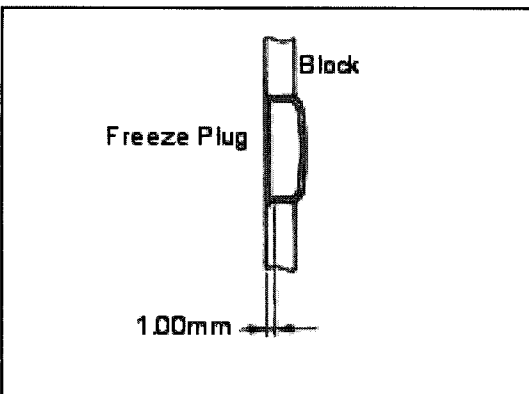
Cylinder Internal Diameter Limit:

65.00-65.03mm

Honing Limit: 0.02mm

Piston Clearance

Limit: 0.02-0.04mm



Block Freeze Plug

1. Replace Freeze Plugs
2. Tap into Block as Shown on the Left. Use Appropriate Sealant Such as Threebond #1102.

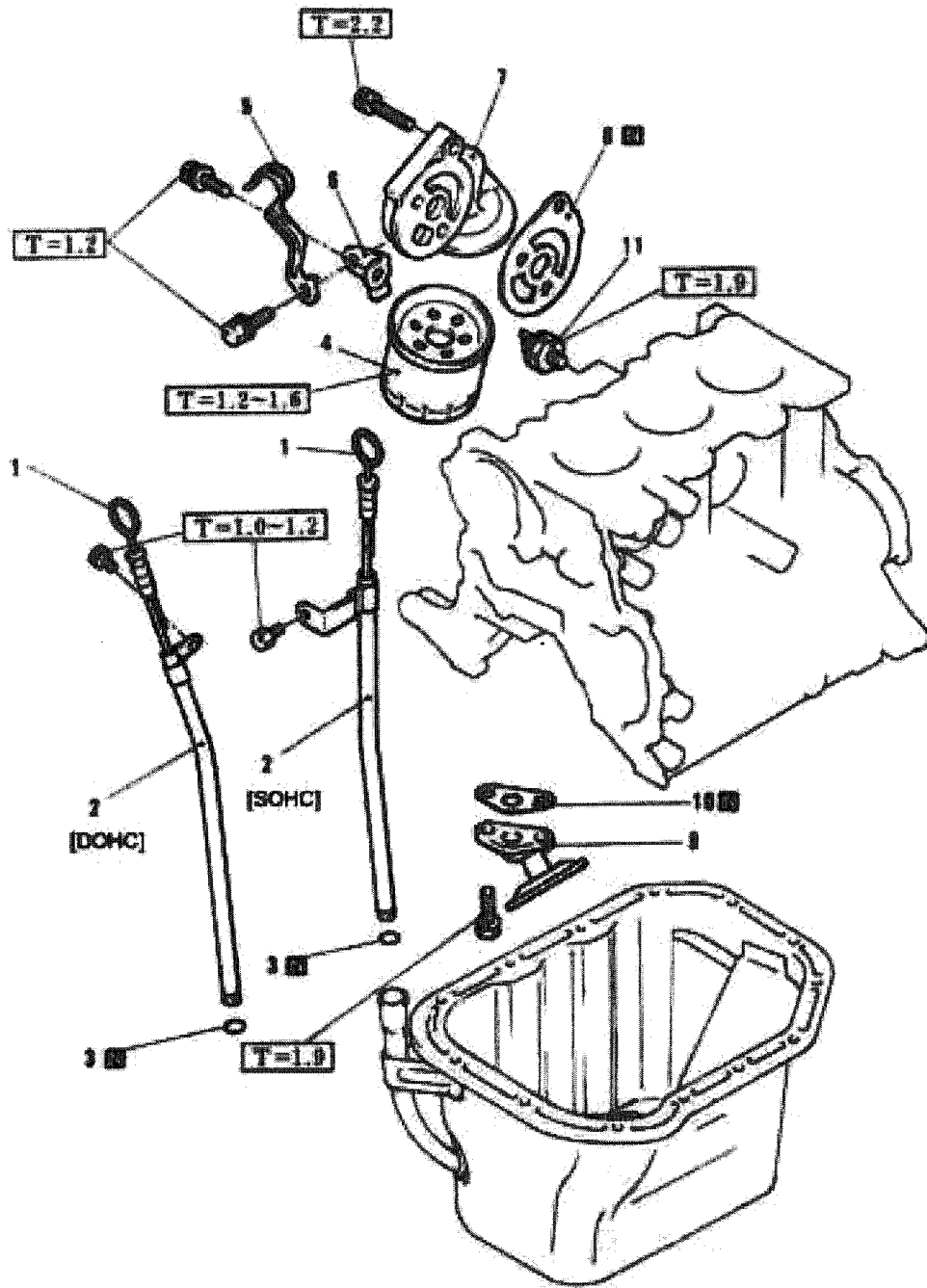
Over Size (OS) Boring Size Chart

Size	Mark	Piston External Diameter	Cylinder Internal Diameter
0.25OS	25	65.22-65.25mm	65.26-65.27mm
0.50OS	50	65.47-65.50mm	65.51-65.52mm
0.75OS	75	65.72-65.75mm	65.76-65.77mm
1.00OS	100	65.97-66.00mm	66.01-66.02mm

Note: OS Pistons Must be Changed as a Set Only

Note: Check Parts Catalogue for OS Pistons and Ring Updated Information.

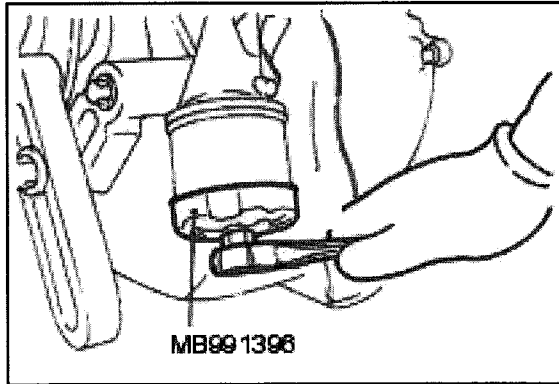
Lubrication System-Oil Filter-Oil Pressure Switch-Oil Pump



Lubrication System-Oil Filter-Oil Pressure Switch-Oil Pump

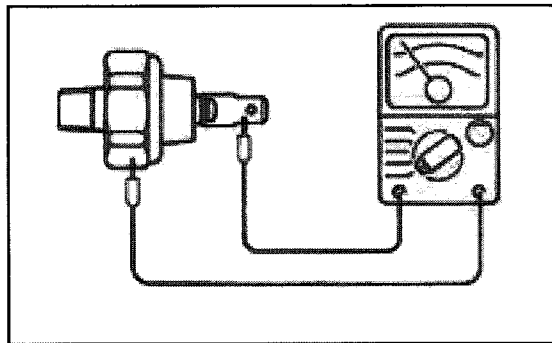
1. Oil Level Gage
2. Dip Stick Tube
3. O Ring
4. Oil Filter
5. Breather Hose Clamp
6. Oil Filter Bracket Holder
7. Oil Filter Bracket
8. Gasket
9. Oil Screen
10. Gasket
11. Oil Pressure Switch

Lubrication System-Oil Filter-Oil Pressure Switch-Oil Pump



Oil Filter removal

1. Drain Engine Oil
2. Remove Filter with attachment MB991396
3. Fill New Filter With 10W-30W and Replace in Reverse Order

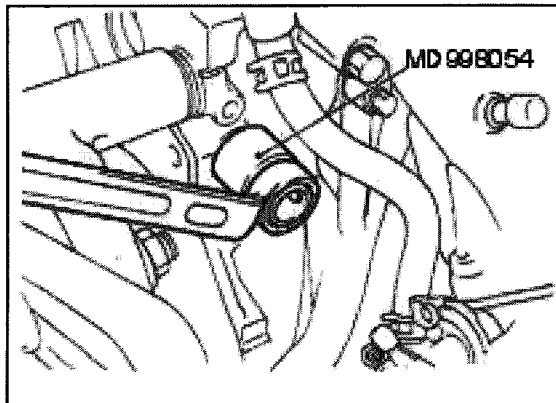


Oil Pressure Switch

Oil Pressure Activation: 0.5kg/cm²

- Power On (Not Start) Warning Light "ON"
- Power "ON" (Not Start) Warning Light "OFF": Bad Switch
- Power "ON" no Pressure Switch Grounded Light "ON"

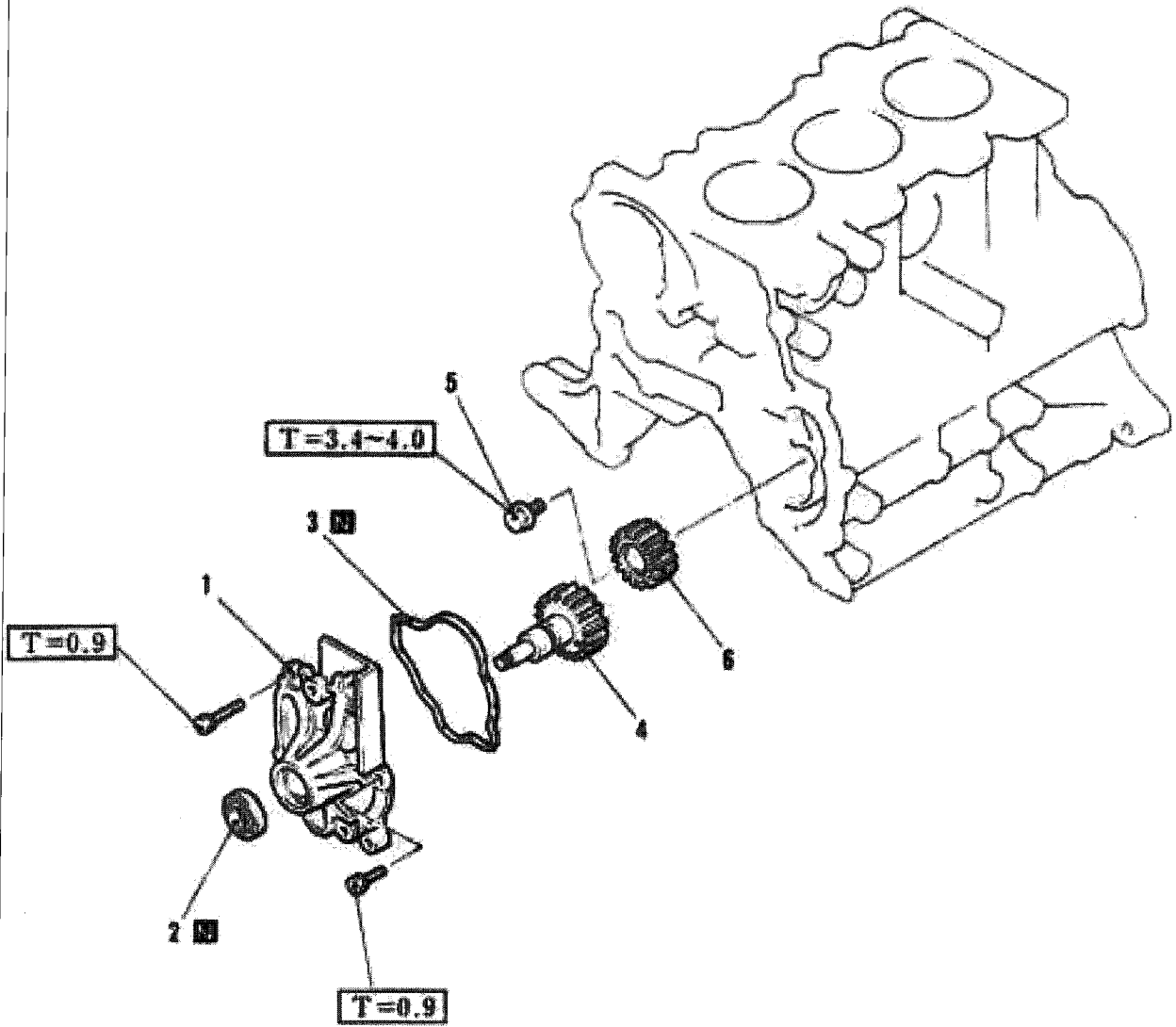
Note: See Electrical Service manual for Wiring Diagram



Oil Pressure Switch Replacement

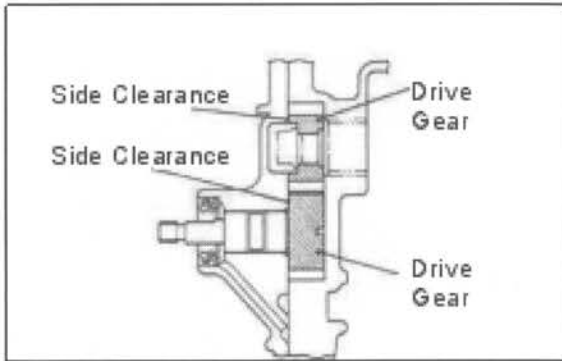
1. Remove Wire Connector
2. Use Tool MD998054 and Remove Oil Pressure Switch.
3. Replace in Reverse Order

Lubrication System-Oil Filter-Oil Pressure Switch-Oil Pump
Oil Pump



1. Oil Pump Cover
2. Oil Seal
3. Gasket
4. Oil Pump Drive Gear
5. F Bolt
6. Oil Pump Driven Gear

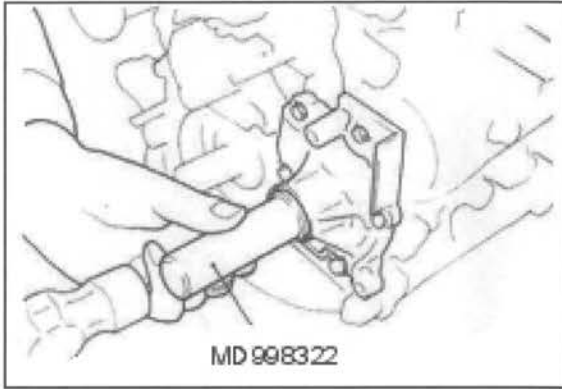
Lubrication System-Oil Filter-Oil Pressure Switch-Oil Pump Oil Pump



Note: See Earlier Part of this Section for Removal

Drive Gear Clearance: 0.06-0.12mm

Driven Gear Clearance: 0.07-0.13mm



Oil pump Seal Replacement

Use Tool MD998322 to Install New Seal

Note: Never Reuse Seals

Note: See Parts Catalogue for Available Replacement Components. Some Units Can Only be replaced as an Assembly

Chapter 4



Fuel System: Carbureted & MPI Fuel Injection

40. Tools
41. Carburetor Specifications
42. Carburetor Components
43. Carburetor Settings
44. Carburetor Linkage
45. Carburetor Solenoids & Actuators
46. Power Valve Pump Circuit
47. Full Auto-Choke Linkage
48. MPI Fuel Injection System Components and Sensor Locations DOHC
49. Check Engine Lamp: Self Diagnostics MPI DOHC
50. MUT Computer Analyzer Test: Computer & Relay PWR Circuit
51. Fuel Pump Circuit MPI
52. Boost Sensor MPI
53. Air Intake Temperature Sensor MPI
54. Throttle Position Sensor (TPS) Manual Transmission MPI
55. Throttle Position Sensor (TPS) Automatic Transmission MPI
56. Idle Switch MPI
57. Crank Sensor
58. Inhibitor Switch (Neutral Safety Switch) A/T Vehicles
59. Speed Sensor Unit
60. AC Fast Idle Solenoid
61. Oxygen Sensor
62. Fuel Injectors Circuit Test
63. Fuel Pressure Test
64. Duty Solenoid (MAF)
65. Ignition Coil Power Transistor
66. MPI Fuel Injection Main Components
67. Throttle Body Unit
68. Fuel Injector Replacement Procedure
69. Fuel Tank Assembly and Component Removal: ALL Vehicles SOHC-DOHC
70. Fuel Line System: SOHC & DOHC
71. Accelerator Cable System: Including Kit Down Switch Installed Vehicles

Tools

Tool	Part #	Use	SOHC	DOHC
	MB991348	Test Harness: Oscilloscope	-	O
	MB991316	Test Harness: TPS Sensor	-	O
	MD998478	Connector: Oscilloscope	-	O
	MD998706	Injector Test Kit	-	O
	MD998741	Injector Test Adapter	-	O
	MD998746	Clip	-	O
	MD999603	Injector Test Adapter	-	O
	MB991399	Hose Adapter	-	O
	MB991223	Test Leads	-	O

Tools

Tool	Part #	Use	SOHC	DOHC
	MB991341	Muti-Use Tester	-	○
	MB991414	Cartridge	-	○

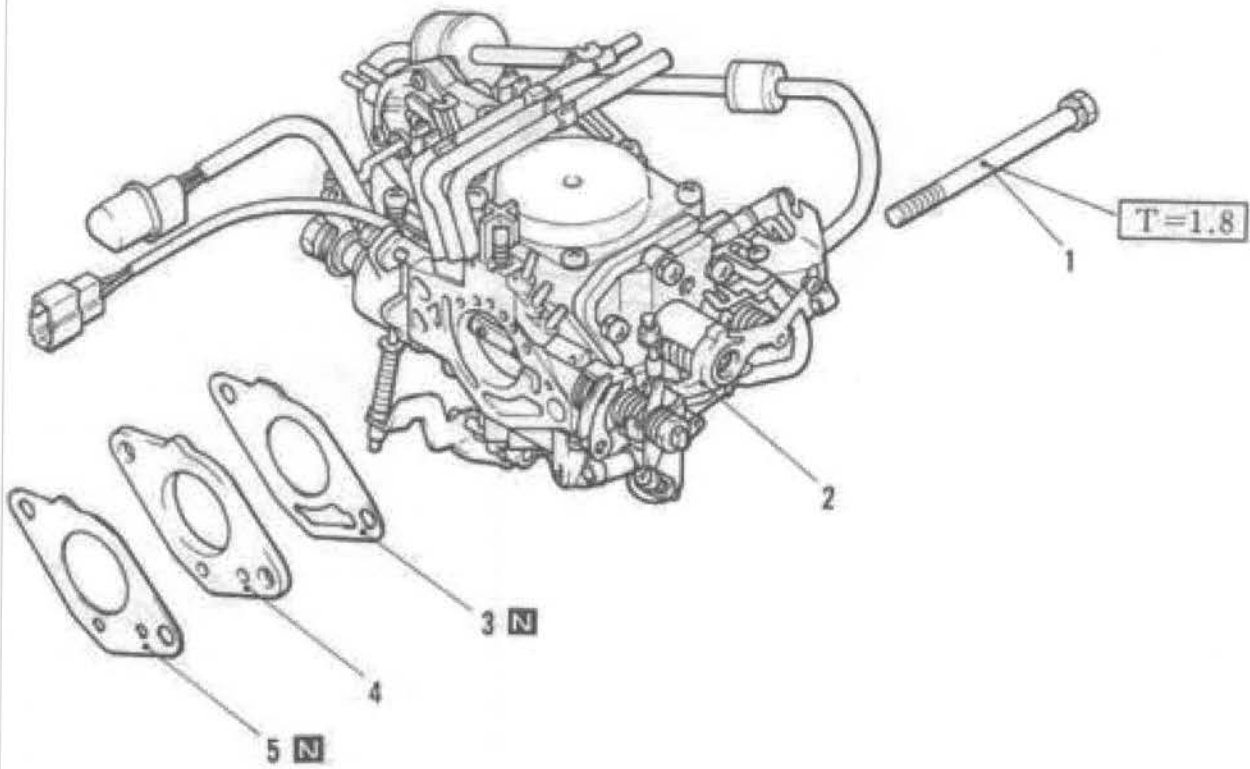
Note: Cartridge MB991414 is Vehicle Specific: Minicab & Bravo Vehicles

Note: Multi-Use Tester MB991341 is a Multi-Vehicle Use Unit.

Carburetor Specifications

Item	SOHC 2Valve				SOHC 4 Valve					
	MT				AT					
A/C		●		●		●		●		●
P/S					●	●			●	●
Series Type	2MB	3MB	4MB	5MB	6MB	7MB	4AB	5AB	6AB	7AB
Maker ID	34SHVT									
Throttle Bore	34mm									
Primary Venturi	20mm									
Full Open Venturi	29mm									
Pump Type	Diaphragm									
Choke Type	Wax Type Auto-Choke									
Choke Breaker	1.8mm		1.9mm				2.0mm			
Fast Idle	6 Degrees @ 23C						7 Degrees @ 23C			
TPS							●	●	●	●
Throttle Positioner							●	●	●	●
Full Cut OFF Solenoid	●	●	●	●	●	●	●	●	●	●

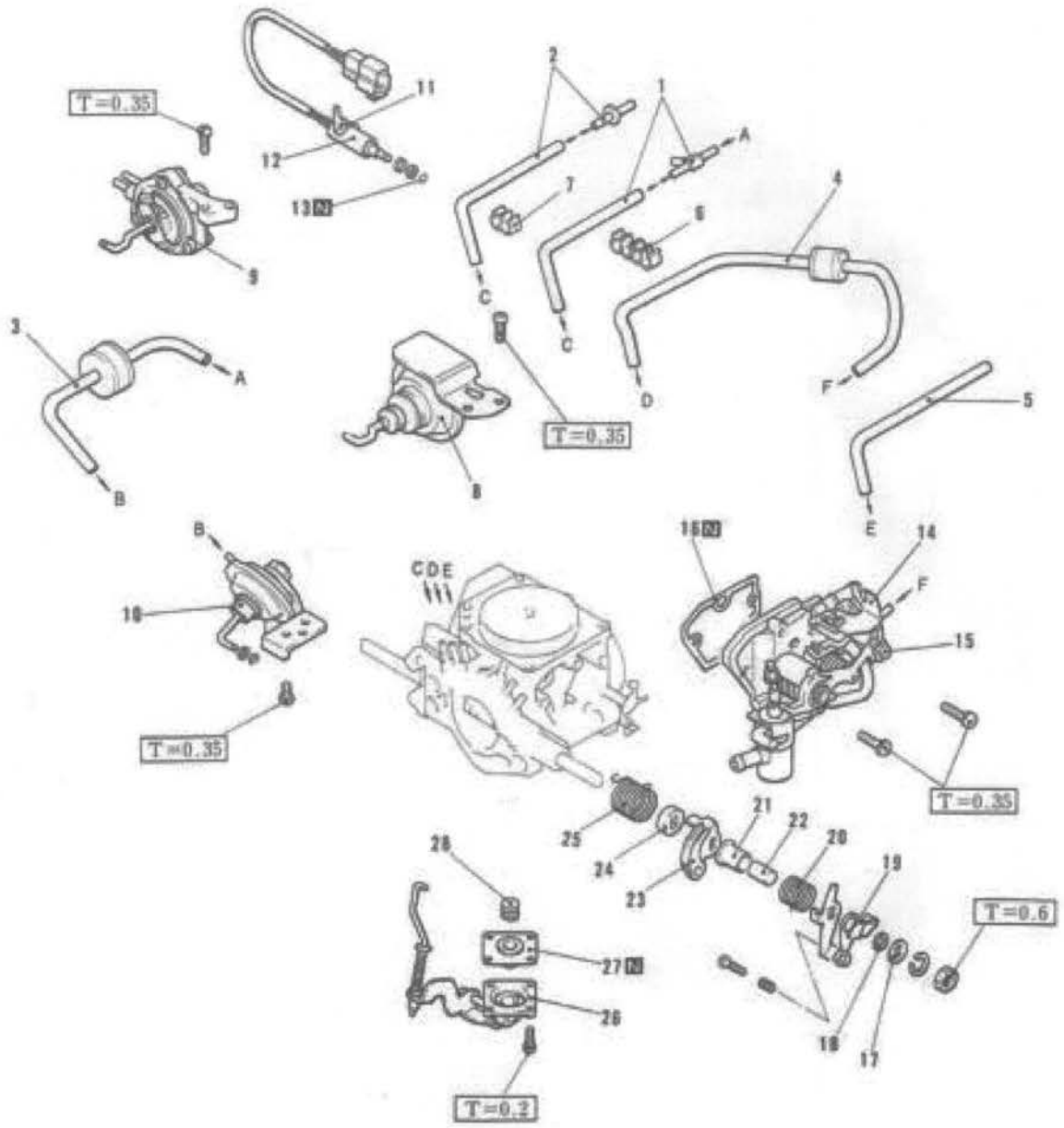
Carburetor Components



Note: N=New parts. Items Must be Replaced

1. Bolt
2. Carburetor Assembly
3. Gasket
4. Heat insulator
5. Gasket

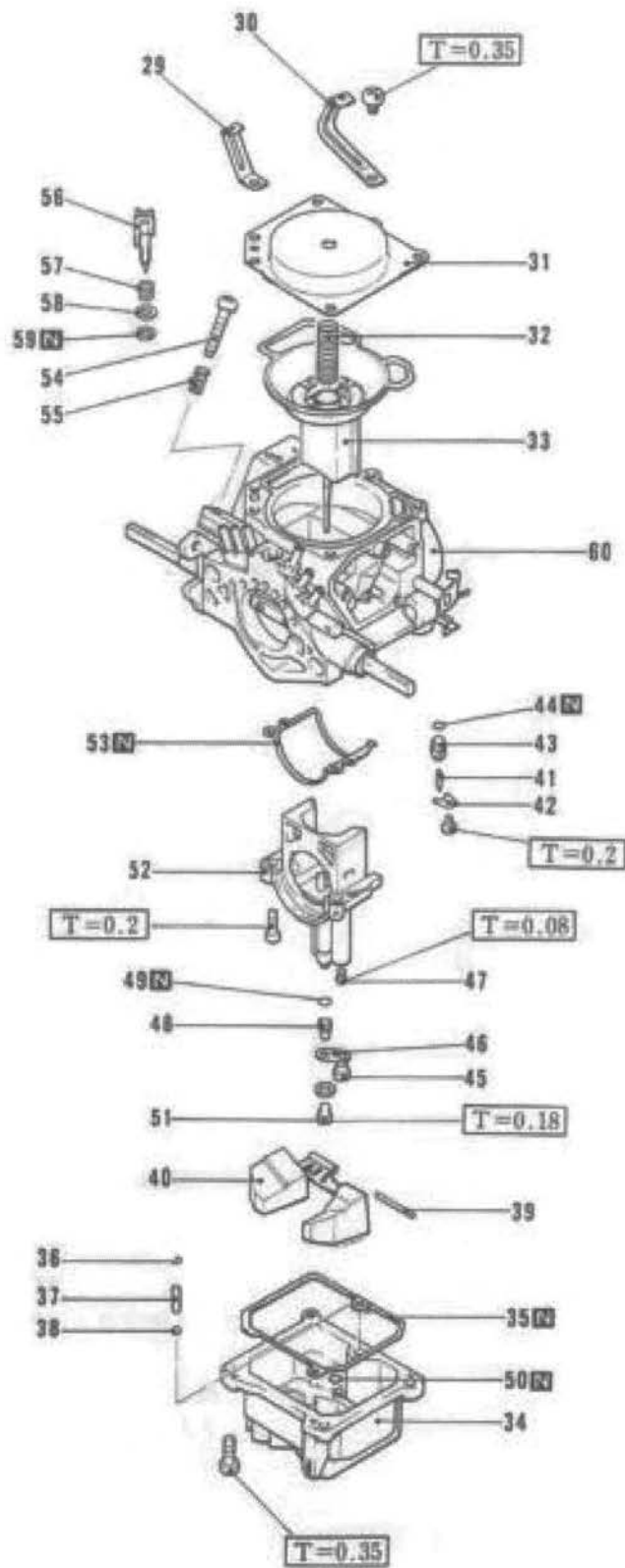
Carburetor Components



Carburetor Components

1. Vacuum hose kit [A/T]
2. Vacuum hose kit [M/T]
3. Vacuum hose kit [A/T]
4. Vacuum hose kit
5. Vacuum hose
6. Hose Clamp
7. Hose Clamp
8. Idle Up Actuator [A/C]
9. Idle Up Actuator [A/C, P/S]
10. Throttle Positioner [A/T]
11. Retainer
12. Fuel Cut Solenoid Valve [FCSV]
13. O Ring
14. Throttle Cable Bracket
15. Auto Choke Body Assembly
16. Gasket
17. Washer
18. Washer
19. Lever [Cam Follow]
20. Spring
21. Guide Ring
22. Pin
23. Throttle Lever
24. Guild Ring
25. Spring
26. Pump Case
27. Diaphragm
28. Spring

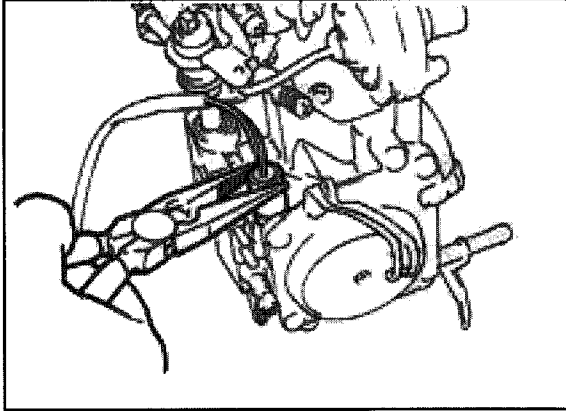
Carburetor Components



Carburetor Components

29. Clip
30. Clip
31. Piston Cover
32. Spring
33. Piston Valve assembly
34. Front Chamber Body
35. O Ring
36. Retainer
37. Weight
38. Ball
39. Pin
40. Float
41. Needle Valve
42. Retainer
43. Needle Valve Seat
44. O Ring
45. Plug
46. Plate
47. Pilot Jet
48. Main Jet
49. o Ring
50. O Ring
51. Power Jet
52. Jet Block
53. O Ring
54. Idle Speed Adjusting Screw [SAS]
55. Spring
56. Mixture Adjusting Screw [MAS]
57. Spring
58. Washer
59. Gasket
60. Mixture Body

Carburetor Settings

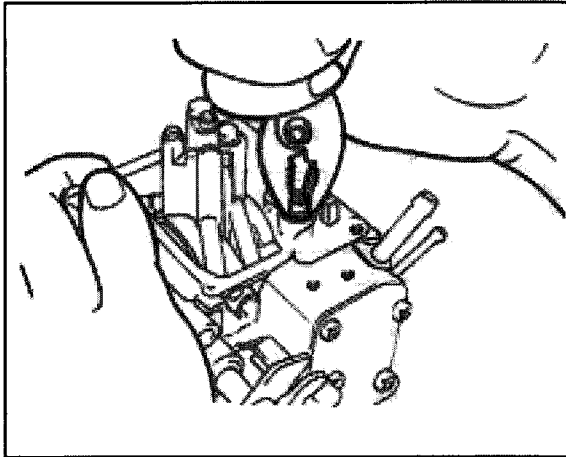


Fuel Cut off Solenoid Valve [FCSV]

Note: O Ring Must be Replaced if valve has been Removed for Any Reason

1. Disconnect Wire Connector
2. Use Needle Nose Pliers and Remove valve

Note: See Following page for Testing of FCSV Valve



Needle Valve Seat

Use Pliers to Unscrew Valve Seat

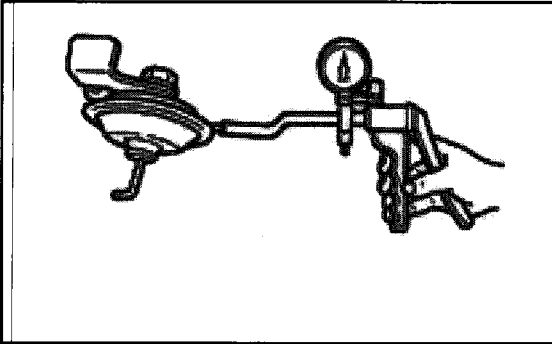
Pilot jet

Use Driver to Remove Jets

Note: See following page for Jet Sizes

Note: See parts Catalogue for Available Jet Sizes

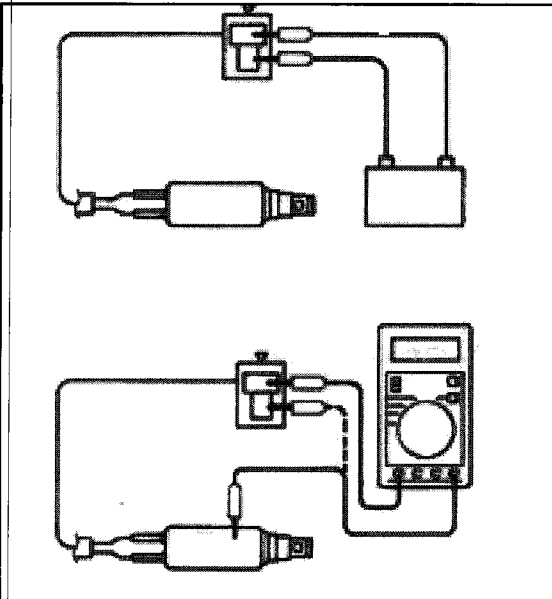
Carburetor Settings



Throttle Positioner

1. Attach Hand Pump Vacuum Gage to Positioner.
2. Pump Gage to Verify Diaphragm Opens.

Note: Adjustment Not Possible. Failed Units Must be Replaced

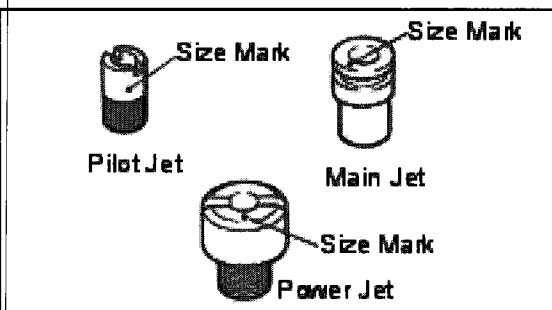


Fuel Cut Off Solenoid valve [FCSV]

1. Attach a 12V power Supply as Show. When Power is Applied a Clicking Sound Will be Heard. If No Sound or Movement is Detected Replace Valve

FCSV Ohm Test

2. Attach Ohm Meter as Shown
Ohm Range 48-60Ω

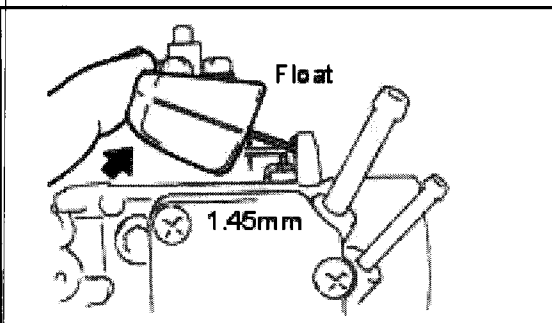


Power Jet-Main Jet-Pilot Jet

Note: Following Sizes are Standard. Verify Size if Non-Standard with parts Catalogue

Note: Size in Millimeters (mm)

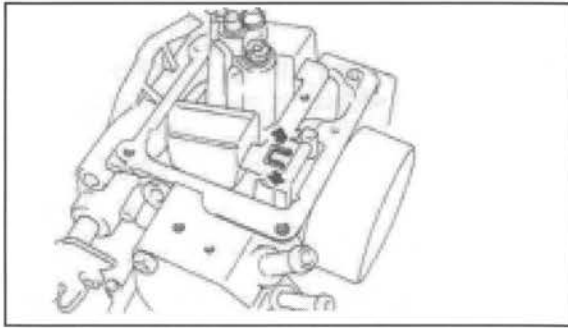
Jet	S4 A/T	S4 M/T	S2 M/T
Power Jet	117.5	117.5	116.3
Main Jet	91.3	91.3	91.3
Pilot Jet	46.3	45	48.8



Float Adjustment (All)

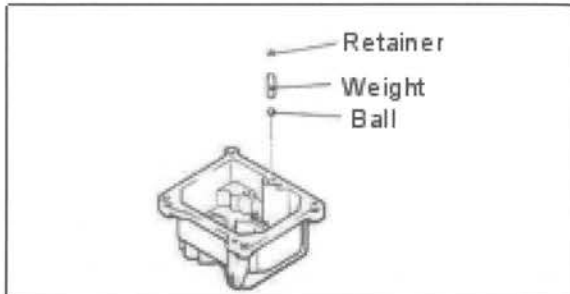
3. Set Float Height to 1.45mm. Bend Lever as Required

Carburetor Settings



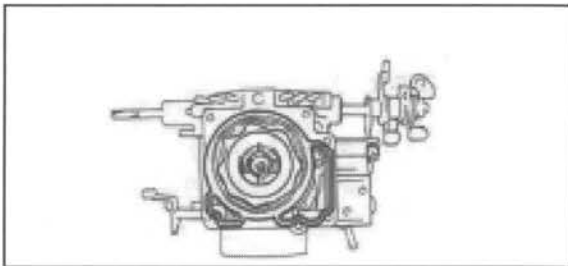
Float Lever Positioning Confirmation

Note: Use Diagram on the Left to Verify Float lever Positioning.



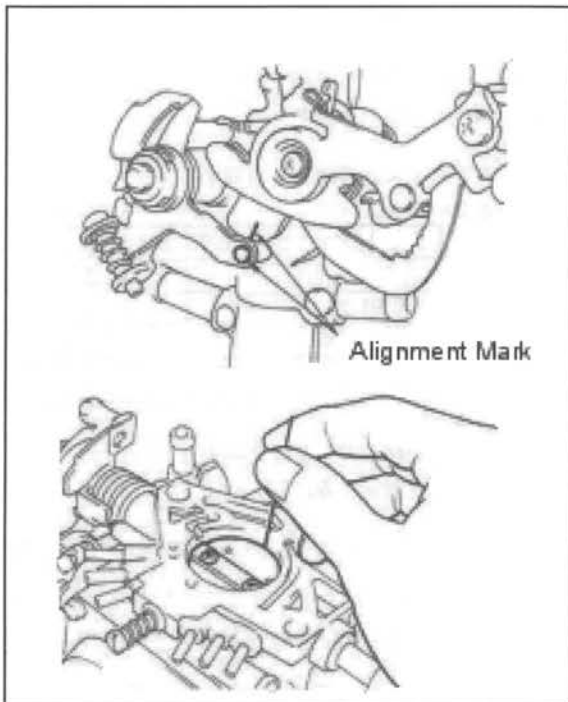
Ball-Weight-Retainer

Note: Verify the following parts are Installed as Shown in the Diagram. Failure to Install retainer will case the System to fail



Piston Valve Assembly

Note: Replace Piston Assembly as Shown. Take Care not to Tear Diaphragm Unit.



Fast Idle Adjustment

Use Alignment Marks to set Fast idle as Shown

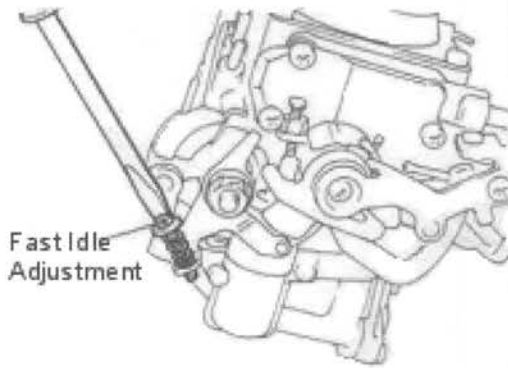
Throttle Valve to Throttle Valve Bore
Clearance

Limit

0.30mm M/T

0.36mm A/T

Carburetor Settings

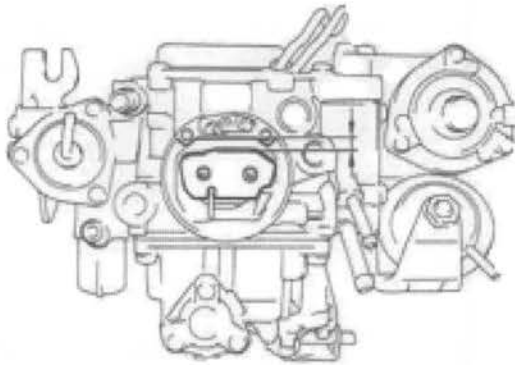


Idle Adjustment

Note: See Individual Engine Compartment Stickers for Idle RPM Settings.

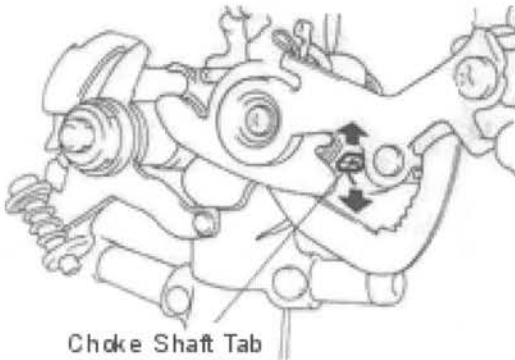
Turn Screw Right: Idle Increase

Turn Screw Counterclockwise: Idle decrease



Choke Bore Gap

Choke Engaged Bore Opening limit: 4mm

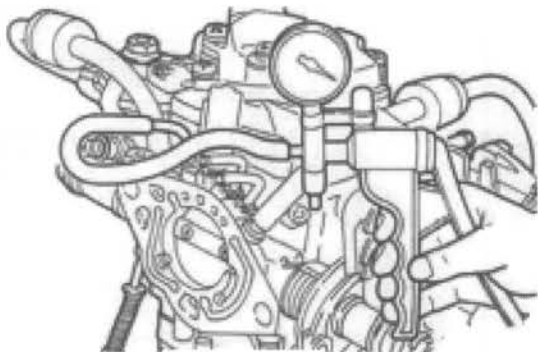


Choke Shaft Adjustment

Note: Bend tab to Set Gap

Bend Down: gap increase

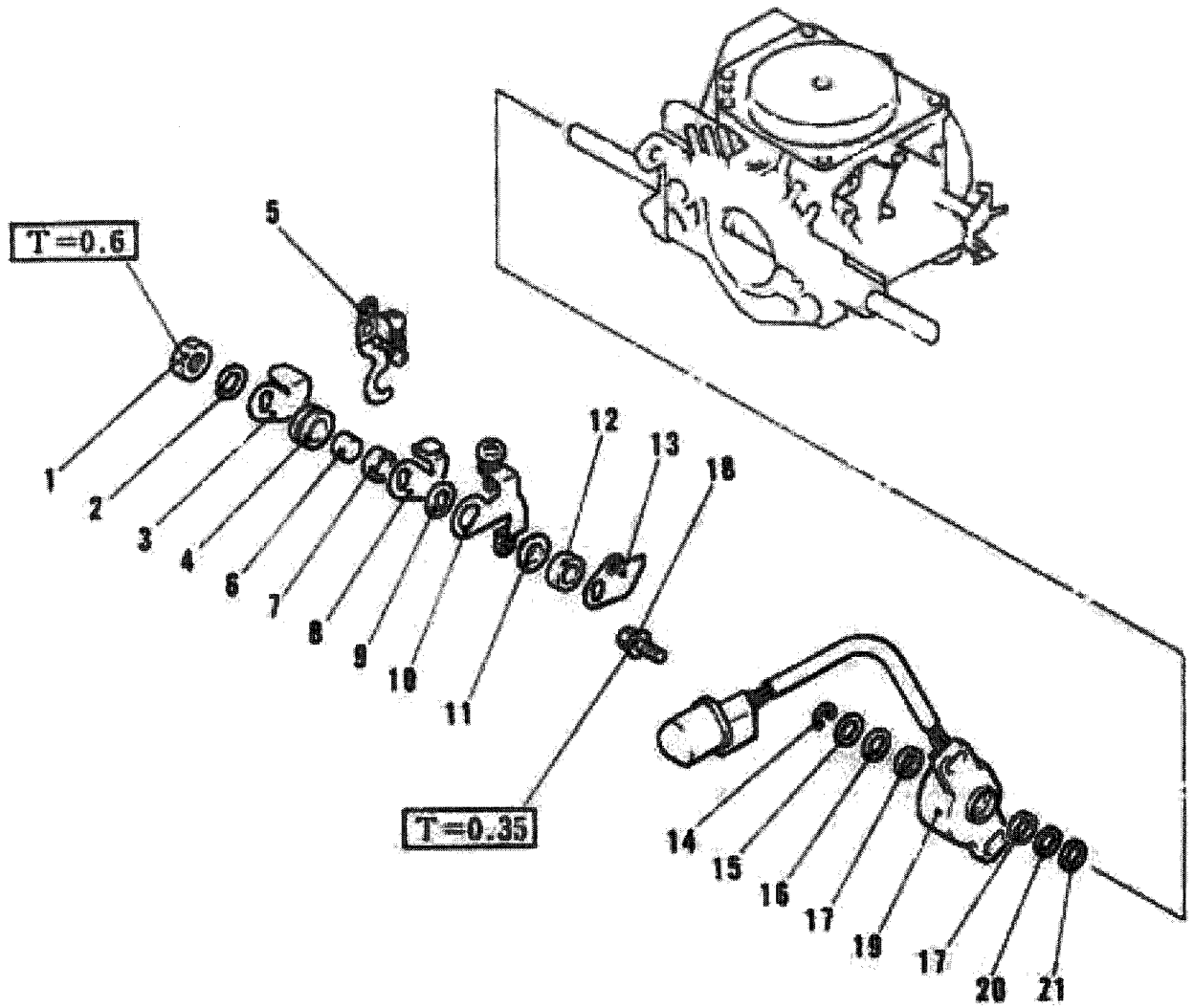
Bend Up: Gap Narrows



Use Vacuum pump to Check main ports for Leak Down Testing. Inspect all vacuum Hoses for Cracks or Holes. Replace as Necessary.

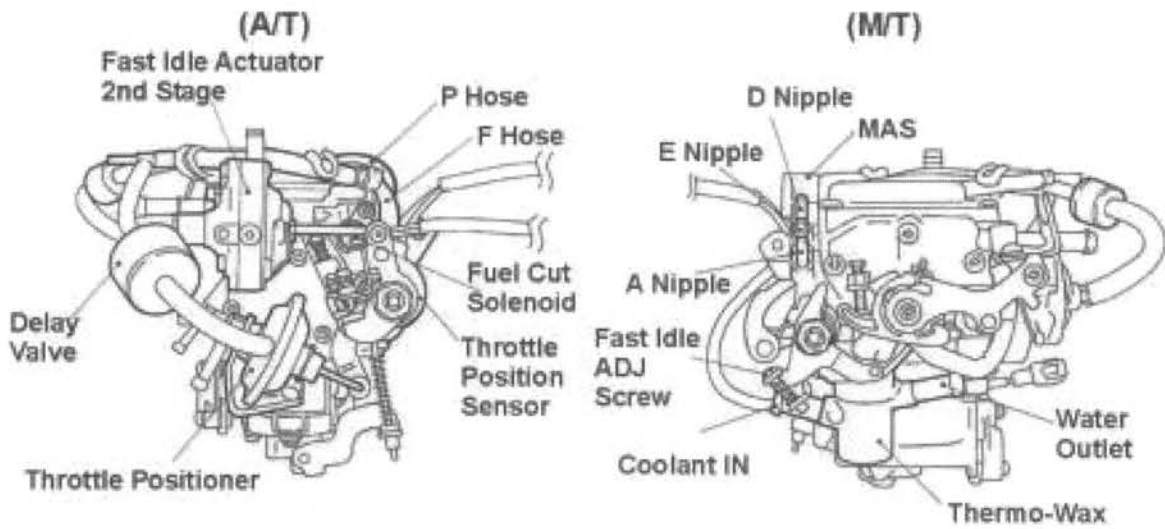
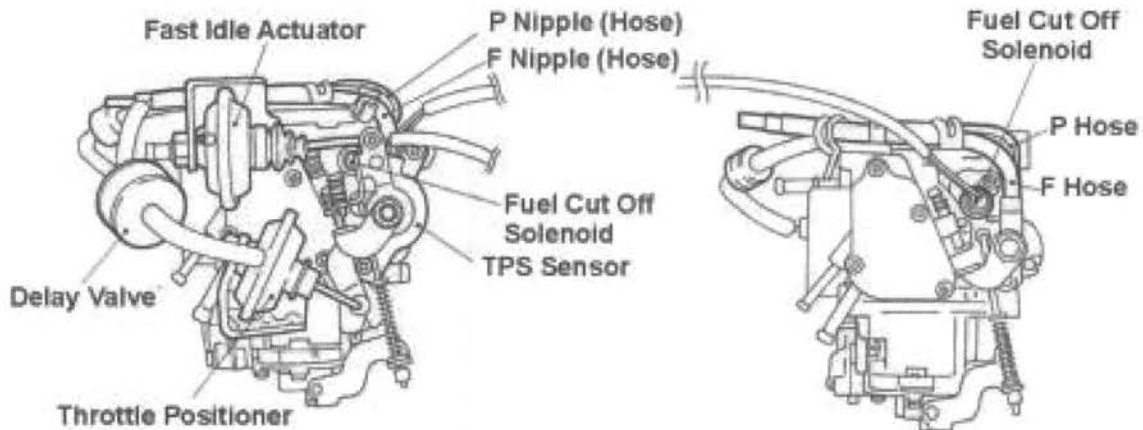
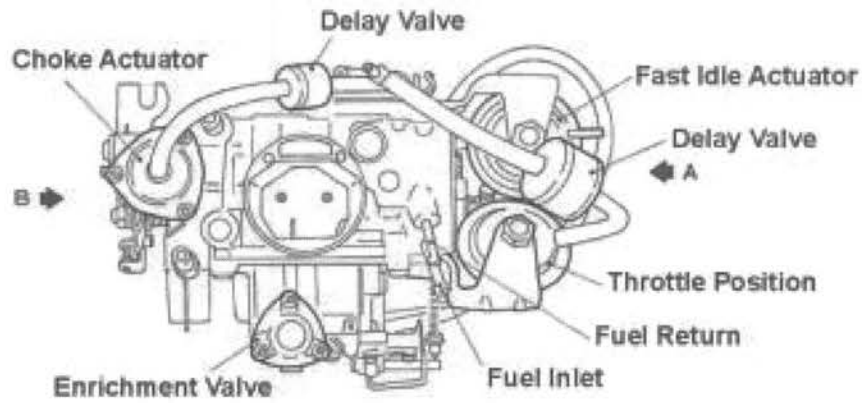
Note: Vacuum Hose is Supplied in Rolls and Not Individually

Carburetor Linkage

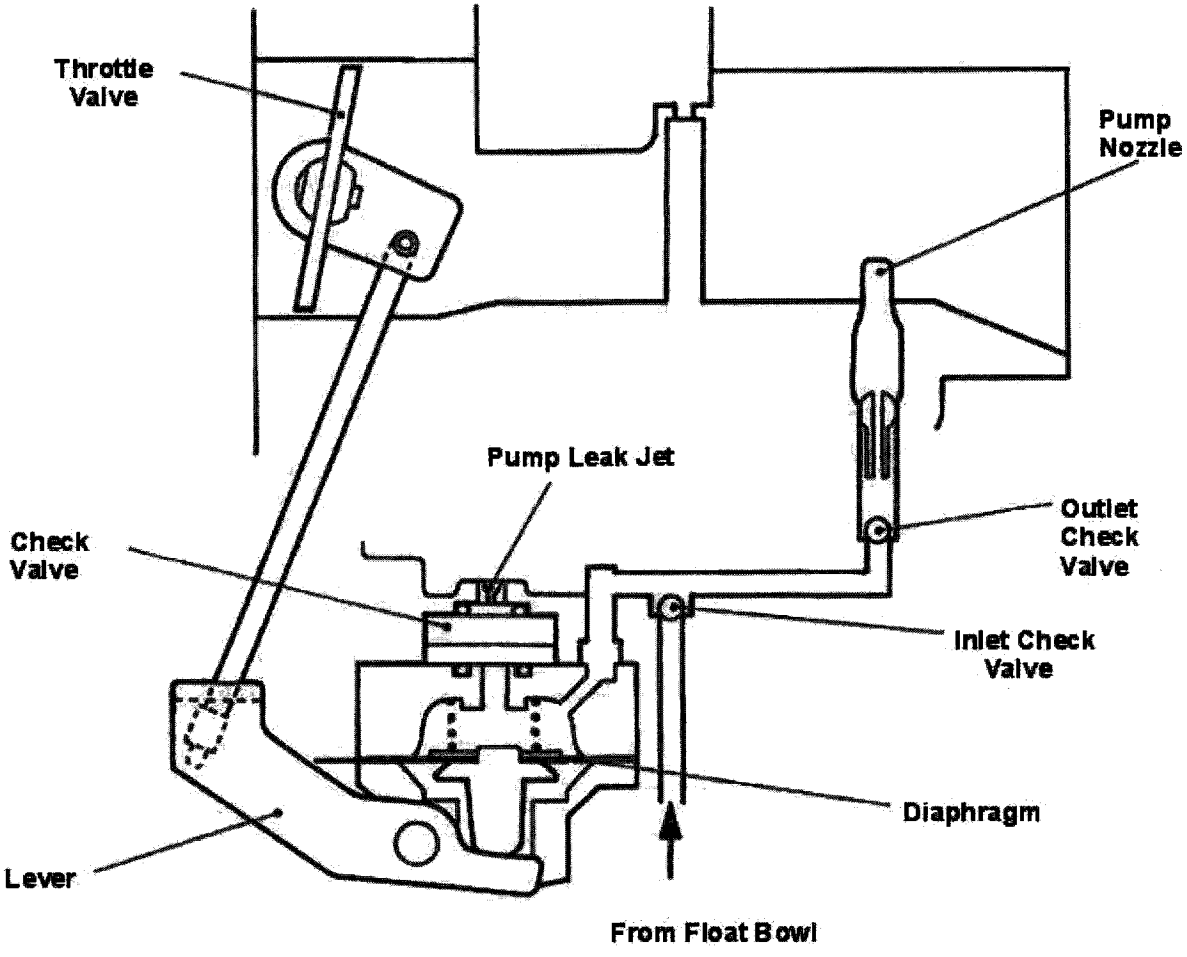


1. Nut	2. Spring Washer
3. lever: Fast idle	4. Spacer
5. Idle Up: Free Travel	6. Pin
7. Spacer	8. Throttle Position Setting Lever
9. Washer	10. Throttle Position Lever: Free
11. Washer	12. Spacer Ring
13. Lever: Pump	14. Snap Ring
15. Washer	16. Washer
17. Oil Seal	18. Screw
19. TPS	20. Washer
21. Seal	

Carburetor Solenoid & Actuators



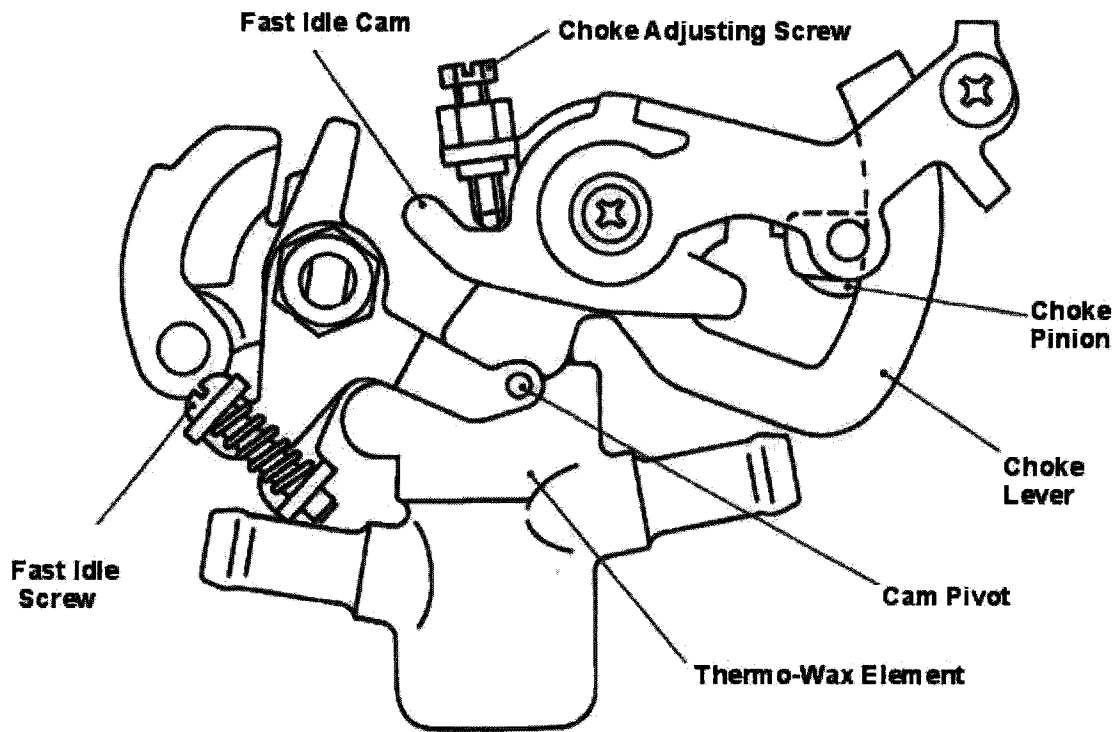
Power Valve Pump Circuit



Note: Power Valve Circuit used for all Models

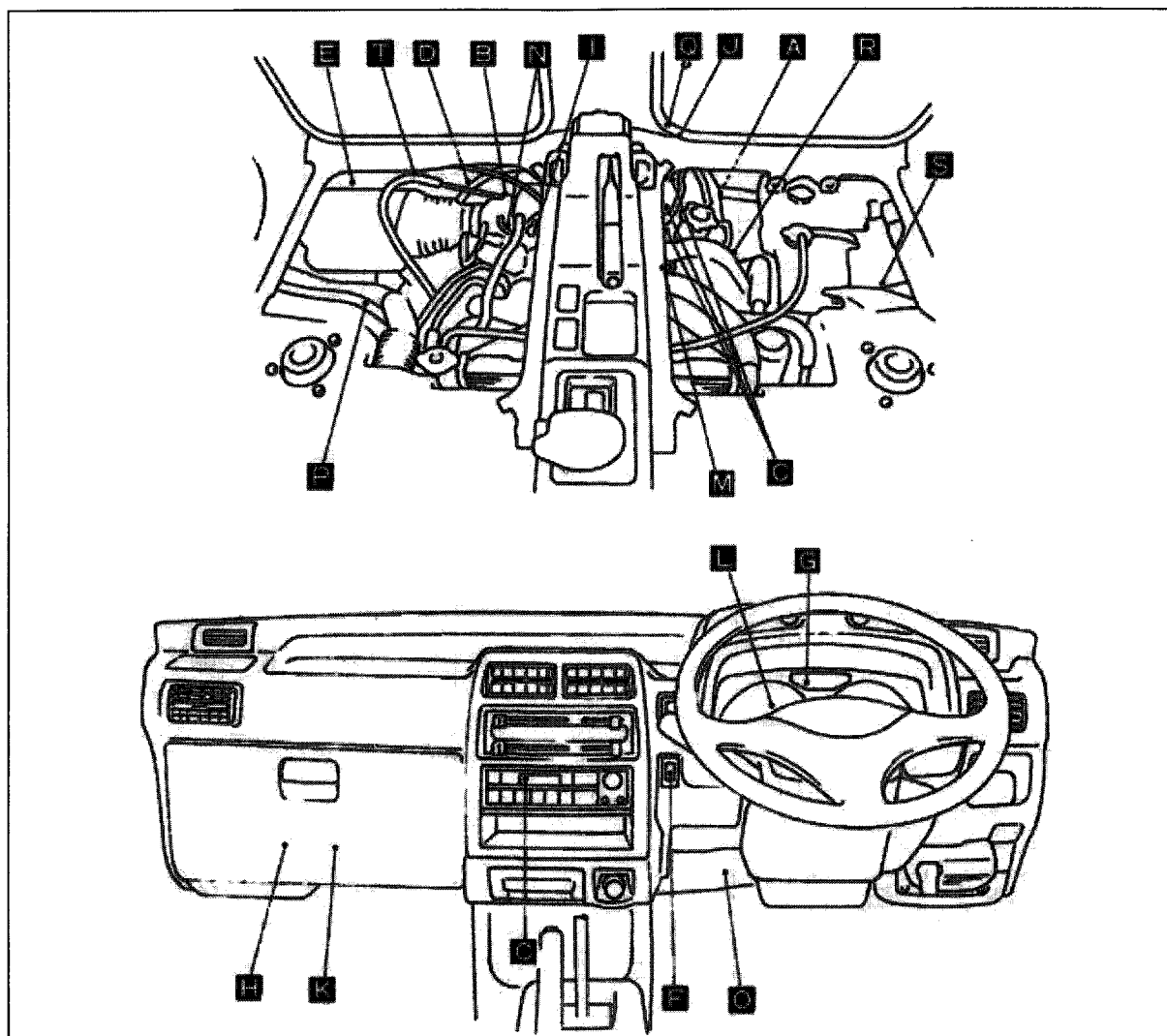
Full Auto-Chock Linkage

Close-up Diagram

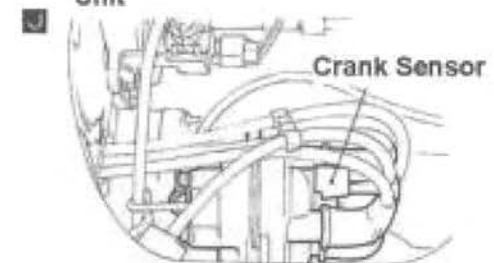
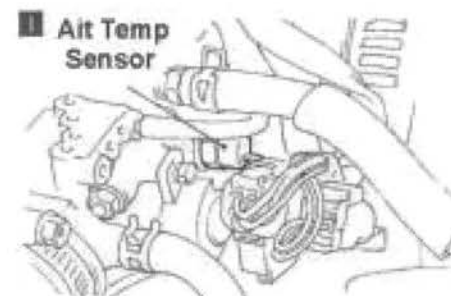
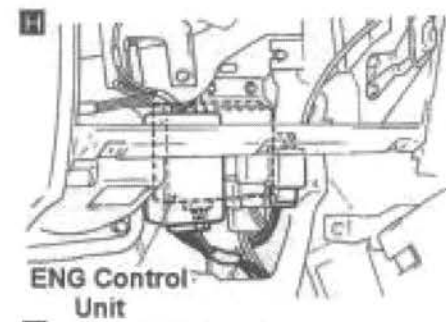
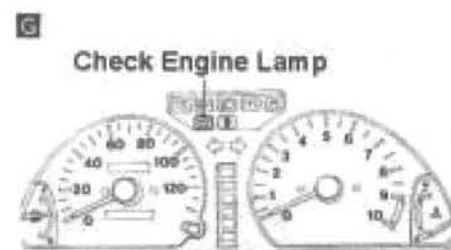
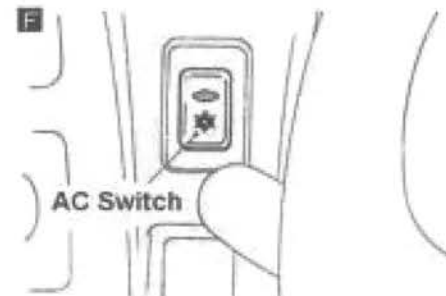
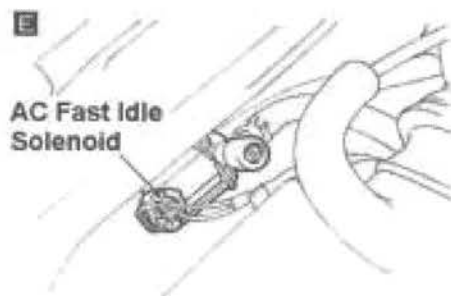
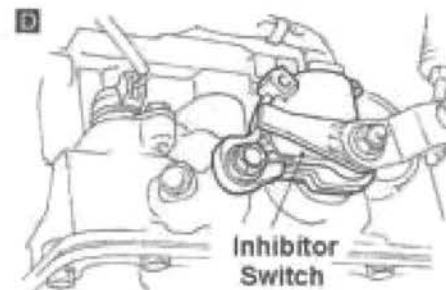
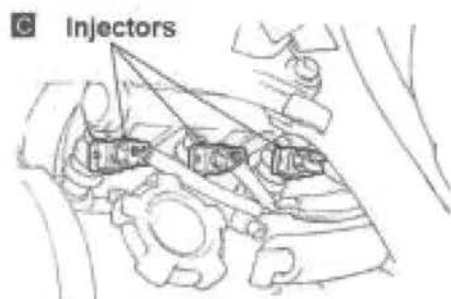
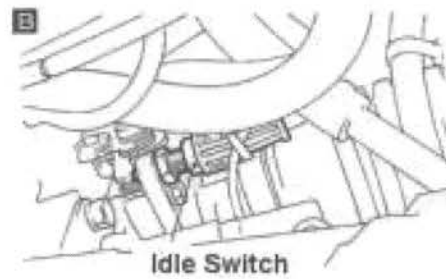


MPI Fuel Injection System Components and Sensor Locations DOHC

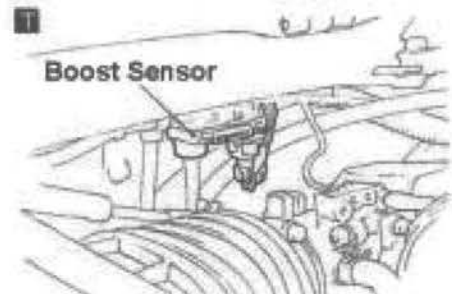
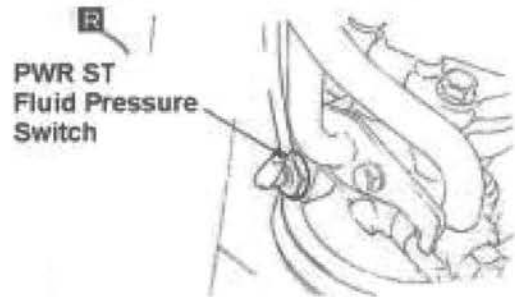
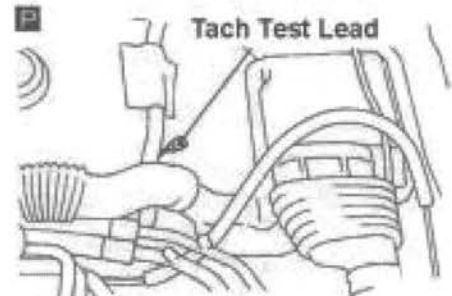
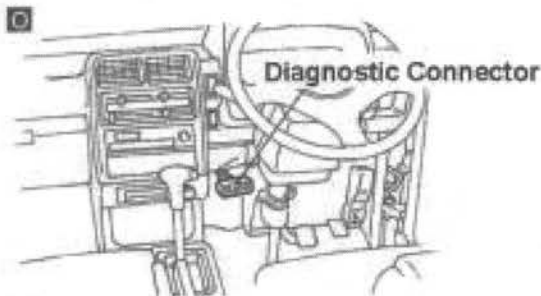
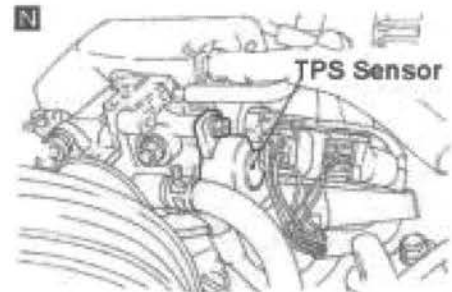
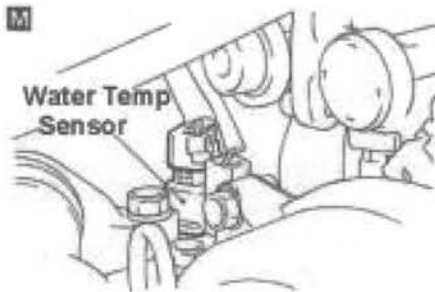
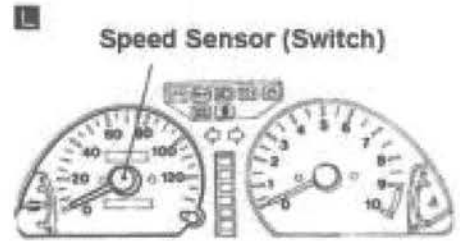
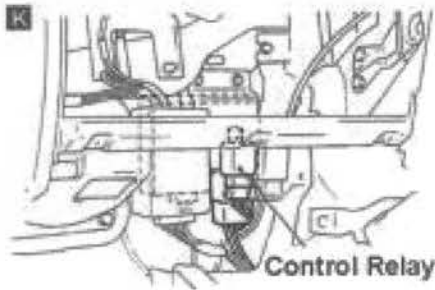
Name	Letter	Name	Letter
O2 Sensor	A	Control Relay	K
Idle Switch	B	Speed Sensor	L
Injector	C	Water Temp Sensor	M
Inhibitor Switch (AT)	D	TPS	N
AC Fast Idle Solenoid	E	Diagnostic Connector	O
AC Switch	F	RPM Test Lead	P
Engine Warning Lamp	G	Duty Solenoid Valve (MAF)	Q
Engine Control Unit	H	PWR Steering FL-PRESS SW	R
Air Temp Sensor	I	Power Transistor	S
Crank Sensor	J	Boost Sensor	T



MPI Fuel Injection System Components and Sensor Locations DOHC



MPI Fuel Injection System Components and Sensor Locations DOHC



Check Engine Lamp: Self Diagnostics





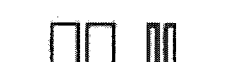



Note: Before Initiating Self Test Confirm Charging System Output is within 12V to 14V.

Lower Voltage will Cause False Readings of All Sensors and Computer Errors.

Note: Confirm Vehicle is properly Tuned-Up and Ignition System is Functioning Properly.

Self Test Procedure

1. Turn Ignition Key to "ON" Position. (Not Start)
2. Wait 5 to 6 Seconds and the "Check Engine" Lamp will begin Flashing Stored Codes
3. Use the Patterns Shown Bellow. The Flash Patterns will show any or all Error Codes Stored in the Computer.
4. To Clear All Codes Remove Negative Battery Cable 15-30 Seconds.

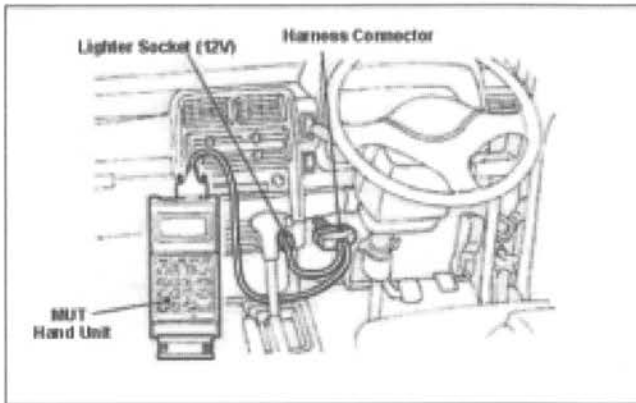
Code #	Unit	Signal Flash Pattern	Check Item
---	Computer Unit		No Response: Change Computer
13	Air Temp Sensor		Inspect Sensor* See Following Pages
14	TPS Sensor		Check TPS Sensor Check Idle Switch
21	Water Temp Sensor		Check Connection Check Sensor* See Following Pages
22	Crank Sensor		Check Distributor* See Following Pages
24	Speed Sensor		Inspect Speed Sensor*
32	Boost Sensor		See Following Pages: Boost Sensor
0	All Clear		No Errors Recorded

Note: Use Hand Held MUT Analyzer for Detailed Diagnostics. Use the "Self Test Method" only if the MUT Analyzer is not available.

Note: On Board Computer Stores Only Limited Codes: Not for All Sensors

Note: See Following Pages for more Details and Circuits for Further Troubleshooting.

MUT Computer Connection

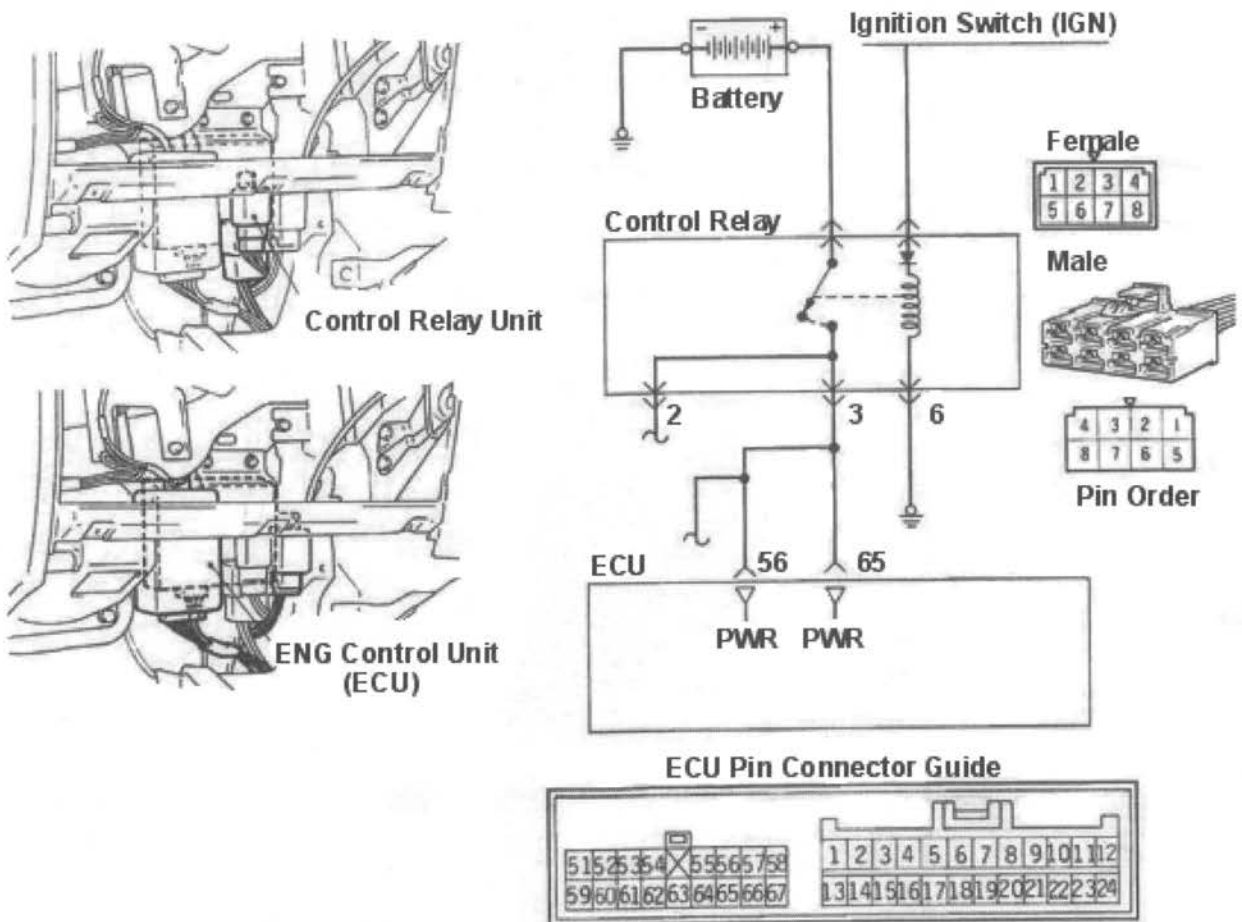


MUT Hand Held Computer Analyzer

1. Attach Unit as Shown. Plug the Computer Unit into the Harness Connector. Plug the Power Plug into the 12V Lighter Socket.
2. Check System Voltage before Proceeding. Computer Errors can be generated or "Ghost Errors" due to Improper Voltage. Limit: 13-14.5Volts
3. Run the Analyzer Program. Check System for Error Codes. If no Error Codes are Reported System Check Clear. If an Error Code appears go to the Individual component and Circuit for Detailed Testing.

Note: Make Adjustments with the MUT Unit only after Troubleshooting ALL Error Codes. Do not Adjust Idle or make RPM adjustments with Error Codes remaining. See MUT Cartridge Unit Instruction Card for System Updates.

Computer Control Unit Power Circuit & PIN Guide

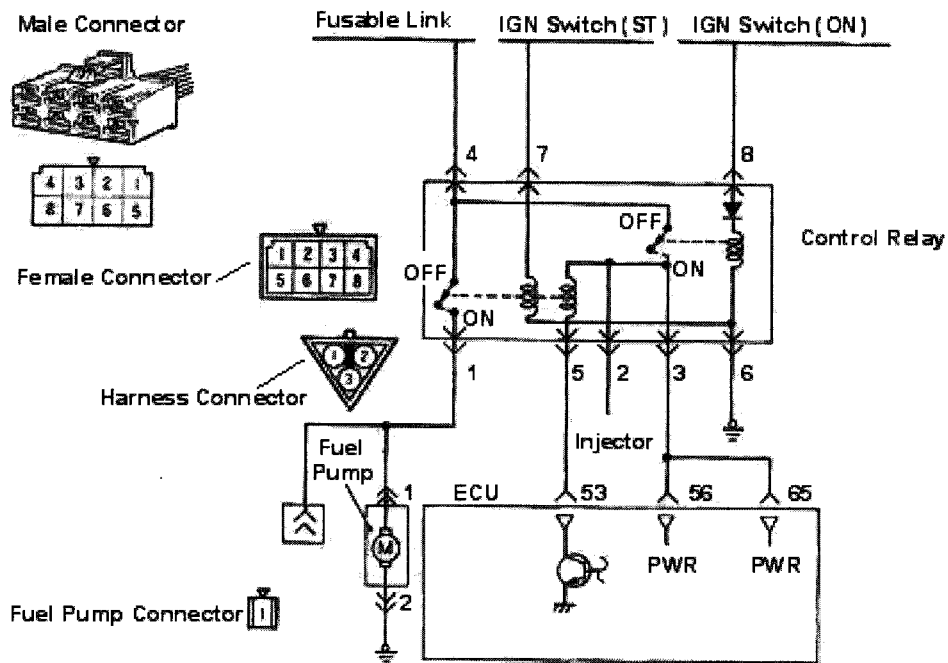
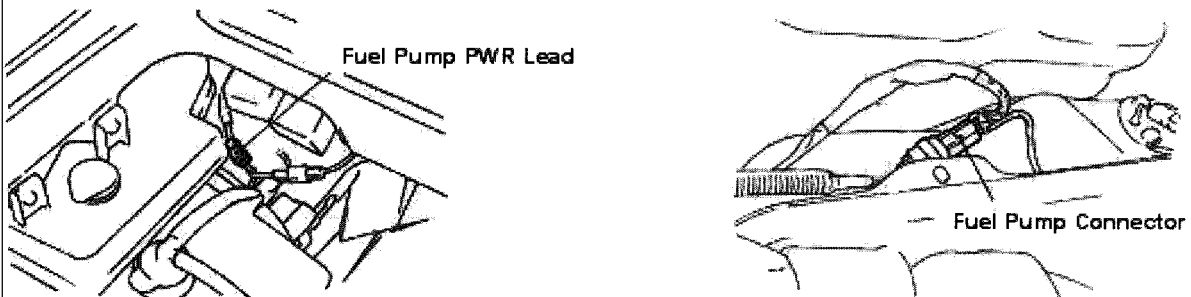


Note: ECU Connector Ground (-) Pins are Number 57 & 66.

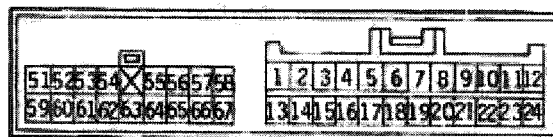
Fuel Pump Circuit

Note: Use the Diagram Below for Troubleshooting Fuel Pump Circuit Problems

Note* Always Check Charging System Voltage! Low Voltage will cause Circuit Failure.



ECU Connector Pin Guide



Troubleshooting Hints:

1. Loose or dirty contacts between the Control Relay & Fuel Pump cause majority of failures. Ground Points (-) are a good place to Inspect for Low Voltage or Intermittent Voltage Reading Problems.
2. If PWR is not present first check "FUSABLE LINK" to PIN #4 of Control Relay.
3. If No PWR to Injectors change Control Relay.

Boost Sensor Component

Component: Boost Sensor

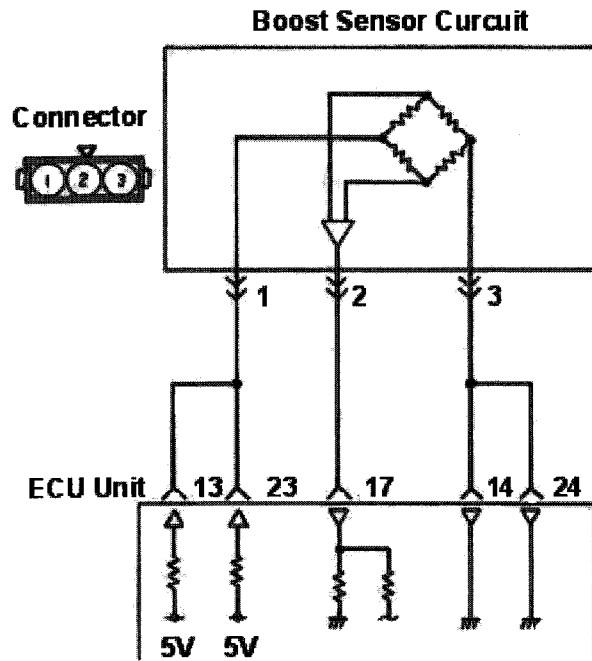
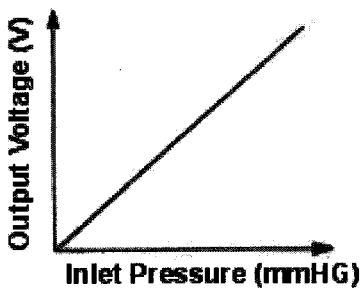
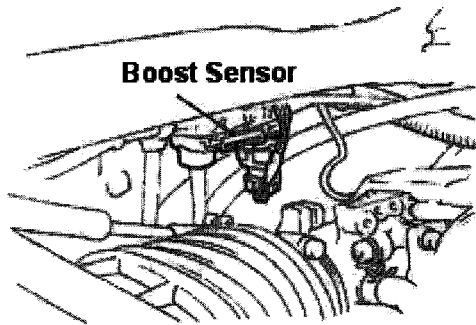
Function: Intake Inlet Pressure Sensor

Error Item Code: 32

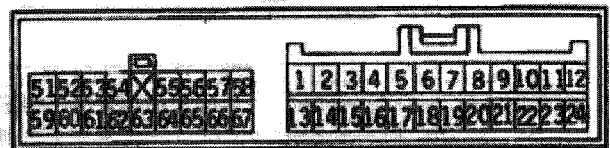
Operating Range: 80-95°C

Operating Volts: Min 4.8V to Max 5.2V

Idle Range: 900 RPM @270-370 mmHG



ECU Connector PIN Guide



Troubleshooting Hints:

1. Bad Boost Sensors can cause too much fuel enrichment. This causes fowling of spark plugs and damage to the Ignition Coil.
2. Vehicle used in High Altitude Areas should check the Boost Sensor Every 20,000 Kilometers

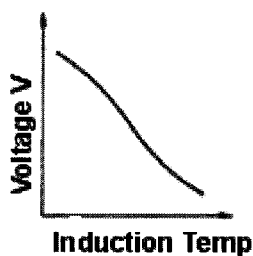
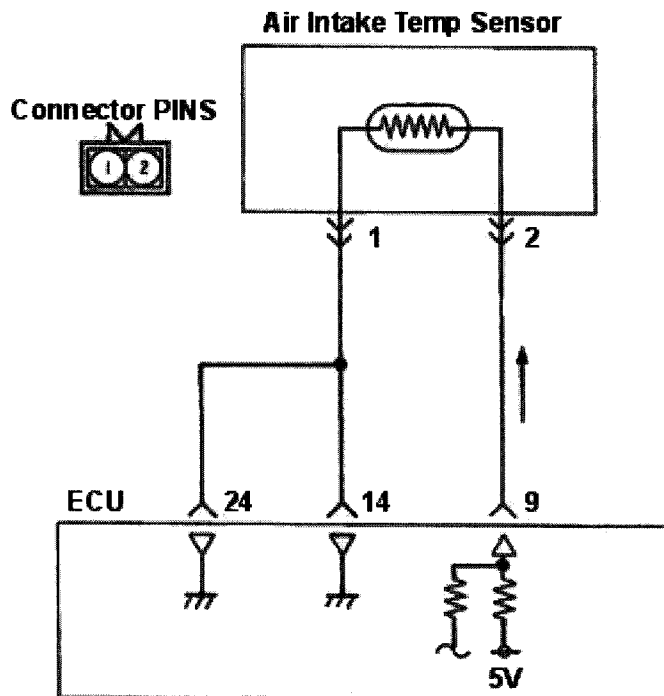
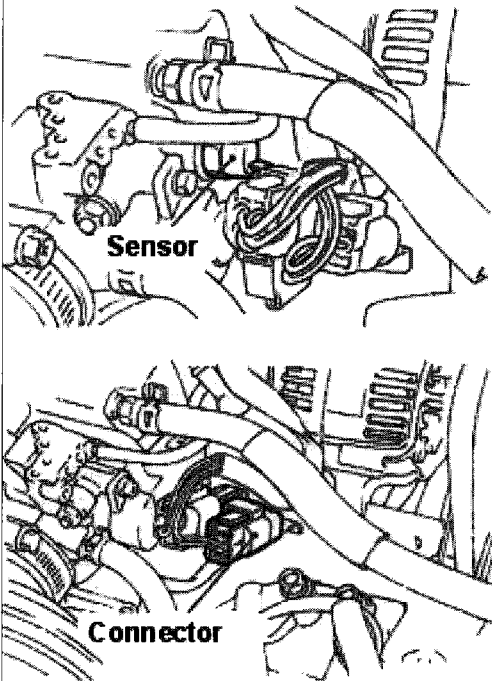
Intake Air Temperature

Component: Intake Air Temperature Sensor

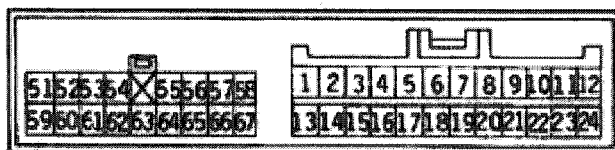
Function: Read Induction Air Temperature

Error Item Code: 13

Operating Voltage: Harness (PIN #2) 4.5V-4.9V



ECU Connector PIN Guide



Troubleshooting Tips

1. Unit has tendency to become oil or carbon coated. Remove and clean Sensor Tip
2. Remove Unit & Attach Ohm Meter to Leads 1 & 2. Use a blow dryer and blow on the Sensor Tip. @0°C=6.0Ω. The Higher the Temperature the Lower the Ohms. Final Ohm Reading @80°C=0.3Ω.
3. Error Codes generally are caused by Faulty Ground Connections or the Sensor Connector Pins are Corroded. Clean thoroughly all Contacts and Re-Test.

Water Temperature Sensor

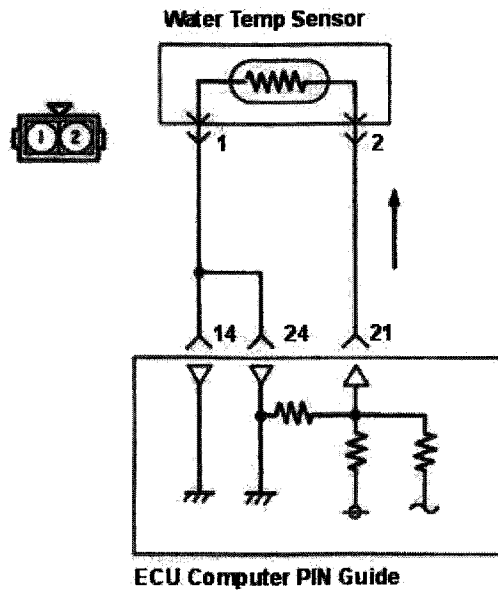
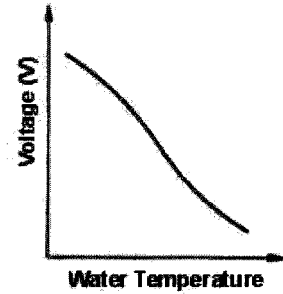
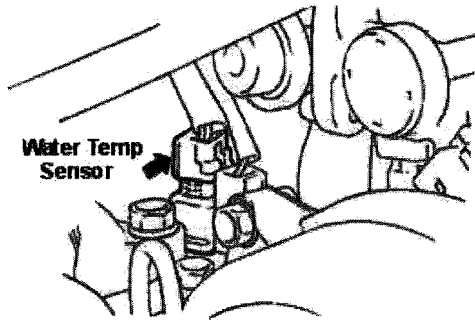
Component: Water Temperature Sensor

Operating Range: -20°C to 80°C (Full)

Function: Send Water Temperature to Fuel Enrichment Side of ECU

Error Item Code: 21

Voltage Range: 4.5-4.9V



Troubleshooting Hints:

1. Dirty or corroded Sensor Tips can cause Engine to run Too Rich. One Sign is Black Soot in the Tailpipe. Remove Sensor and Clean.
2. Testing: Place Sensor in Water Pot and Slowly Heat. Use an Ohm Meter to test. Use the Chart Below.

Ohm Range

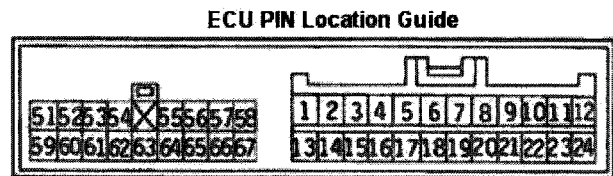
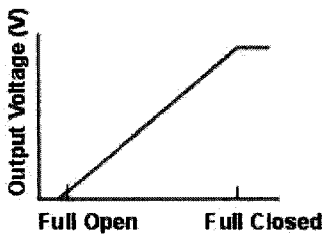
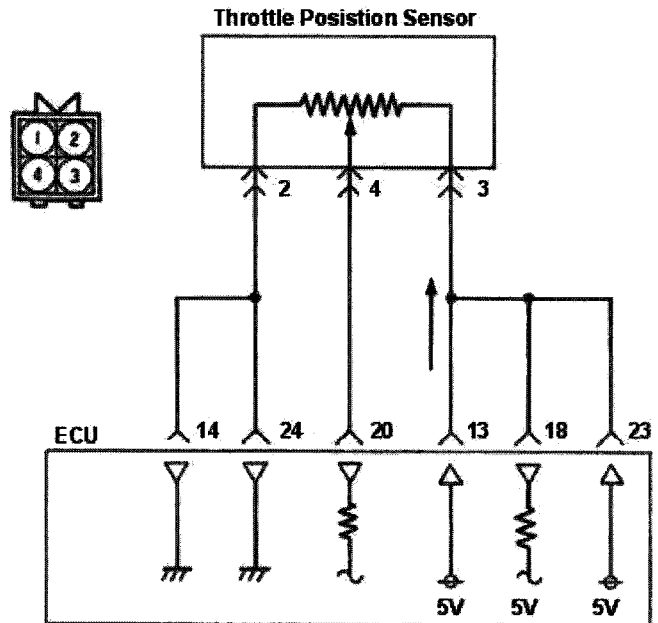
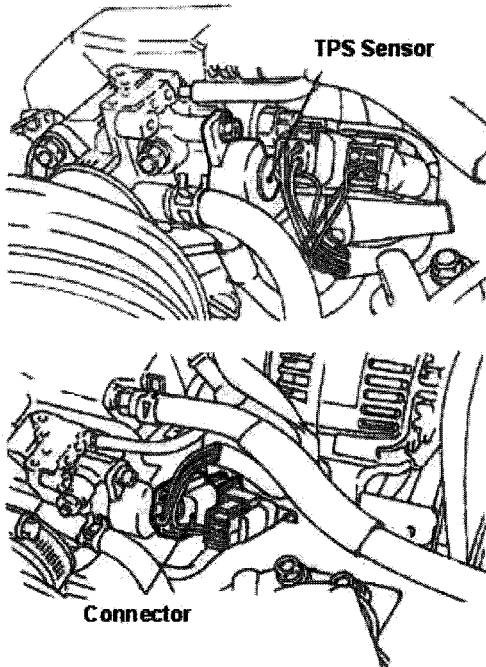
0°C	5.8Ω
20°C	2.4Ω
40°C	1.1Ω
80°C	0.3Ω

Throttle Position Sensor (TPS) MT Vehicle

Component: Throttle Position Sensor (TPS) Manual Transmission Type

Error Item Code: 14

Operating Voltage: 4.8-5.2V (PIN #3)



Troubleshooting Hints

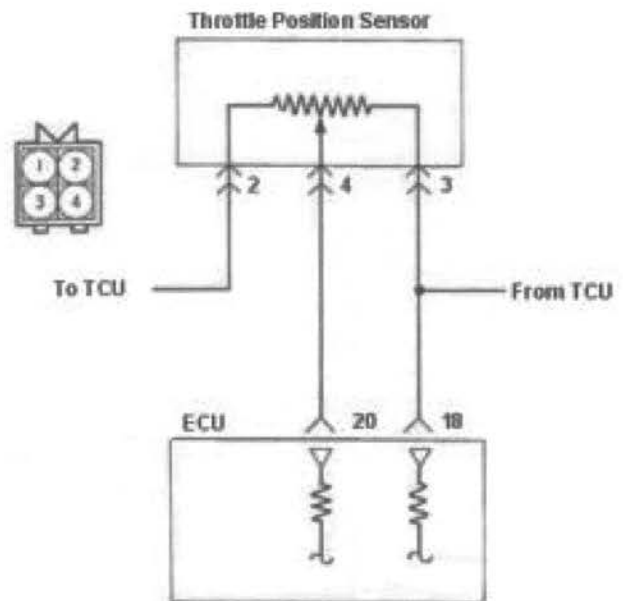
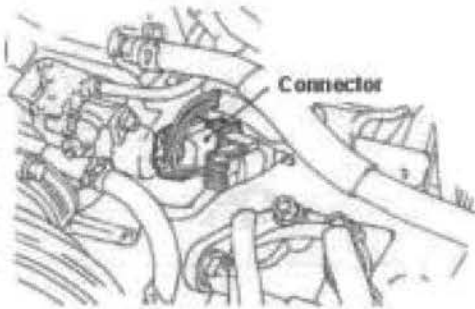
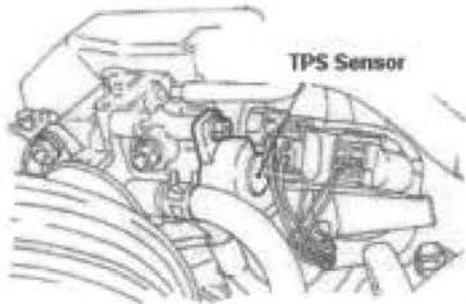
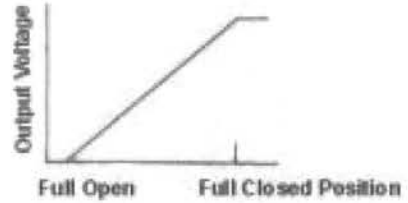
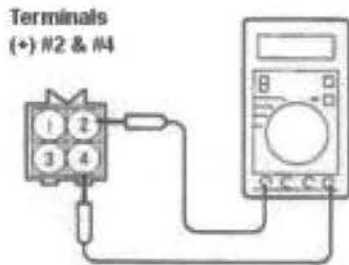
1. Turn Ignition to "ON" for minimum 15 Seconds. Idle Position reading: 450-550mV. Full Open Position reading: 4500-5500mV.
2. Check Ohm Range: Use an Ohm Meter between PINS #3 & #2. Limit: 3.5-6.5kΩ. If out of Range Replace Unit.

Throttle Position Sensor (TPS) AT Vehicle

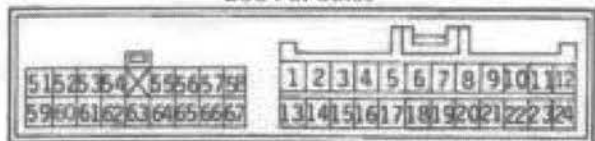
Component: Throttle Position Sensor (TPS) Manual Transmission Type

Error Item Code: 14

Operating Voltage: 4.8-5.2V (PIN #3)



ECU PIN Guide



Troubleshooting Hints

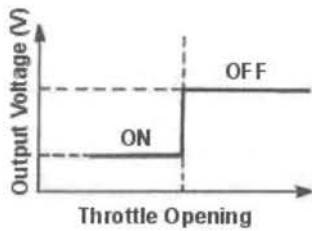
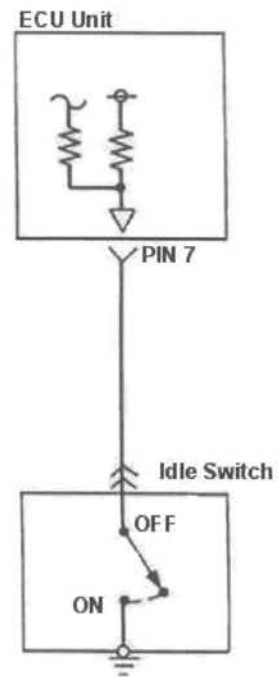
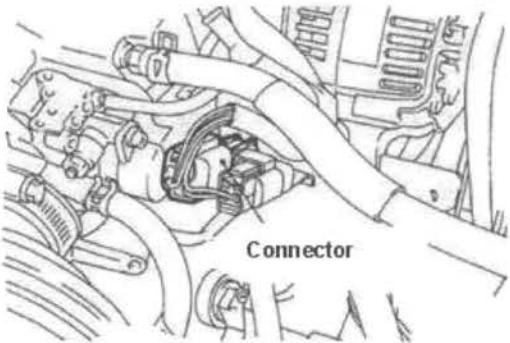
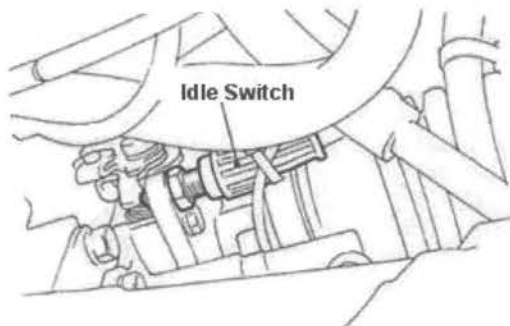
3. Turn Ignition to "ON" for minimum 15 Seconds. Idle Position reading: 450-550mV. Full Open Position reading: 4500-5500mV.
4. Check Ohm Range: Use an Ohm Meter between PINS #3 & #2. Limit: 3.5-6.5kΩ. If out of Range Replace Unit.

Idle Switch

Component: Idle Switch

Error Item Code: 26

Voltage: 4.0V or Over

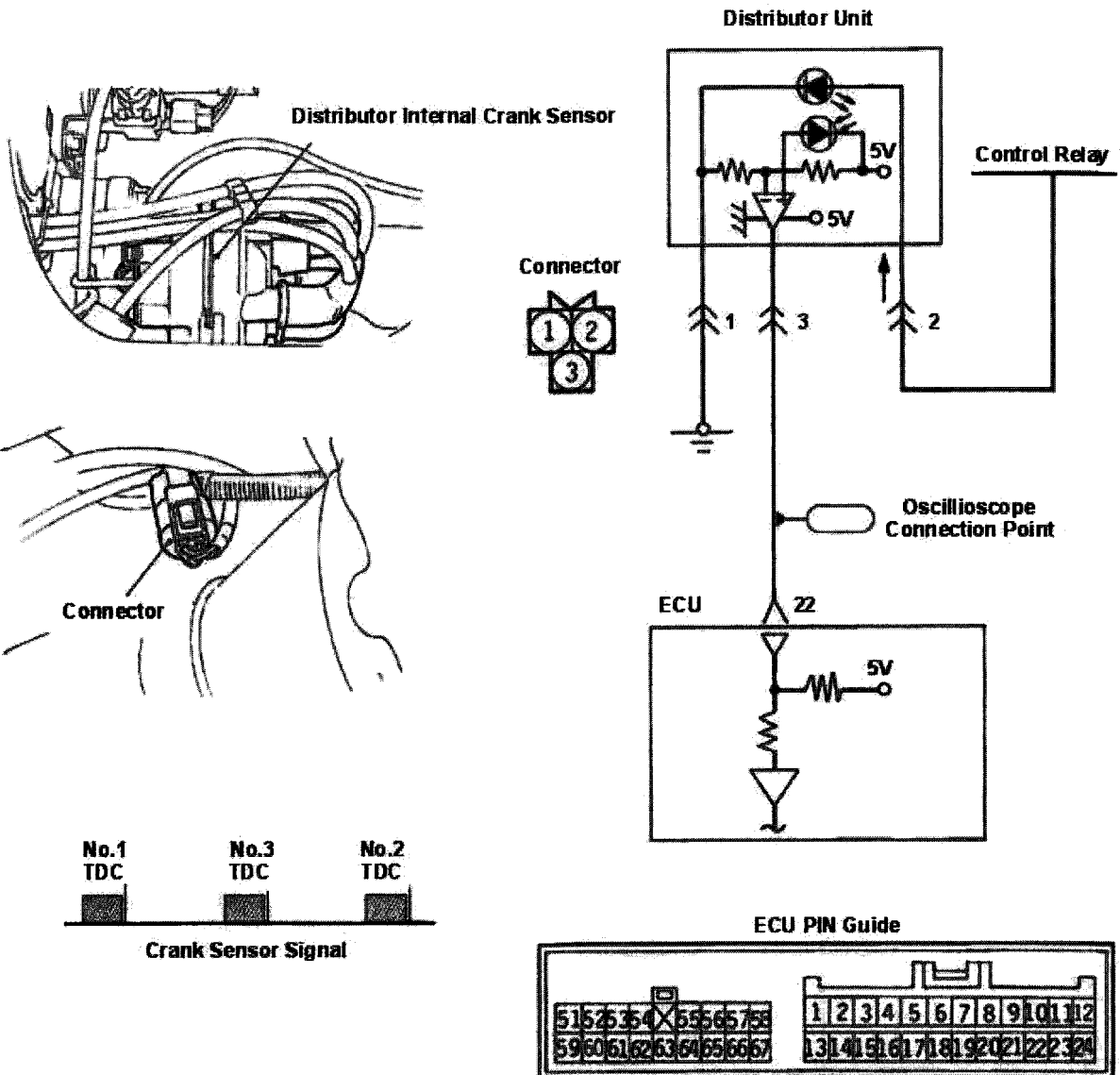


Troubleshooting Hints

1. No Accelerator Pressure: Switch Closed.
2. Accelerator Pressure Applied: Switch OPEN
3. Confirm PWR to Switch through PIN #7

Crank Sensor

Component: Crank Sensor
 Location: Distributor Internal
 Error Item Code: 22



Note: An Oscilloscope is required to test the Crank Sensor

Volts/DIV: 5 Volts

Time/DIV: 20ms@900RPM

Calculation: (RPM)=2÷3T(S)x60

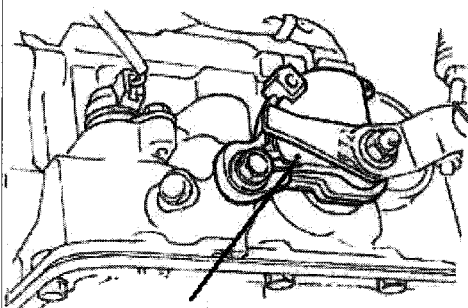
Inhibitor Switch (Neutral Safety Switch) A/T Vehicles

Component: Inhibitor Switch (Neutral Safety Switch)

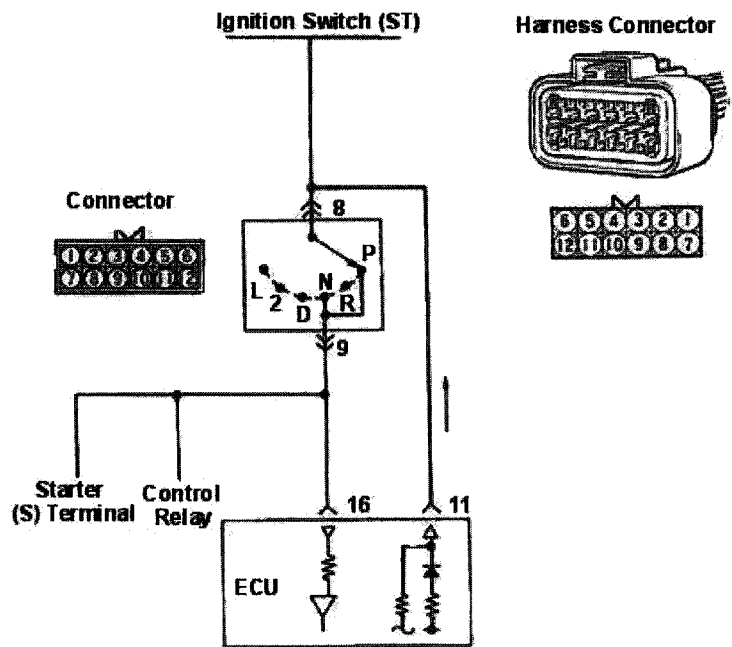
Function: Prevent Engine Starting in Gear. Gear Position Must be in Either "Neutral" or "PARK" Position to Start Engine.

Error Item Code: 18

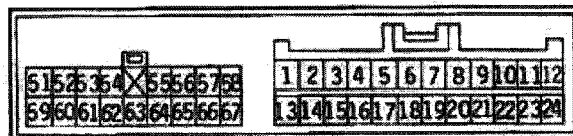
Voltage: Minimum 8 Volts (PIN #16 ECU)



**Neutral Safety Switch
(Inhibitor Switch)**



ECU PIN Guide



Troubleshooting Hints

1. If Engine Starts in any Drive Gear Position Replace Switch
2. Use the Circuit Chart Above to Troubleshoot Continuity Problems

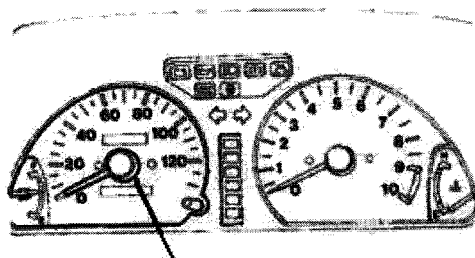
Speed Sensor

Component: Speed Sensor

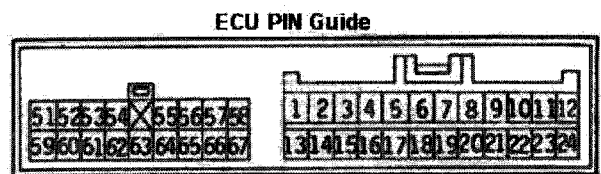
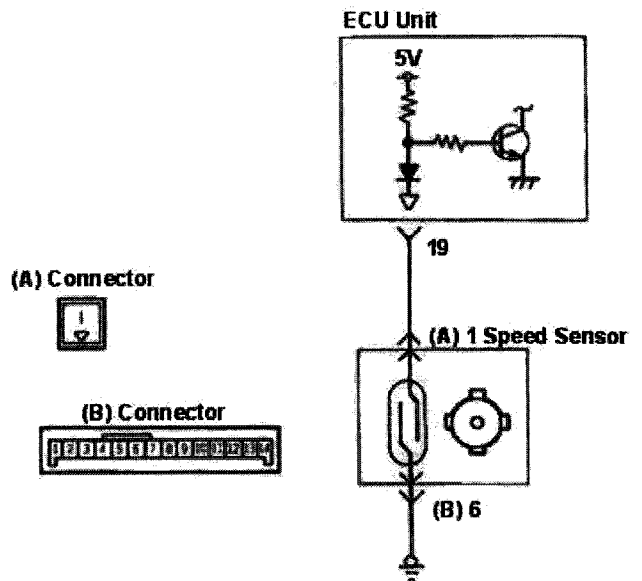
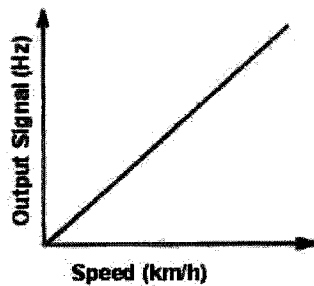
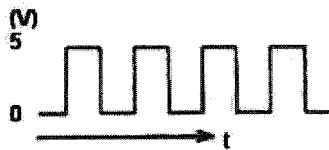
Function: Provide Vehicle Speed Information to ECU

Error Item Code: NA

Voltage: 4.5-4.9V



Internal Speed Sensor



Troubleshooting Hint

1. An Faulty Speed Sensor has been know to cause Engine Stalling. If the Vehicle has Engine Stalling Problems Check the Speed Sensor Circuit.

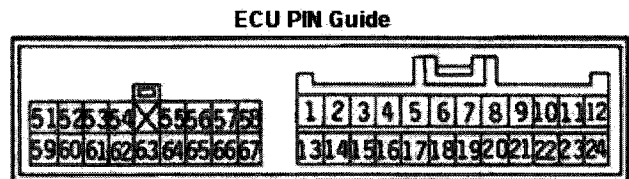
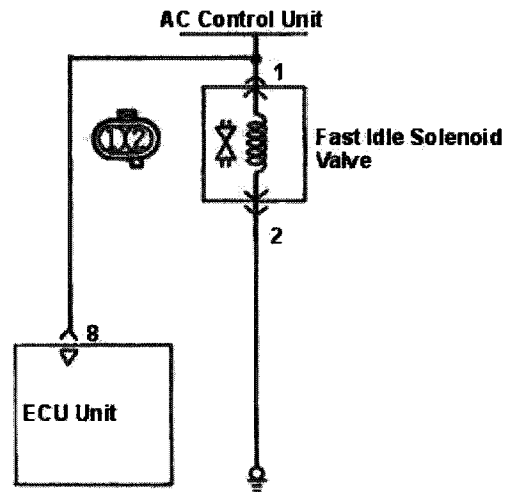
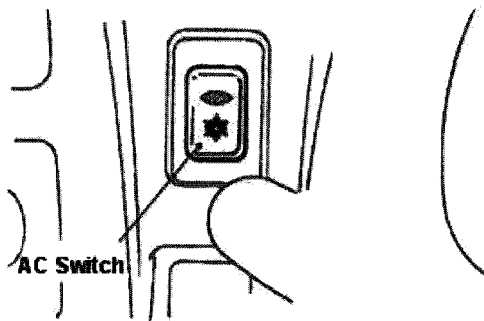
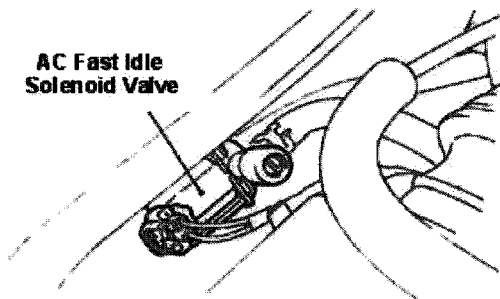
Note: An Error Code Will Not Appear on the MUT Computer. Check Circuit with Ohm Meter.

AC Fast Idle Solenoid

Component: AC Fast Idle Solenoid Valve

Function: AC Engagement Idle Up

Error Item Code: 28 (Switch) 49 (AC Relay)



Troubleshooting Hint

1. Place Vehicle in PARK and Idle Engine. Engage AC Switch. AC Fast Idle Solenoid if Engaging Properly will have a "Clicking" Sound. If no Engagement Slide in a Paper Clip and Use a Voltage Meter to Test for Current (12V). Cycle AC Switch and Test Current. If current is Available Test for Proper Ground (-). If Circuit PWR is Present Replace Solenoid and re-test.

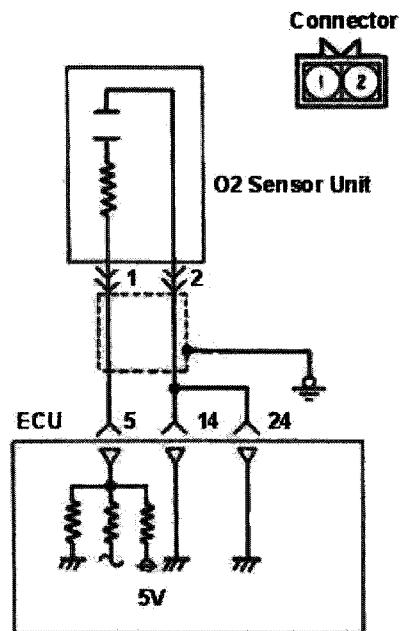
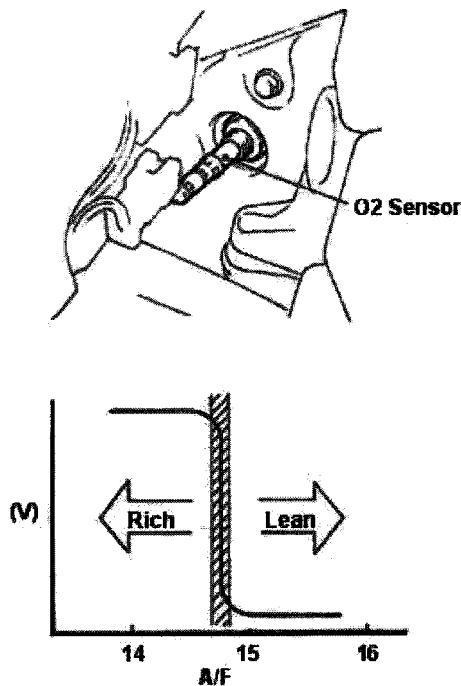
Oxygen Sensor

Component: Oxygen Sensor

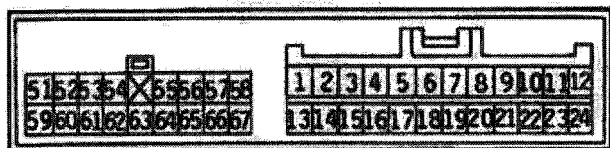
Error Item Code: 11

Idle 900 RPM: Below 400mV

2000 RPM: 600-1000mV



ECU PIN Guide



Troubleshooting Hints

Note: Remove O2 Sensor and Clean before Testing. False Reading can be caused by dirty or coated Sensor.

Note: Before Testing O2 Sensor Make sure other Components in the System are in Proper working order.

1. The majority of O2 Sensors problems are caused by Leaking or Defective Fuel Injectors. See the following pages for inspecting Injectors.
2. Air Leaks at the Intake Manifold can Also cause Sensor Failure.
3. Inspect the following related Sensors: Boost Sensor-Inlet Air Temp Sensor-Water Temp Sensor.

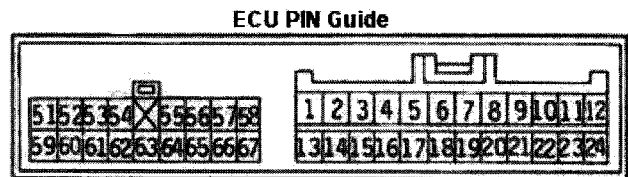
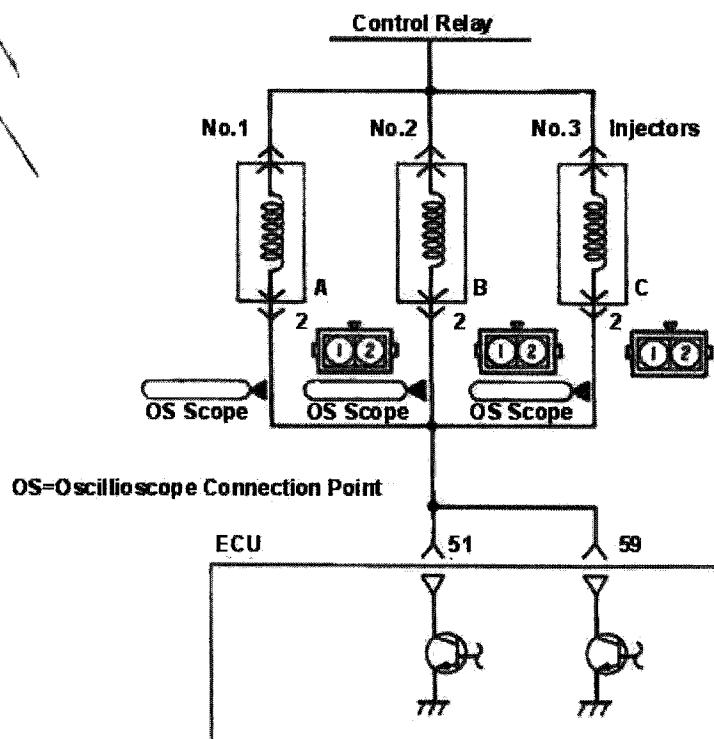
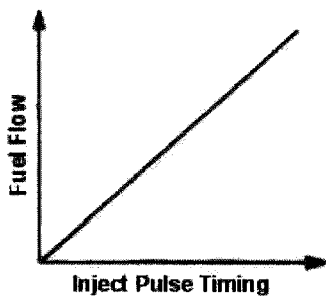
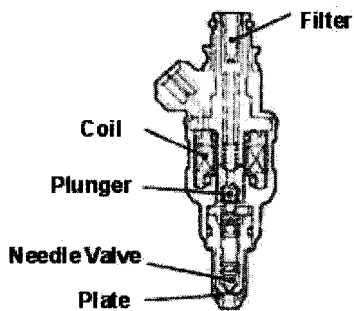
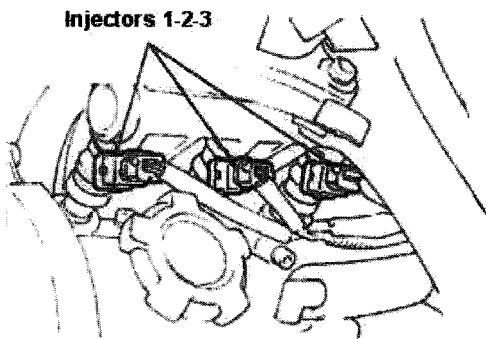
Fuel Injectors

Component: Fuel Injectors

Error Item Code: 41

Engine Start Millisecond Range

Engine Cranking	0°C	16ms
	20°C	8ms
	80°C	3.5ms

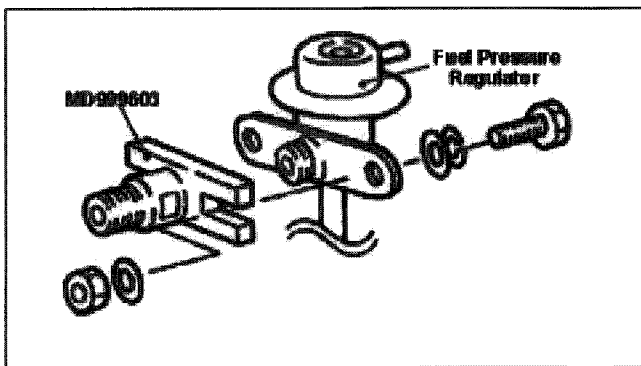
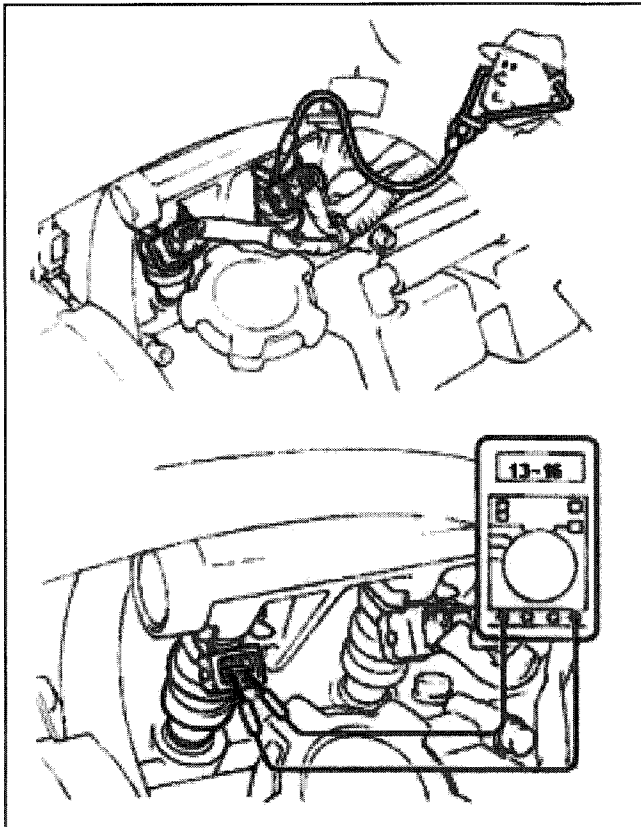


Note: Engine at Normal Operating Temperature 80-95°C

Idle @ 900 RPM: 2.3-3.3ms

Running @ 2000RPM: 2.0-3.0ms

Fuel Injectors



Test Methods

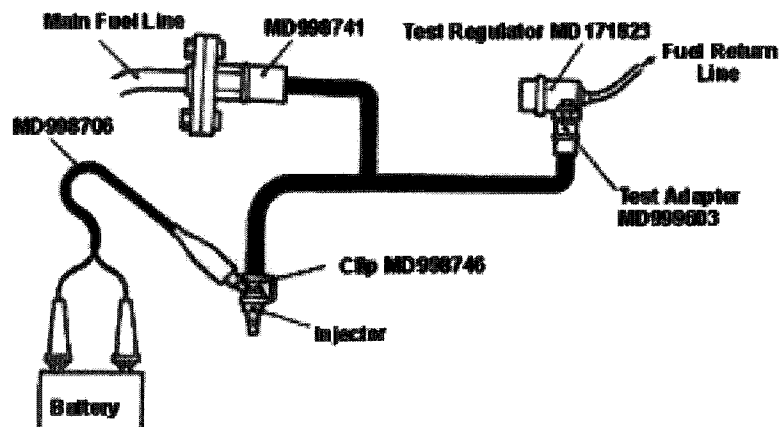
1. Start Engine and warm to operating temperature.
2. Use a Stethoscope and listen for Injectors operating or not. A Distinguishable "Clicking" sound will be heard. If no sound the Injector may have failed.
3. Confirm Power is present. If Power is present and the Injector is silent replace Injector. If Power is present and a slight "Clicking" continue to the following test.

Ohm Limit: $13-16\Omega @ 20^{\circ}\text{C}$

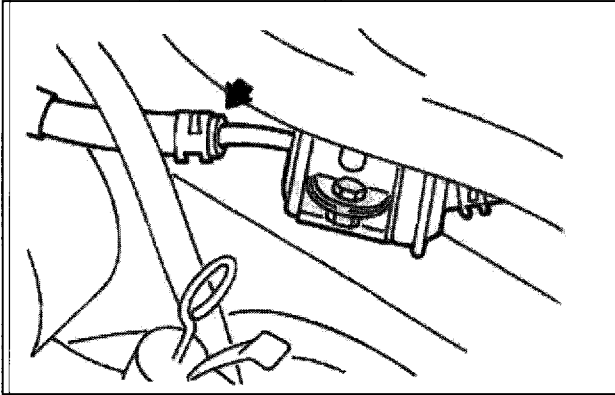
4. Use a Ohm Meter and test the Ohm Range.
5. Replace Injectors that fail within the specified Range.
6. For Injectors that Have PWR and passed the Ohm test Check Full Pressure. Low Fuel Pressure can cause Opening Problems for the Injectors. Remove Injectors one by one and test as shown in the below Diagram. Before applying PWR check for Leaking Injectors. Replace any and all Leaking Injectors.

Fuel Pressure@ Idle: 2.8kg/cm^2

Fuel Pressure@2000RPM $3.3-3.5\text{kg/cm}^2$

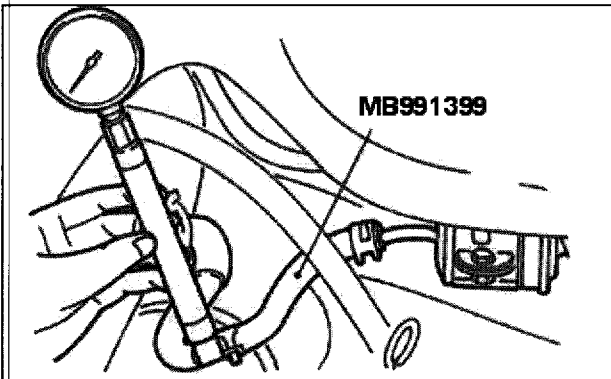


Fuel Pressure Test

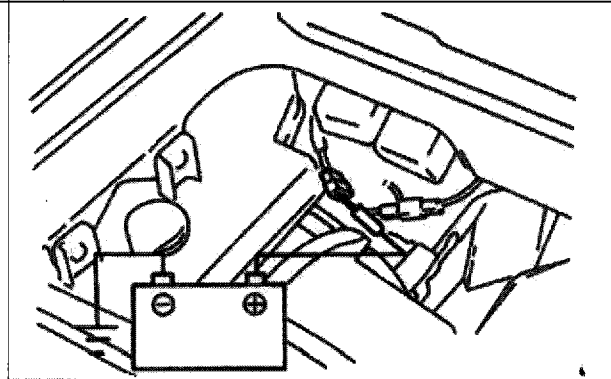


Main Fuel Line Test

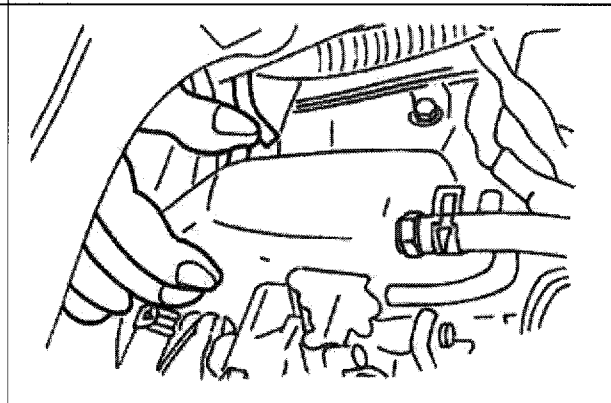
1. Place a Rag under the Fuel Line to Prevent Fuel Spillage.
2. Remove Fuel Line Clamp as Shown and Slide Back Hose.



3. Attach Fuel Pressure Gage MB991399. This is an Inline Gage and must be attached as shown in the Diagram.



4. For Static Line Pressure it is possible to bypass the START Circuit to Test the Pump by Connecting a 12V PWR Supply as shown.



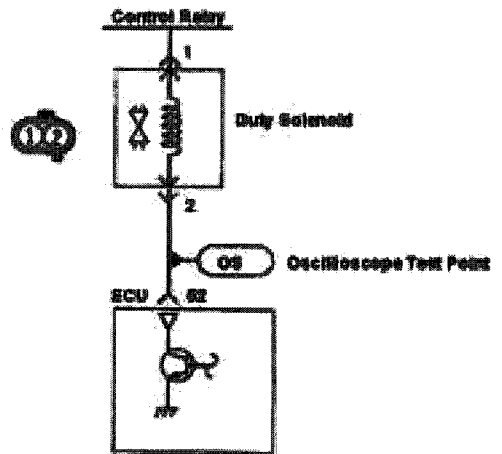
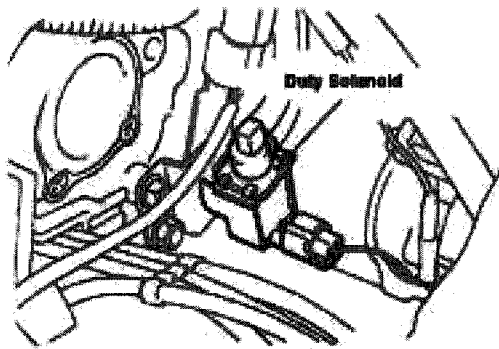
5. Start Vehicle and warm to Operating Temperature at Idle Speed. 80-90°C.
6. Test Fuel Line Pressure
 - @Idle: 2.8kg/cm²
 - @2000 RPM+3.3-3.5kg/cm²

Note: Replace Pump if Pressure Below Limit

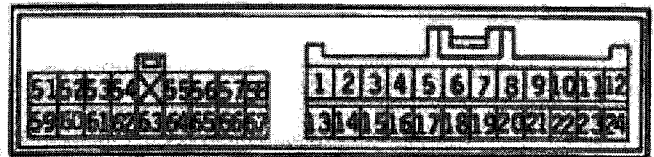
Note: Always Replace Fuel Filters when Replacing Fuel Pump

Duty Solenoid (MAF)

Component: Duty Solenoid
Function: Measure Air Density
Error Item Code: 41
Tools Needed: Oscilloscope
Volts/Div: 10V
Time/DIV: 50ms
Set RPM: 900 RPM
PWR Test PIN: #2
Duty= $T_{on}/T_x \times 100\%$



ECU PIN Guide



Troubleshooting Tips

1. Vehicles being used at High Altitudes many Experience "RICH" running Engines. Use an Oscilloscope and verify Time/DIV Cycle between ECU PIN #52 and Duty Solenoid PIN #2.

Ignition Coil Power Transistor

Component: Ignition Coil Power Transistor

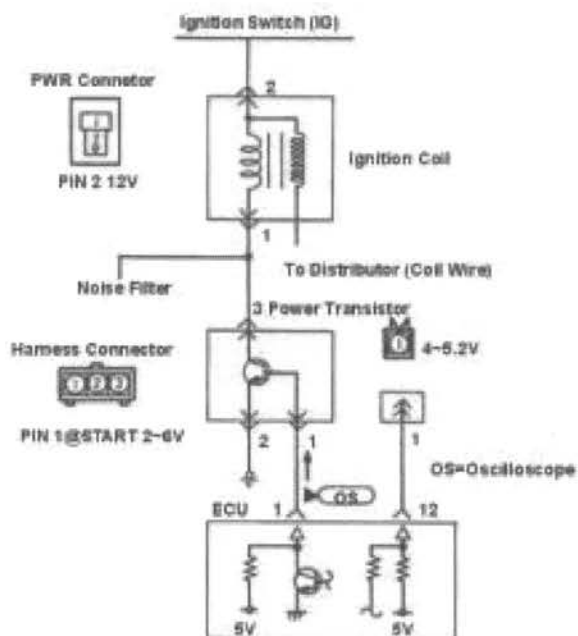
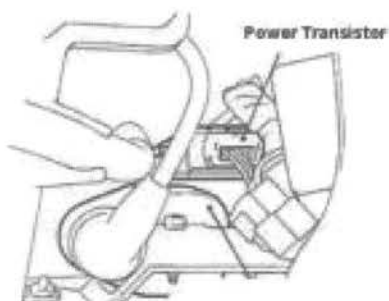
Error Item Code: 44

Volts/DIV: 5V

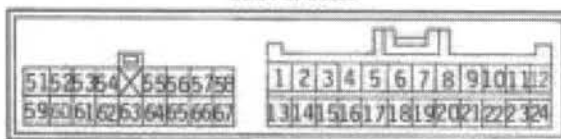
Time/Div: 4ms

Test RPM: 3000 RPM

Power Resister Connector PIN #1@START: 2-6V



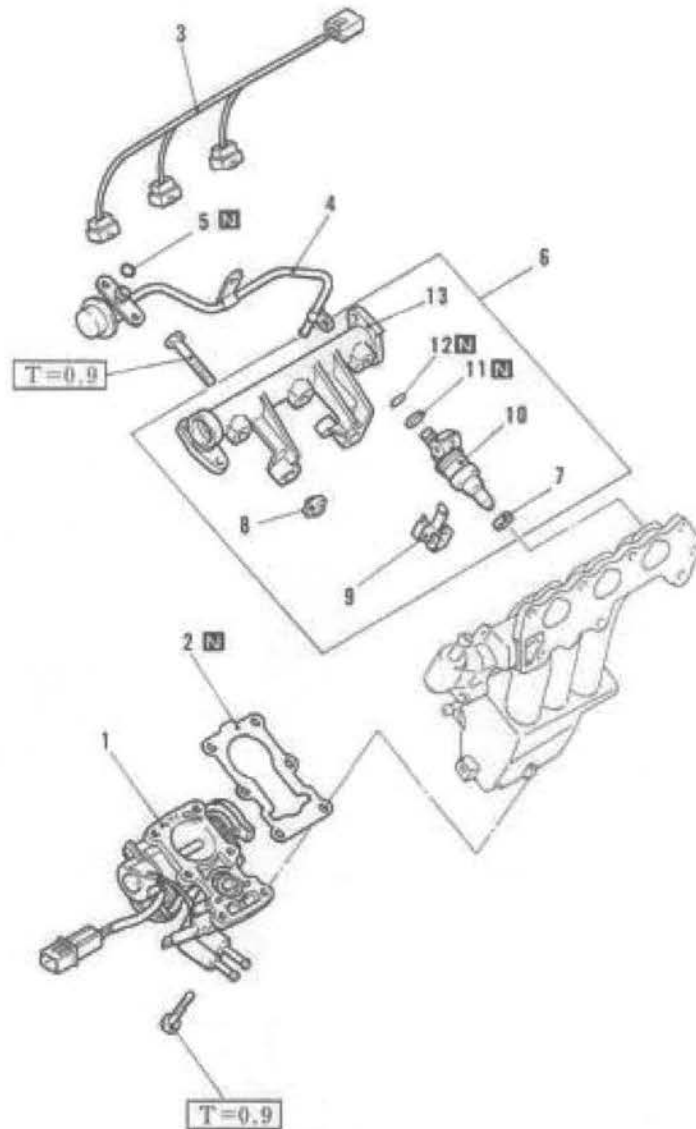
ECU PIN Guide



Troubleshooting Tips

1. If Power is Present ant the Ignition Coil and it Fails to Fire Change the Power Resistor.
2. For detailed Troubleshooting of the Power Resistor Circuit use a Oscilloscope at the Point shown in the Diagram.

MPI Fuel Injection Main Components



1. Throttle Body [B3H130B]	2. Gasket
3. Injector Harness	4. Fuel Pressure Regulator
5. O Ring	6. Fuel Rail System
7. Seal	8. Seal
9. Injector Support	10. Injector
11. Grommet	12. O Ring
13. Fuel Rail	

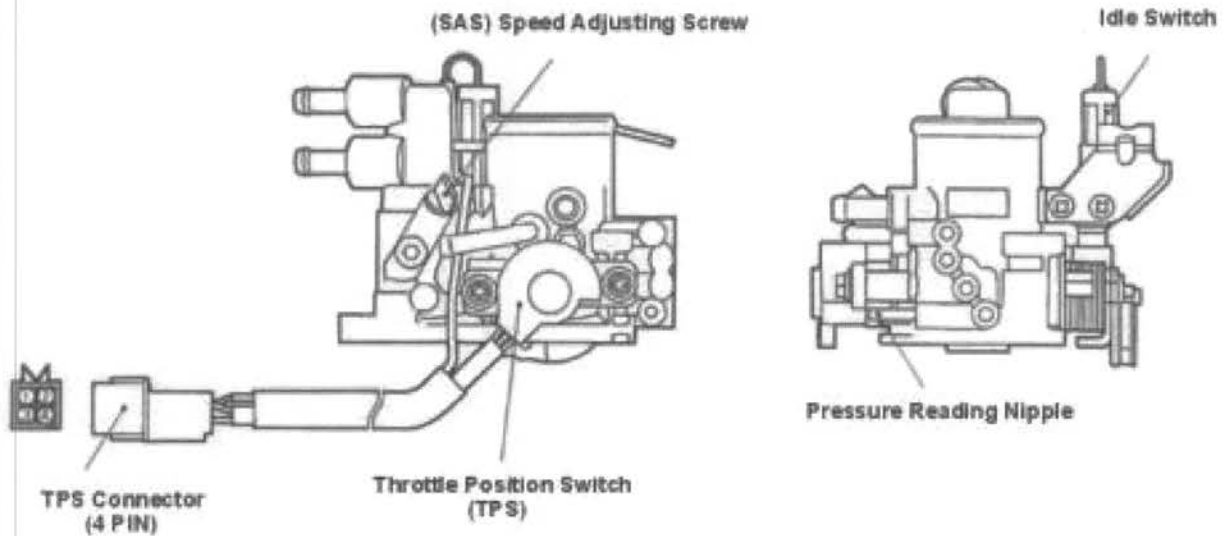
Note: system is Computer Controlled and No Adjustments Can be Made. Consult Electrical Service Manual for Fuel Injection Servicing

Throttle Body Diameter: 38mm

Throttle Body Type: BNM or BNA Series

Throttle Body Diagram

Component: Throttle Body Assembly



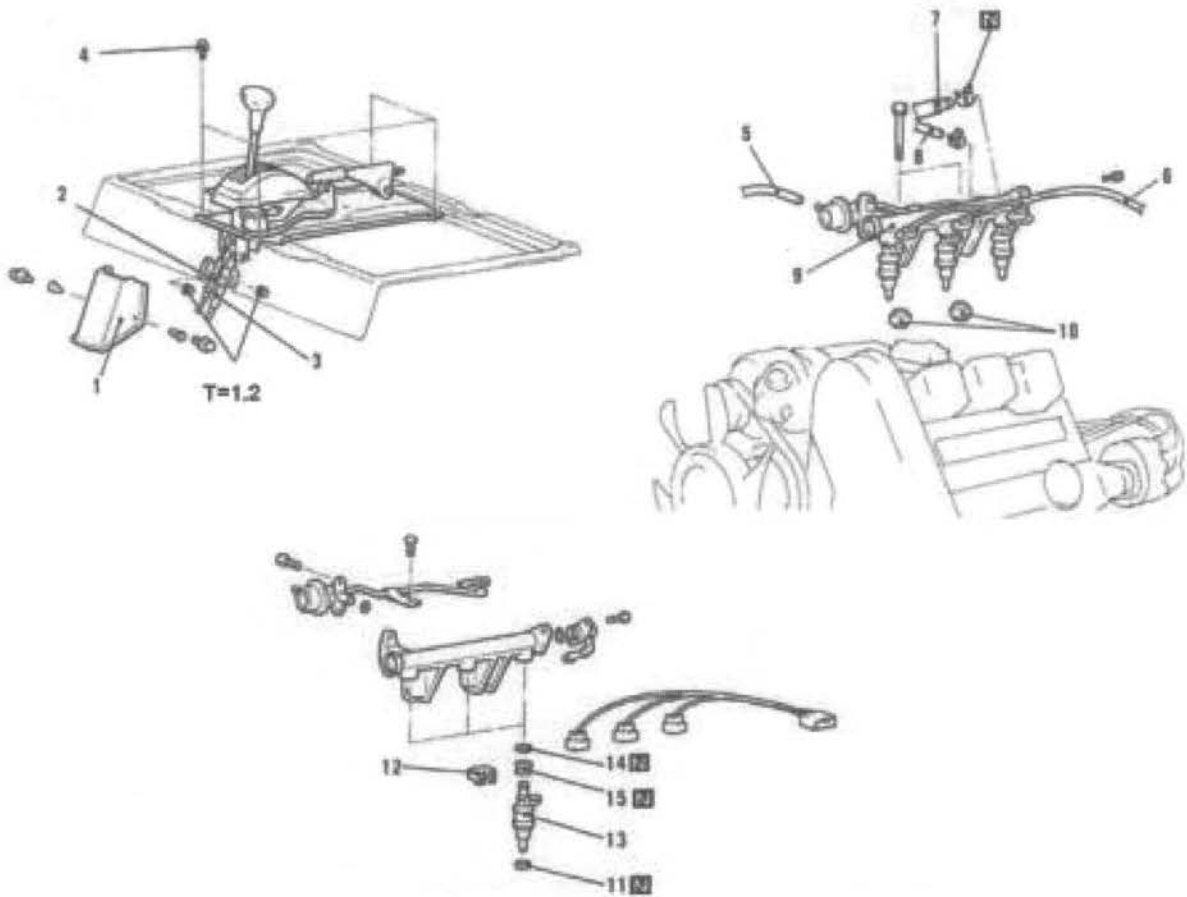
Components

1. TPS Throttle Position Sensor
2. (SAS) Speed Adjusting Screw
3. Idle Switch
4. Pressure Reading Port (Vacuum Test Port)

Note: Do Not Adjust SAS Port Without MUT Computer Attached. System will become Unstable.

Note: See Adjustment Procedure at the beginning of this Manual

Fuel Injector Replacement Procedure

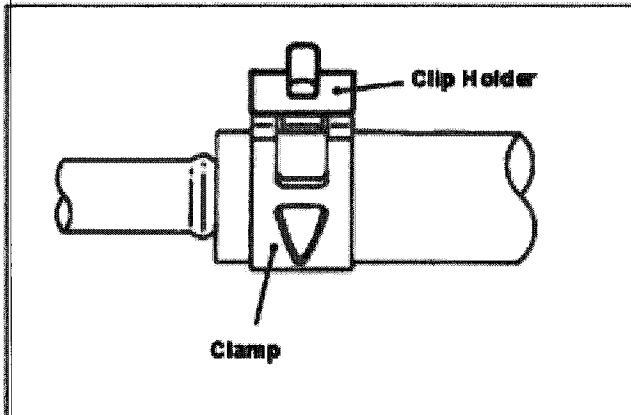


1. (AT) Vehicles: Remove Cable Protector
2. (AT) Disconnect Key Lock Interface Cable
3. Remove Shift Cables
4. Remove Shifter Unit and Center Frame
5. Disconnect vacuum Hose
6. Disconnect Injector Connectors
7. Disconnect Main Fuel Hose
8. Disconnect Return Fuel Line
9. Remove Retaining Bolts and Remove Fuel rail Assembly
10. Remove Seals (Discard)
11. Remove Seals (Discard)
12. Remove Clip
13. Remove Injector
14. Remove O-Ring (Discard)
15. Remove grommet (Discard)
16. Install in Reverse Order

Note: Never Reuse Seals-O-Rings-Gaskets

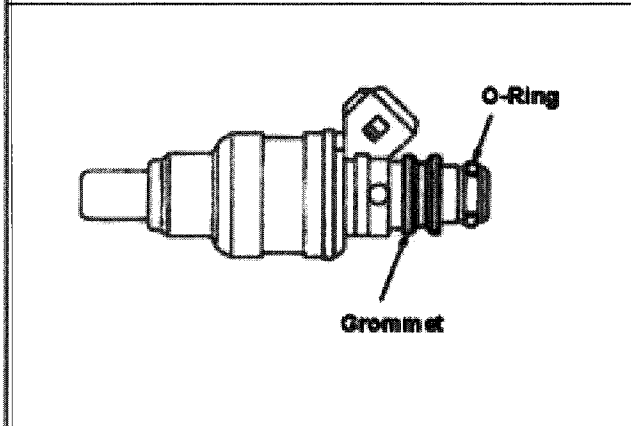
Injector Unit

Proper Hose Clamp Attachment



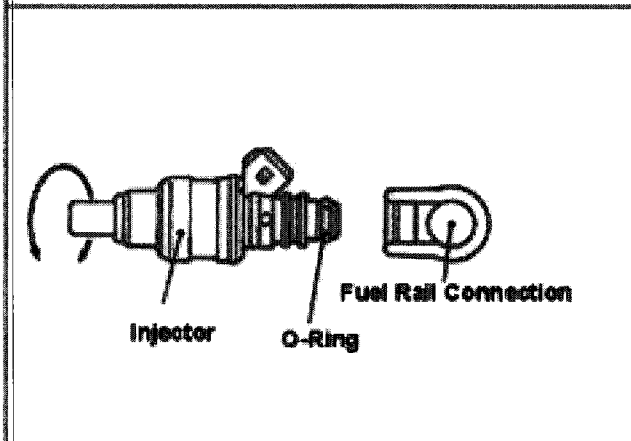
Note: Use the Diagram on the Left to Properly Attach Fuel Hose

Grommet and O-Ring



Note: Coat both Grommet and O-Ring With a Light Coat of Engine Oil Before Sliding onto Injector

Injector Installation

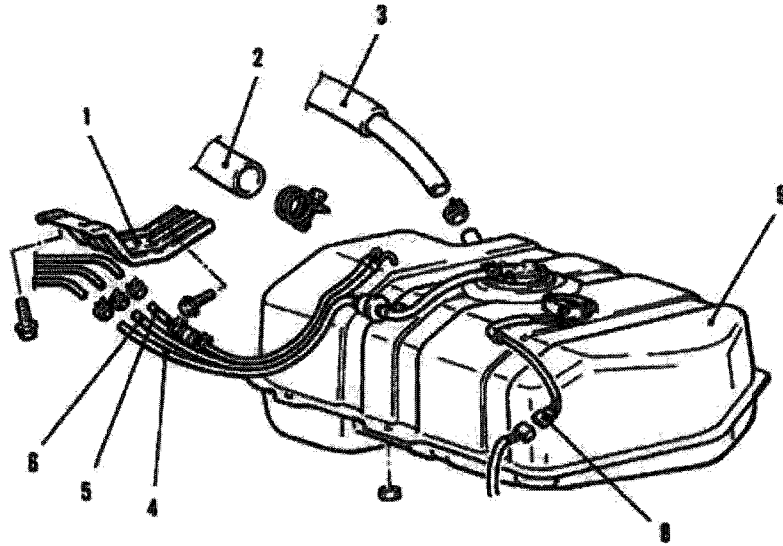


Note: When Installing Injector into Fuel Rail twist slightly into Proper Position

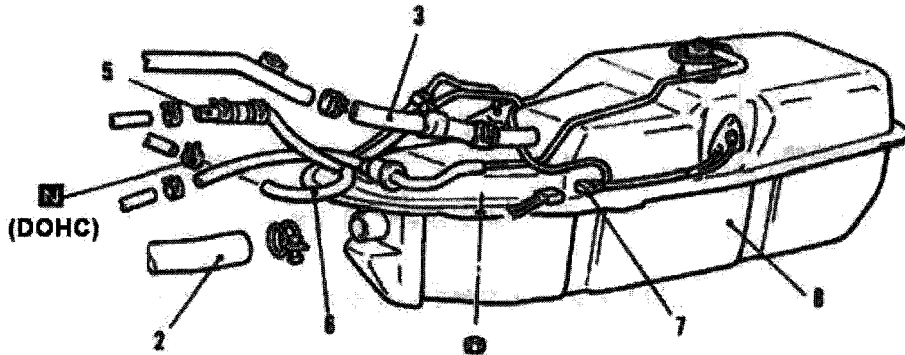
Note: Always use New O-Rings and Grommets during Installation

Fuel Tank Assembly (ALL)

MiniCab (Truck, Panel Van, Dump)



Bravo, MiniCab (Van)



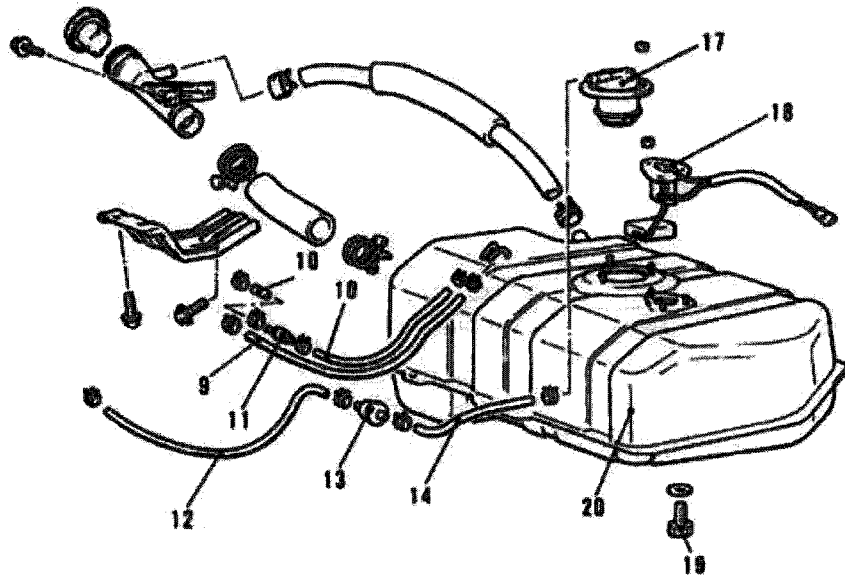
Note: Always Drain Gasoline Tank before Performing Maintenance. Drain Tank by Removing Drain Plug Item 19 on the following Page.

Tank Removal

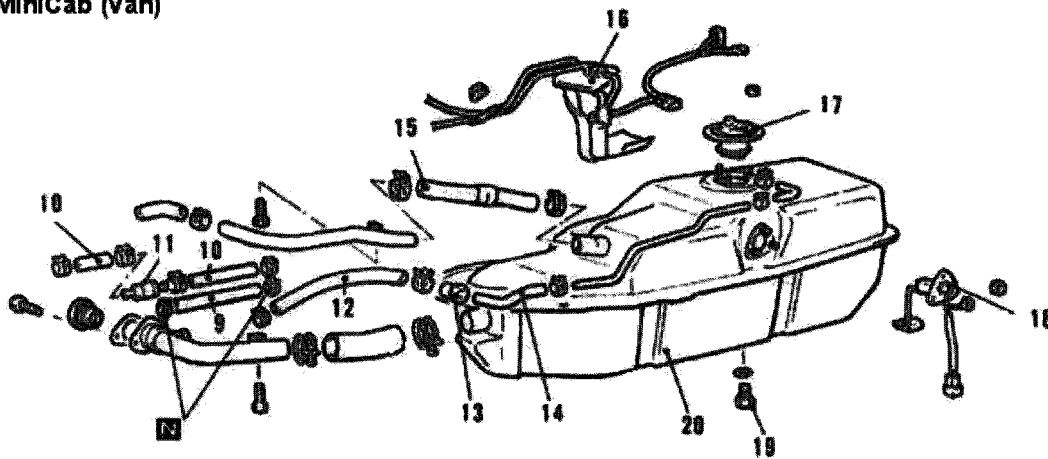
1. Remove Fuel Line Protector
2. Disconnect Filler Hose
3. Disconnect Breather tube
4. Disconnect Fuel Pipe Hose
5. Disconnect Return Line Hose
6. Disconnect Main Fuel Line Hose
7. Disconnect Fuel Gage Sender Unit Connector
8. Unbolt Retaining Bolts and Remove Tank Assembly

Fuel Tank Assembly (ALL)

MiniCab (Truck, Panel Van, Dump)



Bravo, MiniCab (Van)

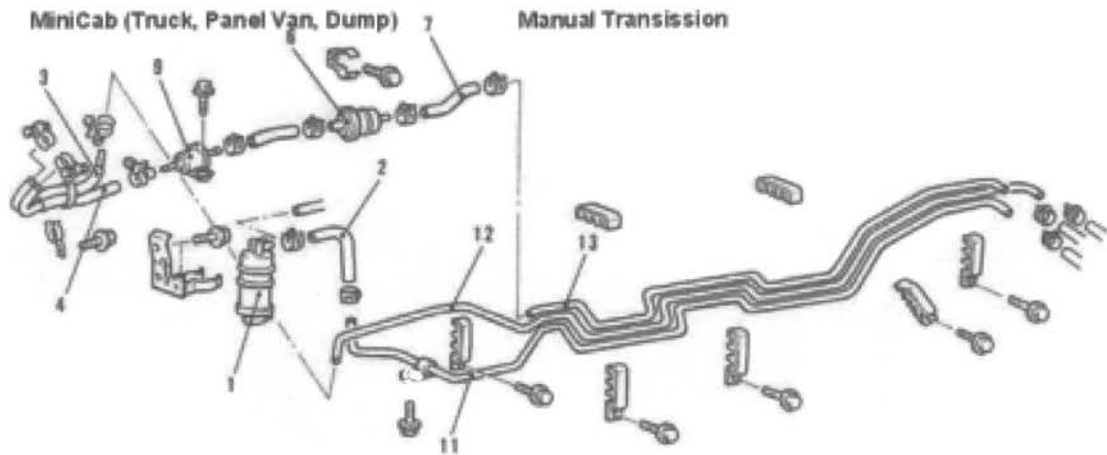


(DOHC)

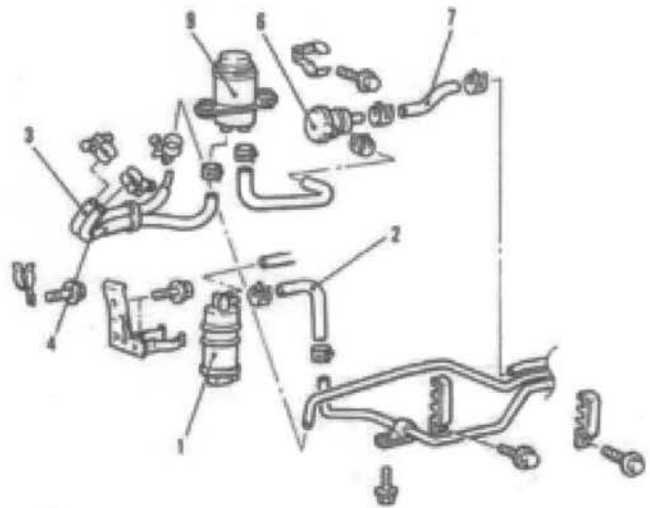
Tank Accessories and Component Disassembly

9. Remove Fuel Main Hose
10. Remove Fuel Return Line
11. Remove Check Valve (SOHC): (One Way Valve)
12. Remove Vapor Hose
13. Remove 2 Way Valve
14. Remove Fuel Vapor Hose
15. Remove Breather Hose
16. Remove Fuel Pump (DOHC) MPI Vehicles
17. Fuel Cutoff Valve
18. Remove Fuel Gage Sending Unit
19. Drain Plug
20. Fuel Tank Unit

Fuel Line System: SOHC & DOHC Vehicles



Automatic Transission

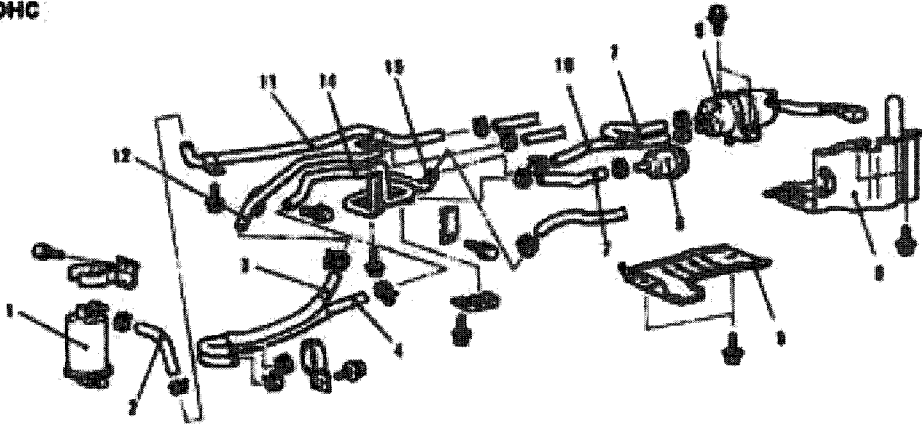


Components

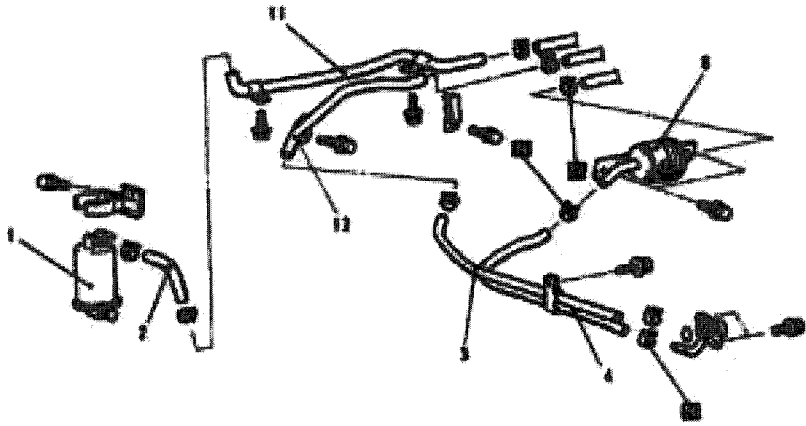
1. Canister
2. Fuel Vapor Hose
3. Fuel Return Line
4. Fuel Main Hose
5. (Omitted)
6. Fuel Filter
7. Fuel Hose
8. (Omitted)
9. Fuel Pump
10. (Omitted)
11. Fuel Vapor Line: Steel
12. Fuel Return Line: Steel
13. Fuel Main Pipe: Steel

Fuel Line System: SOHC & DOHC Vehicles

Bravo, MinCab (Var) SOHC

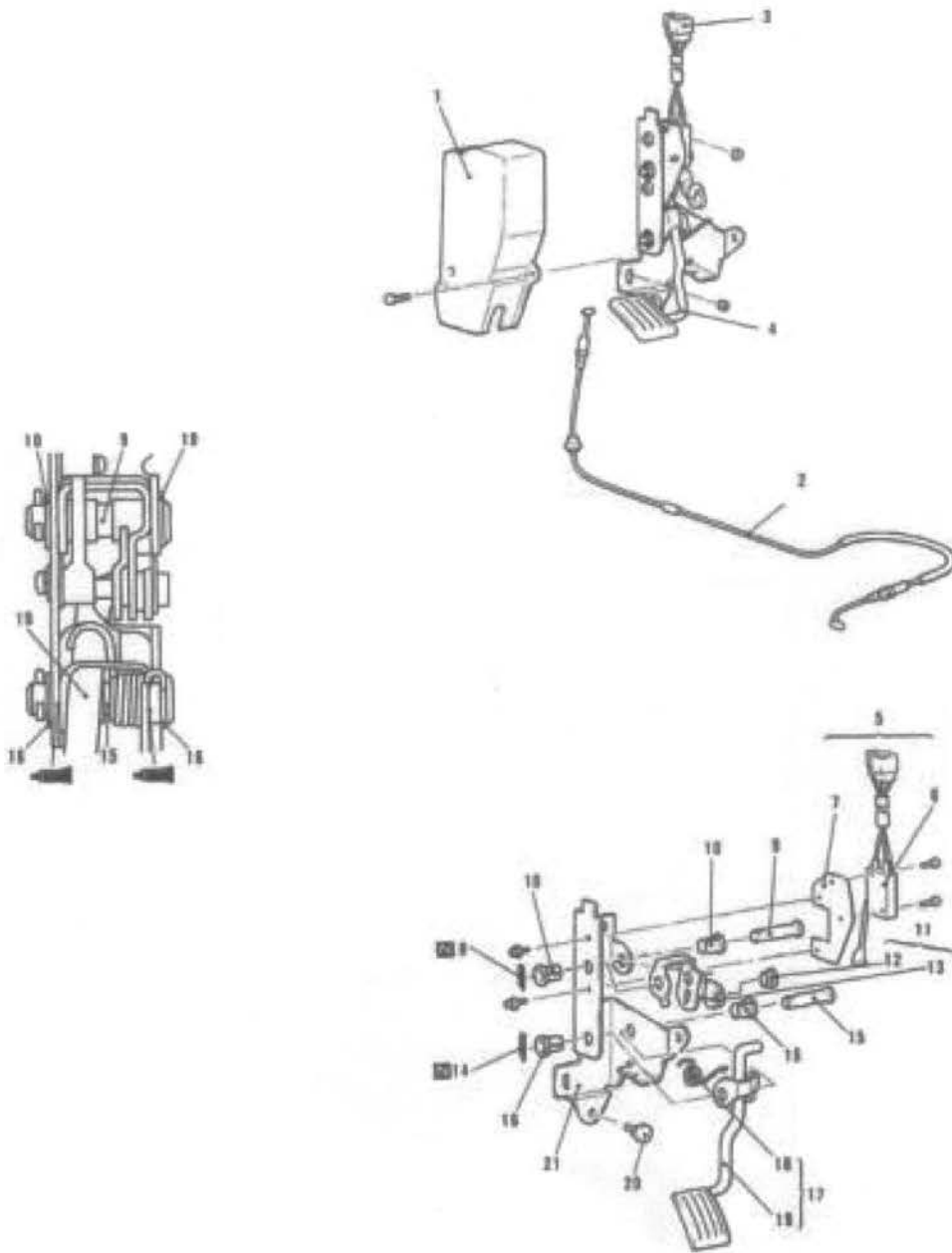


DOHC & MPI Vehicles (ALL)



1. Canister
2. Fuel Vapor Hose
3. Fuel Return Hose
4. Fuel Main Hose
5. Cover
6. Fuel Filter
7. Fuel Hose
8. Fuel Pump Cover
9. Fuel Pump
10. Fuel Hose
11. Fuel Vapor Hard Line
12. Fuel Return Hard Line
13. Fuel Hard Line A
14. Fuel Hard Line B

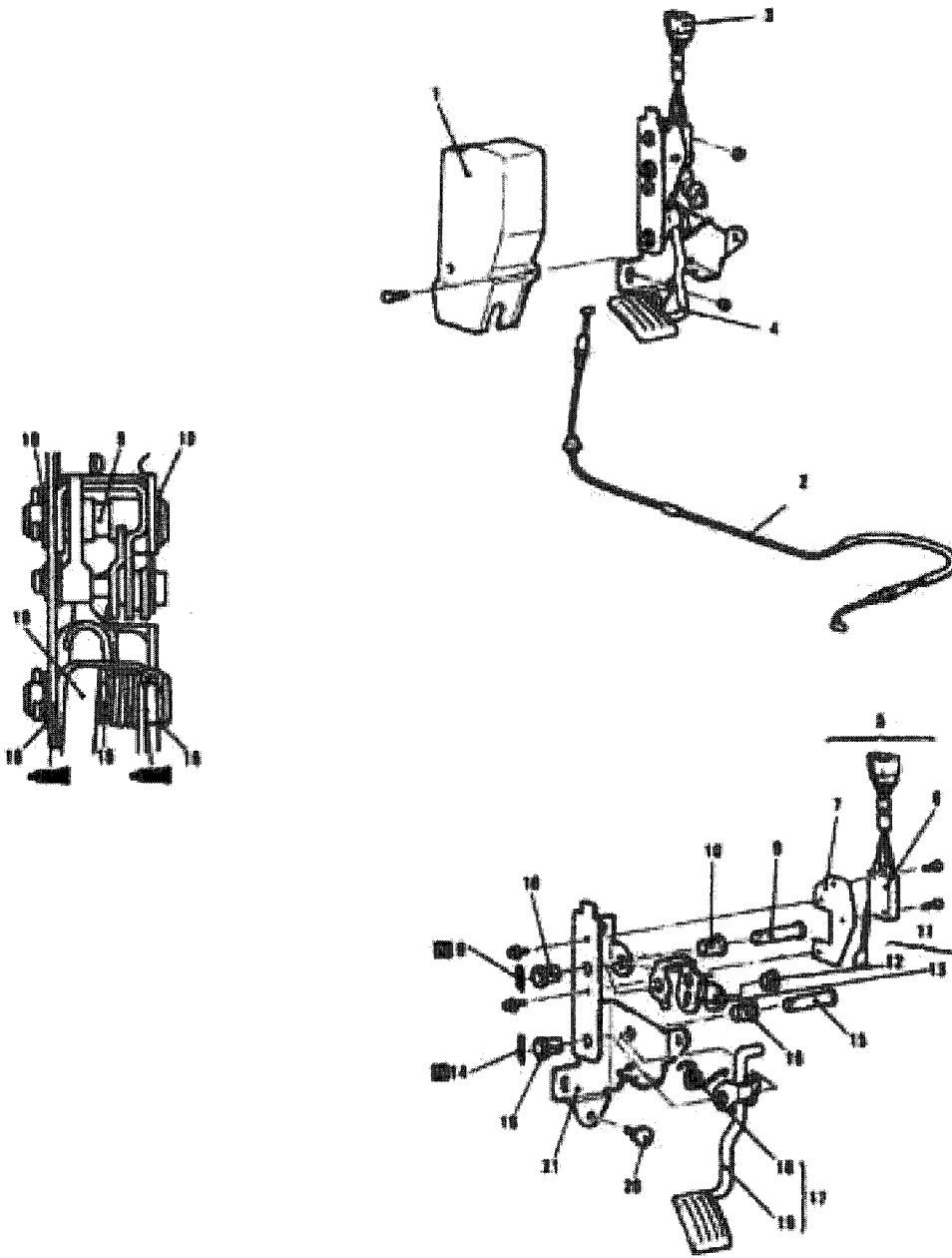
Accelerator Cable System



Accelerator Cable System Components

1. Cover
2. Accelerator Cable
3. Kick-Down Switch Connector
4. Accelerator Pedal Assembly
5. Kick-Down Switch Assembly
6. Kick-Down Switch
7. Switch Bracket
8. Split Pin
9. Clevis Pin
10. Bushing A

Accelerator Cable System



11. Lever Assembly
12. Bushing B
13. Accelerator Lever
14. Split Pin
15. Clevis Pin
16. Bushing A
17. Pedal Assembly
18. Return Spring
19. Accelerator Pedal
20. Rubber Stopper
21. Pedal Bracket

Chapter 5

Cooling System and Components

- 72. Capacity Specifications
- 73. Thermostat SOHC
- 74. Thermostat DOHC
- 75. Cooling Fan SOHC-DOHC
- 76. Water Pump Replacement SOHC
- 77. Water Pump Replacement DOHC
- 78. Radiator SOHC-DOHC

Capacity and Specifications

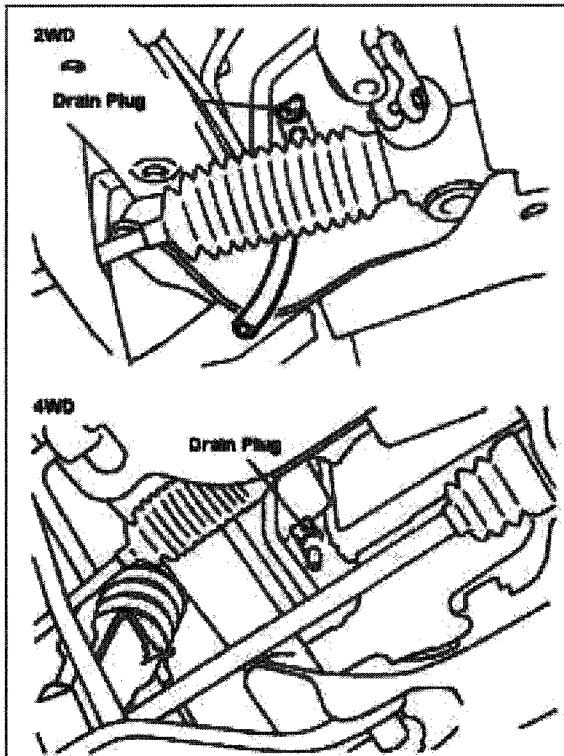
Radiator Cap Relief Valve Pressure: 0.75-1.05 kg/cm²

Coolant Percentage: 30% Summer-60% Winter

Thermostat Opening Temperature: 70°C

Coolant Capacity: 3.5 Liters (Truck) Van with Rear Heater Option: 4.0 Liters

Drain Plug Location



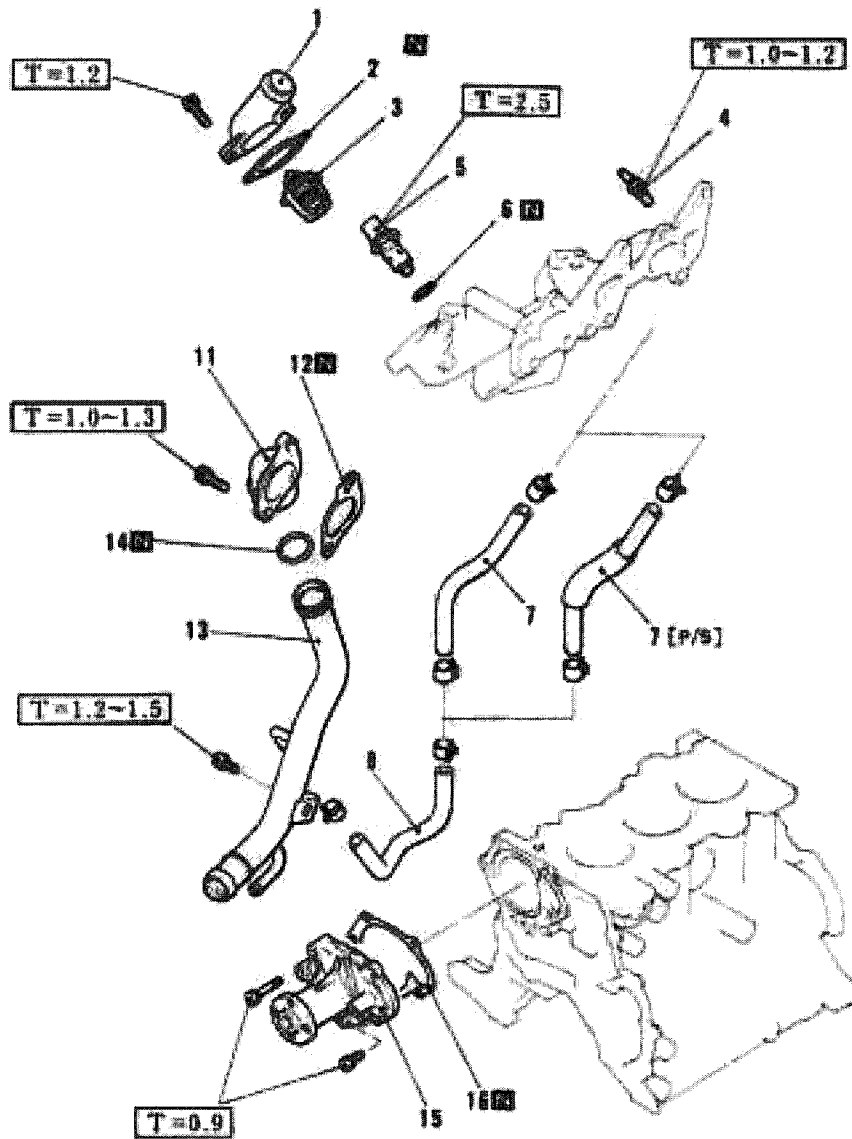
Coolant System Drain Procedure

1. Open Radiator Cap
2. Locate Drain Plug as shown in the Diagram on the Left.
3. Drain Coolant System

Note: Never Reuse Engine Coolant. Replace with New Coolant at all times

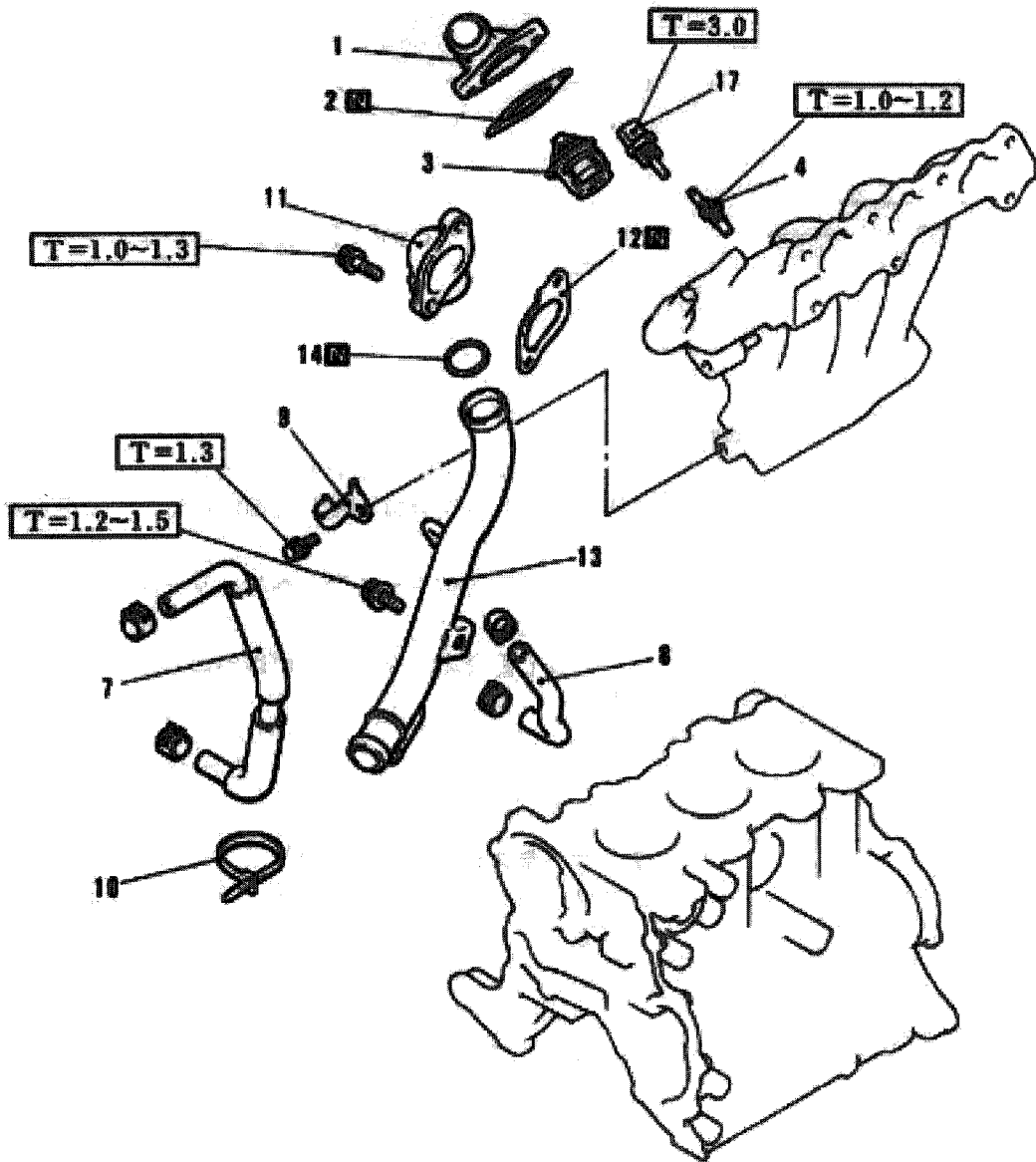
Note: Coolant should be Changed every 24, 000 Kilometers. Extreme Duty Conditions Change Every 12,000 Kilometers

Thermostat SOHC



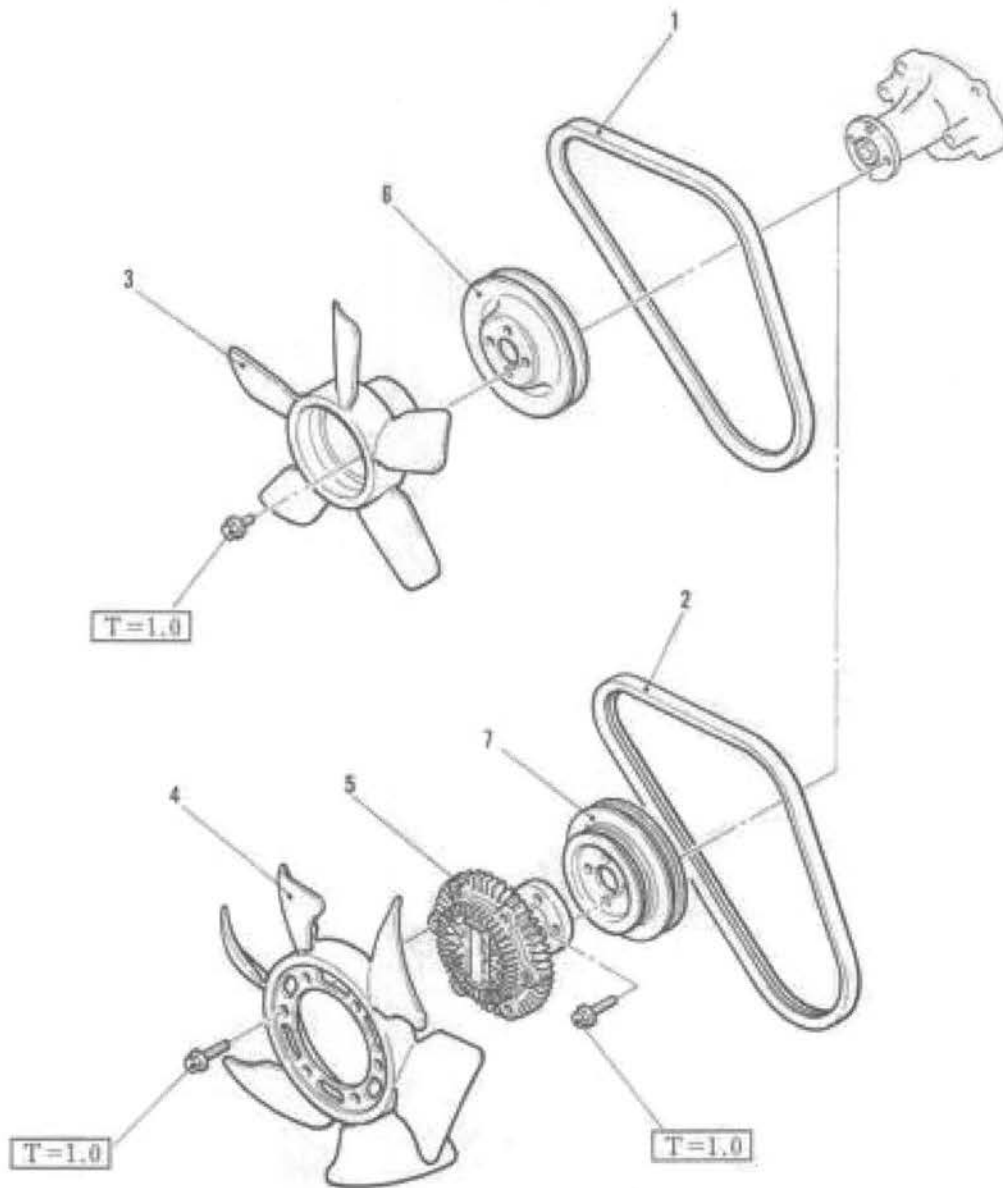
1. Thermostat Housing	2. Gasket
3. Thermostat	4. Temperature Gage Sending Unit
5. Thermo Valve [S4] [S2]	6. O Ring
7. Water Hose	8. Water Hose
11. Water Inlet Fitting	12. Gasket
13. Water Inlet Pipe	14. O Ring
15. Water Pump	16. Water Pump Gasket

Thermostat DOHC



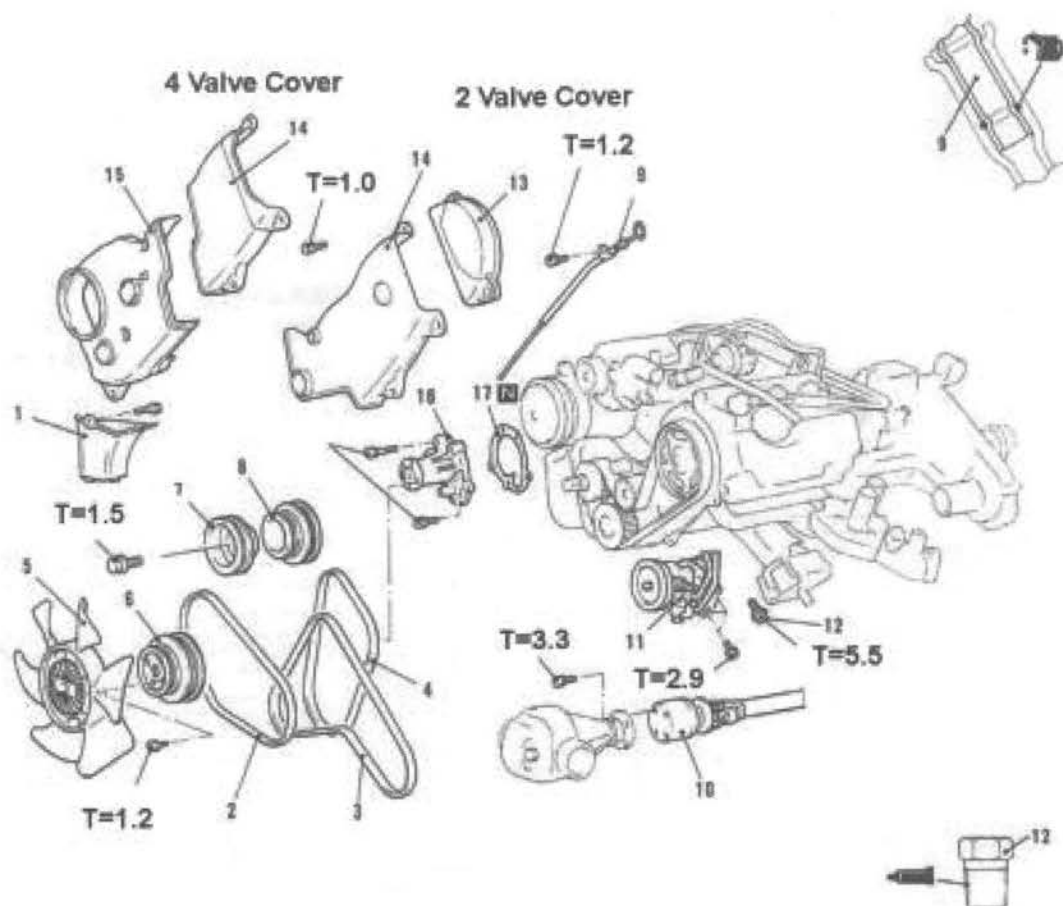
1. Thermostat Housing	2. Gasket
3. Thermostat	4. Temperature Gage Sending Unit
5. Thermo Valve [S4] [S2]	7. Water Hose
8. Water Hose	9. Clamp
10. Band Clamp	11. Water Inlet Housing
12. Gasket	13. Water Inlet Pipe
14. O Ring	15. Water Pump
16. Gasket	17. Water Temperature Sensor

Cooling Fan SOHC DOHC



1. Drive Belt
2. Drive Belt [P/S Option]
3. Cooling Fan [S2]
4. Cooling Fan [S4] [D5]
5. Fan Clutch [S4] [D5]
6. Water Pump Pulley
7. Water Pump Pulley [P/S Option]

Water Pump Replacement SOHC

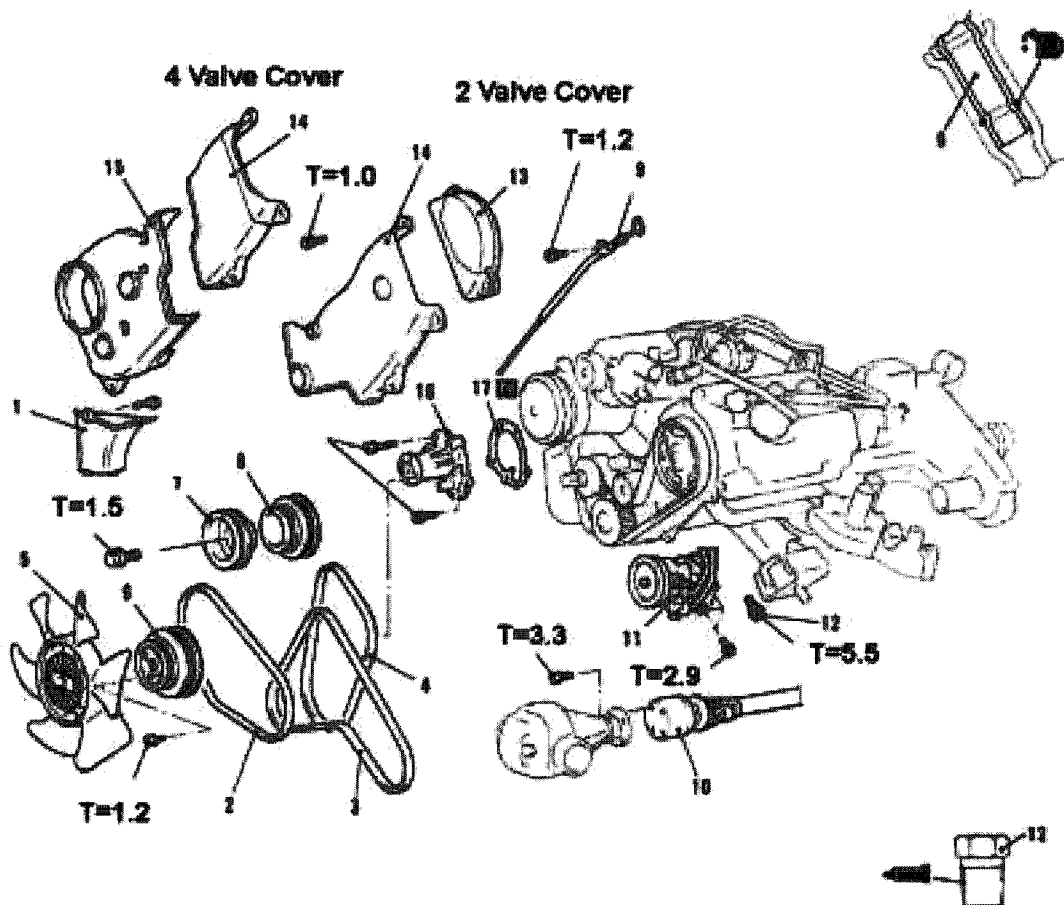


Water Pump Replacement Procedure

Note: Drain Radiator before Proceeding

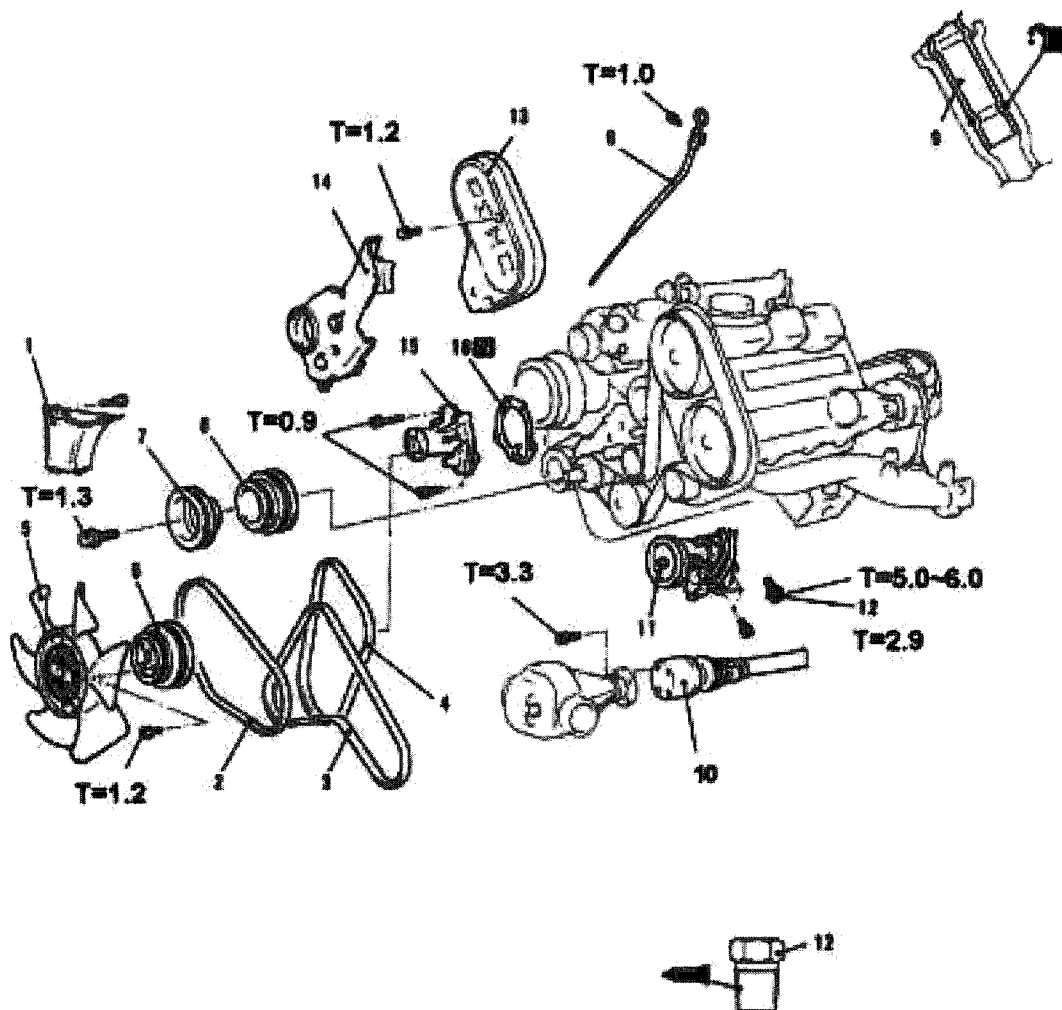
1. Remove Shroud
2. Remove AC Belt (AC Option)
3. Remove Power Steering Belt (PWR Steering Option)
4. Remove Alternator Belt
5. Remove Cooling Fan
6. Remove Water Pump Pulley
7. Remove AC Crankshaft Pulley (AC Vehicles)
8. Remove Crankshaft Pulley

Water Pump Replacement SOHC



9. Remove Dip Stick Tube
10. Disconnect HCU Unit (4WD)
11. Disconnect PWR Steering Pump and put aside
12. Remove Block Drain Plug
13. Remove Timing Belt Cover A
14. Remove Timing Belt Cover B
15. Remove Timing Belt Cover c (4 Valve Only)
16. Remove Water Pump
17. Remove and Discard Water Pump Gasket
18. Installation in Reverse Order

Water Pump Replacement DOHC

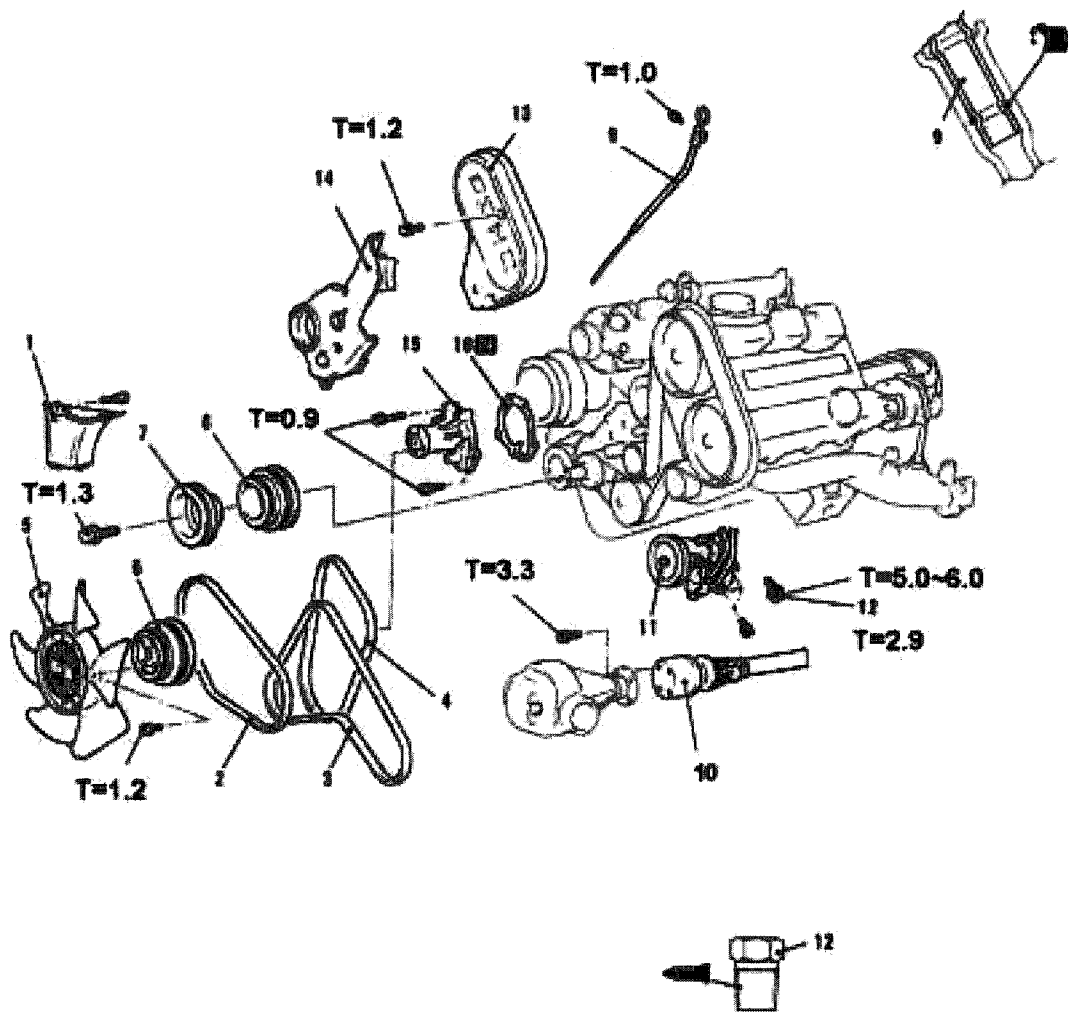


Water Pump Replacement Procedure

Note: Drain Radiator before Proceeding

1. Remove Shroud A
2. Remove AC Belt (AC Vehicles)
3. Remove Power Steering Belt (PWR Steering Vehicles)
4. Remove Alternator Belt
5. Remove Cooling Fan
6. Remove Water Pump Pulley
7. Remove AC Crankshaft Pulley (AC Vehicles)
8. Remove Crankshaft Pulley
9. Remove Dip Stick and Tube

Water Pump Replacement DOHC



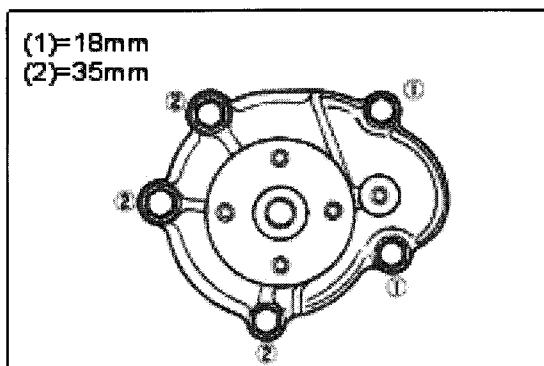
10. Disconnect 4WD HCU Unit
11. Remove Power Steering Pump Assembly
12. Remove Block Drain Plug
13. Remove Timing Belt Upper Cover
14. Remove Timing Belt Lower Cover
15. Remove Water Pump
16. Remove Water Pump Gasket
17. Clean all Areas and Install in Reverse Order

Note: Torque Values are stated in the Above Diagram

Note: Replace Timing Belt if Water Pump Fails below 80,000 Kilometers

Water Pump Replacement DOHC & SOHC

Water Pump Installation Notes



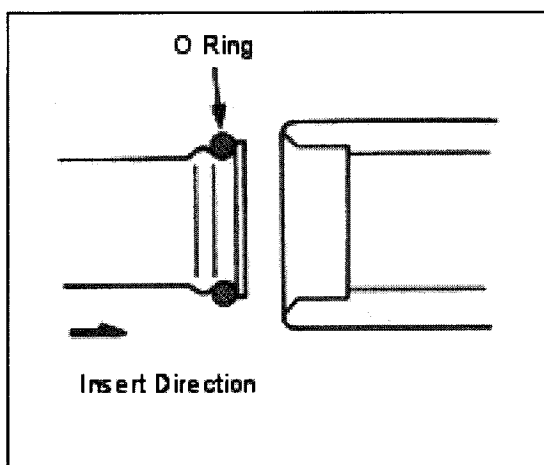
Note: There are Two Lengths of Attachment Bolts.

(1)=18mm

(2)=35mm

Use the Diagram on the Left for Installation Guidance.

Torque: 9.0 kgm

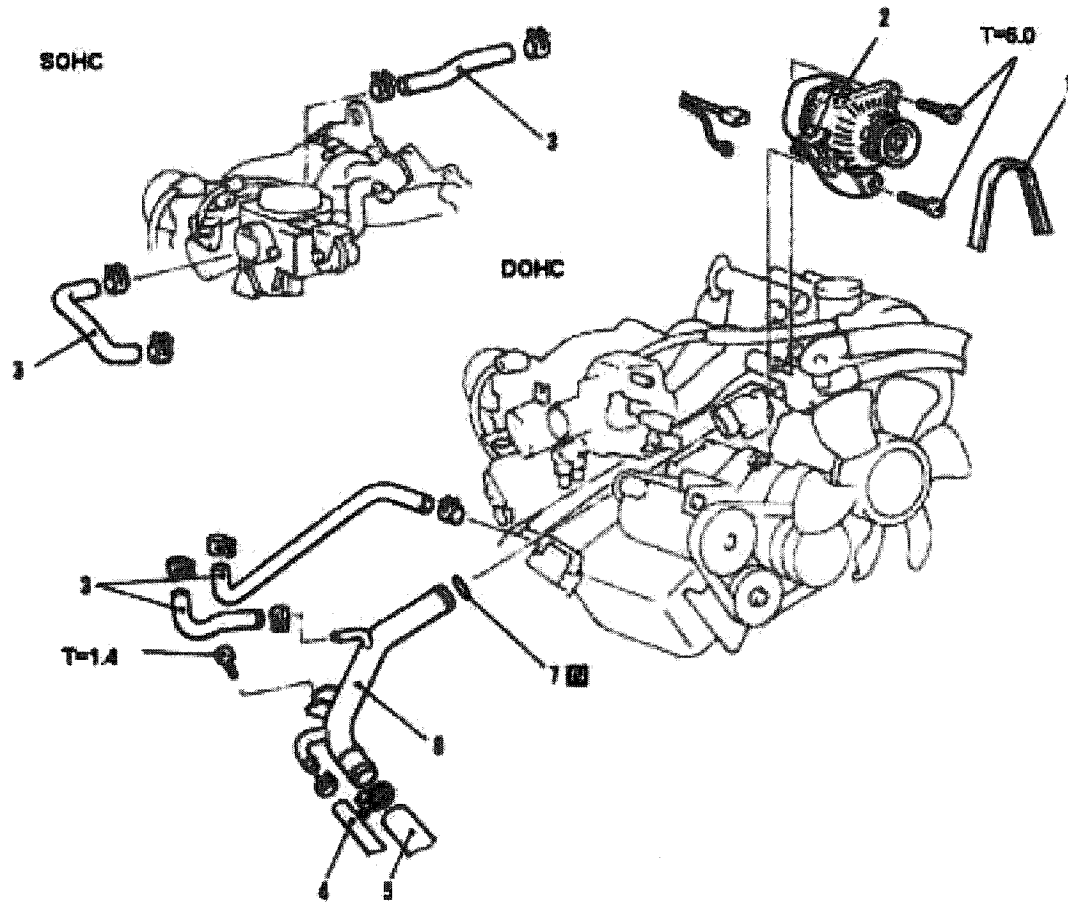


Water Inlet Pipe Installation

Caution: Do Not Put Oil on O-Ring During Installation. The Pipe May Leak and Oil Will Contaminate the Coolant System

Inset Pipe as Shown

Water Pump Hose Routing & Identification



Water Pump Hose Replacement

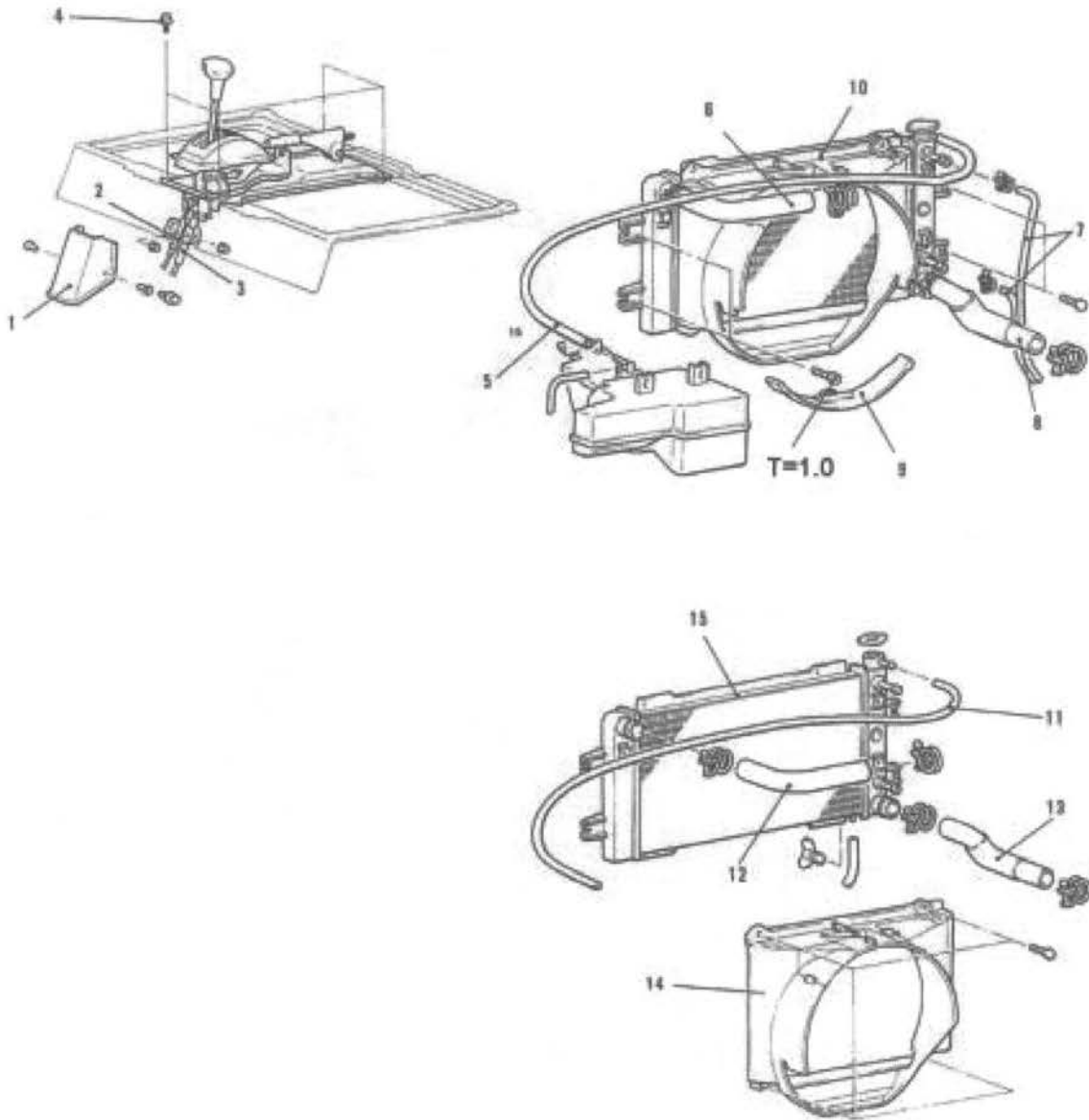
1. Remove Alternator Belt DOHC
2. Remove Alternator DOHC
3. Remove Hose
4. Heater Hose
5. Radiator Lower Hose
6. Water Inlet Pipe
7. O-Ring

Note: Never Reuse O-Rings

Note: Do not Reuse Coolant, always replace with New Coolant

Note: Always replace Hoses over 65,000 Kilometers if Once Removed

Radiator

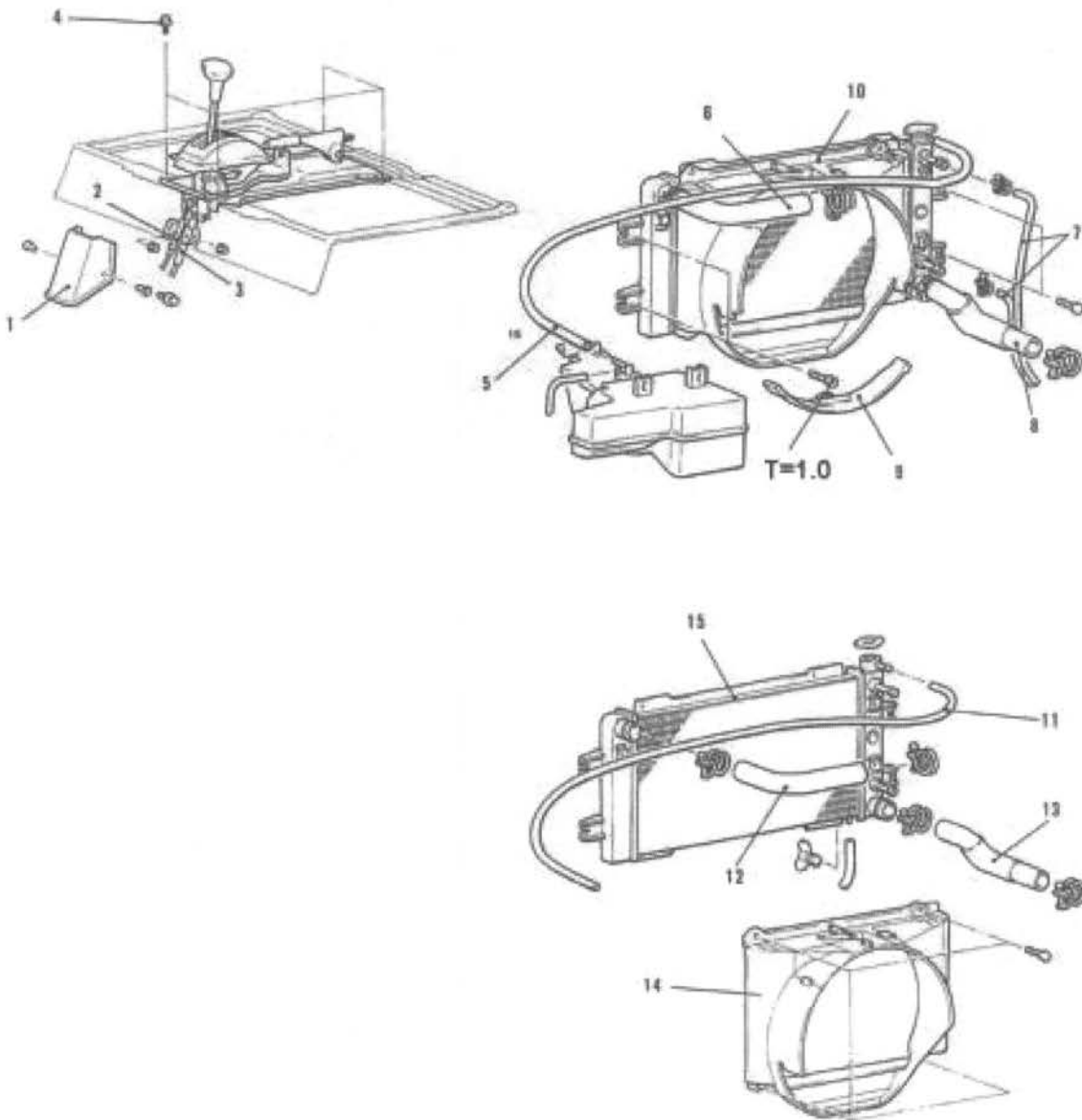


Radiator Removal

Note: Drain Radiator before Removal

1. Remove At Cable Cover (AT)
2. Disconnect Key Interlock Cable (AT)
3. Disconnect Shift Lock Cable (AT)
4. Remove Center Frame
5. Remove Overflow Tube
6. Remove Radiator Upper Hose
7. Disconnect AT Oil Cooler Hose
8. Remove Lower Radiator Hose
9. Remove Cover (DOHC AT)

Radiator



Note: Always use New Coolant

Note: Replace any or all Hoses if over 65,000 Kilometers

Chapter 6

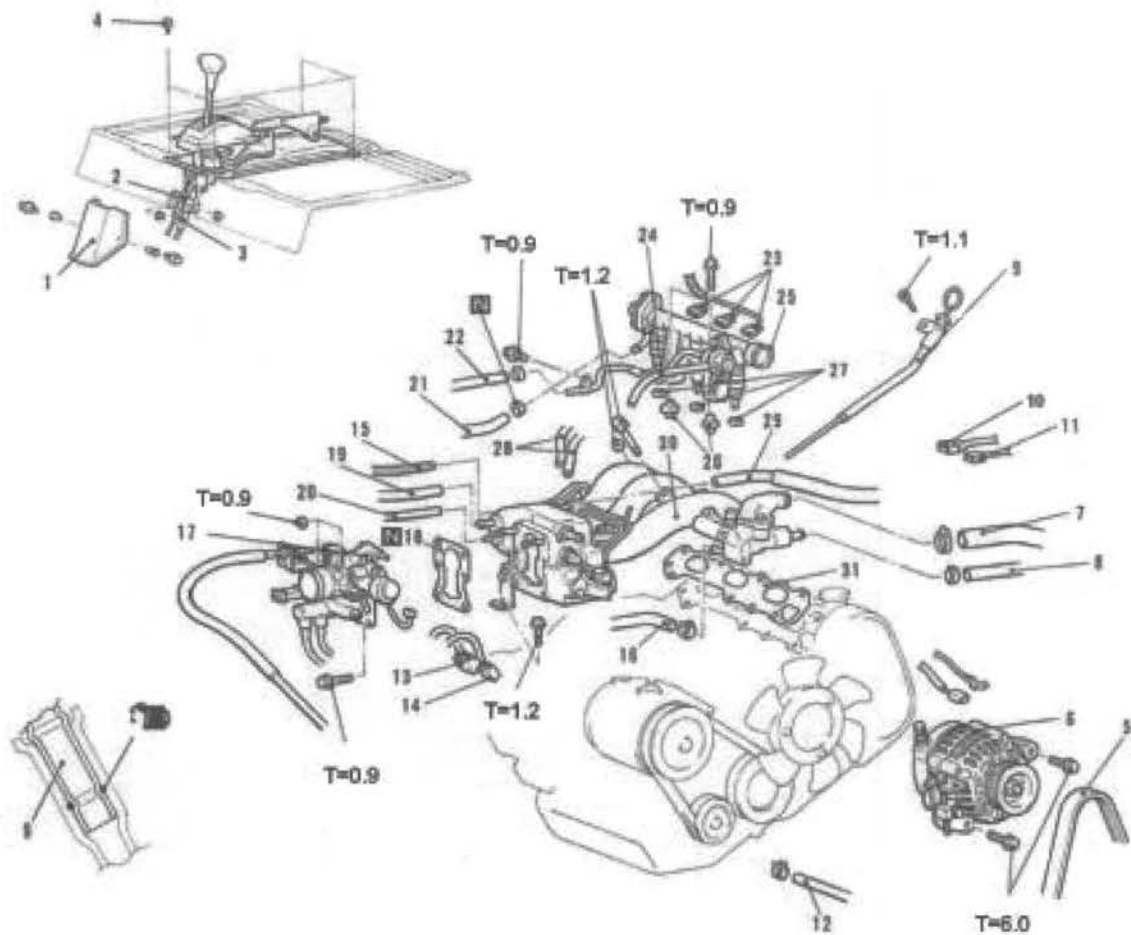
Intake and Exhaust Manifold Components

79. Intake Manifold System DOHC

80. Exhaust Manifold DOHC

81. Exhaust Piping System DOHC-SOHC

Intake Manifold System DOHC

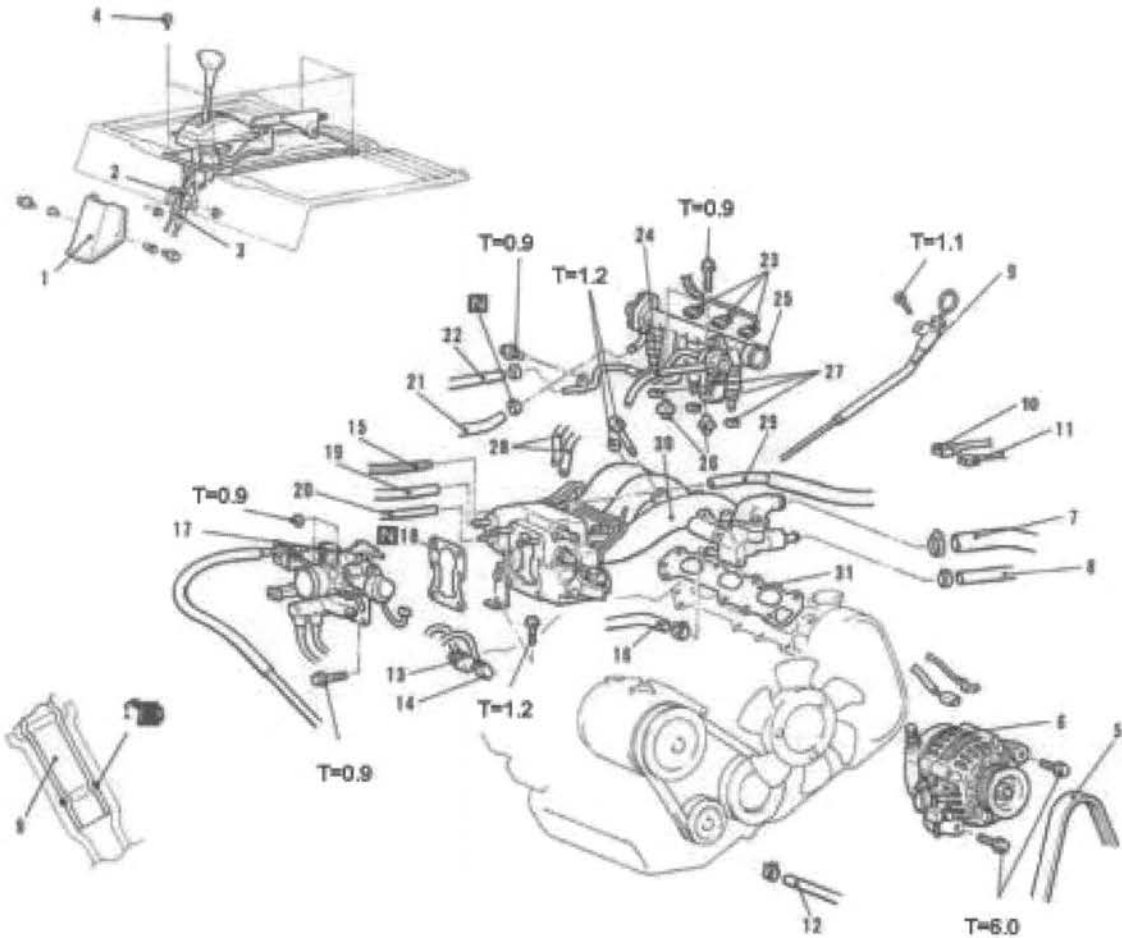


Intake Manifold Removal

Note: Drain Coolant System before Removal Process

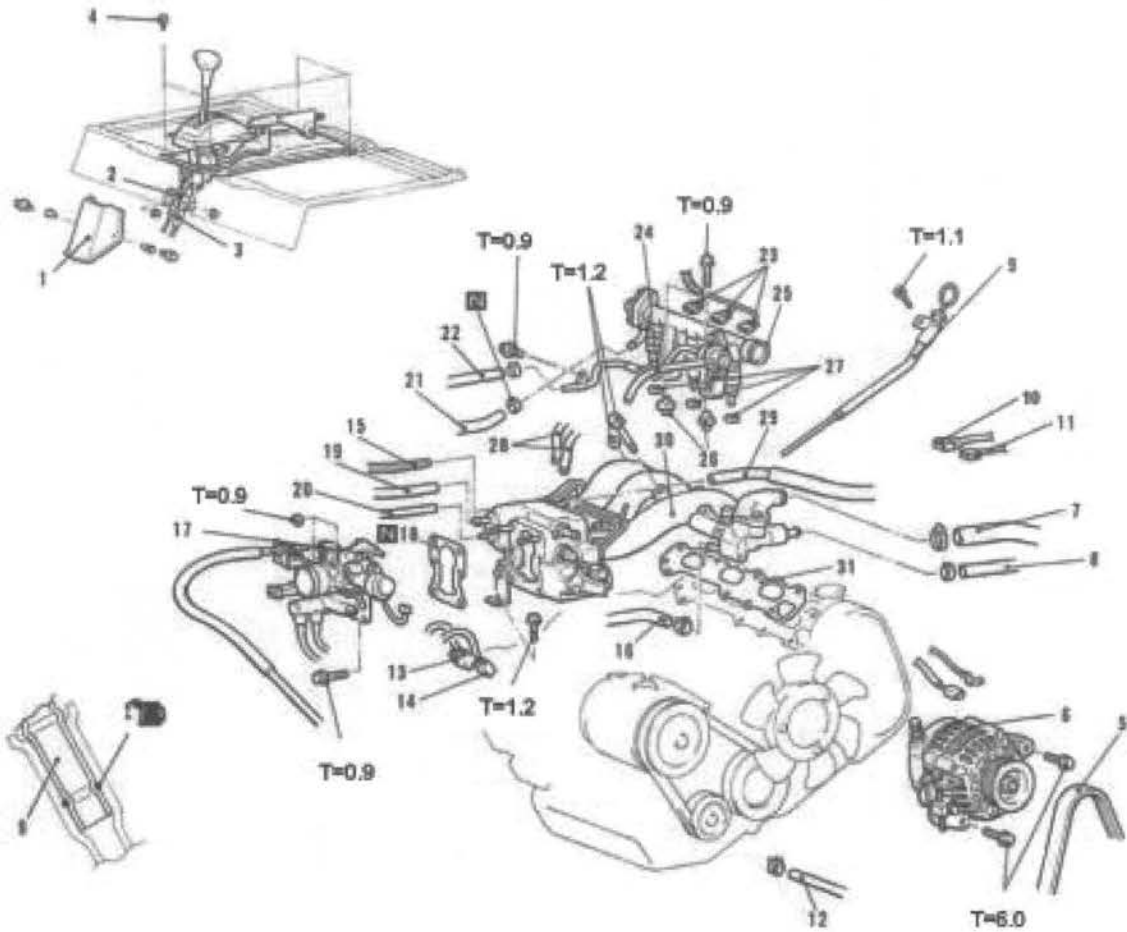
16. Remove At Cable Cover (AT)
17. Disconnect Key Interlock Cable (AT)
18. Disconnect Shift Lock Cable (AT)
19. Remove Center Frame
20. Remove Alternator Belt
21. Remove Alternator
22. Remove Upper Coolant Hose
23. Disconnect Heater Hose
24. Remove Dip Stick and Guide
25. Disconnect Water Temperature Gage Sender Connection
26. Disconnect Water Temperature Sensor Connection
27. Disconnect Brake Booster Vacuum Hose Connection
28. Disconnect TPS Connector

Intake Manifold System DOHC



29. Disconnect MAF Sensor Connector
30. Disconnect Vapor Hose
31. Disconnect Water Hose
32. Remove Throttle Body Assembly
33. Remove and Discard gasket
34. Disconnect AC Fast Idle Hose Connection
35. Disconnect Vacuum Hose
36. Disconnect Fuel Main Line
37. Disconnect Fuel return Line
38. Disconnect Injector Connectors
39. Disconnect Vacuum Hose
40. Remove Fuel Rail Assembly
41. Remove Insulator
42. Remove Seal
43. Disconnect Fast Idle Vacuum Hose

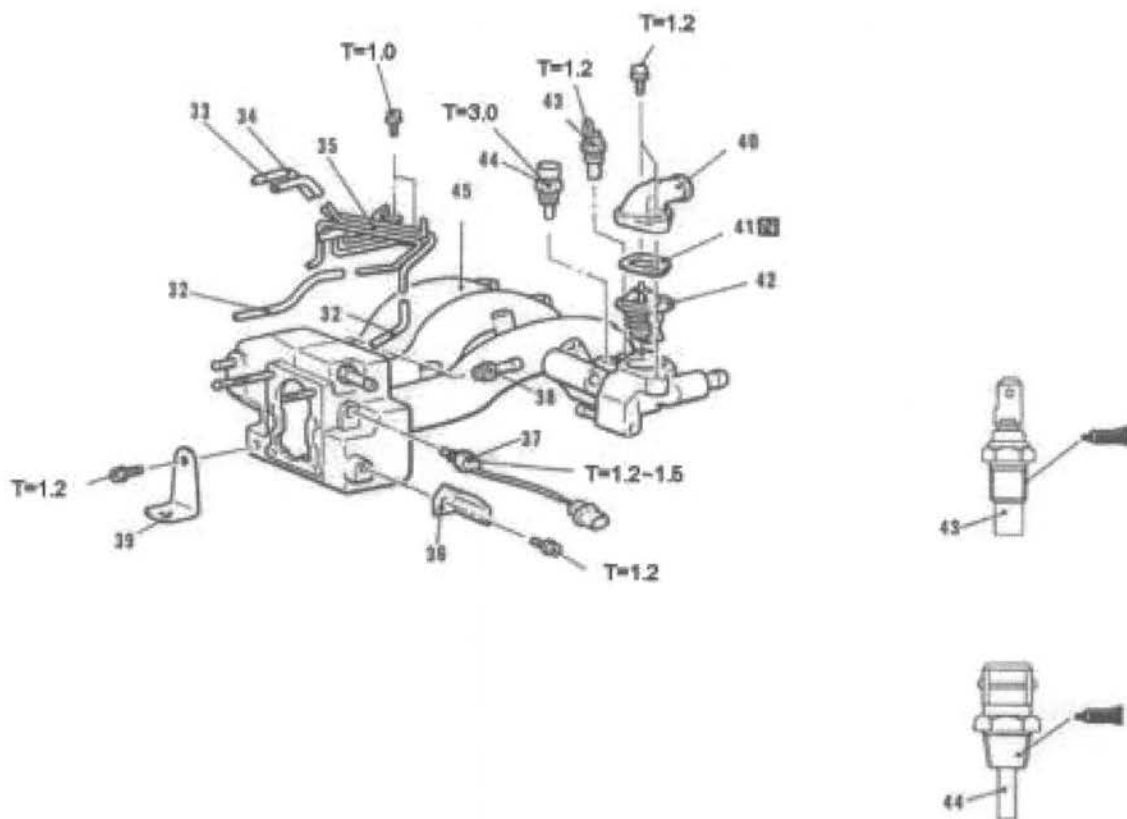
Intake Manifold System DOHC



44. Disconnect Ventilation Hose Connection
45. Remove Intake Manifold
46. Remove and Discard Intake Manifold Gasket

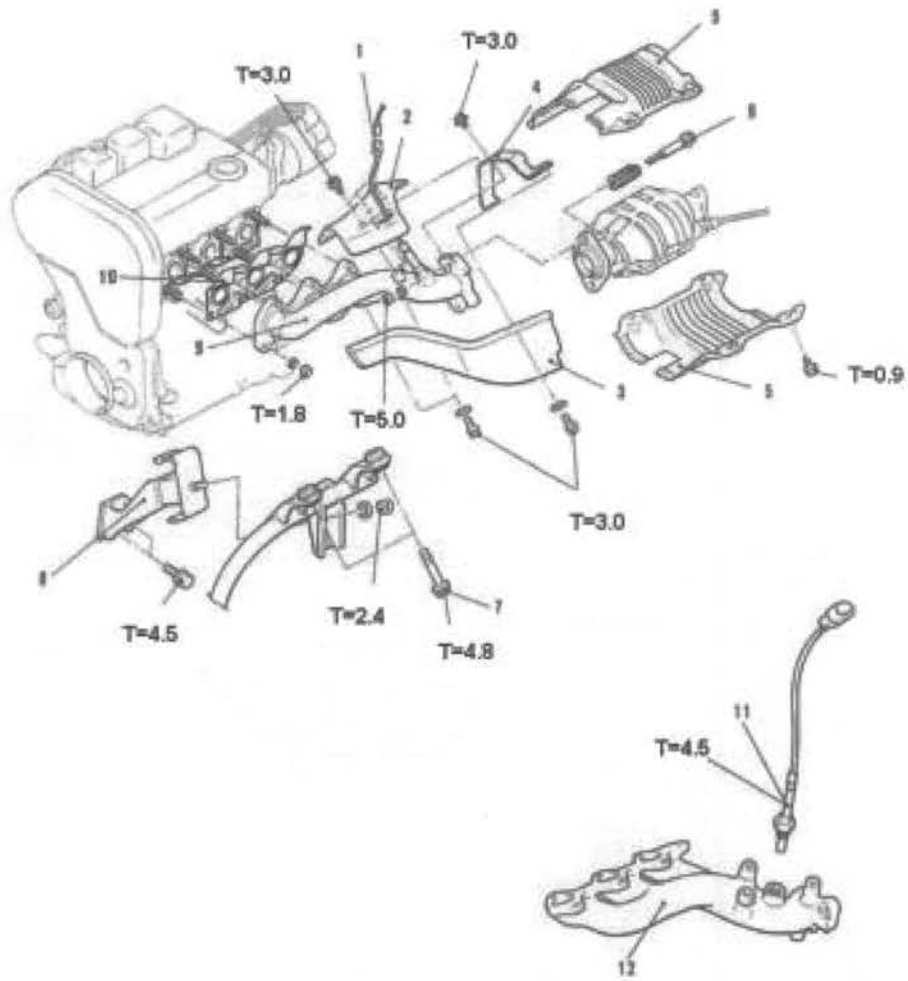
Note: For Continued Disassembly of the Intake Manifold See the Following Page

Intake Manifold System DOHC



47. Remove Vapor Hose
48. Remove Fast Idle Hose
49. Disconnect vacuum hose
50. Remove Vacuum Pipe Assembly
51. Remove Bracket
52. Remove Air Mass Sensor
53. Remove PVC Valve
54. Manifold Stay Bracket
55. Remove Water Outlet Fitting
56. Remove Gasket
57. Remove Thermostat
58. Remove Water Temperature Gage Sending Unit
59. Remove Water Temperature Sensor
60. Intake Bare Manifold
61. Install in Reverse Order

Exhaust Manifold DOHC



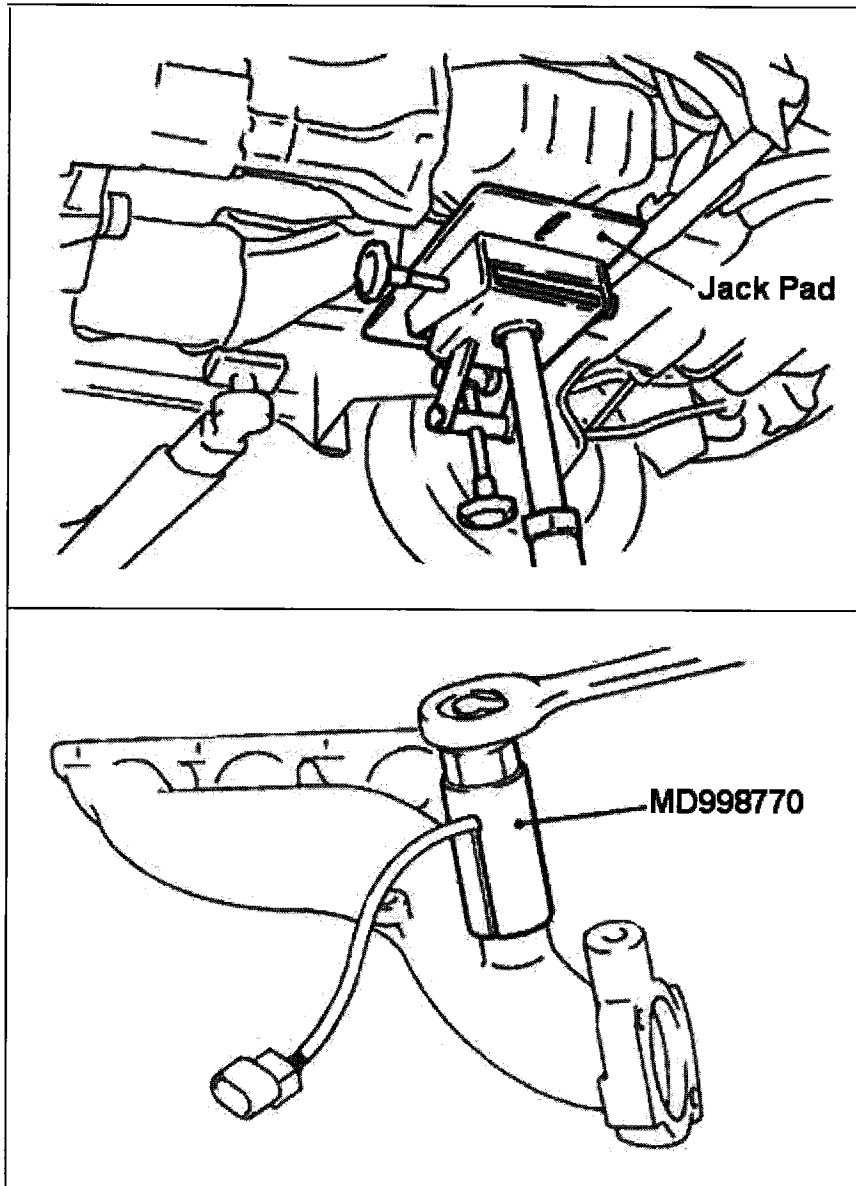
Exhaust Manifold Removal

1. Disconnect Oxygen Sensor Connector
2. Remove Heat Cover
3. Remove Exhaust Manifold Cover
4. Remove Cover Bracket
5. Remove Catalytic Converter Cover
6. Remove Converter Bolts and Lower Converter
7. Remove Engine Mount Bolt and Grommet as Shown
8. Remove Left Side Engine Bracket
9. Remove Exhaust Manifold
10. Remove Manifold Gasket and Discard

Note: Never Reuse Exhaust Manifold Gaskets.

Exhaust Manifold DOHC

Jack Positioning



Oxygen Sensor Removal

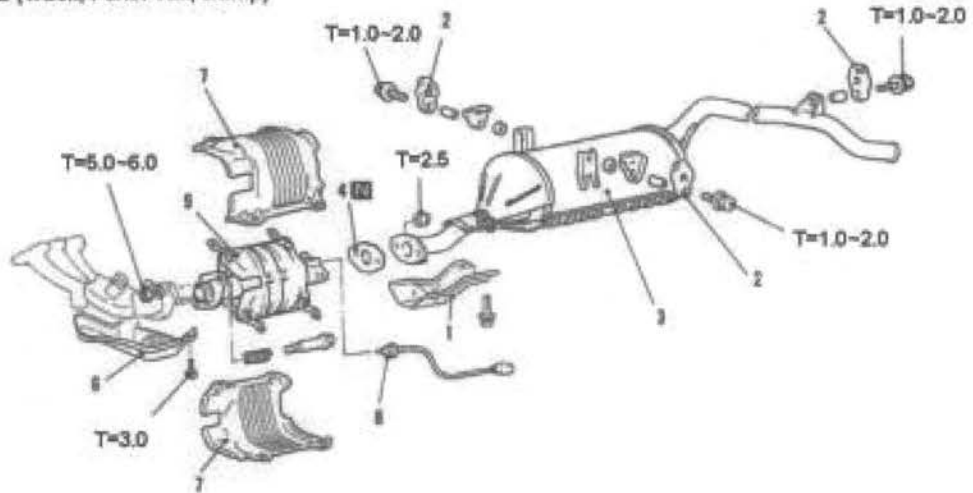
Note: Warm Exhaust Manifold before removing Oxygen Sensor. Do not attempt to remove Oxygen Sensor with Manifold Temperature Below 25°C. Damage to the Sensor may occur.

Note: Never Cut or Splice Oxygen Sensor Lead Wire. The Sensor must be replaced as a Unit.

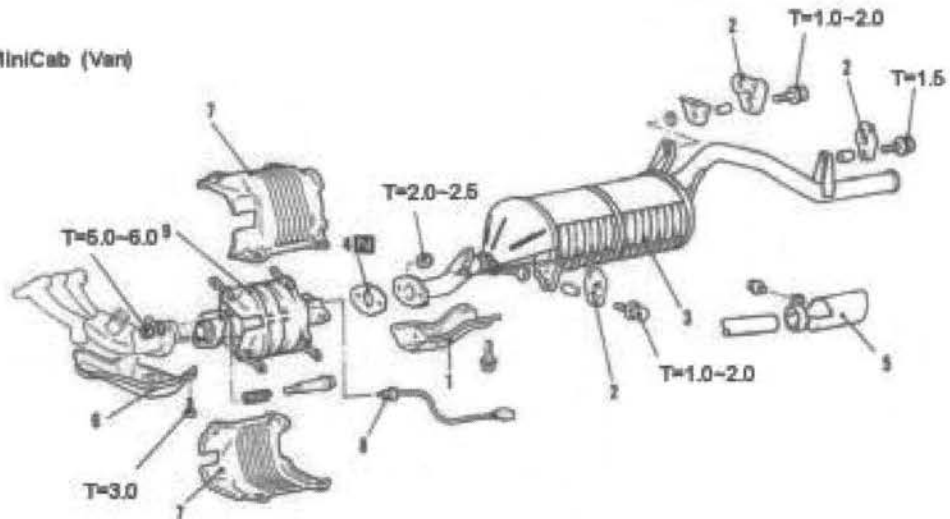
Note: Do not attempt to Start Vehicle with Sensor Disconnected. Damage to the System may occur.

Exhaust Piping System

MiniCab (Truck, Panel Van, Dump)



Bravo, MiniCab (Van)



Exhaust Components

1. Heat Shield
2. Hanger
3. Main Muffler
4. Gasket
5. Muffler Tip (Mr-I, Bravo)
6. Exhaust Manifold Cover
7. Convertor Cover
8. Exhaust Over Temp Sensor: (Dash Panel Warning Lamp)
9. Catalytic Convertor

Note: See Parts Service Manual for Vehicle Specific Amendments

Notes

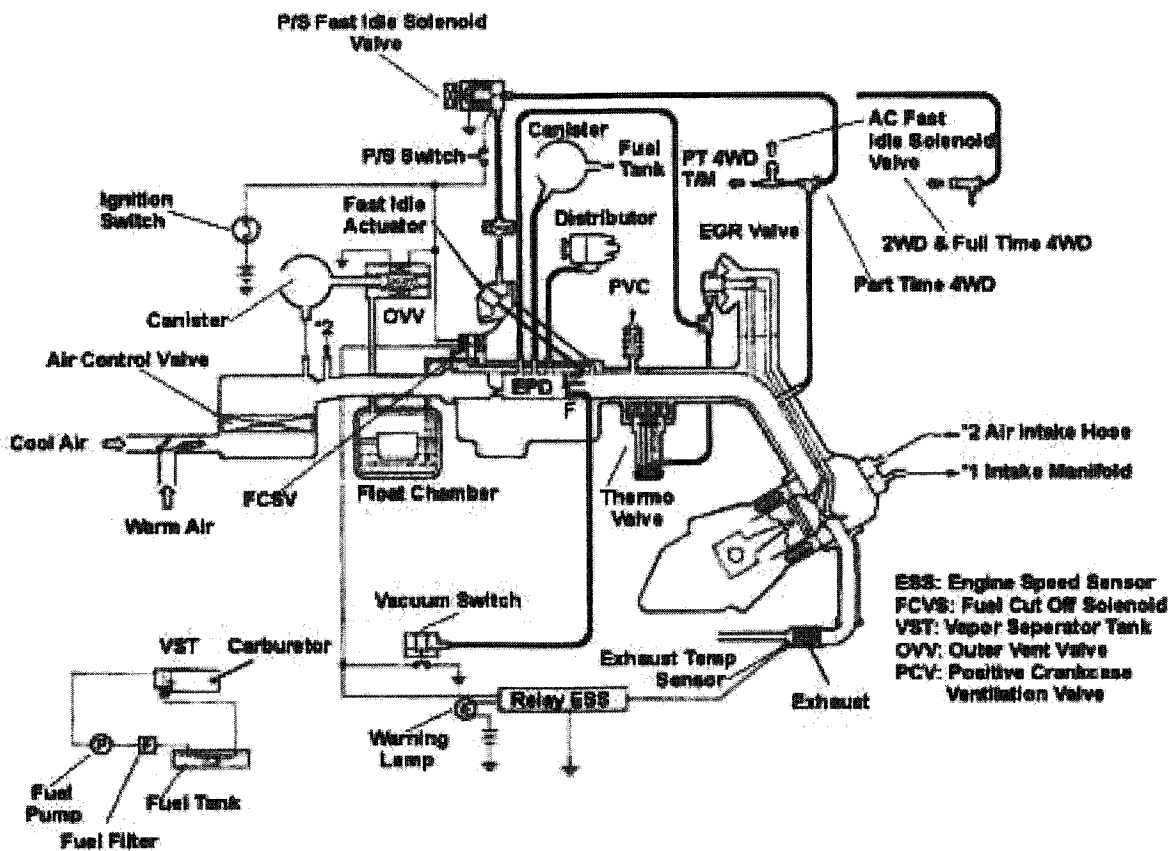
Chapter 7

Emission Controls

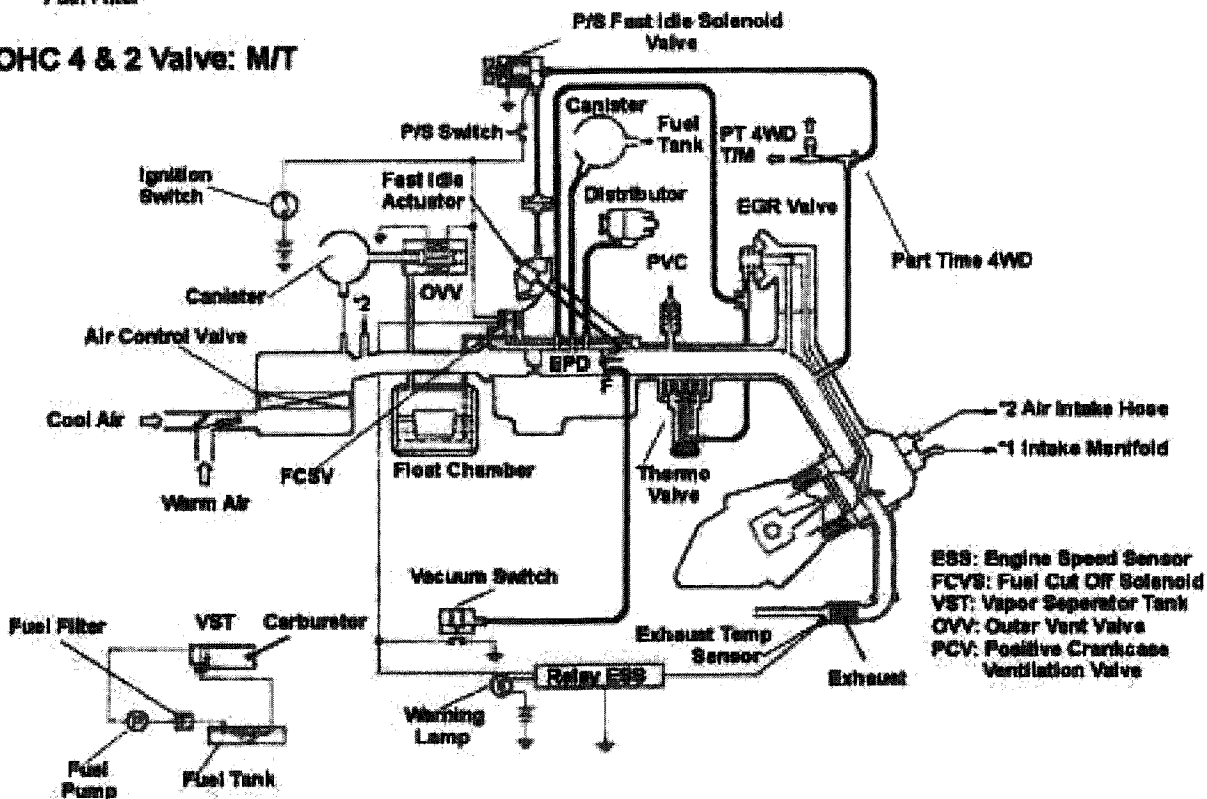
82. Emission Control Schematics SOHC MT
83. Emission Control Schematics SOHC AT
84. Vacuum Hose Routing Schematics SOHC MT Vehicles
85. Vacuum Hose Routing Schematics SOHC AT Vehicles
86. EGR Valve Circuits: SOHC MT-AT
87. PVC System SOHC
88. Fuel Cutoff Solenoid Valve SOHC
89. Vacuum Switch & Speed Sensor (ESS) SOHC Test
90. Exhaust Over Temperature Warning System
91. Emission Control Schematics DOHC
92. Vacuum Hose Routing DOHC

Emission Control Schematics SOHC MT-AT

SOHC 4 Valve: M/T-P/S Option

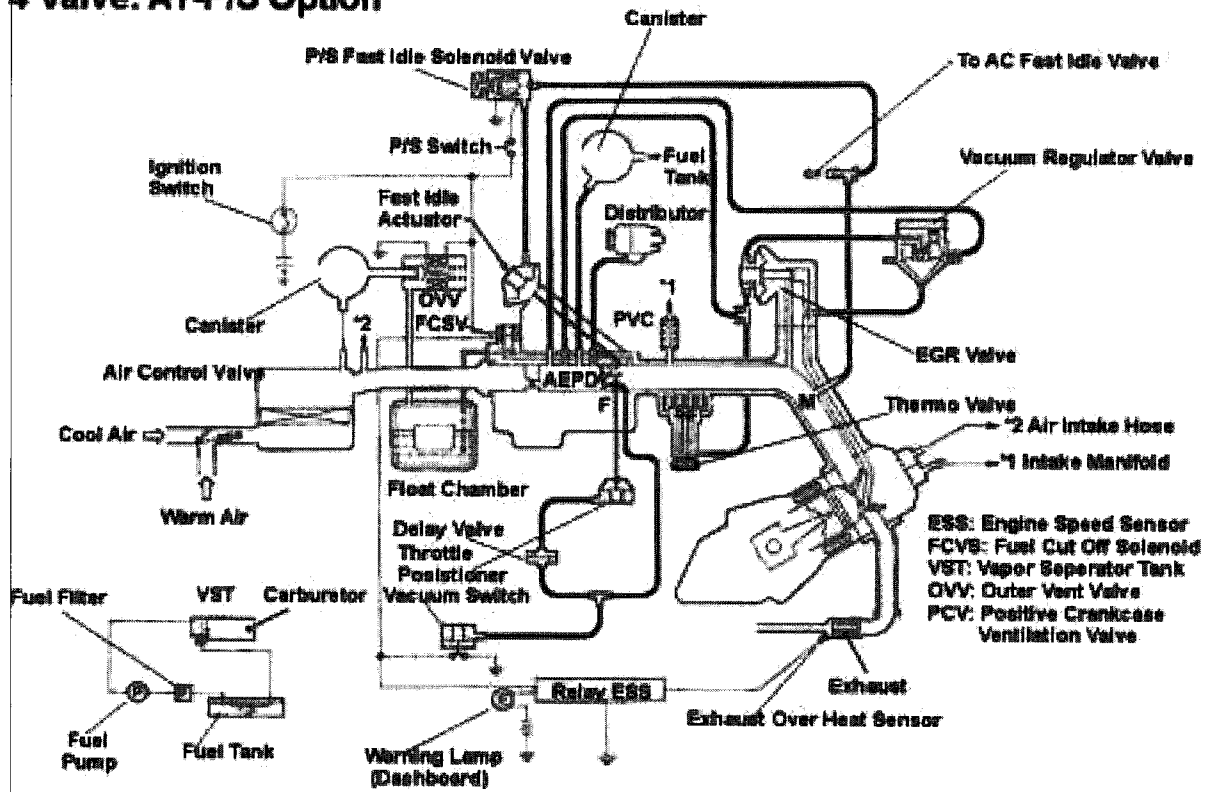


SOHC 4 & 2 Valve: M/T

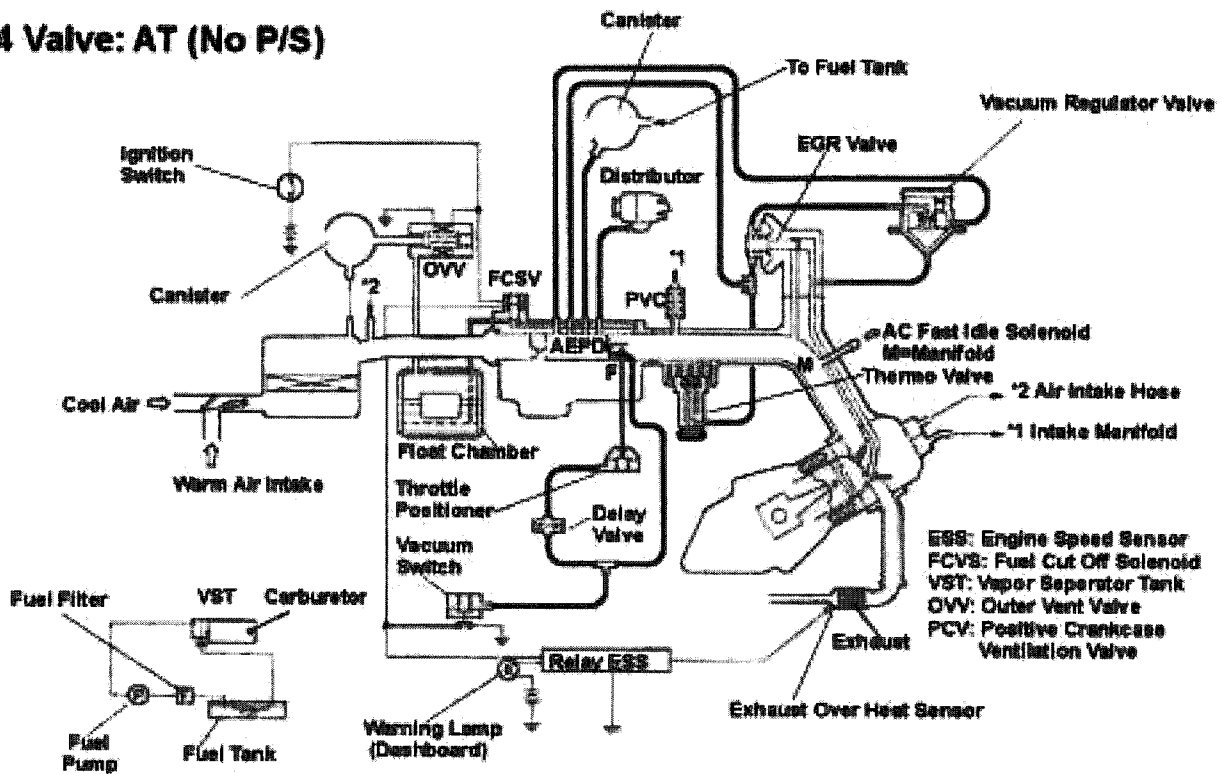


Emission Control Schematics SOHC MT-AT

4 Valve: AT-P/S Option

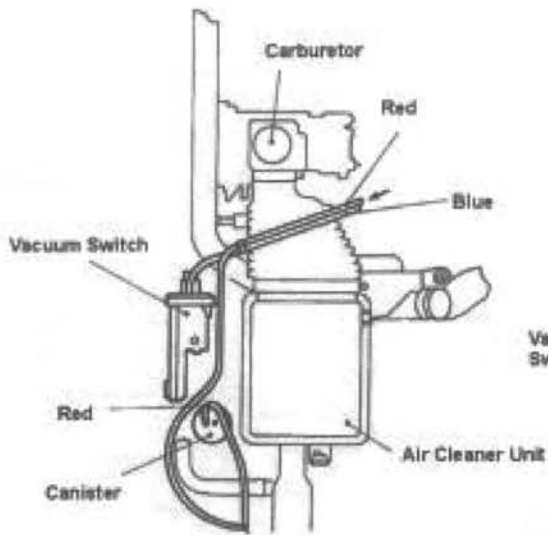
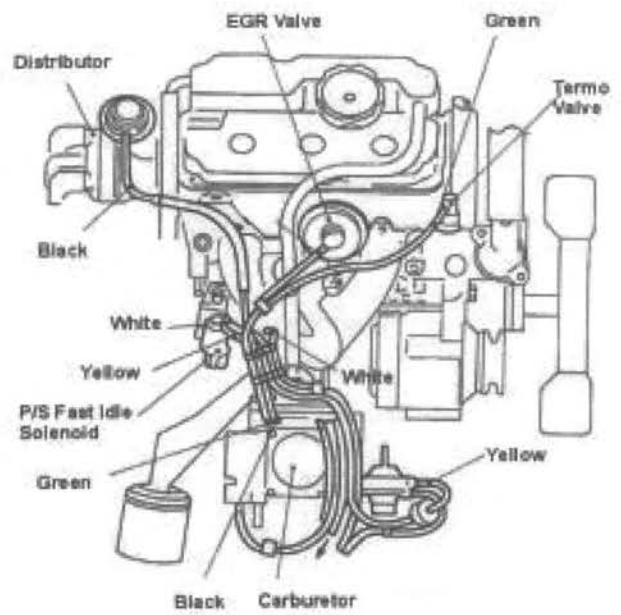
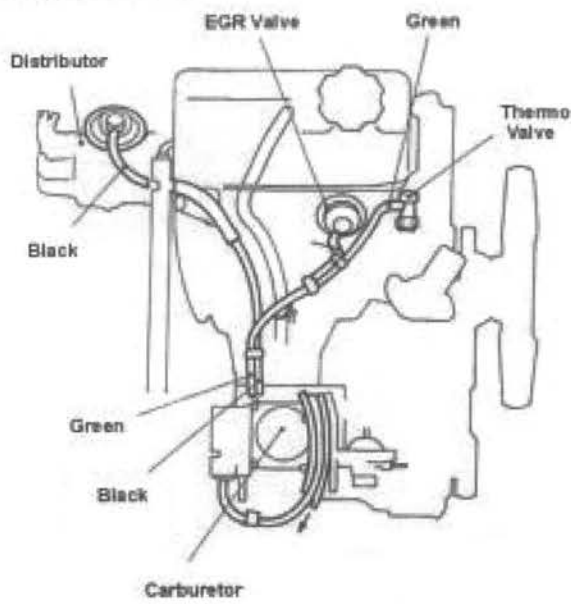


4 Valve: AT (No P/S)

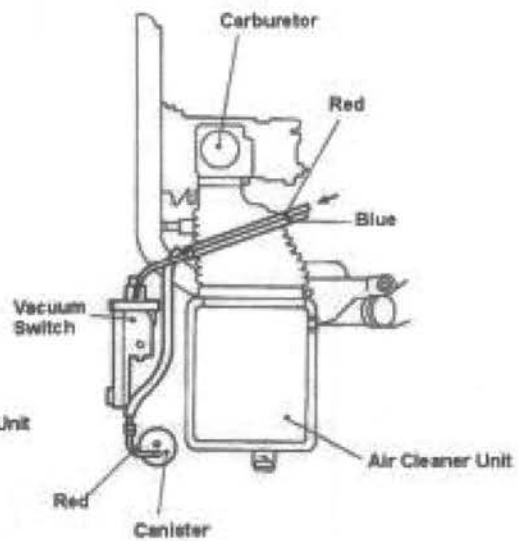


Vacuum Hose Routing SOHC MT Vehicles

MT Vehicles



Bravo MiniCab: Van

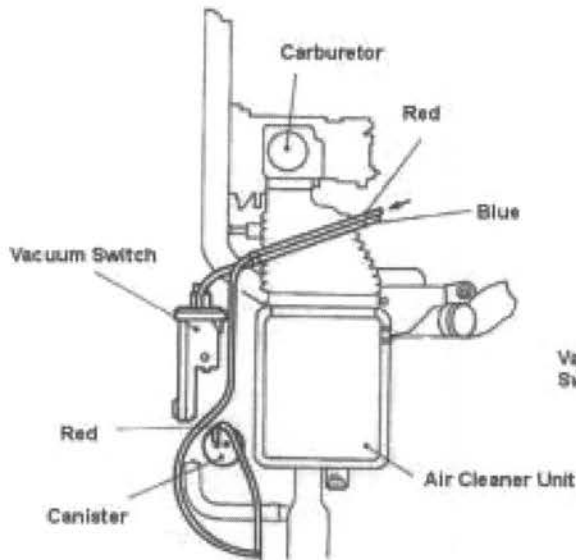
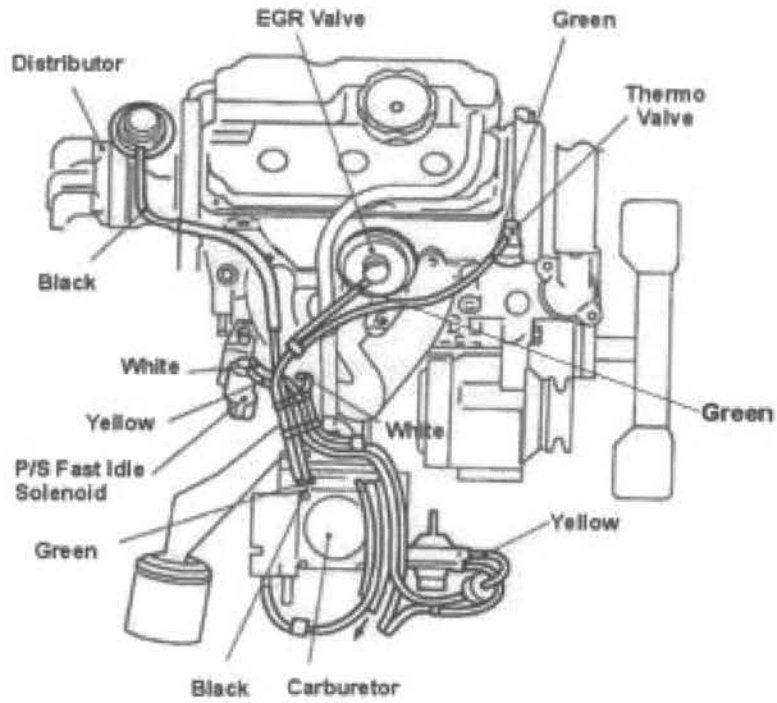


MinCab: Truck, Dump, Panel Van

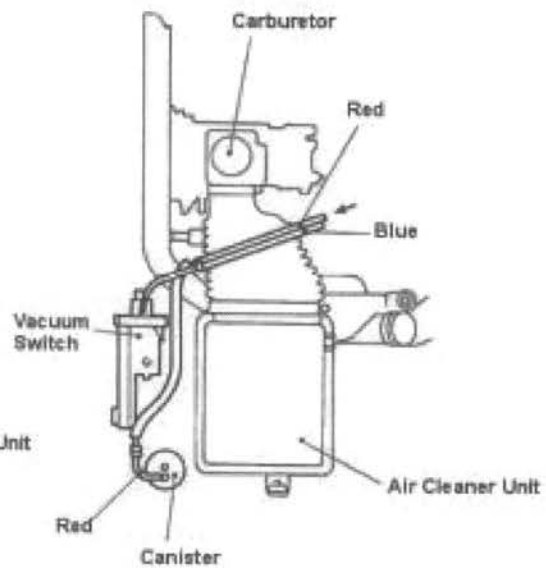
Note: Vacuum Hose connected to EGR Valve is Green coded.

Vacuum Hose Routing SOHC AT Vehicles

AT Vehicles



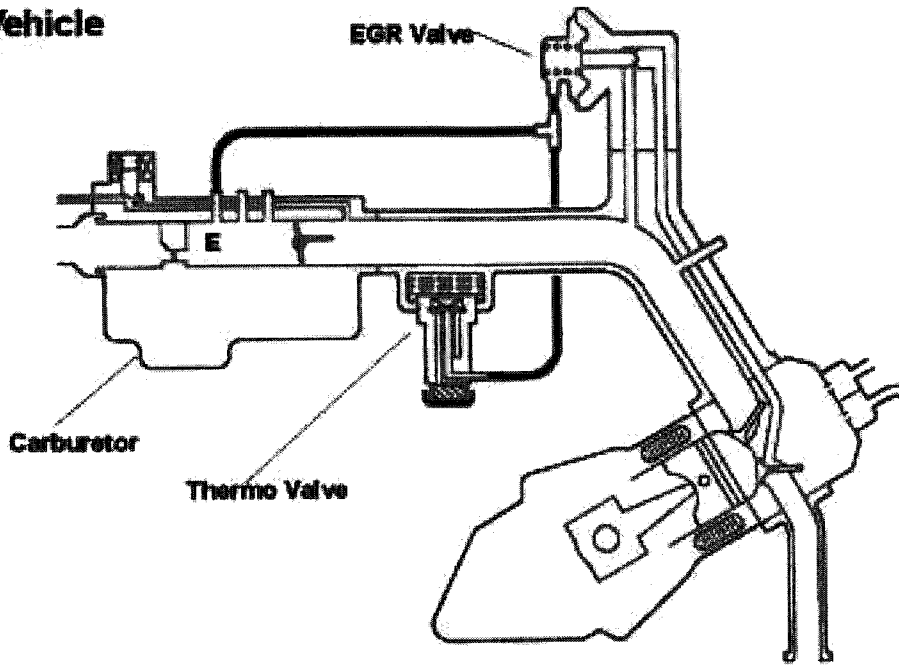
Bravo MiniCab: Van



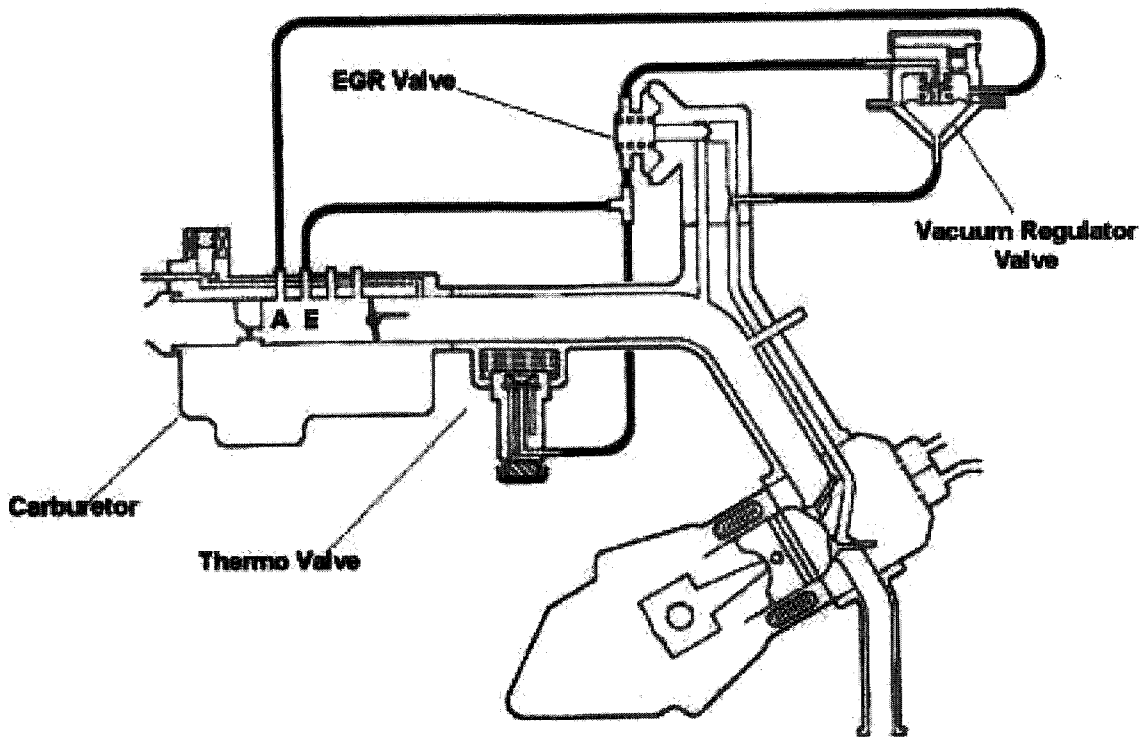
MinCab: Truck, Dump, Panel Van

EGR Valve Circuits: SOHC MT-AT

MT Vehicle



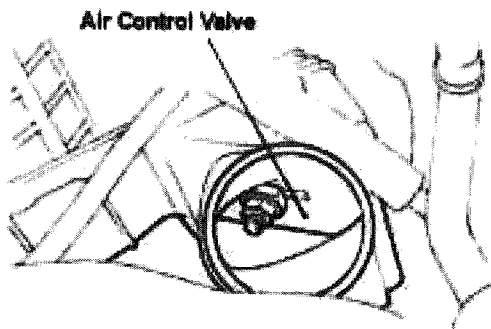
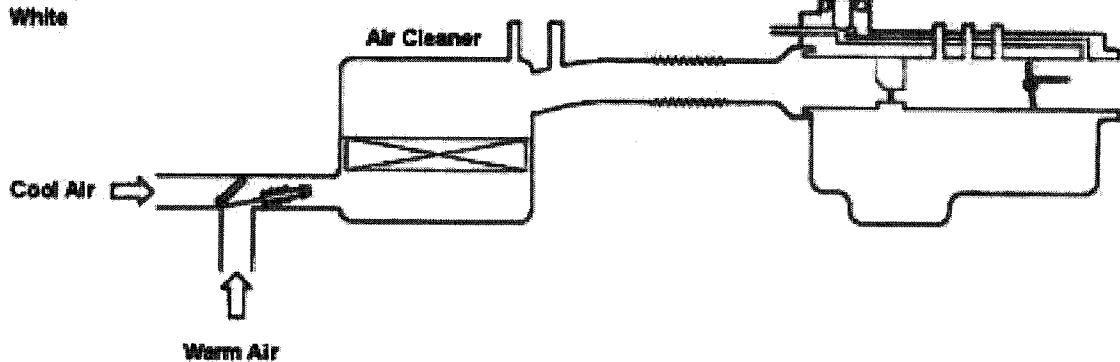
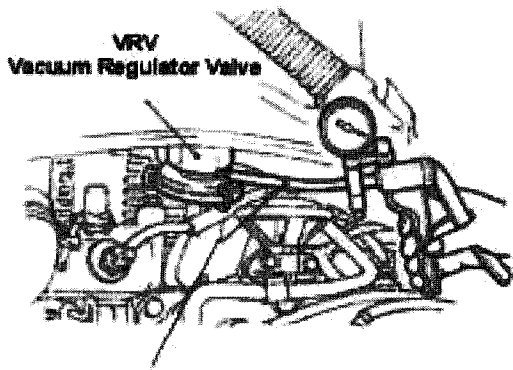
AT Vehicle



Engine Cold: Idle=Below 150mmHg

Engine Warm: Idle=30mmHg

Vacuum Regulator & Thermo Valve



Vacuum Regulator Valve

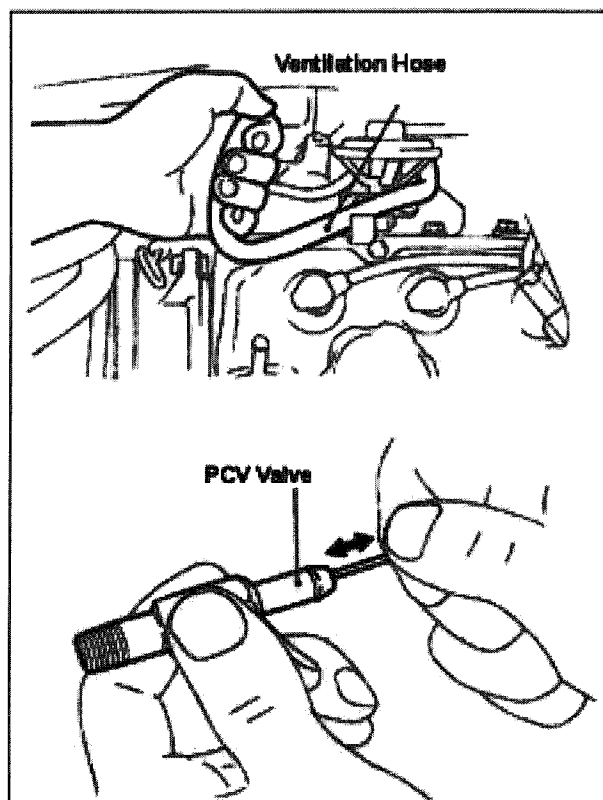
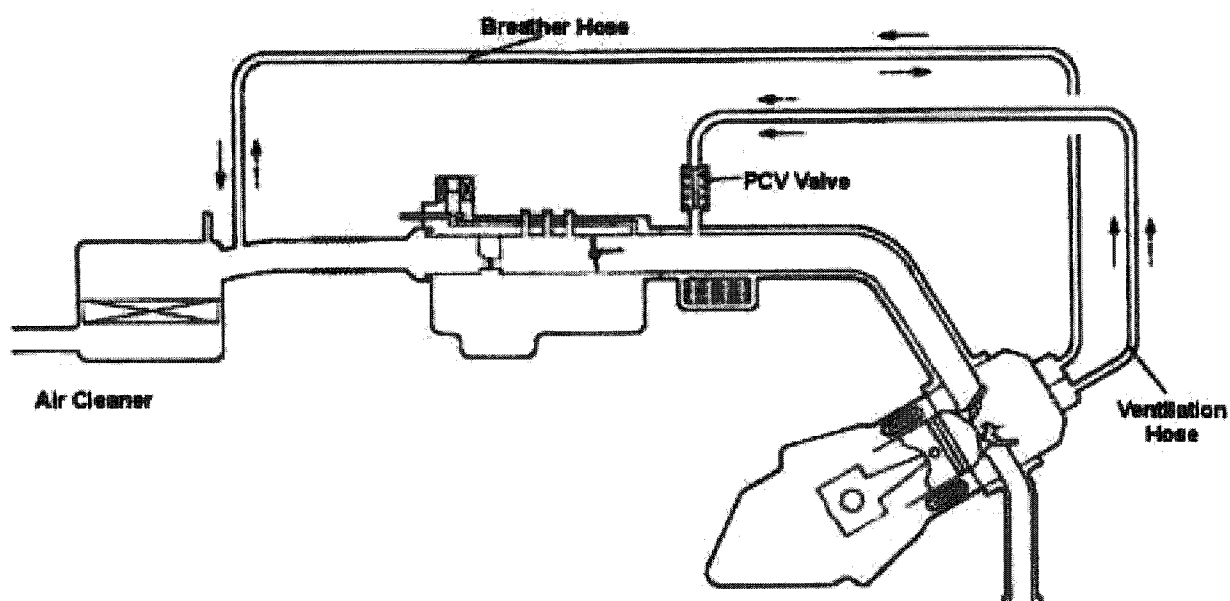
1. Warm Engine
2. Remove Yellow Striped Hose from Regulator and Feel for Air Movement. If Air Movement is Detected Attach Hose to its Original Location.
3. Remove White Stripped Hose as Shown above and attach a Hand Pump.
4. Ventilation Inspection: Pump Hand Held Unit to 400mmHG. @ Idle Valve shall Leak down slowly. @4000 RPM Valve shall hold pressure.

Air Control Valve

1. Remove Air Cleaner Cover and Air Filter. Use the Specifications below for testing.
 - Below 20°C: Valve Closed
 - Above 45°C: Valve Open

Note: Use a Hair Dryer to Test the Valve, Do Not Start the Vehicle.

PCV System SOHC

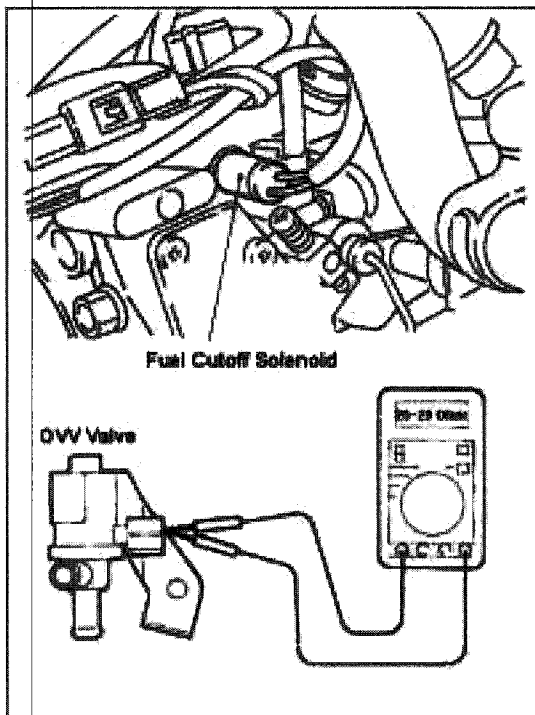
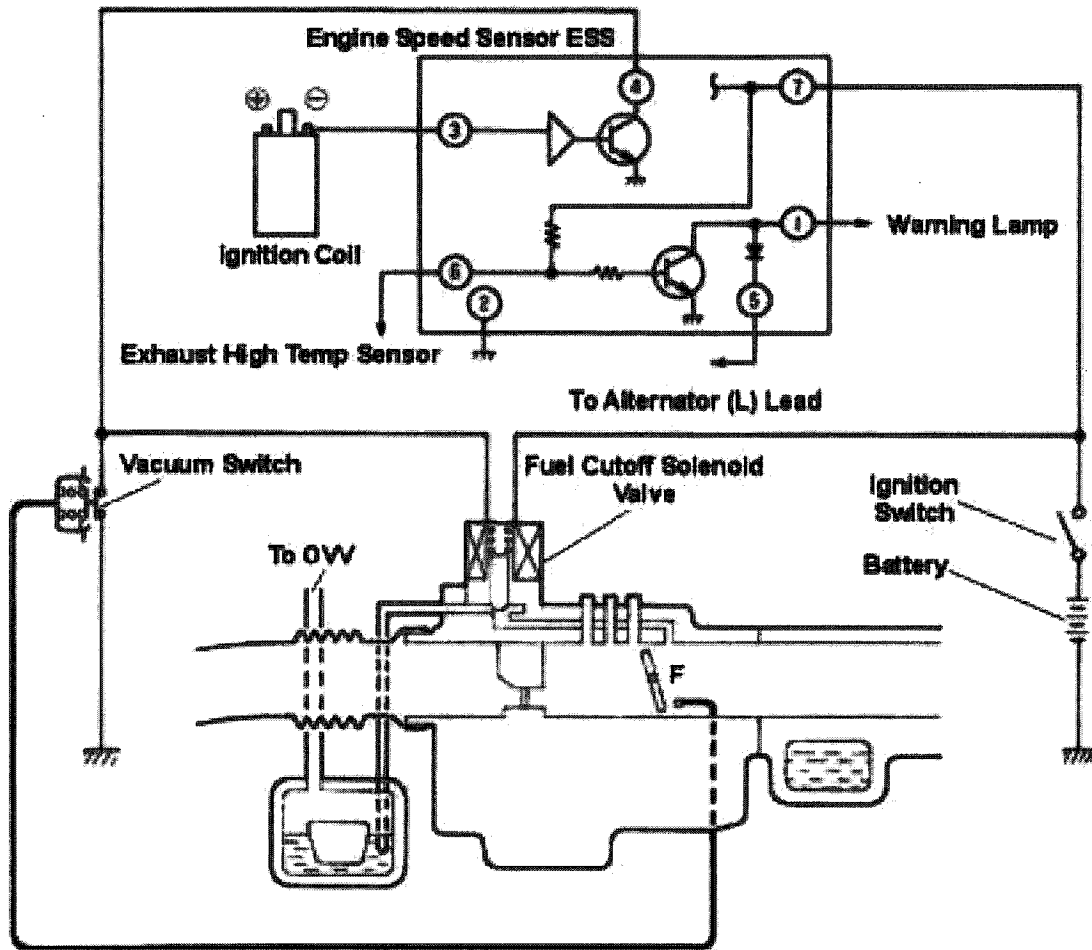


PCV System Test

1. Remove Ventilation Hose from Valve Cover as Shown in the Diagram.
2. Start Engine and Allow to Idle
3. Cover the End of the Hose with a Thumb as Shown. Intake Manifold Pressure Should Increase and PCV Valve Should Open
4. If the Valve Fails to Open Remove and Clean Unit. Reinstall and Retest. If Unit Fails after the Second Test Replace PCV Valve.

PCV Valve Torque: 1.0kgm

Fuel Cutoff Solenoid Valve SOHC



Fuel Cutoff Solenoid

1. Use a Stethoscope and Turn Ignition to "ON" Position. You will hear the Solenoid move.
2. If there is no movement and PWR is present Replace Valve.
3. Ohm Test: $48-60\Omega@20^{\circ}\text{C}$

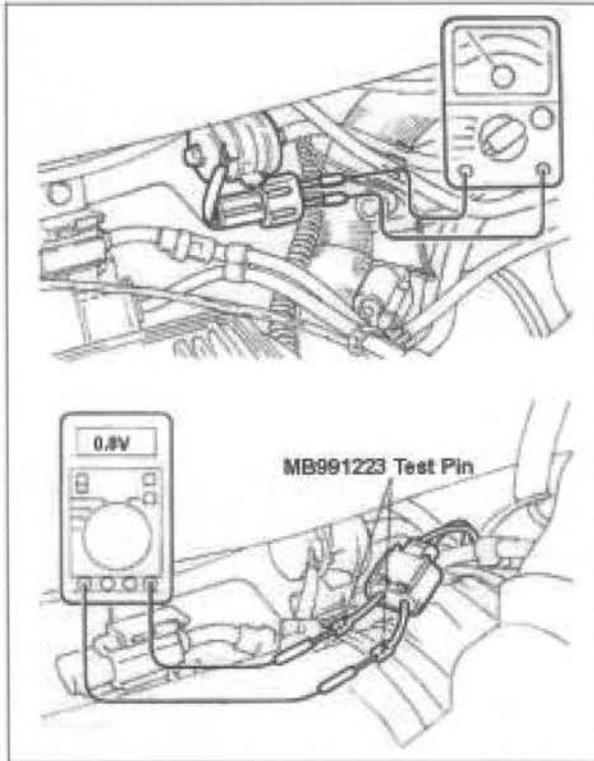
Outer Vent Valve (OVV)

1. Remove Connector
2. Use a Ohm Meter to Test OVV Valve.

Ohm Range: $26-29\Omega@20^{\circ}\text{C}$

Replace defective Valves: No Repair Possible

Vacuum Switch & Speed Sensor (ESS) SOHC Test



Vacuum Switch

Engine Stop PWR "ON": Signal Present

Engine Idle: No Signal

Replace if Faulty: No Repair Possible

Engine Speed Sensor (ESS)

1. Use a Millimeter and Test the Following

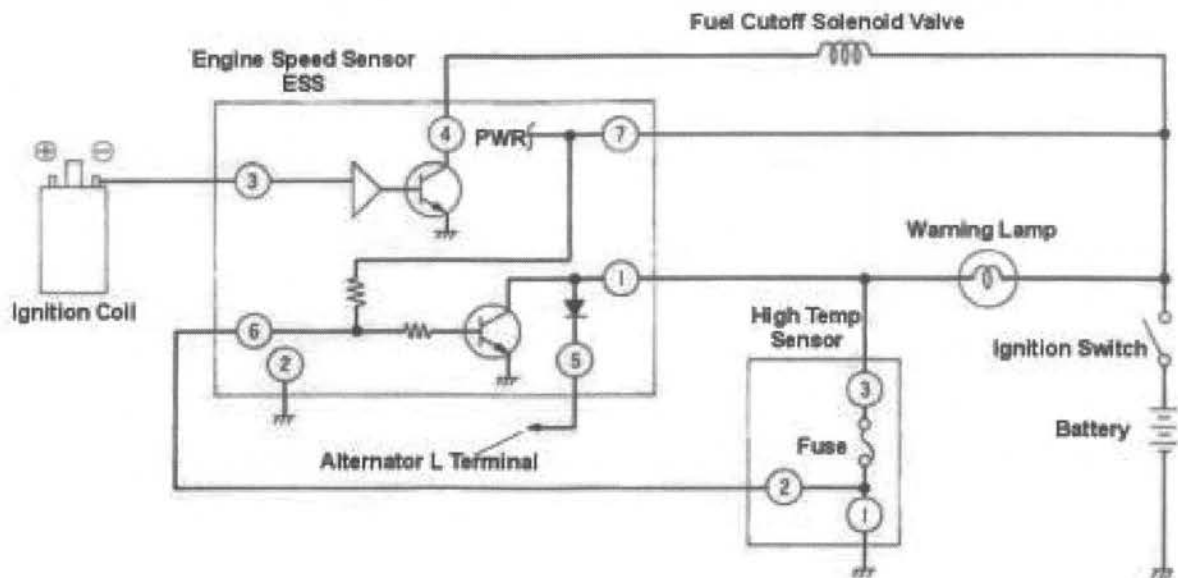
Voltage

@Idle: 0.8V

@3500RPM & Above: 14V (Battery Level)

Replace if Faulty: No Repair Possible

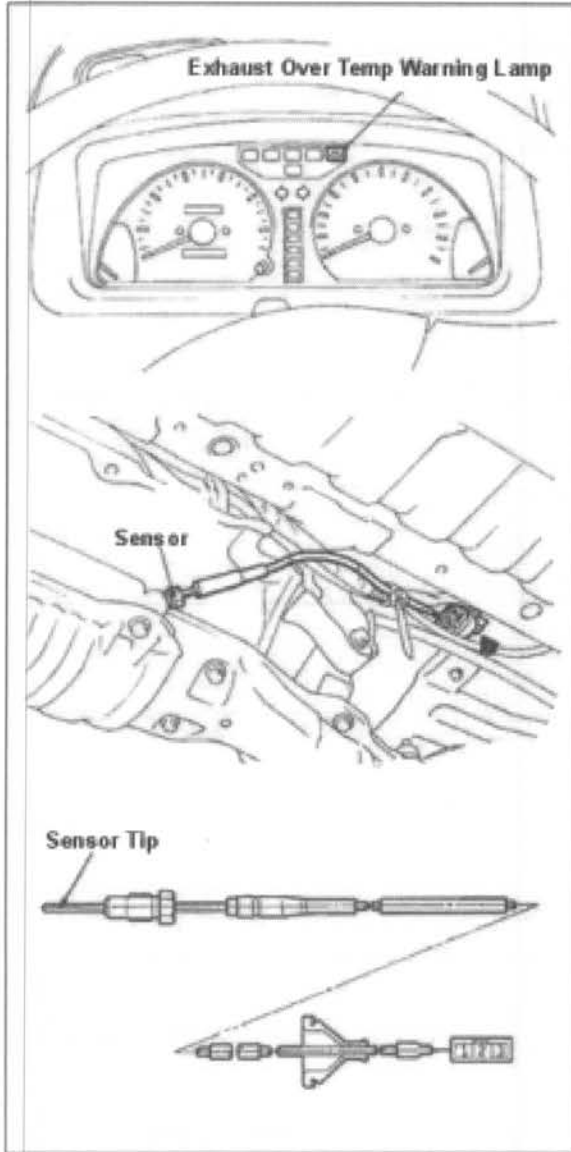
ESS Speed Sensor & Exhaust Over Temp Circuit Diagram



Note: Exhaust Over Temperature Circuit is a Warning for Exhaust Temperature. It was a requirement in Japanese Law. It does not have any effect on system performance.

Note: Do not confuse the Over Temp Sensor for an Oxygen Sensor. They are also not interchangeable.

Exhaust Over Temperature Warning System



Exhaust Temperature Warning Light

Note:

This System lets the Driver Know his Exhaust Temperature is Over-Heated according to Japanese Domestic Guidelines. It does not affect System Performance.

System Test

1. Turn Ignition Switch to "ON". Warning Lamp will engage for 15 Seconds.
2. Turn Ignition to "Start" and Light will go out.

Sensor Location: See Diagram on Left

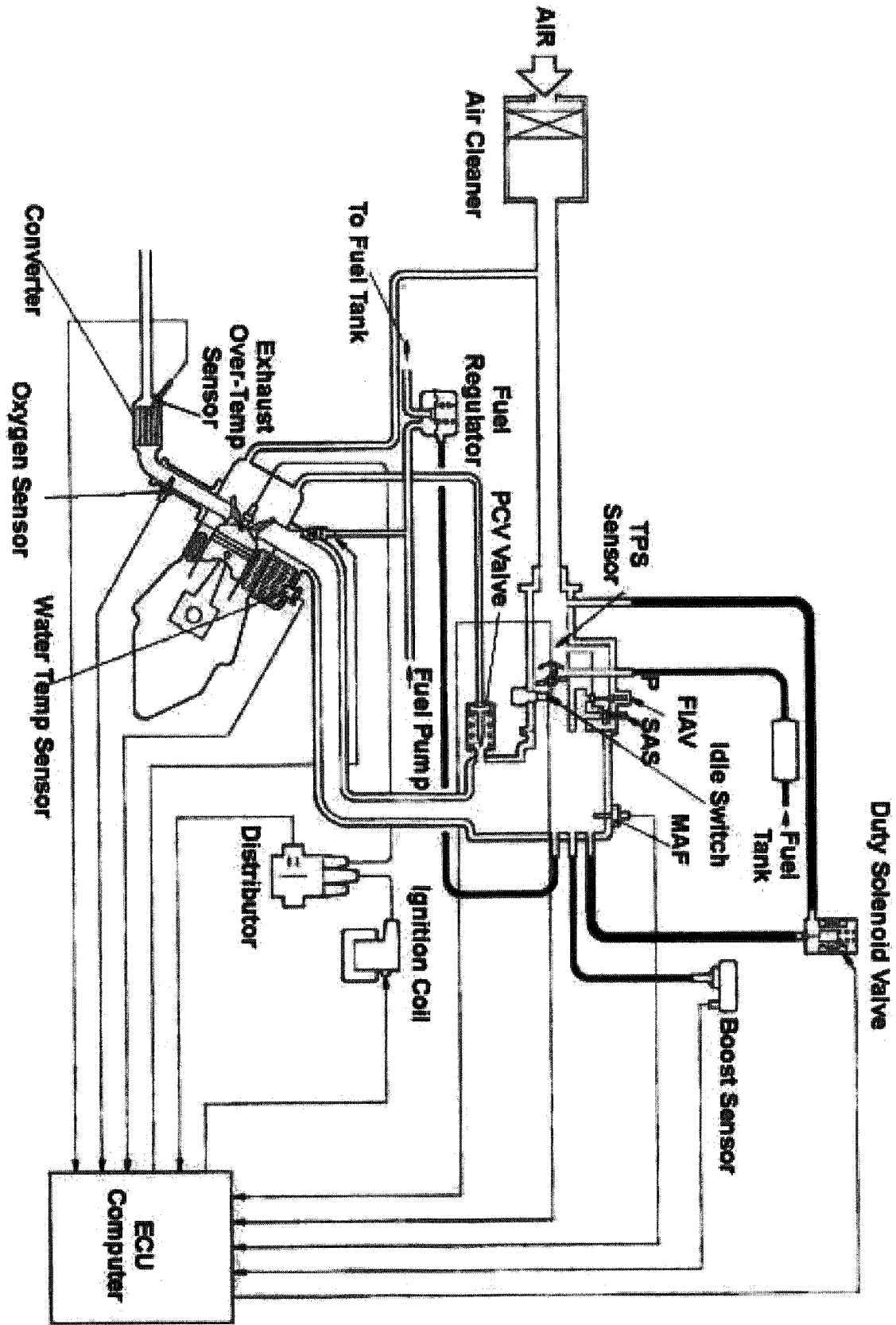
Replacement

1. Remove Sensor
2. Install New Sensor

Troubleshooting Tip

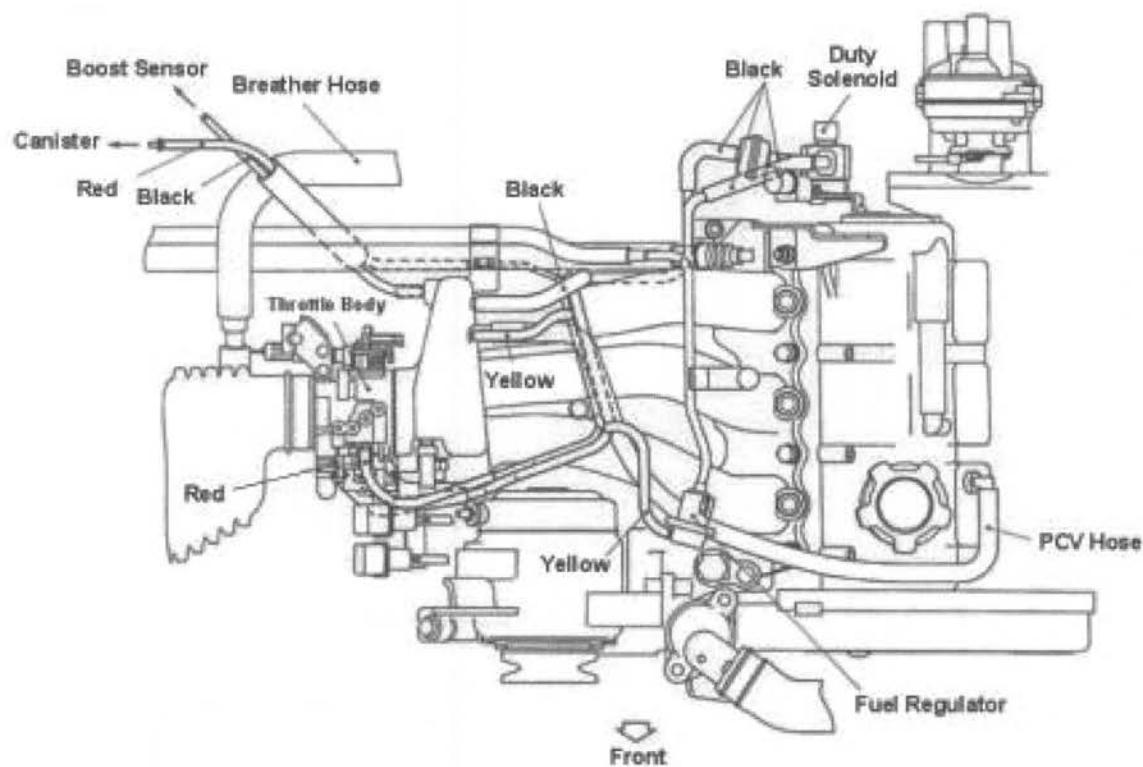
1. If Light does not go out after starting the Engine Replace Sensor.

Emission Control Schematics DOHC



Note: System is Computer Controlled. Use Computer connection to verify settings. See MPI Fuel Section for Troubleshooting.

Vacuum Hose Routing DOHC



Note: If a Vacuum Hose is removed it must be replaced if the Vehicle has over 65,000 Kilometers.

Note: Do not put Grease or other Oil Products on Hoses before Installation. Petroleum Products will degrade the Rubber and cause premature failure.

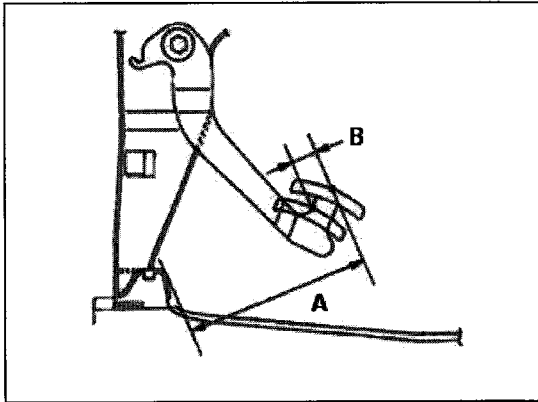
Note: If Engine is Removed Replace all Hoses

Chapter 8

Transmission

93. Clutch Pedal Adjustments
94. Clutch Pedal System
95. Clutch Cable
96. Manual Transmission Capacities
97. Speedometer Gear Identification
98. Manual Transmission Shifter & Cable System
99. Gear Shifter Assembly
100. 4WD Transfer Control Engagement System
101. 4WD Engagement Switch Replacement
102. PTO Control Cable system
103. PTO Control
104. PTO Drive Unit & Indicator Lamp
105. Manual Transmission Removal 2WD
106. Manual Transmission Removal 4WD
107. Manual Transmission Removal & Installation Key Notes 4WD
108. Automatic Transmission Capacities & ATF Fluid Replacement 2WD/4WD
109. Automatic Transmission Oil Pressure Test Procedure
110. ATF Circuit Diagram
111. Automatic Transmission Shift & Controls
112. Automatic Transmission Shifter Assembly
113. ATF Oil Cooler Hose Routing 2WD/4WD
114. Automatic Transmission Removal 2WD
115. Automatic Transmission Removal 4WD
116. Automatic Transmission Removal & Installation Notes

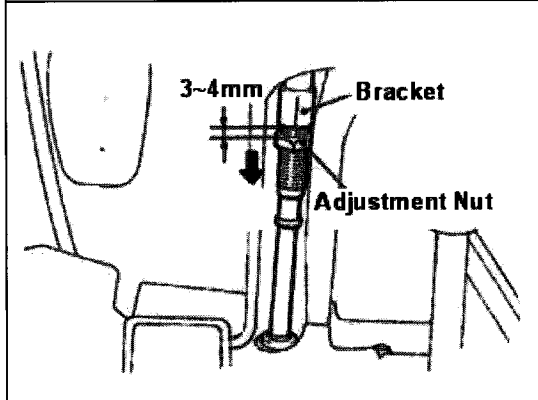
Clutch Pedal Adjustments



Clutch Pedal Adjustment

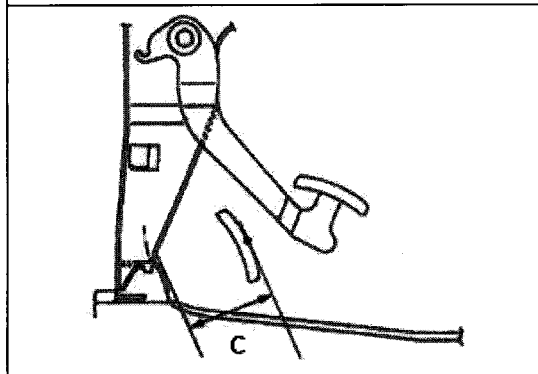
Clutch Height: "A" 163mm

Pedal Free Play: "B" 15-25mm



Adjustment Process

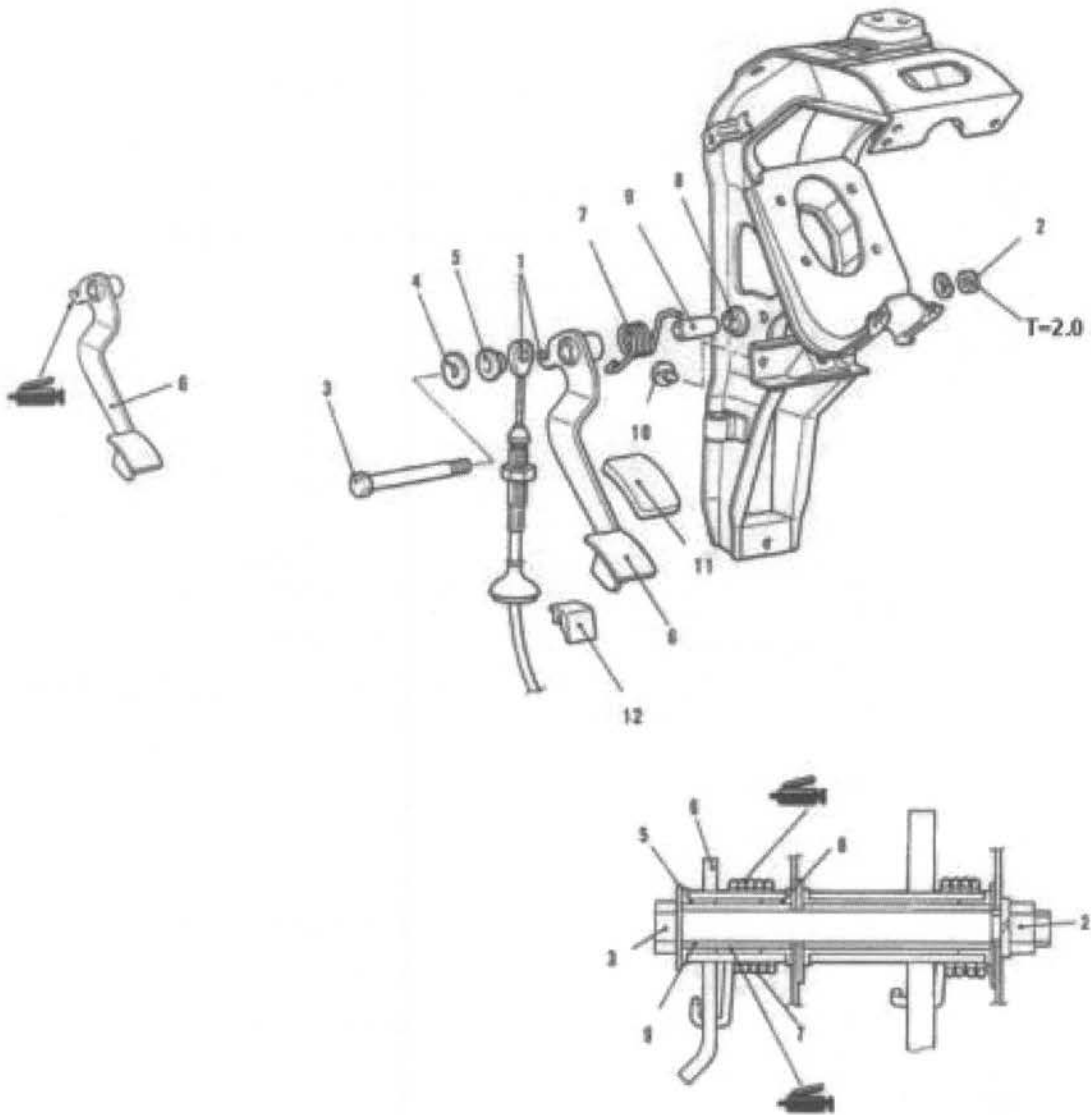
1. Loosen Locknut
2. Adjust as shown
3. Cables that are Out of Adjustment must be Replaced



Pedal to Deck Height

Limit: "C" Above 65mm

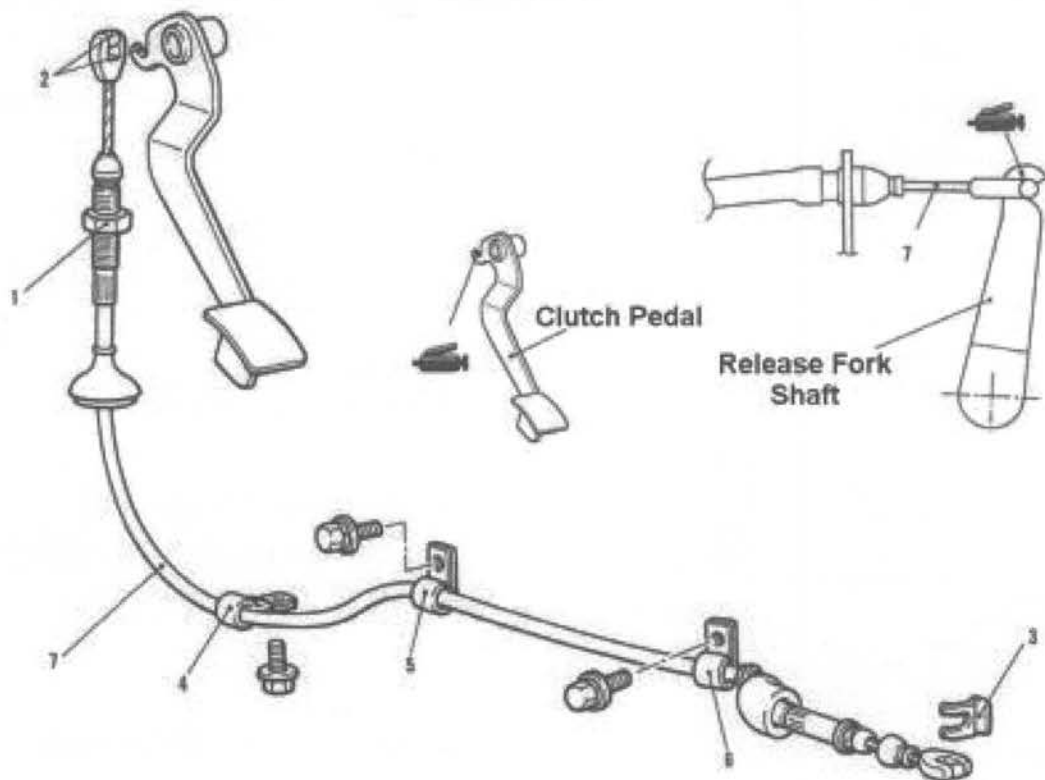
Clutch Pedal System



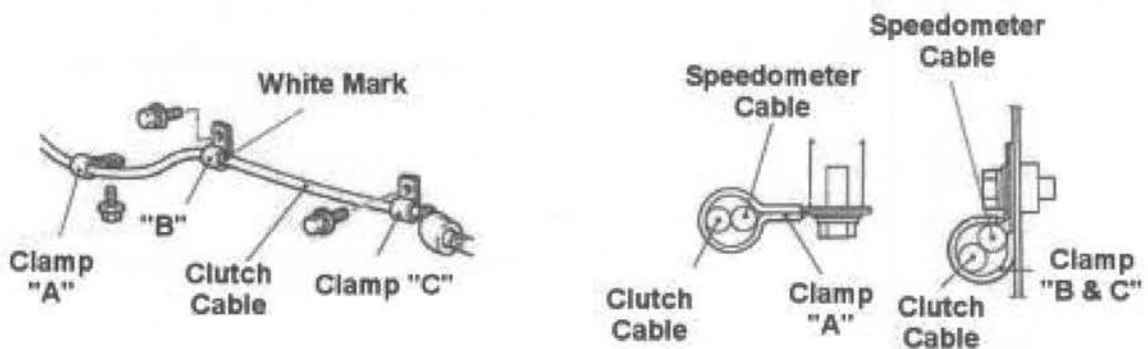
1. Clutch Cable Linkage Point
2. Shaft Bolt Nut
3. Pedal Shaft
4. Plane Washer
5. Bushing
6. Clutch Pedal
7. Clutch Pedal Return Spring
8. Bushing
9. Tube Bushing
10. Rubber Stopper
11. Pedal Pad
12. Rubber Stopper

Note: Use Quality Suspension Grade Grease at Points Shown Above.

Clutch Cable



Proper Cable Routing



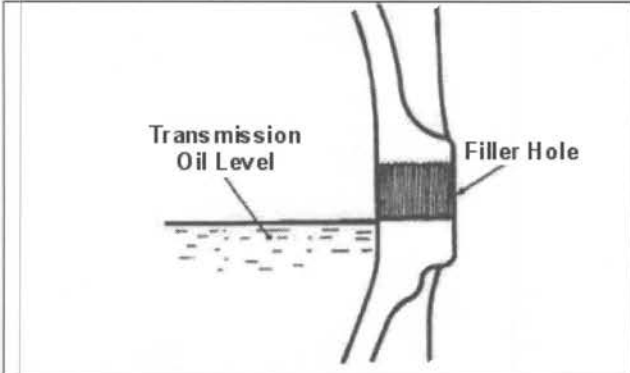
Clutch Cable Components & Proper Routing

Note: It is Important to Route the Cables as shown. Improper routing can cause failure or malfunction.

1. Adjustment Nut
2. Attachment Point
3. Retainer Clip
4. Clamp A
5. Clamp B
6. Clamp C
7. Clutch Cable Assembly

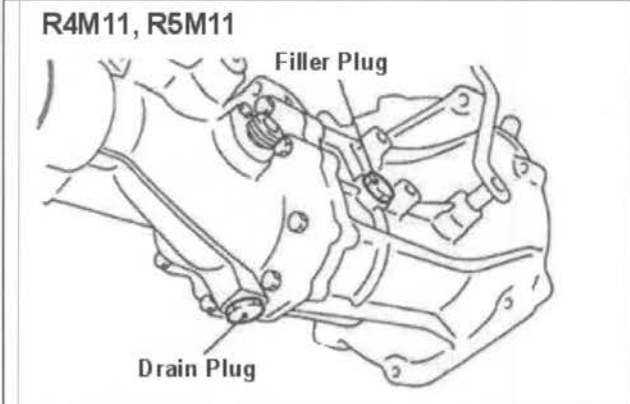
Manual Transmission Capacities

Transmission Series	Oil Capacity (Liter)	Oil Type
R4M11	0.75	75W/85W
R5M11	0.8	
V4M11	1.2 (PTO 1.25)	
V5M11	1.7	



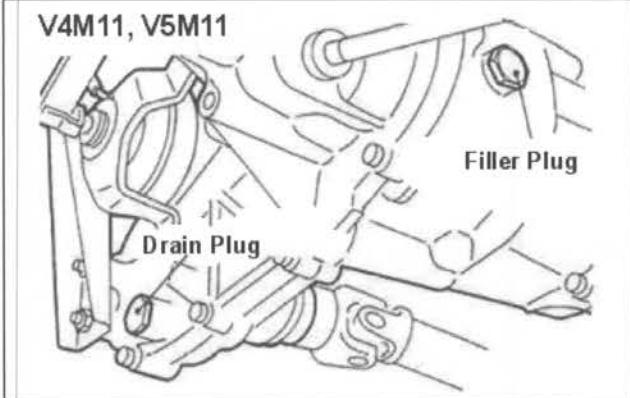
Transmission Oil Level

1. Remove Oil Filler Plug
2. Add Oil as required. See Chart above for Capacity Limits



Oil Change: 24,000 Kilometers

1. Remove Filler Plug
2. Remove Drain Plug
3. Drain for Minimum 10 Minutes
4. Replace Drain Plug
5. Fill Transmission to Capacity



Note: Never reuse Transmission Oil

Note: PTO Option Vehicles require an additional 0.25 Liters

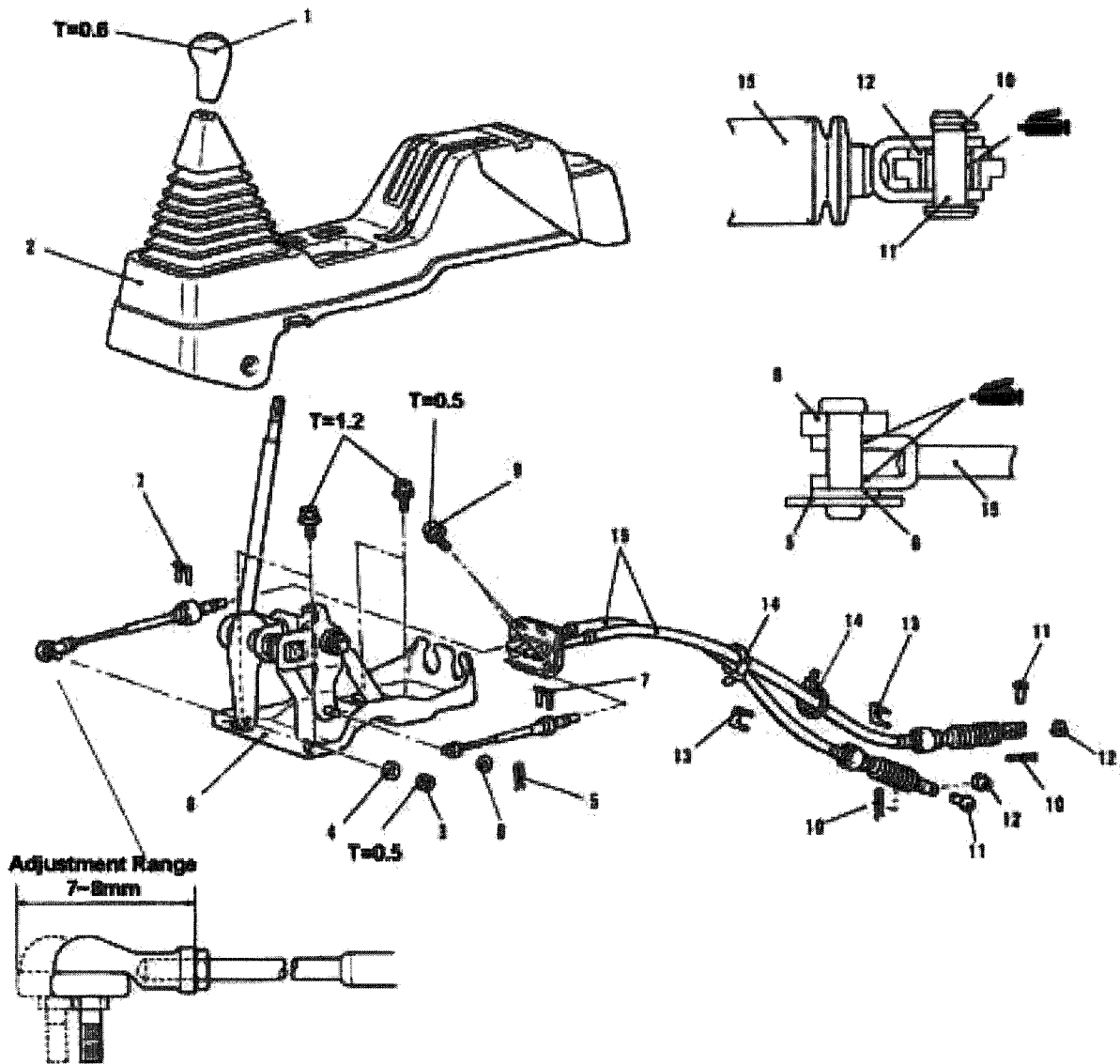
Plug Torque Limits

- Oil Filler Plug: 4.0-5.0kgm
- Drain Plug: 3.0-3.5kgm

Speedometer Gear Identification

Transmission	Adapter Color Code	Drive Gear Mark
R4M11-2-AV	Brown	Brown (24)
R4M11-AVQ		
R4M11-AW	Black	Black (25)
R5M11-2-AV	Brown	Brown (24)
R5M11-2-AW	Black	Black (25A)
V4M11-2-AV	Brown	Brown (24)
V4M11-2-AVQ		
V5M11-2-AV		
V5M11-2-AVJ		
V4M11-2-AW	Black	Black (25A)
V4M11-2-AWQ		
V5M11-2-AW		

Manual Transmission Shifter & Cable System

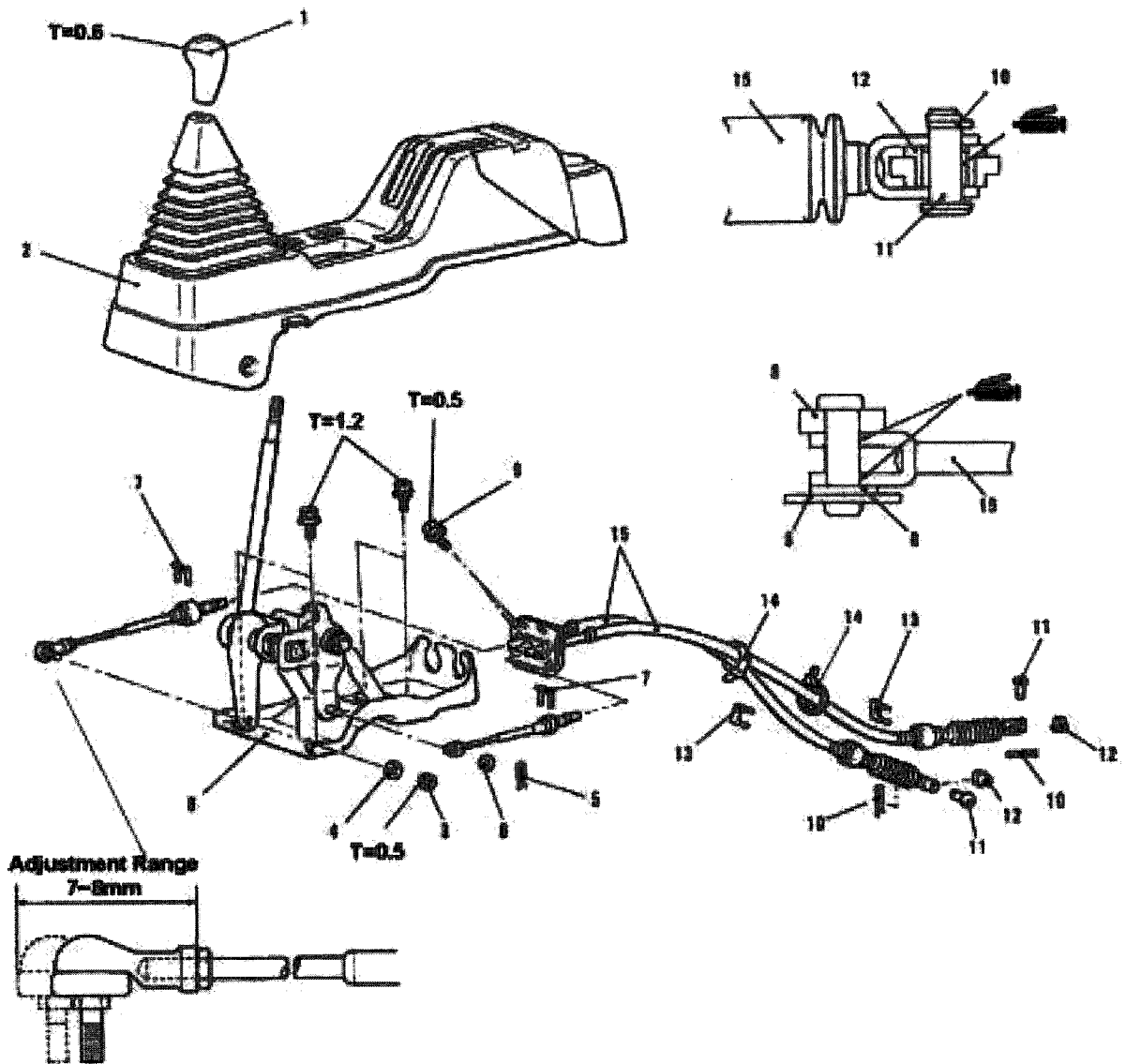


Components

Note: Adjustment Range of Cable is 7-8mm. Cable not Adjustable within Limits must be replaced.

1. Knob
2. Shifter Cover
3. Shift Cable Nut
4. Spring Washer
5. Snap Pin
6. Washer
7. Clip
8. Gear Shifter Assembly
9. Retainer Bolt with Packing Included

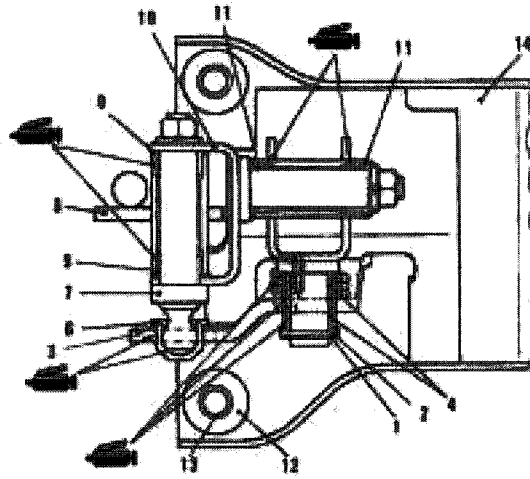
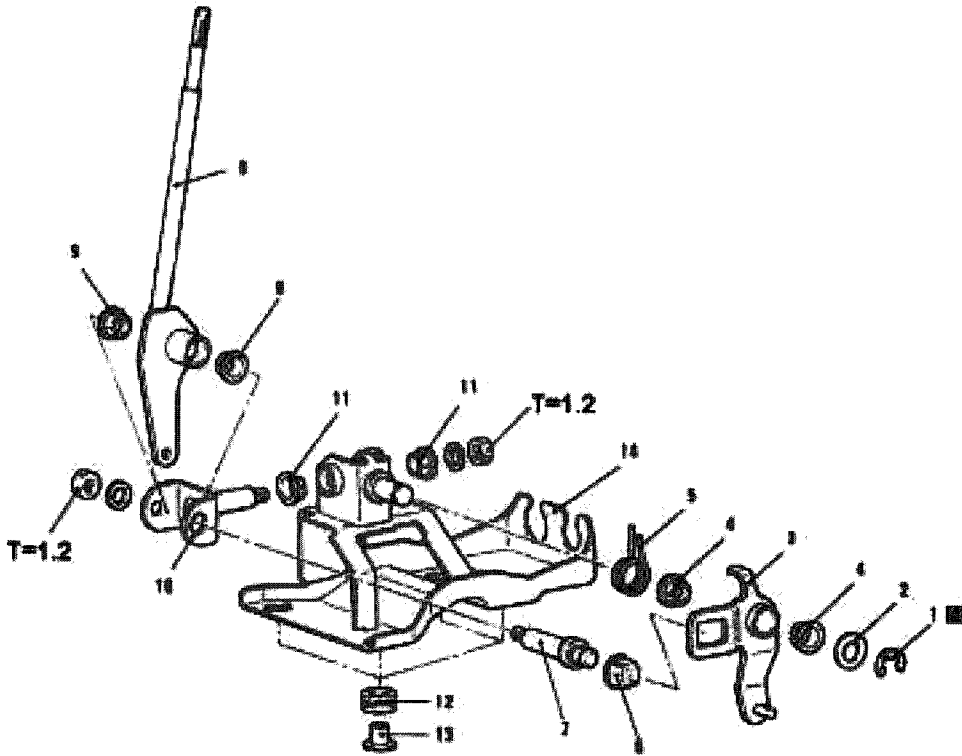
Manual Transmission Shifter & Cable System



- 10. Snap Pin
- 11. Clevis Pin
- 12. Bushing
- 13. Clip
- 14. Clamp
- 15. Cable

Note: Cables must be replaced as a set

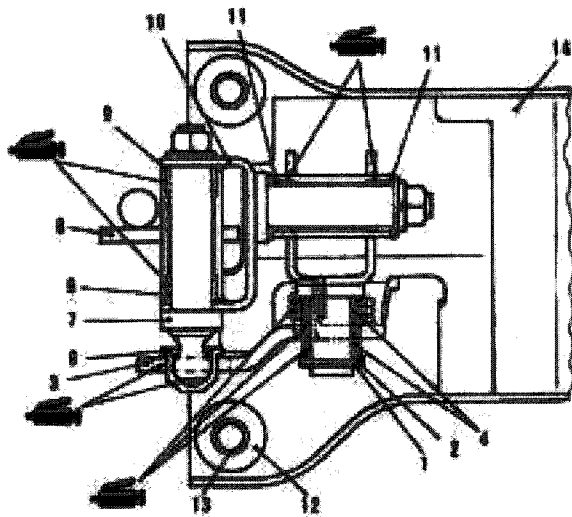
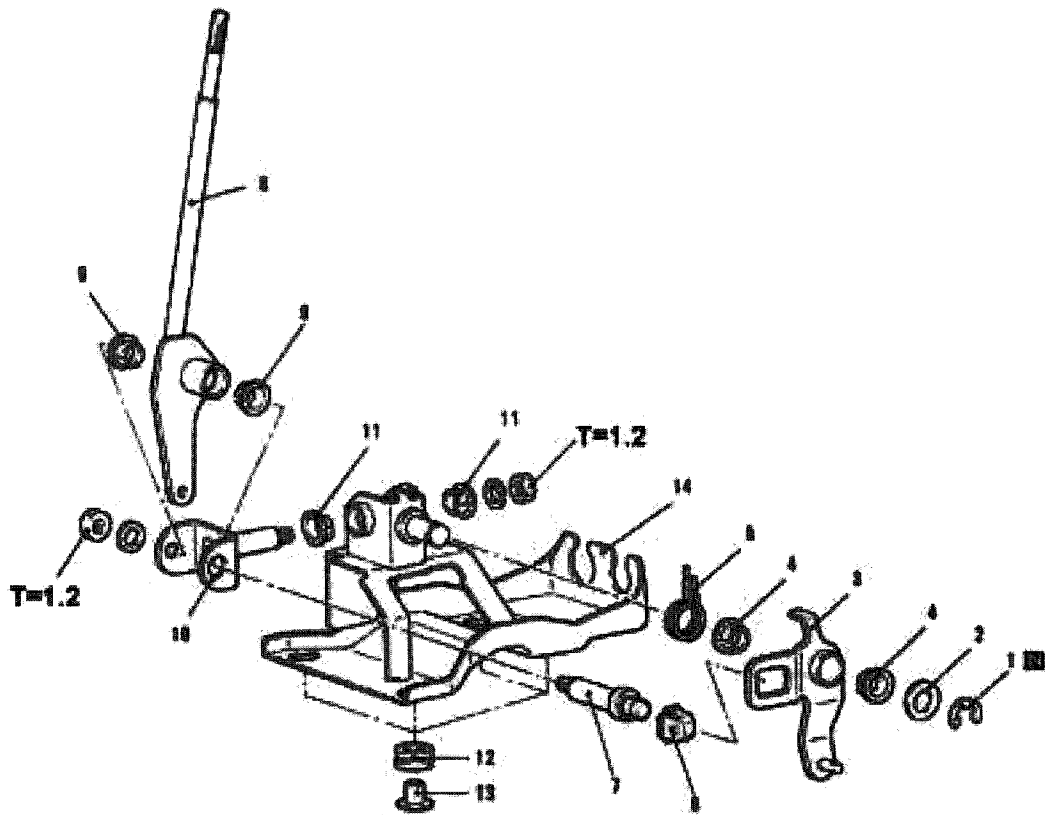
Gear Shifter Assembly



Gear Shifter Components

1. Snap Ring
2. Washer
3. Selection Lever
4. Bushing
5. Select Return Spring
6. Bushing
7. Bolt
8. Gear Select Lever Assembly

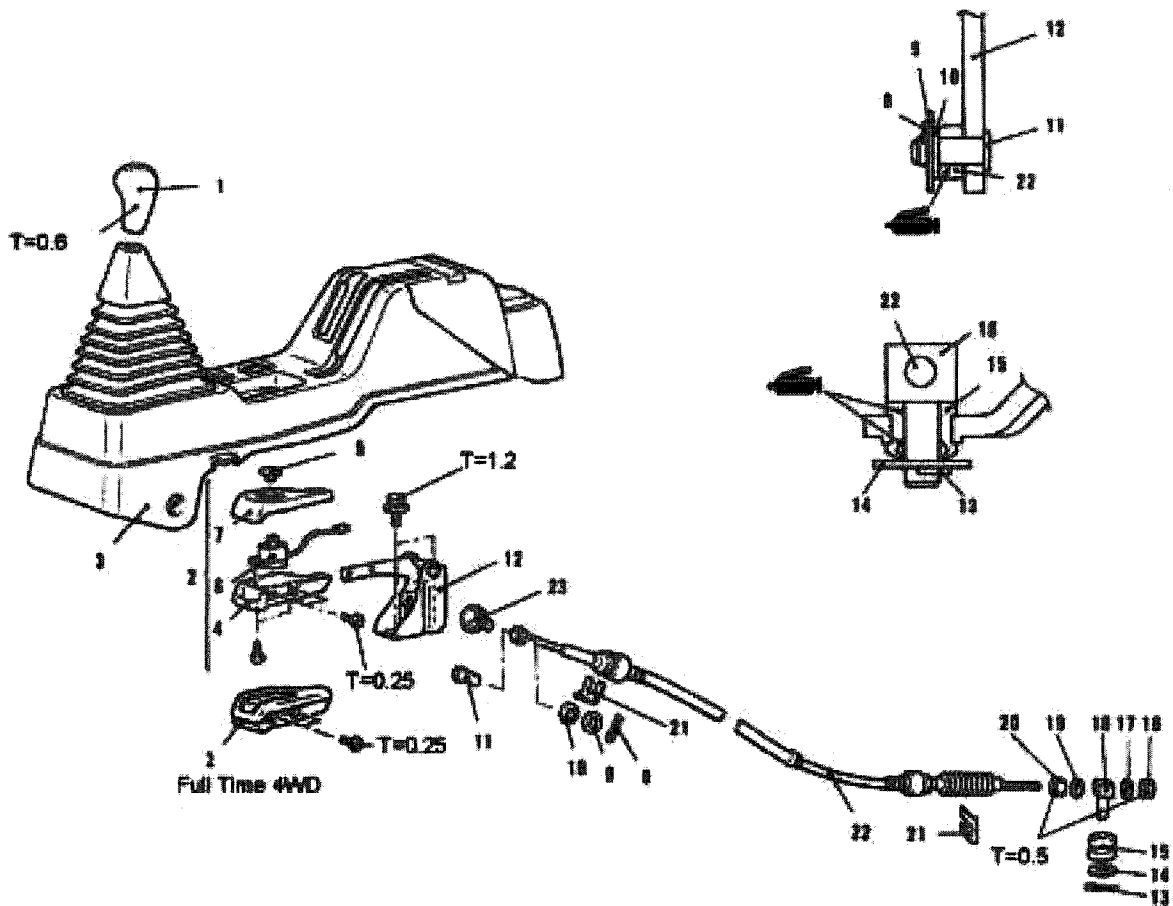
Gear Shifter Assembly



- 9. Bushing
- 10. Gear Select Lever Support
- 11. Bushing
- 12. Bushing
- 13. Pad Spacer
- 14. Gear Select Lever Bracket Assembly

Note: Use a Lithium Based White Grease on Grease Points shown above

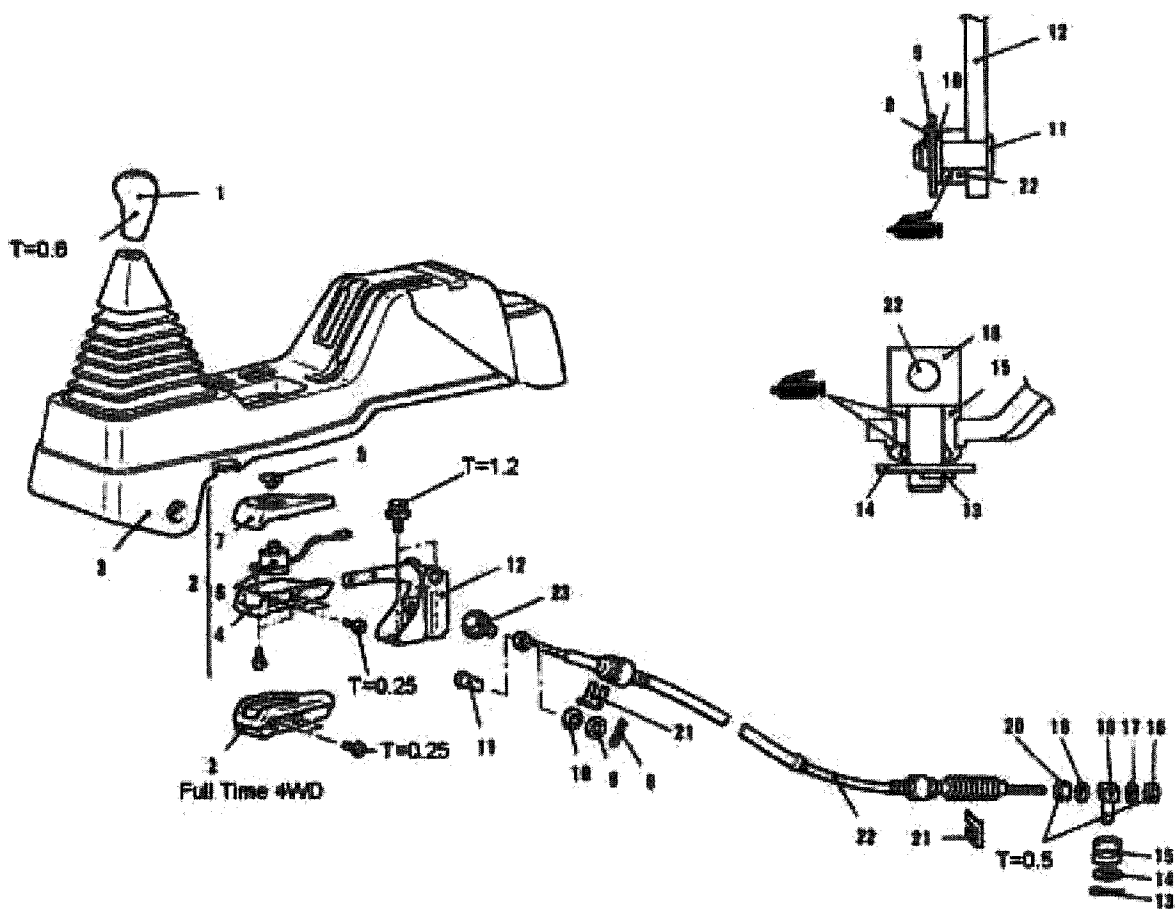
4WD Transfer Control Engagement System



4WD Engagement System Components

1. Shift Knob
2. Transfer Knob Unit
3. Shifter Cover Assembly
4. Lower Knob Casing
5. 2WD/4WD Switch Button (Part Time 4WD)
6. 2WD/4WD: Switch
7. Upper Knob Casing
8. Snap Pin
9. Washer
10. Washer
11. Clevis Pin
12. Transfer Lever Assembly
13. Snap Pin

4WD Transfer Control Engagement System

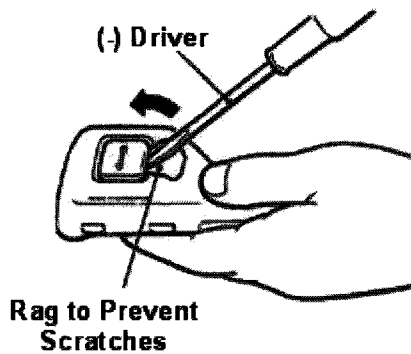


- 14. Washer
- 15. Bushing
- 16. Shim Nut
- 17. Washer
- 18. Adjuster
- 19. Washer
- 20. Jam Nut
- 21. Clip
- 22. Transfer Engagement Cable
- 23. Grommet

4WD Engagement Switch Replacement

4WD Switch Replacement

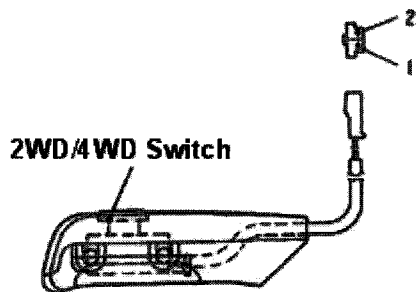
1. Remove the Two Side Screws attaching the Unit to the Transfer Lever Assembly
2. To Replace the Button only place a Rag or Paer Towel as shown to prevent Scratches during removal.
3. Use a (-) Driver and remove Button as shown.
4. Replace on reverse order.



Switch Pin Configuration

Pin 1 cross to Pin 2= Connection

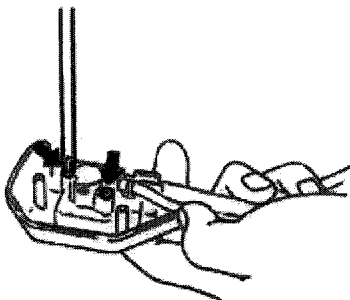
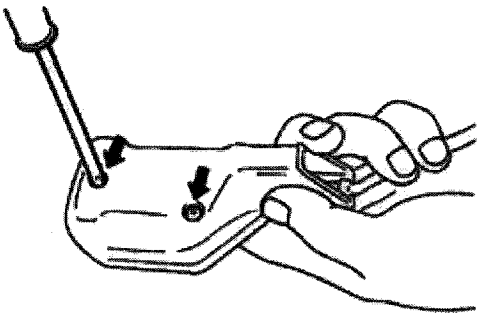
Note: If Power is Present to Pin #1 and Connection can not be made replace Switch.



Switch Replacement

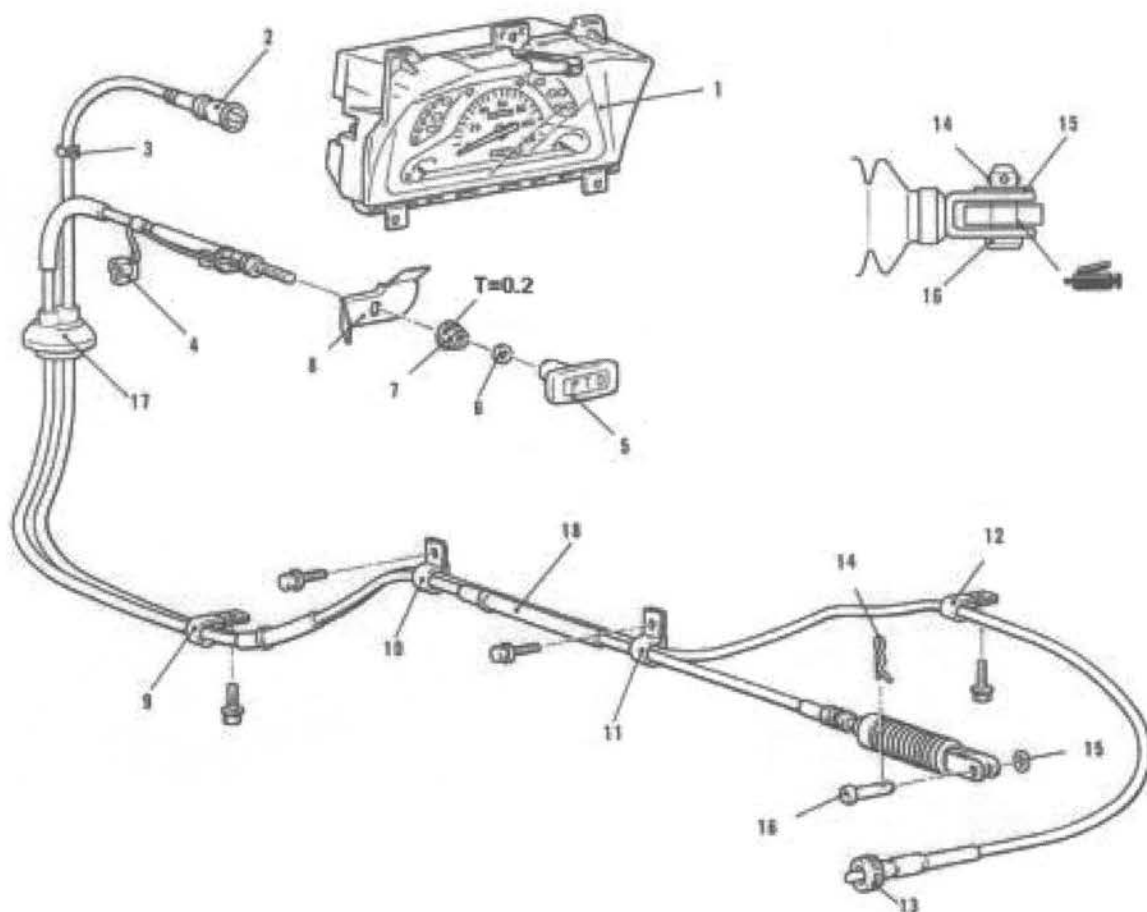
Note: (+) Driver Required

1. Remove retaining Screws as Shown
2. Remove Switch
3. Install New Switch and test Circuit



Note: Using a Jump Clip between Pins 1 & 2 shall activate the Circuit for testing purposes.

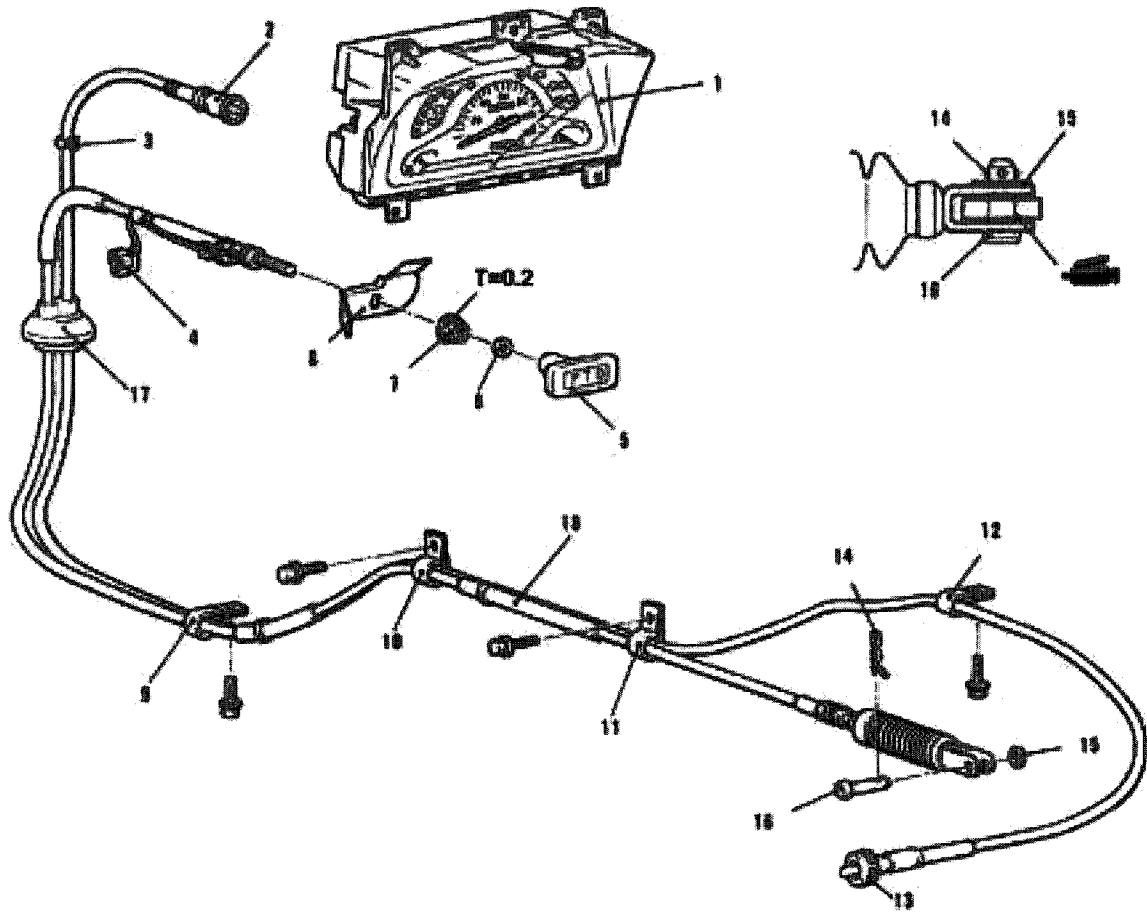
PTO Control Cable System



PTO Cable System and Routing

1. Speedometer Unit
2. Instrument Panel Speedometer Connection
3. Clamp
4. PTO Indicator Lamp Connector
5. PTO Knob
6. Shim Nut
7. Nut
8. PTO Reinforcement Bracket
9. Clamp A
10. Clamp B
11. Clamp C
12. Clamp D

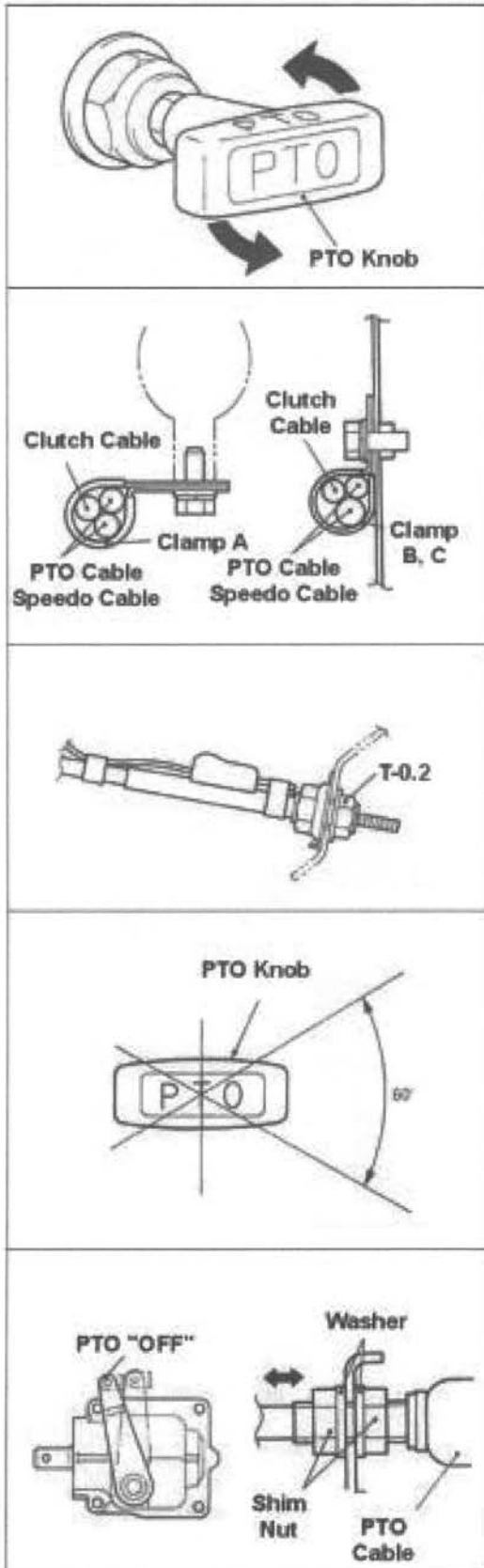
PTO Control Cable System



- 13. Speedometer to Transmission Connection
- 14. Snap Pin
- 15. Washer
- 16. Clevis Pin
- 17. Grommet
- 18. PTO & Speedometer Cable

Note: It is important to Route Cables as shown or malfunction of System Components may occur.

PTO Control



PTO Engagement

1. Turn Knob Towards the Left
2. Loosen Shim Nut if Handle is too Tight

Cable Routing

Note: Route Cables through Clamps (A,B,C) as shown. Improper Routing can cause binding and System Failure.

Shim Nut Torque: 0.2kgm

Loosen Shim Nut when positioning is required

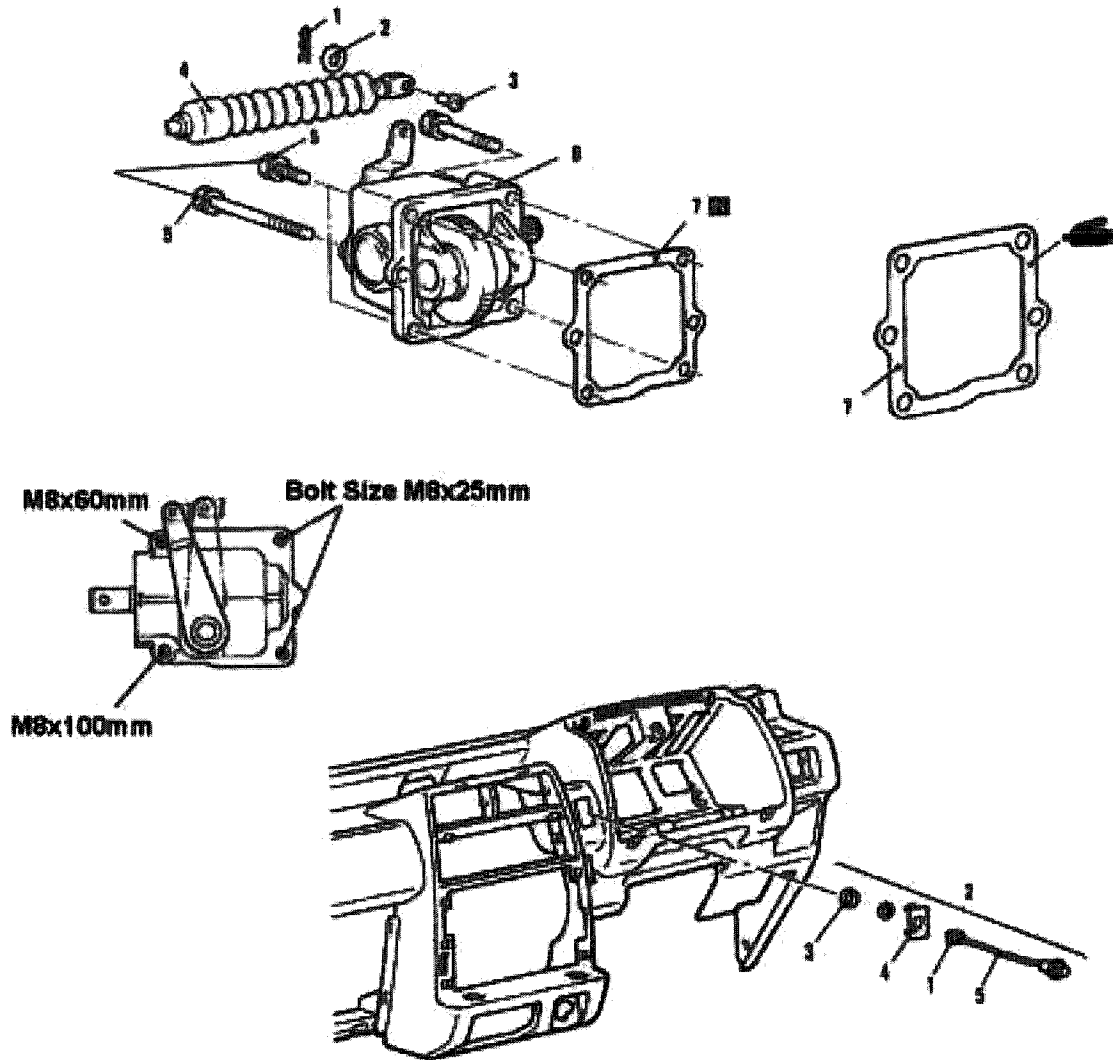
PTO Knob Turning Range

Note: PTO must Engage or Disengage within a 60 Degree turning Radius.

PTO Unit

Note: To set proper Engagement of PTO Unit adjust Shim Nut as shown in the Diagram on the Left.

PTO Drive Unit & Indicator Lamp



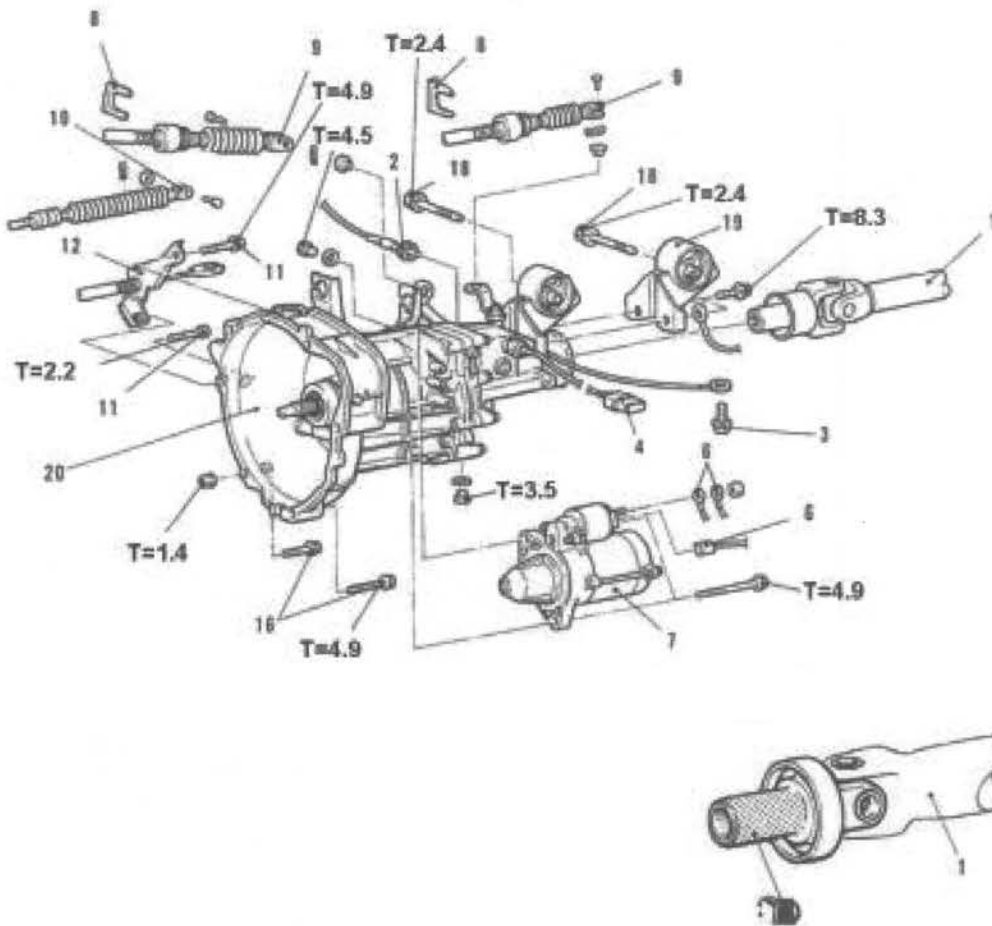
Components: Drive Unit

1. Snap Pin
2. Washer
3. Clevis Pin
4. PTO Cable
5. PTO
6. PTO Gasket

Components: PTO Engagement Indicator Lamp

1. Indicator Lamp Connector
2. Indicator Lamp Assembly
3. Lock Nut
4. Panel
5. Lamp Unit

Manual Transmission Removal 2WD



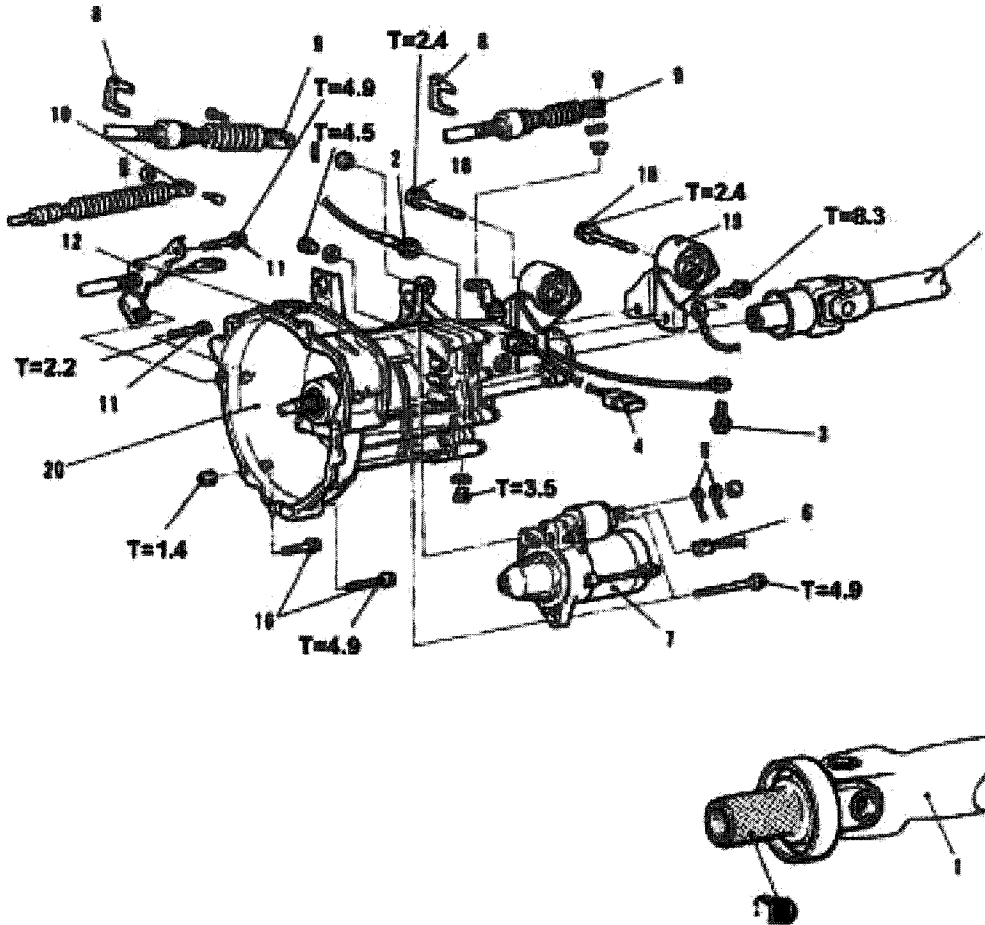
Transmission Removal 2WD

Note: Drain Transmission Oil Before removal

Note: Prepare and Position Transmission Jack as shown in the beginning of this Manual.

1. Remove Driveshaft
2. Disconnect Speedometer Cable
3. Remove Ground Cable
4. Disconnect Backup Lamp Connector
5. NA
6. Disconnect Starter Connections
7. Remove Starter Motor
8. Remove Clip
9. Disconnect Transmission Control Cable
10. Disconnect PTO Cable (PTO Option)
11. Remove Transmission Upper Mount Bolt

Manual Transmission Removal 2WD



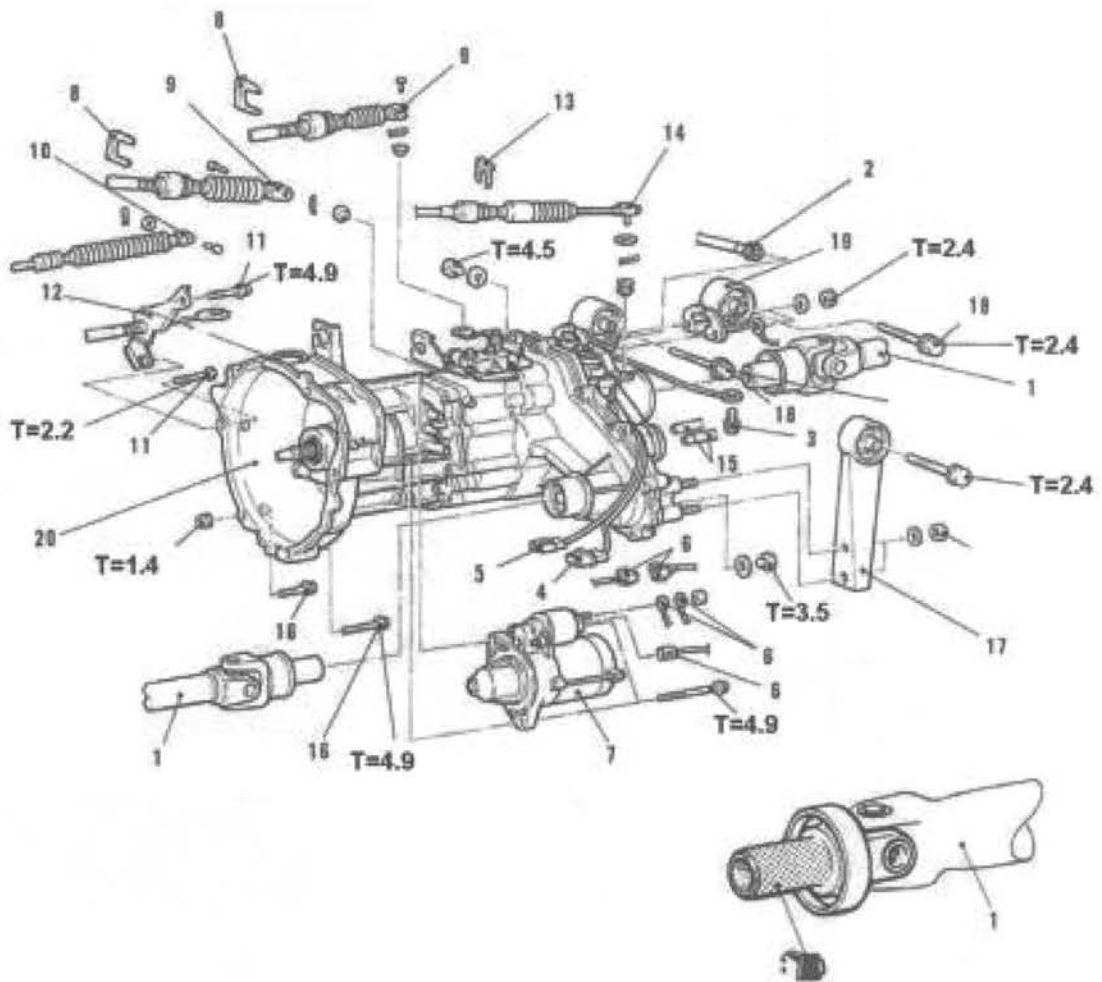
12. Remove Clutch Cable Bracket
13. NA
14. NA
15. NA
16. Remove Lower Bell housing Bolts
17. NA
18. Remove rear Mount Bolt
19. Remove Mount (Truck-Dump)
20. Lower Transmission from Vehicle

Note: Inspect Rubber Mounts before Installation. Vehicles with over 100,000 Kilometers the Rear Mount must be replaced.

Note: Replace Clutch if Vehicle has over 80,000 Kilometers

Note: See the beginning of this Chapter for Oil Capacities.

Manual Transmission Removal 4WD



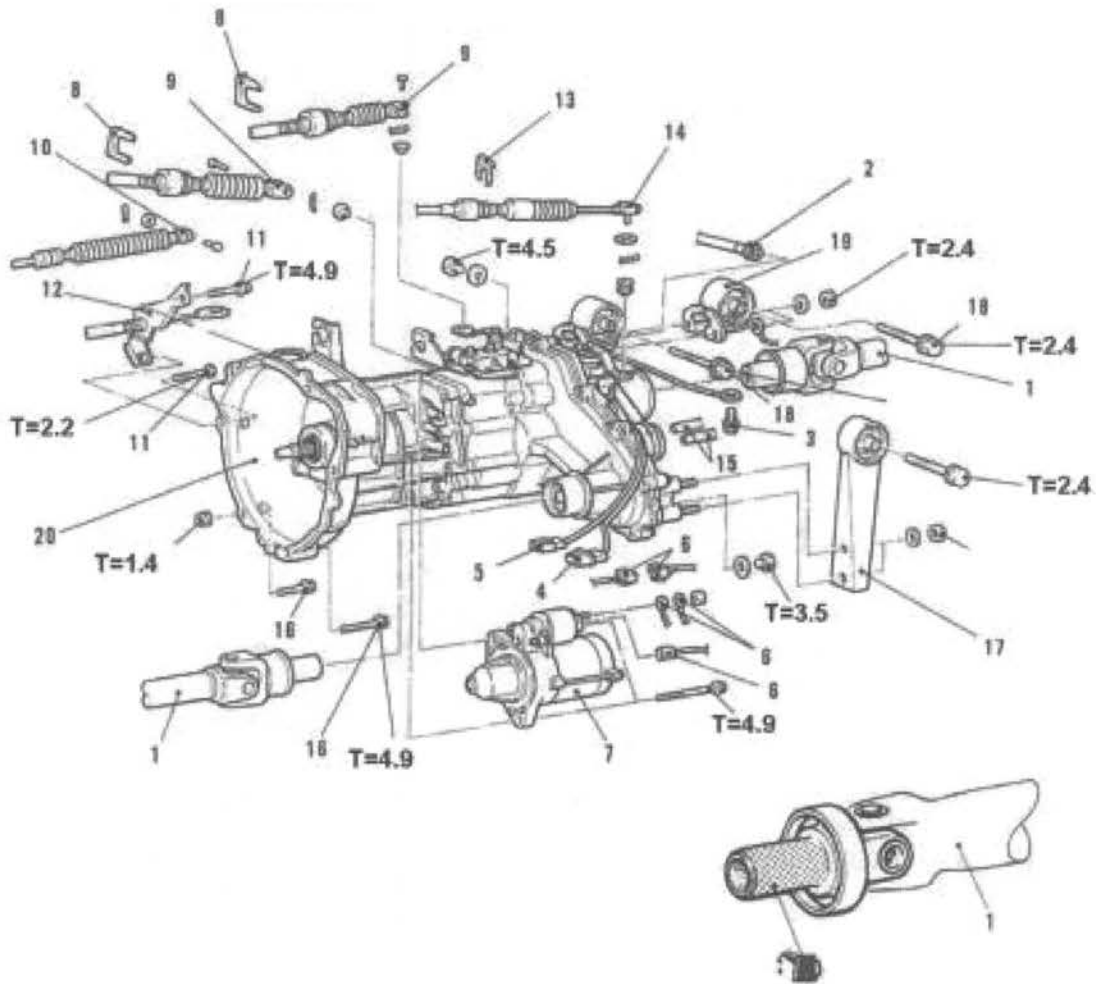
Transmission Removal 4WD

Note: Drain Transmission Oil Before removal

Note: Prepare and Position Transmission Jack as shown in the beginning of this Manual.

1. Remove Front and Rear Driveshaft's
2. Disconnect Speedometer Cable
3. Remove Ground Cable
4. Disconnect Backup Lamp Connector
5. Disconnect 2WD/4WD Engagement Switch Connect (Part Time 4WD)
6. Remove Starter Motor Connections
7. Remove Starter Motor
8. Remove Clip
9. Disconnect Transmission Control Cable
10. Disconnect PTO Cable (PTO Vehicles)
11. Remove Transmission Upper Bell housing Retaining Bolts
12. Remove Clutch Cable Bracket

Manual Transmission Removal 4WD



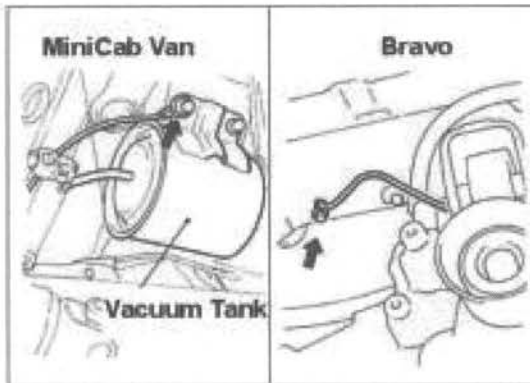
13. Remove Clip
14. Disconnect Transfer Cable
15. Disconnect Vacuum Hose (Part Time 4WD)
16. Remove Transmission Lower Bell housing Bolt
17. Remove Transmission Mount
18. Remove Rear Mount Bolt
19. Remove Rear Mount
20. Lower and Remove Transmission
21. Installation in reverse order

Note: Inspect Rubber Mounts before Installation. Vehicles with over 100,000 Kilometers the Rear Mount must be replaced.

Note: Replace Clutch if Vehicle has over 80,000 Kilometers

Note: See the beginning of this Chapter for Oil Capacities.

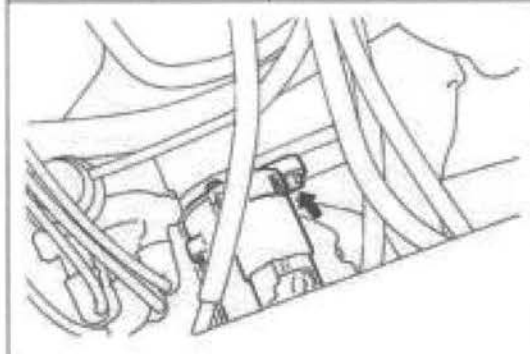
Manual Transmission Installation Key Notes 4WD



Note: These Diagrams Highlight common Issues for Remove and Installation of the transmission.

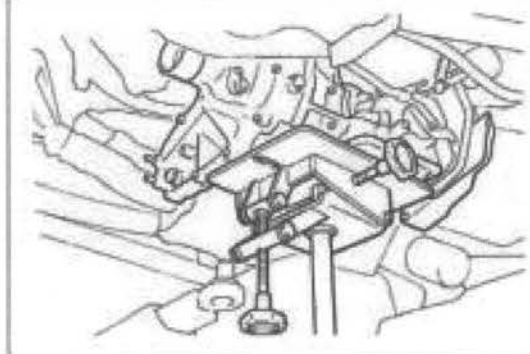
Ground Cable

Note: Improper Installation or missing Ground Cables can Cause Electrical System malfunction. Use the Diagram on the Left for proper location of the Ground Cable.



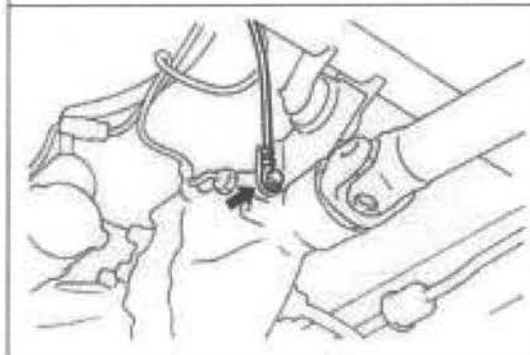
Starter Removal Notice

1. Remove Inspection Panel
2. Remove the Bolt shown in the Diagram first. During installation install this Bolt first.



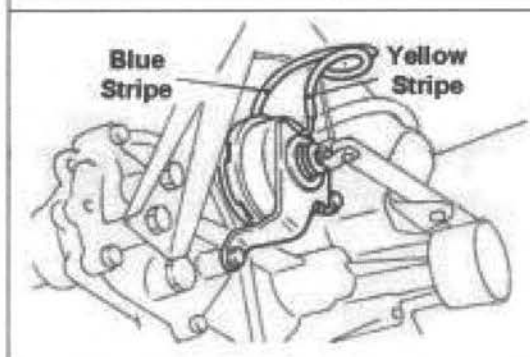
Proper Jack Position

Note: Always use proper Jacking Equipment during Transmission removal. Damage can occur if not properly removed.



Transmission Mount Ground

Note the proper location for the rear Transmission Ground Cable. Replace corroded or missing Cables.



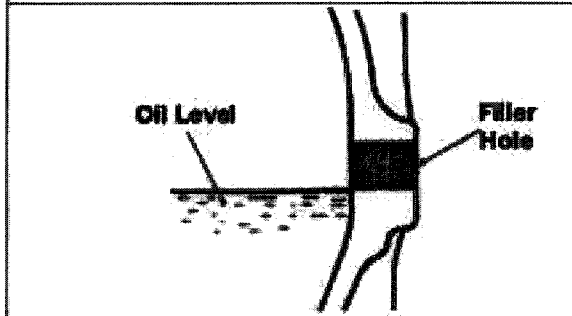
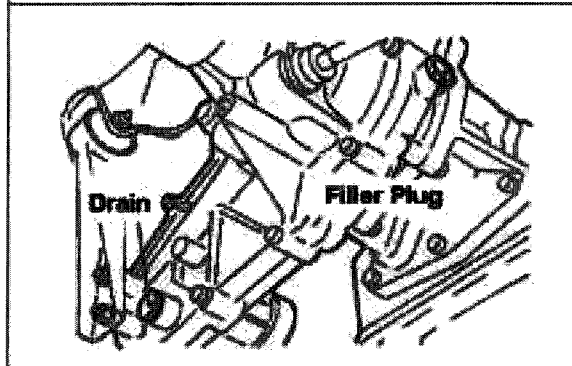
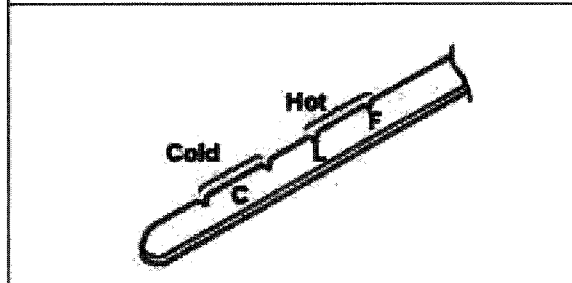
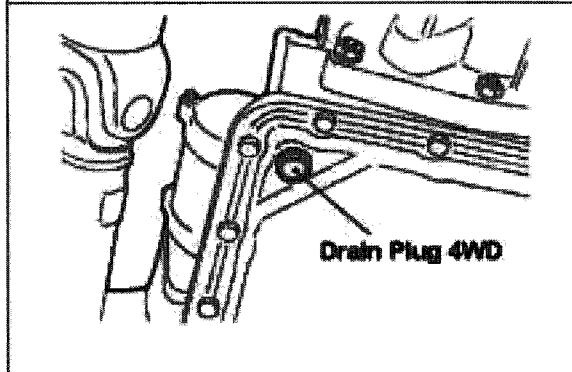
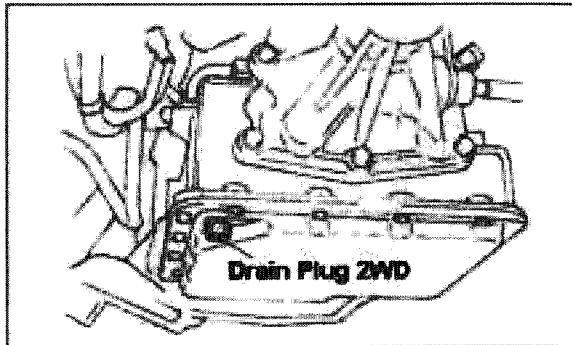
Vacuum Hose (Part Time 4WD)

Note: Improper installation of the Part Time 4WD Vacuum Hose can cause malfunction. Use the color coded Hose information as shown on the Left for proper installation.

Note: Replace Hoses if Vehicle has over 85,000 Kilometer or 4 Years or Older.

Notes

Automatic Transmission Capacities & ATF Fluid Replacement



ATF Capacities

Automatic Transmission: 2.9 Liters

Converter Capacity: 0.8 Liters

Type ATF

Transfer Case Oil: 0.6Liters

Gear Oil 75/85W

1. Remove Drain Plug. Let Transmission Drain for minimum 10 Minutes. If Ambient Temperature is below 15° Drain for 12-15min.
2. Replace Darin Plug. Fill with 2.1 Liters
3. Torque Drain Plug: 2.3kgm

Note: Total ATF Capacity $2.9 - 0.8 = 2.1$ Liters. Do not Overfill. Damage to the transmission can occur.

Fluid Level Gage

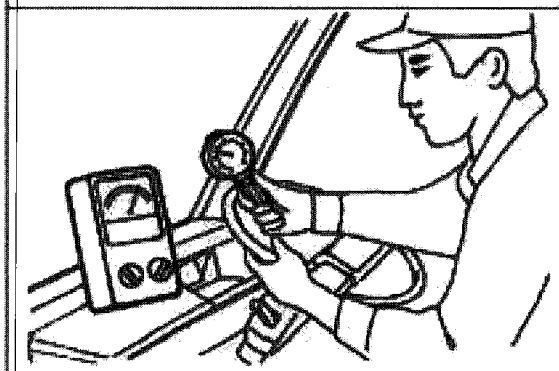
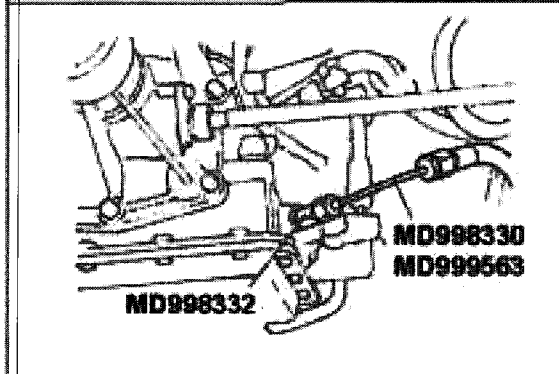
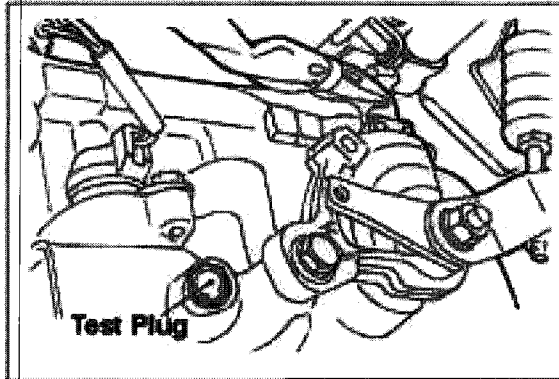
Warm Engine to Operating Temperature: 70-80°C. Remove and inspect ATF Level Gage Fluid Level. Add Fluid as required.

4WD Transfer Case Oil

Note: Do not add ATF Oil into the 4WD Transfer Case. Use only Gear Oil 75W/85W.

1. Remove Filler Plug
2. Remove Drain Plug
3. Drain Transfer Case. Allow Oil to Drain a minimum 10min. If Ambient Temperature is below 15° Drain for 12-15min.
4. Install Drain Plug: Torque 4.0kgm
5. Fill Oil to Level as shown in the Left Diagram.

Automatic Transmission Oil Pressure Test Procedure



Oil Pressure Test

Note: Warm Vehicle to Normal Operating Temperature: 70-80°C

1. Locate Test Plug as shown on the Left
2. Remove Test Plug
3. Connect the following Test Adapters
 - MD998332
 - MD998330
 - MD999563

Note: If Mitsubishi Tools are not available use a similar Hydraulic Line Pressure Adapter.

Pressure Range

4. Apply Side Brake. Start Vehicle in "P"
5. With Foot on Brake place Gear Selector in "D" at Idle.

Pressure Range: 5.3-6.8kg/cm²
6. With Foot on the Brake place Gear Selector in "R" at Idle.

Pressure Range: 12.4-15.7kg/cm²

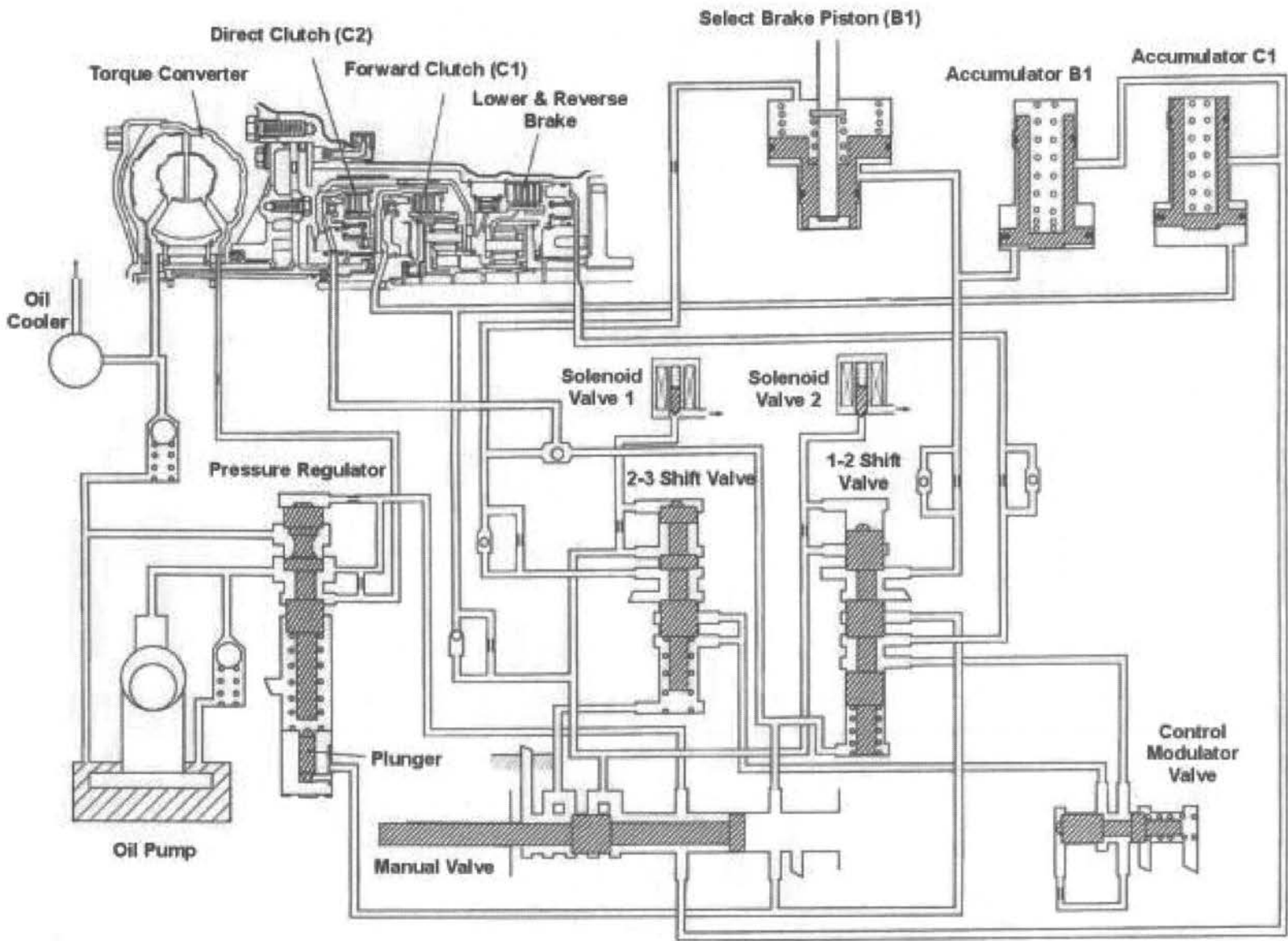
Common Problem Diagnostics

Gear Position	Problem
D or R Range: High Pressure	Bad Regulator Valve
D or R Range: Low Pressure	Oil Pump Regulator Valve
D Range: Low Pressure	Forward Clutch
R Range: Low Pressure	Direct Clutch Low & Reverse Brake

Note: Verify Idle Speed is Correct before Testing

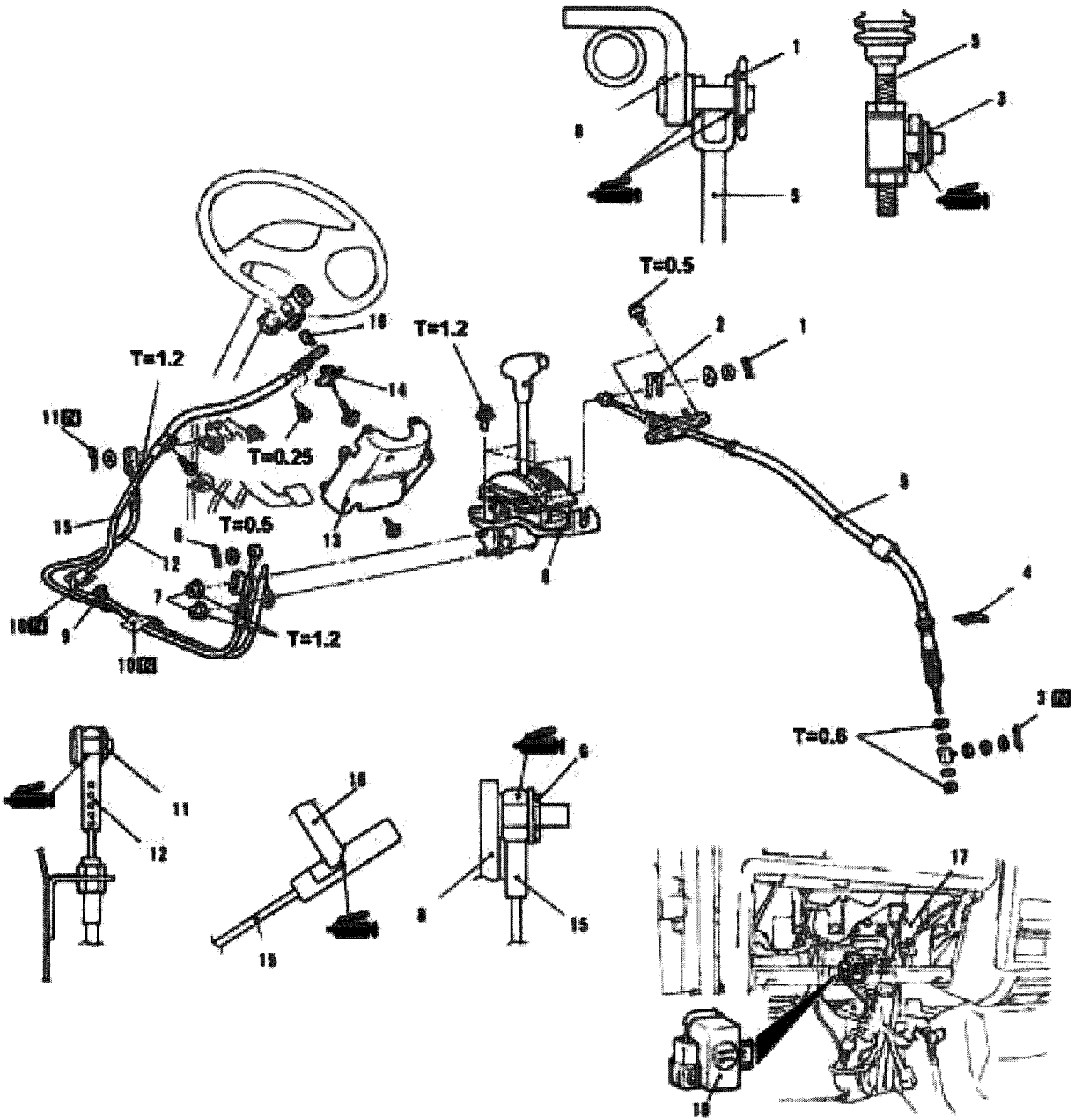
Note: If ATF is Dirty or Contaminated replace ATF & Re-test

*See following Diagram for ATF Circuit Diagnostics



Transmission ATF Circuit Diagram

Automatic Transmission Shift & Controls

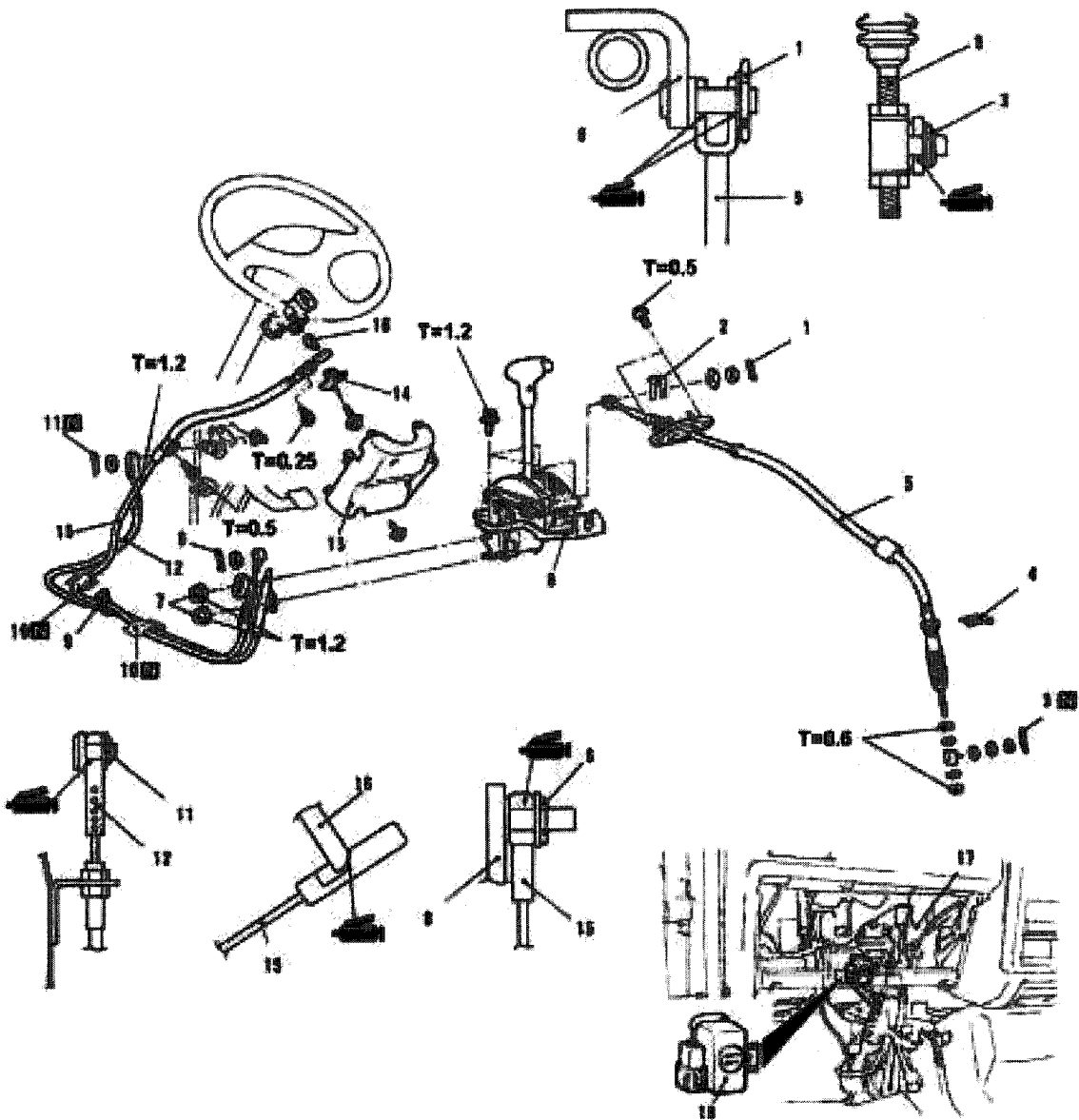


Shifter Cable Components & Routing

Note: Use Lithium Based Grease at Grease Points shown above.

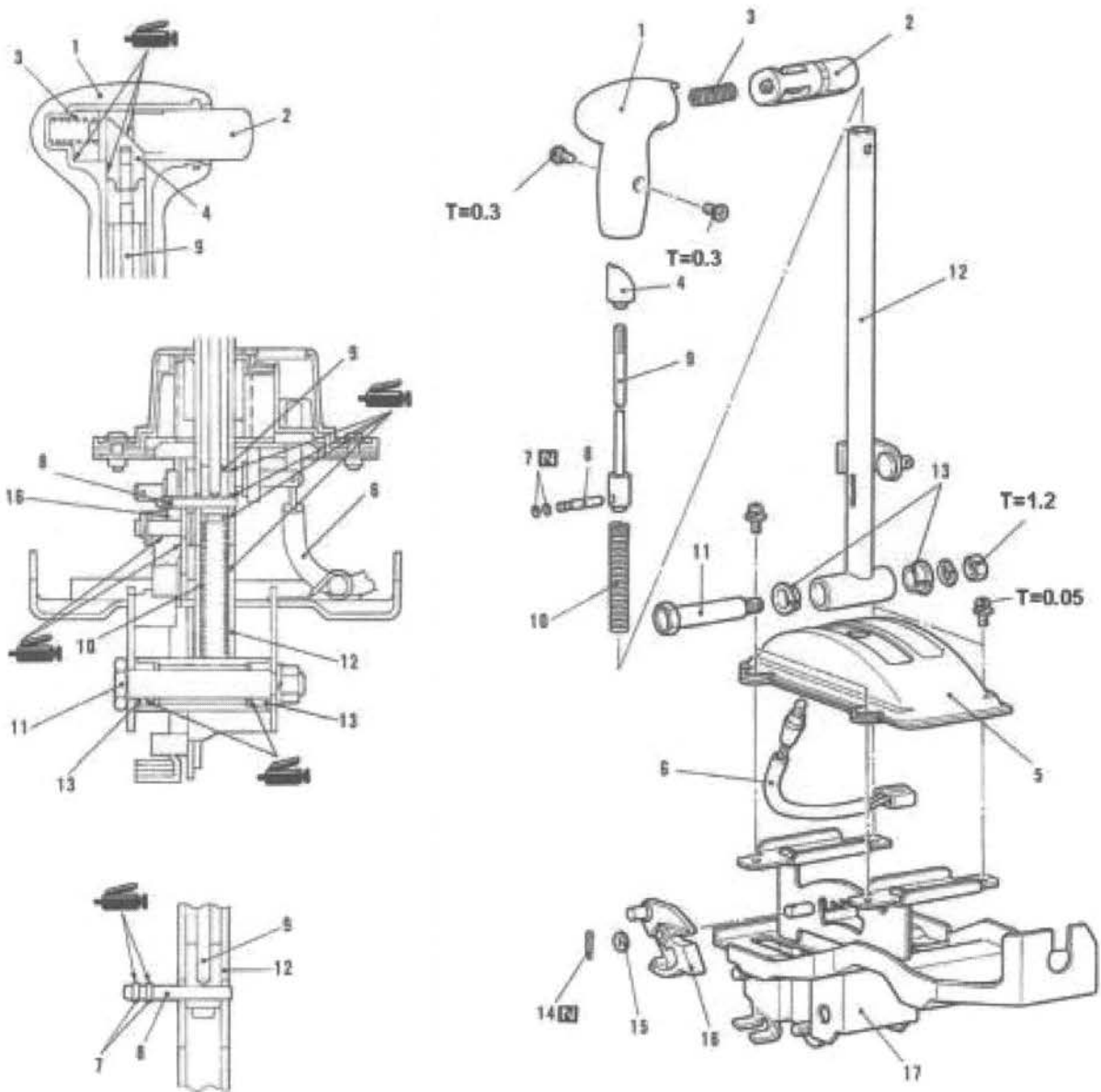
1. Snap Pin
2. Clip
3. Split Pin
4. Clip
5. AT Control Cable
6. Snap Pin
7. Shift Lock Key Interlock Cable Attachment Nuts

Automatic Transmission Shift & Controls



8. A/T Lever Assembly
9. Cable Band
10. Tube
11. Split Pin
12. Shift Lock Cable
13. Lower Column Cover
14. Lever Cover
15. Key Interlock Cable
16. Lock Pin
17. Glove Box
18. Reverse (R) Sound Beeper

Automatic Transmission Shifter Assembly

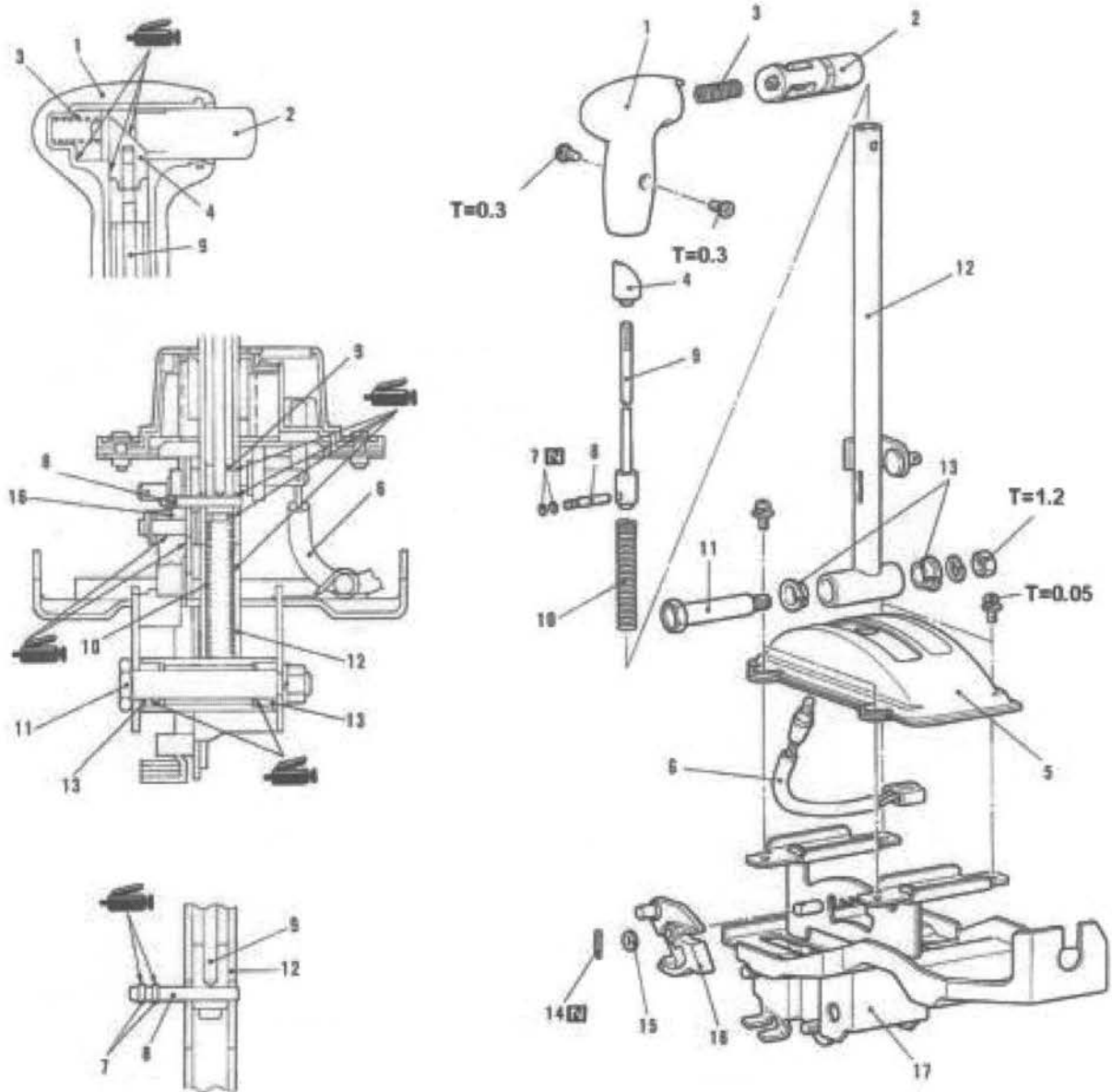


Shifter Components & Grease Points

Note: Use Lithium Based Grease at Grease Points shown above.

1. Shift Lever Knob
2. Button
3. Spring
4. Sleeve
5. Indicator Panel Assembly
6. Light Socket Assembly
7. O Ring
8. Pin
9. Rod Assembly
10. Spring

Automatic Transmission Shifter Assembly

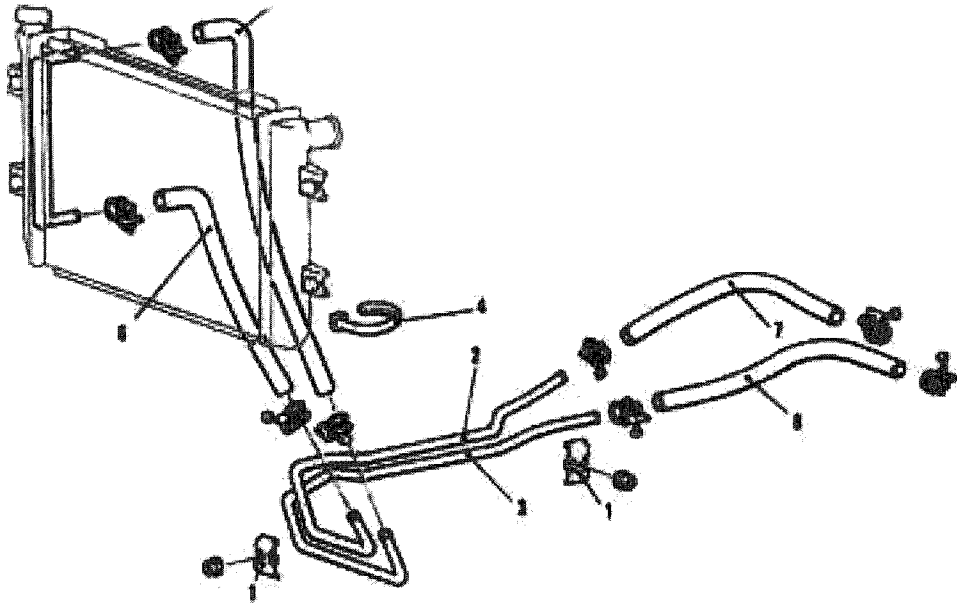


- 11. Lever Attachment Bolt
- 12. Lever Assembly
- 13. Bushing
- 14. Split Pin
- 15. Washer
- 16. Lock Cam
- 17. Plate Assembly

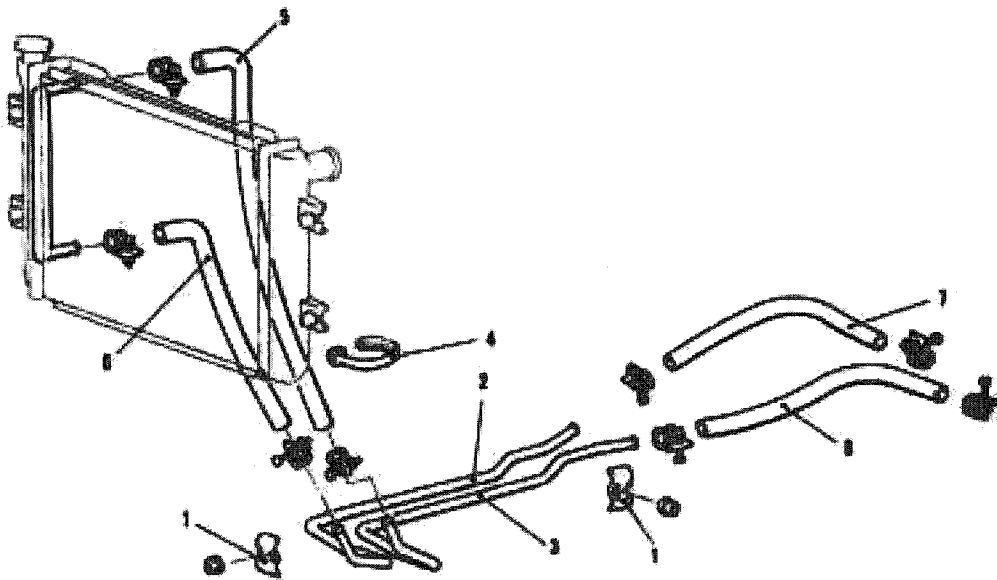
Note: See Parts Catalogue for Updates or Changes in Components

ATF Oil Cooler Hose Routing 2WD/4WD

2WD



4WD



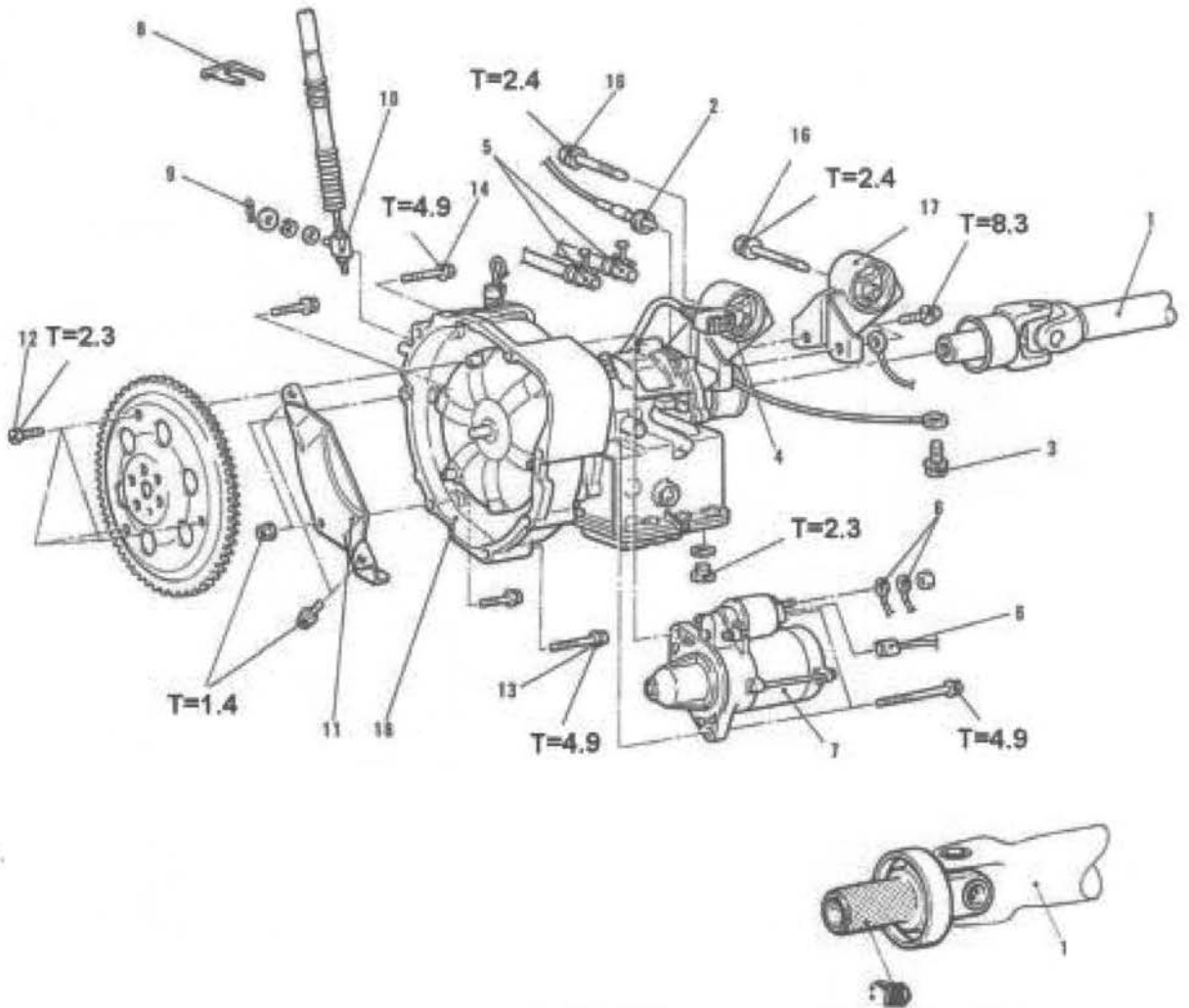
Component Identification

1. Oil Cooler Pipe Attachment Clamp
2. Return Line Pipe
3. Feed Line
4. Cable Band
5. Return Hose
6. Feed Hose
7. Return Hose
8. Feed Hose

Note: Rubber Hoses must be replaced if Vehicle has over 65,000Kilometers once removed.

Automatic Transmission Removal 2WD

2WD



Transmission Removal 2WD

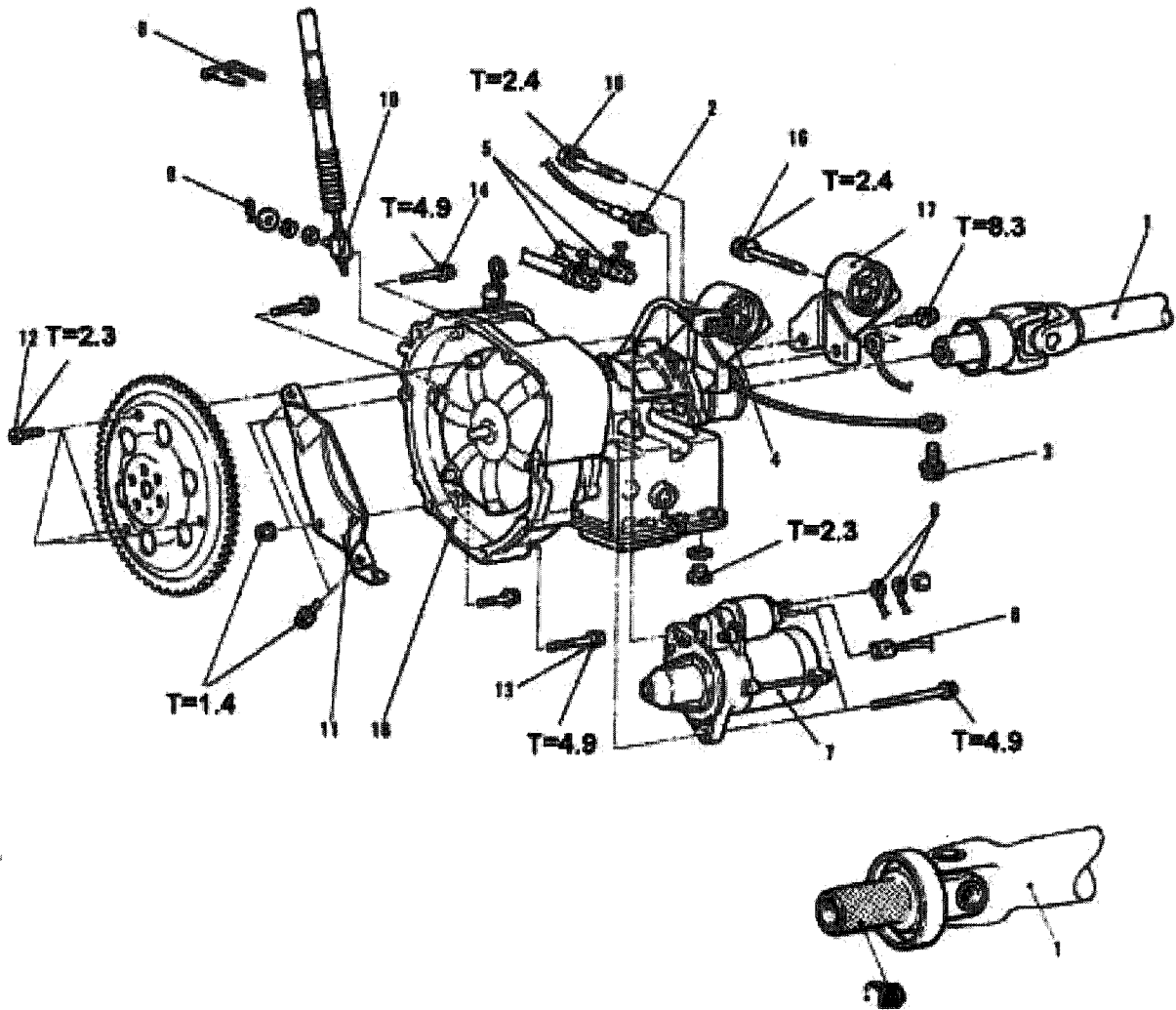
Note: Drain Transmission ATF before Removing Transmission.

Note: Prepare and position Transmission Jack.

1. Remove Driveshaft and Plug Transmission Tail End.
2. Disconnect Speedometer Cable.
3. Remove Ground Wire.
4. Disconnect Inhibitor Switch Connector.
5. Disconnect Oil Cooler Hose.
6. Disconnect Starter harness Connections.
7. Remove Starter.
8. Remove Clip
9. Split Pin
10. Disconnect A/T Control Cable.

Automatic Transmission Removal 2WD

2WD



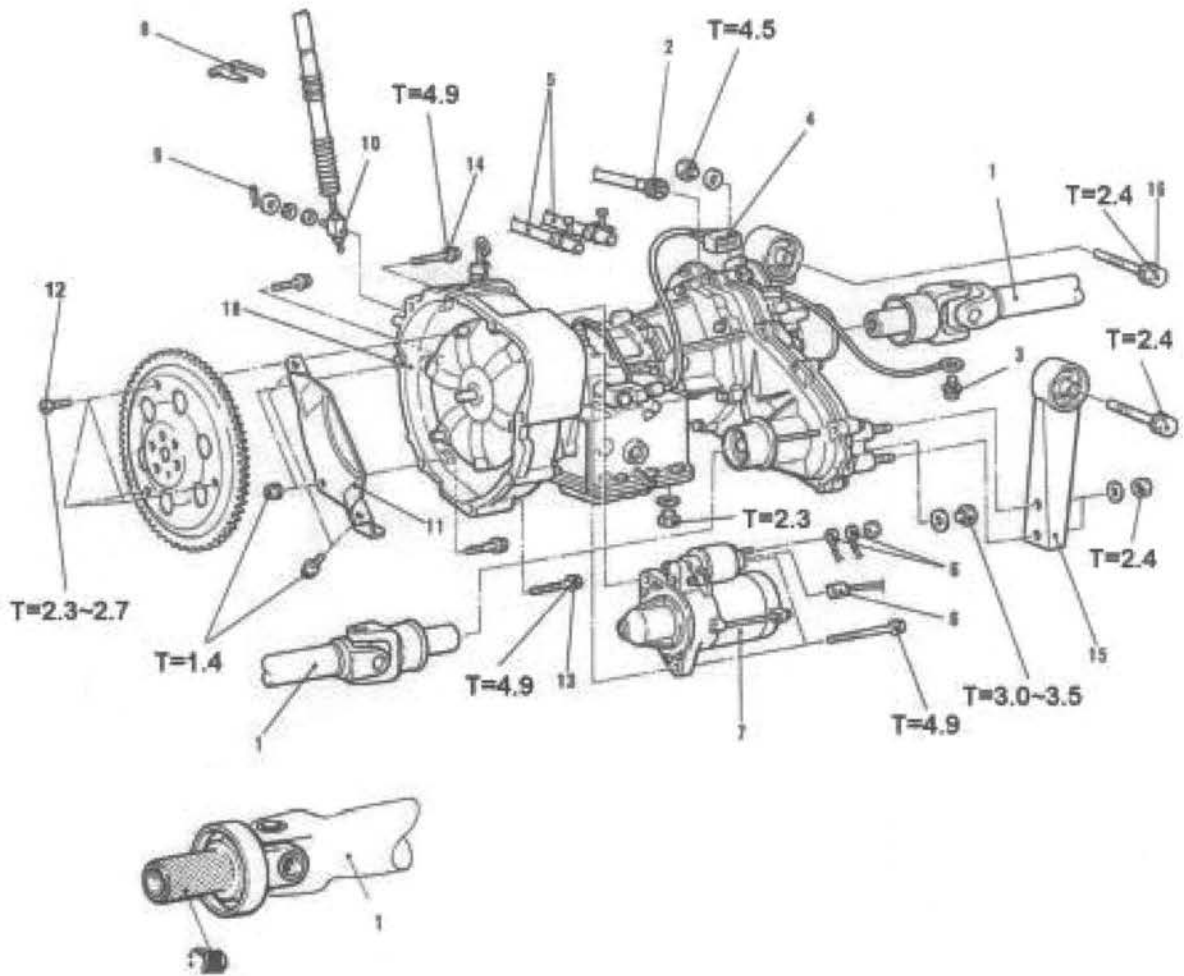
11. Remove Bell housing Dust Cover.
12. Remove Flex Plate to Torque Converter Bolts
13. Remove Bell housing Lower retaining Bolts.
14. Remove Bell housing Upper retaining Bolts.
15. NA
16. Remove Rear Mount Bolt.
17. Remove Rear Mount.
18. Lower Transmission from Vehicle.
19. Install in Reverse Order.

Note: Always replace ATF with new Fluid.

Note: If Draining Torque Converter refill with 0.8 Liters before Installation. Do not install Converter Dry. Failure will occur.

Automatic Transmission Removal 4WD

4WD



Transmission Removal 4WD

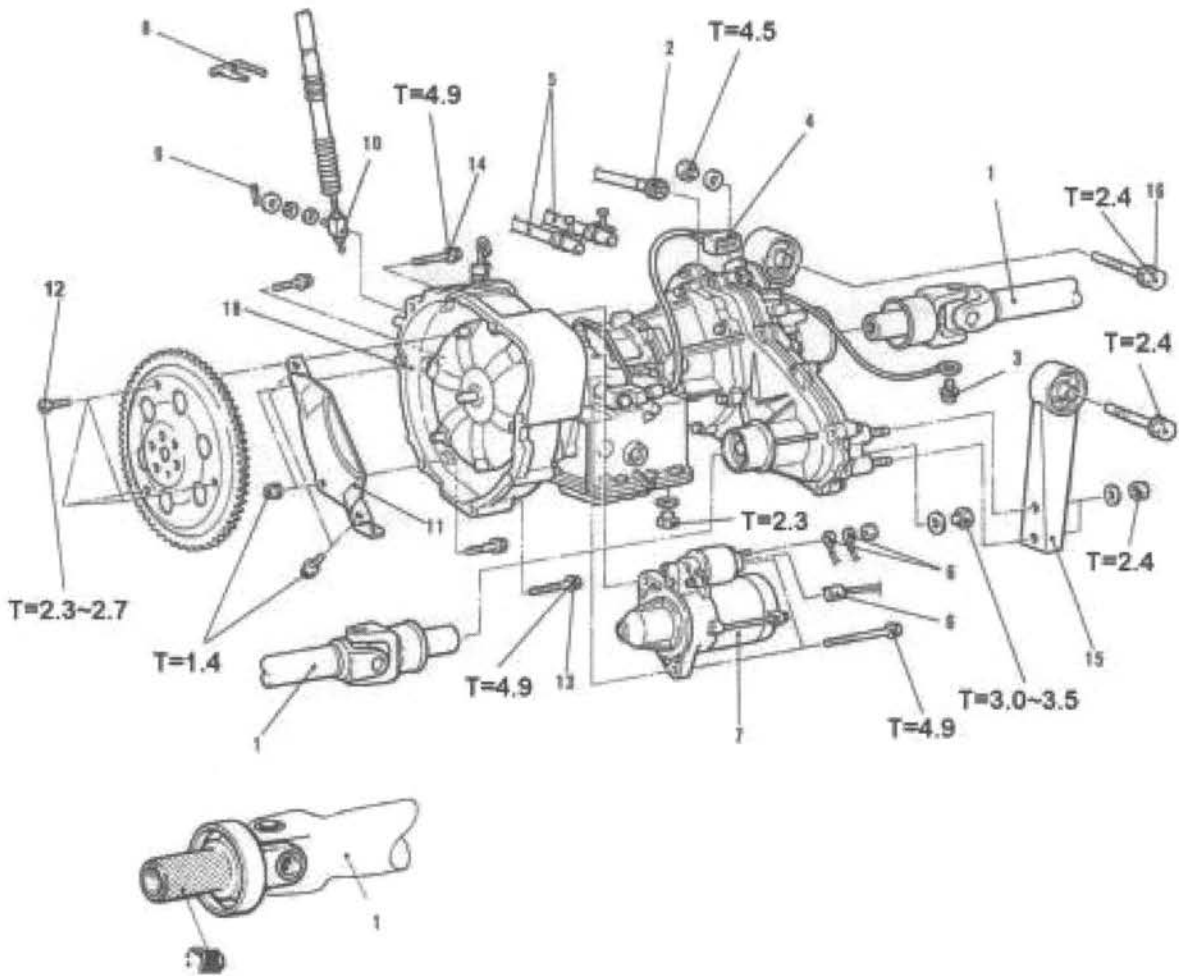
Note: Drain Transmission ATF before Removing Transmission.

Note: Prepare and position Transmission Jack.

1. Remove Front & Rear Driveshaft's
2. Disconnect Speedometer Cable
3. Remove Ground Cable
4. Disconnect Inhibitor Switch Connector
5. Disconnect Oil Cooler Hose
6. Disconnect Starter Harness
7. Remove Starter Motor
8. Remove Clip
9. Remove Split Pin
10. Disconnect Control Cable

Automatic Transmission Removal 4WD

4WD

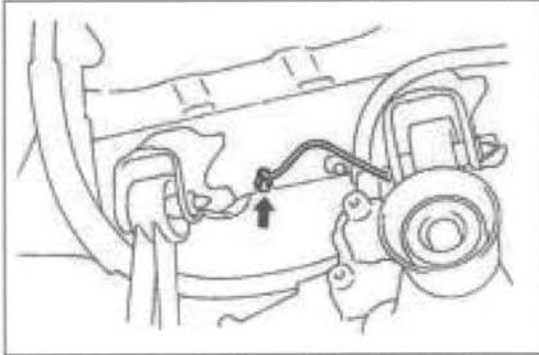


11. Remove Bell housing Dust Cover
12. Remove Torque Converter Attachment Bolts
13. Remove Lower Bell housing Bolts
14. Remove Upper Bell housing Bolts
15. Remove Mount
16. Remove Rear Mount Bolt
17. Remove Rear Mount
18. Lower and Remove transmission
19. Installation in reverse

Note: Always replace ATF with new Fluid.

Note: If Draining Torque Converter refill with 0.8 Liters before Installation. Do not install Converter Dry. Failure will occur.

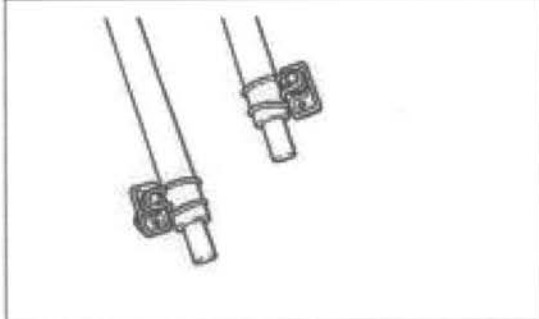
Automatic Transmission Removal & Installation Notes



Important Notes

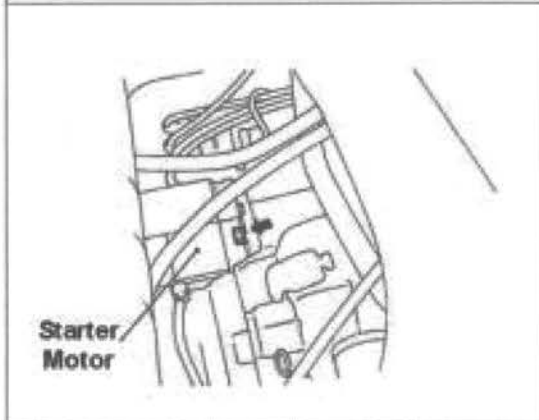
Transmission Mount Ground

Note the proper location for the rear Transmission Ground Cable. Replace corroded or missing Cables.



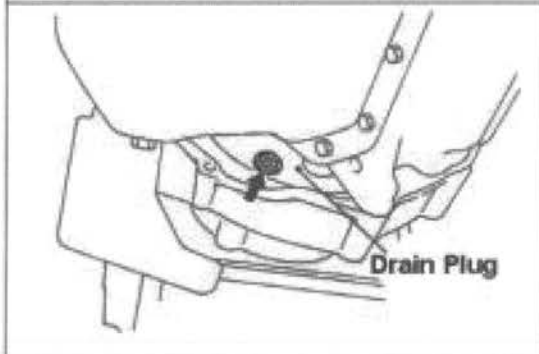
Proper ATF Coolant Line Installation

Note: Proper Installation of High Pressure ATF Coolant Lines must be secured by recommended Clamps. Failure of ATF Lines can cause Transmission failure.



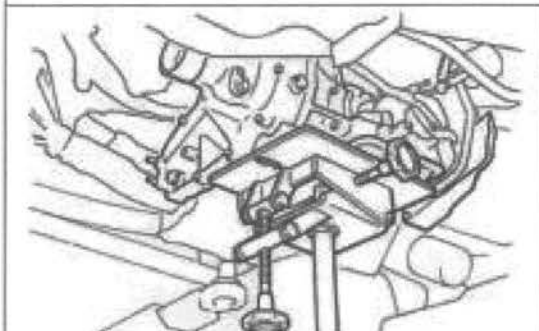
Starter Removal Notice

3. Remove Inspection Panel
4. Remove the Bolt shown in the Diagram first. During installation install this Bolt first.



Torque Converter Attachment

Note: Only correct attachment Bolts may be used when attaching Torque Converter. Failure to use supplied Bolts can lead to mechanical failure and Parts breakage. Improper Bolts may jam against the Dust Shield. See Parts Catalogue for replacement Bolts (3).



Proper Jack Position

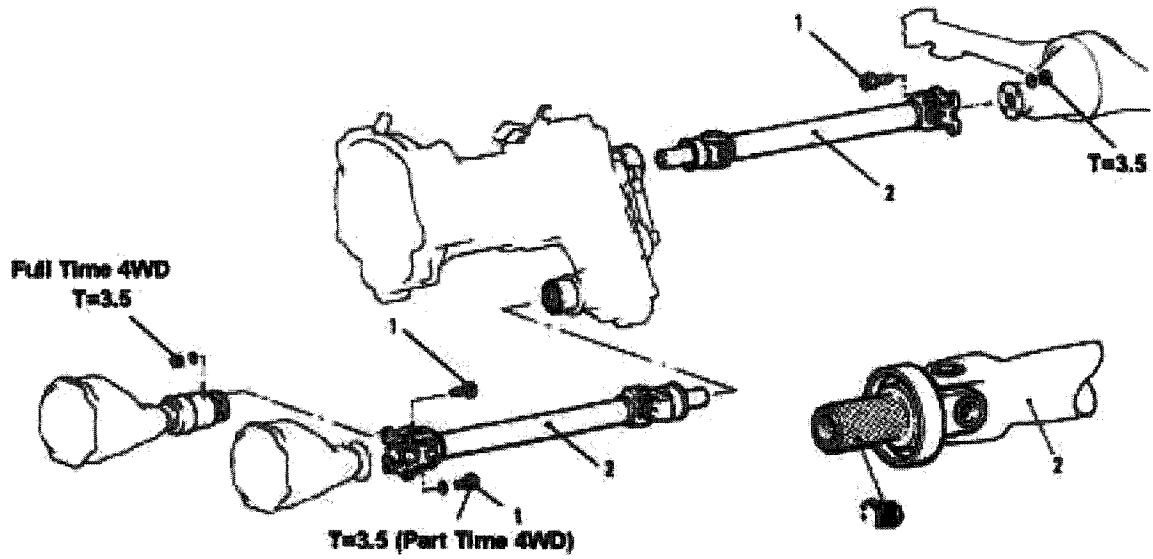
Note: Always use proper Jacking Equipment during Transmission removal. Damage can occur if not properly removed.

Chapter 9

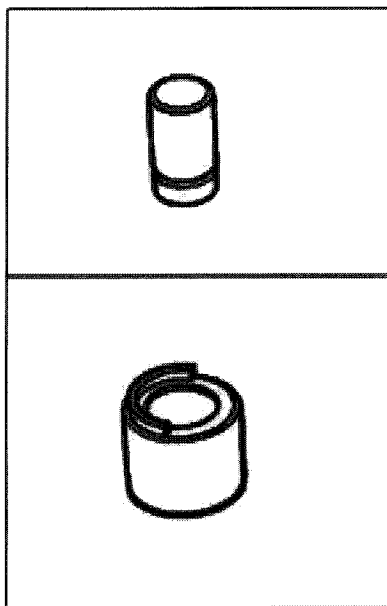
Driveline Components

- 117. Driveshaft 2WD-4WD Components
- 118. Driveshaft Inspection & Removal
- 119. Universal Joint Replacement
- 120. Front Axle Hub & Knuckle: Drum & Disk Type 2WD
- 121. Knuckle Arm Removal 2WD
- 122. Front Axle Hub & Knuckle: 4WD
- 123. Front Hub & Knuckle Disassembly 4WD
- 124. Front Drive Axles 4WD
- 125. Axle & CV Joint Rebuild
- 126. 4WD HCU Coupling Unit
- 127. Front Differential Mounts
- 128. Front Differential Overhaul
- 129. Free Wheel Clutch Assembly: Part Time 4WD
- 130. Free Wheel Clutch Internal Components: Part Time 4WD
- 131. Free Wheel Clutch: Vacuum Line & Component System
- 132. Rear Axle General Inspection
- 133. Rear Axle Assembly Removal (Differential Assembly)
- 134. Rear Axle Removal
- 135. Rear Axle Shaft & Bearing Removal
- 136. Rear Differential Carrier Removal
- 137. Rear Differential Carrier Components: STD Carrier
- 138. Rear Differential Carrier Components: LSD Carrier
- 139. Rear LSD Case Components

Driveshaft 2WD-4WD Components



1. Retainer Bolts
2. Driveshaft Assemblies

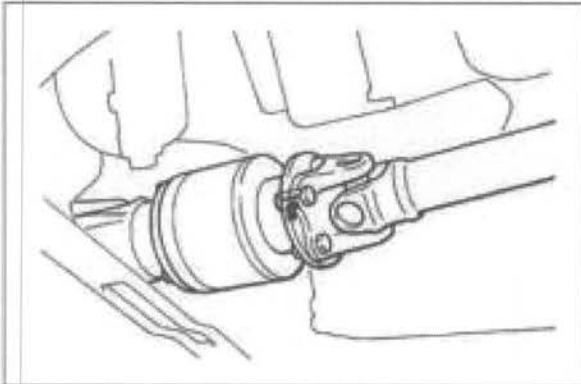


Required Tools

MB990756: Universal Joint Press Out Adapter

MB990758: Vise Adapter & Installer

Driveshaft Inspection & Removal

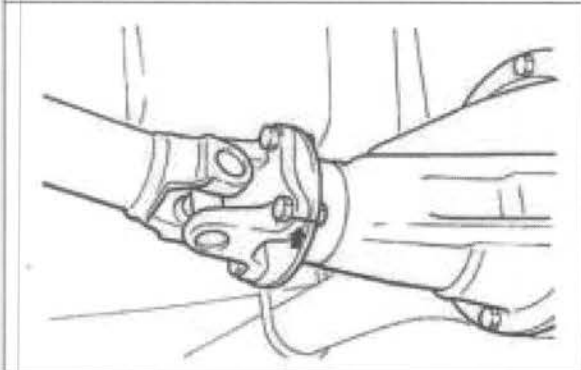


Hydro Link Coupling Removal

Note: Before removing retaining Bolts mark present location for reinstallation.

*Full Time 4WD

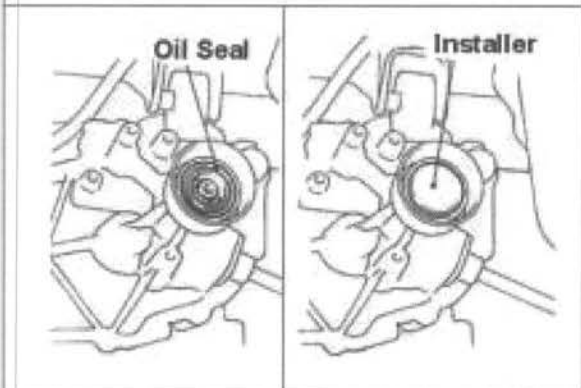
1. Remove Retaining Bolts
2. Remove Driveshaft



Note: Before removing retaining Bolts mark present location for reinstallation.

*Rear Differential (All)

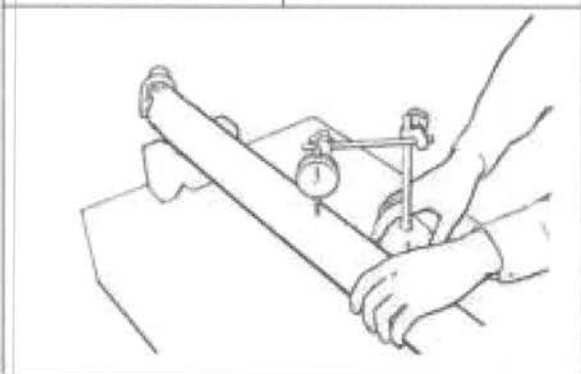
3. Remove Retaining Bolts
4. Remove Driveshaft



Rear Oil Seal

1. Use a Seal Puller and remove Oil Seal
2. Install Rear Oil Seal with Seal Installer Tool

Not: Coat New Seal with Axle grease before Installing



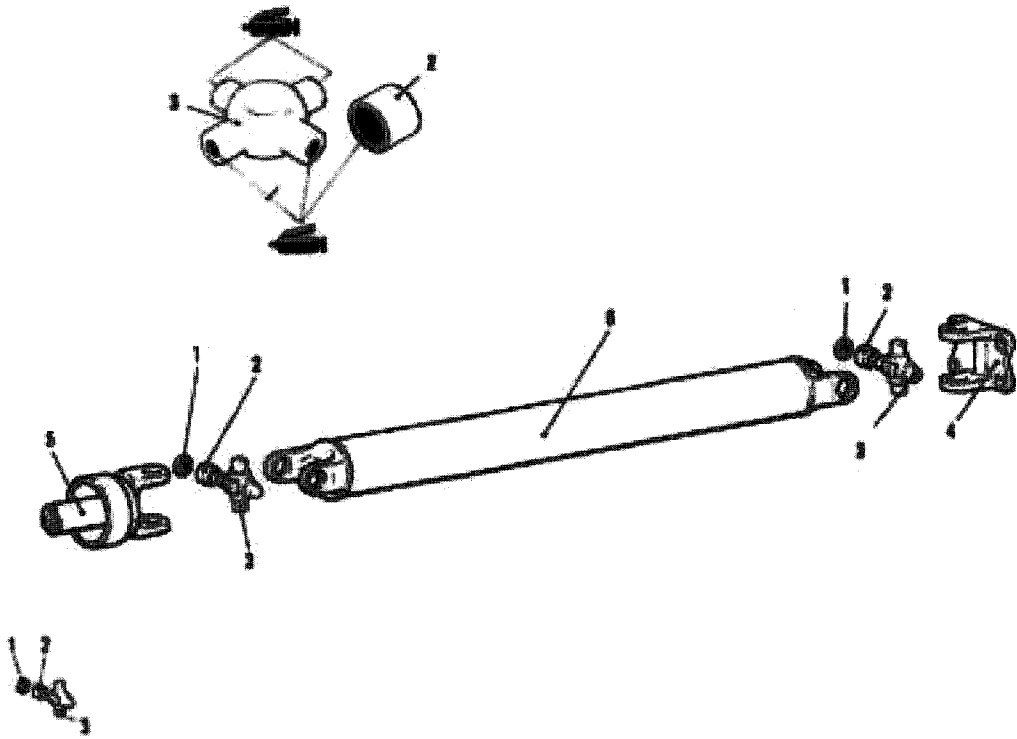
Driveshaft Warpage Inspection.

1. Place Driveshaft between "V" Blocks
2. Use a Micrometer as shown and measure Driveshaft Warpage.

Warpage Limit: 0.5mm (All Vehicles)

Note: See Parts Catalogue for Vehicle Specific Driveshaft Replacements. Driveshaft can not be straightened.

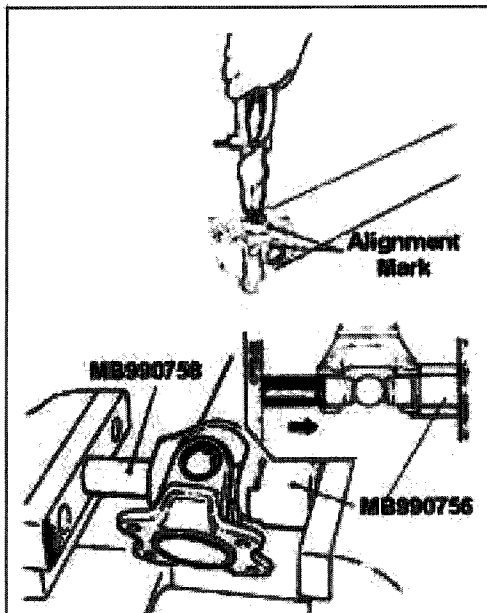
Universal Joint Replacement



Components

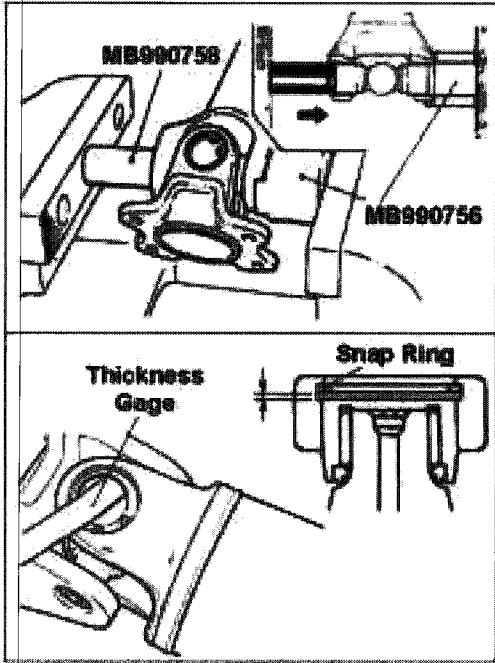
1. Snap Ring
2. Journal Bearing
3. Journal
4. Flange Yoke
5. Sleeve Yoke
6. Driveshaft

Universal Joint Removal



1. Remove Driveshaft
2. Remove Snap Rings as shown in the Diagram on the left.
3. Use Adapters MB990758 & MB990756 or similar Tools to Press-Out Universal Joint Bearing Cups.

Universal Joint Replacement



Installation of New Universal Joints

Note: Clean all areas before installation. Coat all movable Parts with Axle Grease.

1. Use Adapters MB990758 & MB990756 or similar Tools to Press-In Universal Joint Baring Cups.
2. Use a Feeler Gage or Thickness Gage to measure Free-play Gap.

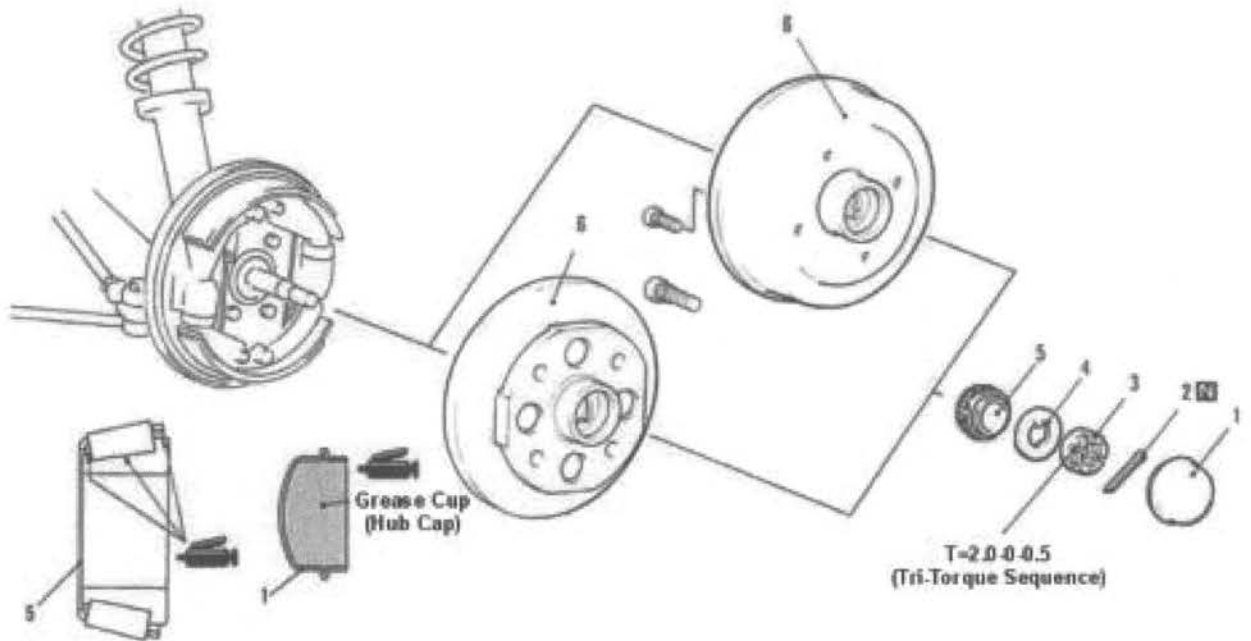
Limit: 0.6mm

Note: See Chart below for alternative Snap Ring thickness sizes.

Snap Ring Color Coded Sizes

Snap Ring Thickness Sizes	Color Code
1.00mm	No Color STD
1.02mm	No Color STD
1.05mm	Yellow
1.08mm	Blue
1.11mm	Brown
1.14mm	Black

Front Axel Hub: Drum & Disk Type 2WD



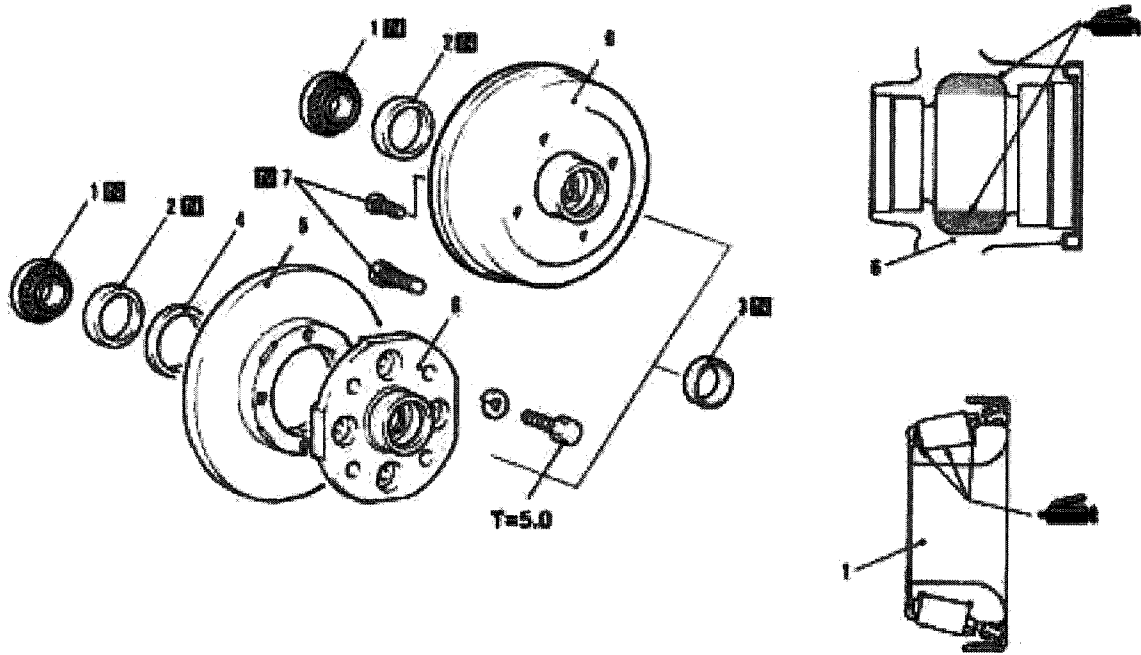
2WD Drum & Hub Removal

Note: Properly Jack Vehicle and Remove Front tire

1. Remove Grease Dust Hub Cap
2. Remove Split Pin
3. Remove Slotted Nut (Axel Nut)
4. Remove Washer
5. Remove Outer Bearing Inner Race
6. Remove Drum Brake or Disk and Hub
7. Installation in Reverse

Note: for Race Replacement see following Page

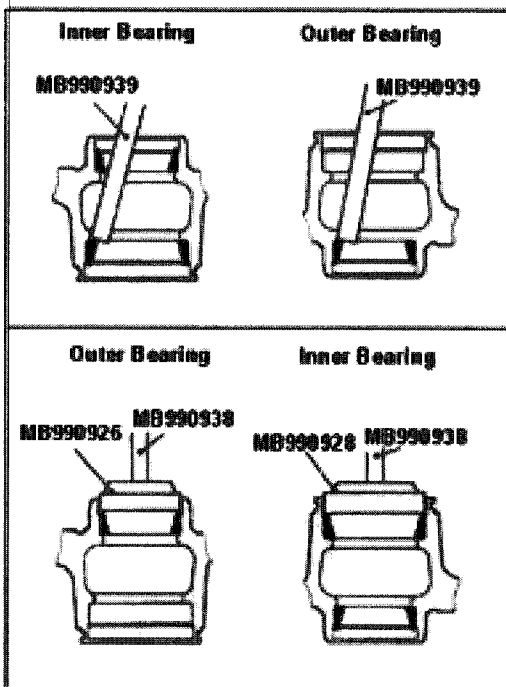
Front Axel Hub: Drum & Disk Type 2WD



Hub Components

1. Inner Bearing & Race	2. Bearing Outer Race	3. Outer Bearing & Race
4. Hub Stud Cover	5. Disk Brake	6. Drum (Drum Brakes)
7. Studs		

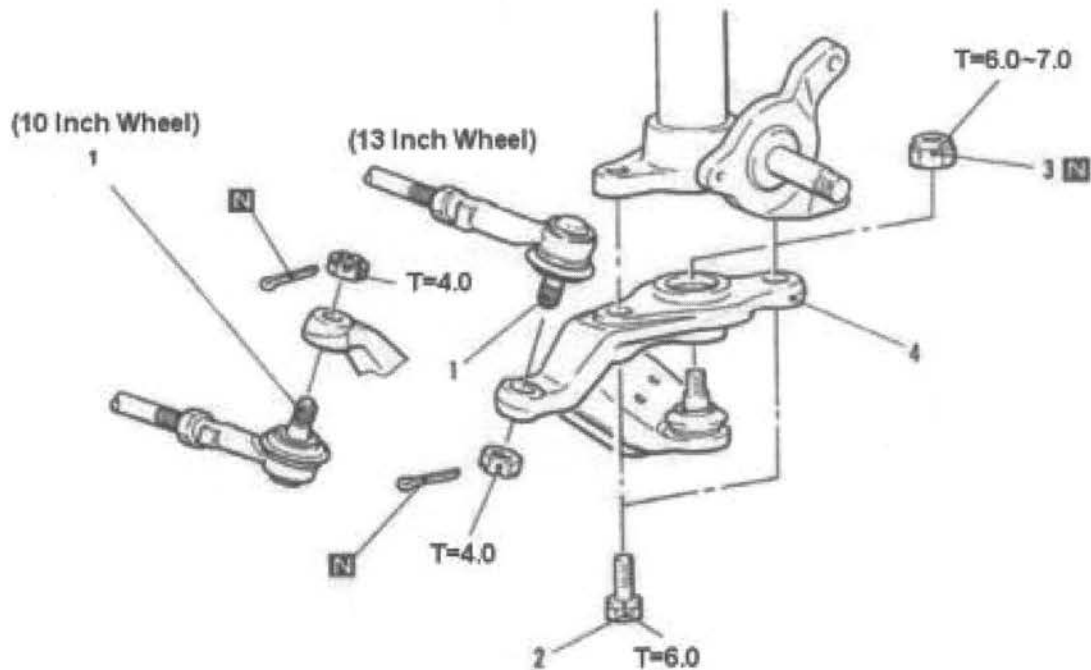
Use the Diagram below to replace Race Bearings



Bearing Inner & Outer Race Removal

1. Use the Tools shown on the Left to remove Bearing Inner & Outer Races.
2. Use the Tools on the Left as shown. Install Outer & Inner Races.
3. Coat with Axle Grease and Install in Vehicle.

Front Axle Hub & Knuckle Arm Removal 2WD

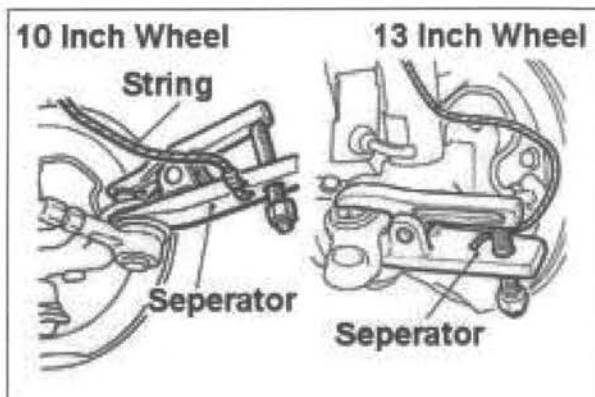


Component Removal

Note: Remove Hub as shown in the previous pages

1. Separate Tie Rod End
2. Remove Knuckle Arm to Strut Attachment Bolts
3. Remove lower Arm Retaining Nut
4. Remove Knuckle Arm

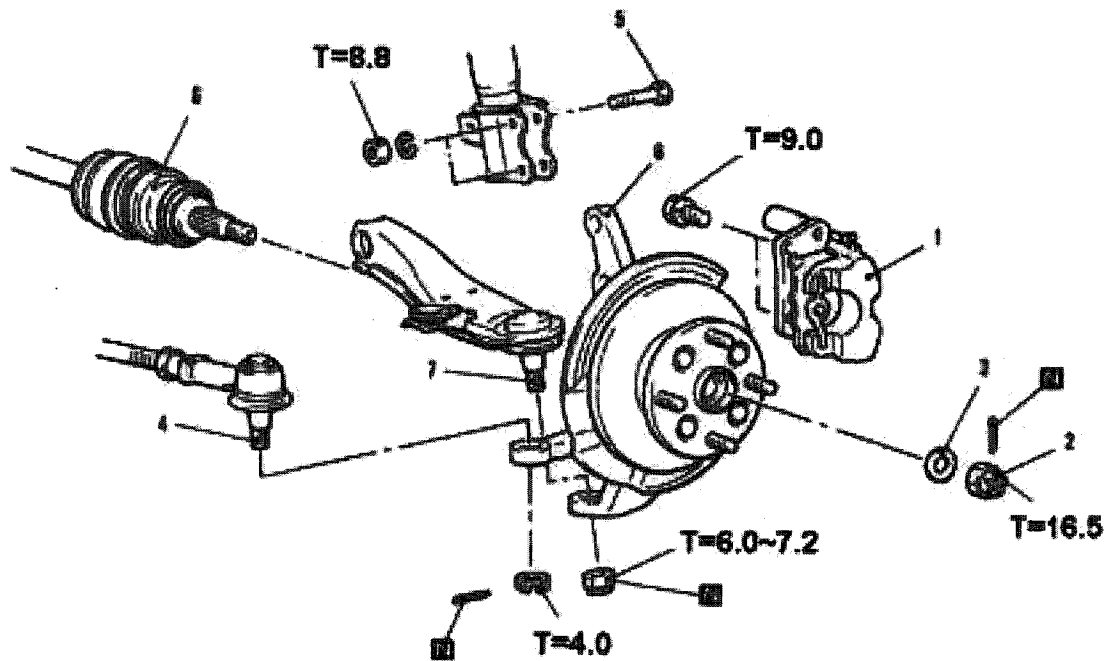
Proper Ball Joint Separator Positioning



Note: Use a Rope or String to prevent Separator from falling off while removing Tie Rod Ends.

Note: The Same Separator Tool can be used for both 10 & 13 Inch Vehicles.

Front Axle Hub & Knuckle Removal 4WD

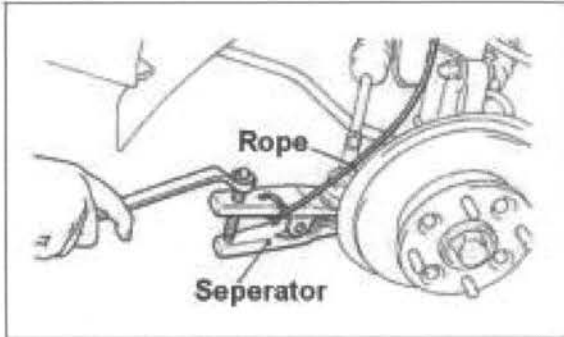


Front Hub & Knuckle Removal 4WD

1. Remove Front Brake Caliper
2. Remove Castle Nut
3. Remove P/S Lock Washer
4. Separate Tie Rod End
5. Remove Strut Attachment Bolt
6. Remove Front Axle shaft
7. Separate Lower Arm Assembly
8. Remove Hub & Knuckle Assembly

Note: see following pages for detailed instructions

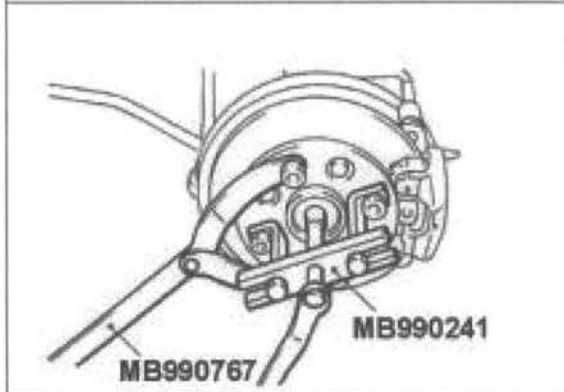
Front Axel Hub & Knuckle Removal 4WD



Tie Rod Separation

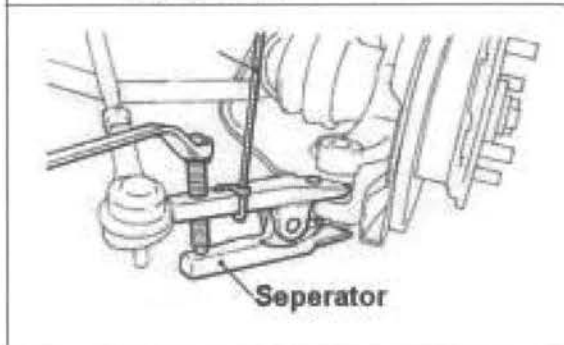
1. Use a Tie Rod End Separator and separate Tie Rod End.

Note: If Vehicle has over 100,000 Kilometers replace Tie Rod Ends before reinstallation.



Front Axel Removal

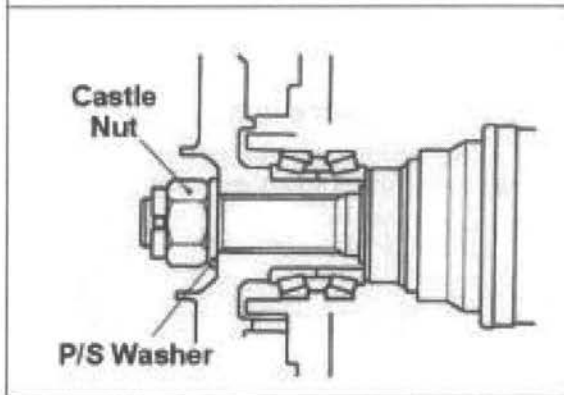
2. Attach Tool MB990241 to Hub assembly as shown
3. Attach Hub Position Holder Tool MB990767
4. Tighten Press Bolt and remove Front Axel.



Lower Arm Removal

5. Use the Separator Tool and Separate Lower Arm from Steering Knuckle.

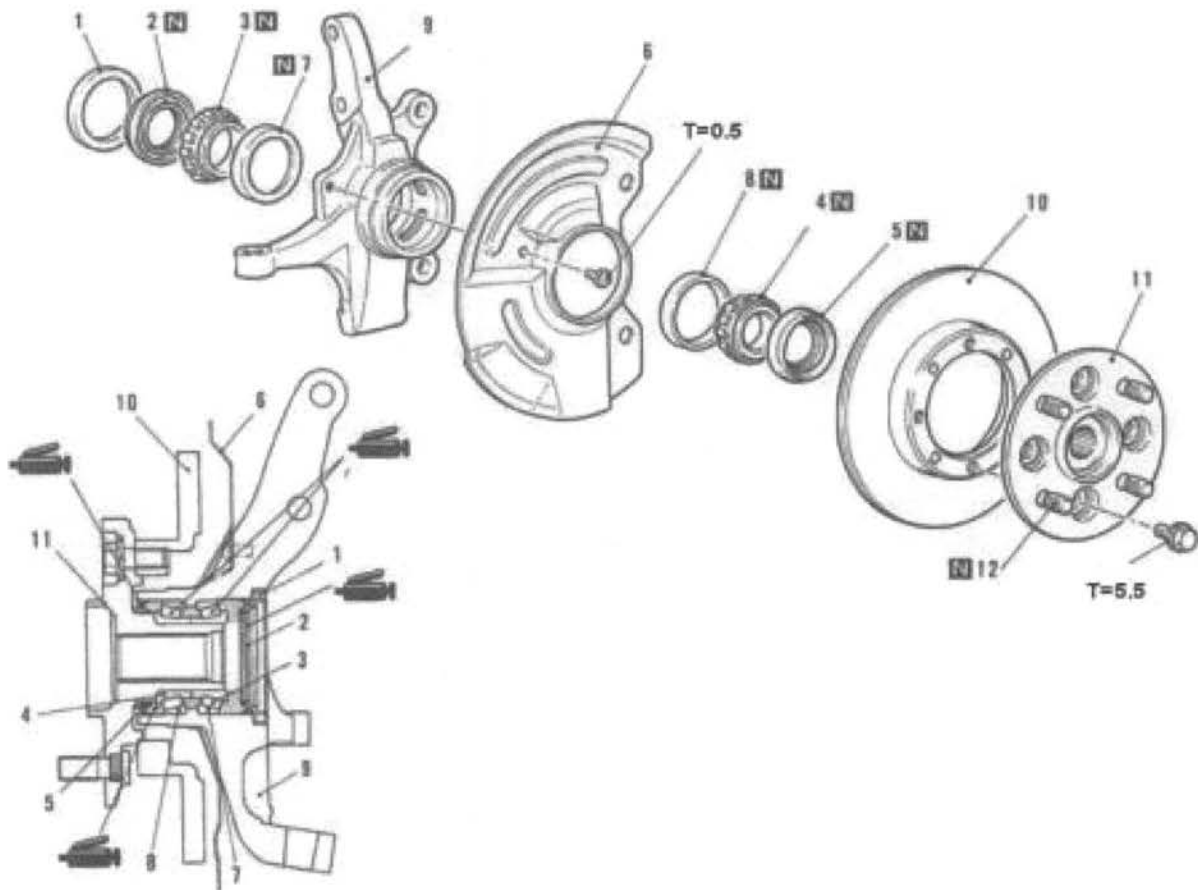
Note: Replace Lower Arm if Vehicle has over 120,000 Kilometers.



Castle Nut

Note: Use the Diagram on the Left to properly assemble Axle Shaft. Castle Nut can be used a maximum two (2) times. Never use a Castle Nut from another Vehicle.

Front Axel Hub & Knuckle Disassembly 4WD



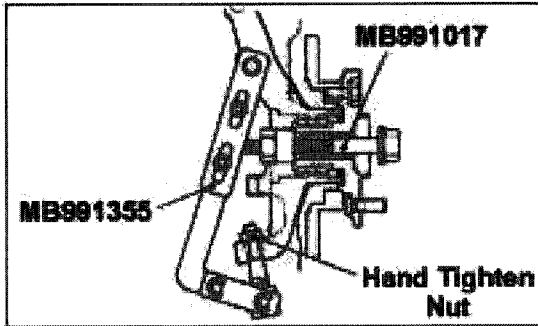
Front Hub & Knuckle Disassembly

Note: Follow previous steps for Hub & Knuckle Removal

1. Remove Dust Seal
2. Remove Driveshaft Oil seal
3. Remove Inner Bearing
4. Remove Wheel Bearing
5. Remove Oil seal
6. Separate Dust Shield
7. Remove Inner Race: See Following Instructions
8. Remove Outer Race: See Following Instructions
9. Knuckle Assembly
10. Brake Disk
11. Front Hub
12. Wheel Studs

Note: Separation of Components see following page

Front Axel Hub & Knuckle Disassembly 4WD

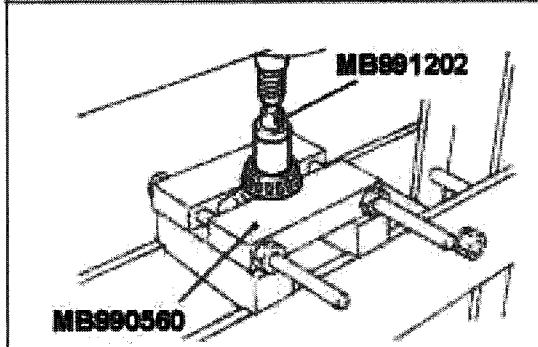


Knuckle & Hub Separator Tool

Note: Use Knuckle & Hub Separator Tools as shown on the Left.

Note: Lower Arm Attachment Nut: Hand Tighten.

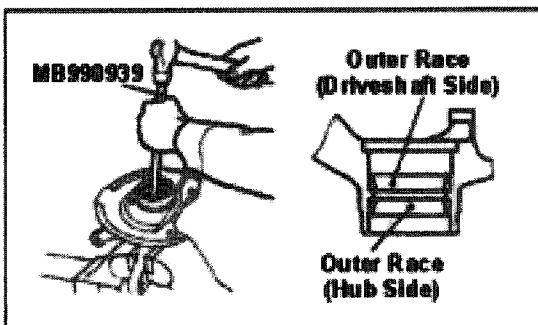
Note: Installation is in reverse order of assembly



Front bearing Removal

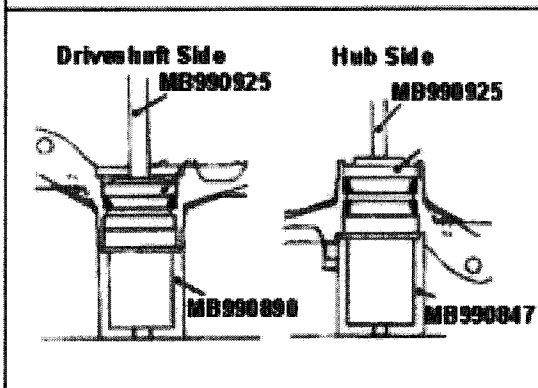
Use a Press as shown to remove Bearing.

Note: Once a Bearing has been removed it must be replaced with a new Bearing.



Use The Following guide Diagrams to Remove & Replace Race Bearings.

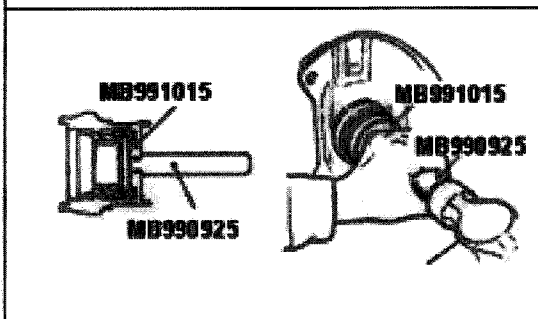
Note: Once Removed Bearings, Races, and Seals must be replaced with New Items.



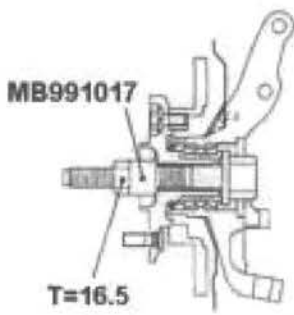
Note:

Driveshaft Side = Towards Center of Vehicle

Hub Side = Away from Vehicle

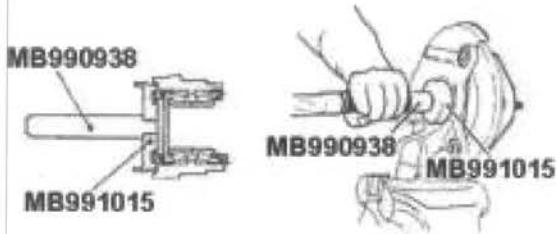


Front Axle Hub & Knuckle Disassembly 4WD



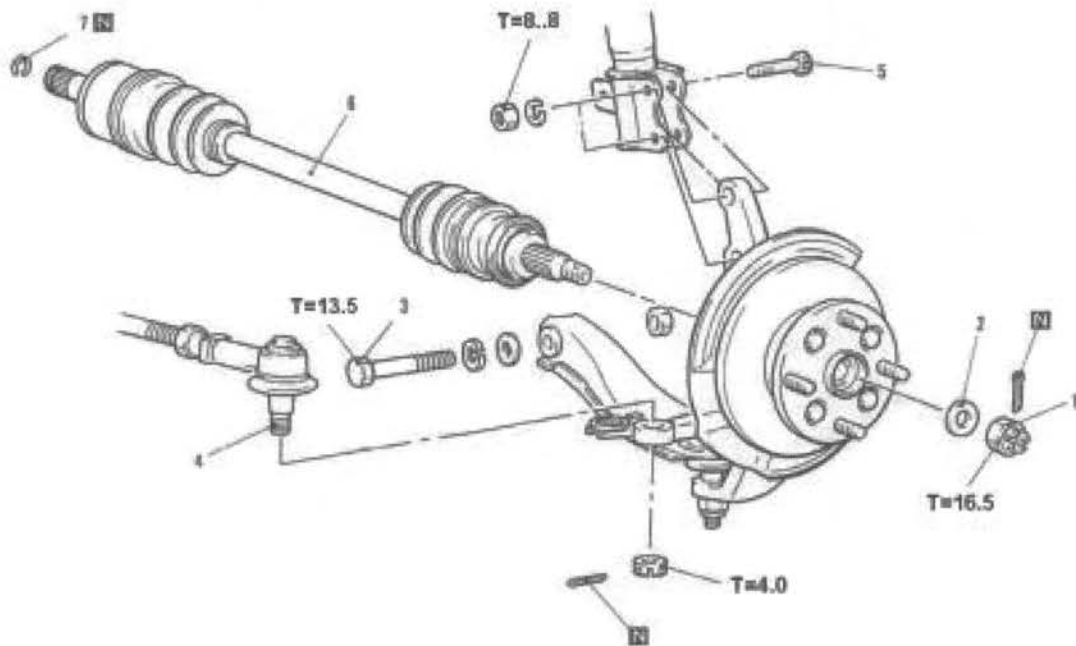
Attach Knuckle to Hub using the Tools shown on the Left

Install New Rear Seal as shown



Note: Do not reuse Seals and or Gaskets. Always use new Parts

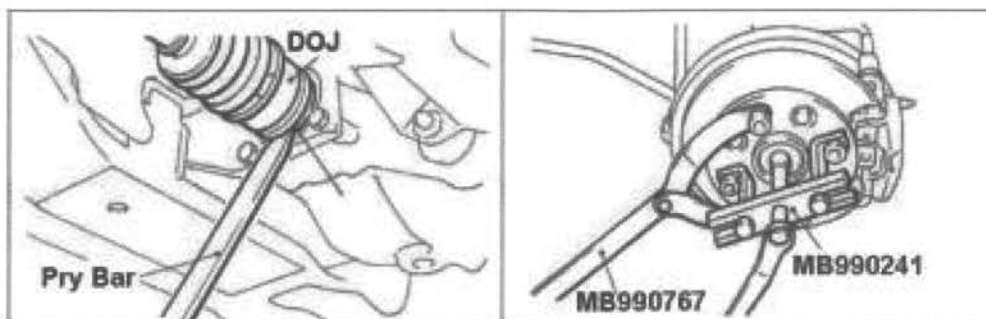
Front Drive Axels 4WD



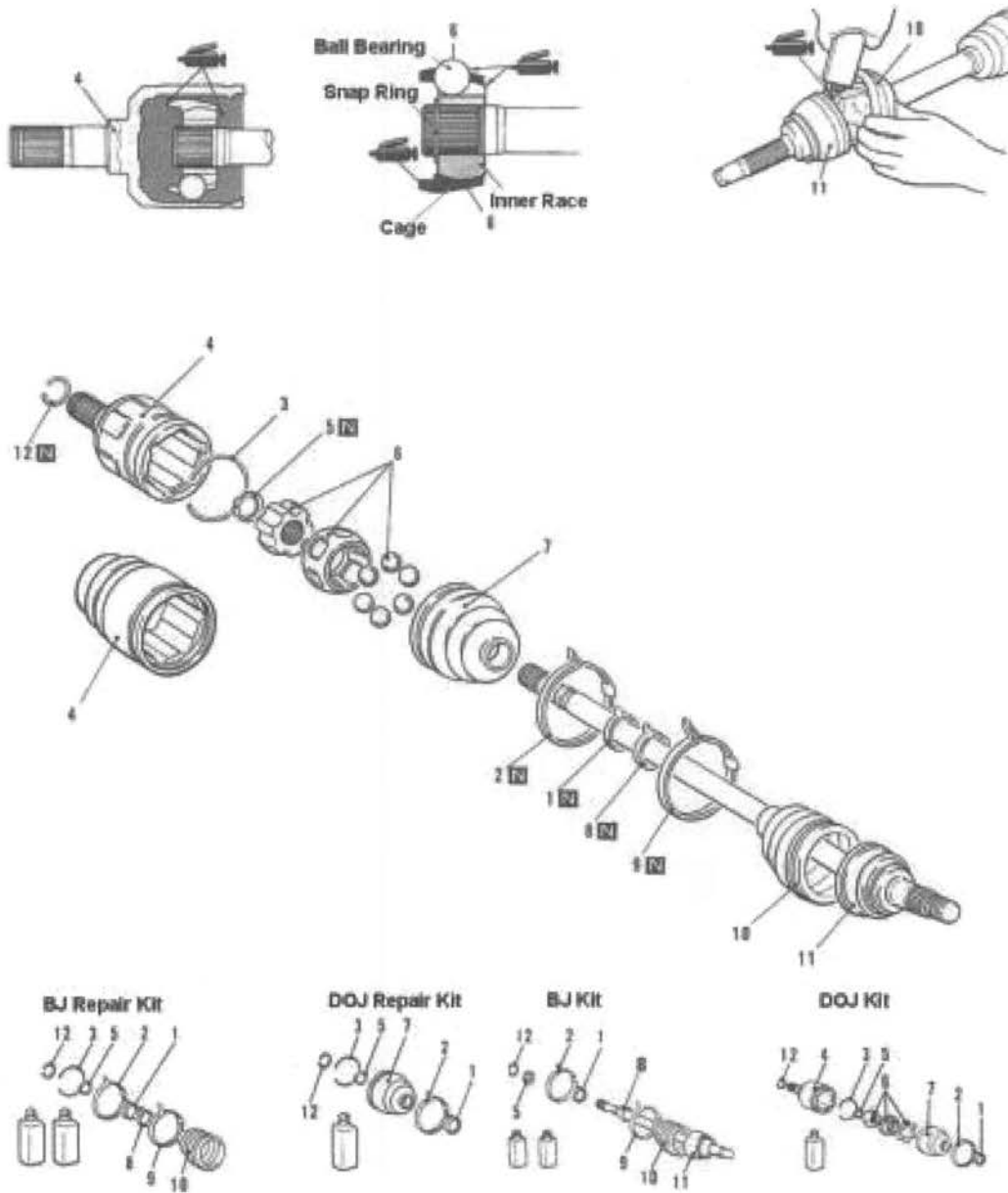
Removal & Components

Note: See previous pages for future removal details

1. Remove Castle Nut
2. Remove P/S Lock Washer
3. Remove Lower Arm to Frame Bolt
4. Separate Knuckle and Tie Rod End
5. Remove Strut Attachment Bolts
6. Remove Driveshaft from Hub
7. Remove C Clip



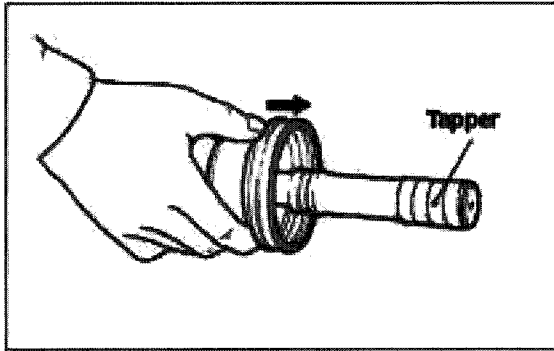
Axel & CV Joint Rebuild



Components

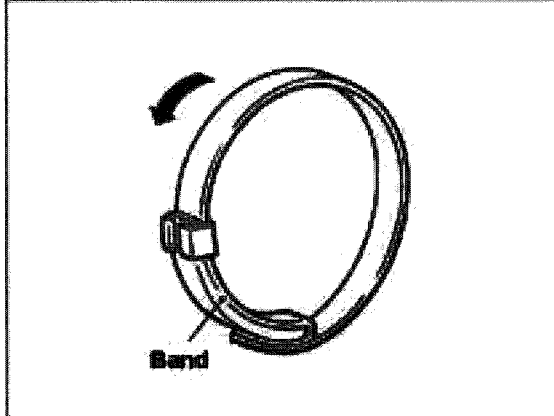
1. Boot Band
2. DOJ Boot Band
3. Circle Clip
4. DOJ Outer Race
5. Snap Ring
6. Inner Race Cage ball Assembly
7. DOJ Boot
8. Boot Band
9. BJ Boot Band
10. BJ Boot
11. BJ
12. Circle Clip

Axel & CV Joint Rebuild

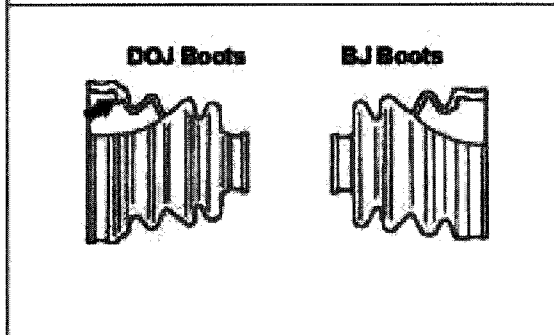


Replacement Key Points

Note: when installing Boots take extra care when sliding Boots over the Tapered End of the Axle Shaft. Grease the Boots adequately with plenty of Multipurpose Grease before installation.

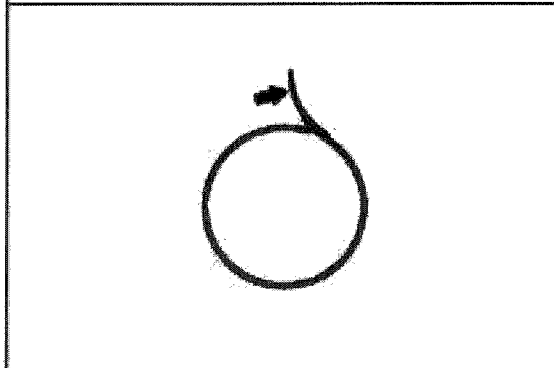


Note: When installing Bands on all series Boots use the Diagram on the Left to show proper closing Direction.

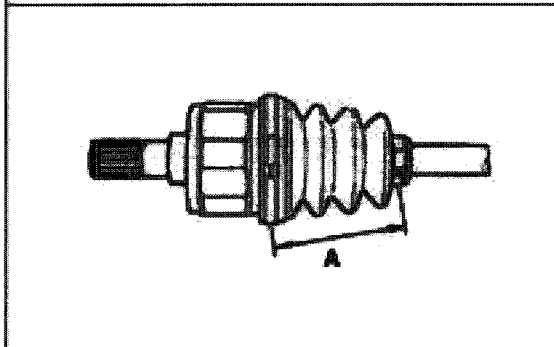


Boot Identification

Note: Notice the difference between the two types of Boots. The DOJ Boots have a Dimple whereas BJ Boots do not. The Boots are not interchangeable.



Note: When installing Bands correctly use the Tang to Pull Tight by Hand. Do not use Tools to Pull on the Tang.



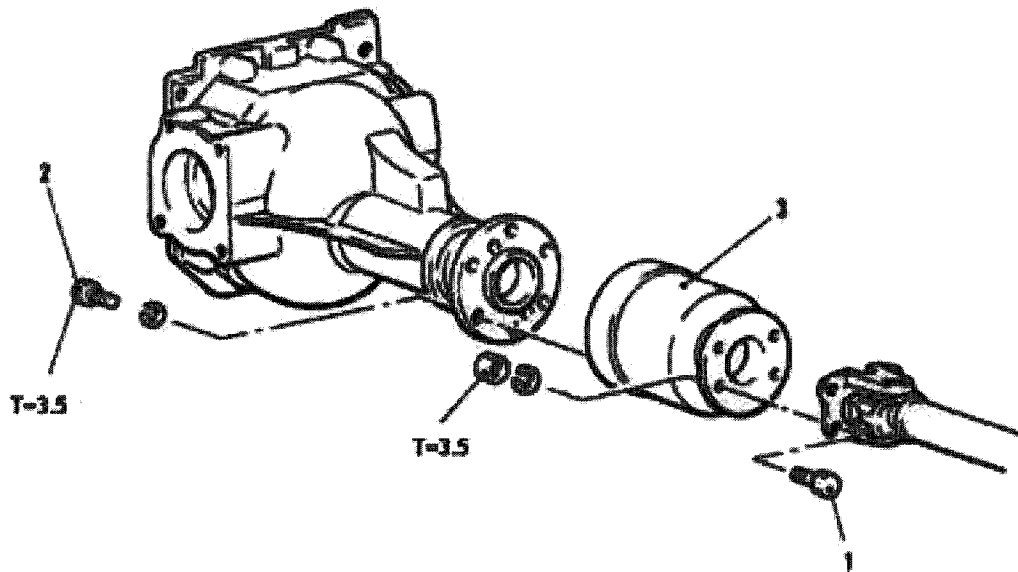
Boot Instalaltion Length

Note: Proper Boot Installation can be verified by measuring the Length as shown.

"A" Distance= $80\pm 3\text{mm}$

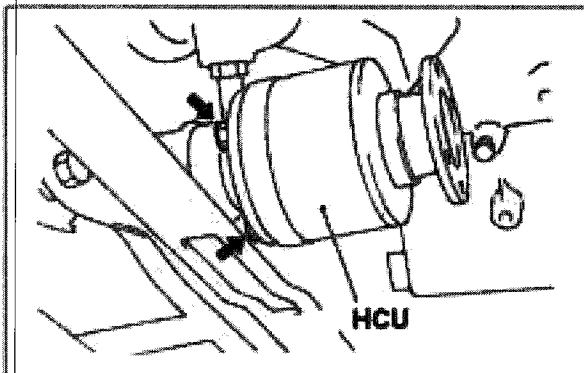
Note: Never reuse Bands or Boots

4WD HCU Coupling Unit



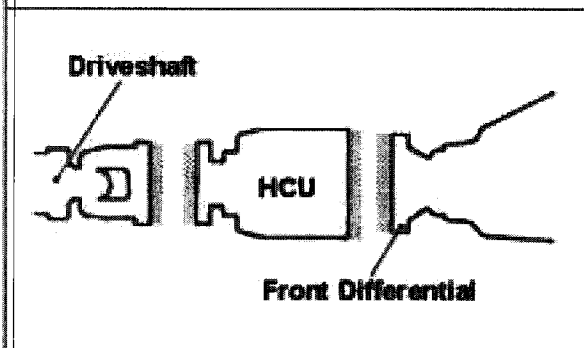
Components

1. Driveshaft attachment Bolts
2. HCU Attachment Bolts
3. HCU Assembly



HCU Removal Diagrams

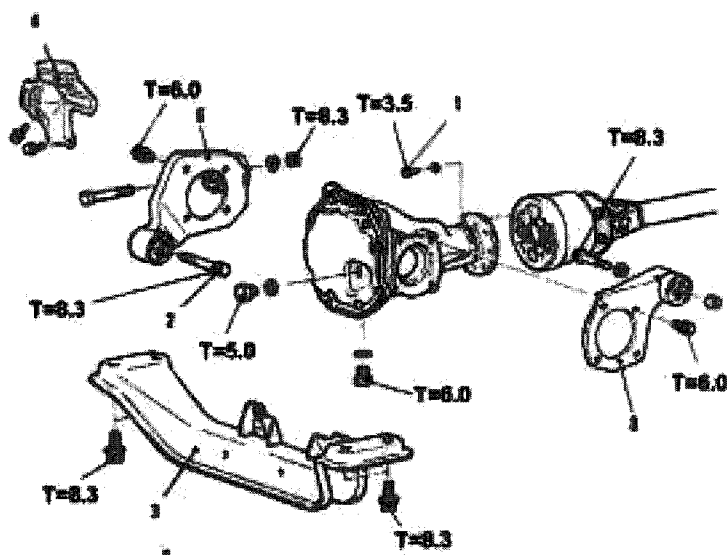
Note: Mark Bolts before removal. Install Bolts in original positions



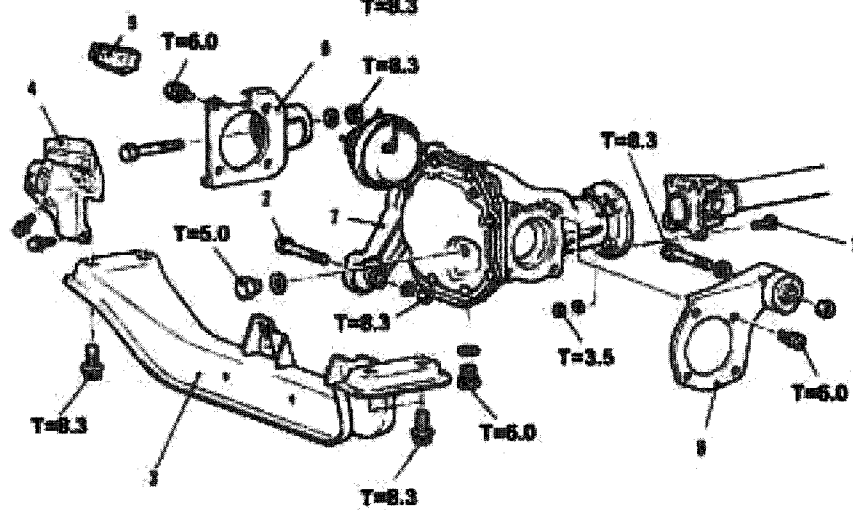
Note: HCU Location

Front Differential Mounts

Full Time 4WD



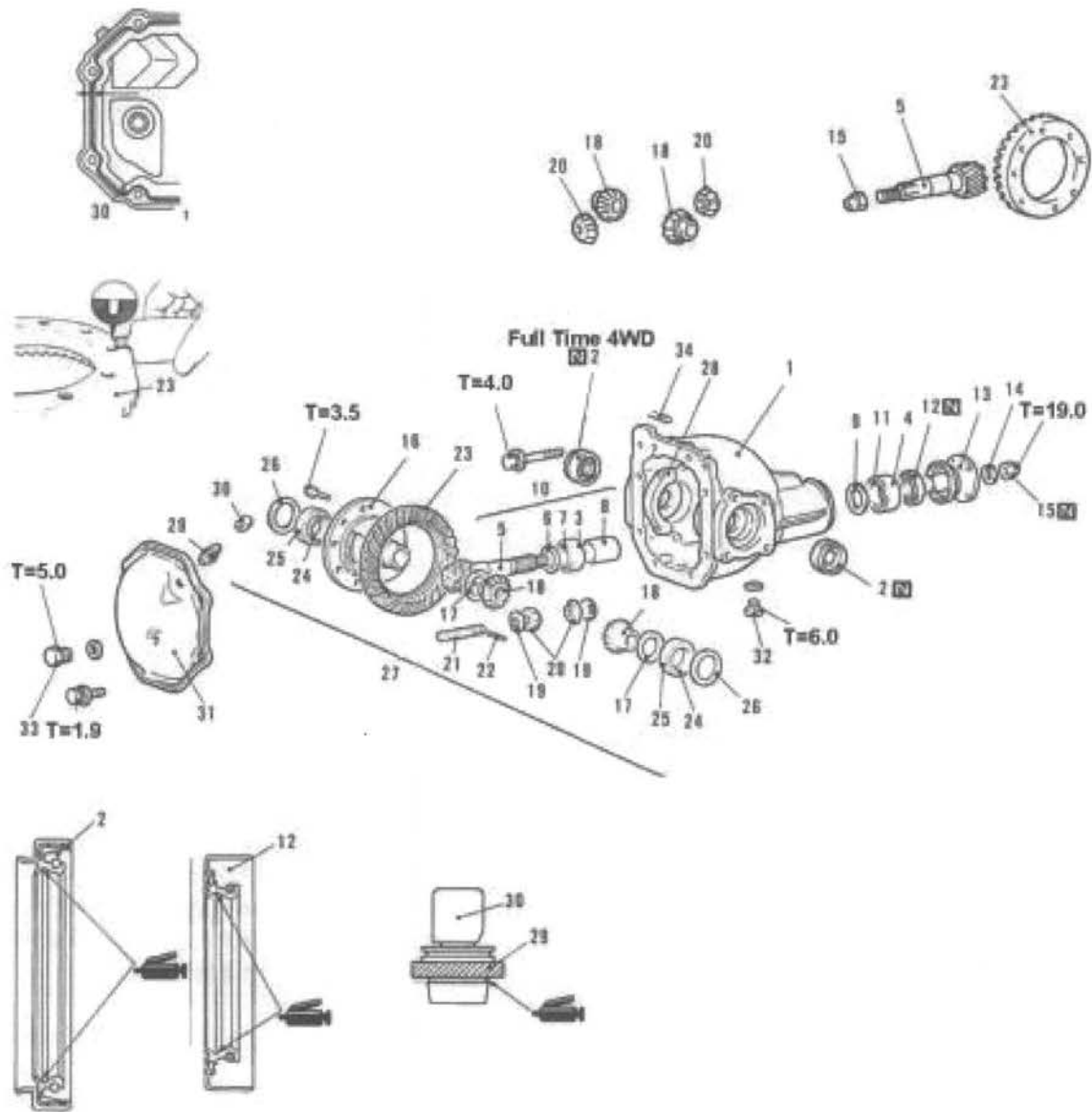
Part Time 4WD



Components

1. HCU or Driveshaft attachment Bolts
2. Mounting Bolts
3. Differential Mounting Cross member
4. Under Cover Rear Plate
5. Protector: Part Time 4WD
6. Differential Mount Bracket (RH)
7. Free wheel Clutch Unit: Part Time 4WD
8. Differential Mount Bracket (LH)

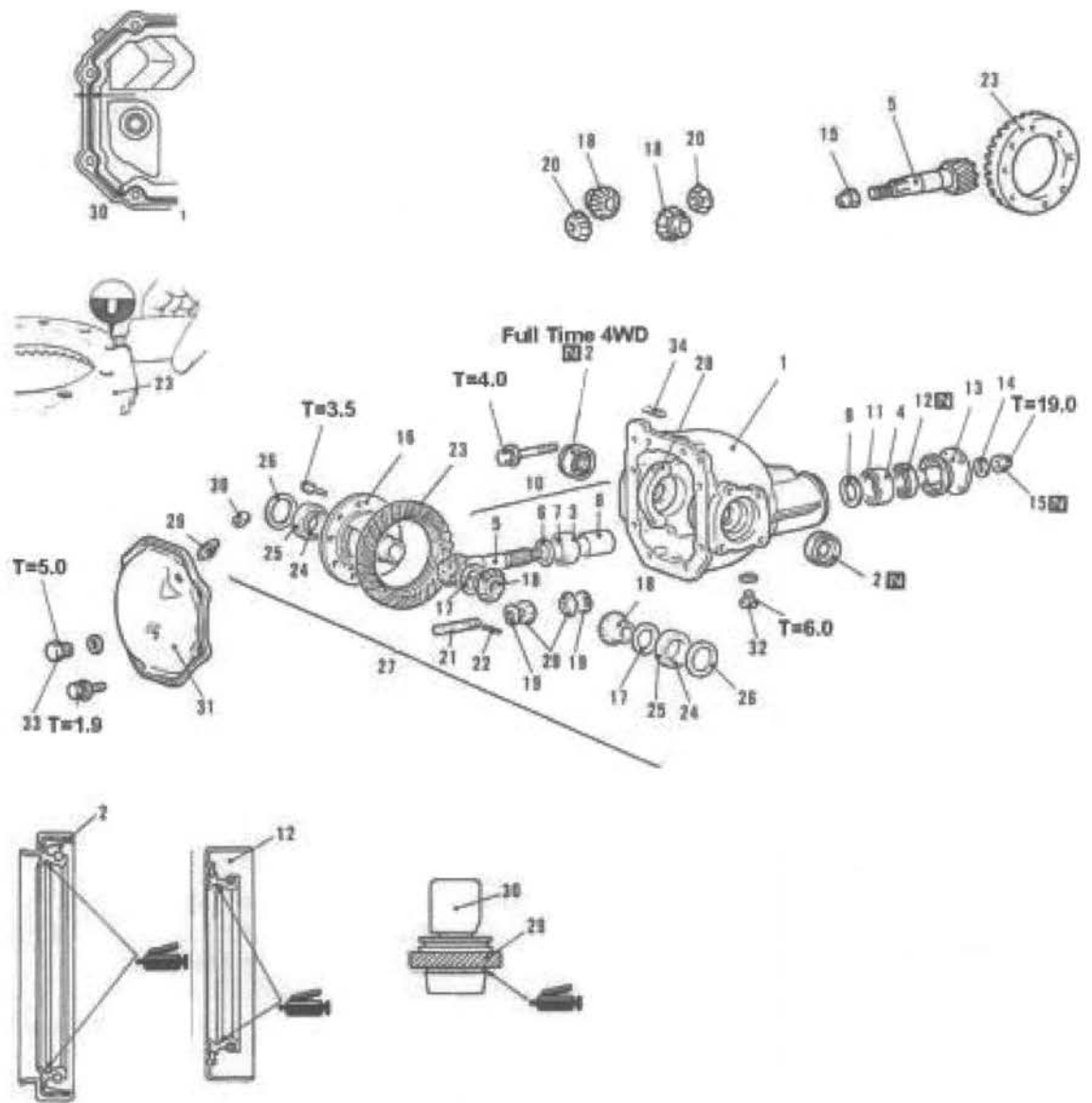
Front Differential Overhaul 4WD



Components

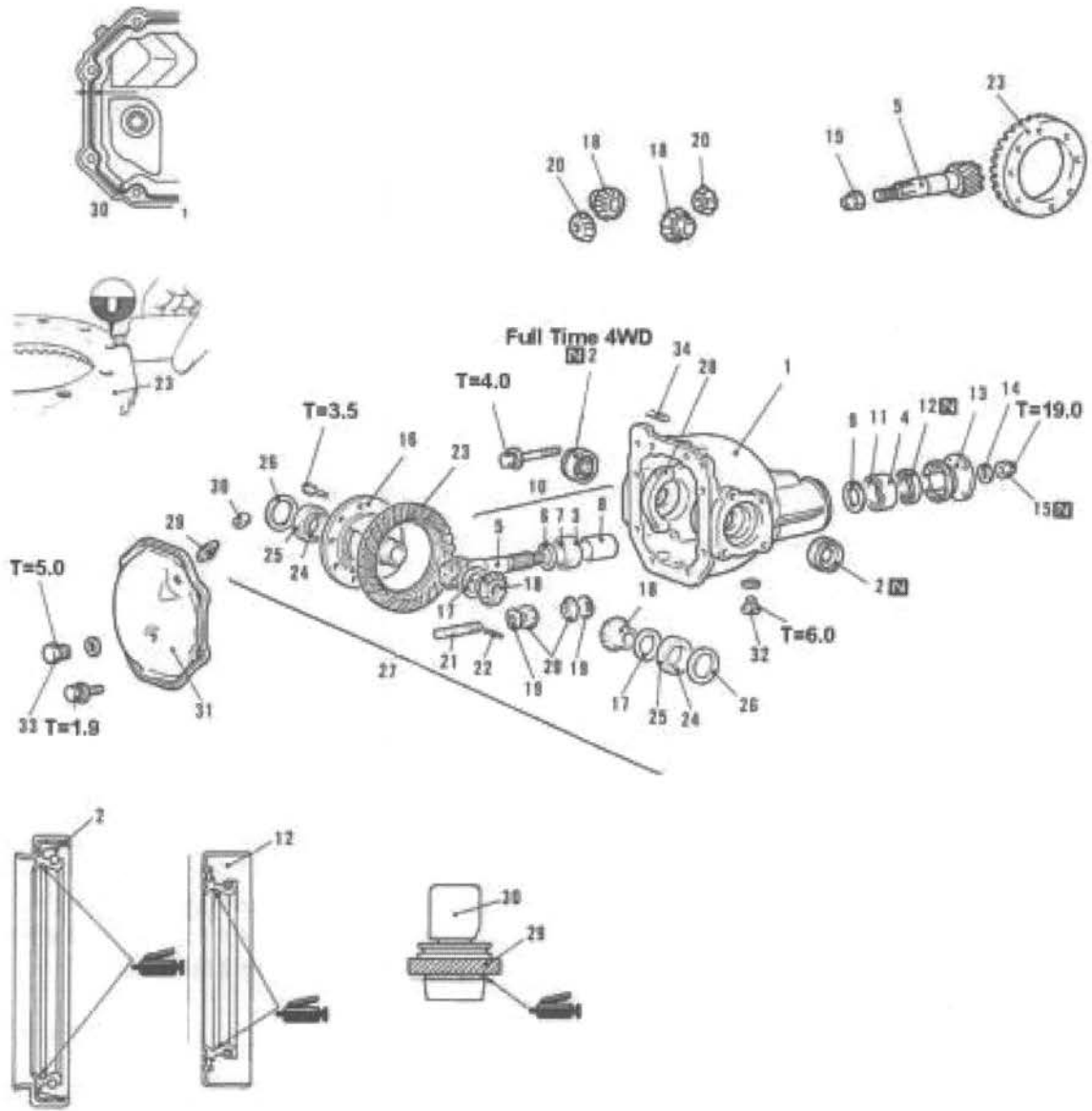
1. Gear Carrier
2. Oil Seal
3. Drive Pinion Rear Bearing Outer Race Bearing
4. Drive Pinion Front Bearing Outer Race Bearing
5. Drive Pinion
6. Drive Pinion Rear Shim
7. Drive Pinion Rear Bearing Inner Race Bearing
8. Drive Pinion Spacer
9. Drive Pinion Front Shim
10. Drive Pinion Assembly
11. Drive Pinion Front Bearing inner Race Unit
12. Oil Seal

Front Differential Overhaul 4WD



13. Companion Flange
14. Washer
15. Self Lock Nut
16. Differential Case
17. Side Gear Spacer
18. Side Gear
19. Pinion Washer
20. Pinion gear
21. Pinion Shaft
22. Lock Pin
23. Drive Gear
24. Side Bearing Inner Race
25. Side Bearing Outer Race
26. Side Bearing Spacer

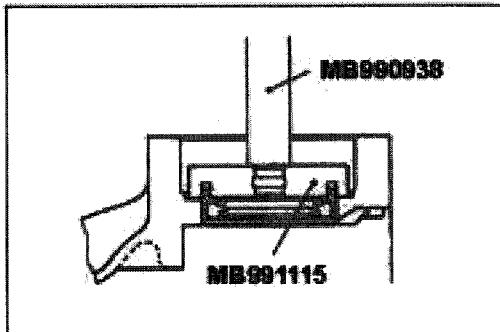
Front Differential Overhaul 4WD



- 27. Differential Case Assembly
- 28. Bearing Cap
- 29. Vent Plug
- 30. Vent Plug Cover
- 31. Cover
- 32. Drain Plug
- 33. Oil Filler Plug
- 34. Dowel Pin (Part Time 4WD)

Note* Item (23) Use ThreeBond #1104

Front Differential Overhaul 4WD

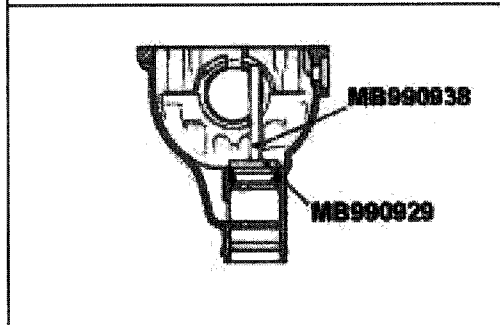


Oil Seal

Note: Coat Seal with Multi-Purpose Axle Grease before installation

1. Install Oil Seal as Shown on the Left.

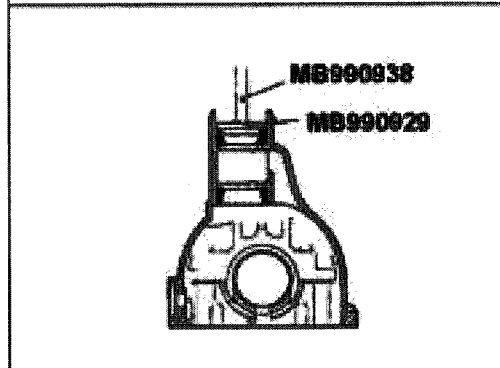
Note: Never Reuse Oil Seals



Drive Pinion Rear Bearing Outer Race

2. Install Outer Race as shown. Do not use a blunt item to install Races. Always use proper tools.

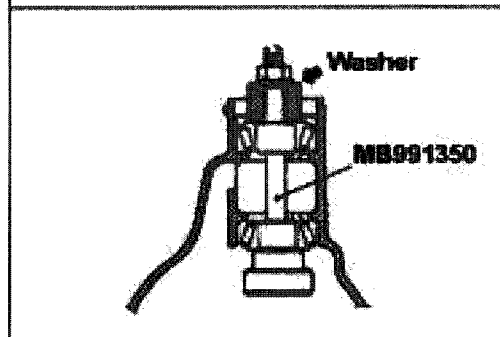
Note: If Ambient Temperature is below 20°C warm Carrier Unit before installation



Drive Pinion Front Bearing Outer Race

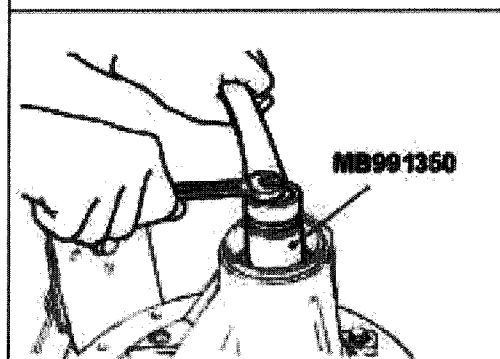
3. Install Outer Race as shown. Do not use a blunt item to install Races. Always use proper tools.

Note: If Ambient Temperature is below 20°C warm Carrier Unit before installation



Drive Pinion Height

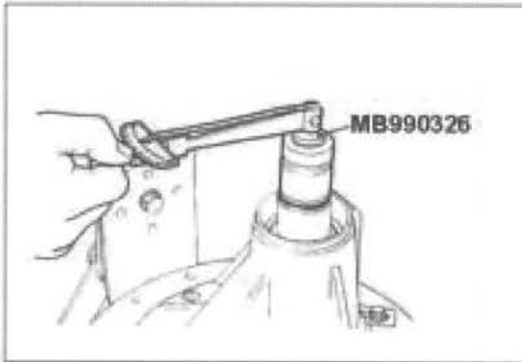
Note: Utilize Drive Pinion Height Gage MB991350 to measure Height.



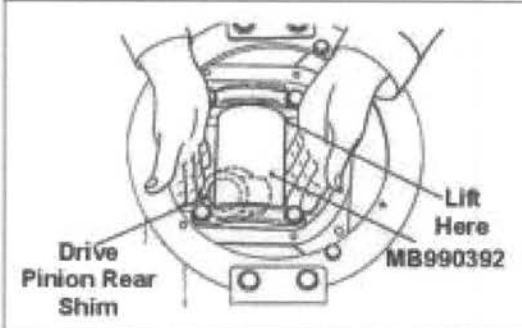
Note: Without the Oil Seal Installed first tighten attachment Nut firmly. Confirm free travel and no binding.

Front Differential Overhaul 4WD

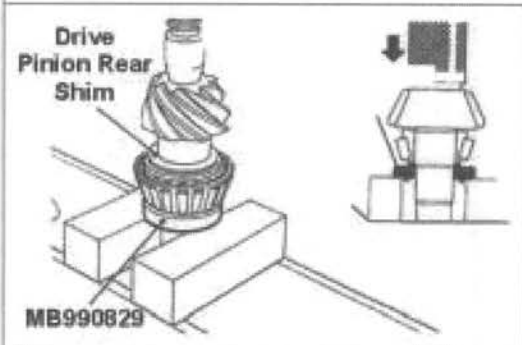
Initial Torque Setting



4. Torque to 10.0-13.0kgm and reconfirm. This shall preset Bearings and Races.

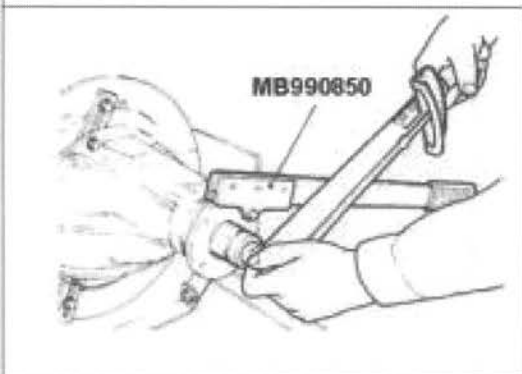


5. To confirm Carrier Straightness Install MB990392 Cylinder Gage Unit. Using Shims confirm required size of Drive Pinion Rear Shim.

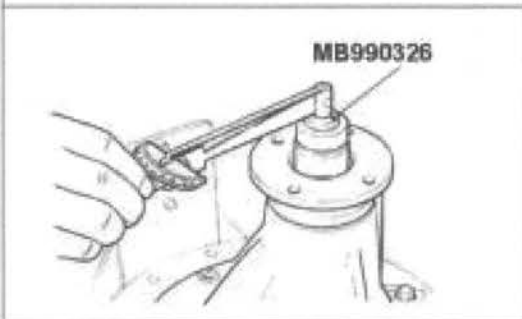


6. Once Determined correct Drive Pinion rear Shim Install with a Press as shown.

Note: Shims are not reusable. See Parts Catalogue for optional Sizes.

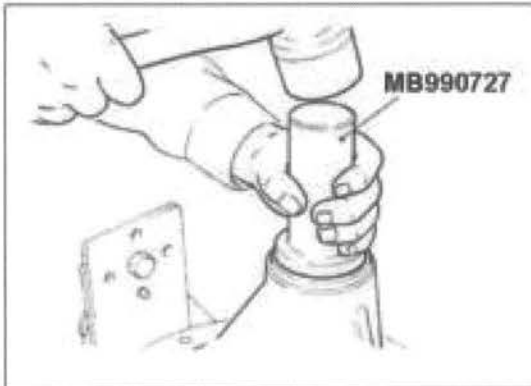


7. Preassemble Unit minus Oil Seal.



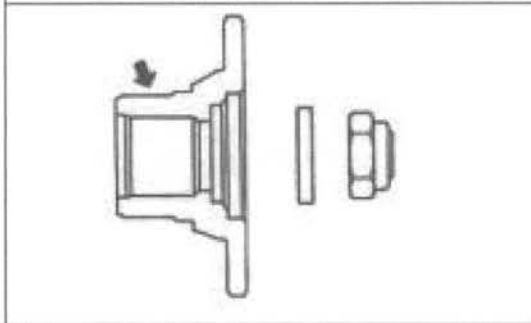
8. Torque to 10.0-13.0kgm. Check Free Travel.
9. After Test remove Nut and Flange. Clean area and prepare Oil Seal.

Front Differential Overhaul 4WD

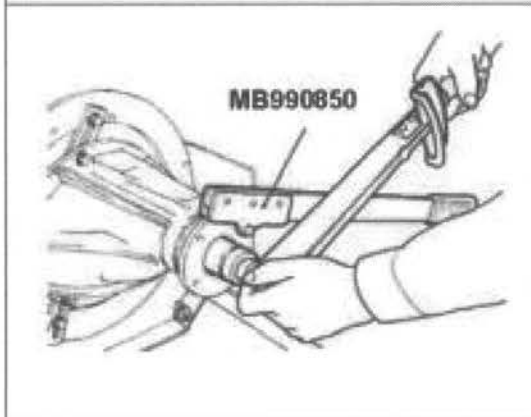


Oil Seal Installation

10. Coat Oil Seal with Multi-Purpose Grease before installation
11. Install Oil Seal as shown on the Left.

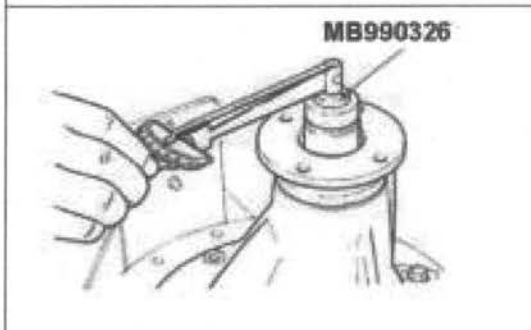


12. Inspect Flange and prepare New Nut & Washer. Do not reuse previous Nut and Washer for final installation.



13. Install Flange

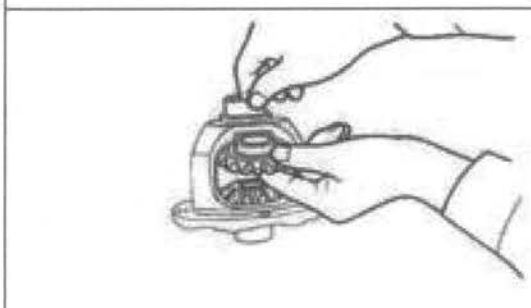
14. Torque Stage 1: 13.0kgm.
Second Stage 2: 16.0-19.0kgm



15. Measure Drive Pinion Bearing Preload
Preload: 6.5-8.0kgm

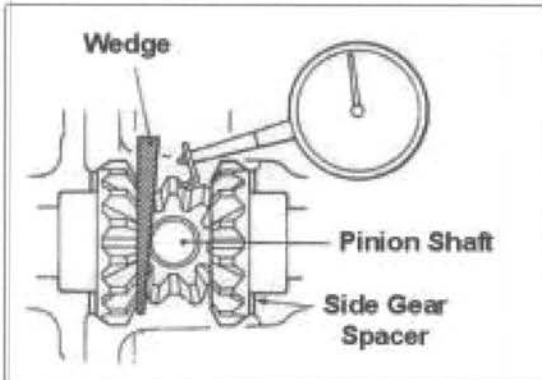
Differential Gear Backlash

Note: When removing Bearing Caps Paint a Mark on the Cap and the Boss for reinstallation purposes.



16. Remove Side Gears and Components to Inspect. Chipped or excessive visibly worn Gears must be replaced.

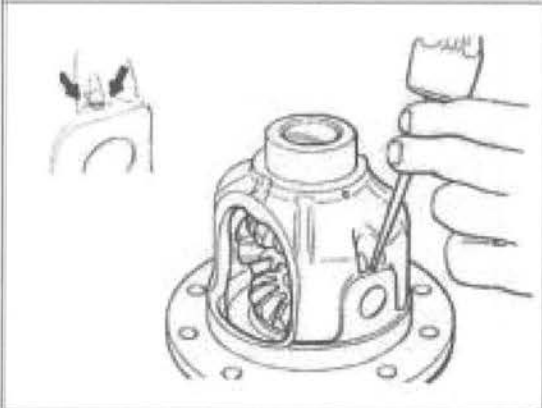
Front Differential Overhaul 4WD



17. Use a Micrometer and Check Limits

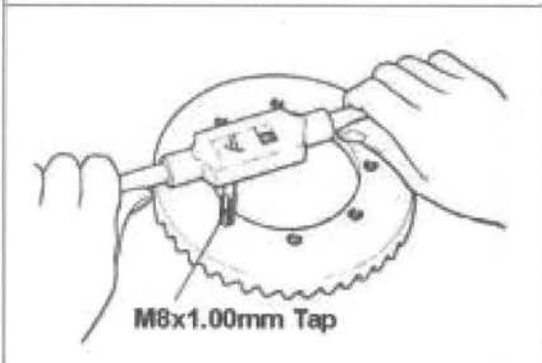
Limit: 0.05-0.15mm

Over Limit: 0.2mm



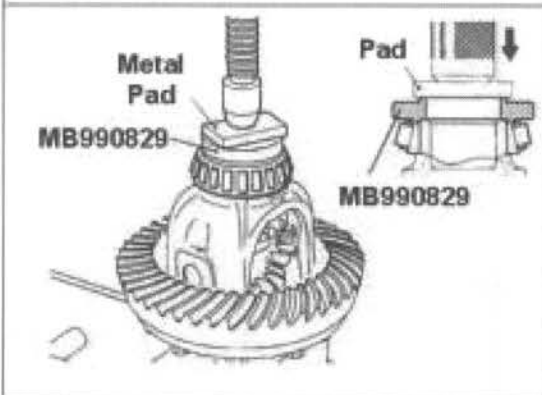
Drift Pin

18. Use a Drift Pin Punch to Install or Remove Pins.



Drive Gear Preparation

19. Inspect Drive Gear Teeth for Chips or Scratches. Replace Unit if defective. If Gear is to be reused tap threads using a M8x1.00mm Tap.

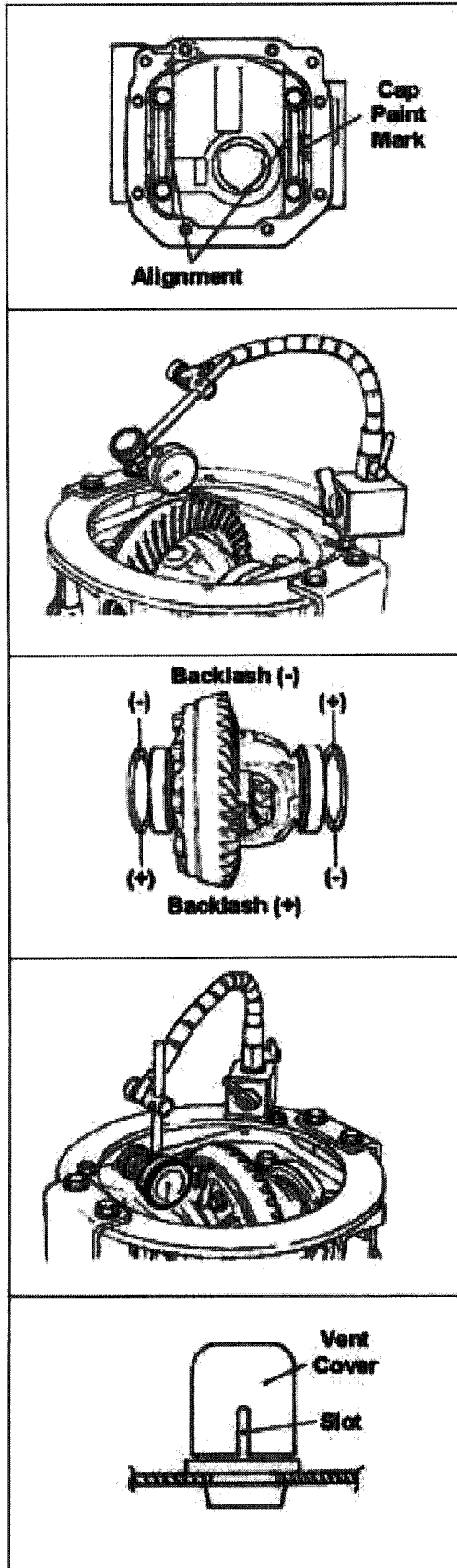


Side Gear Inside Race

20. Use a Press as shown on the Left to install Side Gear Inside Race

Note: Never Reuse Bearings or Races once removed.

Front Differential Overhaul 4WD



Bearing Caps

Note: Before installing Carrier Gear Set confirm Bearing Caps are in their original position. Check for Paint Mark that was marked during disassembly.

21. Place a Dial Gage as shown on the left. Rotate Ring Gear Assembly and measure.

Limit: 0.10-0.15mm

Backlash

22. To set Backlash adjustments change the Side Bearing Spacers as required. Check Parts Catalogue for replacement Sizes.

Drive Gear Clearance

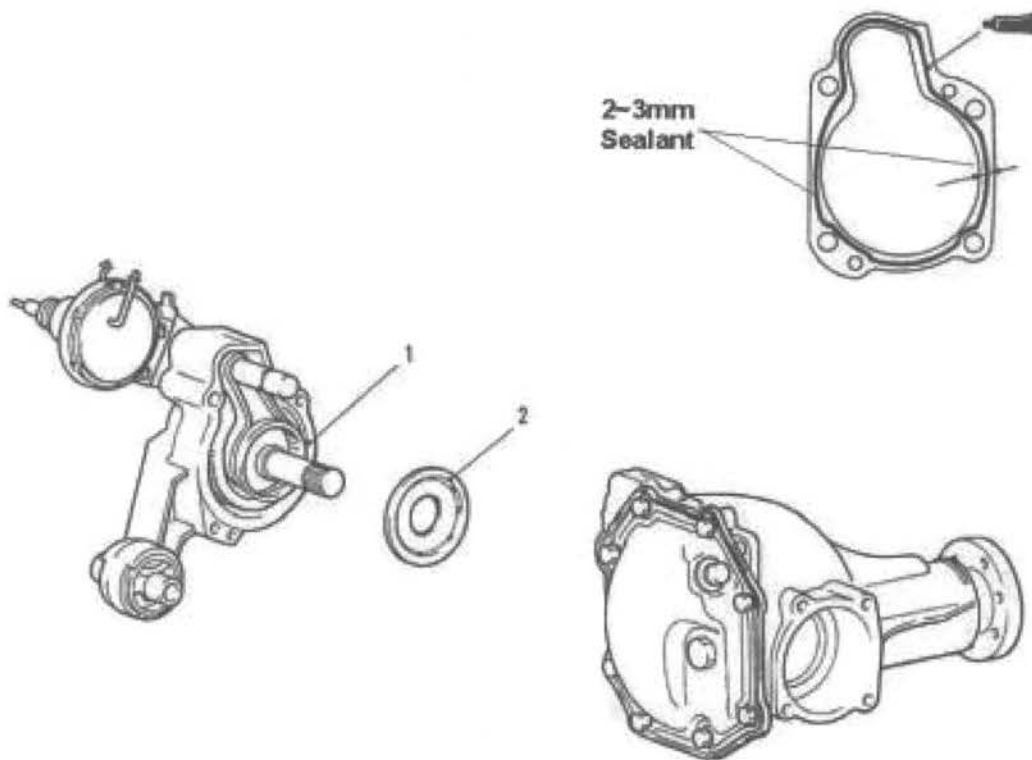
23. Seat Dial Gage as shown

Limit: 0.05

Vent Plug

24. Verify Vent Plug condition. Inspect for cracks or other damage. Replace if damaged
25. Install Rear Cover and assemble remaining components by using the Diagram at the beginning of this section.

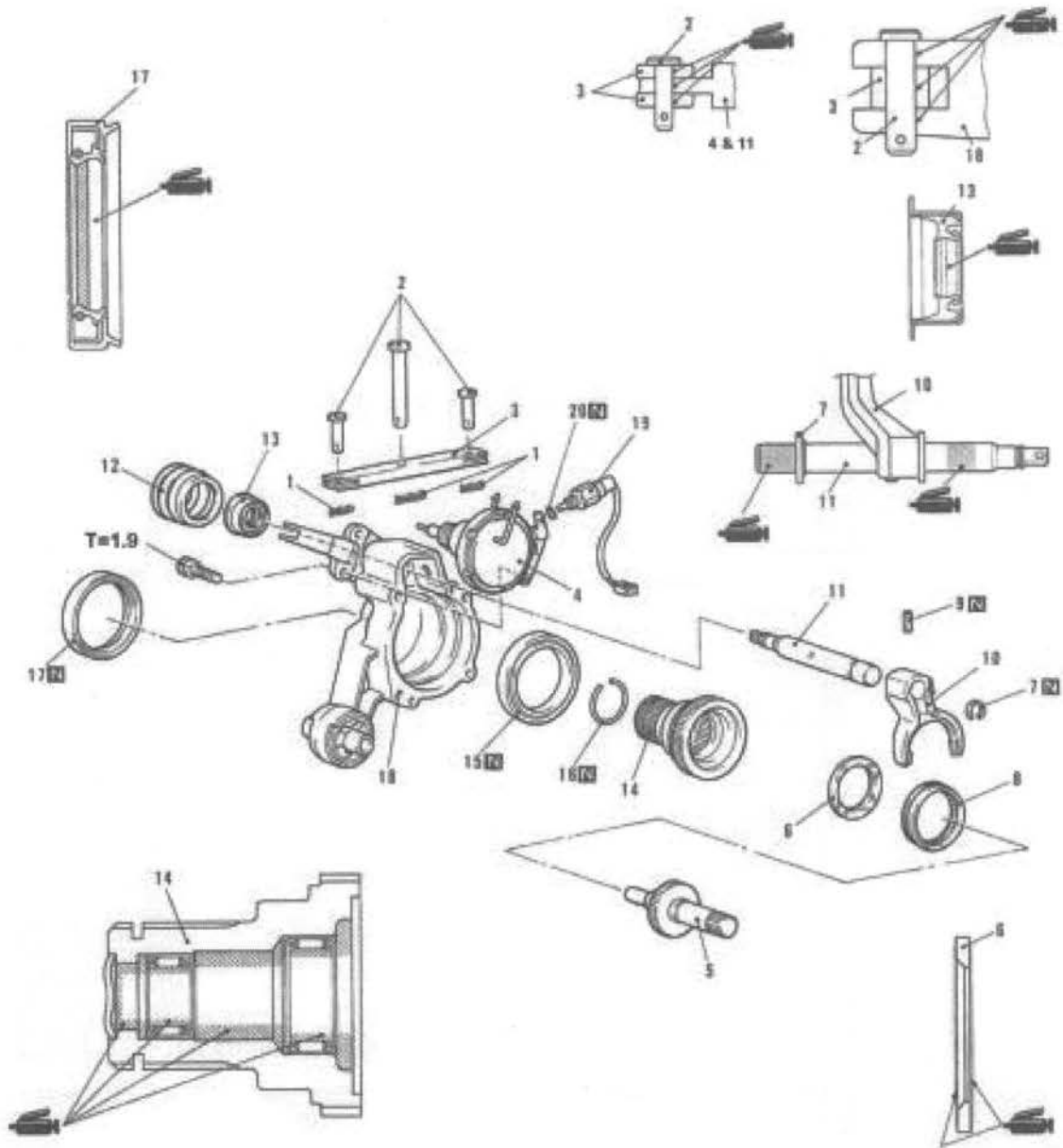
Free Wheel Clutch Assembly: Part Time 4WD



Components

1. Free Wheel Clutch Assembly
2. Thrust Bushing

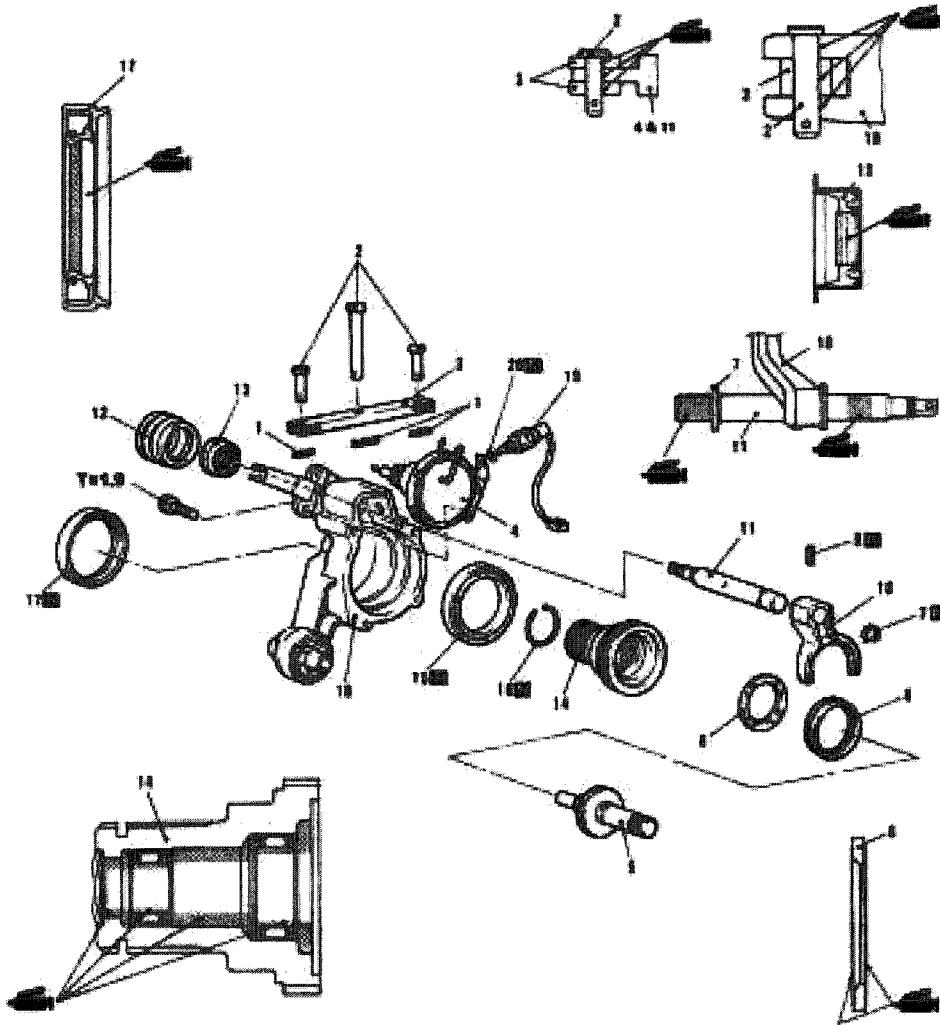
Free Wheel Clutch Internal Components: Part Time 4WD



Disassembly: Remove in Order

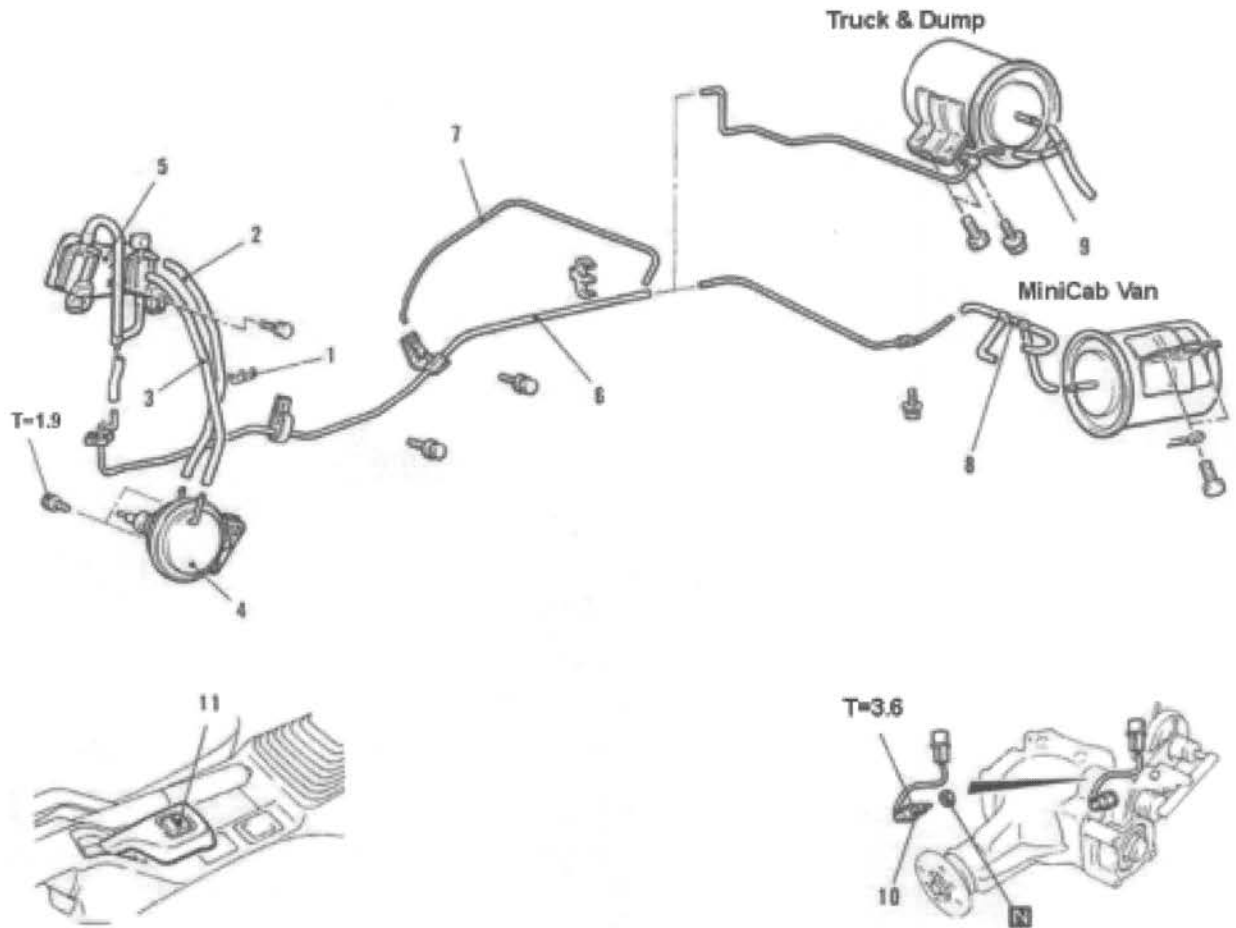
1. Remove Snap Pins
2. Remove Clevis Pins
3. Separate Arm Unit
4. Remove Select Actuator Assembly
5. Remove Main Shaft Assembly
6. Remove Spacer
7. Remove Snap Ring
8. Remove Clutch Spring

Free Wheel Clutch Internal Components: Part Time 4WD



9. Remove Split Pin
10. Remove Shaft Fork
11. Remove Shaft Rod
12. Remove Boot and Discard. New Boot must be used for installation.
13. Remove and discard Seal
14. Remove Clutch gear
15. Remove Bearing
16. Remove Clip
17. Remove and discard Oil Seal
18. Adapter Casing: Inspect for Cracks or other Damage
19. Engagement Switch: 2WD/4WD Position Switch
20. Gasket: Discard
21. Install in reverse order

Free Wheel Clutch Vacuum Line & Components System

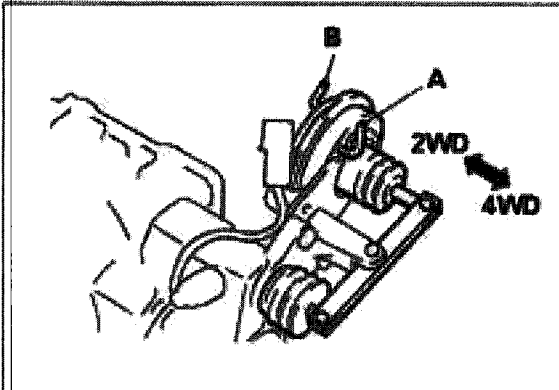


Components

1. Hose Clamp
2. Vacuum Hose (White Stripe)
3. Vacuum Hose (Blue Stripe)
4. Selector Actuator Assembly
5. Solenoid Valve Assembly
6. Vacuum Pipe
7. Vacuum Hose
8. Vacuum Hose (Minicab Van-4WD)
9. Vacuum Hose (Truck-Dump-4WD)
10. Engagement Switch (2WD/4WD Position Switch)
11. 2WD/4WD Engagement Switch: Center Console

Note: If Vehicle has over 65,000 Kilometers or over 5 Years Old Replace Hoses if removed for maintenance.

Free Wheel Clutch Vacuum Line & Components System



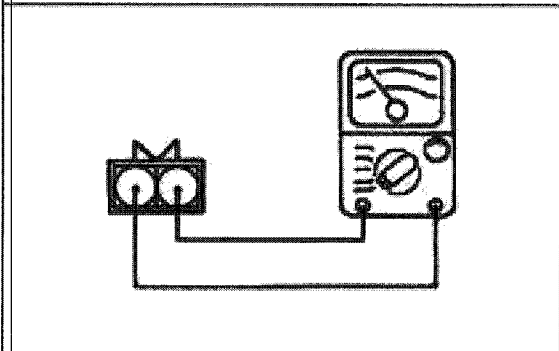
Note: Careful attention to Hose Installation is required. Hoses are Color Coded

"A" Nipple: White Stripe

"B" Nipple: Blue Stripe

Outward Lever Action: 4WD Engaged

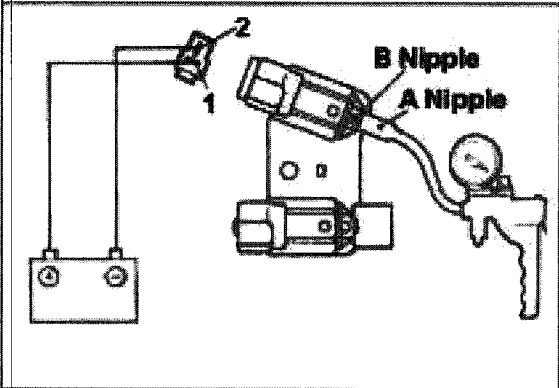
Inward Lever Action: 4WD Disengaged



Power Circuit

ON/OFF 12-14Volts (Battery Power)

Note: If Power is not present replace Switch



Actuator Solenoid Test

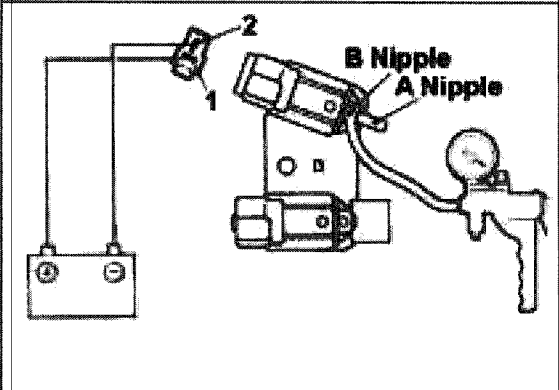
Solenoid A

Note: Disconnect Connector and provide a 12Volt Power Source for these tests.

1. Attach a Hand Held Vacuum Pump Gage to Nipple A. Pump to 450mmHg

No Circuit Power Applied: Pressure Hold

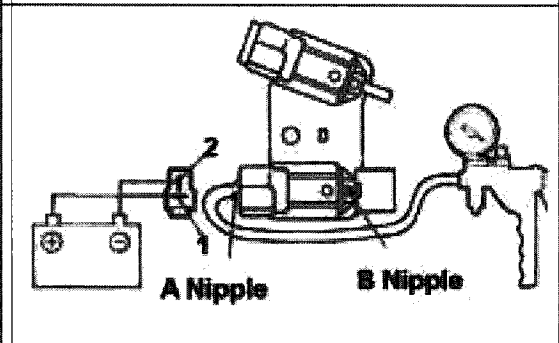
Power to Circuit Applied: Port Bleed (B) Port Hold



2. Attach a Hand Held Vacuum Pump Gage to Nipple B. Pump to 450mmHg

No Circuit Power Applied: Pressure Bleed

Power to Circuit Applied: Port Billed (A) Port Hold



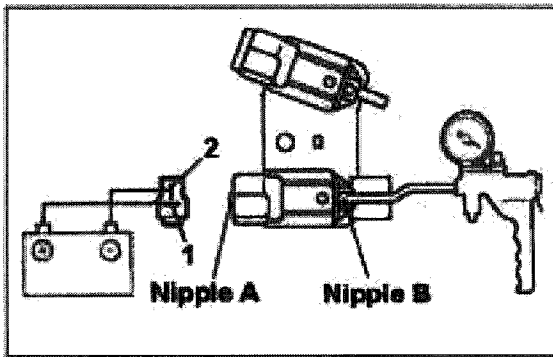
Solenoid B

1. Attach Vacuum Pump to Port A. Pump to 450mmHg

Power to Solenoid: A Port: Hold Pressure

No Power to solenoid: A Port: Bleed B Port Hold

Free Wheel Clutch Vacuum Line & Components System



Solenoid B

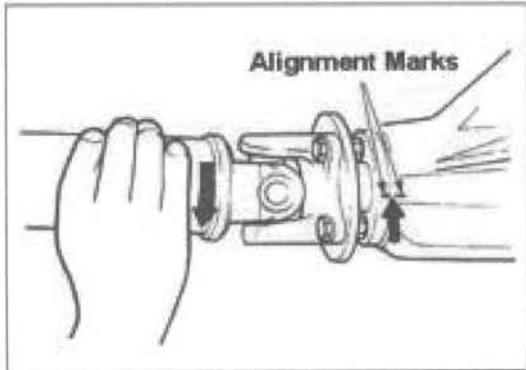
2. Attach Vacuum Pump to Port B. Pump to 450mmHg

Power to Solenoid: B Port: Bleed

No Power to Solenoid: A Port Hold

Notes

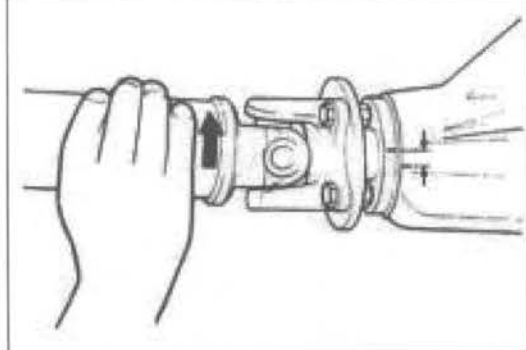
Rear Axel General Inspection



Rear Axel Backlash Test

1. Turn Driveshaft Clockwise to the Alignment Marks.

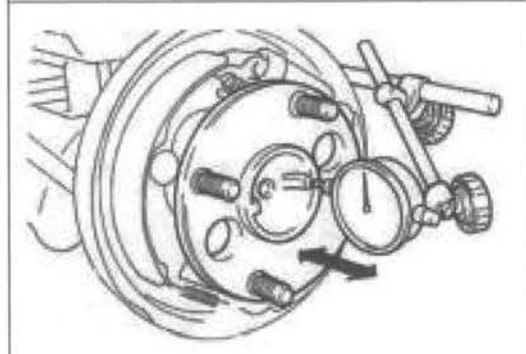
Note: If Alignment Marks are missing use a Straight Edge and etch two lines as shown.



2. Turn Driveshaft counterclockwise until Gear engagement is felt. Measure the distance between the two alignment marks.

Backlash Limit: 5mm

Note: If Backlash is over 5mm disassemble Carrier and inspect.

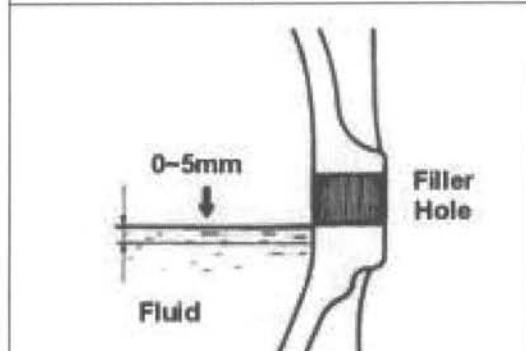


End Play Limit

3. Attach a Dial gage as shown on the left.
4. Measure Axle Shaft End Play

Limit: 0.8mm

Note: If over 0.8mm disassemble Carrier and inspect Shims.



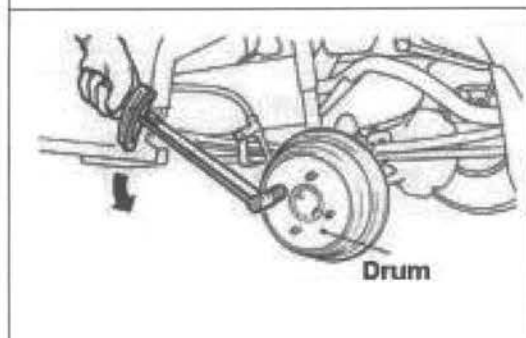
Gear Oil Level

5. Remove Filler Plug and Check Fluid Level.

Limit: $\pm 0-5\text{mm}$

Standard Axle: GL5 Gear Oil 1.1 Liters

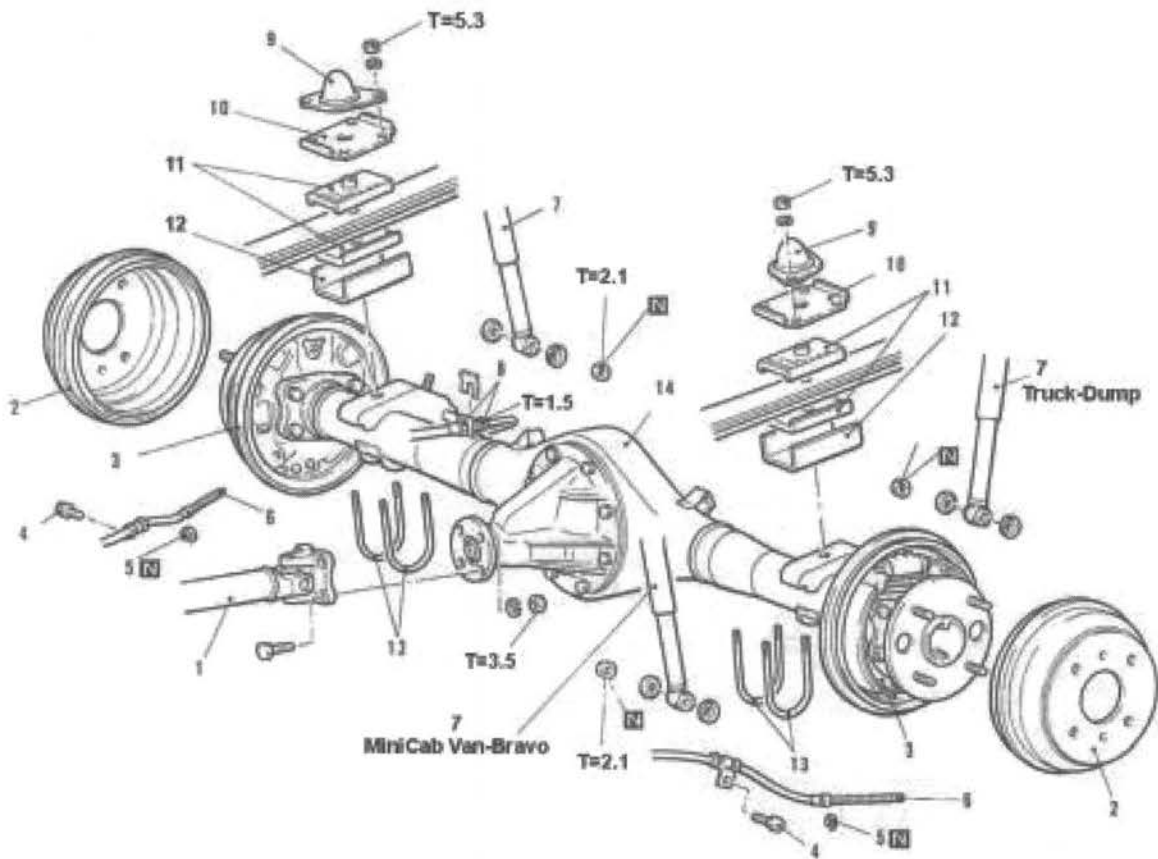
LSD Differential: LSD Carrier Oil 1.1 Liters



Axle Pre-Load Torque

Limit: Above 1.0kgm

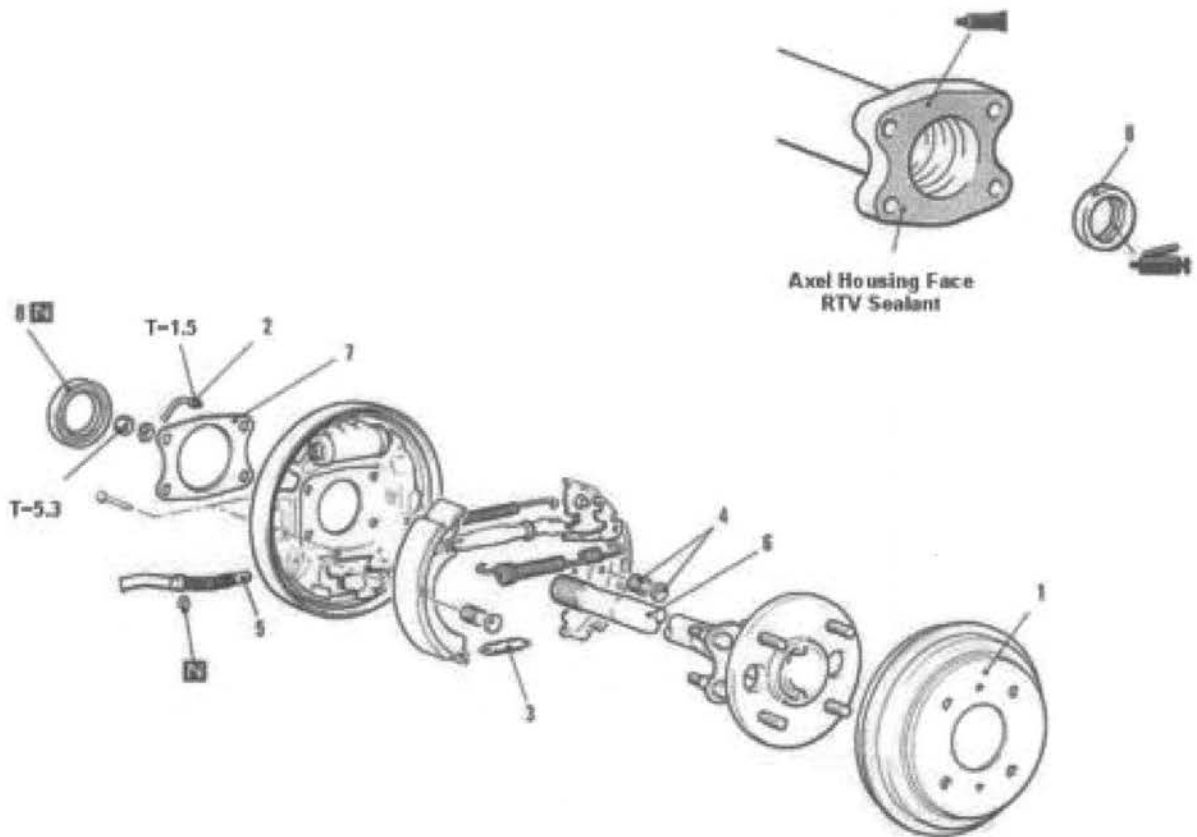
Rear Axel Assembly Removal



Rear Axel Removal

1. Remove Drive Shaft
2. Remove Brake Drums: Optional
3. Remove Shoe and Linings: Optional
4. Remove Parking Brake Cable Attachment Bolt
5. Remove Snap Rings
6. Separate Parking Brake Cable from Leaf Spring Bracket
7. Unbolt Lower Shock Absorber attachment Bolts
8. Separate Rear Brake Line from Differential
9. Remove Rubber Bumper
10. U Bolt Seat
11. Spring Pad
12. Clamp
13. Unbolt U-Clamps and remove
14. Lower and remove Rear Axel Assembly

Rear Axel Removal

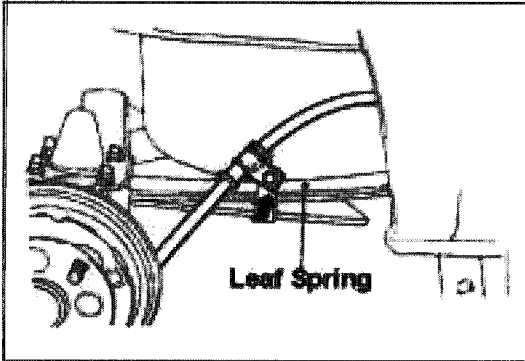


Components & Removal

1. Remove Brake Drum
2. Disconnect Rear Brake Fluid Line
3. Remove Retainer Spring
4. Remove Brake Shoe Hold Down Springs
5. Disconnect Rear Parking Brake Cable
6. Unbolt Axel Shaft Retainer
7. Remove Plate
8. Remove & Replace Oil Seal

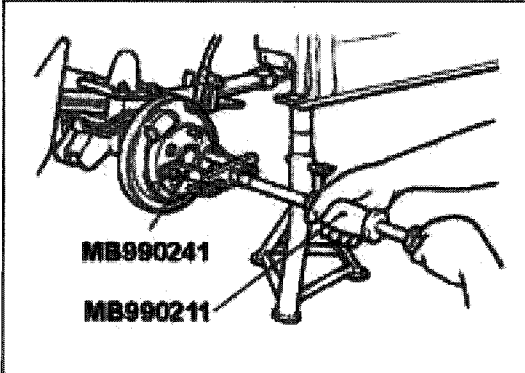
Note: See the Following Pages for Details on Removal

Rear Axel Removal



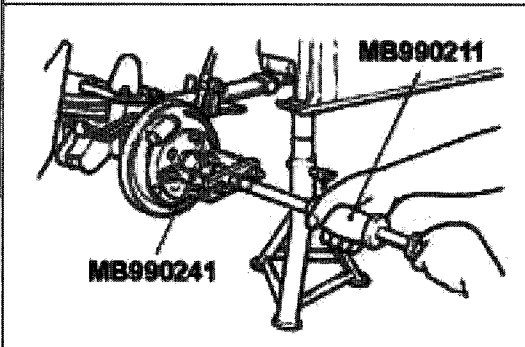
Parking Brake Cable

Note: The Parking Brake Cable is attached to the Leaf Spring as shown. Remove the attachment Bolt at this Point.



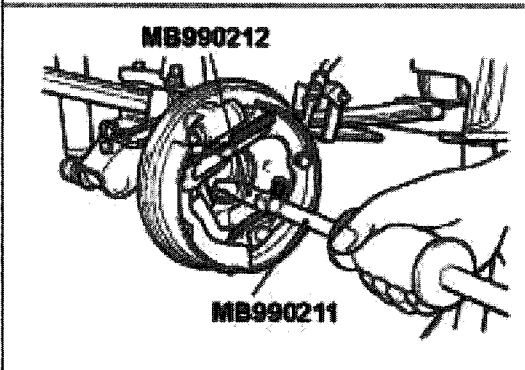
12 & 13 Inch Wheel Size Axel Removal

Attach Axel Adapter: MB990241
Attach Slide Hammer: MB990211
Remove Axel



10 Inch Wheel Size Axel Removal

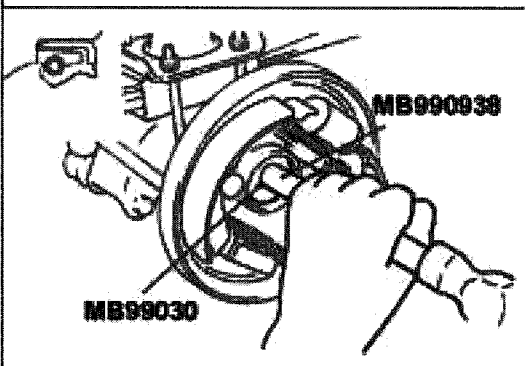
Attach Axel Adapter: MB990241
Attach Slide Hammer: MB990211
Remove Axel



Oil Seal removal

Use MB990212 Oil Seal Puller Adapter or similar available Tool to remove Oil Seal as shown.

Note: Always replace Seal with New Parts

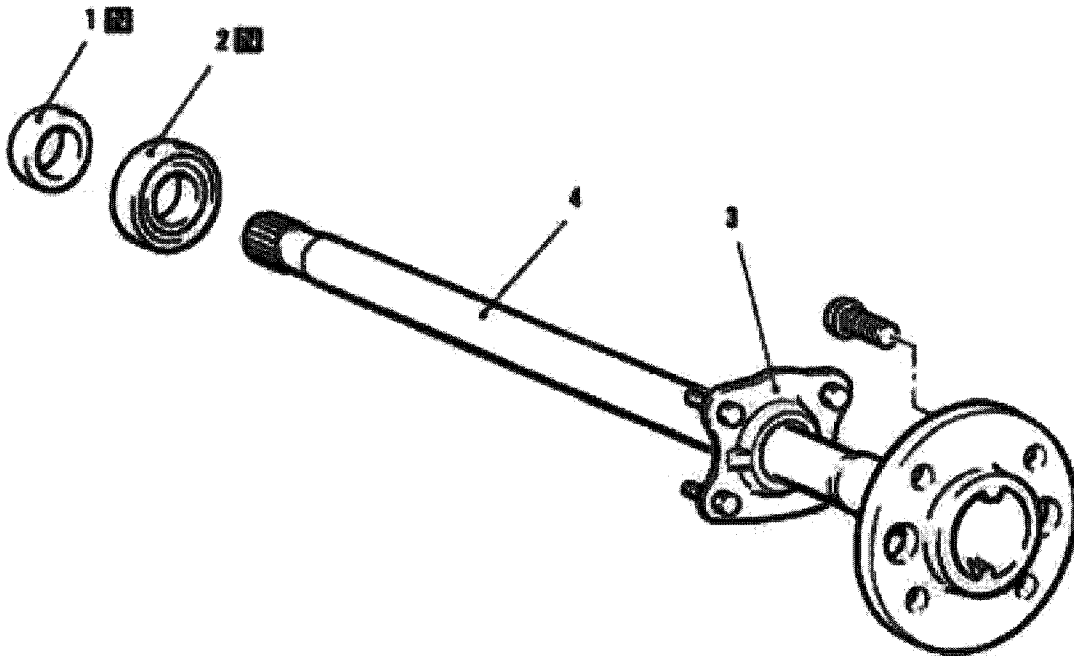


Oil Seal Installation

Install Oil Seal as shown.

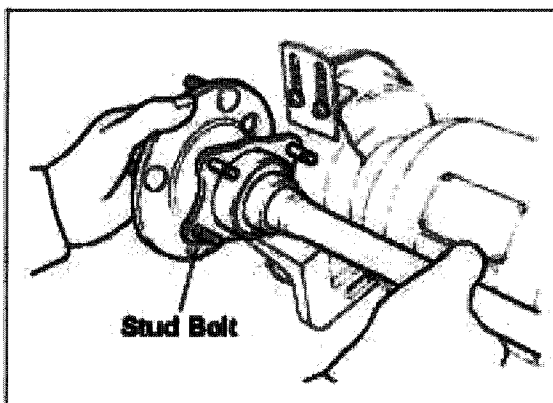
Note: Coat Seal with Multi-Purpose Axel Grease before installation.

Rear Axel Shaft and Bearing Removal



Components

1. Bearing Inner Retainer
2. Bearing
3. Bearing Outer Retainer
4. Axel Shaft



Bearing Inner Retainer Bearing

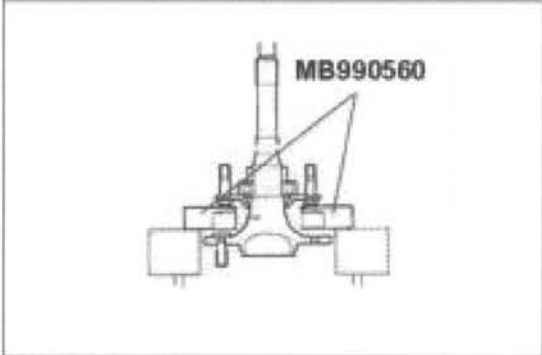
Note: Inner Retainer Thickness is approximately 1.0-1.1mm thick.

1. Use a Grinder to remove Inner Race. Use Extra Caution when grinding not to get the Stud Bolts in the way of the Grinding Wheel. It is only necessary to grind on Point and then carefully knock off the Bearing Race. See following Page.

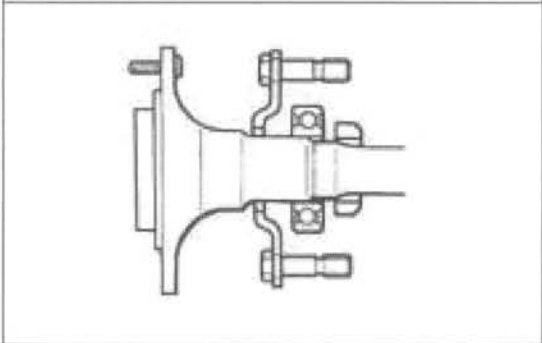
Rear Axel Shaft and Bearing Removal



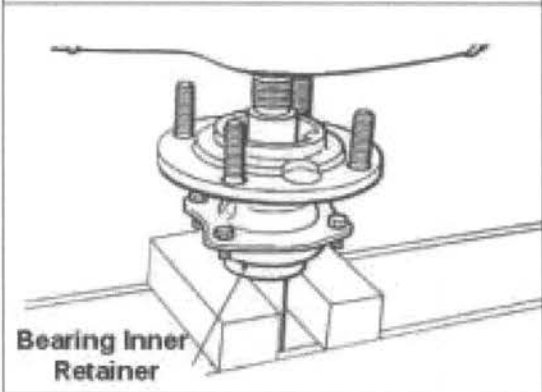
2. After Grinding a Patch use a adequate Chisel to remove remaining Bearing Race Metal.



3. Utilize Press Adapter Plate MB990560 for New Bearing Race installation.

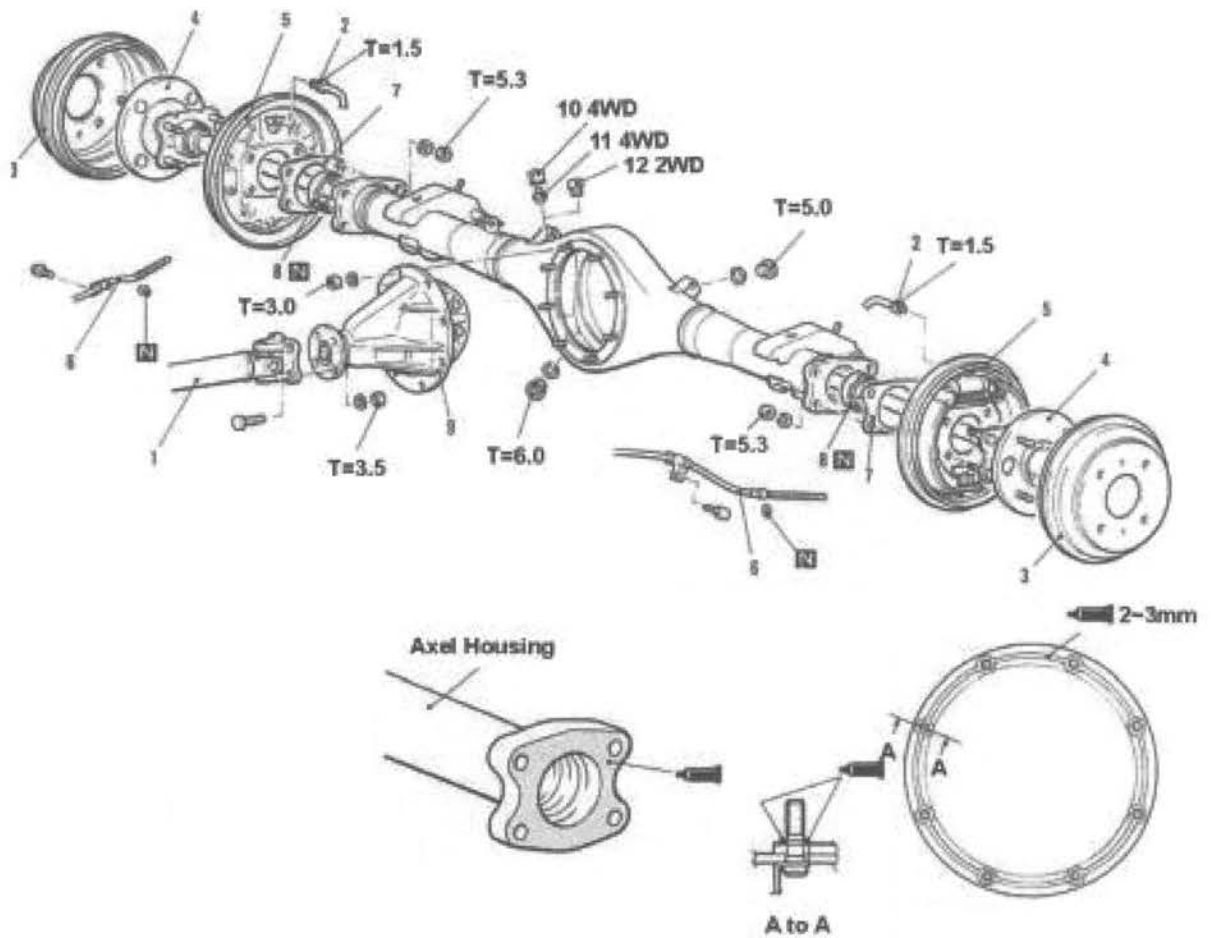


4. Instillation of Parts Diagram. Verify Parts installation using the Diagram on the Left.



5. Install Bearing Inner Retainer as shown.
6. Reinstall Axel Shaft into Vehicle

Rear Differential Carrier Removal

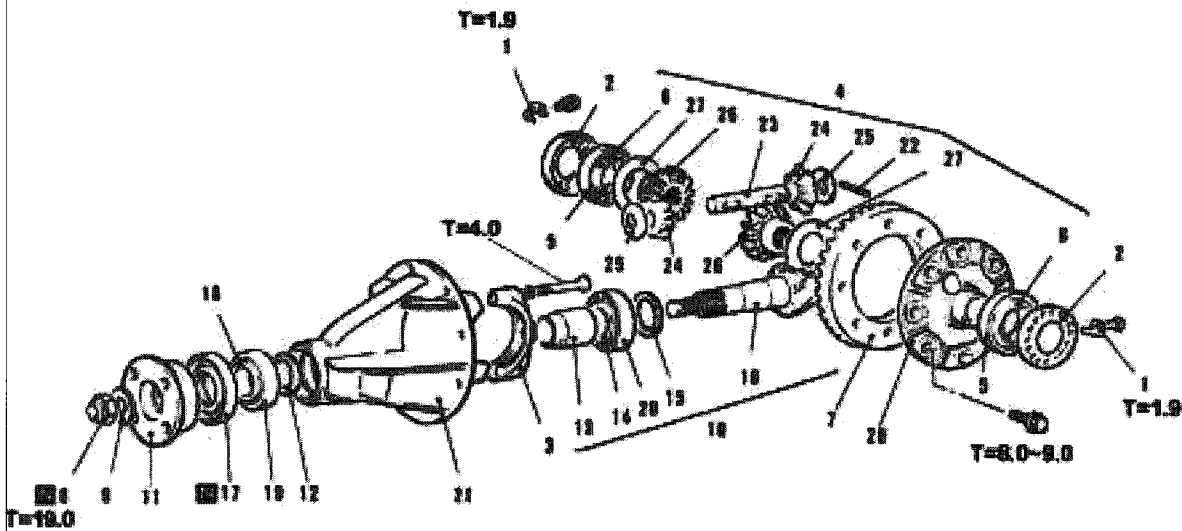


Components & Removal

Note: Drain Carrier Oil before proceeding

1. Remove Driveshaft
2. Disconnect Brake Line
3. Remove Brake Drum
4. Remove Axle Shafts
5. Remove Rear Brakes
6. Disconnect Rear Parking Cable
7. Remove Shim
8. Remove Oil Seal
9. Remove Differential Carrier
10. Remove Plug Cover: 4WD
11. Remove Vent Plug
12. Installation in reverse

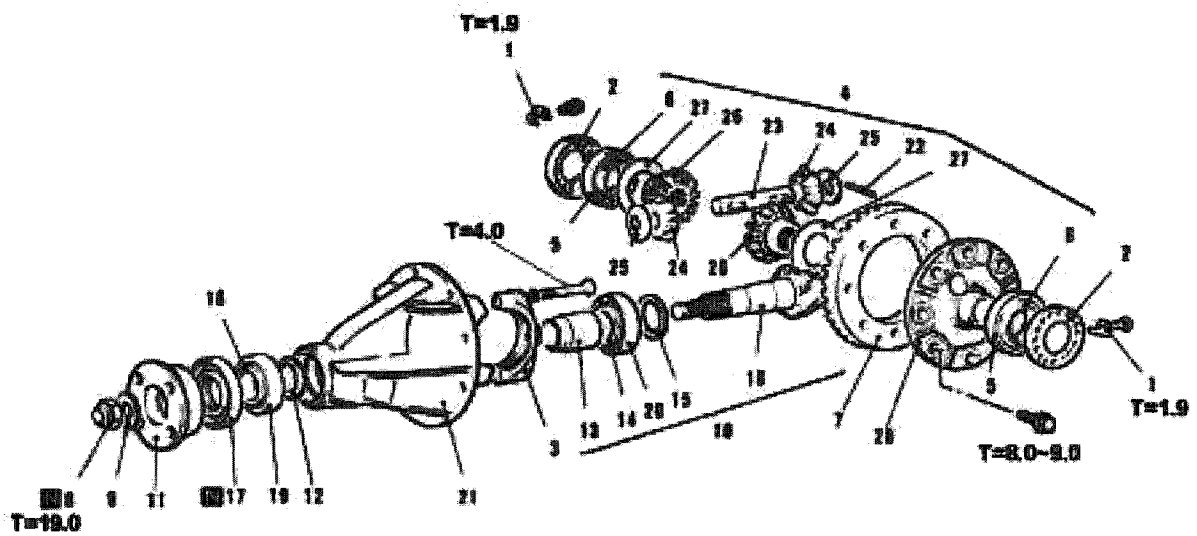
Rear Differential Carrier Components: STD Version



Components & Removal

1. Remove Lock Plate
2. Remove Side Bearing Plate
3. Remove Bearing Cap
4. Complete Gear Assembly Unit
5. Remove Side Bearing Outer Race
6. Side Bearing Inner Race
7. Disassemble Side Gear
8. Remove Self-Lock Nut
9. Washer
10. Drive Pinion assembly
11. Companion Flange
12. Drive Pinion Front Shim
13. Remove Drive Pinion Spacer
14. Drive Pinion Rear Bearing Inner Race
15. Drive Pinion Rear Shim
16. Drive Pinion Unit
17. Remove Oil Seal and Discard
18. Drive Pinion Front Bearing Inner Race
19. Drive Pinion Front Bearing Outer Race
20. Drive Pinion Rear Bearing Outer Race
21. Gear Carrier

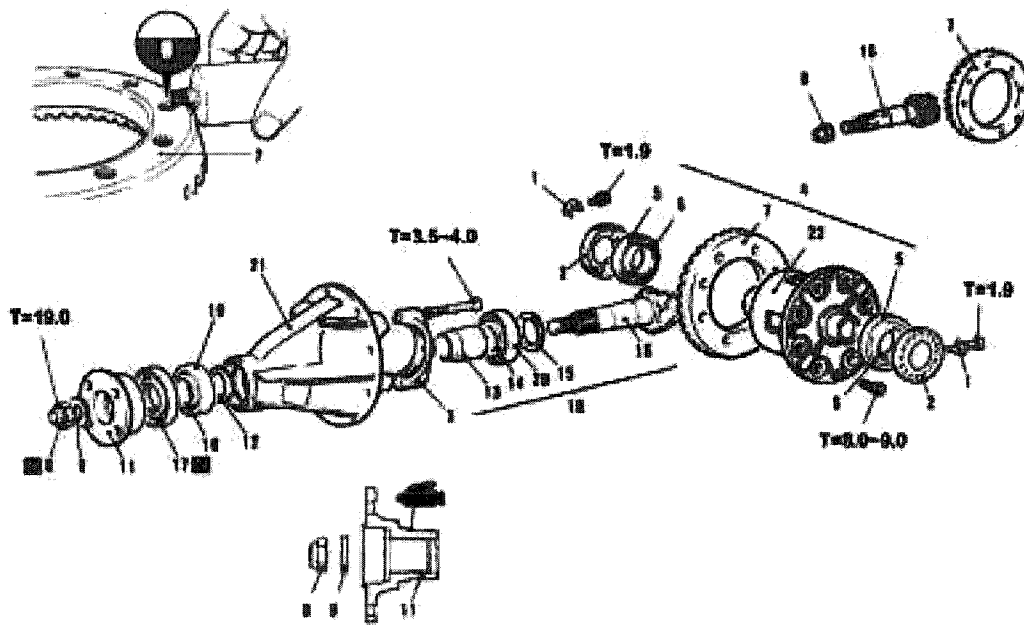
Rear Differential Carrier Components: STD Version



- 22. Lock Pin
- 23. Pinion Shaft
- 24. Pinion Gear
- 25. Pinion Washer
- 26. Side Gear
- 27. Side Gear Spacer
- 28. Differential Case
- 29. Install all Components in Reverse Order

Note: See Parts Catalogue for Optional Shim and Spacer Sizes

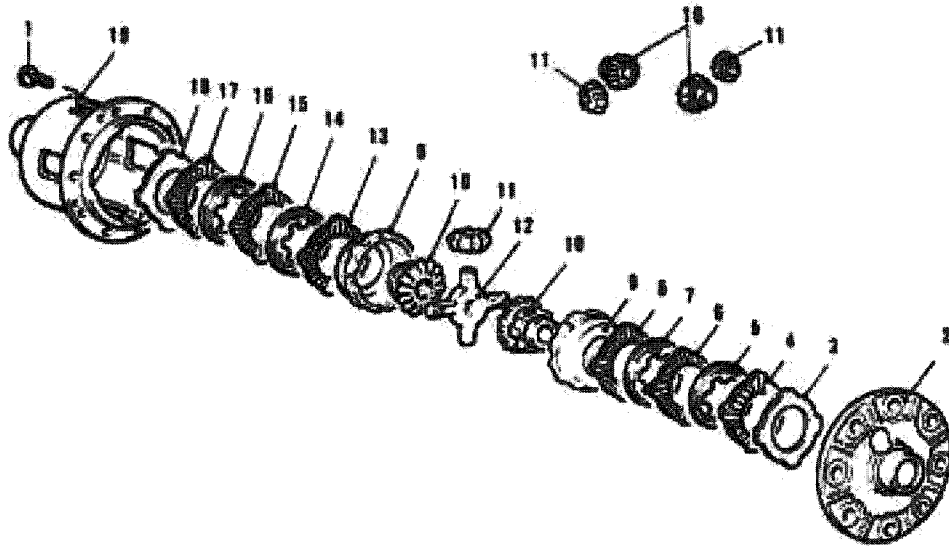
Rear Differential Carrier Components: LSD Version



Components & Assembly

1. Lock Plate
2. Side Bearing Plate
3. Bearing Cap
4. Differential Case Assembly
5. Side Bearing Outer Race
6. Side Bearing Inner Race
7. Drive Gear
8. Self Locking Nut
9. Washer
10. Drive Pinion Assembly
11. Companion Flange
12. Drive Pinion Front Shim
13. Drive Pinion Spacer
14. Drive Pinion Rear Bearing Inner Race
15. Drive Pinion Rear Shim
16. Drive Pinion
17. Oil Seal
18. Drive Pinion Front Bearing Inner Race
19. Drive Pinion Front Bearing Outer Race
20. Drive Pinion Rear Bearing Outer Race
21. Gear Carrier
22. LSD Case Assembly

Rear LSD Case Components



LSD Components

Note: See Parts Catalogue for Individual Components

1. Screw
2. Differential Case "A" Lock Plate
3. Spring Plate
4. Friction Plate
5. Friction Disk
6. Friction Plate
7. Friction Disk
8. Friction Plate
9. Pressure Ring
10. Side Gear
11. Pinion Gear
12. Pinion Shaft
13. Friction Plate
14. Friction Disk
15. Spring Plate
16. Friction Disk
17. Friction Plate
18. Spring Plate
19. Differential Case "B"

Note: Friction Plate and Disk Thickness Limit: 0.1mm. Measurement taken between Disk or Plate Body and Tang.

Chapter 10

Suspension

- 140. Front End Alignment Specifications: Also see Steering Section
- 141. Front Strut Assembly 2WD
- 142. Front Strut Assembly 4WD
- 143. Lower Arm, Stabilizer Bar, and Torsion Bar 2WD
- 144. Lower Arm, Stabilizer Bar, and Torsion Bar 4WD
- 145. Cross Member 2WD-4WD
- 146. Rear Suspension

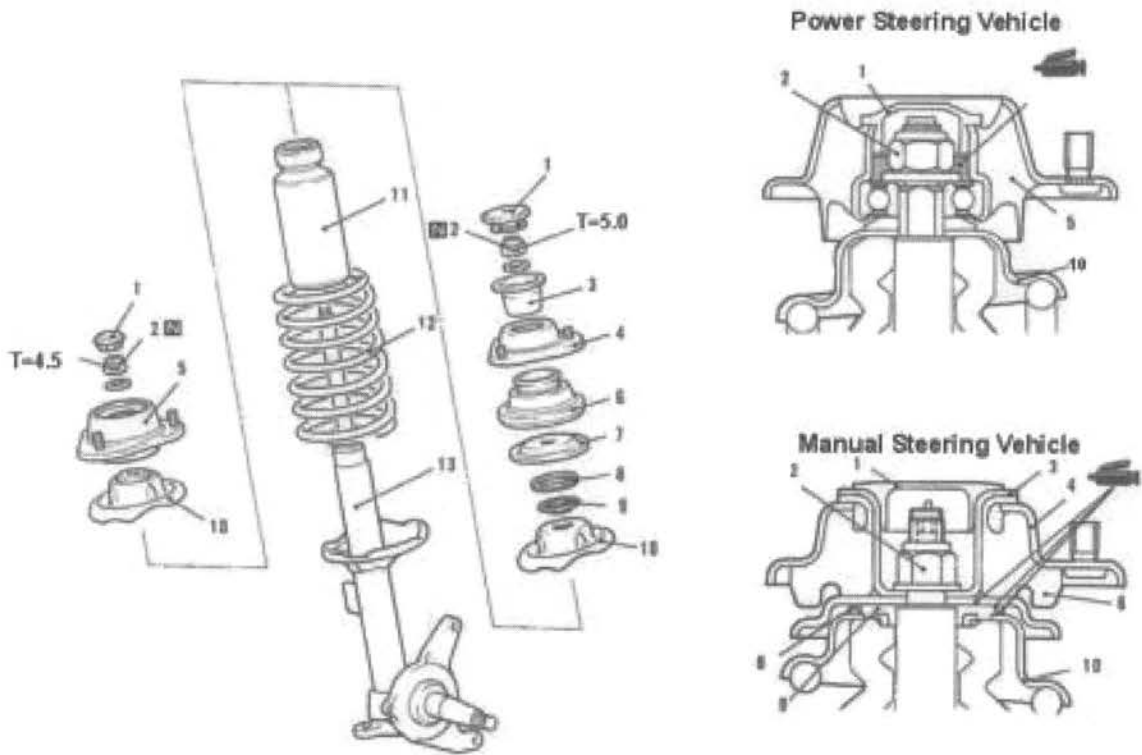
Front End Alignment Specifications

Component		Limit	Vehicle Type
Toe In		2-7mm	All
Handle Turning Degree	Inside	37°00'+0°-3°	2WD
	Outside	36°00'+0°-3°	4WD
Camber		1°40±45'	2WD 10'Wheel
		2°00'±45'	2WD 12' or 13' Wheel
		1°30±45'	4WD
Caster		3°00'±1°	2WD 10' Wheel
		3°20'±1°	2WD 10' or 13' Wheel
		2°40'±1°	4WD
Side Slip		0±3mm	All
Ball Joint Revolution Torque		30~100kgcm	2WD
		10-80kgcm	4WD

Note: Mitsubishi Has Three Series of Wheel Sizes

1. 10'= 10 Inches (2WD)
2. 12'= 12 Inches (2WD)
3. 13'= 13 Inches (4WD)

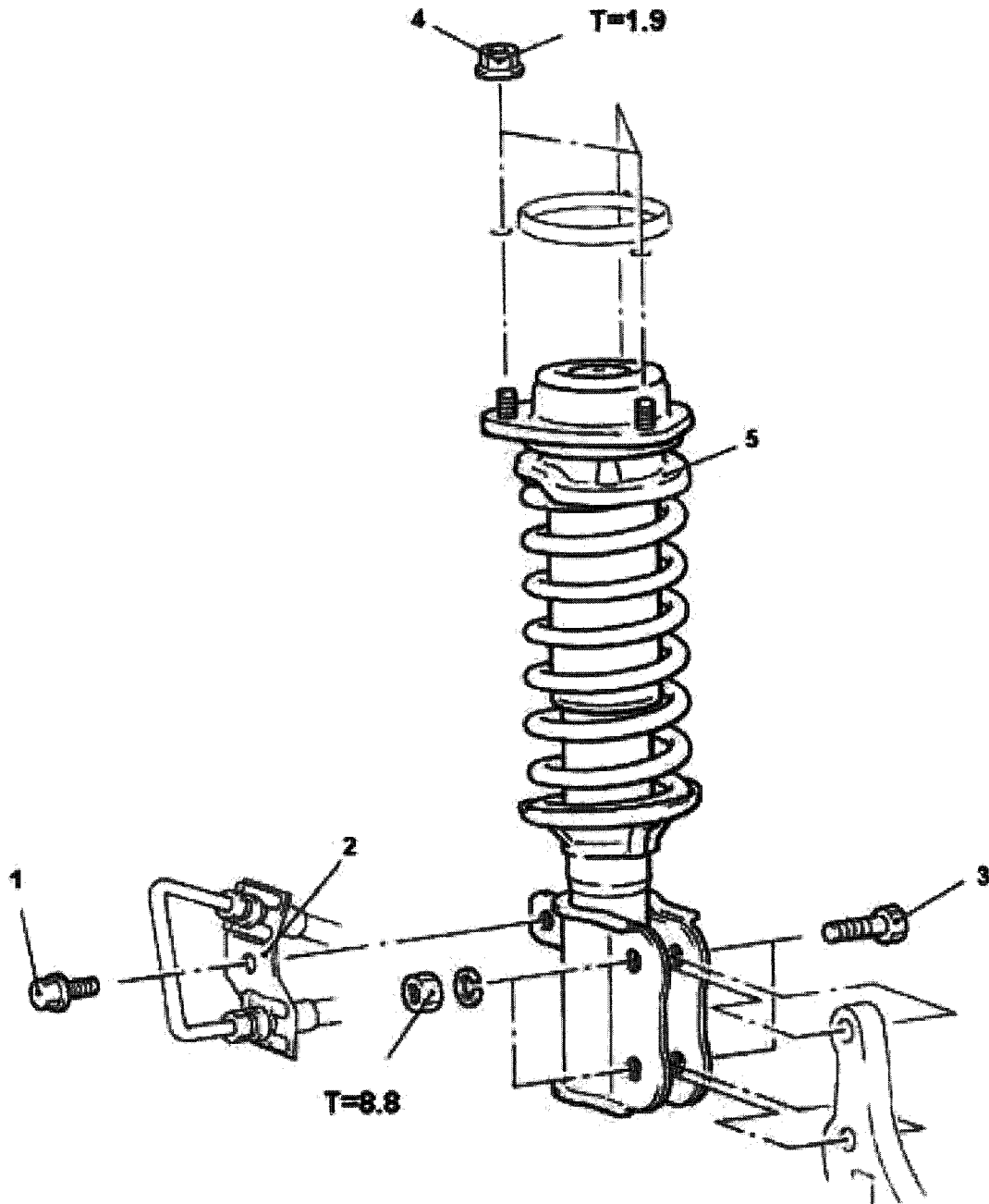
Front Strut Assembly 2WD



Front Strut Components

1. Dust Cover
2. Self Lock Nut
3. Stopper (Manual Steering)
4. Insulator Bracket Assembly (Manual Steering)
5. Thrust Insulator Assembly (Power Steering)
6. Isolator Cover (Manual Steering)
7. Support Bracket (Manual Steering)
8. Bearing (Manual Steering)
9. Dust Seal (Manual Steering)
10. Spring Seat Assembly (PWR Steering) Spring Upper Seat (Manual Steering)

Front Strut Assembly 4WD

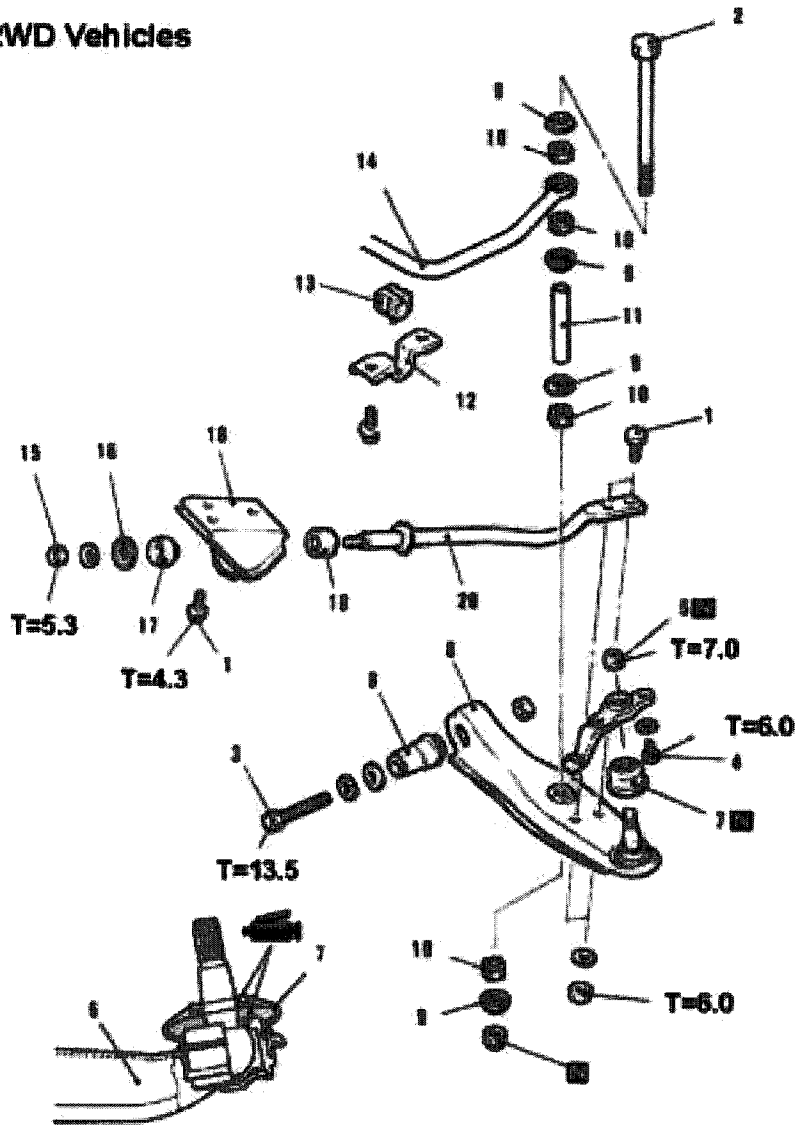


Component Removal & Replacement Order

1. Remove Brake Hose Attachment Bolt
2. Remove retaining Clips & Bracket
3. Remove Strut Lower Attachment Bolts
4. Remove Strut Upper Attachment Bolts
5. Remove Strut
6. Install in reverse order

Lower Arm, Stabilizer Bar, and Torsion Bar 2WD

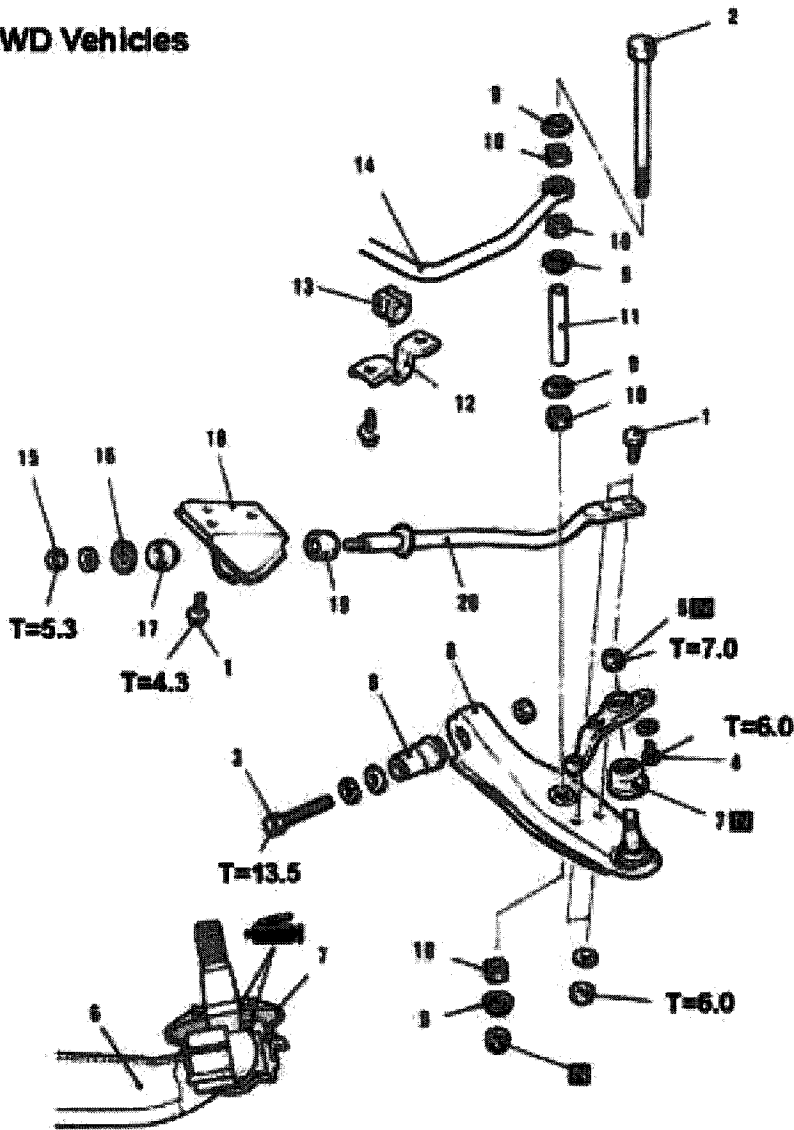
2WD Vehicles



1. Torsion Bar Attachment Bolt
2. Link Pin Bolt
3. Lower Arm Attachment Bolt
4. Knuckle Arm Bolt
5. Ball Joint Nut
6. Lower Arm Assembly
7. Dust Boot
8. Bushing
9. Joint Cup "A"
10. Stabilizer Bushing
11. Spacer Tube
12. Bushing Bracket
13. Stabilizer Bushing

Lower Arm, Stabilizer Bar, and Torsion Bar 2WD

2WD Vehicles



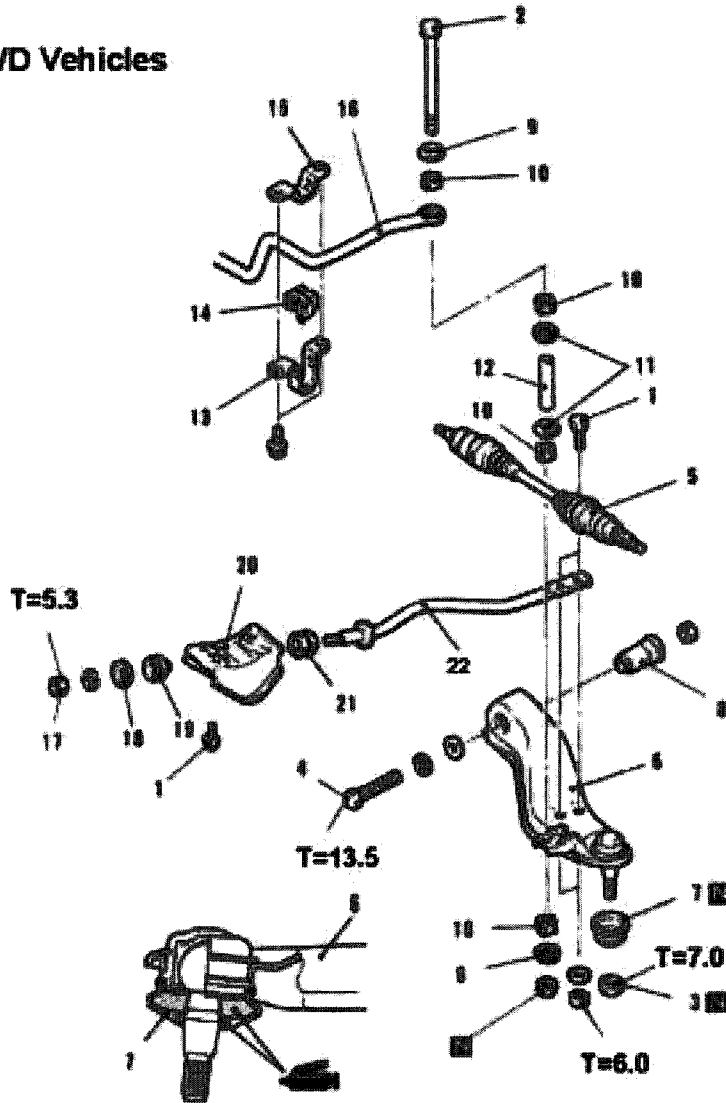
14. Stabilizer Bar
15. Torsion Bar Nut
16. Washer
17. Torsion Bushing "A"
18. Torsion Bar Bracket
19. Torsion Bar Bushing "B"
20. Torsion Bar

Note: Replace all Rubber Bushings once removed

Note: Lower Arm Ball Joint must be Replaced once removed if Vehicle has over 100,000 Kilometers

Lower Arm, Stabilizer Bar, and Torsion Bar 4WD

4WD Vehicles

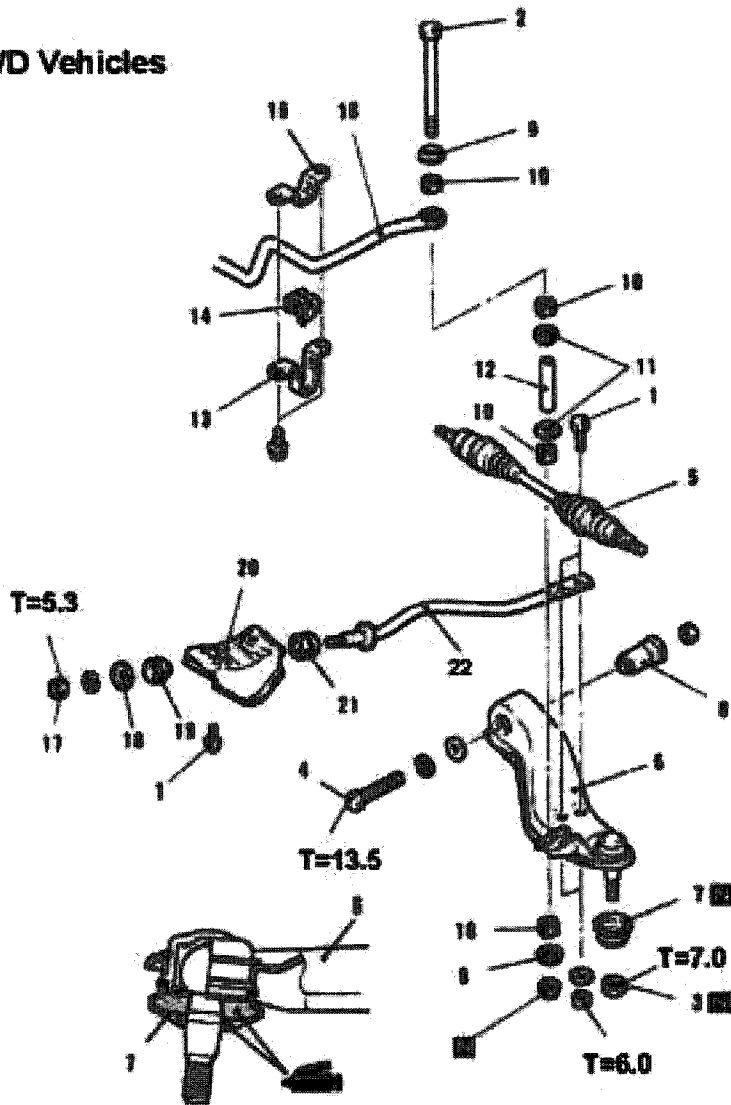


Component Removal & Replacement Order

1. Bracket Attachment Bolt
2. Link Pin Bolt
3. Knuckle Retaining Nut
4. Lower Arm Cross Member Bolt
5. Drive Shaft
6. Lower Arm Assembly
7. Dust Boot
8. Bushing
9. Joint Cup "A"
10. Stabilizer Bushing
11. Joint Cup "B"
12. Spacer Tube

Lower Arm, Stabilizer Bar, and Torsion Bar 4WD

4WD Vehicles



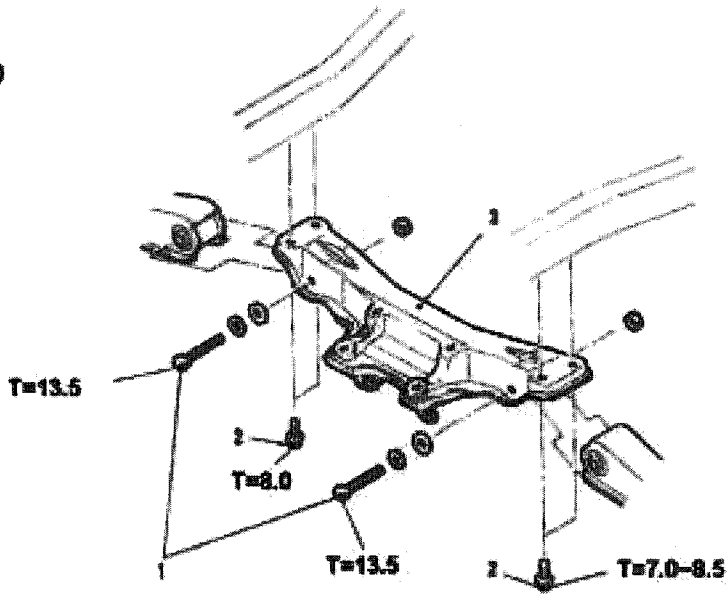
13. Bushing Retaining Bracket
14. Stabilizer Bushing
15. Upper Bracket
16. Stabilizer Bar
17. NA
18. Washer
19. Torsion Bushing "A"
20. Torsion Bracket
21. Torsion Bushing "B"
22. Torsion Bar

Note: Replace all Rubber Bushings once removed

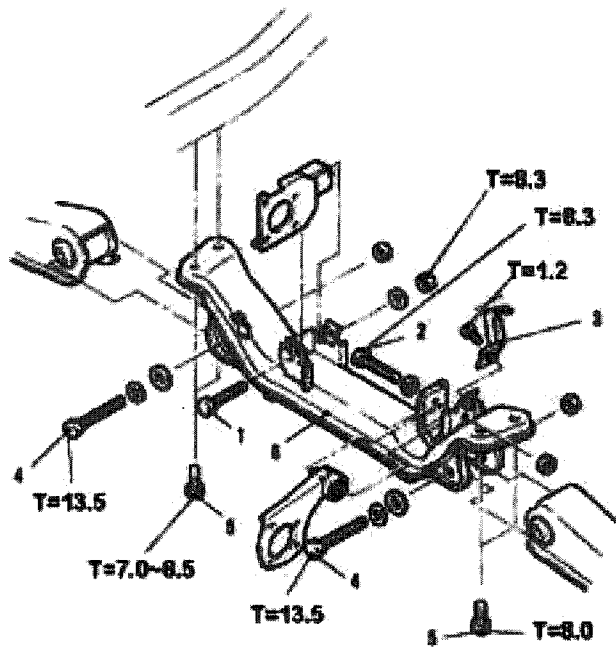
Note: Lower Arm Ball Joint must be Replaced once removed if Vehicle has over 100,000 Kilometers

Cross Member 2WD-4WD

2WD



4WD



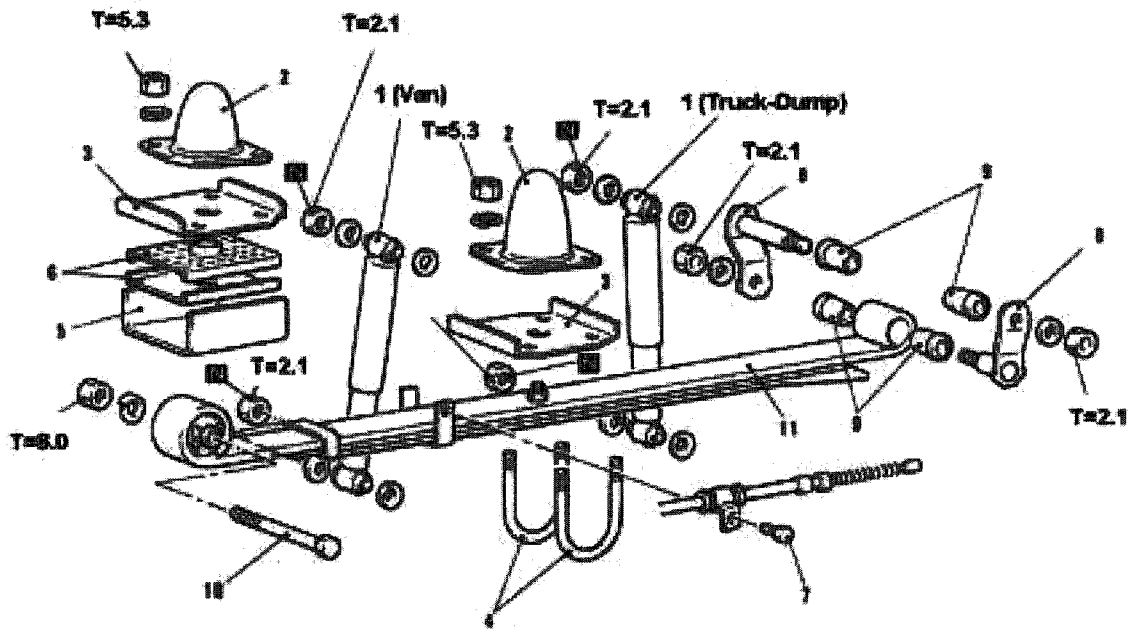
2WD

1. Lower Arm attachment Bolts
2. Cross Member to Frame Attachment Bolts
3. Cross Member Unit

4WD

1. Differential Mount Bracket RH
2. Differential Mount Bracket LH
3. Power Steering Hose Bracket
4. Lower Arm Attachment Bolts
5. Cross Member to Frame Bolts
6. Cross Member

Rear Suspension



Rear Suspension Components

1. Shock Absorber
2. Bumper Stopper
3. U-Bolt Bracket
4. U-Bolts
5. Clamp
6. Spring Pad
7. Rear Parking Brake Cable Clamp
8. Spring Shackle
9. Spring Bushing
10. Rear Spring Front Attachment Bolt
11. Rear Spring assembly

Note: Once disassembled Spring Pads can not be reused. They must be replaced with New Parts.

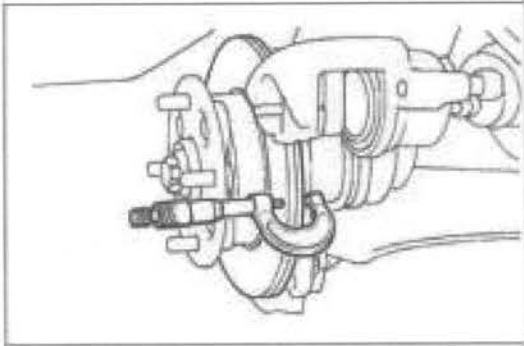
Note: Shock Absorbers should be replaced every 80,000 Kilometers

Chapter 11

Brake system

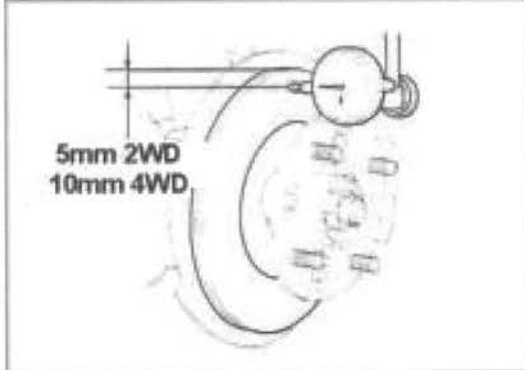
- 147. Brake Inspection & Specification Limits
- 148. Brake Pedal Assembly: Manual Transmission
- 149. Brake Pedal Assembly: Automatic Transmission
- 150. Master Cylinder & Brake Booster
- 151. Master Cylinder Disassembly and Components
- 152. Brake Line System 2WD & 4WD
- 153. Front Brake Drum System
- 154. Front Disk Brake System: 2WD & 4WD
- 155. Disk Brake Caliper Assembly
- 156. Caliper Installation Tips & Pad Measurement
- 157. Rear Drum Brakes
- 158. Parking Brake Cable System

Brake Inspection & Specification Limits



Front Disk thickness Inspection

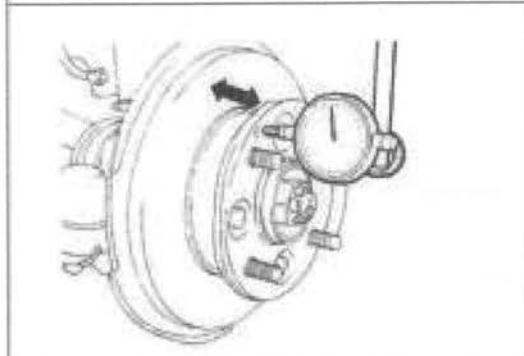
1. Use a Micrometer as shown on the Left. Check Disk Thickness.
Limit: 11.00mm
Replace: 9.4mm



Front Disk Warpage Inspection

2. Place a Dial Gage as shown

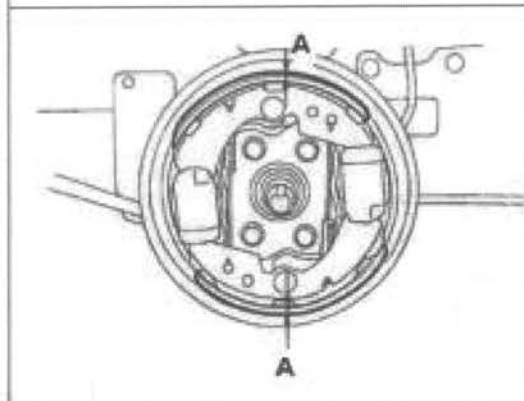
Note: 2WD Measure 5mm from Top of Disk
4WD Measure 10mm from top of Disk
Limit: Below 0.15mm



Hub Free Play Inspection

3. Attach a Dial gage as shown

2WD Limit: 0mm
4WD Limit: 0.2mm



Drum Brake Pad Thickness Inspection

4. Measure Pad Lining Thickness at Point "A"

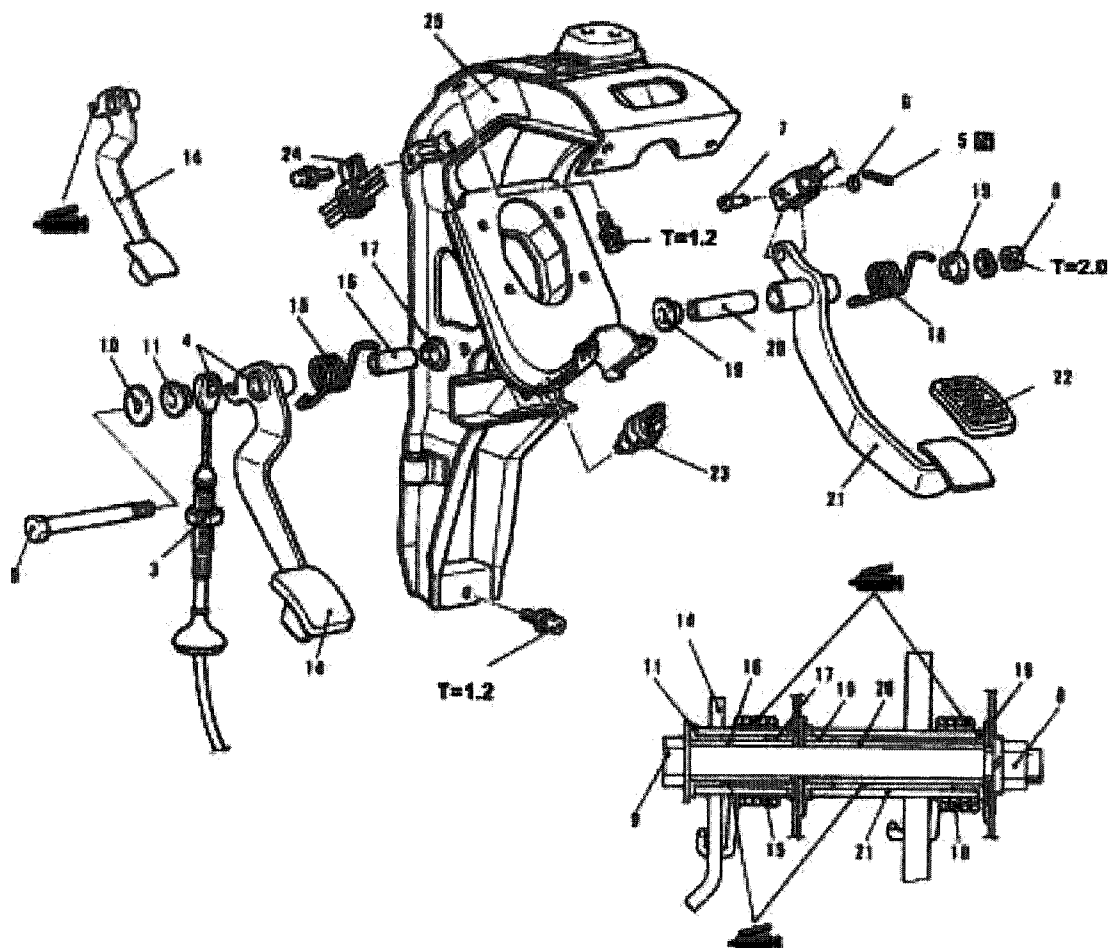
Front Drum: 4.9mm
Rear Drum: 4.3mm



Drum Brake Drum Inspection

5. Use a Dial Gage as shown
Front Drum Radius Limit: 190mm
Rear Drum Radius Limit: 180mm
Front Replace@ 192mm
Rear Replace@ 182mm

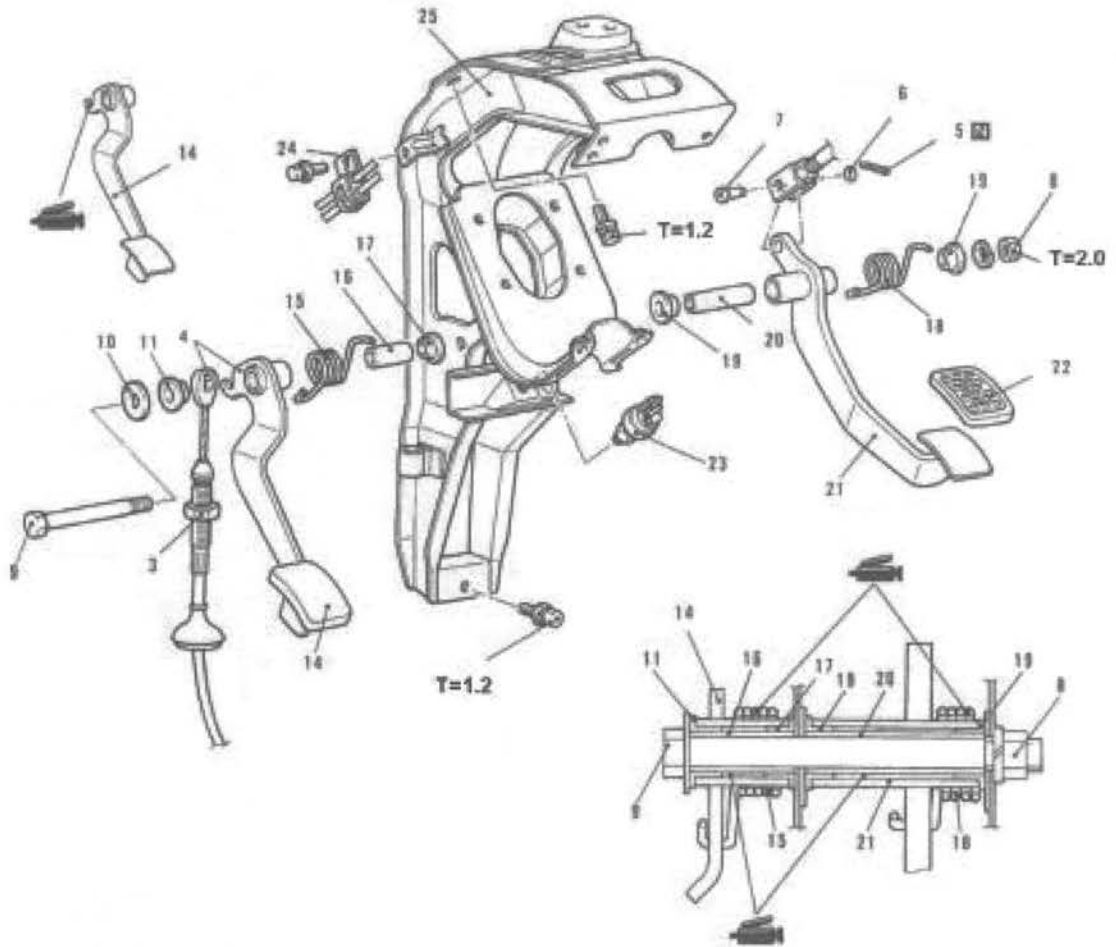
Brake Pedal Assembly: Manual Transmission



Components & Torque Settings

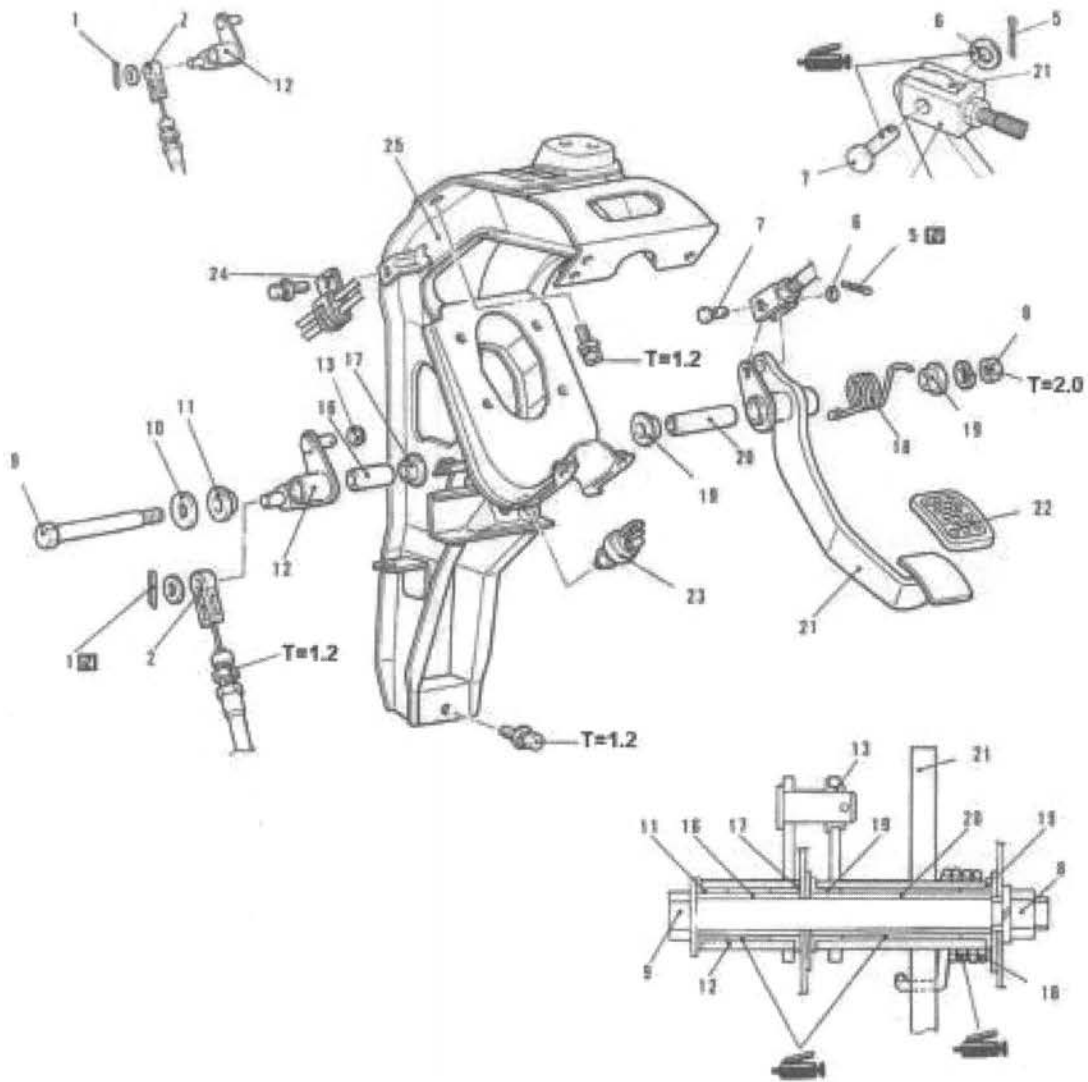
1. NA
2. NA
3. Adjustment Nut
4. Clutch Pedal Adjustment Nut: See Clutch Section
5. Split Pin
6. Washer
7. Clevis Pin
8. Pedal Shaft Nut
9. Pedal Shaft
10. Washer
11. Bushing
12. NA
13. NA
14. Clutch Pedal
15. Clutch Pedal Return Spring

Brake Pedal Assembly: Manual Transmission



- 16. Spacer Tube
- 17. Bushing
- 18. Brake Pedal return Spring
- 19. Bushing
- 20. Spacer Tube
- 21. Brake Pedal
- 22. Pad
- 23. Stop Lamp Switch
- 24. Clamp
- 25. Pedal Support Member

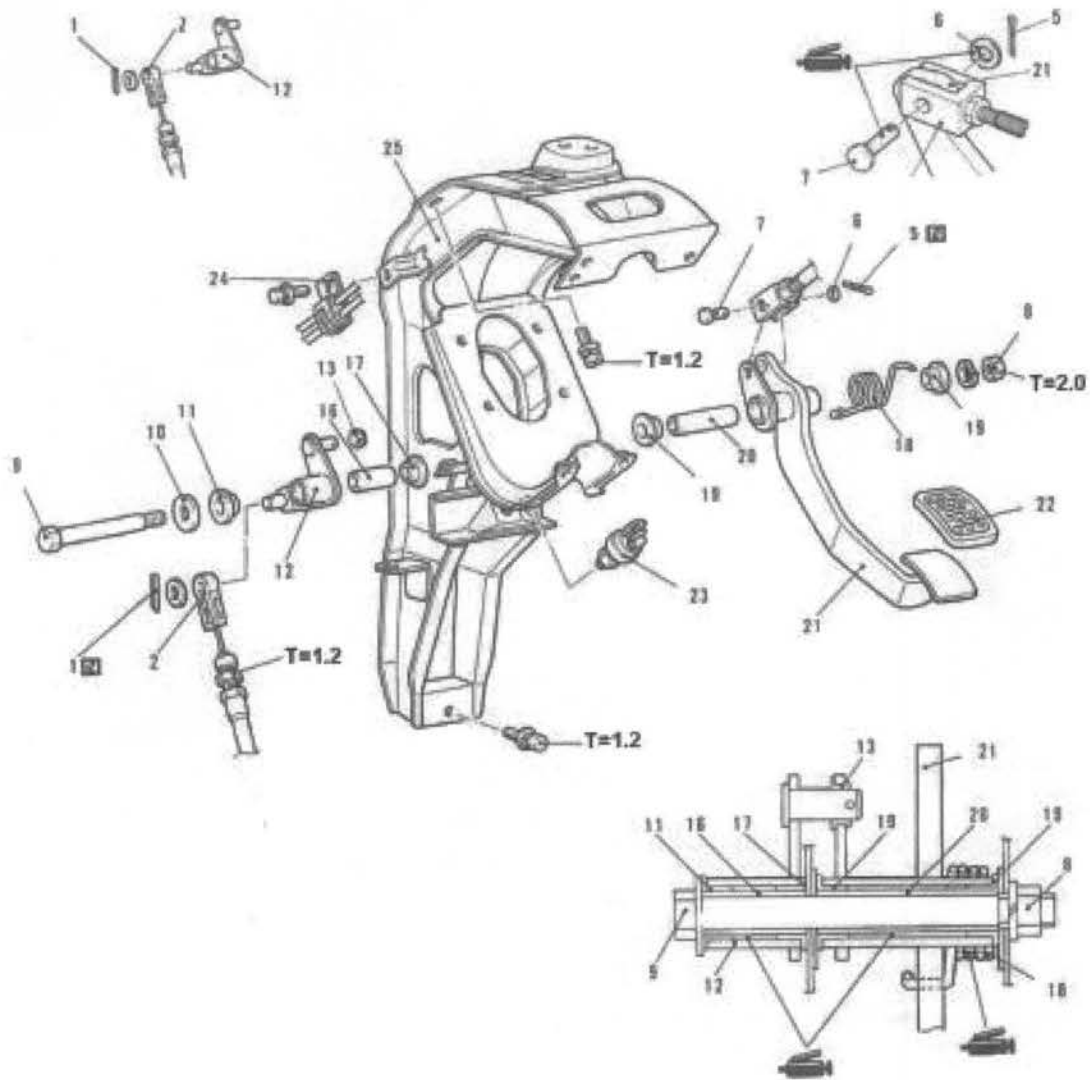
Brake Pedal Assembly: Automatic Transmission



Components & Torque Settings

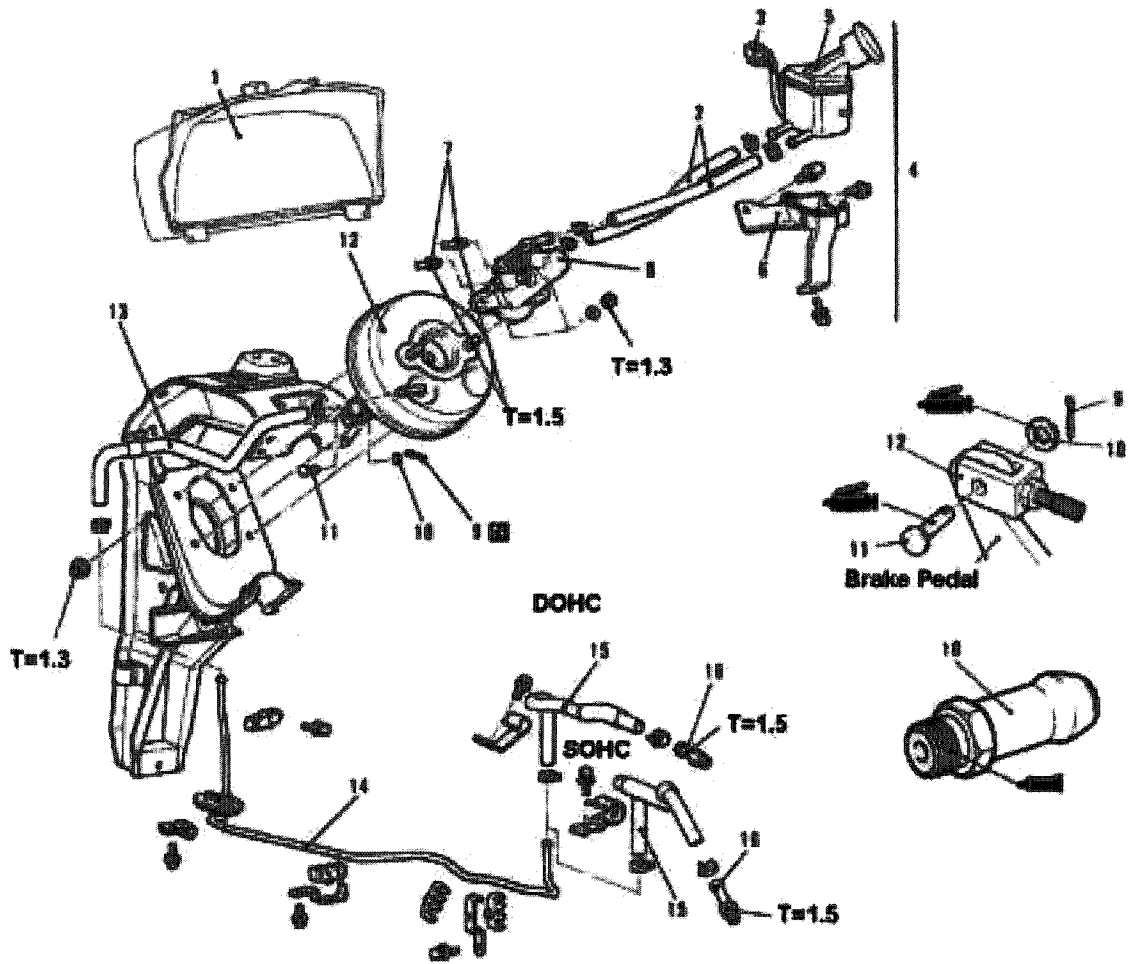
1. Split Pin
2. Shift Lock Cable: Neutral Safety
3. NA
4. NA
5. Split Pin
6. Washer
7. Clevis Pin
8. Pedal Shaft Nut
9. Pedal Shaft
10. Washer
11. Bushing
12. Shift Lock Lever

Brake Pedal Assembly: Automatic Transmission



13. Shift Lever Bushing
14. NA
15. NA
16. Spacer Tube
17. Bushing
18. Brake Pedal return Spring
19. Bushing
20. Spacer Tube
21. Brake Pedal
22. Pad
23. Stop Lamp Switch
24. Clamp
25. Pedal Support Member

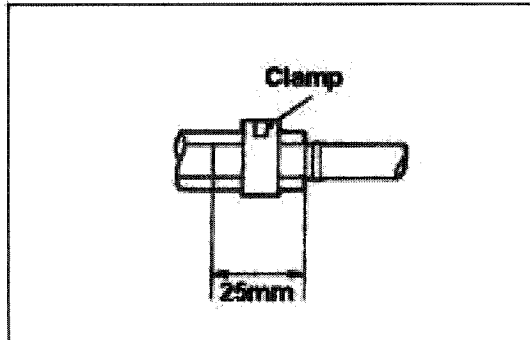
Master Cylinder & Brake Booster



Master Cylinder & Brake Booster

1. Combination Meter: Speedometer Head Unit
2. Reserve Hose
3. Fluid Level Sensor Connector
4. Reserve Bracket Assembly
5. Reserve Tank
6. Reserve Bracket
7. Brake Line Connection Ends
8. Master cylinder
9. Split Pin
10. Washer
11. Clevis Pin
12. Brake Booster Unit
13. Vacuum Hose (With Internal Check Valve)
14. Vacuum Pipe (Hard Line)
15. Vacuum Hose
16. Fitting

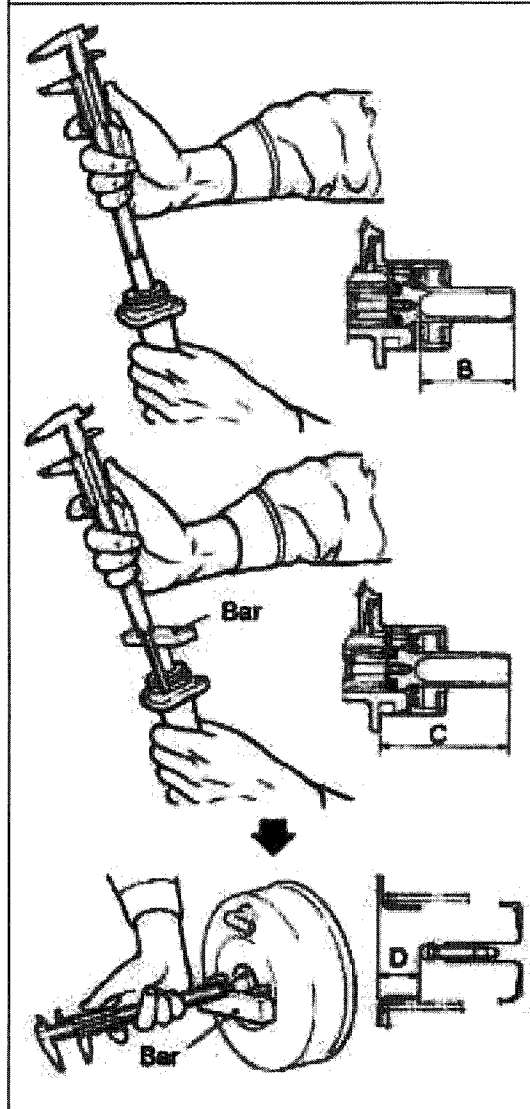
Master Cylinder & Brake Booster



Proper Vacuum Hose Clamping

Note: When sliding Vacuum Hose over Steel Piping be sure to slide the Hose over a minimum 25mm before clamping.

Note: Vehicles over 65,000 kilometer must replace Rubber Hoses once removed.



Master Cylinder Primary Piston & Booster Pushrod Inspection

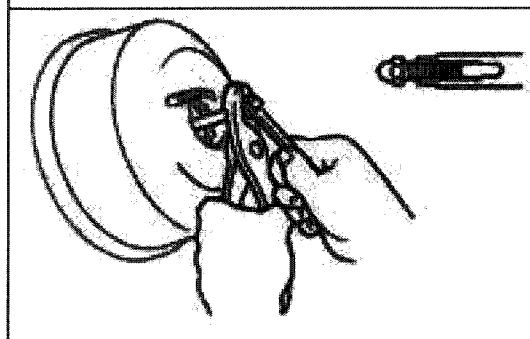
1. Use the Diagrams on the left as an Example. Use the following formula to inspect correct settings.

@Atmospheric Pressure A: 0.21-46mm

$$A=B+D-C$$

Brake Booster Vacuum @500mmHg

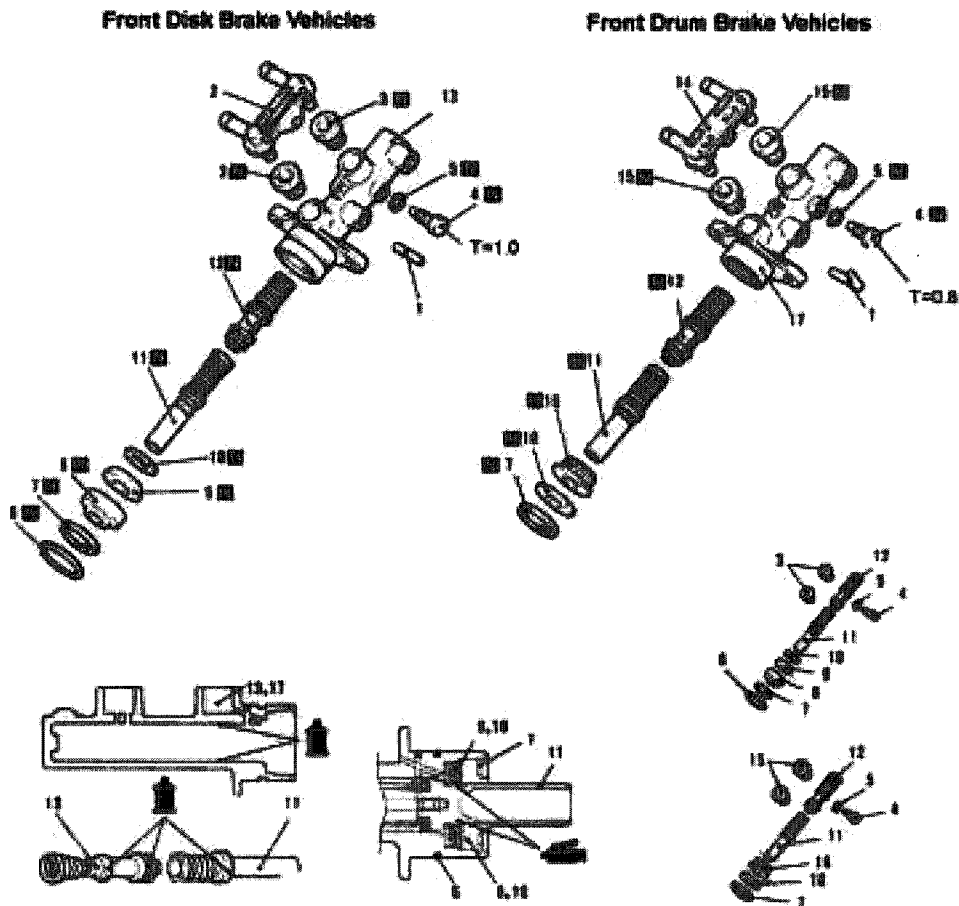
(A)= 0.1-0.35mm



2. For Booster Piston Height Adjustment use Pliers to Hold Rod in place. Use a Box Wrench to adjust Rod Tip Height.

Note: Use caution when utilizing Pliers not to scratch the Rod. Rap the Rod with Vinyl Tape to prevent damage. Remove Tape after adjustment.

Master Cylinder Disassembly & Components



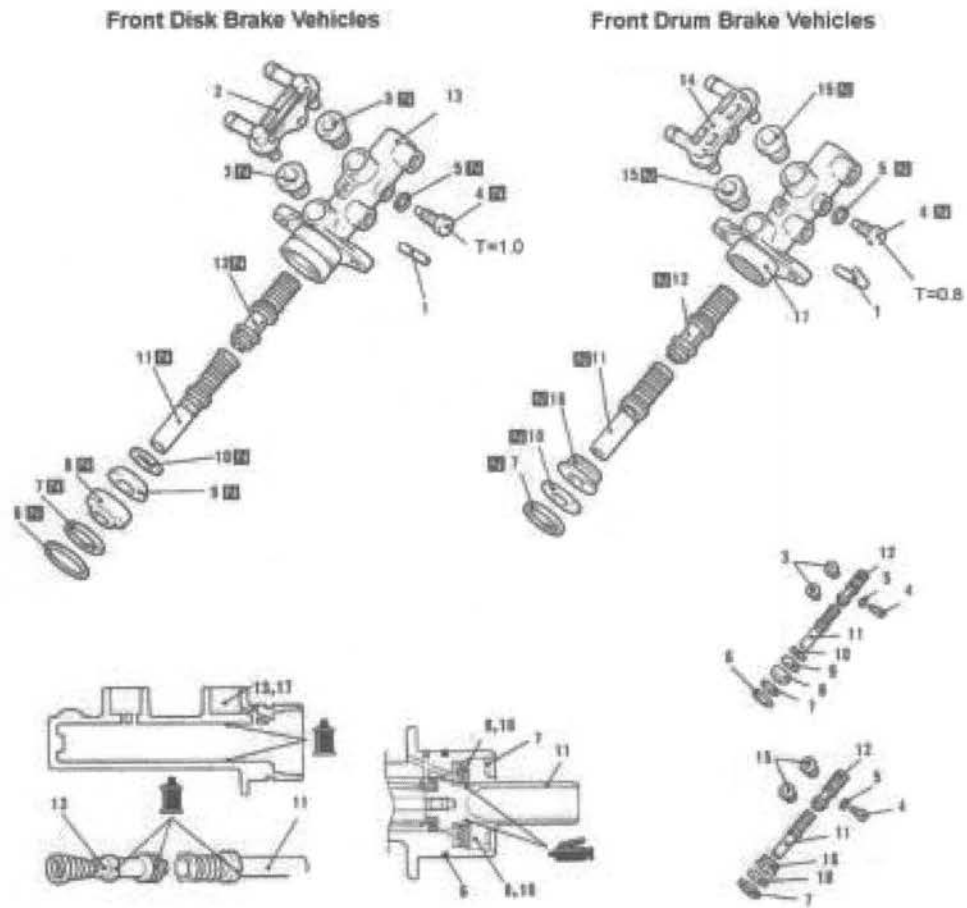
Master Cylinder & Overhaul Order

Note: Before assembly coat all moving and internal Parts with DOT 4 Brake Fluid. Disk & Drum Brake Master Cylinders although similar are Not Interchangeable

Disk Brake Vehicle

1. Pin
2. Union
3. Reserve Grommet
4. Stopper Bolt
5. Gasket
6. O-Ring
7. Snap Ring
8. Piston Guide
9. Secondary Cup
10. Plate
11. Primary Piston Assembly
12. Secondary Piston Assembly
13. Master Cylinder Body: Disk
14. Connector

Master Cylinder Disassembly & Components

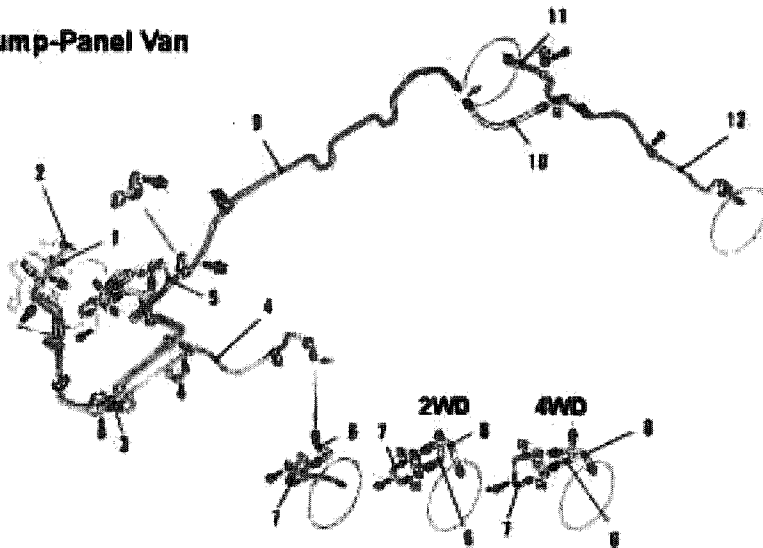


- 15. Grommet
- 16. Guide Assembly
- 17. Cylinder Body Assembly: Drum

Note: See Parts Catalogue for Rebuild Kits

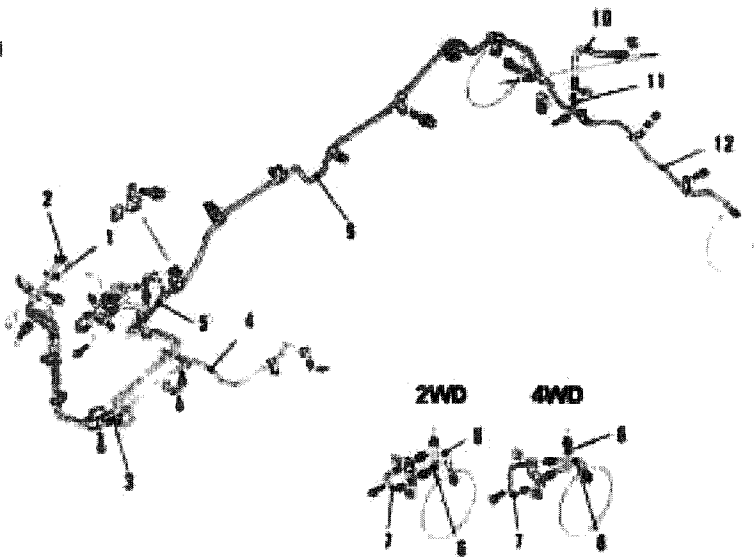
Brake Line System 2WD & 4WD

Truck-Dump-Panel Van



T=1.5

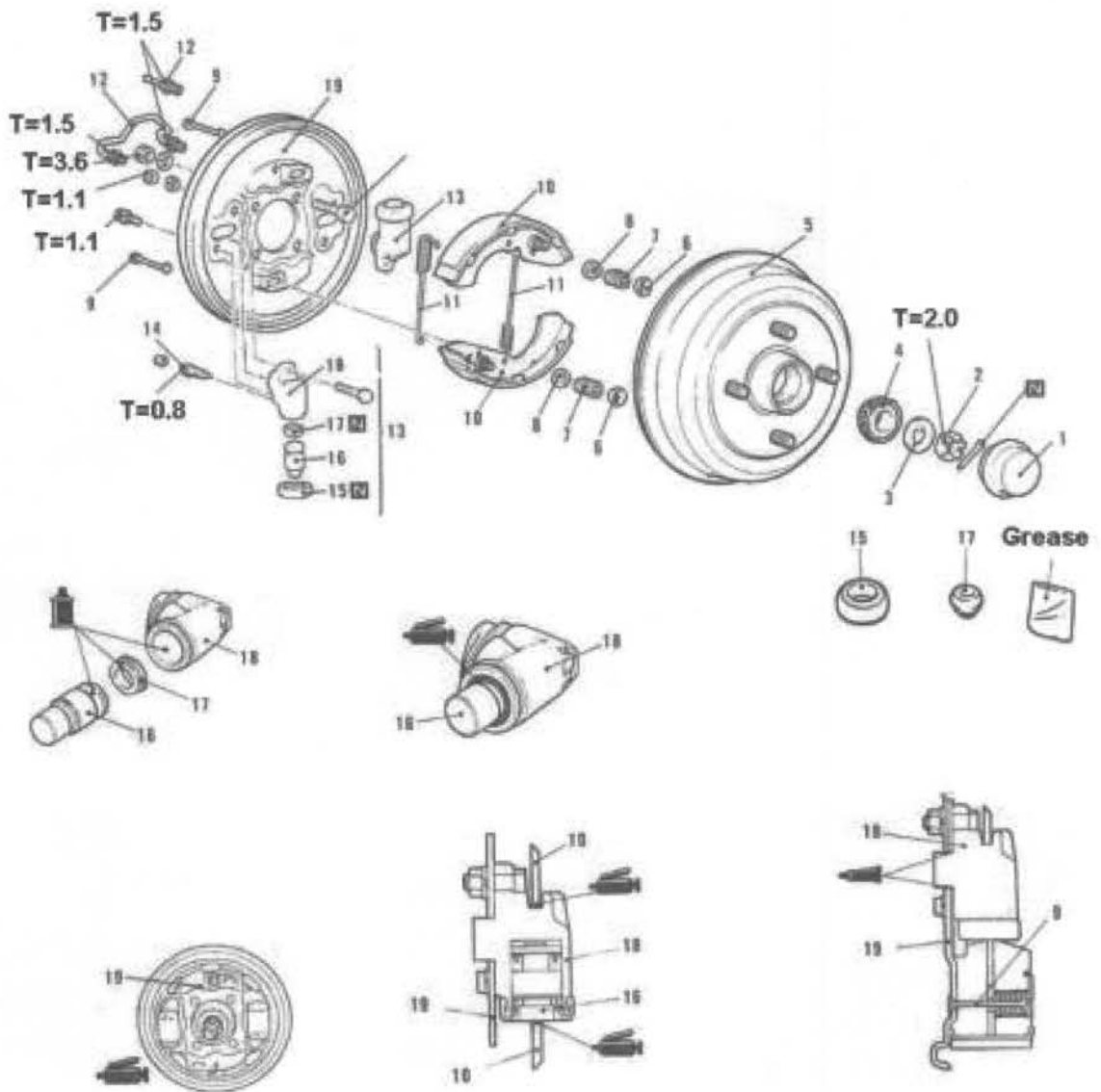
Bravo Van



Brake Lines

1. Brake Pipe "A"
2. Brake Pipe "B"
3. Blend Proportion Valve
4. Brake Pipe: FL
5. Brake Pipe: FR
6. Front Brake Hose: LH Note: RH is Same
7. Front Brake Pipe
8. Front Brake Hose: Disk Brake
9. Brake Pipe
10. Rear Brake Hose
11. Brake Pipe: RR
12. Brake Pipe: RL

Front Drum Brake System

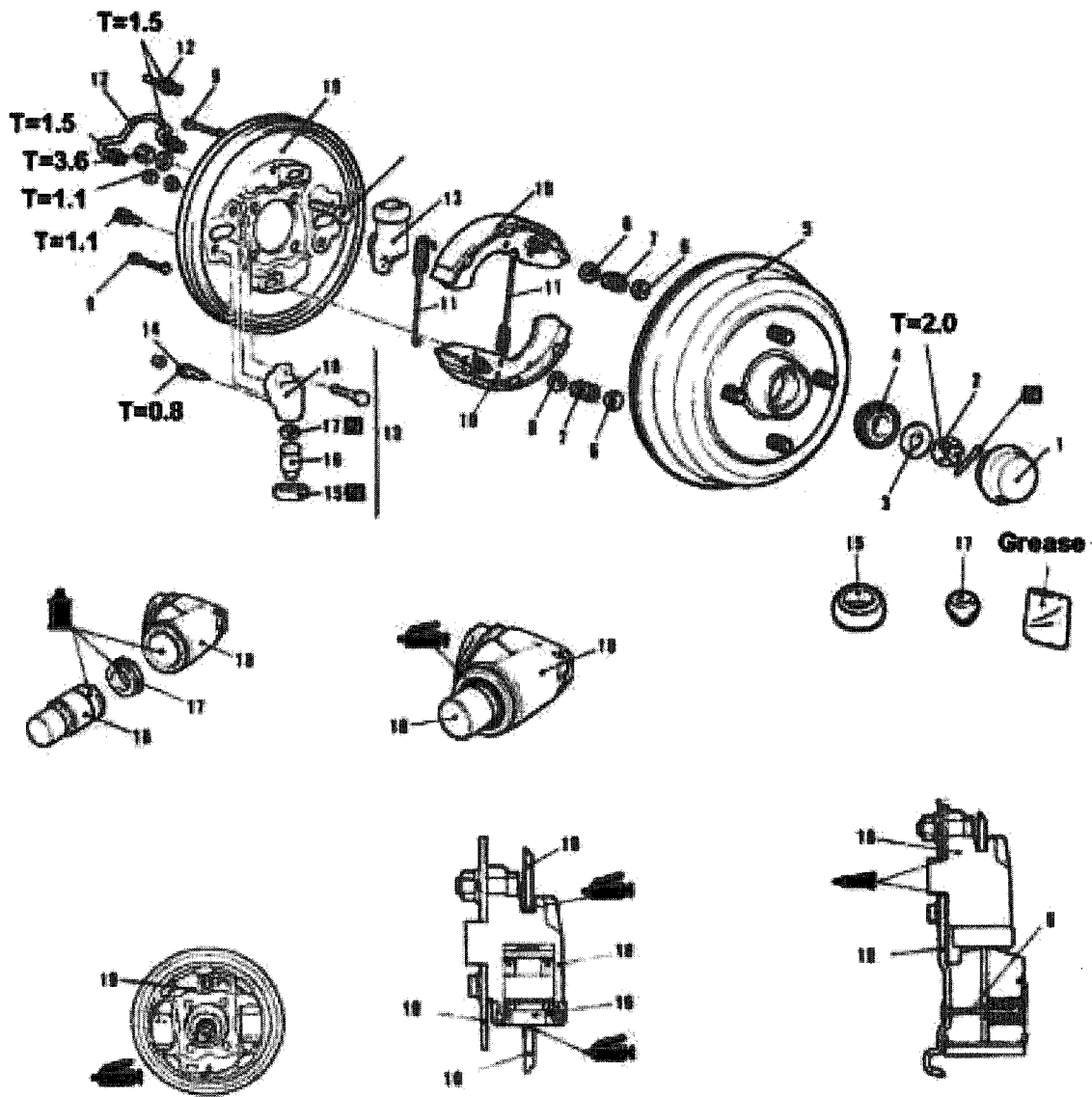


Components & Replacement

Note: Drum Brake equipped Vehicles require DOT 3 Brake Fluid.

1. Dust Cover
2. Castle Nut
3. Washer
4. Wheel Bearing
5. Brake Drum
6. Shoe Hold Down Cup
7. Shoe Hold Down Spring
8. Shoe Hold Down Cup
9. Shoe Hold Down Pin
10. Brake Shoes: (2)
11. Return Spring

Front Drum Brake System

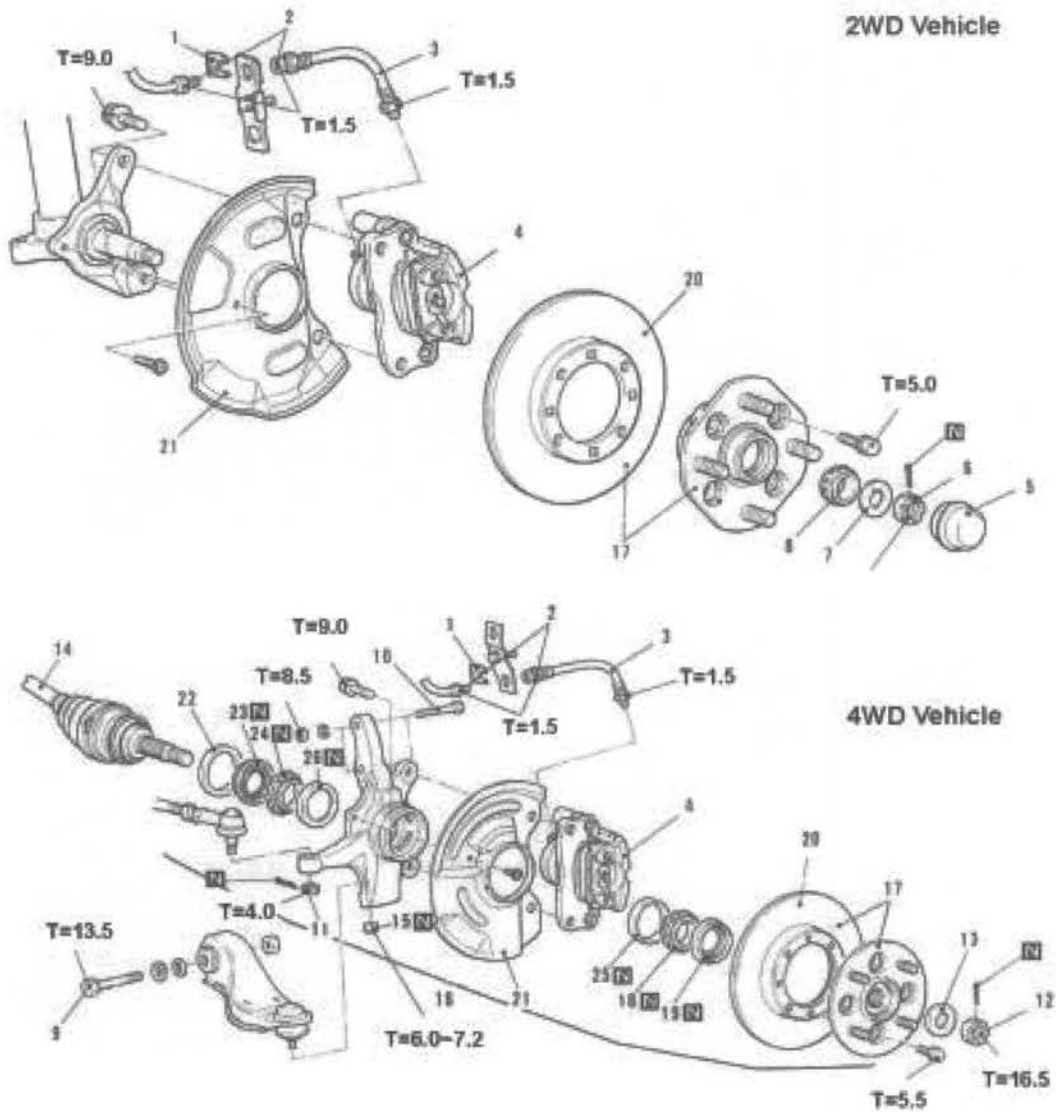


12. Brake Line: Steel
13. Wheel Cylinder
14. Bleed Screw
15. Wheel Cylinder Boot
16. Piston
17. Piston Cup
18. Wheel Cylinder Casing
19. Back Plate

Note: If Wheel Cylinders have been disassembled New Cups must be used. Coat with DOT 3 Brake Fluid before Installation.

Note: If Brake Lines have been disconnected the System must be bled for Air.

Front Disk Brakes System: 2WD & 4WD



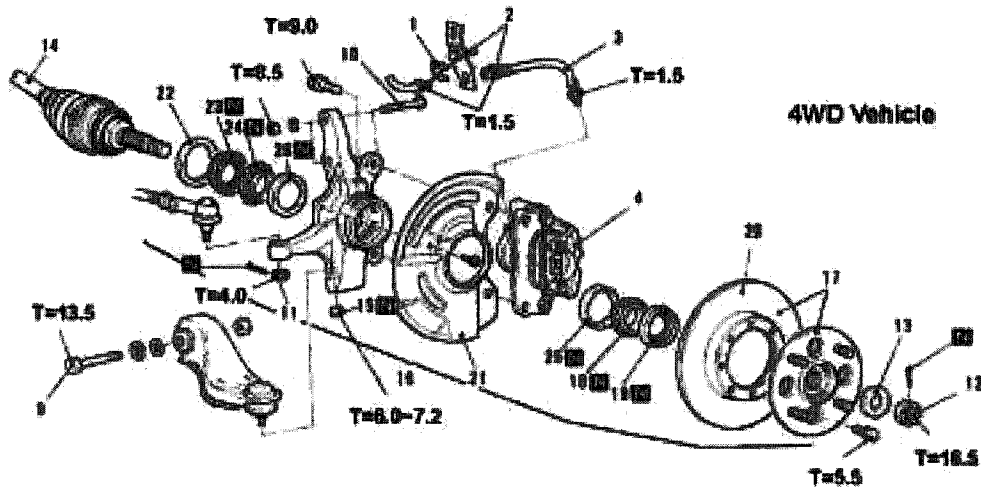
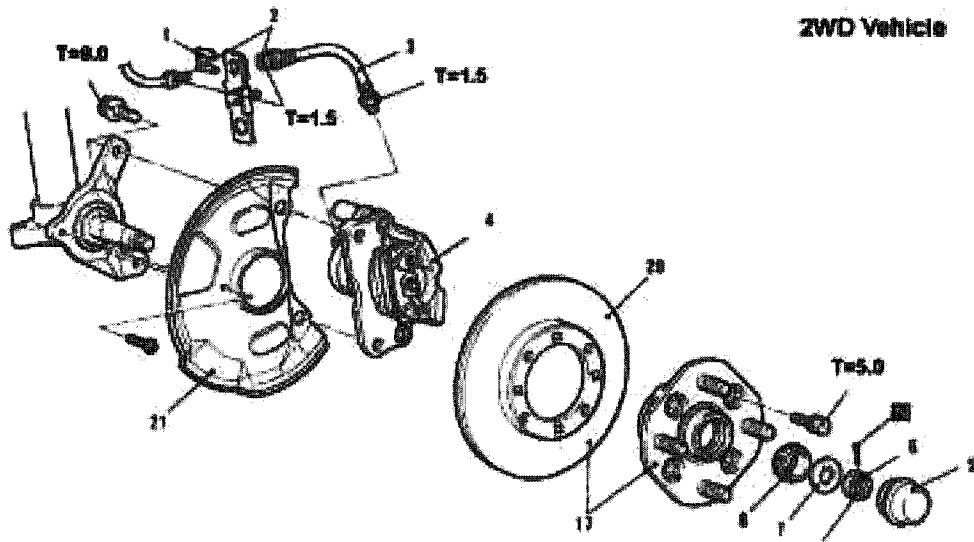
2WD Vehicle

Note: For Changing Brake Pads Only Remove Caliper & Change Pads

1. Hose Clip
2. Separate Brake Pipe & Hose Connection: (If removing Caliper)
3. Brake Flexible Hose: (Remove only if replacing Hose)
4. Caliper Assembly
5. Hub Cap
6. Remove Castle Nut
7. Washer
8. Wheel Bearing: Outer Bearing Inner Race
17. Disk & Hub Unit
20. Brake Disk Unit
21. Dust Cover

See Following Page for 4WD Components

Front Disk Brakes System: 2WD & 4WD

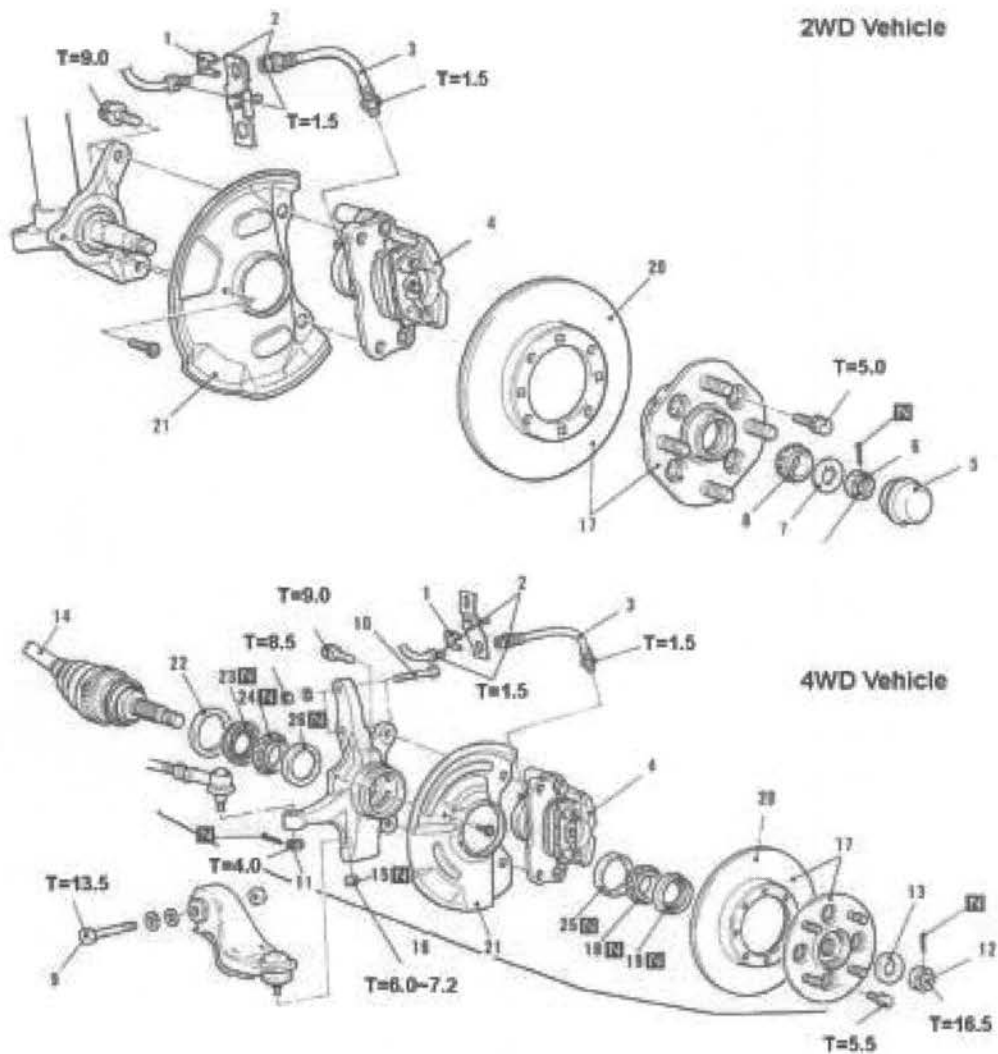


4WD Vehicle

Note: For Changing Brake Pads Only Remove Caliper & Change Pads

1. Hose Clip
2. Brake Pipe to Hose Connection
3. Brake Hose
4. Caliper Assembly
5. NA
6. NA
7. NA
8. NA
9. Lower Arm to Cross Member Bolt
10. Knuckle Attachment Bolt
11. Tie Rod End
12. Castle Nut
13. P/S Lock Washer

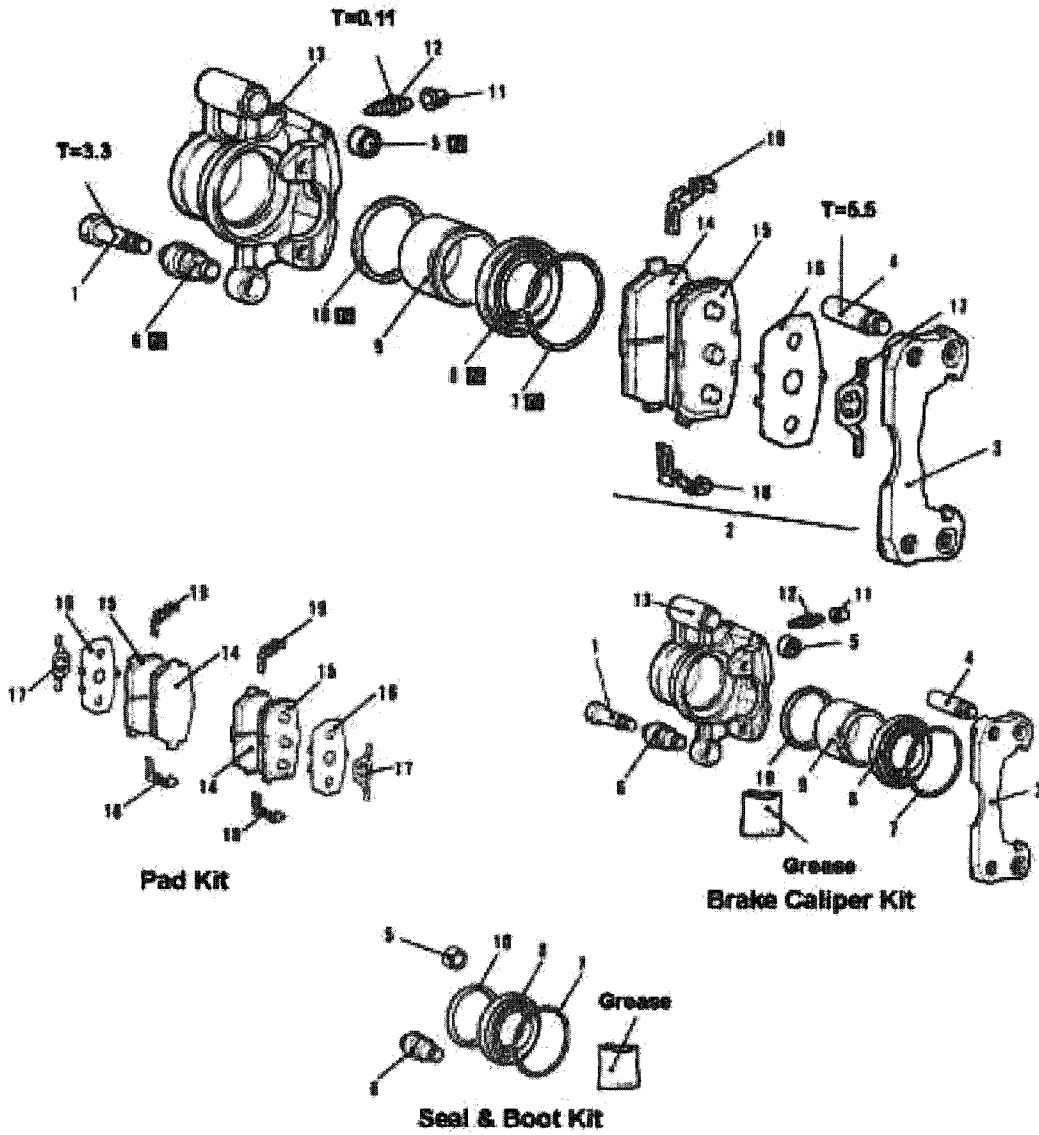
Front Disk Brakes System: 2WD & 4WD



4WD Vehicle

- 14. Drive Axel
- 15. Knuckle to Lower Arm Attachment Nut
- 16. Hub & Knuckle Assembly
- 17. Hub & Brake Disk
- 18. Wheel Bearing Inner Race
- 19. Oil Seal
- 20. Brake Disk
- 21. Dust Cover
- 22. Dust Seal
- 23. Oil Seal: Axel Side
- 24. Wheel Bearing: Inner
- 25. Wheel Bearing Outer Race
- 26. Wheel Bearing Outer Race: Drive Axel Side

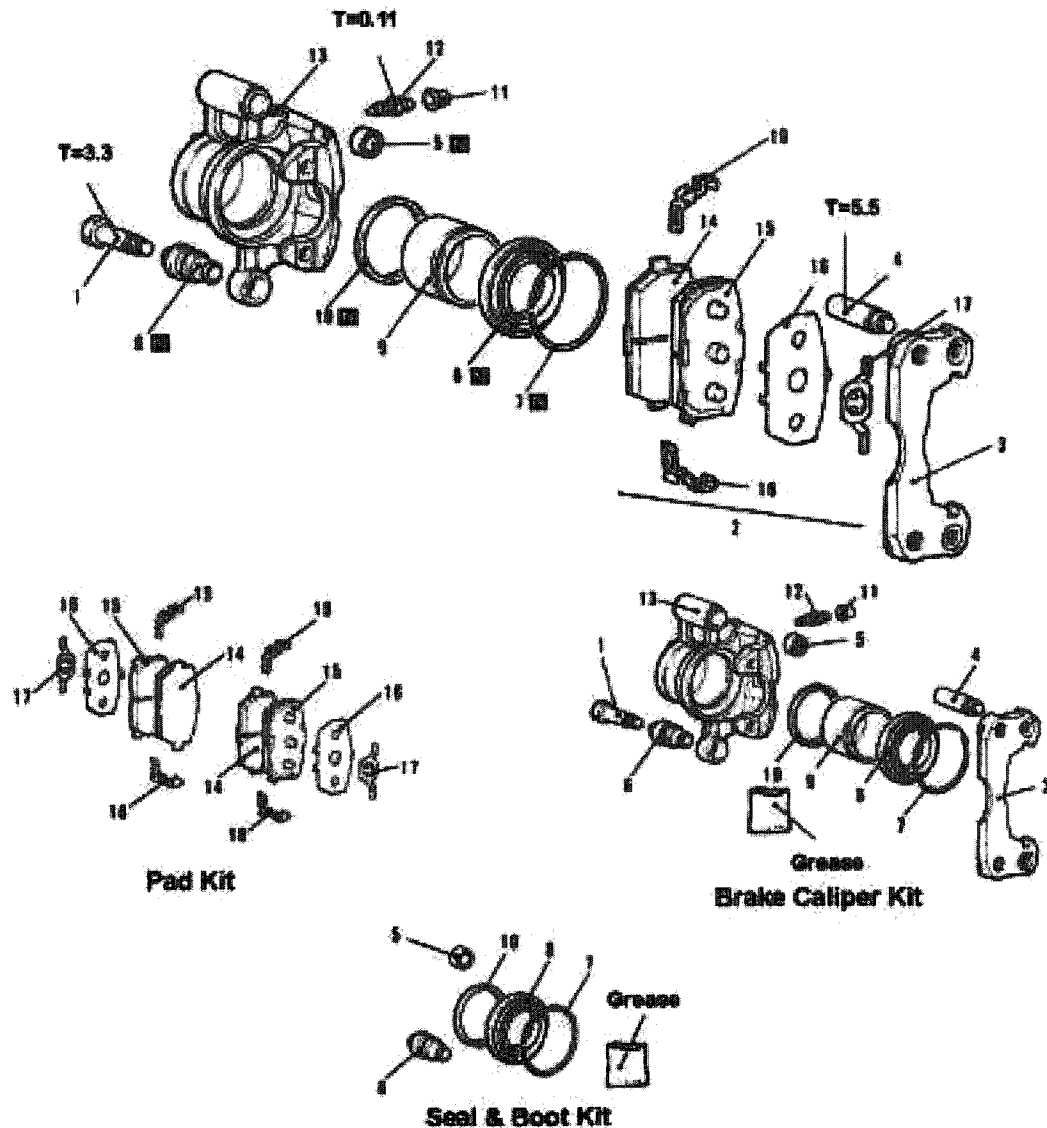
Disk Brake Caliper Assembly



Caliper Assembly

1. Thrust Pin Attachment Bolt
2. Pad assembly
3. Disk Brake Mounting Plate
4. Thrust Pin Attachment Bolt #2
5. Dust Boot
6. Bushing
7. Ring Set
8. Boot
9. Disk Brake Piston
10. Piston Seal
11. Bleeder Plug Cap
12. Bleeder Plug
13. Caliper Casting

Disk Brake Caliper Assembly



Pad Assemblies

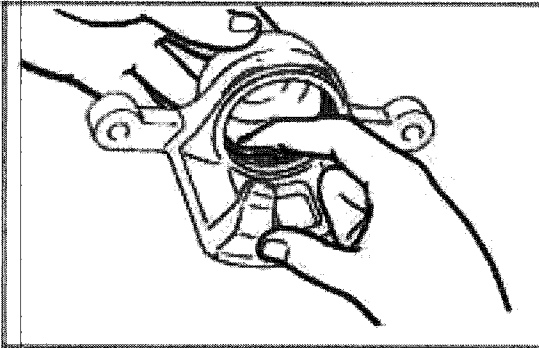
1. Remove Thrust Pin Attachment Bolt
14. Remove Pad #1
15. Remove Pad #2
16. Remove Anti-Squeal Plate
17. Remove Anti-Squeal Plate Back Spring
18. Remove Pad Support No.1
19. Remove Pad Support No.2

Install in reverse Order

Note: Three Separate Repair Kits Available: see Parts Catalogue

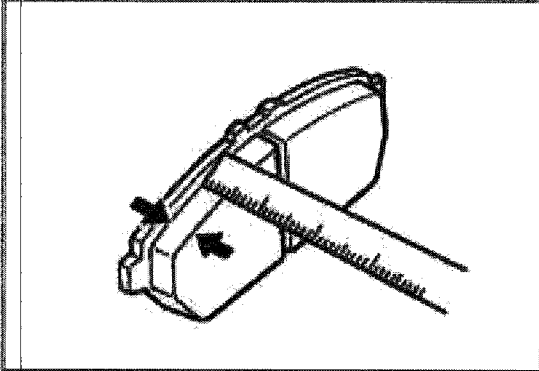
1. Pad Kit
2. Brake Caliper Kit: Includes Grease Pack
3. Seal & Boot Kit: Includes Grease Pack

Caliper Installation Tips & Pad Measurement



Piston Seal Installation

Note: When installing New Seals in the Caliper you must coat the Seal with DOT 3 or DOT 4 Grade Brake Fluid. Do not use Axle Grease or other Grease Based Products.



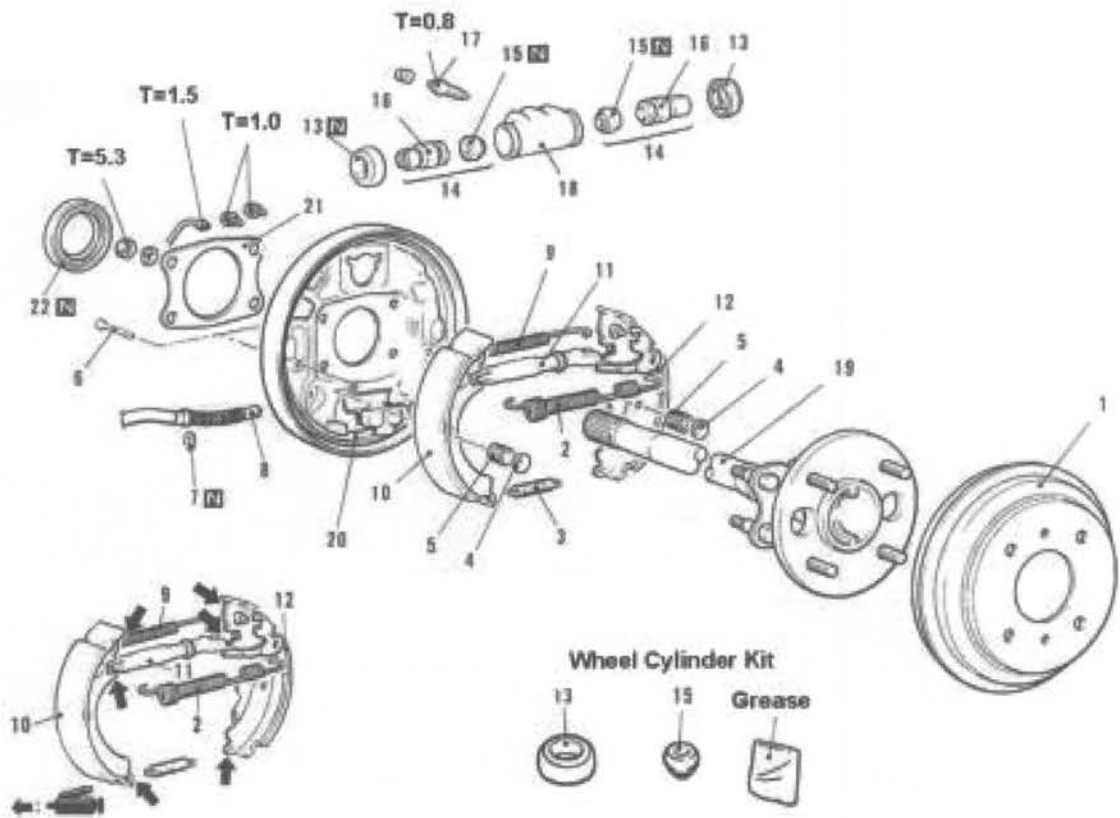
Pad Thickness Measurement

Note: Measure the Pad thickness as shown.

Pad Thickness Limit: 10mm

Note: If Pad thickness is more than 2mm difference between wheels inspect Brake Rotors. Pads must be replaced in sets. Never change single Pads.

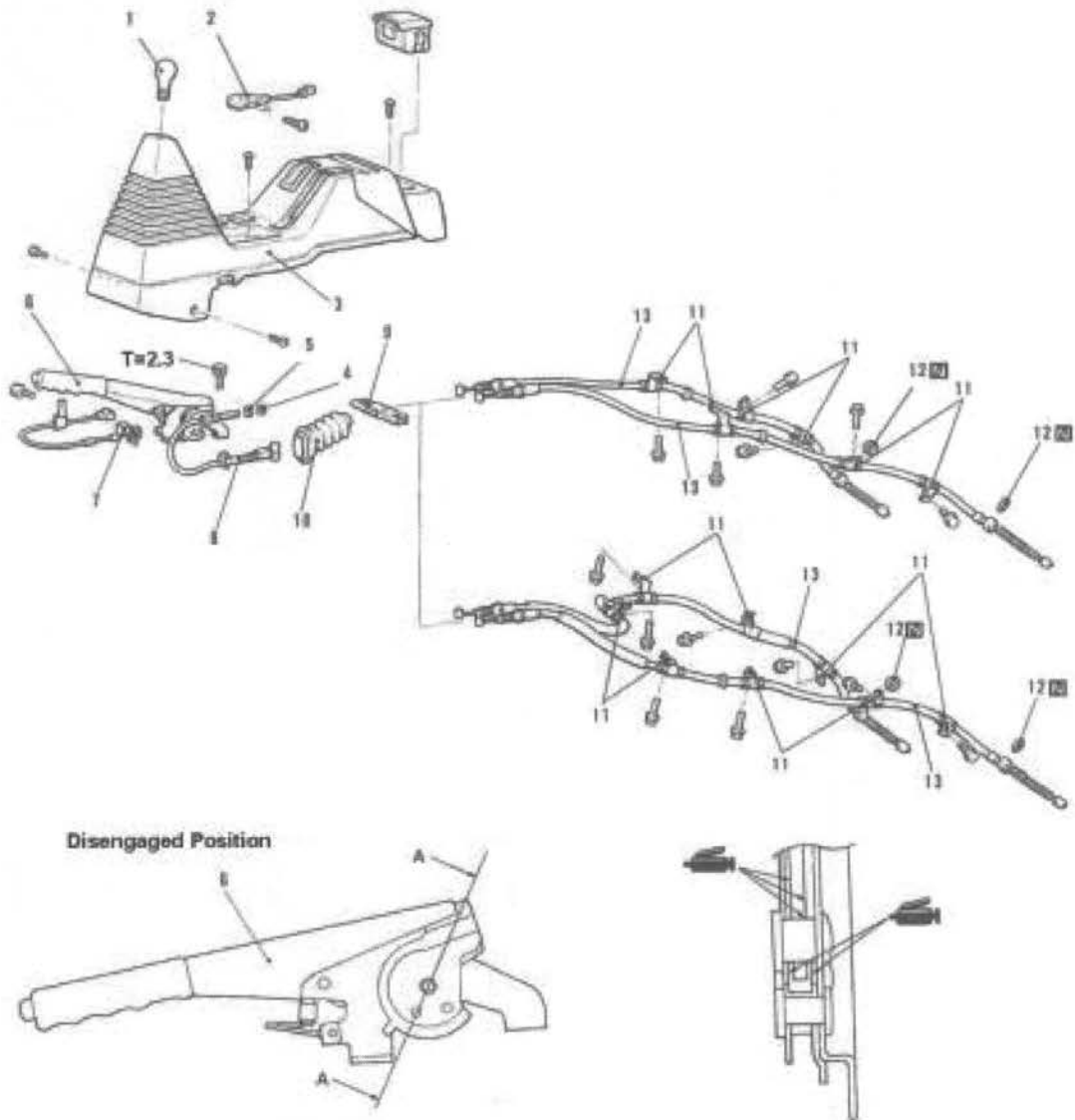
Rear Drum Brakes



Rear Drum Brake Components

1. Brake Drum
2. Shoe Spring
3. Retainer Spring
4. Shoe Hold Down Cup
5. Shoe Hold Down Spring
6. Shoe Hold Down Pin
7. Snap Ring
8. Parking Brake Cable
9. Back Spring
10. Shoe Assembly (2)
11. Adjuster
12. Shoe: Trailing Assembly
13. Boot
14. Piston Assembly
15. Piston Cup
16. Piston

Parking Brake Cable System



Cable Components

1. Shift Knob: MT
2. 4WD Engagement Switch: 4WD Vehicles
3. Floor Consul
4. Lock Nut
5. Adjusting Nut
6. Parking Brake Lever
7. Parking Brake Switch
8. Front Parking Brake Cable
9. Cable Equalizer (Balancer)
10. Boot
11. Clamp
12. Snap Ring
13. Rear Parking Brake Cable

Chapter 12

Steering System

- 159. Front End Alignment Specifications
- 160. Steering Column: Manual
- 161. Steering Wheel Removal
- 162. Steering Wheel Lock Removal
- 163. Steering Column: Tilt
- 164. Steering Lower Linkage
- 165. Rack & Pinion Steering Assembly: Manual 2WD-4WD
- 166. Rack & Pinion Disassembly: Manual 2WD-4WD
- 167. Rack & Pinion Steering Assembly: Power Steering 2WD-4WD
- 168. Rack & Pinion Disassembly: Power Steering 2WD-4WD
- 169. Power Steering Pump
- 170. Power Steering Pump Disassembly
- 171. Power Steering Hose System: 2WD-4WD

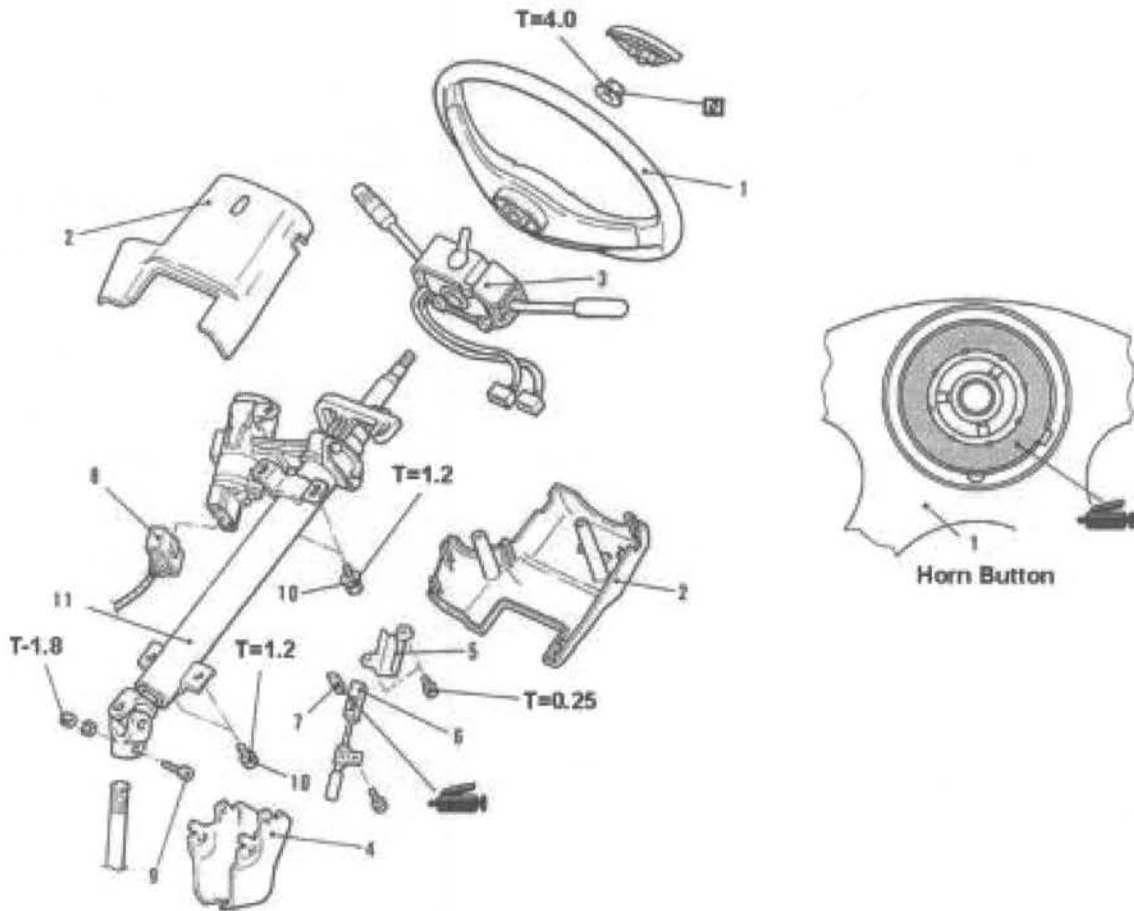
Front End Alignment Specifications

Component		Limit	Vehicle Type
Toe In		2-7mm	All
Handle Turning Degree	Inside	37°00'+0°-3°	2WD
	Outside	36°00'+0°-3°	4WD
Camber		1°40'±45'	2WD 10'Wheel
		2°00'±45'	2WD 12' or 13' Wheel
		1°30'±45'	4WD
Caster		3°00'±1°	2WD 10' Wheel
		3°20'±1°	2WD 10' or 13' Wheel
		2°40'±1°	4WD
Side Slip		0±3mm	All
Ball Joint Revolution Torque		30~100kgcm	2WD
		10-80kgcm	4WD

Note: Mitsubishi Has Three Series of Wheel Sizes

4. 10'= 10 Inches (2WD)
5. 12'= 12 Inches (2WD)
6. 13'= 13 Inches (4WD)

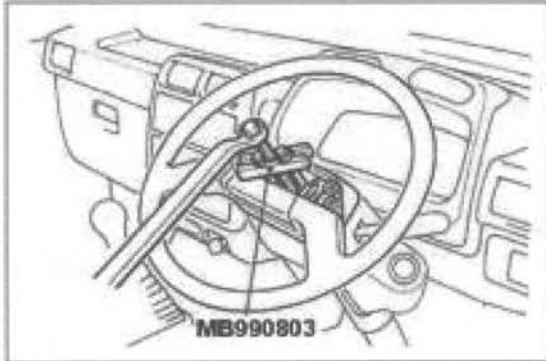
Steering Column: Manual



Manual Steering Components

1. Steering Wheel
2. Upper & Lower Column Cover
3. Column Switch: Combination
4. Cover
5. Cover: AT vehicles
6. Key Interlock Safety Cable connection
7. Lock Pin: AT Vehicles
8. Ignition Switch Connector
9. U-Joint Bolt
10. Column Attachment Bolts
11. Steering Column

Steering Wheel Removal



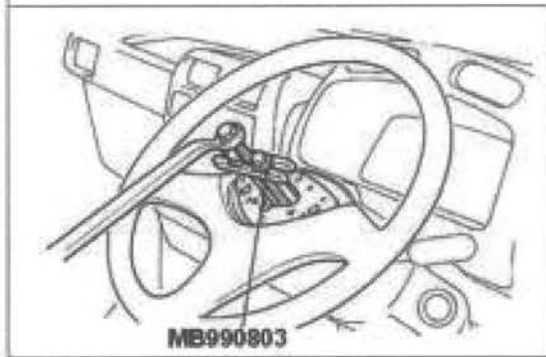
Steering Wheel Removal

1. Straighten Wheel
2. Remove Horn Pad
3. Attach MB990803 Steering Wheel Puller
4. Remove Steering Wheel



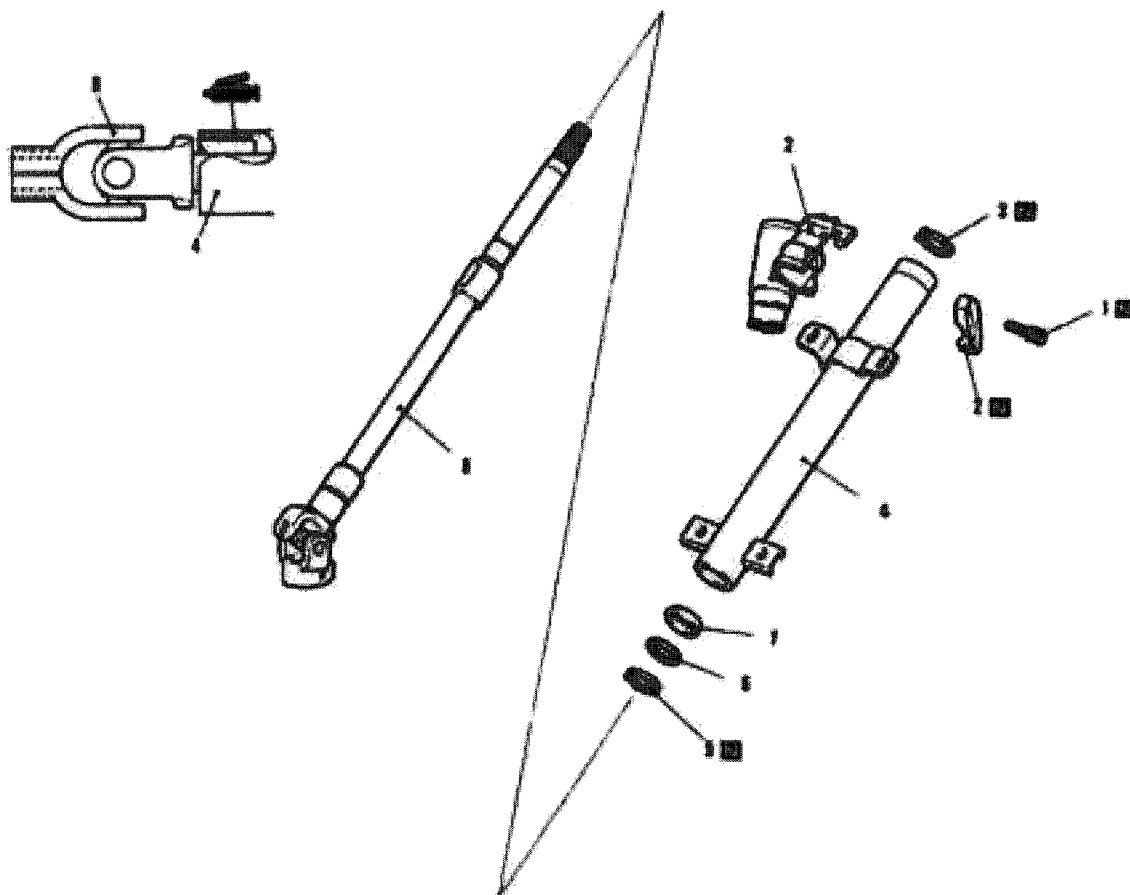
Tri-Spoke Steering Wheel

5. Straighten Wheel
6. Remove Horn Pad



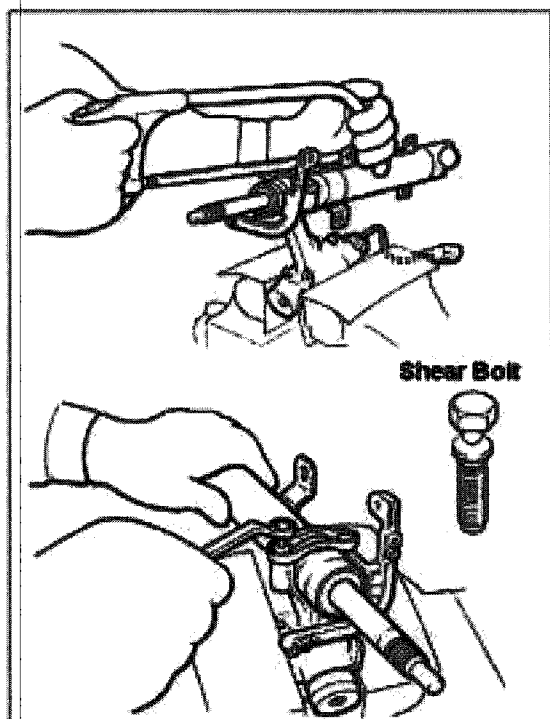
7. Attach MB990803 Steering Wheel Puller
8. Remove Steering Wheel

Steering Lock Removal



Components

1. Special Bolt	2. Lock Unit	3. Snap Ring	4. Column Tube
5. Snap Ring	6. Stopper	7. Spacer	8. Shaft Assy

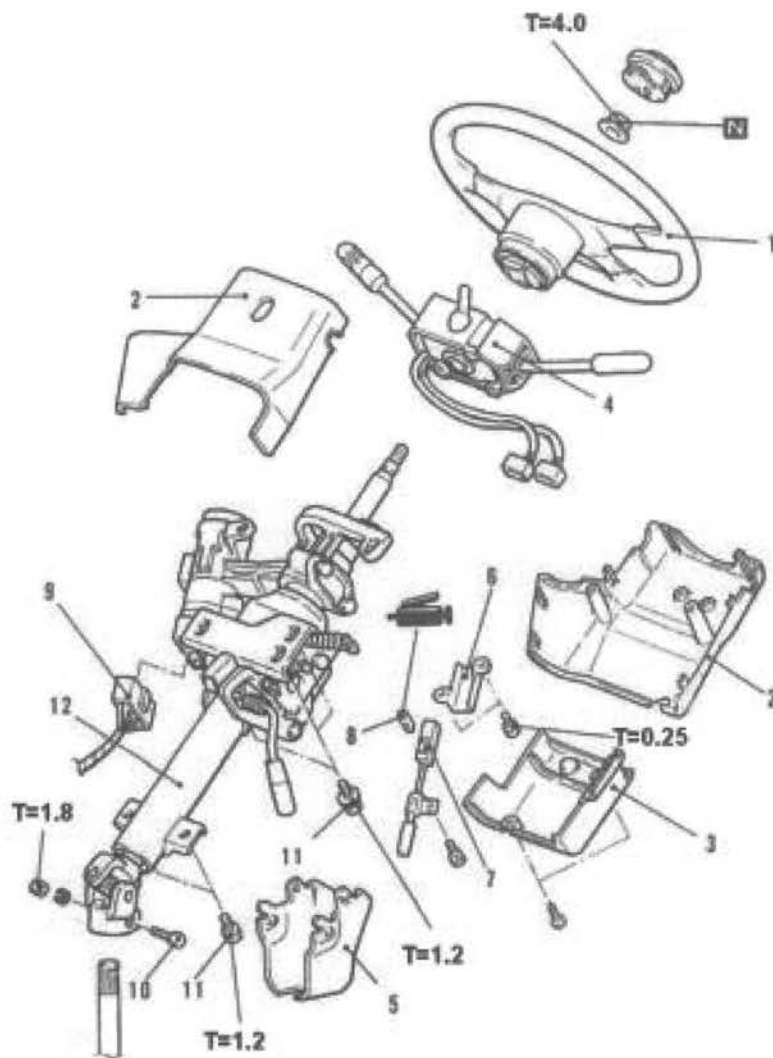


Lock Removal

Note: the Lock Mechanism is attached by Shear Bolts. When installing the Top Portion of the Bolt twist off the Body of the Bolt. These Bolts must be cut as shown. New Bolts Must be used.

1. Place Column in a Vise as shown
2. Use a Hacksaw and cut of as shown in the Diagram.
3. Attach New Bolts. Tighten until the Head twist off.

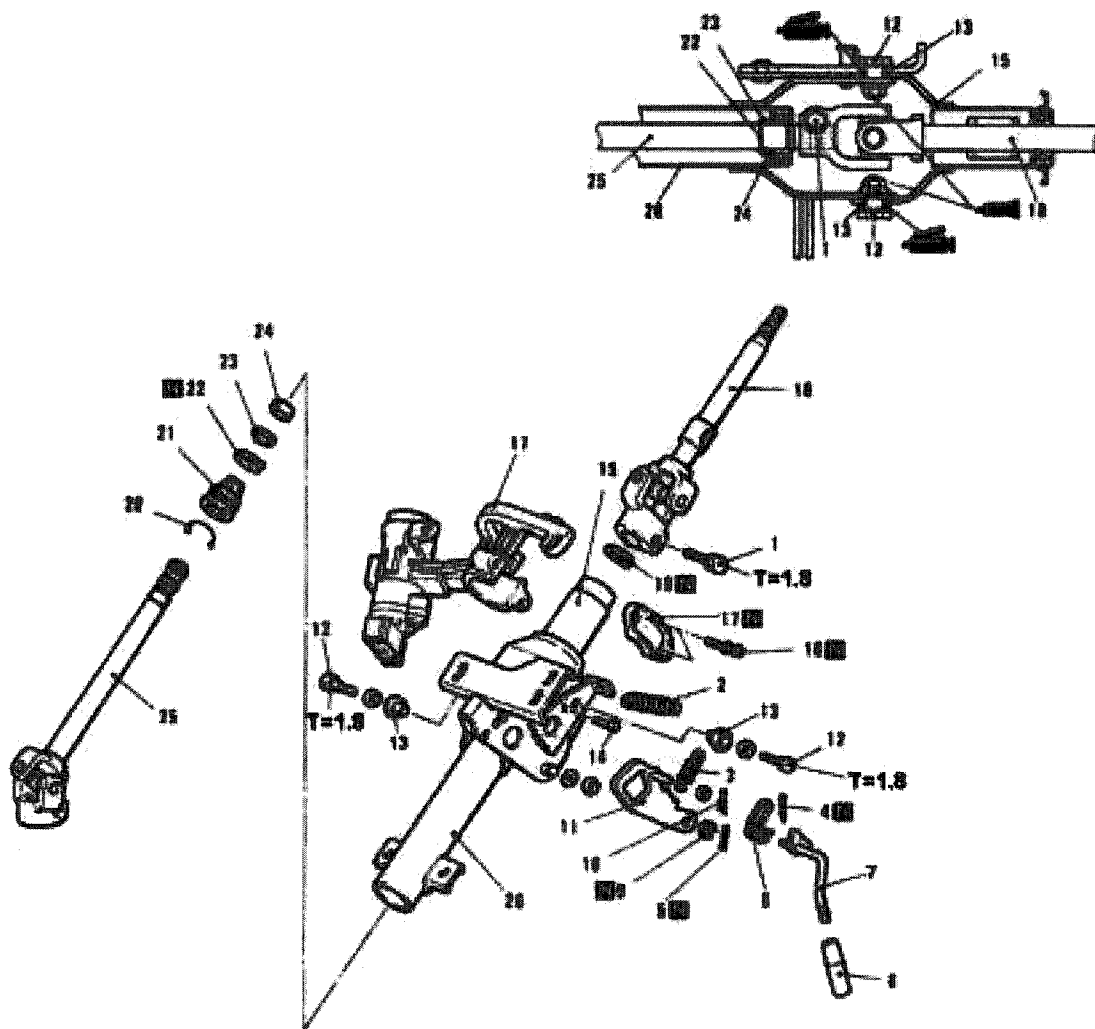
Steering Column: Tilt



Tilt Steering Column Components

1. Steering Wheel
2. Steering Column Upper & Lower Cover
3. Column Cover "B"
4. Column Combination Switch
5. Cover
6. Cover: AT Vehicles
7. Key Interlock Mechanism: AT Vehicles
8. Lock Pin: AT Vehicles
9. Ignition Switch Connector
10. U-Joint Bolt
11. Steering Column attachment Bolt (2)
12. Steering Column Unit

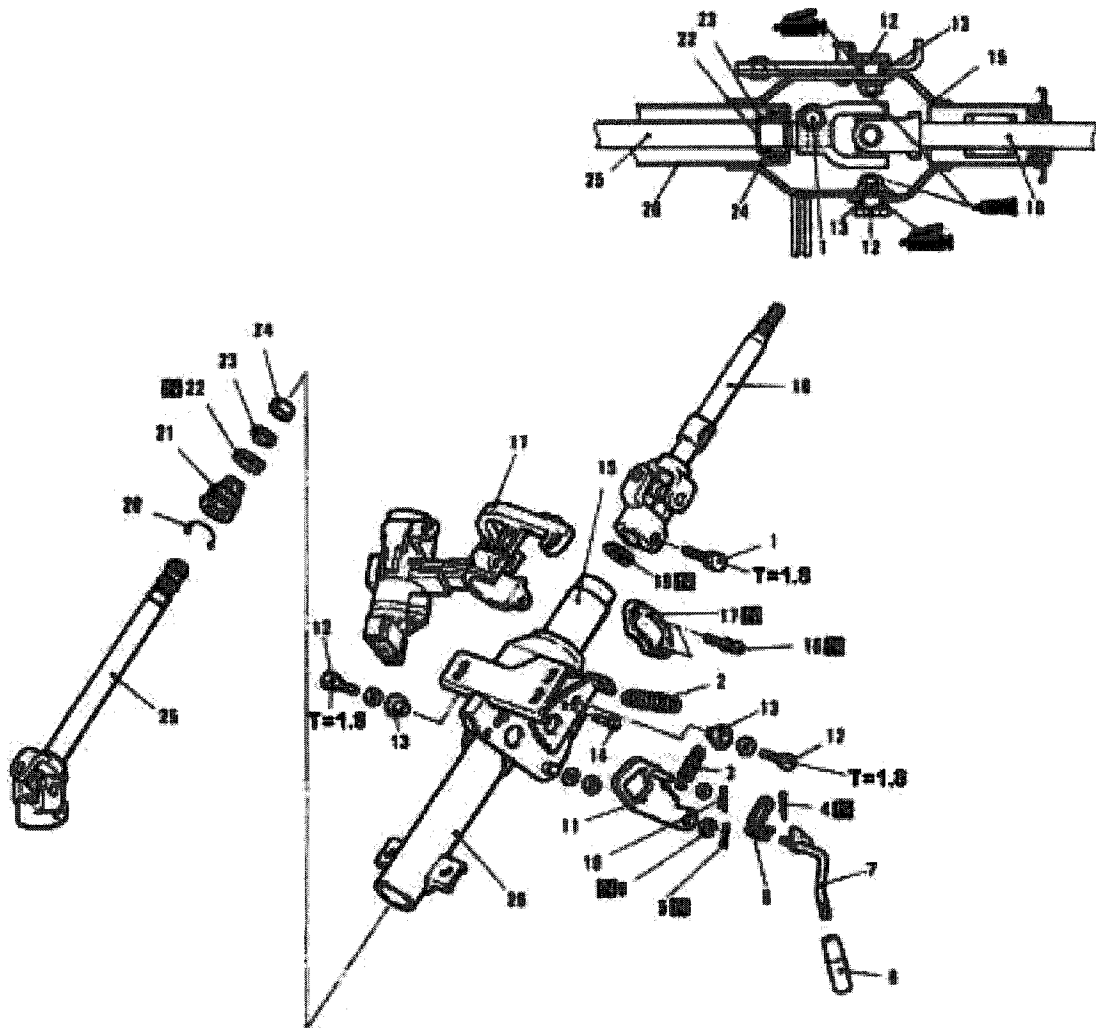
Steering Column: Tilt



Steering Column Internal Components

1. Shaft "A" & "B" Attachment Bolt
2. Return Spring
3. Return Spring
4. Slit Pin
5. Snap Pin
6. Return Spring
7. Lever Assembly
8. Knob
9. Snap Ring
10. Snap Pin
11. Plate Assembly
12. Bolt
13. Bushing
14. Clevis Pin

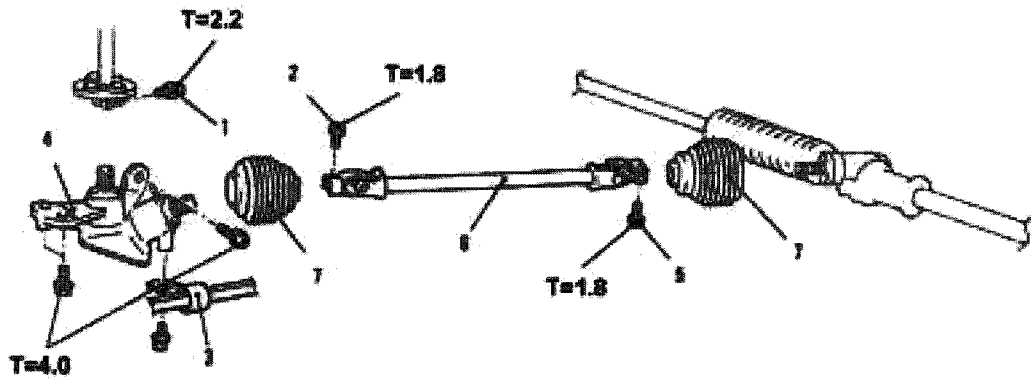
Steering Column: Tilt



- 15. Column Tube "A"
- 16. Steering Lock Special Bolt (Shear Bolt)
- 17. Steering Lock Mechanism
- 18. Shaft "A"
- 19. Snap Ring
- 20. Stopper
- 21. Bearing
- 22. Snap Ring
- 23. Stopper
- 24. Bearing Spacer
- 25. Shaft "B"
- 26. Column Tube "B"

Note: Item (16) Shear Bolts are not reusable. To remove Shear Bolts see previous pages.

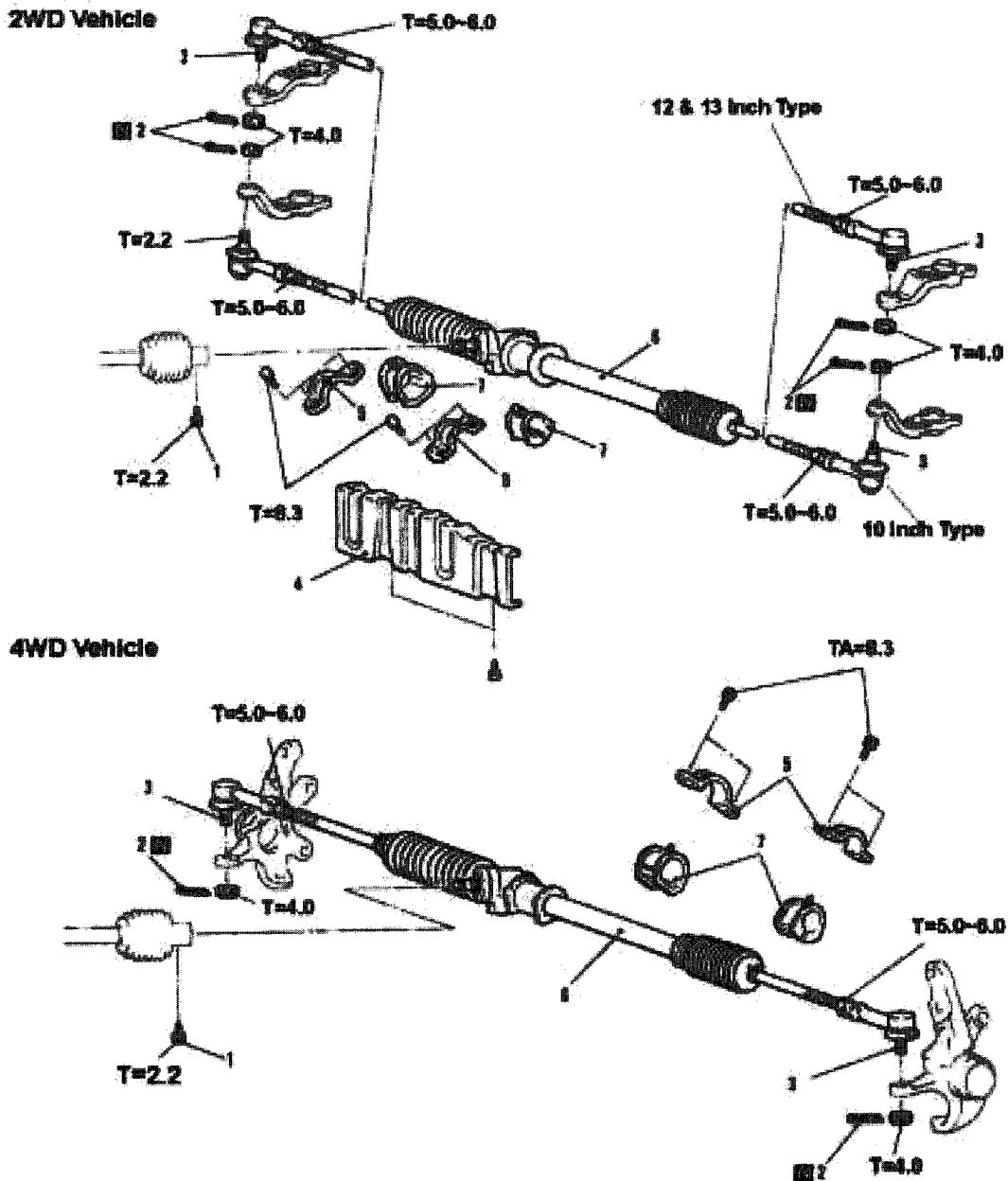
Column Lower Linkage



Column Lower Linkage

1. Babble Gear Attachment Bolt
2. Babble Gear to Steering Shaft Attachment Bolt
3. Speedometer & Clutch Cable Clamp
4. Babel Gear Box
5. Shaft to Rack & Pinion Steering Box Attachment Bolt
6. Steering Gear Shaft
7. Boot

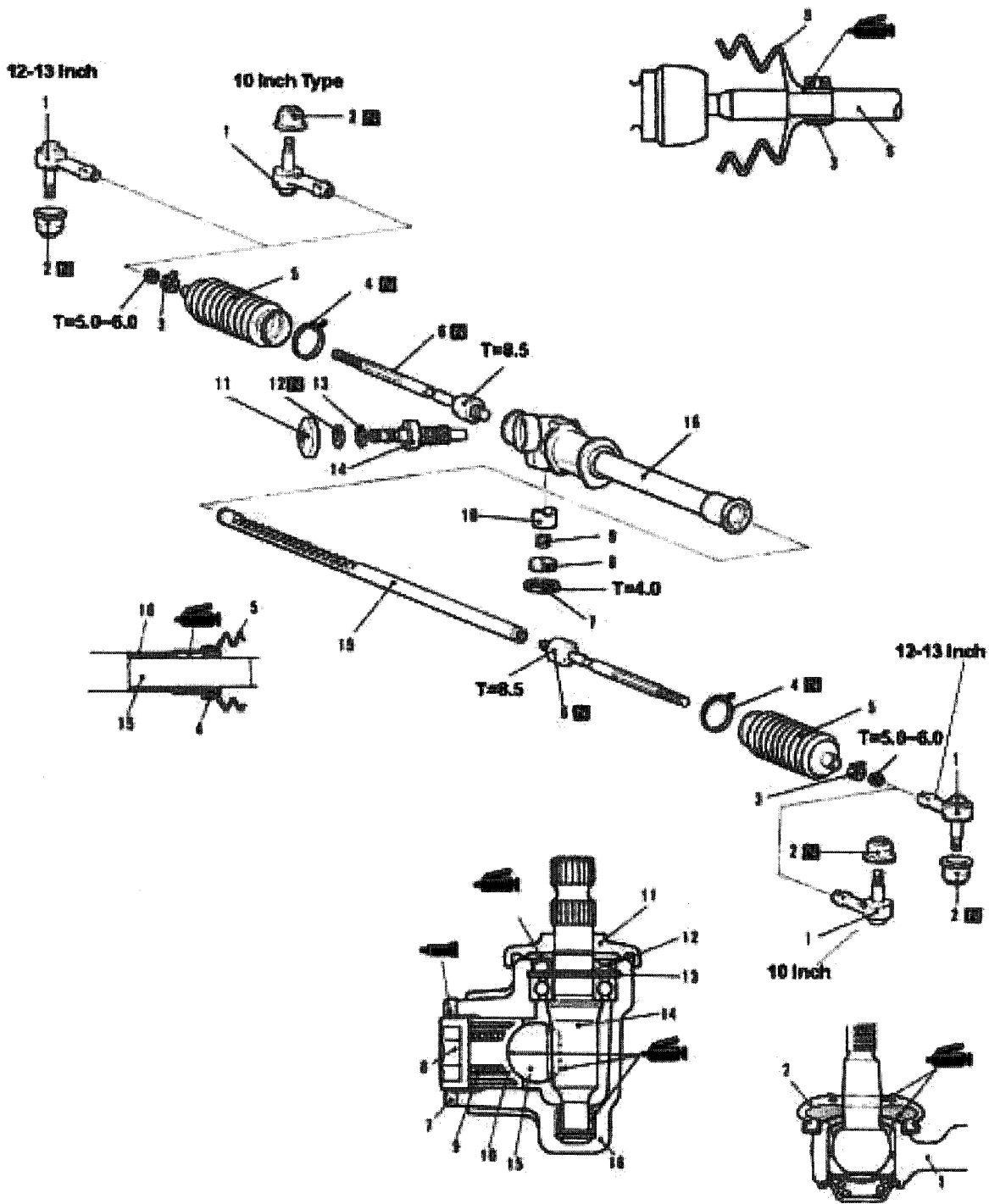
Rack & Pinion Steering Assembly: Manual 2WD-4WD



Components

1. Steering Shaft to Rack Attachment Bolt
2. Split Pin
3. Tie Rod End to Steering Knuckle Attachment
4. Dust Shield Plate: 2WD
5. Housing Clamps
6. Rack & Pinion Gear Box
7. Bushings

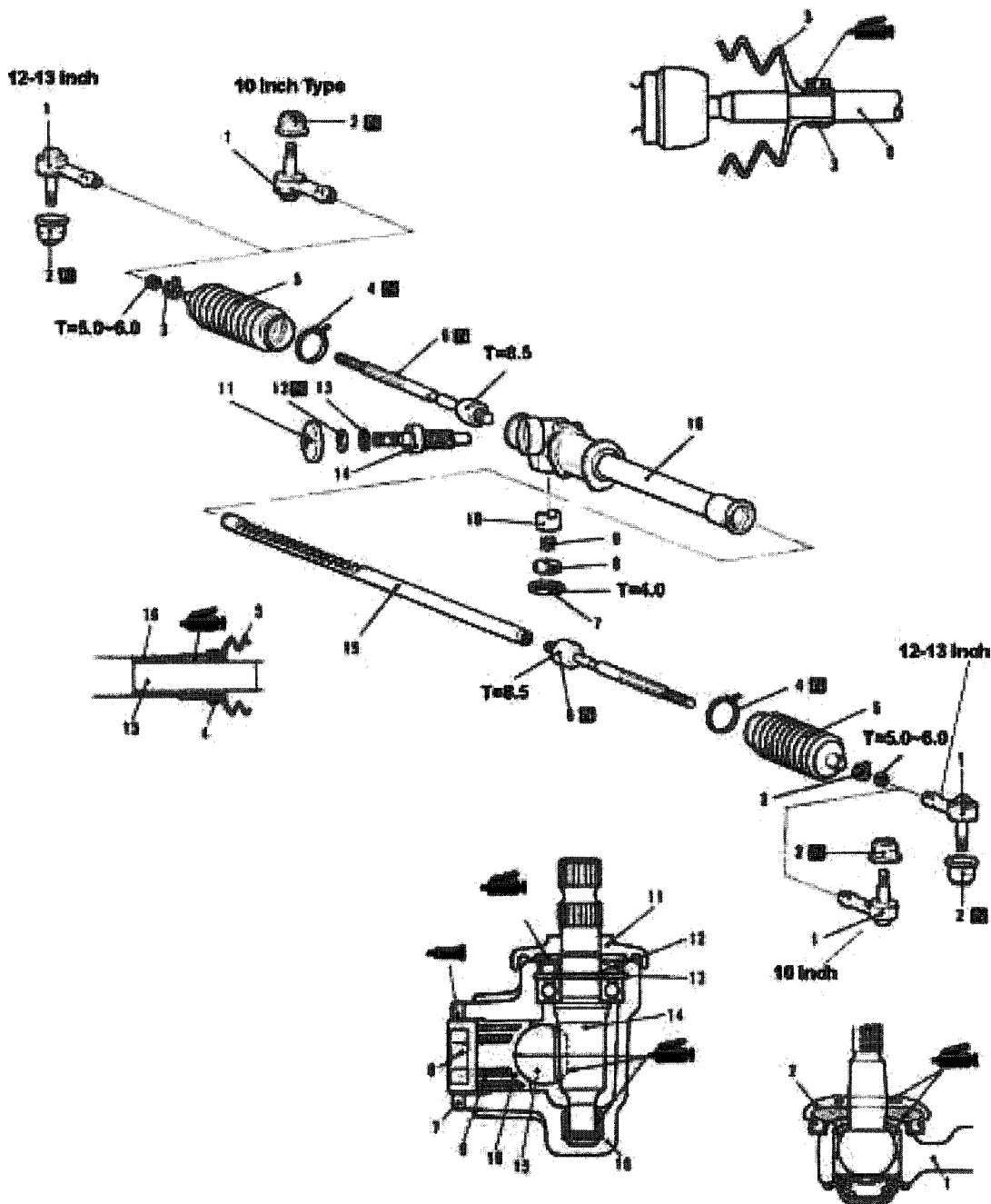
Rack & Pinion Disassembly: Manual 2WD-4WD



Disassembly: remove in Order

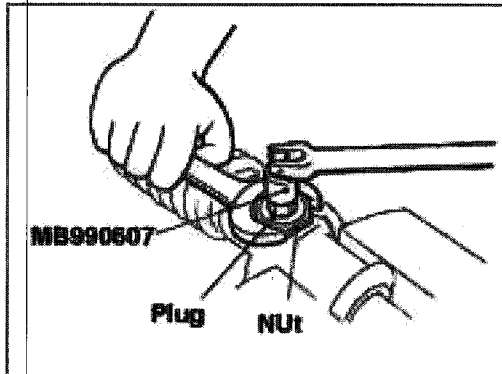
1. Tie Rod Ends
2. Tie Rod End Dust Boot Covers
3. Clip
4. Band: Replace during Installation
5. Boots: Inspect and replace if cracked or damaged
6. Lock Nut
7. Lock Nut

Rack & Pinion Disassembly: Manual 2WD-4WD



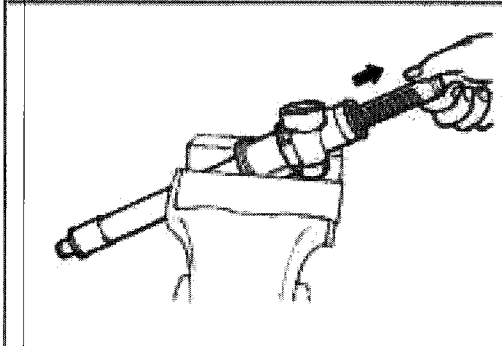
8. Yoke Plug
9. Yoke Spring
10. Support Cup
11. Dust Cover
12. Shaft Seal
13. Snap Ring
14. Pinion Bearing Assembly
15. Rack Unit
16. Rack Housing
17. Install in reverse order

Rack & Pinion Disassembly: Manual 2WD-4WD

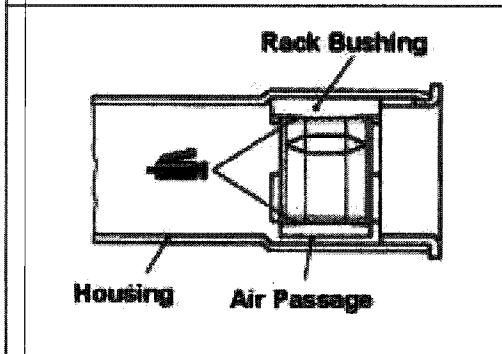


Disassembly Points

1. Place Housing in a Vise. Place a Towel around Housing to prevent damage.
2. Use MB990607 or similar Tool and remove Yoke Plug and associated components.



3. Remove Rack



Installation Points

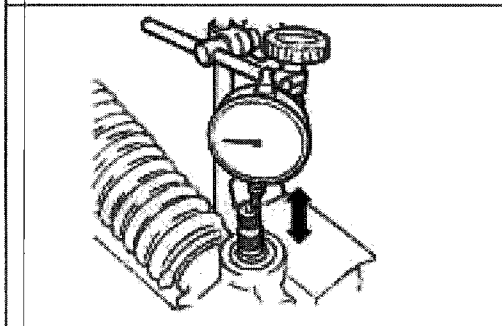
4. When Installing Rack Bushing Pre-Lubricate Points Shown. Never install Bushings "Dry".
5. End Play Adjustment. Set a Dial Gage as shown.

Limit: Below 0.1mm

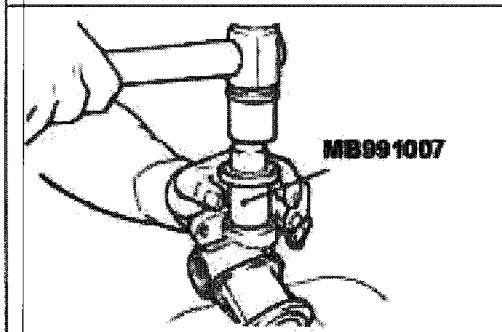
Note: the following Snap Ring Sizes available.

- 1.35 mm Yellow Code
- 1.41 mm Brown Code
- 1.46 mm White Code
- 1.52mm Blue Code
- 1.57mm (Not Coded)

See Parts Catalogue for Details

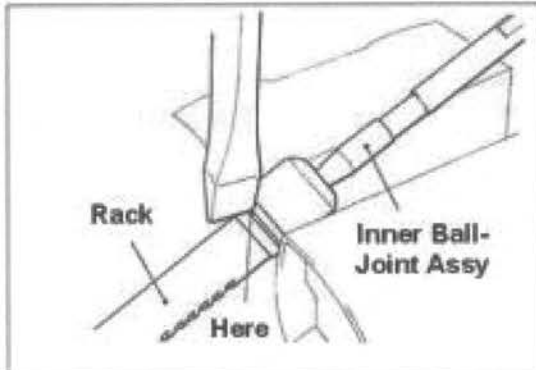


Shaft Seal Installation.



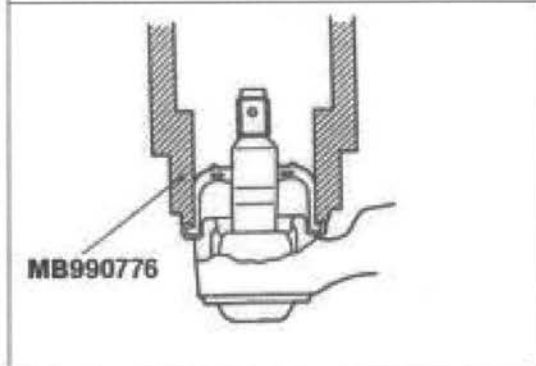
6. Coat Seal with multipurpose Grease & Install with MB991007 Seal Installer Adapter. Tap lightly to prevent Housing damage.

Rack & Pinion Disassembly: Manual 2WD-4WD



Inner Ball Joint Assembly

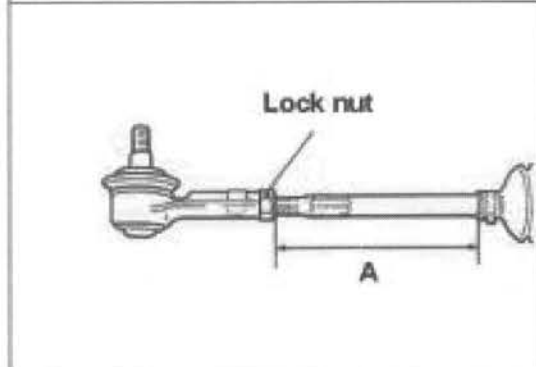
7. Place in a Vise as shown on the left.
8. Push down with a Flat Tipped Screw Driver (-) as shown. Connect Inner Ball Joint assembly with the Rack Assembly.



Tie Rod End Dust Cover Installation

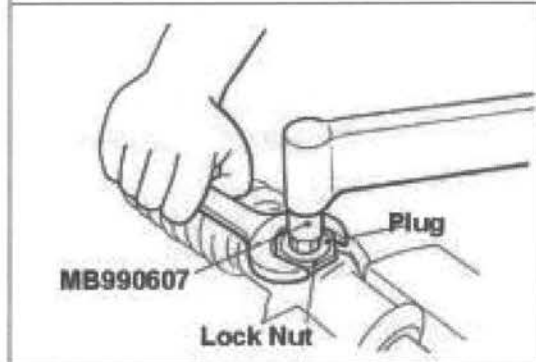
9. Coat the Inside of the Dust Cover with High Temp Axle Grease and install Cover as shown using MB990776.

Note: New Tie Rod Ends come with Dust Cover Pre-Installed.



Tie Rod End Pre-Set Instructions

10. Preset Tie Rod End Length before installation.
 - 134±2.5mm 10' Wheel Vehicles
 - 145±2.5mm 2WD 12' & 13' Vehicles
 - 149±2.5mm 4WD Vehicles (All)



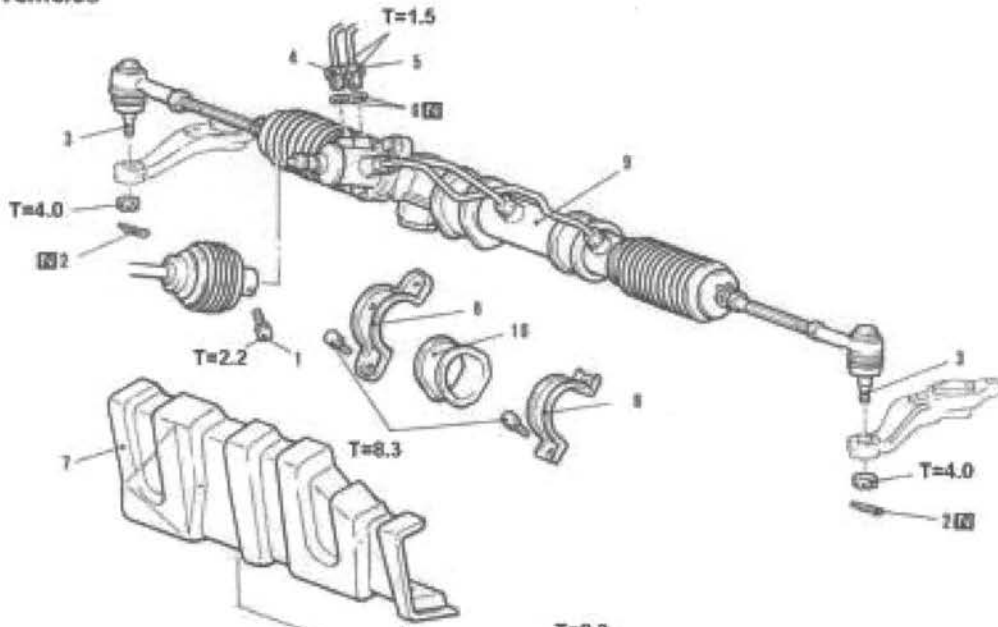
Pinion Torque Setting

11. Set Pinion Torque as shown 3-10kgcm. Set in increments at 1/4 Turn settings
Note: Do not over tighten. Unit will fail, tighten gradually.

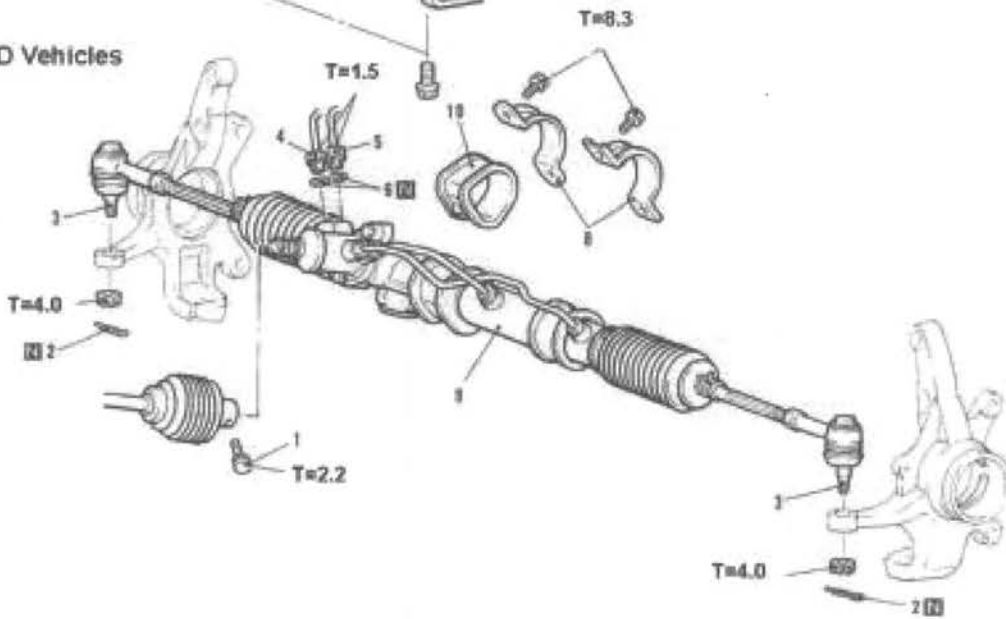
Note: When Assembling Internal Rack & Pinion Components confirm all Parts are coated with grease. Use Multipurpose High Temp MB2 Series Grease.

Rack & Pinion Steering Assembly: Power Steering 2WD-4WD

2WD Vehicles



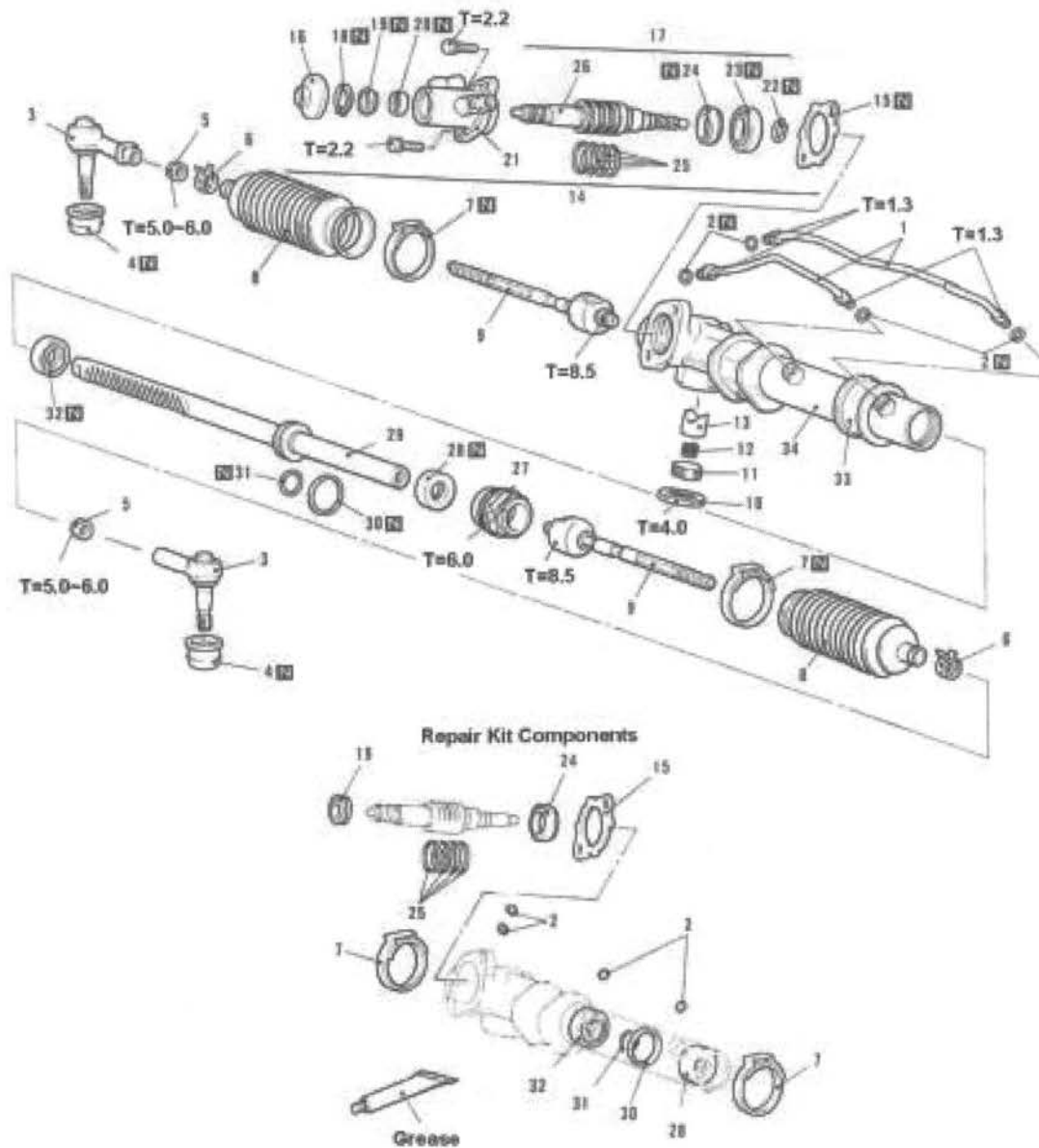
4WD Vehicles



Components

1. Steering Shaft and Rack & Pinion Attachment Bolt
2. Split Pin
3. Tie Rod End Attachment Nut
4. Return Pipe
5. Pressure Pipe
6. O-Ring
7. Cover
8. Retainer Brackets
9. Steering Gear Assembly
10. Mounting Rubber Bushings

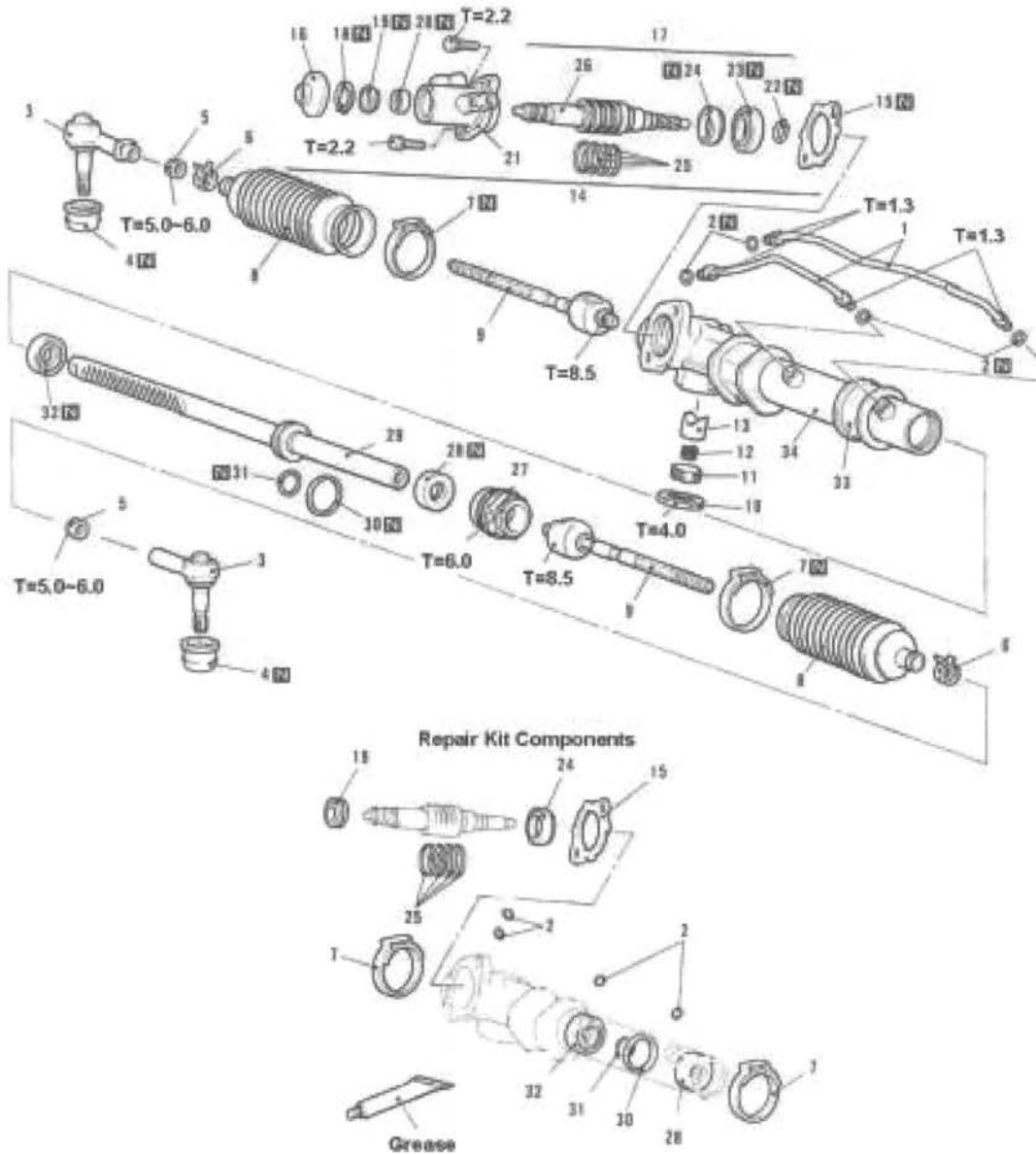
Rack & Pinion Steering Disassembly: Power Steering 2WD-4WD



Disassemble in Order

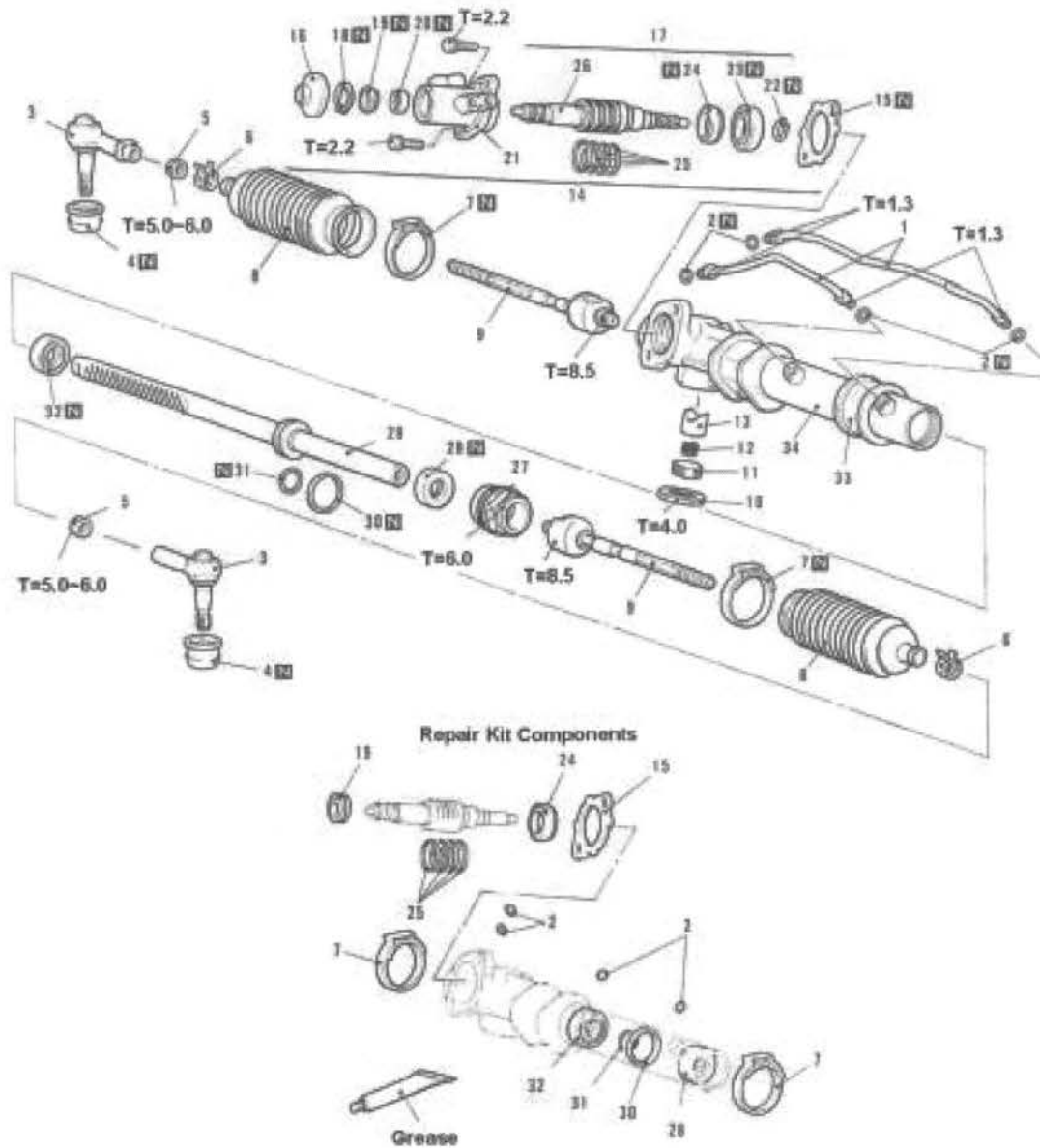
1. Feed Lines: Fluid
2. O-Ring
3. Tie Rod Ends
4. Dust Covers
5. Lock Nut
6. Hose Clip
7. Band: Discard
8. Bellows Boot
9. Inner Ball Joint Assembly
10. Lock Nut
11. Plug

Rack & Pinion Steering Disassembly: Power Steering 2WD-4WD



12. Spring
13. Support Cup (Retainer)
14. Valve Housing & Pinion Assembly
15. Gasket: Discard
16. Dust Cover
17. Seal Components Kit
18. Snap Ring
19. Oil Seal
20. Needle Bearing
21. Valve Housing
22. Snap Ring
23. Ball Bearings

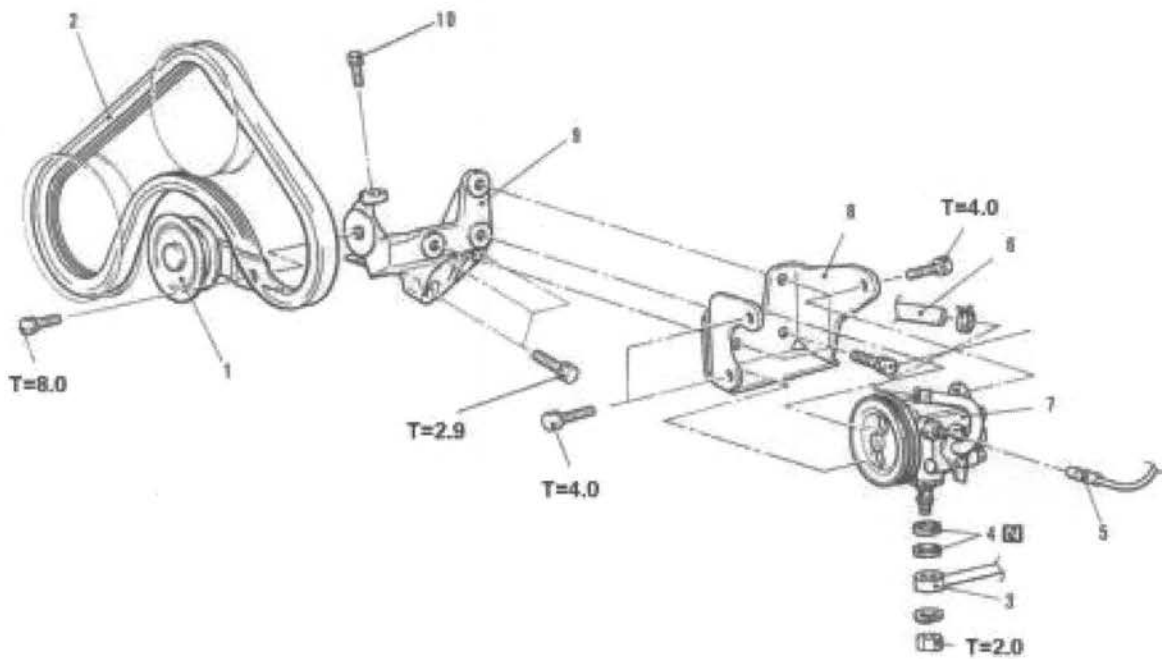
Rack & Pinion Steering Disassembly: Power Steering 2WD-4WD



24. Oil Seal
25. Ring Seals
26. Pinion & Valve Assembly
27. Housing Rack Bushing
28. Oil Seal
29. Rack
30. Piston Ring
31. O-Ring
32. Oil Seal
33. Rubber Mount
34. Rack Housing Unit

Note: See Parts Catalogue for Kit Details.

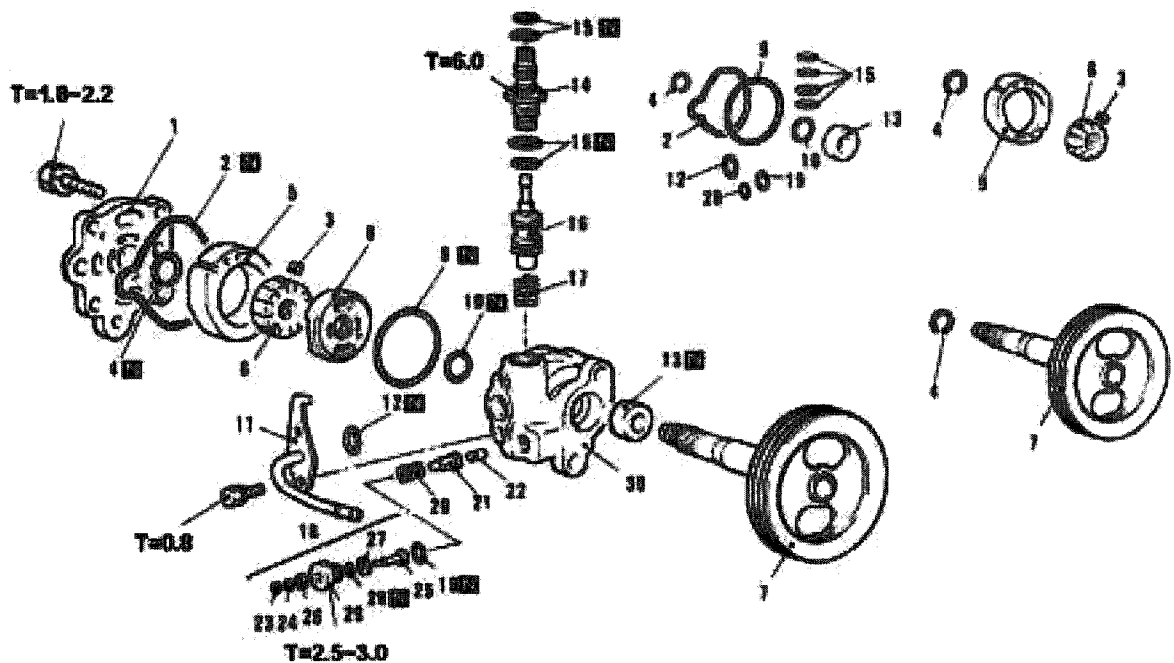
Power Steering Pump



Power Steering Pump

1. Idler Pulley
2. V-Belt
3. Pressure Hose
4. O-Ring
5. Power Steering Oil Pressure Switch Connector
6. Suction Hose
7. Oil Pump
8. Oil Pump Bracket
9. Oil Pump Mount Bracket
10. Tension Pulley Adjustment Bolt

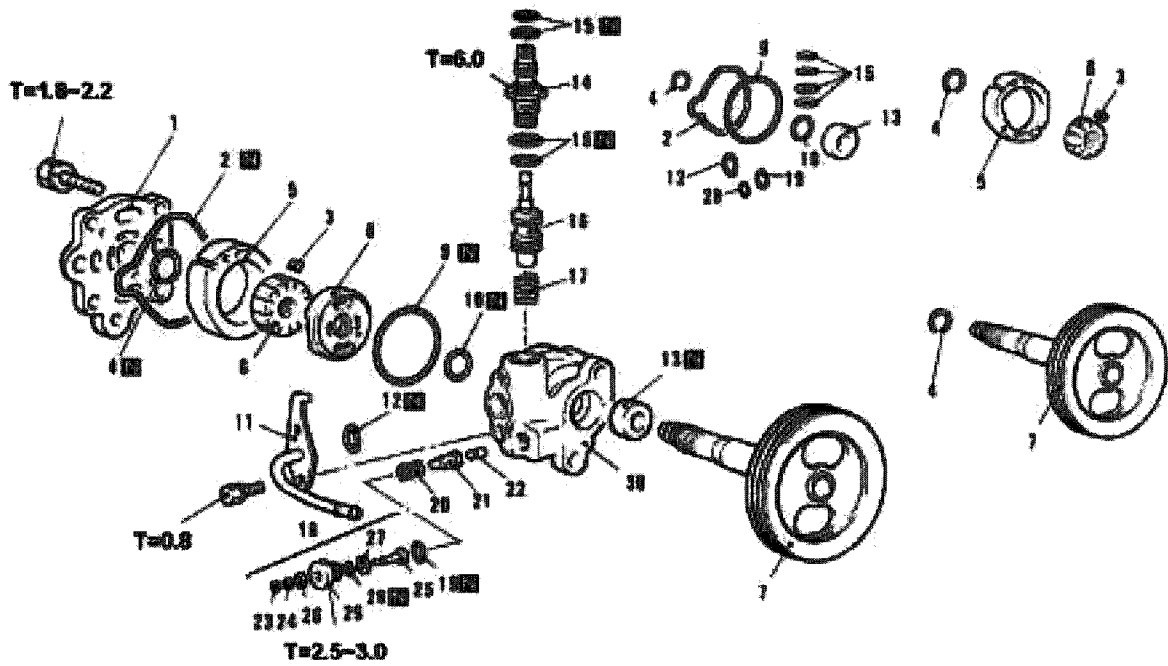
Power Steering Pump Disassembly



Components

1. Pump Cover
2. O-Ring
3. Chuck
4. Snap Ring
5. Cam Ring
6. Rotor
7. Pulley & Shaft
8. Side Plate
9. O-Ring
10. O-Ring
11. Suction Connector
12. O-Ring
13. Oil Seal
14. Connector
15. O-Ring
16. Flow Control Valve
17. Flow Control Spring
18. Terminal Parts

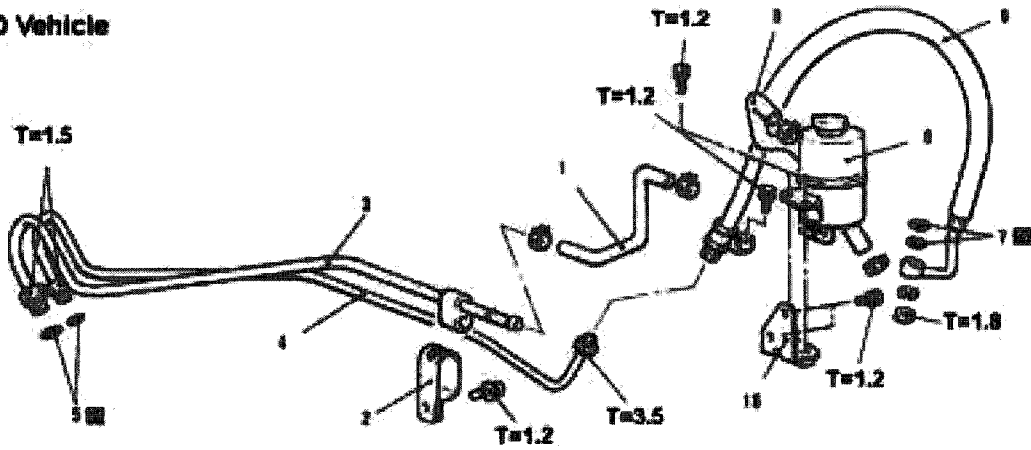
Power Steering Pump Disassembly



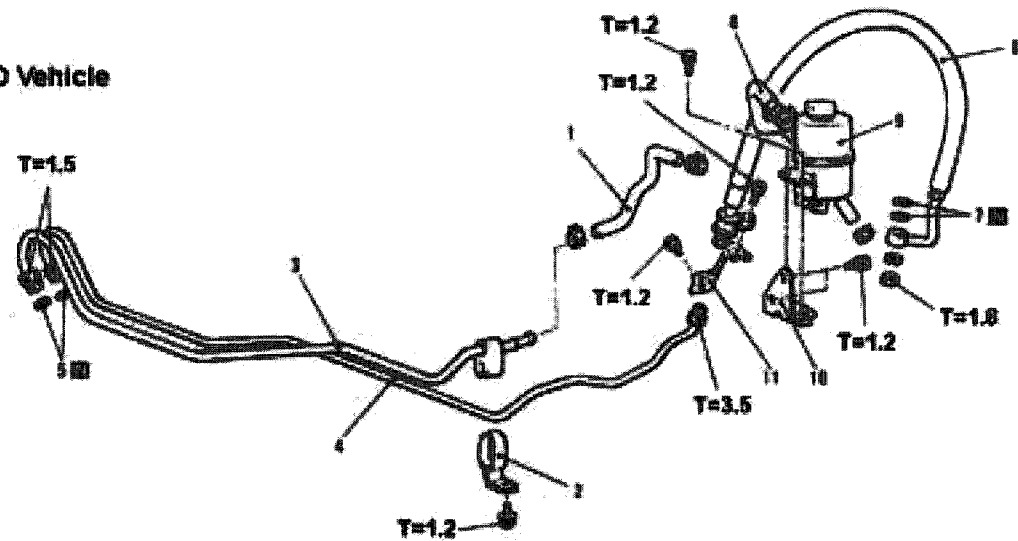
- 19. O-Ring
- 20. Spring
- 21. Piston Rod
- 22. Plunger
- 23. Snap Ring
- 24. Washer
- 25. Terminal
- 26. Insulator
- 27. Insulator
- 28. O-Ring
- 29. Plug
- 30. Oil Pump Body

Power Steering Hose System: 2WD-4WD

2WD Vehicle



4WD Vehicle



Routing & Components

1. Return Hose
2. Clip
3. Return Pipe
4. Pressure Pipe
5. O-Ring
6. Pressure Hose
7. O-Ring
8. Suction Hose
9. Oil Reserve
10. Oil Reserve Bracket
11. Pressure Hose Bracket: 4WD

Chapter 13

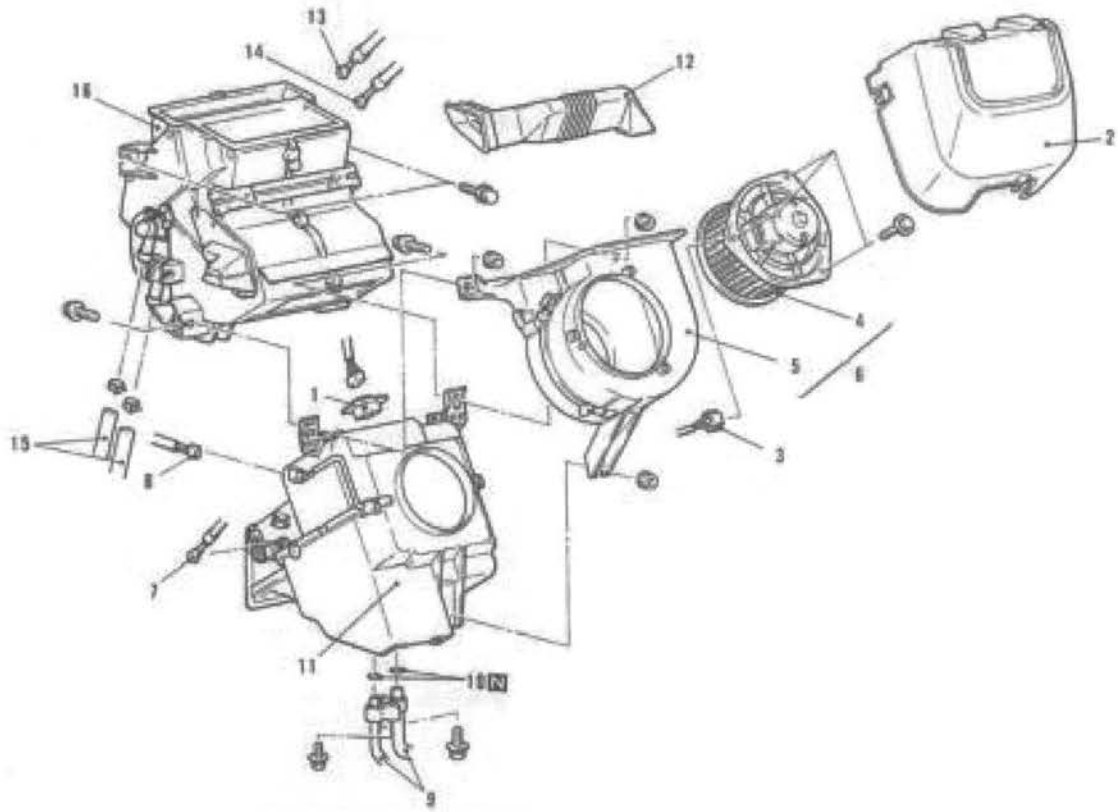
Heater

172. Heater Unit

173. Heater Core

174. Heater Hose Routing

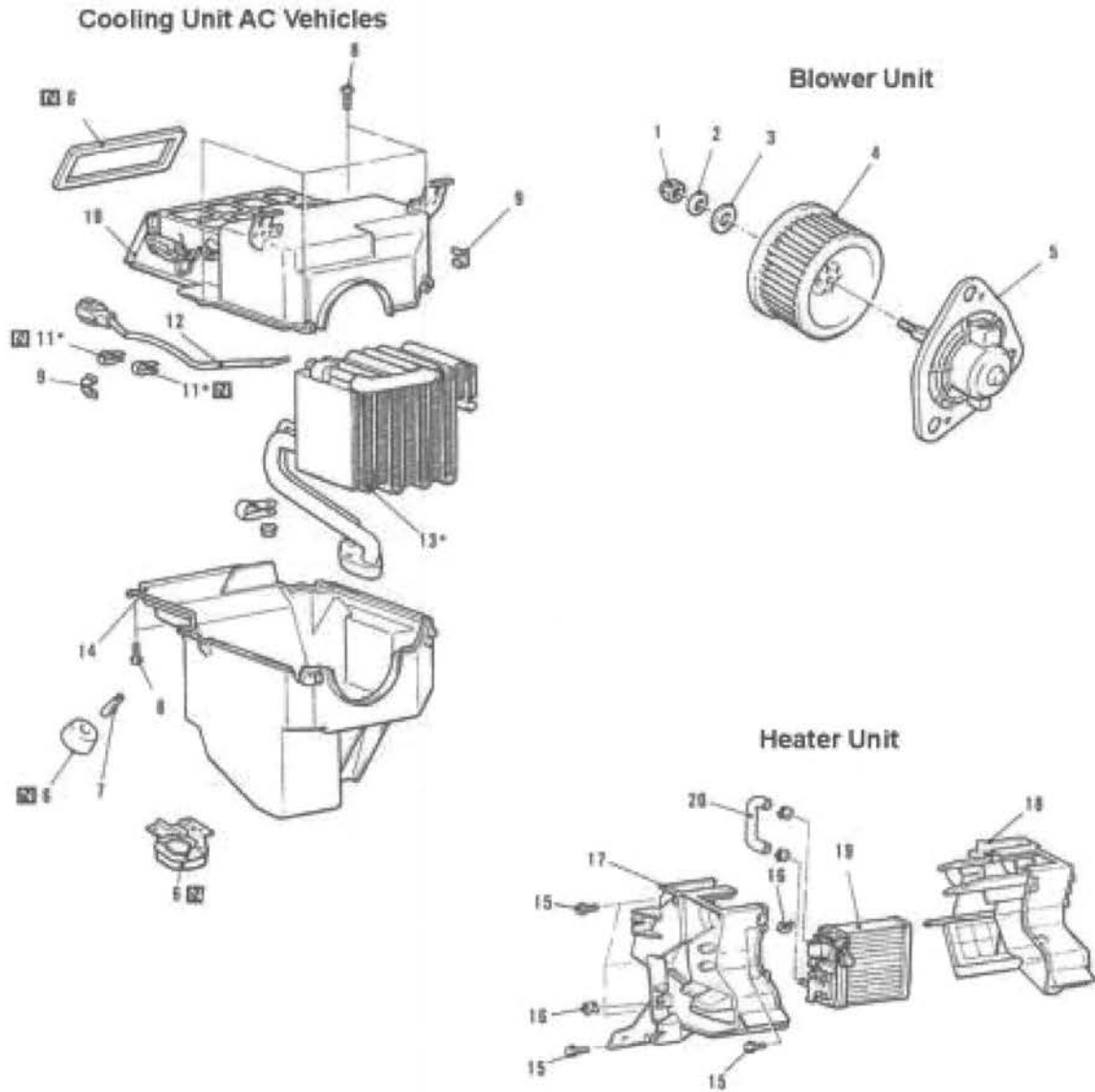
Heater Unit



Heater Control Unit

1. Resistor
2. Motor Cover
3. Blower Connector
4. Fan Motor Assembly
5. Blower Case
6. Fan-Motor-Blower Case Assembly
7. Outside/Recycle Air Control Cable
8. Air thermo Sensor Connector: AC Vehicle
9. AC coolant Lines: AC Vehicle (See AC Supplement Manual for AC Components)
10. O-Ring: AC Vehicle
11. Air Intake Box or Cooling Unit (AC Vehicles)
12. Foot Duct
13. Control Cable
14. Temperature Control Cable
15. Heater Hose
16. Heater Unit

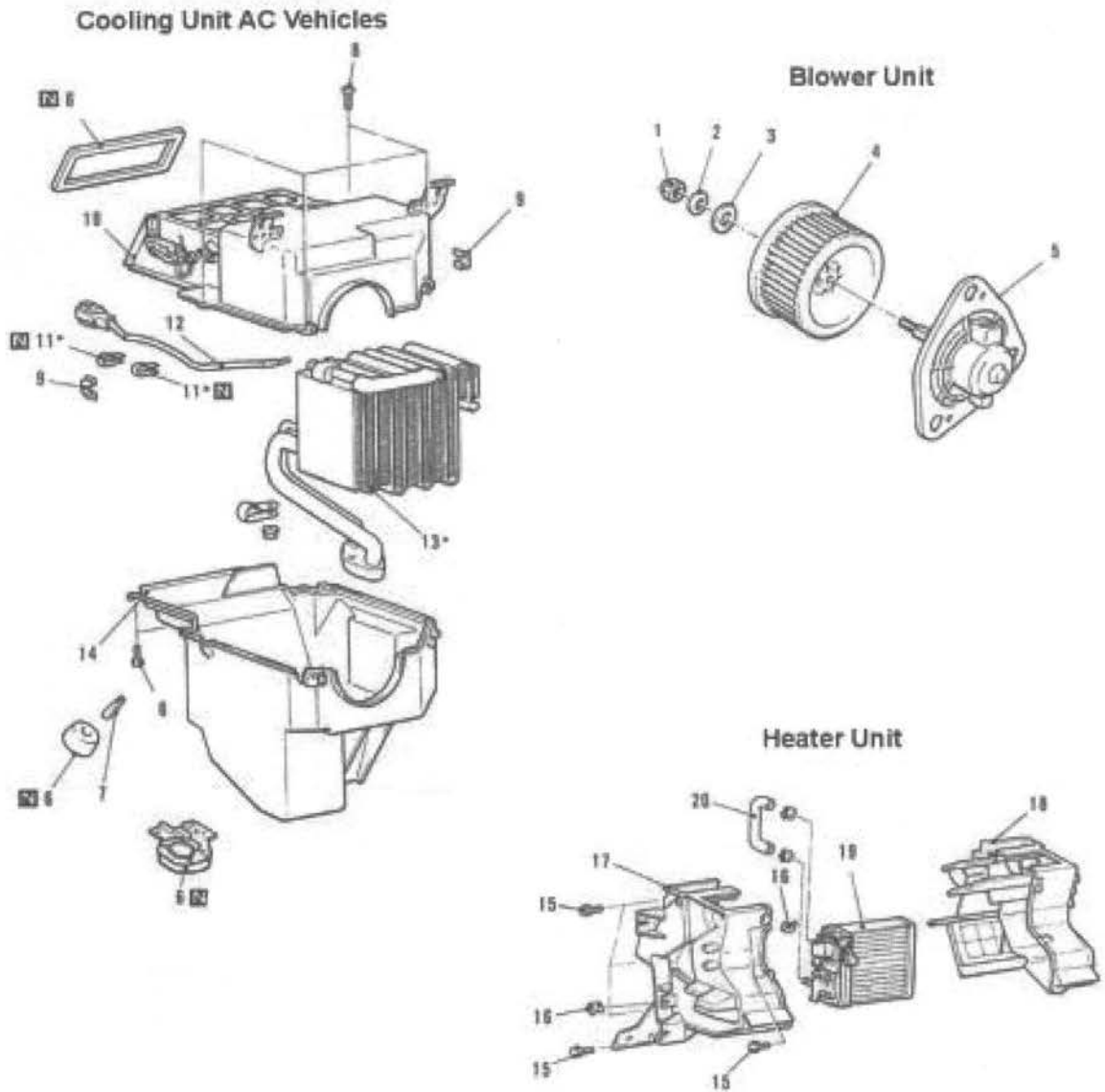
Heater Core



Components

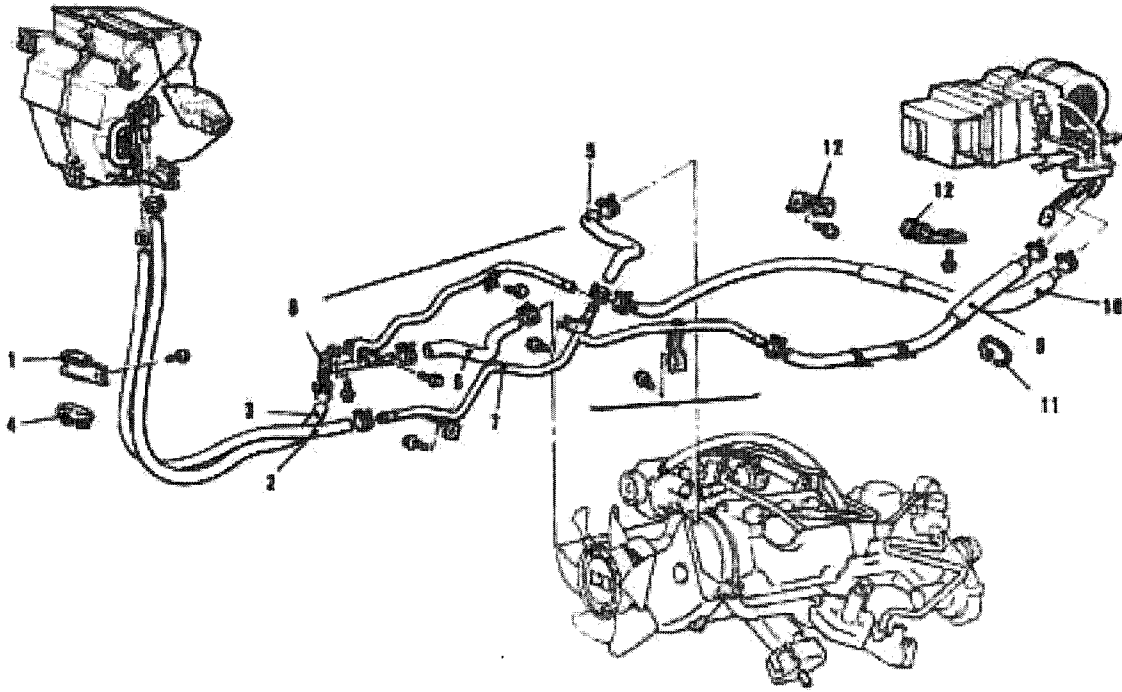
1. Nut
2. Spring Washer
3. Washer
4. Fan
5. Motor
6. Packing
7. Drain Hose
8. Screw
9. Clip
10. Air Intake Case: Upper
11. Vinyl Tap
12. Air Thermo Sensor: AC
13. Evaporator Unit: AC
14. Lower Case

Heater Core



- 15. Screw
- 16. Clip
- 17. Case: Left
- 18. Case: Right
- 19. Heater Core
- 20. Hose

Heater Hose Routing



Hose Components & Routing: Option Rear Heater (Van)

1. Clamp
2. Water Hose: Inlet
3. Water Hose: Outlet
4. Grommet
5. Water Hose: In
6. Water Hose: Out
7. Heater Pipe "A"
8. Heater Pipe "B"
9. Water Hose Rear: In
10. Water Hose Rear: Out
11. Cable band
12. Clamp

Note: For Coolant Information See Cooling Section of the Manual.

Note: Hoses removed for Maintenance on Vehicles over 65,000 Kilometers must be replaced.

Torque Conversion

Convert Units of Torque						
From	To	Multiply		From	To	Multiply
lb. in.	lb. ft.	0.08333		lb. ft.	lb. in.	12
lb. in.	kg. cm.	1.152		kg. cm.	lb. in.	0.8679
lb. in.	kg. m.	0.01152		kg. m.	lb. in.	86.796
lb. in.	N cm.	11.2984		N cm.	lb. in.	0.0885
lb. in.	Nm	0.11298		Nm	lb. in.	8.8507
lb. ft.	kg. m.	0.13825		kg. m.	lb. ft.	7.233
lb. ft.	Nm	1.3558		Nm	lb. ft.	0.73756
Nm	kg. cm.	10.197		kg. cm.	Nm	0.09806
Nm	kg.m	0.10197		kg. m.	Nm	9.80665

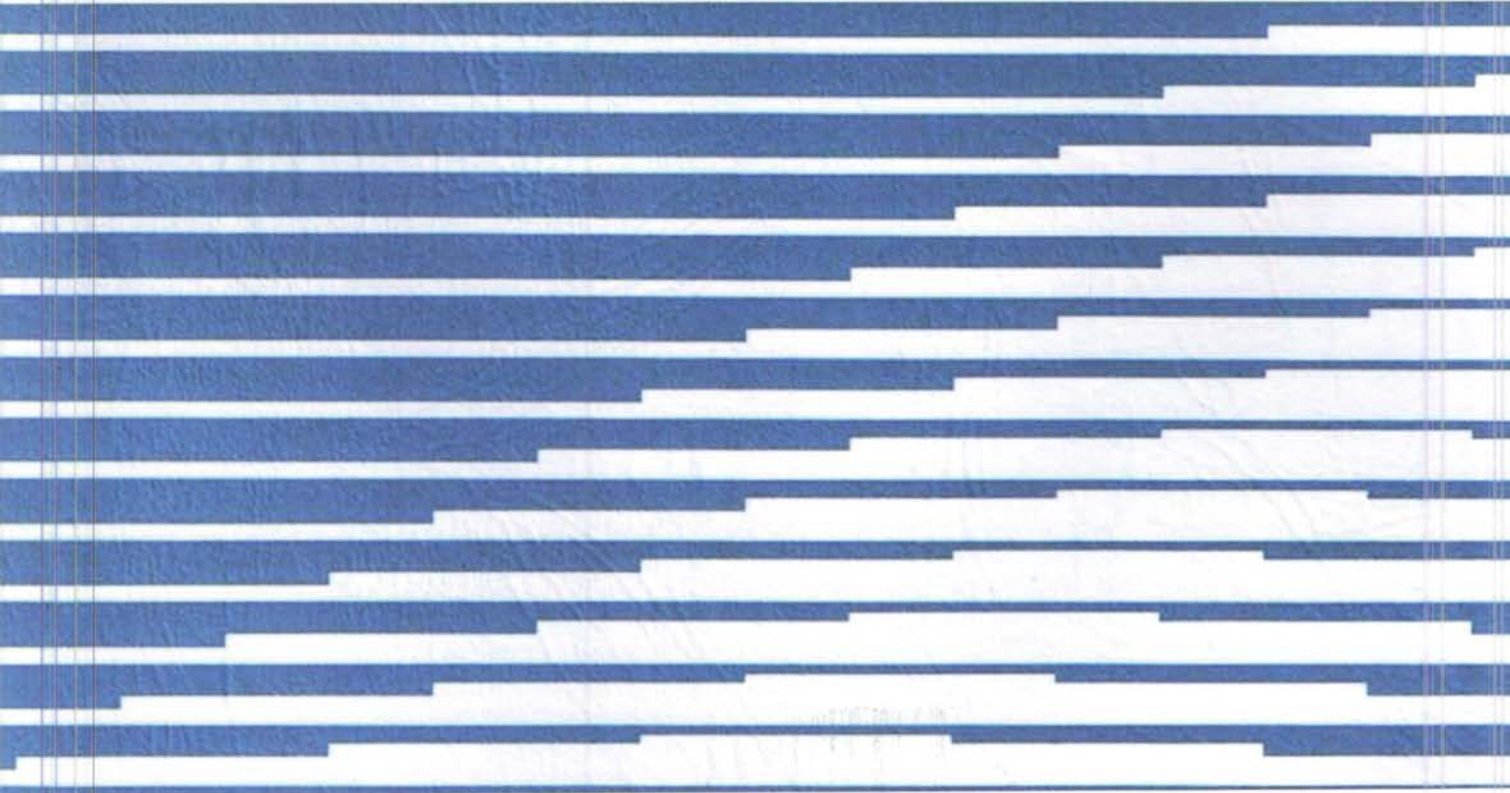
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