



SERVICE NEWS

**Perfect Timing
for the Camry**

**Idle Thoughts
About TCCS**

**On the
Circuit with
Ammeters**

**MR2
Supercharger
Oil
Maintenance**



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CONTINUING SUPPORT TO**

AFTERMARKET REPAIR.

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Remanufactured and rebuilt parts are not created equal.

Genuine Toyota Remanufactured Parts are built to fit and perform exactly like the original part — right down to the core.

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WHAT IS A STAR DEALER?

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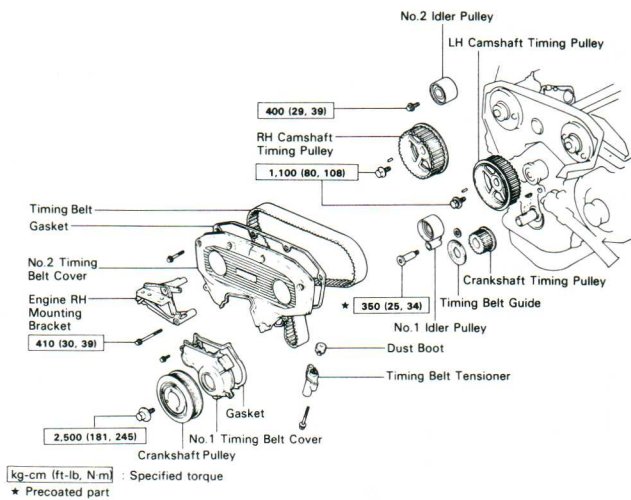
CAMRY TIMING BELT INSPECTION AND INSTALLATION

Model Application: 1988 Camry

An important part of conducting an engine tune-up involves the inspection and adjustment of the timing belt.

Under normal operating conditions, all of the Camry's drive belts should be inspected and adjusted or replaced at 30,000 miles (or 36 months). After the vehicle reaches the 60,000 mile mark, the belts should be inspected every 10,000 miles (or 12 months).

Timing Belt Components



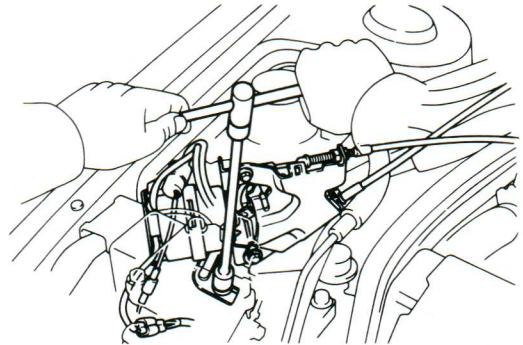
Removing the Timing Belt

1. Disconnect the cable from the negative terminal of the battery.

2. If the vehicle is equipped with cruise control, you will need to remove the cruise control actuator and vacuum pump.

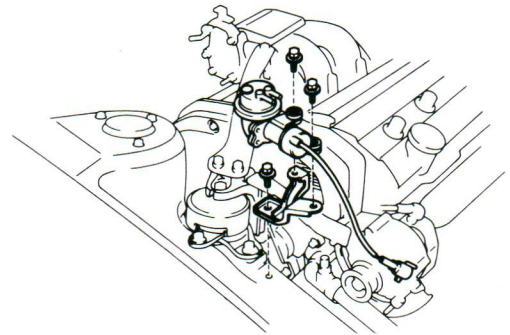
If the vehicle is equipped with A.B.S., follow this procedure:

- a. Remove the dust cover.
- b. Disconnect the actuator vacuum hoses and actuator connector.
- c. Remove the four bolts, actuator and bracket.



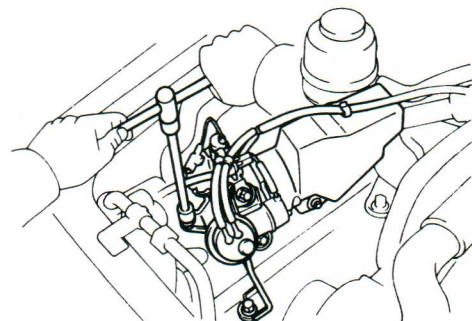
d. Disconnect the vacuum pump connector.

e. Remove the three bolts, vacuum pump and bracket.



If the vehicle is not equipped with A.B.S., follow this procedure:

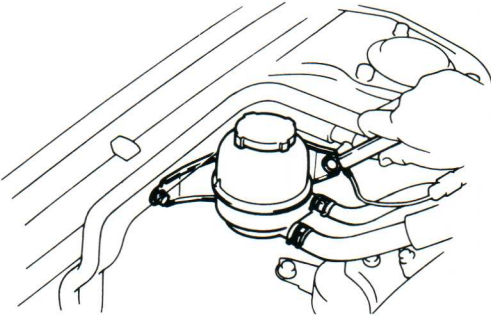
a. Disconnect the actuator vacuum hose from the air intake chamber. Then disconnect the actuator connector, the vacuum pump connector and the vacuum switch connector.



b. Remove the three bolts, the actuator, the vacuum pump and the vacuum switch assembly.

Features

3. Now, remove the power steering oil reservoir tank, making sure not to disconnect the hoses.



4. Remove RH front wheel.

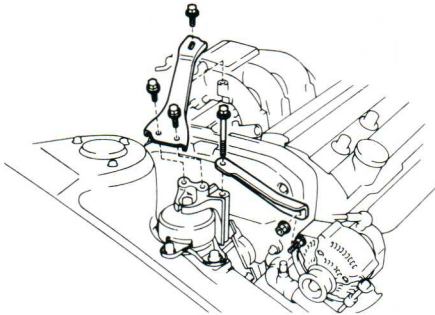
5. Remove the alternator drive belt.

6. Remove the RH fender apron seal.

7. Remove the power steering drive belt.

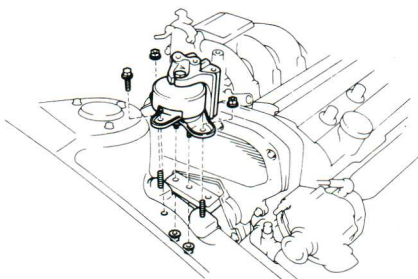
8. Remove the engine RH mounting stays.

First, remove the three bolts and the No. 1 mounting stay. Then, remove the bolt, nut and No. 2 mounting stay.

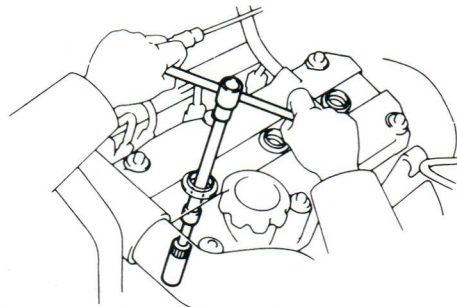


9. Raise the engine up just enough to remove the weight from the engine mounting on the right side.

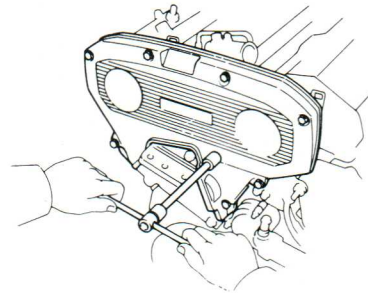
10. Remove the engine RH mounting insulator. If the vehicle is equipped with ABS, remove the clamp bolts of the power steering oil cooler pipes. Remove the four nuts, bolt and mounting insulator.



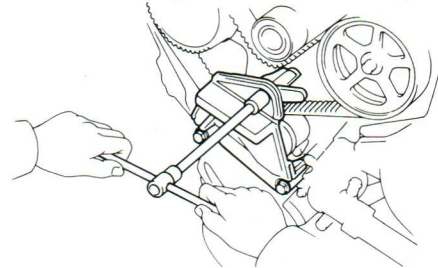
11. Remove the spark plugs, using a 16 mm plug wrench.



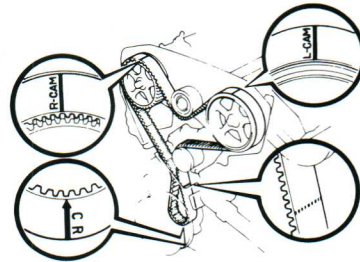
12. Remove the eight bolts, cover and gasket of the No. 2 timing belt cover.



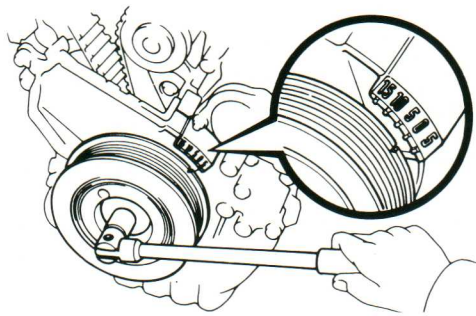
13. Remove the engine RH mounting bracket.



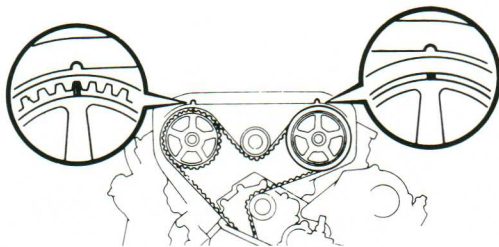
If you plan to re-use the timing belt, check the installation marks. You should find four installation marks by turning the crankshaft pulley as shown. If the installation marks have disappeared, place a new installation mark on the belt before removing each part.



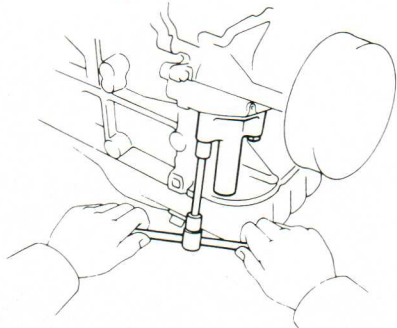
15. Set the No. 1 cylinder to TDC/ compression. Align the crankshaft pulley groove with the "0" timing mark of the No. 1 timing belt cover.



Make sure that the timing marks on the camshaft timing pulleys and the No. 3 timing belt cover are aligned. If they are not, turn the crankshaft one revolution (360 degrees).

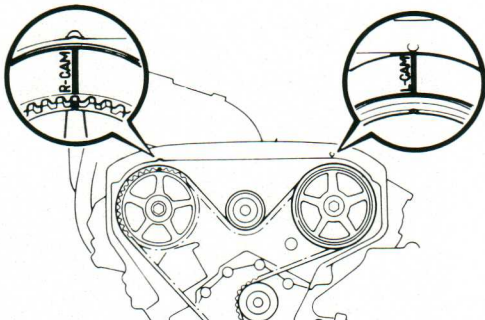


16. Remove the two bolts, tensioner and dust boot of the timing belt tensioner.

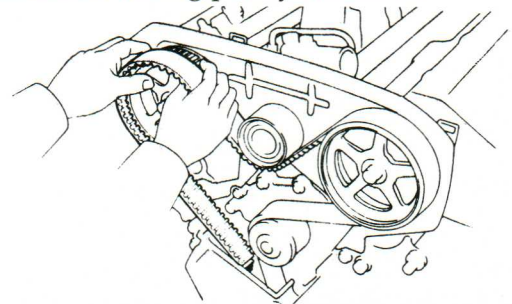


17. Remove the timing belt from the camshaft timing pulley.

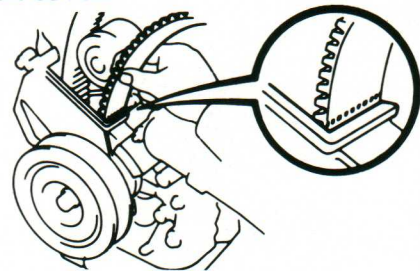
If you are going to re-use the timing belt and the installation marks have disappeared, place new installation marks on the belt that match the timing marks of the camshaft timing pulleys.



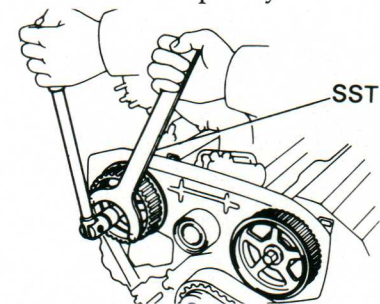
Loosen the tension between the LH and RH camshaft timing pulleys by slightly turning the LH camshaft timing pulley clockwise.



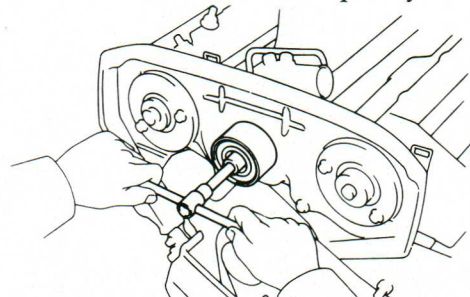
Remove the timing belt from the camshaft timing pulleys. If you are going to re-use the timing belt and the installation marks have disappeared, place a new installation mark on the timing belt to match the end of the No. 1 timing belt cover.



18. Remove the camshaft timing pulleys, using special service tool 09278-54012 to remove the bolt, timing pulley and knock pin. Make sure to arrange the RH and LH pulleys.

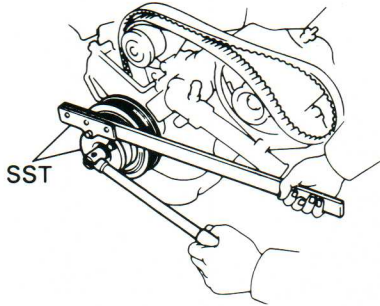


19. Remove the No.2 idler pulley.

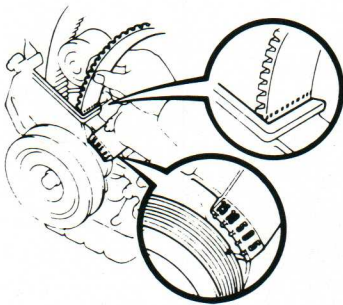


Features

20. Remove the crankshaft pulley using special service tools 09213-54014 (body), 90213-70010, (90105-08076 (bolt)), and 09330-00021 to remove the pulley bolt.



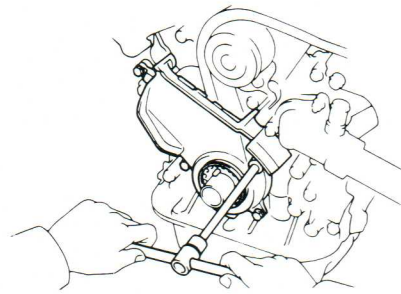
If you are going to re-use the timing belt, check the alignment of the timing mark on the crankshaft pulley and on the belt, in case they may have slipped.



Remove the pulley using special service tool 09213-60017.



21. Remove the four bolts, timing belt cover and gasket of the No. 1 timing belt.



22. Remove the timing belt guide.

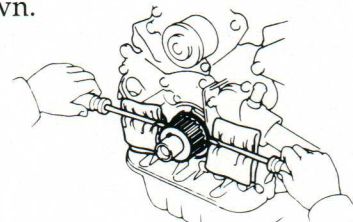
23. Remove the timing belt. If the installation marks have disappeared and you plan to re-use the belt, place a new installation mark on the timing belt to match the drilled mark on the crankshaft timing pulley.



24. Using an 8 mm hexagon wrench, remove the bolt, idler pulley and plate washer of the No. 1 idler pulley.



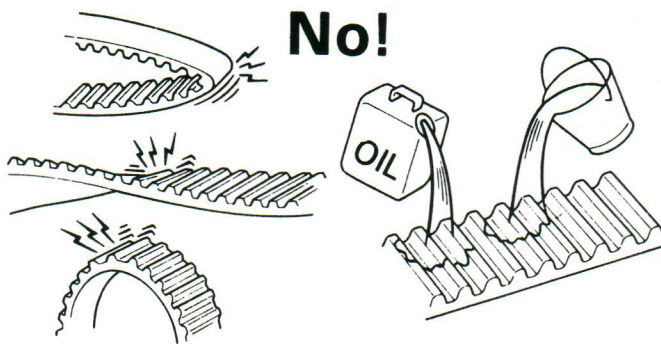
25. Remove the crankshaft timing pulley. If you cannot remove the pulley by hand, use two screwdrivers. To prevent damage, position shop rags as shown.



INSPECTING TIMING BELT COMPONENTS

Before you begin the inspection, follow these guidelines:

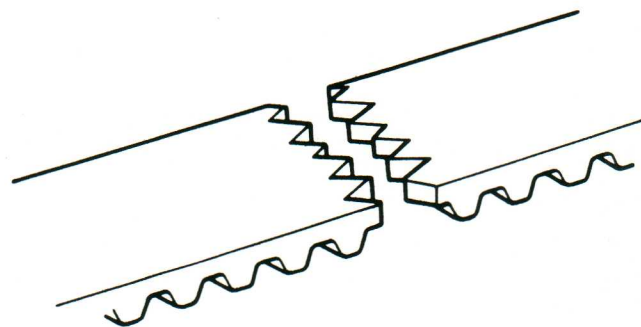
- Do not bend, twist or turn the timing belt inside out.
- Keep oil, water and steam away from the belt.



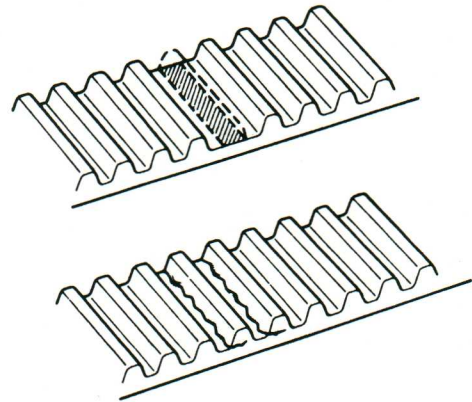
- To prevent damage to the timing belt, make use of special service tools when you install or remove the mount bolt of the camshaft timing pulley.

1. Inspect the timing belt, looking for the following items:

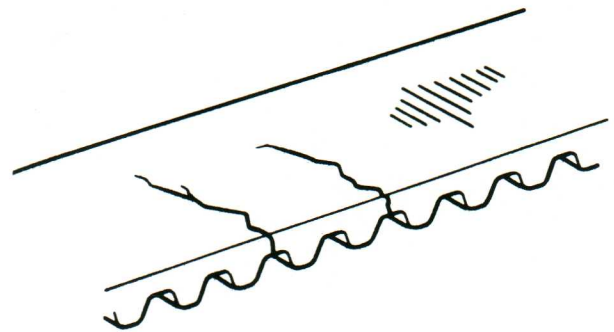
a. If there is premature parting, check to see whether the belt was properly installed. Also check the timing cover gasket for damage and to make sure that it has been properly installed.



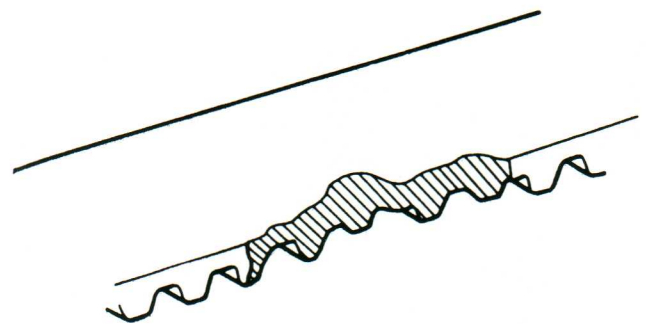
b. If the timing belt teeth are cracked or damaged, check to see if the camshaft is locked.



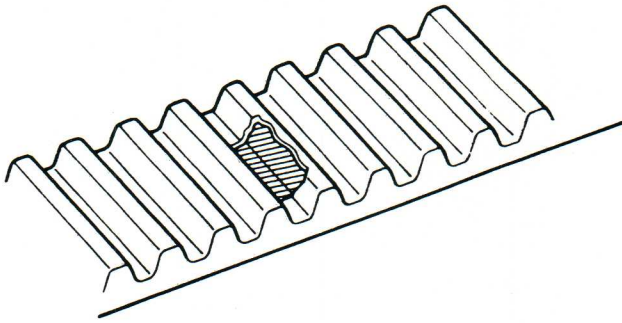
c. If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.



d. If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.



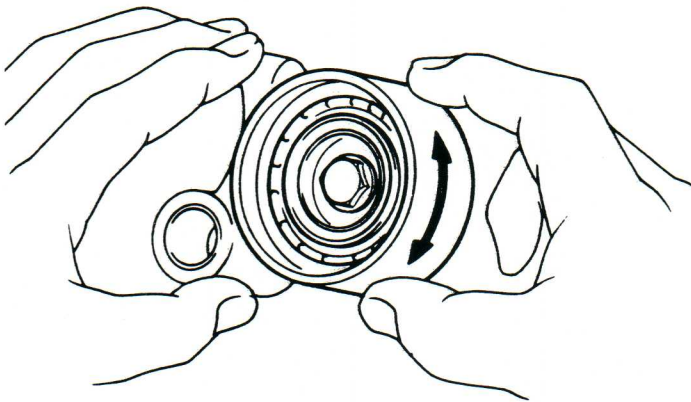
e. If there is noticeable wear on the belt teeth, check the timing cover for damage and check that the gasket has been installed properly. Also, look for foreign material on the pulley teeth.



If you find any of the above damage, replace the timing belt.

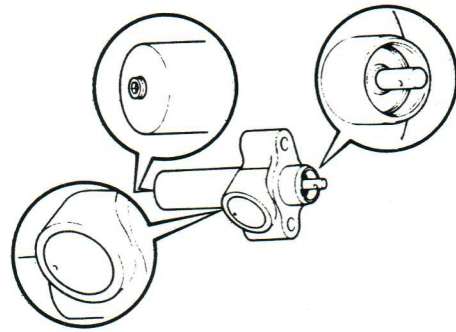
Inspecting Idler Pulleys

Check to make sure that the idler pulley turns smoothly. If not, replace the idler pulley.

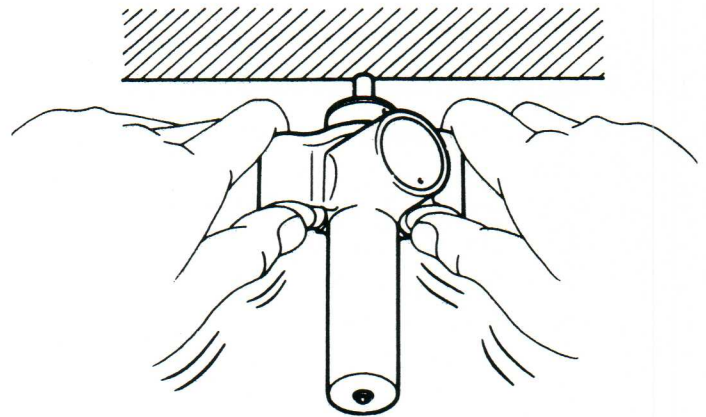


Inspecting the Timing Belt Tensioner

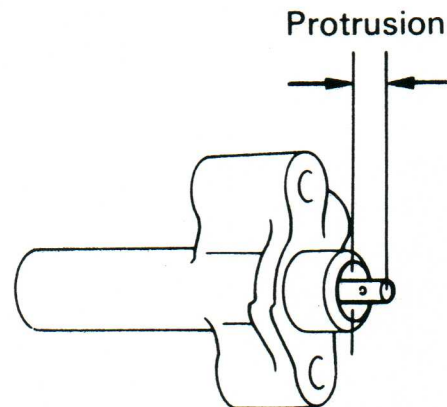
Check the tensioner for oil leakage. If you find only a faint trace of oil on the seal of the push rod side, the tensioner is fine. However, if you spot a leakage, replace the tensioner.



Holding the tensioner firmly with both hands, push the push rod strongly against the floor or wall. If the push rod moves, replace the tensioner.



The protrusion of the push rod from the housing end should measure between 10.5 - 11.5 mm (0.413-0.453 in.). If it does not, replace the tensioner.

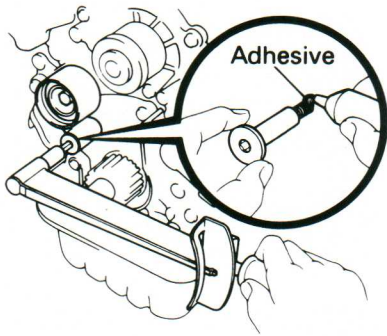


INSTALLING THE TIMING BELT

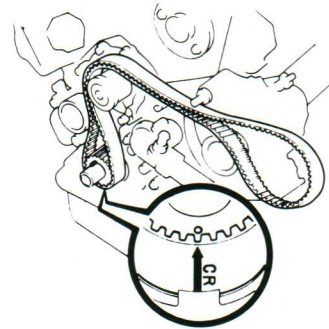
1. Install the crankshaft timing pulley. Begin by aligning the pulley set key with the key groove of the timing pulley. Slide the timing pulley so that the flange side faces inward.



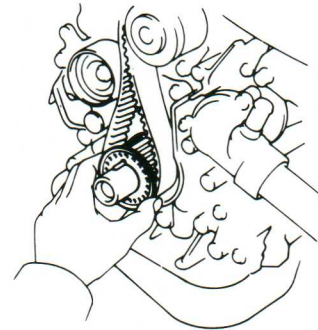
2. Install the No. 1 idler pulley. Apply adhesive (part no. 08833-00080, three bond 1344, Loctite 242 or the equivalent) to two or three threads of the mount bolt end. Using an 8 mm hexagon wrench, install the idler pulley with the plate washer and bolt. Torque the bolt to 350 kg-cm (25 ft-lb, 34 N•m). Make sure that the pulley bracket moves smoothly.



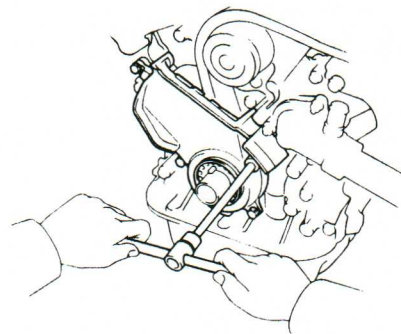
3. Making sure that the engine is cold, temporarily install the timing belt. Remove any water or oil from the crankshaft timing, No. 1 idler, and water pump pulleys. Align the timing belt installation mark with the drilled mark on the crankshaft timing pulley. Install the timing belt on the crankshaft timing, No. 1 idler and water pump pulleys.



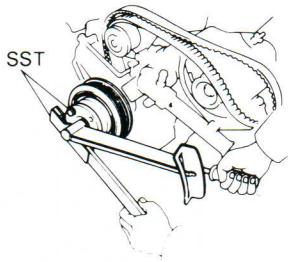
4. Install the timing belt guide so that the cup side faces outward.



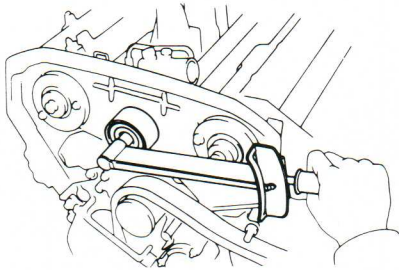
5. Install the No. 1 timing belt cover. Begin by installing the gasket to the timing belt cover. Then, install the timing belt cover with the four bolts.



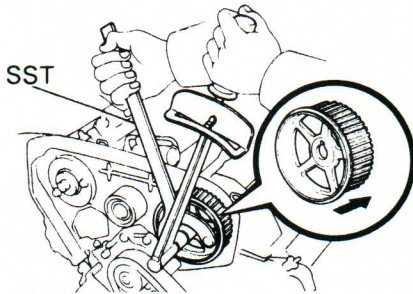
6. Install the crankshaft pulley by aligning the pulley set key with the key groove of the pulley. Slide the pulley. Using special service tools 09213-54014 (body), 09213-70010, (90105-08076 (bolt)), and 09330-00021, install the bolt. The torque should be 2,500 kg-cm (181 ft-lb, 245 N•m).



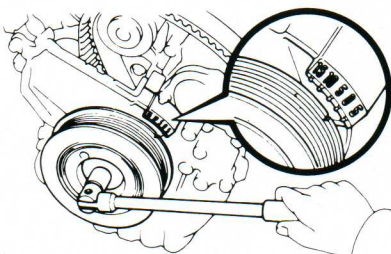
7. Install the No. 2 idler pulley with the bolt. Torque the bolt to 400 kg-cm (29 ft-lb, 39 N•m). Make sure that the idler pulley moves smoothly.



8. Install the LH camshaft timing pulley. With the flange side facing out, slide the timing pulley. Align the camshaft's knock pin hole with the knock pin groove of the timing pulley. Install the knock pin. Using special service tool 09278-54012, install the bolt. Torque the bolt to 1,100 kg-cm (80 ft-lb, 108 N•m).

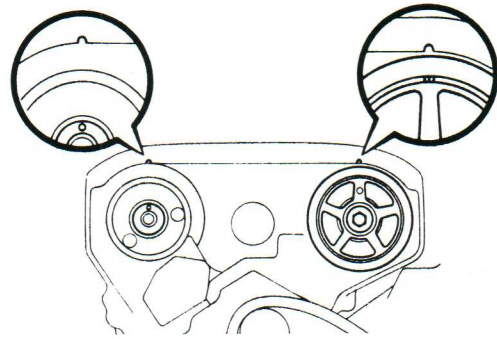


9. Set the No. 1 cylinder to TDC/compression.
a. Crankshaft position. Align the groove of the crankshaft pulley with the "0" timing mark on the No. 1 timing belt cover.



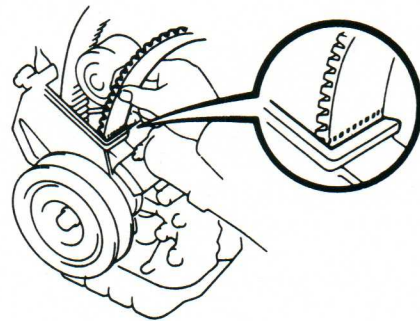
b. RH camshaft pulley position. Align the knock pin hole of the camshaft with the timing mark of the No. 3 timing belt cover.

c. LH camshaft pulley position. Align the timing marks on the camshaft timing pulley and the No. 3 timing belt cover.



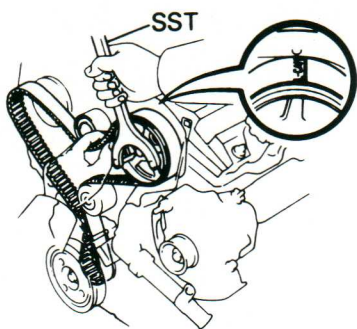
10. Install the timing belt to the LH camshaft timing pulley.

a. Make sure that the installation mark on the timing belt matches the end of the No. 1 timing belt cover. If the marks do not align, shift the meshing of the timing belt and the crankshaft timing pulley until they do.



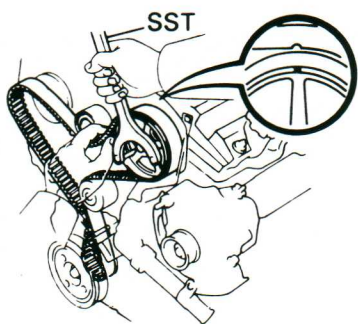
b. Remove any water or oil from the LH camshaft timing pulley.

c. Using special service tool 09278-54012, slightly turn the LH camshaft timing pulley clockwise. Align the installation mark on the timing belt with the timing mark of the camshaft pulley. Hang the timing belt on the LH camshaft timing pulley.



d. Using the same special service tool 09278-54012, align the timing marks of the LH camshaft pulley and the No. 3 timing belt cover.

e. There should be tension between the crankshaft timing and LH camshaft timing pulleys.

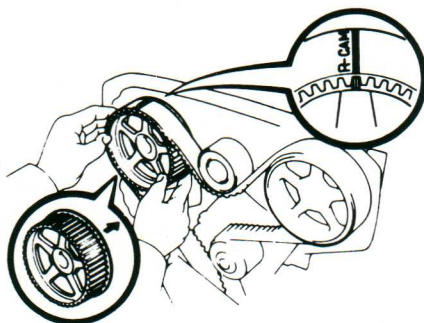


11. Install the RH camshaft timing pulley and timing belt.

a. Remove any water or oil from the RH camshaft timing and No. 2 idler pulleys.

b. Align the installation marks on the timing belt with the timing mark on the RH camshaft timing pulley.

c. Hang the timing belt on the RH camshaft timing pulley with the flange side facing in.

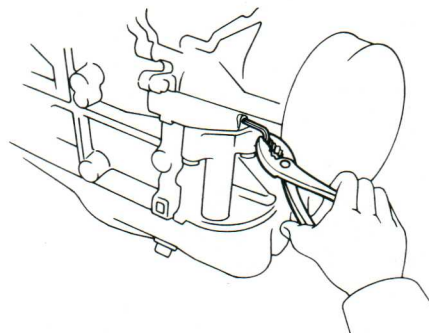


d. Align the timing marks of the RH camshaft timing pulley and the No. 3 timing belt cover.

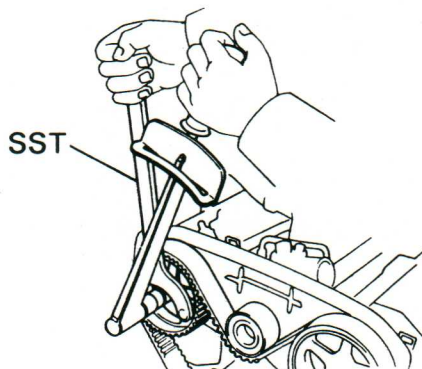
e. Slide the RH camshaft timing pulley onto the camshaft.



f. Using special service tool 09278-54012, align the knock pin hole of the camshaft with the knock pin groove of the pulley. Install the knock pin.

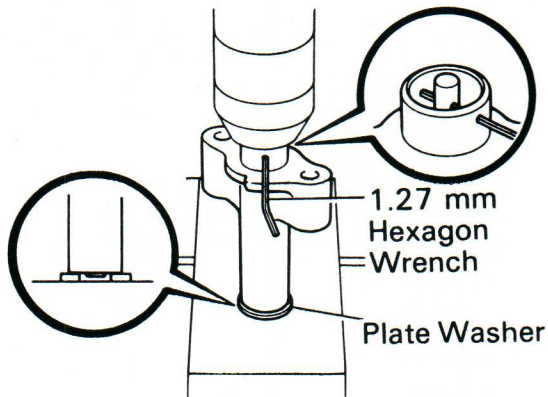


g. Using the same special service tool 09278-54012, install the bolt. Torque the bolt to 1,100 kg-cm (80 ft-lb, 108 N•m).

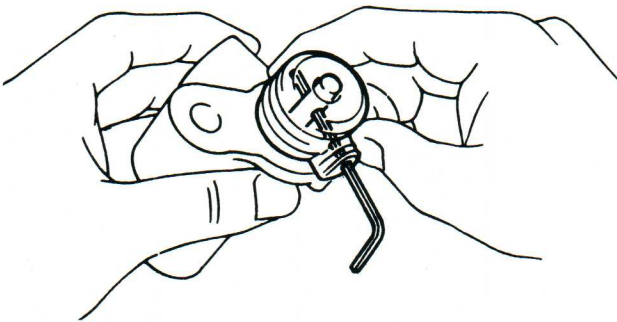


Features

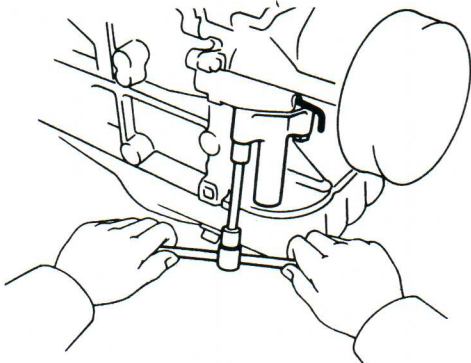
12. Set the timing belt tensioner by placing a plate washer between the tensioner and a block. Using a press, slowly push in the push rod using 100 - 1,000 kg (220 - 2,205 lb., 981 - 9,807 N) of pressure.



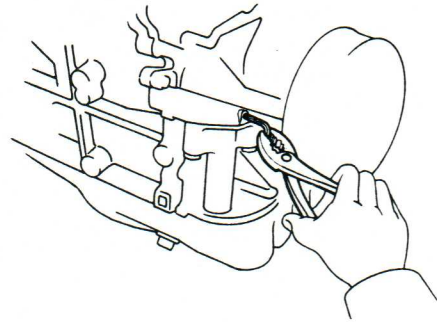
Align the holes of the push rod and the housing. Pass a 1.27 mm hexagon wrench through the holes aligned. Release the press.



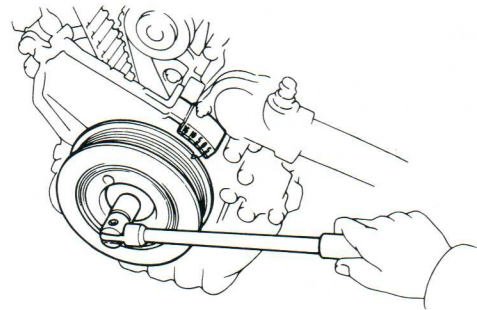
13. Install the timing belt tensioner with two bolts. Torque the bolts to 270 kg-cm (20 ft-lb, 26 N•m).



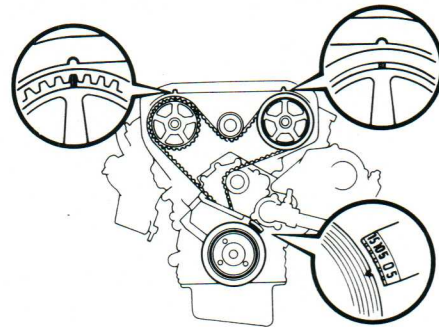
Remove the 1.27 mm hexagon wrench from the tensioner.



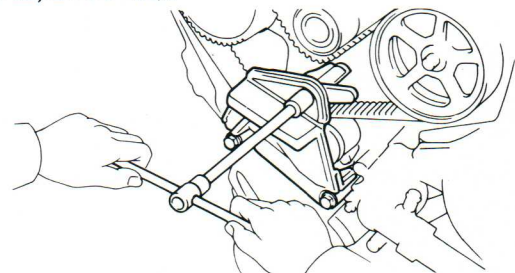
14. Check the valve timing by turning the crankshaft pulley two revolutions from TDC to TDC. Always turn the crankshaft clockwise.



Check that each pulley aligns with the timing marks as shown. If the marks do not align, remove the timing belt and reinstall it.

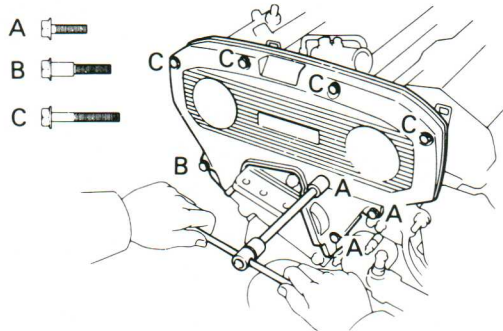


15. Install the engine RH mounting bracket and three bolts. Torque each bolt to 410 kg-cm (30 ft-lb, 39 N•m).



Features

16. Install the gasket to the No. 2 timing belt cover. Install the timing belt cover with eight bolts. (See illustration to determine which bolts to use).

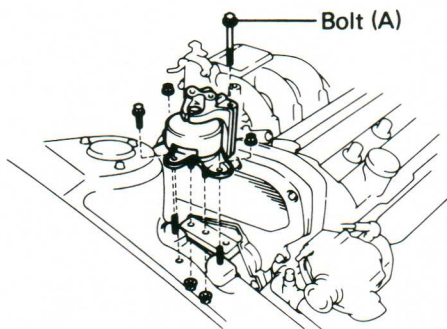


17. Install the spark plugs. (see page IG-7). Torque is 180-kg-cm (13 ft-lb, 18 N•m).

18. Install the engine RH mounting insulator.

a. Attach the mounting insulator to the mounting bracket and body, and temporarily install the four mounting insulator nuts, bolt and the mounting stay bolt (A).

b. Torque the four mounting insulator nuts and bolt. Do not torque the mounting stay bolt (A) yet.



Torque:

Nut (to bracket) 530 kg-cm (38 ft-lb, 52 N•m).

(to body) 900 kg-cm (65 ft-lb, 88 N•m).

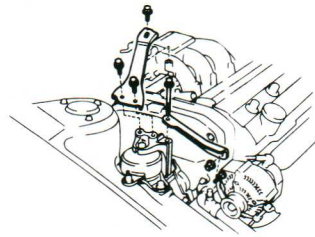
Bolt 490 kg-cm (35 ft-lb, 48 N•m).

c. If the vehicle is equipped with ABS, install the two clamp bolts of the power steering oil cooler pipes.

19. Install the engine RH mounting stays.

a. Install the No. 1 mounting stay with three bolts. Torque each bolt to 530 kg-cm (38 ft-lb, 52 N•m).

b. Install the No. 2 mounting stay with the bolt and nut. Torque the bolt to 890 kg-cm (64 ft-lb, 87 N•m). Torque the nut to 530 kg-cm (38 ft-lb, 52 N•m).



20. Lower the engine.

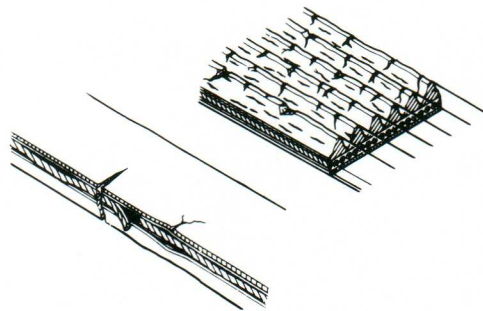
21. Install the power steering pump drive belt.

Drive belt tension: New belt 125 ± 20 lb

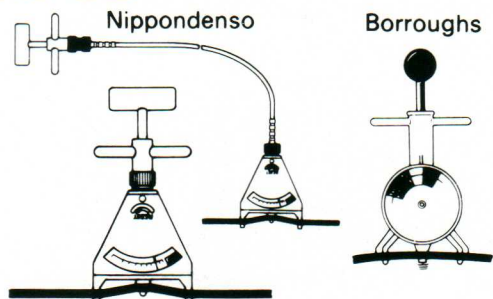
Used belt 80 ± 25 lb

22. Install the alternator drive belt. Adjust the drive belt.

a. Visually inspect the drive belt for separation of the adhesive rubber above or below the core, core separation from the belt side, a severed core, separation of the rib from the adhesive rubber, cracking or separation of the ribs, and torn or worn ribs or cracks in the inner ridges of the ribs. If the belt has any of the above defects, replace it.



b. Using a belt tension gauge, measure the drive belt tension.



Belt tension gauge:

Nippondenso BTG-20 (95506-00020)

Borroughs No. BT-33-73F

Drive belt tension: New belt 175 ± 5 lb

Used belt 115 ± 20 lb



CORRECT

WRONG

WRONG

- "New belt" refers to a belt which has been used five minutes or less on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for five minutes or more.
 - Make sure that the belt fits properly in the ribbed grooves.
 - Check to make sure that the belt has not slipped out of the groove on the bottom of the pulley.
 - After installing a new belt, run the engine for about five minutes and recheck the belt tension.

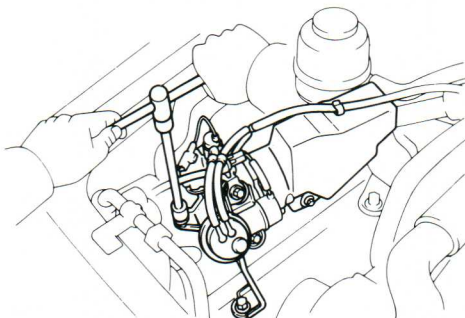


CORRECT

WRONG

WRONG

23. Install the RH front fender apron seal.
24. Install the RH front wheel.
25. Install the power steering oil reservoir tank.

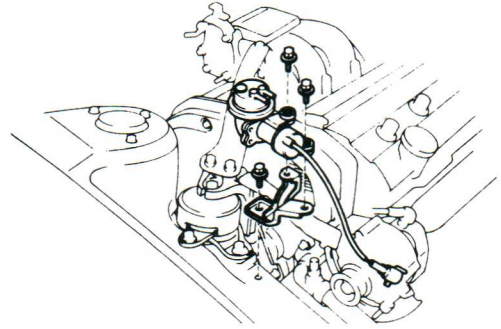


26. If the vehicle is equipped with cruise control, install the cruise control actuator and vacuum pump.

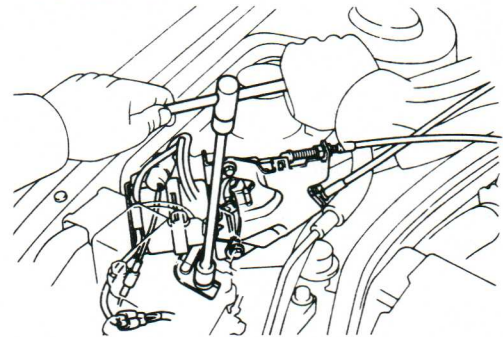
If the vehicle has A.B.S.:

- a. Install the vacuum pump and bracket with the three bolts.

- b. Connect the vacuum pump connector.

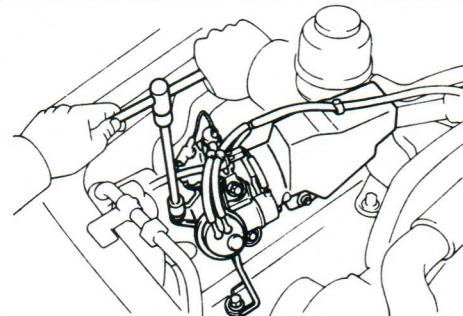


- c. Install the actuator and the bracket with four bolts.
- d. Connect the actuator vacuum hoses and actuator connector.
- e. Install the dust cover.



If the vehicle does not have A.B.S.:

- a. Install the actuator, vacuum pump and vacuum switch assembly with the three bolts.
- b. Connect the actuator vacuum hose from the air intake chamber, the actuator connector, the vacuum pump connector and the vacuum switch connector.



27. Connect the cable to the negative terminal of the battery.

This procedure is taken from the 1988 1/2 Camry Repair Manual. Please refer to it or contact your Toyota STAR dealer for further reference.

FOUR WAYS TO CONTROL IDLE SPEED

Application: All models with EFI

The Toyota EFI (Electronic Fuel Injection) system is composed of three basic subsystems: fuel induction, air induction and electronic control. The electronic control subsystem is called the TCCS system, or Toyota Computer Control System. The TCCS centrally controls the Electronic Fuel Injection (EFI), Electronic Spark Advance (ESA), diagnostic systems and fail safe functions by means of an Electronic Control Unit (ECU).

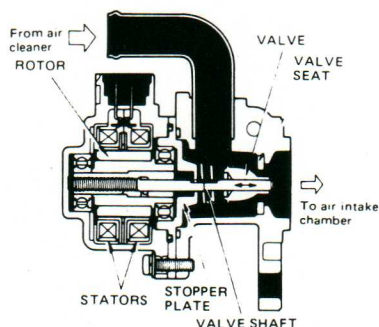
One of the main components in the Toyota TCCS system is the ISCV (Idle Speed Control Valve). The ISCV controls engine speed by changing the volume of air flowing through the throttle bypass, based on signals sent by the ECU. The ISCV helps optimize engine speed during all conditions.

Here is a brief description of each of the four different types of ISC valves found on Toyota vehicles:

Step Motor Type

The step motor type ISCV is found on 7M, 5M and 3F-E engines. This ISCV is found on the throttle body. It is called a step motor type because a step motor is built into the ISCV.

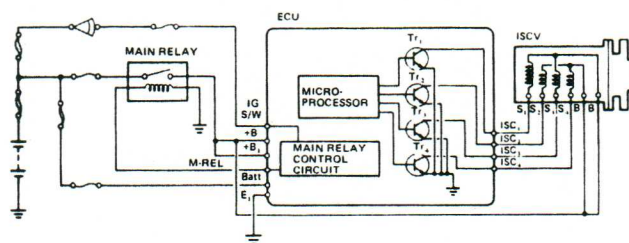
The step motor type ISCV controls engine idle speed by increasing or decreasing the amount of air that is allowed to bypass the throttle valve, based on signals from the ECU.



On this particular ISCV, a valve shaft is screwed into the rotor. A stopper plate prevents

the valve shaft from turning, so it moves in and out as the rotor turns, which increases or decreases the clearance between the valve and the valve seat, regulating the amount of air allowed to pass through. The valve can be opened to 125 possible positions.

The step motor type ISCV is connected to the ECU as shown below. The target engine speeds for each coolant temperature and air conditioner operating state are stored in the ECU's memory.



The ECU determines the idle speed based on the throttle valve opening angle and vehicle speed signals. Current is then sent to the ISCV coils until the target engine idle speed is reached.

To improve engine startability, the ISCV opens to the 125th step (fully open) when the engine is off, which allows the maximum amount of air to pass through the ISCV. However, after the engine has started, if the valve was left fully open the engine speed would rise too high. To prevent this, the ECU uses actual engine speed feedback, low battery voltage idle-up, and "learned data" to control the warm-up fast idle engine speed. Signals are sent from the ECU to the ISCV once the engine reaches the target speed, causing it to close to a point determined by the coolant temperature.

"Learned data" is what helps the ECU "remember" the target engine speed. The ECU's role is to control the idle speed by changing the ISCV step position. Because idle speed changes with engine running conditions, the ECU sends the ISC signals to return the idle speed to the target level through feedback control. When the

target speed is reached, the ECU stores that step position in back-up memory and uses it thereafter in idling.

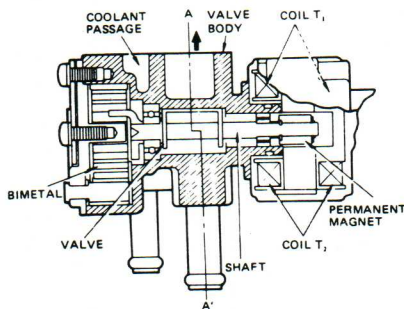
When servicing the ISCV, please note: If all power to the ECU is cut off because an EFI fuse is removed or a battery terminal is disconnected, the "learned data" value stored in back-up memory will be erased.

When you restart the engine, the ISCV step position is set at the initial value that is stored in the memory. This value may not match the engine's current running conditions, and the idle speed may not immediately reach the target speed, but it will gradually approach the target speed as the feedback control function begins operation.

Rotary Solenoid Type

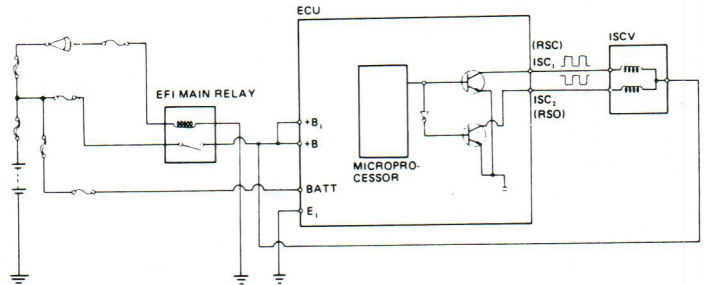
The rotary solenoid type ISCV is used on the 3S-FE, 3S-GTE and 4A-GZE engines. It is a small, lightweight rotary solenoid type valve mounted on the throttle body. Intake air bypassing the throttle valve is directed to the ISCV.

This ISCV controls the volume of intake air that is allowed to bypass the throttle valve based on duty cycle type signals from the ECU. It consists of a permanent magnet, a bypass air valve, two coils that act as electromagnets and a bimetallic strip assembly that detects changes in coolant temperatures. The bimetallic strip is similar to those found in regular carburetor choke assemblies.



A guard is attached to one end of the bimetallic strip to sense the position of the valve shaft lever running through the notch in the guard. As long as the ISC system is operating normally— or as long as the bimetallic strip does not contact the notched section on the guard, the lever will not

trigger bimetallic strip operation. This fail-safe device helps prevent the engine from running too high or too low a speed.



The rotary solenoid type ISCV carries out feedback control through duty control (0-100 percent) over the full idle speed range, regardless of whether the engine is cold or hot. Air conditioner idle-up is handled by a separate idle-up device.

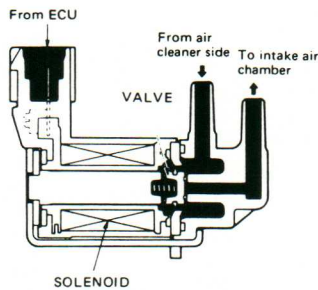
For improved startability, the ISCV is opened in accordance with pre-existing data that has been stored in the ECU memory. The system also governs warm-up control, feedback control, and "learned data" control.

In this system, "learned data" means the duty ratio. In this type of system, the ECU controls the ISCV based on the duty ratio. The duty ratio may remain the same, even though running conditions and idle speeds change. Through feedback control, the ECU outputs ISC signals to the ISCV to change the duty ratio, which in turn returns the idle speed to the target speed. Once the target speed has been attained, the duty ratio is stored in back-up memory as the basic duty ratio for those conditions.

As in the step motor type, if the power to the ECU is cut off because an EFI fuse is removed or a battery terminal is disconnected, the "learned data" that has been stored will be erased. When the engine is restarted, an initial duty ratio value is used. The initial idle speed may not be the same as the target speed, but it will gradually approach target speed as the engine warms up and feedback control starts.

Duty Control VSV Type

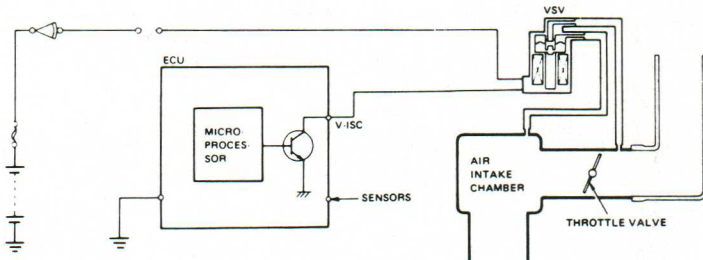
The duty control VSV type ISCV can be found on the Corolla's 4A-FE engine.



While current flows based on a signal from the ECU, the coil is excited and the valve moves. This movement changes the gap between the solenoid valve and the valve body, thus controlling idle speed. Fast-idle speed is controlled using an air valve.

When in use, the coil is switched on and off every 100 msec, so the position of the solenoid valve is determined by the proportion of time the signal is on and the time it is off. The longer current flows to the coil, the wider the valve opens.

The VSV controls the volume of air passing through the throttle valve by means of a duty signal from the ECU.



The VSV is mounted in the intake manifold. The air flow volume is determined by the duty ratio the ratio of the times the air flow volume signal from the ECU is on and off.

If the idle speed drops due to changes over time or changes in the electrical load when the air conditioner switch or neutral start switch is operated, for example the VSV controls the volume of air bypassing the throttle valve in response to the signal from the ECU. This helps to stabilize the idle speed. During warm-up, the fast-idle speed is controlled by a separate air valve.

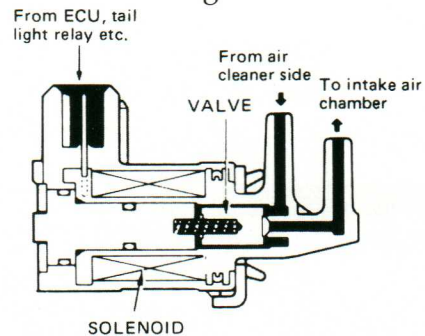
Controls include cranking stability, engine speed change estimate control, constant duty control and feedback control.

Please note when servicing the duty type VSV type

ISCV: connecting the T and E1 terminals to the check connector causes the ECU to fix the VSV operating angle, regardless of engine operating conditions.

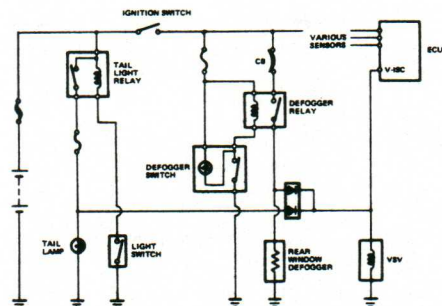
On-Off Control VSV Type

The on-off control VSV type ISCV is found on the 3S-GE and 4Y-E engines.



A signal from the ECU causes current to flow to the coil. This excites the coil, which opens the valve, increasing the idle speed by approximately 100 rpm. As in the duty type VSV type ISCV, fast-idle speed is controlled using a separate air valve.

Based on engine speed, throttle position and coolant temperature, the ECU sends signals to the VSV to change or maintain idle speed.



The engine will idle faster during the following conditions:

- When the engine is cranking or immediately after starting.
- When engine speed falls below a pre-determined rpm.
- When the gear selector is moved from "P" or "N" into gear. (auto. transmission only).
- When the lights are turned on.
- When the rear window defogger is on.

For more information about the specific ISC valve that you're working on, see the appropriate Toyota Repair Manual.

HOW TO USE AN AMMETER

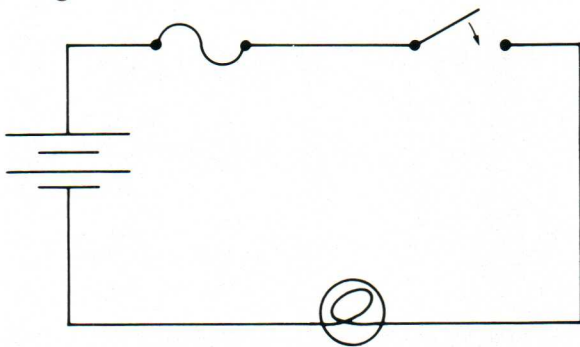
Knowing how to use an ammeter properly can take a significant amount of time out of your repair and help you make the correct repair the first time.

Ammeters are not as widely used as multimeters, ohmmeters and voltmeters, but they're just as important in the electrical system troubleshooting process.

The amount of amperage in a circuit can tell you how well a circuit is operating. If a circuit is drawing more than the specified current, there could be a shorted component or a grounded wire. The greater the flow the greater the heat, and excessive amperage and heat can cause a breaker to open.

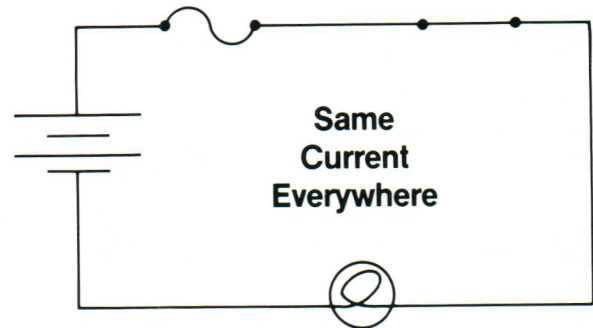
A circuit with too low of amperage has excessive resistance. If one of the lead wires is carrying more amps than it should, the result is too much heat into the circuit.

First, what is amperage? Amperage is the amount of current flowing through a circuit, or the number of electrons traveling past a specific point within a given period of time. If you connected a switch and a fuse in a series to a battery and then closed the switch, you would have current flowing through the series circuit.



If you were to pick a point in the circuit and count the number of electrons flowing past it within one second, you would know the amperage. One ampere, or amp, equals 6,240,000,000,000,000 electrons in one second.

In this example, the number of amps traveling through the switch is the same as that going through the bulb and the fuse.



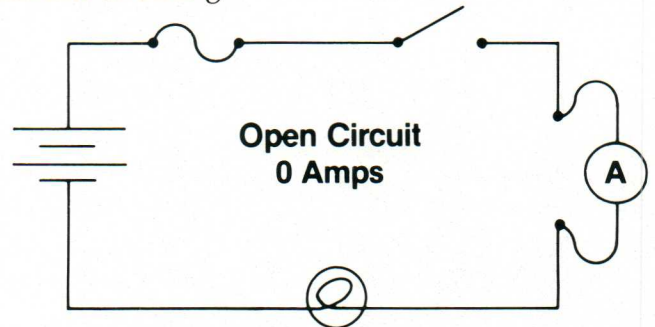
Before you hook an ammeter up to a live circuit you must do three things:

1. Check the specs to see how many amps the circuit should draw.
2. Use a fused jumper wire to momentarily operate the circuit. This will verify that you're not dealing with very high amperage, as would occur with a complete short or ground.
3. Select an ammeter that has the capacity to measure more than the amount of current you expect to find.

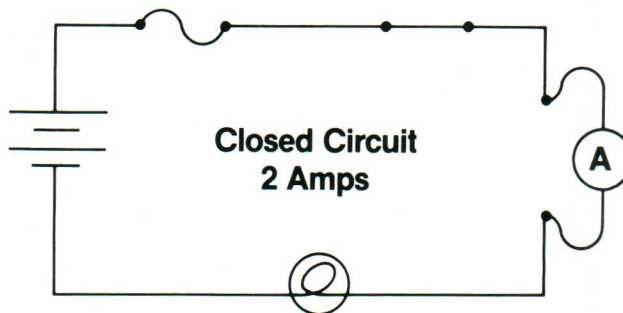
To measure the current flow in a circuit, you must break, or open, the circuit and connect the ammeter in series. Because the current that flows through the circuit is the same everywhere, you can break the circuit wherever it is most convenient. If you break the circuit on the bulb side of the switch, you can connect one lead to the switch terminal and the other to the wire.

Connect the red ammeter lead to the switch terminal. Connect the black lead to the wire that is connected to the negative battery post.

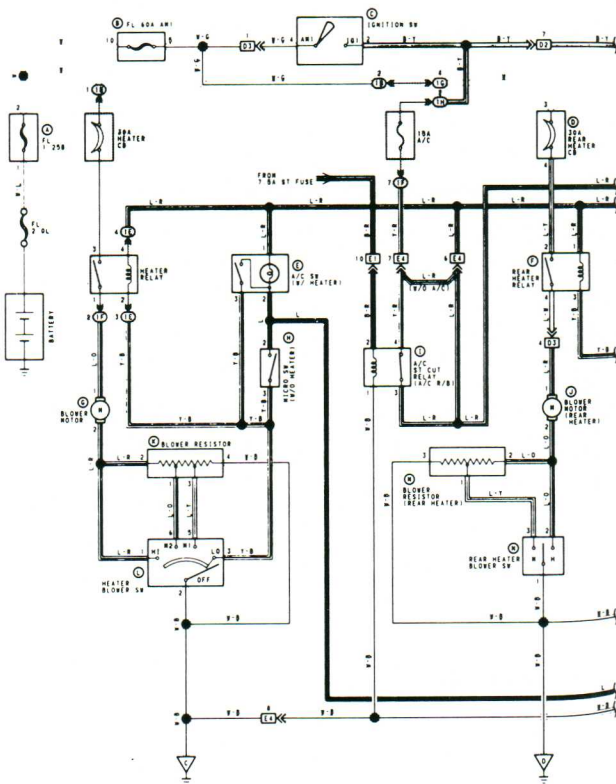
If you were to read the ammeter now, you would have a reading of zero amps, because the circuit is open. When you turn the switch on, you can take a reading.



If you checked the specs on this circuit, you would find that it should draw 2 amps. According to your ammeter reading it does, so it is functioning properly.



Now consider a circuit breaker and a blower motor. It's a series circuit with protection (circuit breaker), controls (relay and switch) and a load (motor).



The repair order states that the blower motor has stopped running after several minutes of operation, then cycled on and off every few minutes before it completely stopped working.

You can confirm the condition by using a test lamp. Connect the lead to the ground and test

for power at the circuit breaker. The test lamp lights only on the positive side of the breaker, not on the negative, or blower, side. You can check to see if the circuit breaker is the problem by removing the breaker from the circuit and testing it with an ohmmeter. The test shows that it is open.

When you install a new circuit breaker the blower operates normally. Was the circuit breaker the problem or was it the result of something else that could have made the circuit breaker overheat?

Whenever you find an open breaker or blown fuse, it's a good time to do an "amperage draw" test. To do this, substitute an ammeter for the protective device, turn the circuit on and see how many amps are flowing. Compare your reading with the specs.

In this instance, if you were to connect the ammeter in series and take a reading after the motor has run for a few seconds you would find that the reading was 15 amps, a bit low for a 20 amp circuit breaker.

Taking everything you know about ammeters into consideration and examining the wire going to and from the circuit breaker will help you solve the problem. In this case, the wire is an 18-gauge wire in excellent condition. This wire is carrying a 20 amp draw. As you know, as wire diameter decreases, resistance increases and current flow through resistance causes heat.

The condition of the wire tells you two things:

1. The heat from the wire was transmitted to the breaker, causing the element to overheat and open. When it cooled, it would reset, but then would overheat and open.

2. The wire's high resistance explains the slightly lower than normal amperage draw.

By taking a little more time, you can determine that the problem was not the circuit breaker, but the wire. Replacing the undersized wire with one that has the correct current carrying capacity ensures that you not only fixed the problem, you helped prevent a come-back with the same problem.

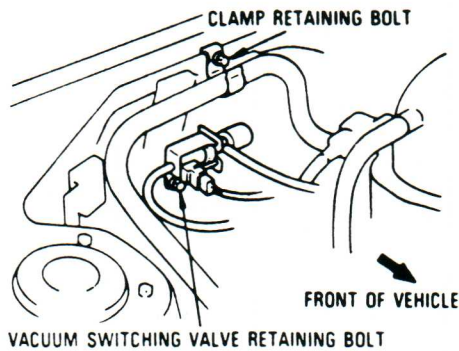
MR2 SUPERCHARGER OIL MAINTENANCE

Model Application: 1988+ MR2s with 4A-GZE engines

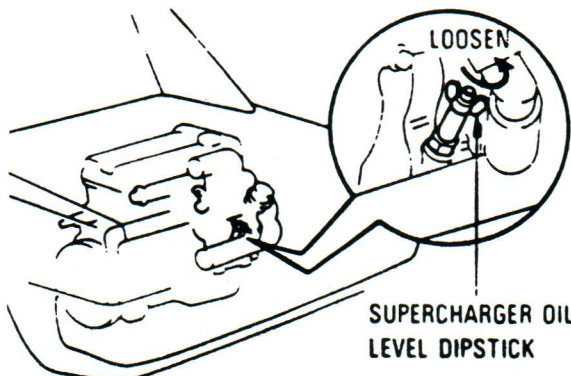
The following maintenance procedures should be followed when checking or replenishing the oil level of the supercharger assembly.

1. When the engine is cold, check the oil level with a dipstick. The following procedure will improve access to the dipstick:

- a. Remove the clamp retaining bolt.
- b. Remove the vacuum switching valve retaining bolt.
- c. **Do not disconnect the hoses from the vacuum switching valve.**

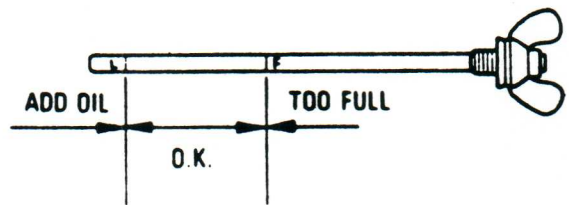


2. Turn the yellow-headed supercharger oil level dipstick counterclockwise and remove.
3. Wipe the dipstick clean.
4. Reinsert the dipstick and turn it fully clockwise. If you do not do this, the reading will not be correct.



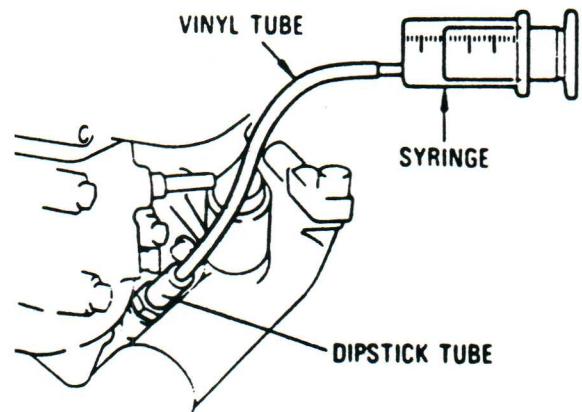
5. Remove the dipstick again and check the oil level.

If the reading is between the "F" and "L" marks, the level is okay. If the oil level is below the "L" mark, add oil up to the "F" line.



6. You can add oil through the dipstick tube by using the vinyl tube and a syringe that is packed with the oil.

7. Now, recheck the oil level, keeping in mind that **overfilling or underfilling can cause damage to the supercharger.**



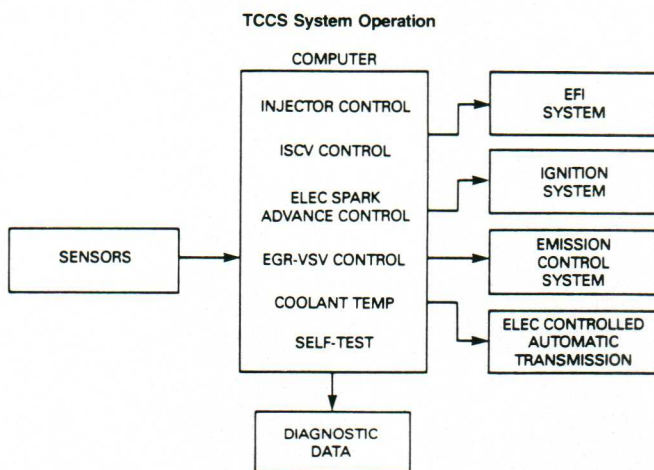
The oil level should be checked every 30,000 miles (48,000 km) or every 36 months. Only Toyota supercharger oil should be used to service the supercharger assembly.

TOYOTA REMANUFACTURED COMPUTERS MEAN CUSTOMER SATISFACTION

When you think of the quality of Toyota Remanufactured Parts, you may think of parts such as alternators, water pumps, starters or A/C compressors. But Toyota offers a selected line of remanufactured computers as well.

Take for example the TCCS computer. The TCCS computer is used in place of a conventional EFI computer. The TCCS uses a more sophisticated Electronic Control Unit (ECU) with built-in microprocessor. The TCCS ECU stores data to precisely control various engine functions and related systems such as:

- Fuel injection duration
- Injection timing
- Ignition spark timing
- Idle speed control
- Exhaust Gas Recirculation (EGR)
- Electronically Controlled Transmission (ECT)
- Toyota Variable Induction System (T-VIS)
- Diagnosis



The Basic system. The TCCS controls the operation of various systems according to present running conditions as informed by electronic signals sent to the ECU by various sensors. The functions will vary depending on the application.

When you offer your customers Toyota Genuine Reman Computers, you can offer them Toyota quality and value at substantially lower prices than new computers.

But that is only part of the story. These computers are remanufactured under the same strict engineering standards as new Toyota computers, using the same precision parts. Also, any component innovations that establish the latest Toyota specifications are also incorporated at this time. They carry the same limited warranty and are approved for use as replacement parts under the Toyota new vehicle warranty.

Besides the TCCS computer, Toyota offers the following remanufactured computers:

- EFI computer
- Digital speedometer
- Digital Tachometer
- Digital Speedometer/Tachometer
- Digital Fuel and Temperature Gauge
- Combination Meter
- ECT Computers

For more information, contact your local Toyota STAR dealer today.

TOYOTA GENUINE PARTS

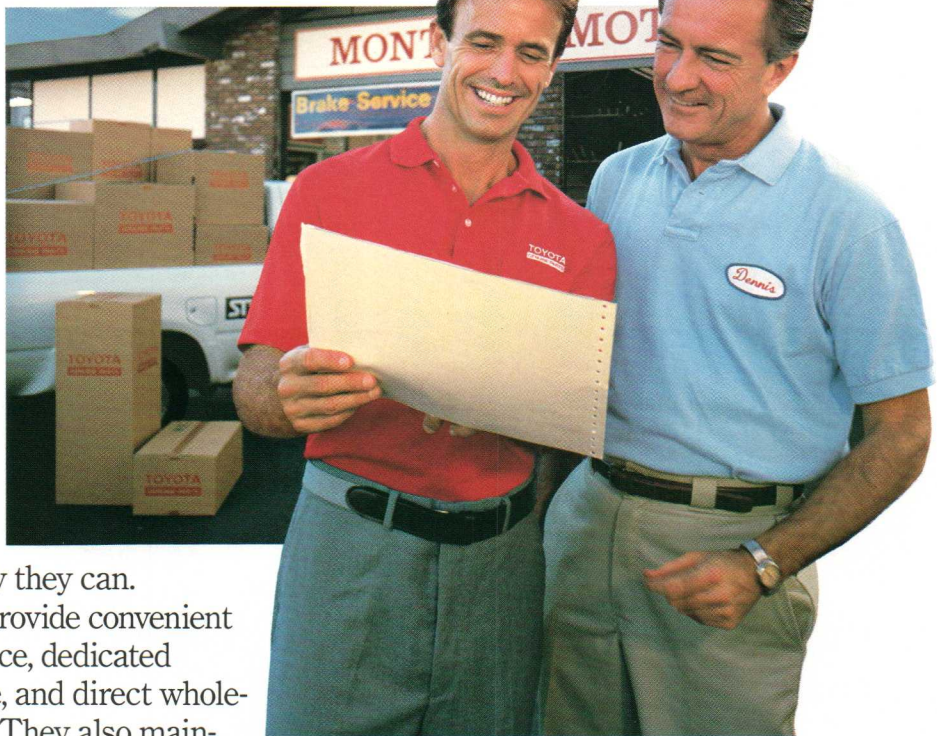
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Toyota's STAR Dealers have been recognized for their outstanding performance in serving the wholesale market. To them, you're not the competition. You're the customer. A valued customer. And they'll support you in any way they can.

STAR Dealers provide convenient daily delivery service, dedicated outside salespeople, and direct wholesale parts hotlines. They also main-

tain a large inventory of competitively priced Toyota Genuine Parts, which means you can get most parts immediately. If not, their direct

access to the Toyota Parts Distribution Network can get you almost any part you need within 24 hours. And finally,



if you have a question about a specific part or repair job, just ask. No one knows Toyotas, or the parts needed to repair them, like a Toyota STAR Dealer.

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"I love what you do for me."



Are insurance companies asking you to paint over inferior replacement parts?

When working on Toyotas, it's wise to use only Genuine Toyota Body Parts, even though insurance companies often suggest that you use imitation replacements. Many imitation replacement parts simply do not meet Toyota's high quality standards for fit and corrosion resistance.

You'll appreciate what the real thing does for you. Genuine Toyota Body Parts have proven quality and durability. They look right, fit right and maintain maximum corrosion protection—which can save you work now and complaints later. What's more, Toyota dealers offer you competi-



tive prices, prompt delivery and the technical advice you may need.

See your local STAR Dealer for more information, and *accept no substitutes*. Use only Genuine Toyota Body Parts. They'll make both you and your repairs look good.

"I love what you do for me."

