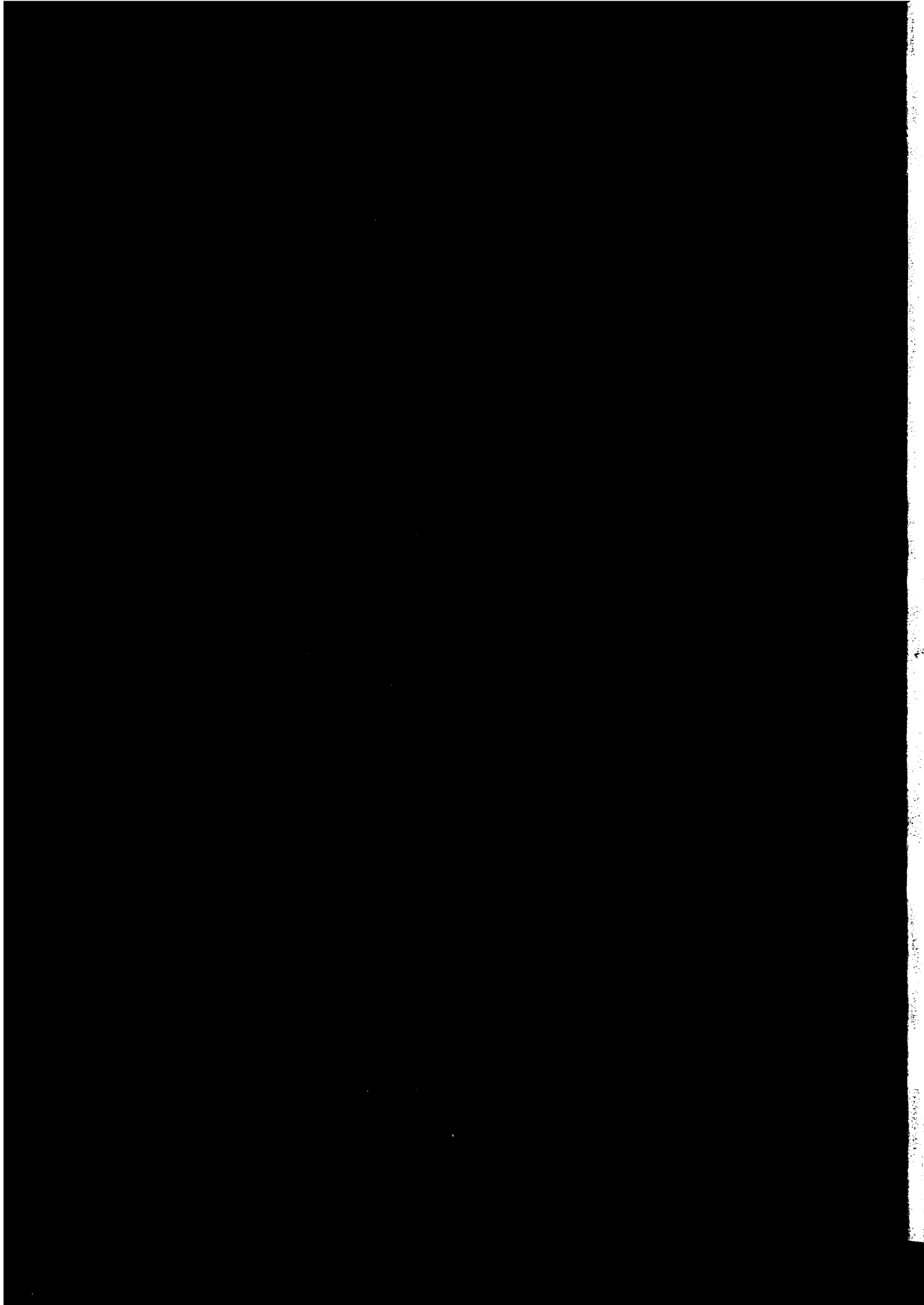




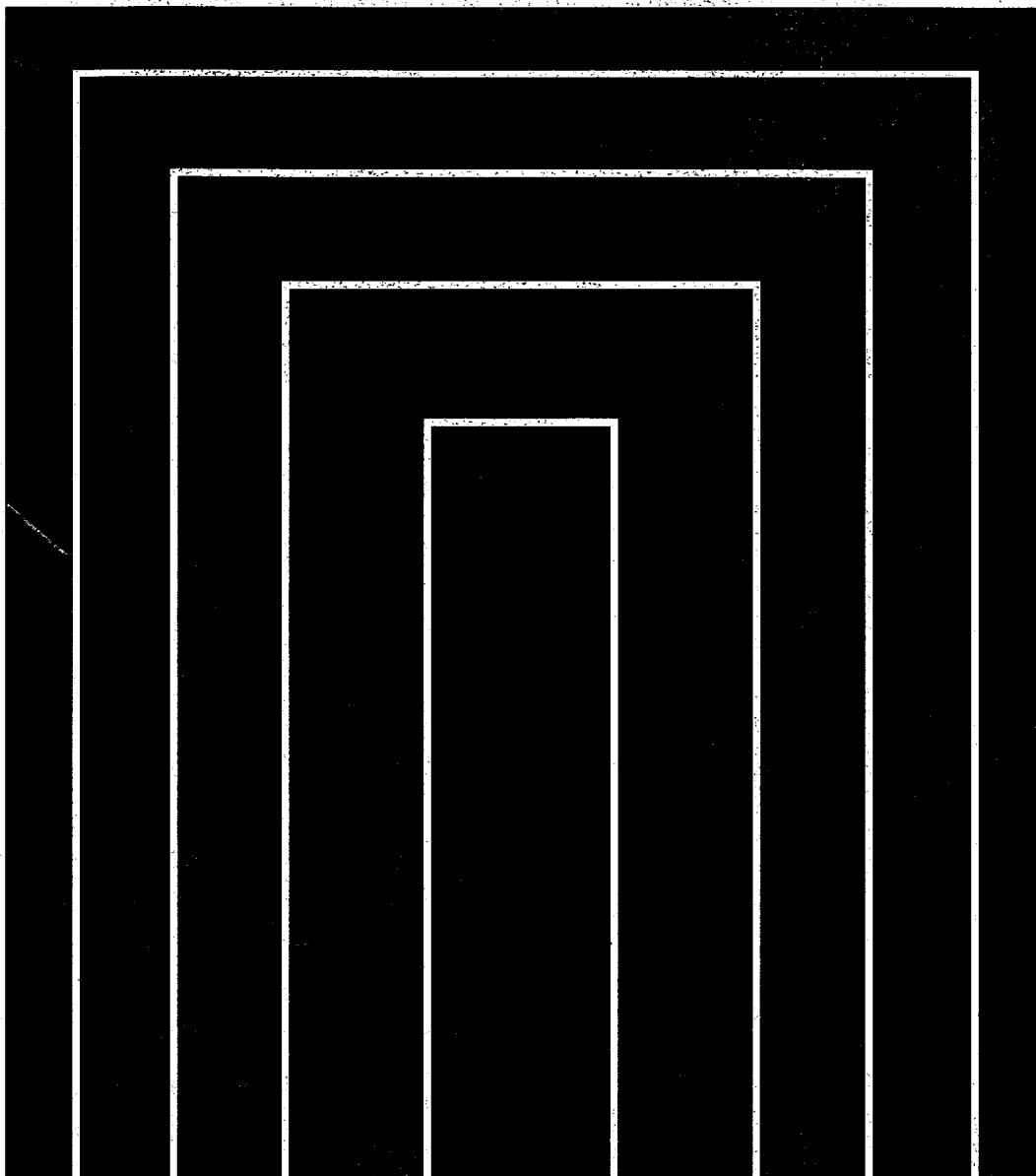
TOYOTA

4A-FE, 4A-GE

ENGINE

REPAIR MANUAL

Sep., 1989



Pub.No.RM163E

FOREWORD

This repair manual has been prepared to provide information covering general service repairs for the 4A-FE and 4A-GE engines equipped on the TOYOTA COROLLA, CARINA II and CELICA.

Applicable models:

4A-FE engine

AE92, 95, AT171 (Ex. 4A-FE Engine w/ Lean Burn),
AT180 series

4A-GE engine

AE92 series

Please note that the publications below have also been prepared as relevant service manuals to the components and system in this engine.

Manual Name	Pub. No.
● Celica New Car Features (For Europe)	NCF 057E
● 4A-FE Engine Repair Manual Supplement (For Carina II)	RM 100E
● 4A-FE, 4A-GE Engine For Emission Control (For Europe)	ERM 052E

All information in this manual is based on the latest product information at the time of publication. However, specifications and procedures are subject to change without notice.

TOYOTA MOTOR CORPORATION

CAUTION

This manual does not include all the necessary items about repair and service. this manual is made for the purpose of the use for the persons who have special techniques and certifications. In the cases that non-specialized or uncertified technicians perform repair or service only using this manual or without proper equipment or tool, that may cause severe injury to you or other people around and also cause damage to your customer's vehicle.

In order to prevent dangerous operation and damages to your customer's vehicle, be sure to follow the instruction shown below.

- Must read this manual thoroughly. It is especially important to have good understanding all the contents written in the PRECAUTION of "IN" section.
- The service method written in this manual is very effective to perform repair and service. When performing the operations following the procedures using this manual, be sure to use tools specified and recommended. If using non-specified or recommended tools and service method, be sure to confirm safety of the technicians and any possibility of causing personal injury or damage to the customer's vehicle before starting the operation.
- If part replacement is necessary, must replace the part with the same part number or equivalent part. Do not replace it with inferior quality.
- It is important to note that this manual contains various "Cautions" and "Notices" that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these "Cautions" and "Notices" are not exhaustive, because it is important to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

TOYOTA 4A-FE, 4A-GE ENGINE REPAIR MANUAL

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IN

HOW TO USE THIS MANUAL

To assist you in finding your way through this manual, the Section Title and major heading are given at the top of every page.

An **INDEX** is provided on the 1st page of each section to guide you to the item to be repaired.

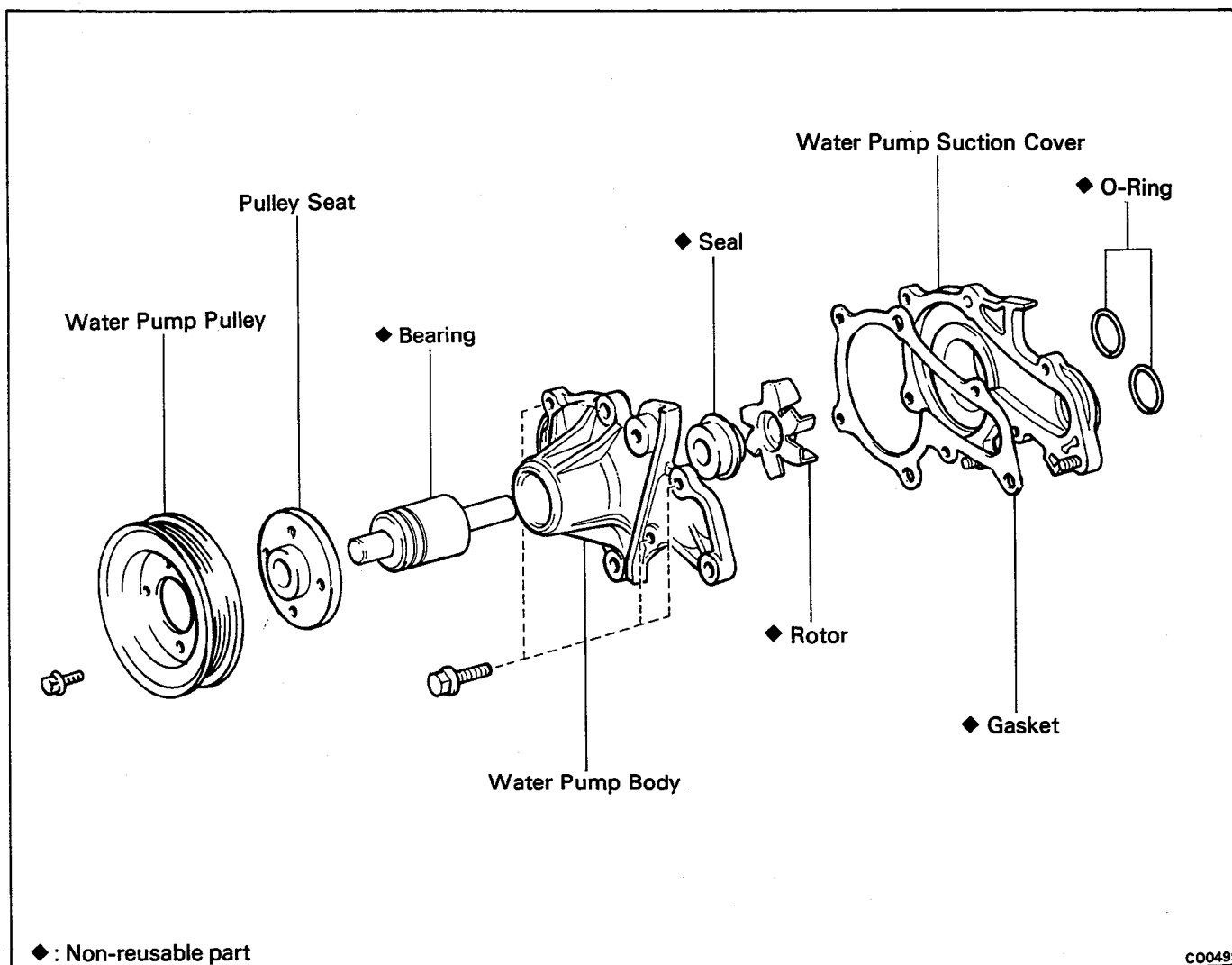
At the beginning of each section, **PRECAUTIONS** are given that pertain to *all* repair operations contained in that section. *Read these precautions before starting any repair task.*

TROUBLESHOOTING tables are included for each system to help you diagnose the system problem and find the cause. The repair for each possible cause is referenced in the remedy column to quickly lead you to the solution.

REPAIR PROCEDURES

Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.

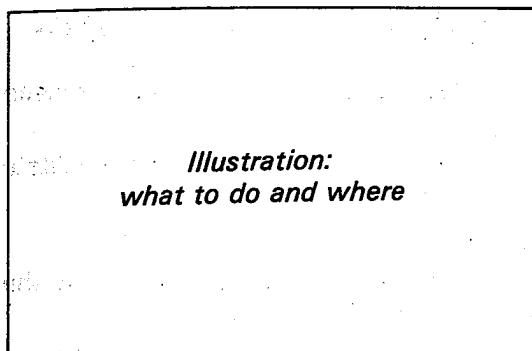
Example:



The procedures are presented in a step-by-step format:

- The illustration shows *what* to do and *where* to do it.
- The task heading tells *what* to do.
- The detailed text tells *how* to perform the task and gives other information such as specifications and warnings.

Example:



3. DISCONNECT CONNECTING ROD FROM PISTON

Using SST, press out the pin from the piston.

SST 09221-25022

(09221-00050, 09221-00130, 09221-00140)

Set part No.

Component part No.

Detail text: how to do it

- (d) Install and alternately tighten the cap nuts in several passes.

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

Specification

This format provides the experienced technician with a FAST TRACK to the information needed. He can read the task headings and only refer to the detailed text when he needs it. Important specifications and warnings always stand out in bold type.

REFERENCES

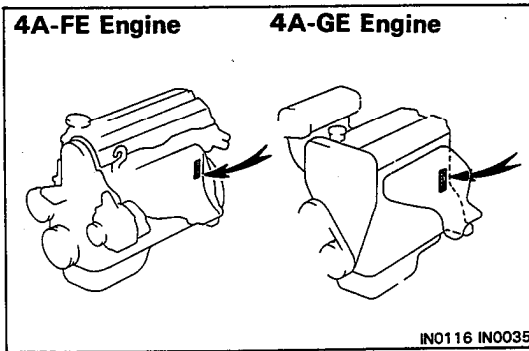
References have been kept to a minimum. However, when they are required, you are given the page to go to.

SPECIFICATIONS

Specifications are presented in bold type throughout the text in the applicable step. You never have to leave the procedure to look up your specifications. All specifications are also found in Appendix A, for quick reference.

CAUTIONS, NOTICES, HINTS:

- **CAUTIONS** are presented in bold type, and indicate the possibility of injury to you or other people.
- **NOTICES** are also presented in bold type and indicate there is a possibility of damage to the components being repaired.
- **HINTS** are separated from the text but do not appear in bold type. They provide additional information to help you efficiently perform the repair.



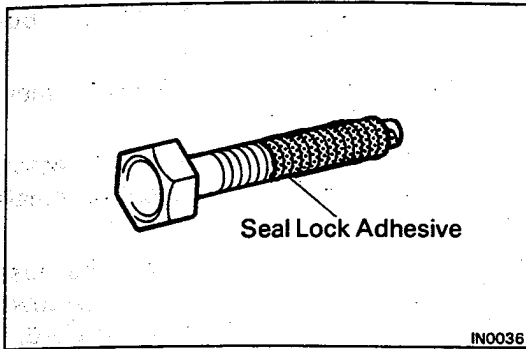
IDENTIFICATION INFORMATION

ENGINE SERIAL NUMBER

The engine serial number is stamped on the left side of the cylinder block.

GENERAL REPAIR INSTRUCTIONS

1. Use fender, seat and floor covers to keep the vehicle clean and prevent damage.
2. During disassembly, keep parts in order to facilitate reassembly.
3. Observe the following:
 - (a) Before performing electrical work, disconnect the negative cable from the battery terminal.
 - (b) If it is necessary to disconnect the battery for inspection or repair, always disconnect the cable from the negative (–) terminal which is grounded to the vehicle body.
 - (c) To prevent damage to the battery terminal post, loosen the terminal nut and raise the cable straight up without twisting or prying it.
 - (d) Clean the battery terminal posts and cable terminals with a shop rag. Do not scrape them with a file or other abrasive object.
 - (e) Install the cable terminal to the battery post with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the terminal onto the post.
 - (f) Be sure the cover for the positive (+) terminal is properly in place.
4. Check hose and wiring connectors to make sure that they are secure and correct.
5. Non-reusable parts
 - (a) Always replace cotter pins gaskets, O-rings, oil seals, etc. with new ones.
 - (b) Non-reusable parts are indicated in the component illustrations by the symbol "◆".



6. Precoated Parts

Precoated parts are the bolts, nuts, etc. which are coated with a seal lock adhesive at the factory.

(a) If a precoated part is tightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.

(b) Recoating of Precoated Parts

(1) Clean off the old adhesive from the part's threads.

(2) Dry with compressed air.

(3) Apply the specified seal lock adhesive to the part's threads.

(c) Precoated parts are indicated in the component illustrations by the symbol "★".

7. When necessary, use a sealer on gaskets to prevent leaks.

8. Carefully observe all specifications for bolt torques. Always use a torque wrench.

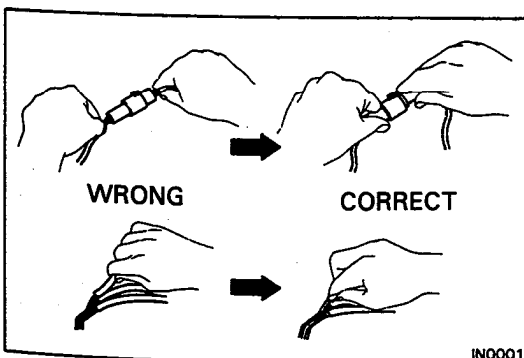
9. Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found at the back of this manual.

10. When replacing fuses, be sure the new fuse is the correct amperage. DO NOT exceed the fuse amp rating or use one of a lower rating.

11. Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.

(a) If the vehicle is to be jacked up only at the front or rear end, be sure to chock the wheels in order to ensure safety.

(b) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on a jack alone, even for a small job that can be finished quickly.



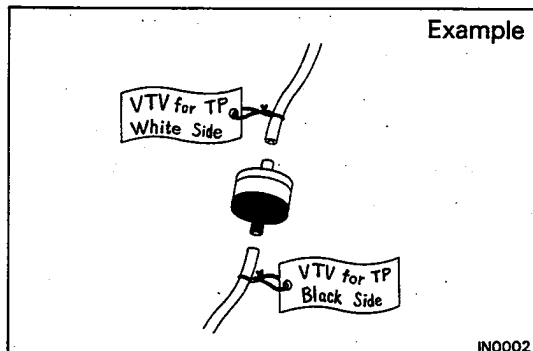
12. Observe the following precautions to avoid damaging the parts:

(a) Do not open the cover or the case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)

(b) To disconnect vacuum hoses, pull on the end of the hose, not the middle.

(c) To pull apart electrical connectors, pull on the connector itself, not the wires.

- (d) When steam cleaning an engine, protect the distributor, coil, air filter, and VCV from water.
- (e) Never use an impact wrench to remove or install thermo switches or thermo sensors.
- (f) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
- (g) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.



13. Tag hoses before disconnecting them:

- (a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
- (b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

PRECAUTIONS FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

CAUTION: If large amounts of unburned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this, observe the following precautions and explain them to your customer.

1. Use only unleaded gasoline.
2. Avoid prolonged idling.
Avoid running the engine at fast idle speed for more than 10 minutes and at idle speed for more than 20 minutes.
3. Avoid spark jump test.
 - (a) Perform spark jump test only when absolutely necessary and as quickly as possible.
 - (b) While testing, never race the engine.
4. Avoid prolonged engine compression measurement.
Engine compression tests must be made as quickly as possible.
5. Do not run engine when fuel tank is nearly empty.
This may cause the engine to misfire and create an extra load on the converter.
6. Avoid coasting with ignition turned off and prolonged braking.
7. Do not dispose of used catalyst along with parts contaminated with gasoline or oil.

ABBREVIATIONS USED IN THIS MANUAL

A/C	Air Conditioner
ACV	Air Control Valve
Approx.	Approximately
A/T	Automatic Transmission
BTDC	Before Top Dead Center
BVSV	Bi-metal Vacuum Switching Valve
DP	Dash Pot
ECU	Electronic Controlled Unit
EFI	Electronic Fuel Injection
EGR	Exhaust Gas Recirculation
ESA	Electronic Spark Advance
EX	Exhaust (manifold, valve)
Ex.	Except
FIPG	Formed in Place Gasket
FL	Fusible Link
IG	Ignition
IIA	Integrated Ignition Assembly
IN	Intake (manifold, valve)
ISC	Idle Speed Control
LH	Left-Hand
LHD	Left-Hand Drive
LLC	Long Life Coolant (Year Around Coolant)
MP	Multipurpose
M/T	Manual Transmission
O/S	Oversized
PCV	Positive Crankcase Ventilation
RH	Right-Hand
RHD	Right-Hand Drive
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TDC	Top Dead Center
TEMP.	Temperature
TWC	Three-Way Catalyst
U/S	Undersized
VSV	Vacuum Switching Valve
w/	With
w/o	Without
2WD	Two Wheel Drive
4WD	Four Wheel Drive

ENGINE MECHANICAL

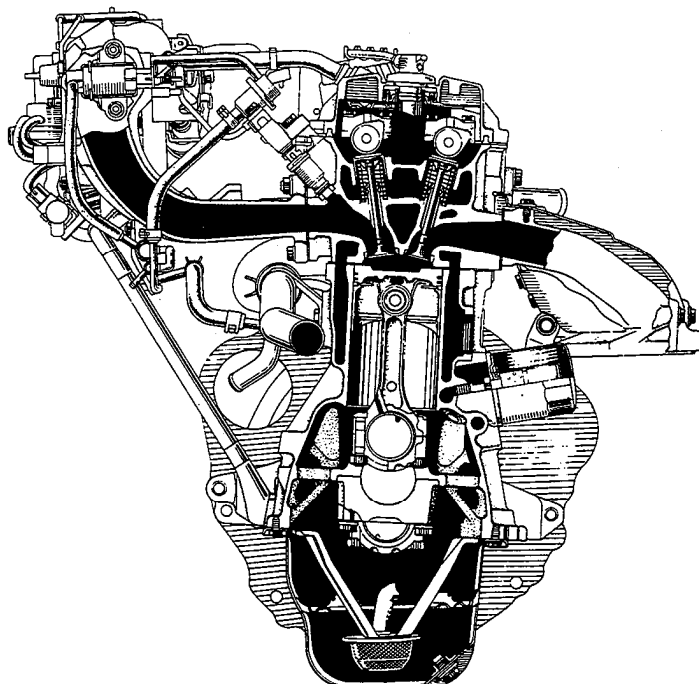
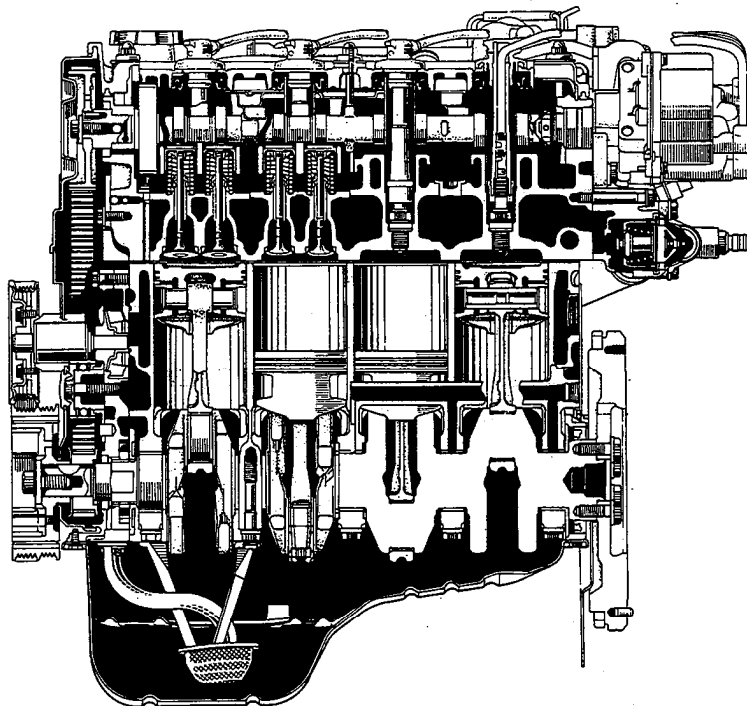
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EM

DESCRIPTION

4A-FE ENGINE

The 4A-FE engine is an in-line 4-cylinder 1.6 liter DOHC 16 valve engine.



The 4A-FE engine is an in-line 4-cylinder engine with the cylinders numbered 1-2-3-4 from the front. The crankshaft is supported by 5 specified bearings inside the crankcase. These bearing are made of aluminum alloy.

The crankshaft is integrated with 8 weights which are cast with it for balane. Oil holes are made in the center of the crankshaft to supply oil to the connecting rods, bearing, pistons and other components.

The ignition order is 1-3-4-2. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout with pent roof type combustion chambers. The spark plugs are located in the center of the combustion chamber. The intake manifold has 4 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

Exhaust and intake valves are equipped with irregular pitch springs made of special carbon steel which are capable of functioning no matter what the engine speed.

The exhaust side cam shaft is driven by a timing belt and a gear on the exhaust side cam shaft engages with a gear on the intake side cam shaft to drive it. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journal gear is accomplished by oil being supplied through the oiler port in the center of the camshaft.

Adjustment of the valve clearance is done by means of an outer shim type system, in which valve adjusting shims are located above the valve lifters. This permits replacement of the shims without removal of the camshafts.

The resin timing belt cover is made of 3 pieces. A service hole is provided in the No.1 belt cover for adjusting the timing belt tension.

Pistons are made of highly temperature-resistant aluminum alloy, and a depression is built into the piston head to prevent interference with valves.

Piston pins are the semi-floating type, with the pins fastened to the connecting rods by pressure fitting, allowing the pistons and pins to float.

The No.1 compression ring is made of stainless steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No.1 and No.2 work to prevent the leakage of gas from the cylinder and oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chambers.

The cylinder block is made of cast iron. It has 4 cylinders which are approximately 2 times the length of the piston stroke. The top of the cylinders is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The oil pan is bolted to the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed steel sheet. A dividing plate is included inside the oil pan to keep sufficient oil at the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from making waves when the vehicle is stopped suddenly and thus shifting the oil away from the oil pump suction pipe.