FOREWORD

TOYOTA MOTOR CORPORATION

This Repair Manual has been prepared to provide information covering general service repairs for the 1ZZ-FE and 3ZZ-FE engines equipped on the TOYOTA COROLLA.

Applicable models: ZZE121, 122 series series

First Printing: Aug. 15, 2000 01–000815–00–2

Please note that the publications below have also been prepared as relevant service manuals for the components and systems in this vehicles.

Manual Name	Pub. No.
• COROLLA Repair Manual	RM821E
• COROLLA Electrical Wiring Diagram	EWD434E

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.

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.

INTRODUCTION

HOW TO USE THIS MANUAL

0100A-03

GENERAL INFORMATION

1. GENERAL DESCRIPTION

(a) This manual is made in accordance with SAE J2008.

(b) Repair operations can be separated mainly in the following 3 processes:
   1. Diagnosis
   2. Removing and Installing, Replacing, Disassembling, Installing and Checking, Adjusting
   3. Final Inspection

(c) This text explains ”Removing and Installing, Replacing, Disassembling, Installing and Checking, Adjusting”, but ”Final Inspection” are omitted.

(d) The following essential operations are not written down in the this manual, these operations, however, must be done in the practical situation.
   (1) Operation with a jack and lift
   (2) Cleaning of a removed part when necessary
   (3) Visual check

2. INDEX

(a) An alphabetical INDEX is provided as a section on the end of the book to guide you to the item to be repaired.

3. PREPARATION

(a) Use of special service tools (SST) and special service materials (SSM) may be required, depending on the repairing condition. Be sure to use SST and SSM when they are required and follow the working procedure properly. A list of SST and SSM is in the Preparation section in this manual.

4. REPAIR PROCEDURES

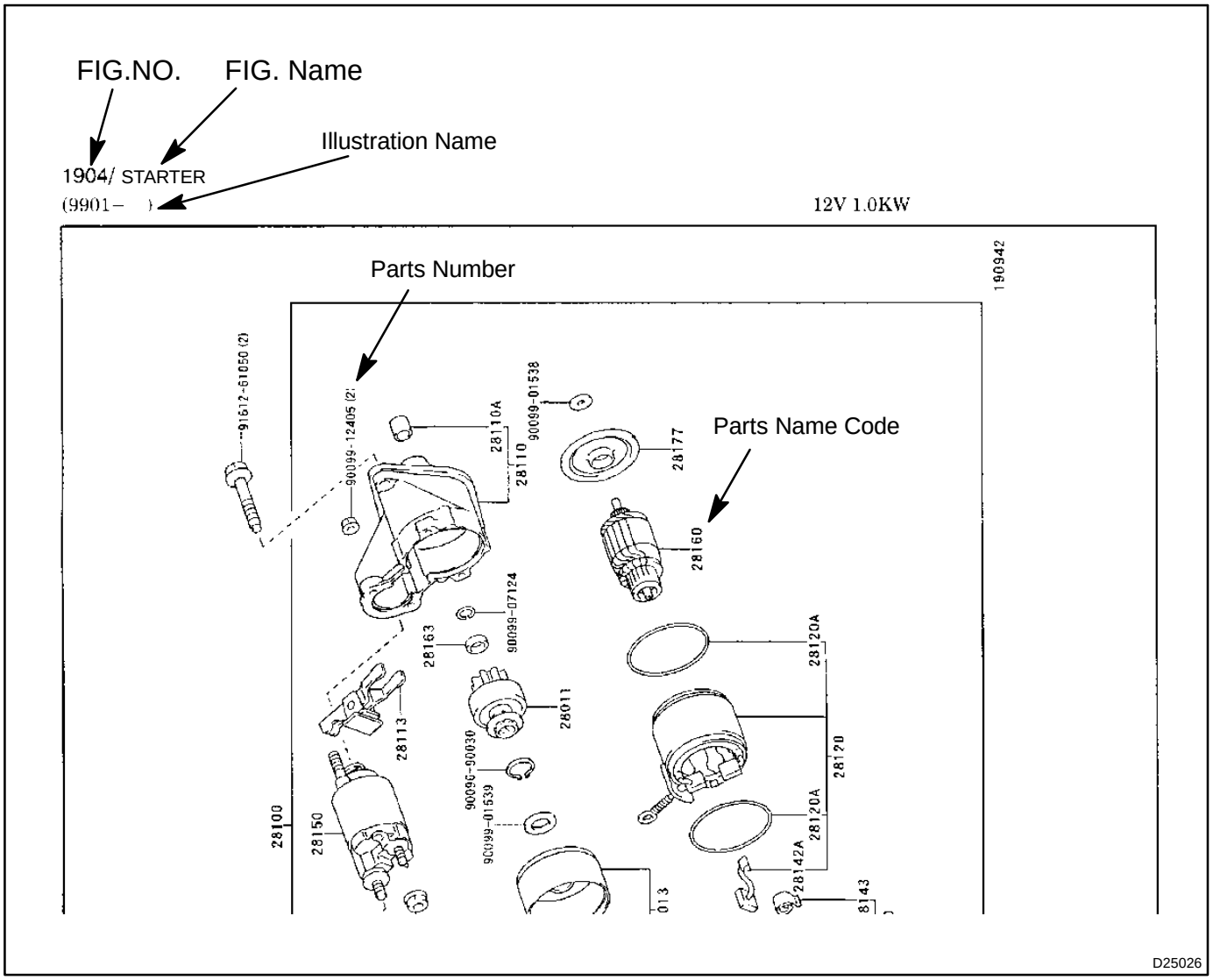
(a) Component drawing is placed as ”Component section.” It enables you to understand the fitting condition of the components.

(b) Illustrations of the parts catalog are placed as the component drawing.
   (In the illustration, parts codeof the parts catalog is described.)

NOTICE:

The parts code described in this text is as of August, 2000. There is a case where the parts code or ten digits of the parts No. may change, so be sure to place an order using the parts catalog.

Example:



(c) Tightening torque, oil applying position, and non-reusable parts are described as points of the procedure.

NOTICE:

In case that the above items can be indicated only by an illustration, component drawing which describes the points is placed. In that case, all the information such as torque, oil, etc. are described in the illustration.

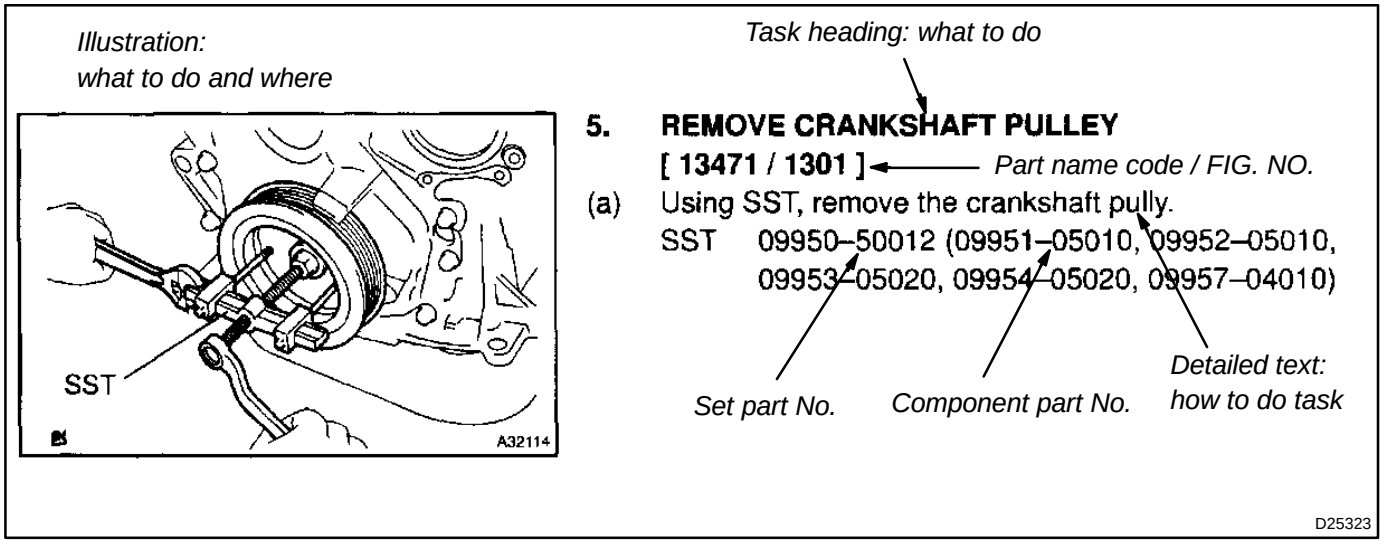
(d) Installing procedure of operation items is performed in the reverse order of the removing, and only the case with points is described.

(e) Only items with points are described in the procedure, and the operational portion and content are placed using an illustration. In the explanations, details of the operational method, standard value and notice are placed.

(f) There may be a case where the illustrations are used in common with similar models. Therefore the details might be different from the actual vehicle in that case.

(g) The procedures are presented in a step-by-step format:
   (1) The illustration shows what to do and where to do it.
   (2) The task heading tells what to do.
   (3) The detailed text tells how to perform the task and gives other information such as specifications and warnings.

Example:



HINT:
This format provides an experienced technician with a FAST TRACK to the necessary information. The upper case task heading can be read at a glance when necessary, and the text below it provides detailed information. Important specifications and warnings always stand out in bold type.

5. SERVICE SPECIFICATIONS

(a) Specifications are presented in bold type throughout the text where needed. You never have to leave the procedure to look up your specifications. They are also found in the Service Specifications section for a quick reference.

6. TERMS DEFINITION

CAUTION	Indicate the possibility of injury to you or other people.
NOTICE	Indicate the possibility of damage to the components being repaired.
HINT	Provide additional information to help you perform the repair efficiently.

7. SI UNIT

(a) The UNITS given in this manual are primarily expressed according to the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the English System.
Example:
Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

REPAIR INSTRUCTION

0101E-01

PRECAUTION

1. TO PREVENT FROM ENTERING FOREIGN SUBSTANCES.

(a) When foreign substances such as dust, grain of sand or metallic dust enter inside of engine, it often causes functional failure of the engine.

(1) Precaution before disassembly.

- Remove adequately all sand and mud adhere to the outside of engine.

(2) Precaution at reassembly.

- Protect disassembled parts from dust by using vinyl sheet to cover.

2. TO PREVENT SCRATCHES ON THE PARTS.

(a) The existence of scratches on the contact and revolving surfaces often causes oil leak and seisure.

(1) Precautions at disassembly and reassembly.

- When disassemble the contact surface of the parts, use plastic hummer striking lightly. (Do not pry out by screwdriver).
- When fix the parts to the vise, do not directly catch it in the vise. Fix the parts through aluminum bar.

3. TO CLEAN AND WASH THE PARTS.

(a) Each parts needs to be well cleaned, washed, and dried by air, and apply specified oil before reassembly.

(1) Cleaning and washing by alkaline solvent is prohibited:

- Parts made of aluminum and rubber. (ex. cylinder head cover gasket etc.)

(2) Cleaning and washing by flushing oil (ex. kerosene, white gasoline etc.) is prohibited:

- Parts made of rubber. (ex. cylinder head cover gasket etc.)

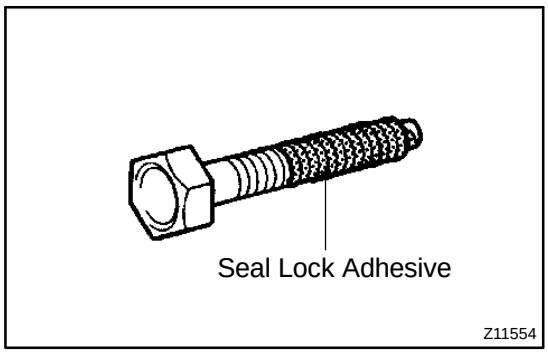
4. POSITION AND DIRECTION OF EACH PARTS.

(a) Each parts needs to be reassembled as the same position and direction as it disassembled.

(1) Precautions at disassembly and reassembly.

- Follow the directions when the manual designates to mark the matchmark and/or direction mark.
- Disassembled parts needs to be put in order as disassembled, not to change position and/or direction.
- Follow the directions when the manual instructs the position and direction.

5. INSTALL ENGINE ASSEMBLY TO OVERHAUL STAND WHEN OVERHAUL THE ENGINE.
6. PUT THE DISASSEMBLED PARTS IN ORDER AS THEY DISASSEMBLED.
7. APPLY ENGINE OIL TO THE SLIDING AND ROTATING SURFACES.
8. NON-REUSABLE PARTS SUCH AS GASKET AND SEAL NEEDS TO BE CHANGED TO THE NEW PARTS.
9. BASIC REPAIR HINT



(a) Precoated Parts:

(1) Precoated parts are bolts, nuts, etc. that are coated with a seal lock adhesive at the factory.

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

(3) When reusing precoated parts, clean off the old adhesive and dry with compressed air. Then apply the specified seal lock adhesive to the bolt, nut or threads.

NOTICE:

Do the torque checking with the lower limit value of the torque tolerance.

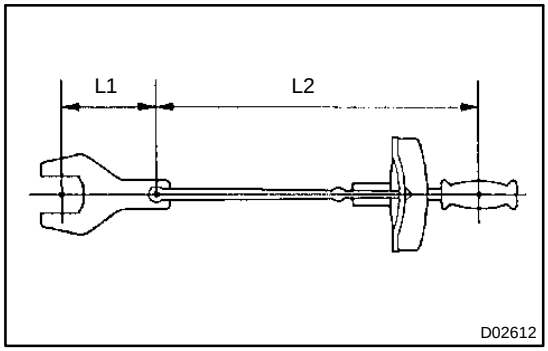
(4) Depending on the seal lock agent to apply, there may be a case where it is necessary to leave it for a specified time until it hardens.

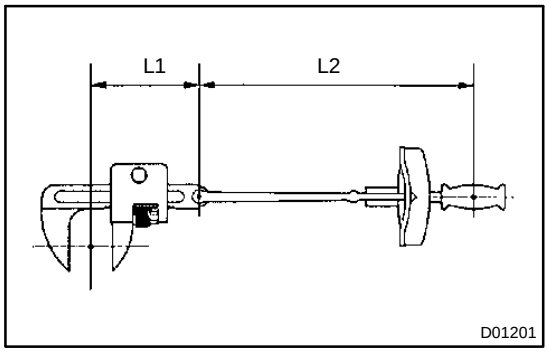
(b) Gaskets:

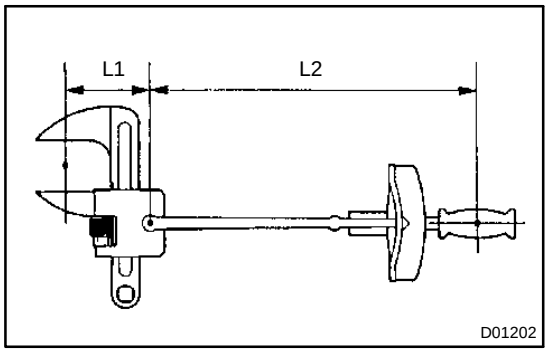
When necessary, use a sealer on gaskets to prevent leaks.

(c) Bolts, Nuts and Screws:

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







(d) Torque When Using Extension Tool with Torque Wrench:

(1) In case of tightening by extending the entire length of the torque wrench combined with SST or tool, if you tighten until the reading of the torque wrench reached the specified torque value, the actual torque becomes excessive.

(2) In this text, only the specified torque is described. In case of using SST or extension tool, find the reading of the torque wrench by the formula.

(3) Formula T'=T x L2/(L1 + L2)

T'	Reading of torque wrench {N·m (kgf·cm, ft·lbf)}
T	Torque {N·m (kgf cm, ft·lbf)}
L1	Length of SST or tool (cm)
L2	Length of torque wrench (cm)

10. REMOVAL AND INSTALLATION OF FUEL CONTROL PARTS

(a) Place for Removing and Installing Fuel System Parts:

(1) Place with good air ventilation and without anything flammable such as welder, grinder, drill, electric motor or stove in the surroundings.

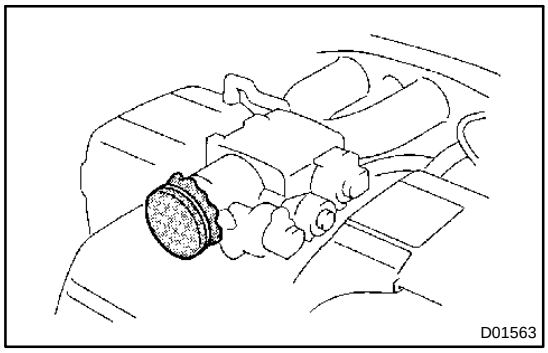
(2) Never work in a place like a pit or nearby pit as there is a possibility that vaporized fuel fills those places.

(b) Removing and Installing of Fuel System Parts:

(1) Prepare a fire extinguisher before starting the operation.

(2) For prevention of the static electricity, install a ground on the fuel changer, vehicle and fuel tank, and do not spray much water so as to prevent slipping.

(3) Never use any electric equipment like an electric motor or a working light as they may cause spark or high temperature.
(4) Never use an iron hammer as it may cause spark.
(5) Dispose the shop lag separately from any fuel deposit.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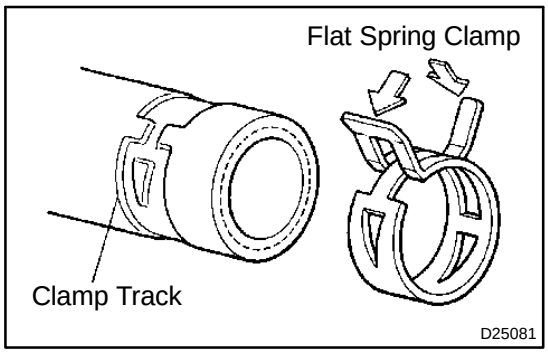
11. REMOVAL AND INSTALLATION OF ENGINE INTAKE PARTS

(a) If any metal tip is mixed in the inlet pass, that may give a bad effect to the engine and turbo charger.
(b) When removing and installing of the inlet system parts, close the opening of the removed inlet system parts and the engine with a clean shop lag or gum tape.
(c) When installing the inlet system parts, check that there is no mixing of a metal tip.



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12. HANDLING OF HOSE CLAMPS

(a) Before removing the hose, check the depth of inserting portion and the clamp position to restore it surely.
(b) Change a deformed or dented into a new one.
(c) In case of reusing the hose, install the clamp on the hose where it has a clamp track.
(d) For a flat spring type clamp, make it adjust by adding force to the arrow mark direction after the installation.

TERMS

ABBREVIATIONS USED IN THIS MANUAL

0101F-01

Abbreviations	Meaning
ABS	Anti-Lock Brake System
A/C	Air Conditioner
AC	Alternating Current
ACC	Accessory
ACIS	Acoustic Control Induction System
ACSD	Automatic Cold Start Device
A.D.D.	Automatic Disconnecting Differential
A/F	Air-Fuel Ratio
AHC	Active Height Control Suspension
ALR	Automatic Locking Retractor
ALT	Alternator
AMP	Amplifier
ANT	Antenna
APPROX.	Approximately
ASSY	Assembly
A/T	Automatic Transmission (Transaxle)
ATF	Automatic Transmission Fluid
AUTO	Automatic
AUX	Auxiliary
AVG	Average
AVS	Adaptive Variable Suspension
B+	Battery Voltage
BACS	Boost Altitude Compensation System
BAT	Battery
BDC	Bottom Dead Center
B/L	Bi-Level
B/S	Bore-Stroke Ratio
BTDC	Before Top Dead Center
BVSV	Bimetallic Vacuum Switching Valve
CB	Circuit Breaker
CCo	Catalytic Converter For Oxidation
CD	Compact Disc
CF	Cornering Force
CG	Center Of Gravity
CH	Channel
CKD	Complete Knock Down
COMB.	Combination
CPE	Coupe
CPS	Combustion Pressure Sensor
CPU	Central Processing Unit
CRS	Child Restraint System
CTR	Center
C/V	Check Valve
CV	Control Valve
CW	Curb Weight
DC	Direct Current
DEF	Defogger
DFL	Deflector

Abbreviations	Meaning
DIFF.	Differential
DIFF. LOCK	Differential Lock
D/INJ	Direct Injection
DLC	Data Link Connector
DLI	Distributorless Ignition
DOHC	Double Overhead Cam
DP	Dash Pot
DS	Dead Soak
DSP	Digital Signal Processor
DTC	Diagnostic Trouble Code
ECAM	Engine Control And Measurement System
ECD	Electronic Controlled Diesel
ECDY	Eddy Current Dynamometer
ECT	Electronic Control Transmission
ECU	Electronic Control Unit
ED	Electro-Deposited Coating
EDU	Electronic Driving Unit
EDIC	Electric Diesel Injection Control
EFI	Electronic Fuel Injection
E/G	Engine
EGR	Exhaust Gas Recirculation
EGR-VM	EGR-Vacuum Modulator
ELR	Emergency Locking Retractor
ENG	Engine
ESA	Electronic Spark Advance
ETCS	Electronic Throttle Control System
EVAP	Evaporative Emission Control
EVP	Evaporator
E-VRV	Electric Vacuum Regulating Valve
EX	Exhaust
FE	Fuel Economy
FF	Front-Engine Front-Wheel-Drive
F/G	Fuel Gauge
FIPG	Formed In Place Gasket
FL	Fusible Link
F/P	Fuel Pump
FPU	Fuel Pressure Up
FR	Front
F/W	Flywheel
FW/D	Flywheel Damper
FWD	Front-Wheel-Drive
GAS	Gasoline
GND	Ground
HAC	High Altitude Compensator
H/B	Hatchback
H-FUSE	High Current Fuse
HI	High
HID	High Intensity Discharge (Head Lamp)
HSG	Housing
HT	Hard Top
HWS	Heated Windshield System

Abbreviations	Meaning
IC	Integrated Circuit
IDI	Indirect Diesel Injection
IFS	Independent Front Suspension
IG	Ignition
IIA	Integrated Ignition Assembly
IN	Intake (Manifold, Valve)
INT	Intermittent
I/P	Instrument Panel
IRS	Independent Rear Suspension
ISC	Idle Speed Control
J/B	Junction Block
J/C	Junction Connector
KD	Kick-Down
LAN	Local Area Network
LB	Liftback
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	Left-Hand
LHD	Left-Hand Drive
L/H/W	Length, Height, Width
LLC	Long-Life Coolant
LNG	Liquified Natural Gas
LO	Low
LPG	Liquified Petroleum Gas
LSD	Limited Slip Differential
LSP & PV	Load Sensing Proportioning And Bypass Valve
LSPV	Load Sensing Proportioning Valve
MAP	Manifold Absolute Pressure
MAX.	Maximum
MIC	Microphone
MIL	Malfunction Indicator Lamp
MIN.	Minimum
MP	Multipurpose
MPI	Multipoint Electronic Injection
MPX	Multiplex Communication System
M/T	Manual Transmission
MT	Mount
MTG	Mounting
N	Neutral
NA	Natural Aspiration
NO.	Number
O2S	Oxygen Sensor
O/D	Overdrive
OEM	Original Equipment Manufacturing
OHC	Overhead Camshaft
OHV	Overhead Valve
OPT	Option
O/S	Oversize
P & BV	Proportioning And Bypass Valve
PCS	Power Control System
PCV	Positive Crankcase Ventilation

Abbreviations	Meaning
PKB	Parking Brake
PPS	Progressive Power Steering
PS	Power Steering
PTO	Power Take–Off
P/W	Power Window
R & P	Rack And Pinion
R/B	Relay Block
RBS	Recirculating Ball Type Steering
R/F	Reinforcement
RFS	Rigid Front Suspension
RRS	Rigid Rear Suspension
RH	Right–Hand
RHD	Right–Hand Drive
RLY	Relay
ROM	Read Only Memory
RR	Rear
RRS	Rear–Wheel Drive
RWD	Rear–Wheel Drive
SDN	Sedan
SEN	Sensor
SICS	Starting Injection Control System
SOC	State Of Charge
SOHC	Single Overhead Camshaft
SPEC	Specification
SPI	Single Point Injection
SRS	Supplemental Restraint System
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
STJ	Cold–Start Fuel Injection
SW	Switch
SYS	System
T/A	Transaxle
TACH	Tachometer
TBI	Throttle Body Electronic Fuel Injection
TC	Turbocharger
TCCS	TOYOTA Computer–Controlled System
TCV	Timing Control Valve
TDC	Top Dead Center
TEMP.	Temperature
TEMS	TOYOTA Electronic Modulated Suspension
TFT	Toyota Free–Tronic
TIS	Total Information System For Vehicle Development
T/M	Transmission
TMC	TOYOTA Motor Corporation
TMMK	TOYOTA Motor Manufacturing Kentucky, Inc.
TRC	Traction Control System
TURBO	Turbocharge
TWC	Three–Way Catalyst
U/D	Underdrive
U/S	Undersize

Abbreviations	Meaning
VCV	Vacuum Control Valve
VENT	Ventilator
VIN	Vehicle Identification Number
VPS	Variable Power Steering
VSC	Vehicle Skid Control
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
VVT–i	Variable Valve Timing–intelligent
W/	With
WGN	Wagon
W/H	Wire Harness
W/O	Without
1ST	First
2ND	Second
2WD	Two Wheel Drive Vehicle (4 x 2)
3RD	Third
4TH	Fourth
4WD	Four Wheel Drive Vehicle (4 x 4)
4WS	Four Wheel Steering System
5TH	Fifth

01016-02

GLOSSARY OF SAE AND TOYOTA TERMS

This glossary lists all SAE-J1930 terms and abbreviations used in this manual in compliance with SAE recommendations, as well as their TOYOTA equivalents.

SAE ABBREVIATIONS	SAE TERMS	TOYOTA TERMS ( )--ABBREVIATIONS
A/C	Air Conditioning	Air Conditioner
ACL	Air Cleaner	Air Cleaner, A/CL
AIR	Secondary Air Injection	Air Injection (AI)
AP	Accelerator Pedal	-
B+	Battery Positive Voltage	+B, Battery Voltage
BARO	Barometric Pressure	HAC
CAC	Charge Air Cooler	Intercooler
CARB	Carburetor	Carburetor
CFI	Continuous Fuel Injection	-
CKP	Crankshaft Position	Crank Angle
CL	Closed Loop	Closed Loop
CMP	Camshaft Position	Cam Angle
CPP	Clutch Pedal Position	-
CTOX	Continuous Trap Oxidizer	-
CTP	Closed Throttle Position	LL ON, Idle ON
DFI	Direct Fuel Injection (Diesel)	Direct Injection (DI)
DI	Distributor Ignition	-
DLC1 DLC2 DLC3	Data Link Connector 1 Data Link Connector 2 Data Link Connector 3	1: Check Connector 2: Total Diagnosis Comunication Link (TDCL) 3: OBD II Diagnostic Connector
DTC	Diagnostic Trouble Code	Diagnostic Code
DTM	Diagnostic Test Mode	-
ECL	Engine Control Level	-
ECM	Engine Control Module	Engine ECU (Electronic Control Unit)
ECT	Engine Coolant Temperature	Coolant Temperature, Water Temperature (THW)
EEPROM	Electrically Erasable Programmable Read Only Memory	Electrically Erasable Programmable Read Only Memory (EEPROM), Erasable Programmable Read Only Memory (EPROM)
EFE	Early Fuel Evaporation	Cold Mixture Heater (CMH), Heat Control Valve (HCV)
EGR	Exhaust Gas Recirculation	Exhaust Gas Recirculation (EGR)
EI	Electronic Ignition	TOYOTA Distributorless Ignition (TDI)
EM	Engine Modification	Engine Modification (EM)
EPROM	Erasable Programmable Read Only Memory	Programmable Read Only Memory (PROM)
EVAP	Evaporative Emission	Evaporative Emission Control (EVAP)
FC	Fan Control	-
FEEPROM	Flash Electrically Erasable Programmable Read Only Memory	-
FEPROM	Flash Erasable Programmable Read Only Memory	-
FF	Flexible Fuel	-
FP	Fuel Pump	Fuel Pump
GEN	Generator	Alternator
GND	Ground	Ground (GND)

HO2S	Heated Oxygen Sensor	Heated Oxygen Sensor (HO_2S)
IAC	Idle Air Control	Idle Speed Control (ISC)
IAT	Intake Air Temperature	Intake or Inlet Air Temperature
ICM	Ignition Control Module	–
IFI	Indirect Fuel Injection	Indirect Injection (IDL)
IFS	Inertia Fuel–Shutoff	–
ISC	Idle Speed Control	–
KS	Knock Sensor	Knock Sensor
MAF	Mass Air Flow	Air Flow Meter
MAP	Manifold Absolute Pressure	Manifold Pressure Intake Vacuum
MC	Mixture Control	Electric Bleed Air Control Valve (EBCV) Mixture Control Valve (MCV) Electric Air Control Valve (EACV)
MDP	Manifold Differential Pressure	–
MFI	Multiport Fuel Injection	Electronic Fuel Injection (EFI)
MIL	Malfunction Indicator Lamp	Check Engine Lamp
MST	Manifold Surface Temperature	–
MVZ	Manifold Vacuum Zone	–
NVRAM	Non–Volatile Random Access Memory	–
O2S	Oxygen Sensor	Oxygen Sensor, O_2 Sensor (O_2S)
OBD	On–Board Diagnostic	On–Board Diagnostic System (OBD)
OC	Oxidation Catalytic Converter	Oxidation Catalyst Convert (OC), CCo
OP	Open Loop	Open Loop
PAIR	Pulsed Secondary Air Injection	Air Suction (AS)
PCM	Powertrain Control Module	–
PNP	Park/Neutral Position	–
PROM	Programmable Read Only Memory	–
PSP	Power Steering Pressure	–
PTOX	Periodic Trap Oxidizer	Diesel Particulate Filter (DPF) Diesel Particulate Trap (DPT)
RAM	Random Access Memory	Random Access Memory (RAM)
RM	Relay Module	–
ROM	Read Only Memory	Read Only Memory (ROM)
RPM	Engine Speed	Engine Speed
SC	Supercharger	Supercharger
SCB	Supercharger Bypass	E–ABV
SFI	Sequential Multiport Fuel Injection	Electronic Fuel Injection (EFI), Sequential Injection
SPL	Smoke Puff Limiter	–
SRI	Service Reminder Indicator	–
SRT	System Readiness Test	–
ST	Scan Tool	–
TB	Throttle Body	Throttle Body
TBI	Throttle Body Fuel Injection	Single Point Injection Central Fuel Injection (Ci)
TC	Turbocharger	Turbocharger
TCC	Torque Converter Clutch	Torque Converter

TCM	Transmission Control Module	Transmission ECU, ECT ECU
TP	Throttle Position	Throttle Position
TR	Transmission Range	-
TVV	Thermal Vacuum Valve	Bimetallic Vacuum Switching Valve (BVSV) Thermostatic Vacuum Switching Valve (TVSV)
TWC	Three-Way Catalytic Converter	Three-Way Catalytic (TWC) Manifold Converter CC_{RO}
TWC+OC	Three-Way + Oxidation Catalytic Converter	CC_R + CCo
VAF	Volume Air Flow	Air Flow Meter
VR	Voltage Regulator	Voltage Regulator
VSS	Vehicle Speed Sensor	Vehicle Speed Sensor
WOT	Wide Open Throttle	Full Throttle
WU-OC	Warm Up Oxidation Catalytic Converter	-
WU-TWC	Warm Up Three-Way Catalytic Converter	-
3GR	Third Gear	-
4GR	Fourth Gear	-

PREPARATION

ENGINE MECHANICAL

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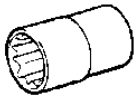
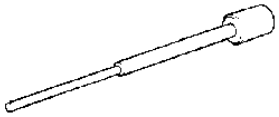
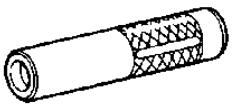
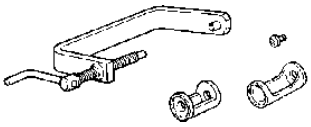
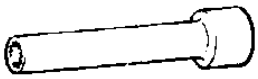
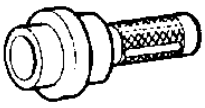
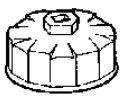
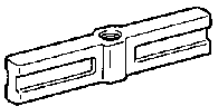
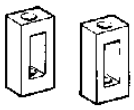
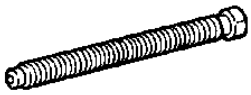
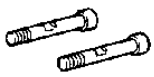
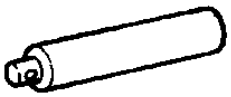
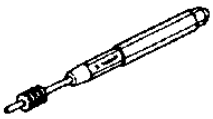
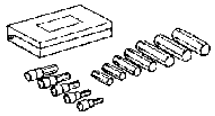
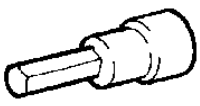
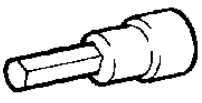
PREPARATION

SST

	09011-38121	12 mm Socket Wrench for 12 Pointed Head	CYLINDER BLOCK(1ZZ-FE/3ZZ-FE)
	09032-00100	Oil Pan Seal Cutter	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	09201-01055	Valve Guide Bushing Remover & Replacer 5.5	CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE)
	09201-10000	Valve Guide Bushing Remover & Replacer Set	CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE)
	09201-41020	Valve Stem Oil Seal Replacer	CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE)
	09202-70020	Valve Spring Compressor	CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE)
	09205-16010	Cylinder Head Bolt Wrench	CYLINDER BLOCK(1ZZ-FE/3ZZ-FE)
	09213-70011	Crankshaft Pully Holding Tool	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	09222-30010	Connecting Rod Bushing Remover & Replacer	CYLINDER BLOCK(1ZZ-FE/3ZZ-FE)
	09223-15030	Oil Seal & Bearing Replacer	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	09223-22010	Crankshaft Front Oil Seal Replacer	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	09228-06501	Oil Filter Wrench	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)

	09330-00021	Companion Flange Holding Tool	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	09950-50012	Puller C Set	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	(09951-05010)	Hanger 150	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	(09952-05010)	Slide Arm	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	(09953-05020)	Center Bolt 150	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	(09954-05020)	Claw No.2	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	09950-70010	Handle Set	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE) CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE)
	(09951-07100)	Handle 100	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE) CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE)

Recomended Tools

	09031-00040	Pin Punch .	CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE)
	09040-00011	Hexagon Wrench Set	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE) CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE)
	(09043-20100)	Socket Hexagon Wrench 10.	CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE)
	(09043-20120)	Socket Hexagon Wrench 12.	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
	09043-50100	Bi-hexagon Wrench 10 mm	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)

Equipment

Reamer	
V-block	
Piston ring compressor	
Piston ring expander	
Valve seat cutter	
Connecting rod aligner	
Cylinder gauge	
Dial indicator or dial indicator with magnetic base	
Feeler gauge	
Micrometer	
Precision straight edge	
Steel square	Valve spring
Torque wrench	
Vernier calipers	
Plastigage	
Heater	

SSM

08826-00080	Seal Packing Black or equivalent (FIPG)	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE) CYLINDER BLOCK(1ZZ-FE/3ZZ-FE)
08826-00100	"Seal Packing 1282B," THREE BOND 1282B or equivalent (FIPG)	PARTIAL ENGINE ASSY(1ZZ-FE/3ZZ-FE)
08833-00070	"Adhesive 1324," THREE BOND 1324 or equivalent	CYLINDER HEAD ASSY(1ZZ-FE/3ZZ-FE) CYLINDER BLOCK(1ZZ-FE/3ZZ-FE)

LUBRICATION

02021-01

PREPARATION

Equipment

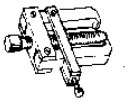
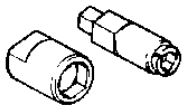
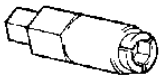
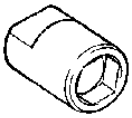
Feeler gauge	
Precision straight edge	

STARTING & CHARGING

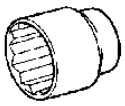
02016-01

PREPARATION

SST

	09286-46011	Injection Pump Spline Shaft Puller	GENERATOR ASSY(1ZZ-FE/3ZZ-FE)
	09820-63010	Alternator Pulley Set Nut Wrench Set	GENERATOR ASSY(1ZZ-FE/3ZZ-FE)
	(09820-06010)	Alternator Rotor Shaft Wrench	GENERATOR ASSY(1ZZ-FE/3ZZ-FE)
	(09820-06020)	Alternator Pulley Set Nut 22 mm Wrench	GENERATOR ASSY(1ZZ-FE/3ZZ-FE)

Recomended Tools

	09011-12291	Socket Wrench for 29 mm .	GENERATOR ASSY(1ZZ-FE/3ZZ-FE)
	09082-00040	TOYOTA Electrical Tester.	STARTER ASSY(1ZZ-FE/3ZZ-FE) GENERATOR ASSY(1ZZ-FE/3ZZ-FE)
	(09083-00150)	Test Lead Set	STARTER ASSY(1ZZ-FE/3ZZ-FE)

Equipment

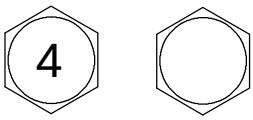
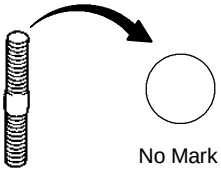
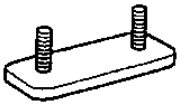
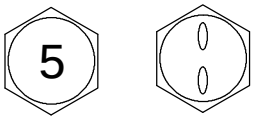
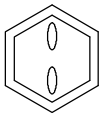
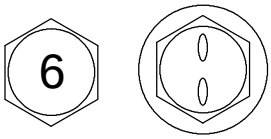
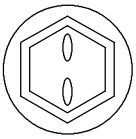
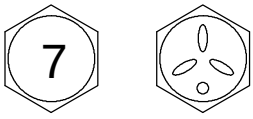
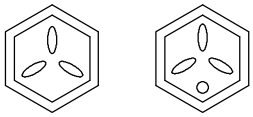
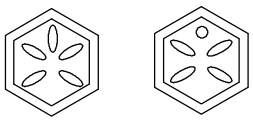
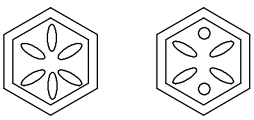
Soldering iron and solder	
File	
Dial indicator or dial indicator with magnetic base	Commutator
V-block	
Torque wrench	
Plastic Hammer	
Vernier calipers	

SERVICE SPECIFICATIONS

STANDARD BOLT

HOW TO DETERMINE BOLT STRENGTH

0301Z-02

Bolt Type				Class
Hexagon Head Bolt		Stud Bolt	Weld Bolt	
Normal Recess Bolt	Deep Recess Bolt			
 No Mark	 No Mark	 No Mark		4T
				5T
 w/ Washer	 w/ Washer			6T
				7T
				8T
				9T
				10T
				11T

B06431

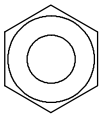
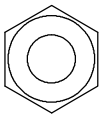
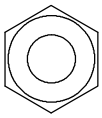
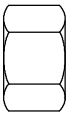
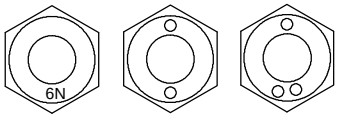
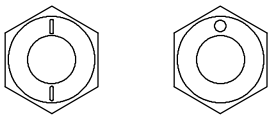
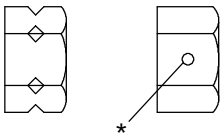
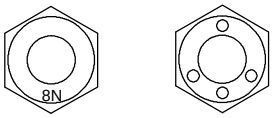
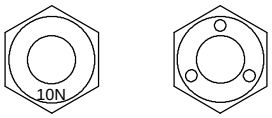
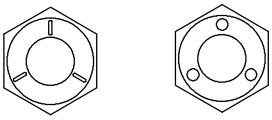
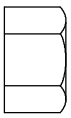
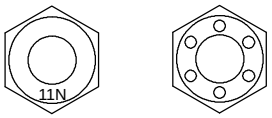
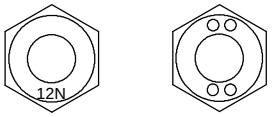
0301Y-02

SPECIFIED TORQUE FOR STANDARD BOLTS

Clas	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N·m	kgf·cm	ft·lbf	N·m	kgf·cm	ft·lbf
4T	6	1	5	55	48 in.·lbf	6	60	52 in.·lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	-	-	-
5T	6	1	6.5	65	56 in.·lbf	7.5	75	65 in.·lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	-	-	-
6T	6	1	8	80	69 in.·lbf	9	90	78 in.·lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	-	-	-
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	-	-	-
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

03020-02

HOW TO DETERMINE NUT STRENGTH

Nut Type			Class
Present Standard Hexagon Nut	Old Standard Hexagon Nut		
	Cold Forging Nut	Cutting Processed Nut	
 No Mark			4N
 No Mark (w/ Washer)	 No Mark (w/ Washer)	 No Mark	5N (4T)
 6N			6N
		 *	7N (5T)
 8N			8N
 10N		 No Mark	10N (7T)
 11N			11N
 12N			12N

*: Nut with 1 or more marks on one side surface of the nut.

B06432

HINT:

Use the nut with the same number of the nut strength classification or the greater than the bolt strength classification number when tightening parts with a bolt and nut.

Example: Bolt = 4T

Nut = 4N or more

ENGINE MECHANICAL
SERVICE DATA

03008-01

Chain length at 16 links	Maximum	112.6 mm (4.827 in.)
Camshaft timing sprocket diameter (w / chain)	Minimum	97.3mm (3.831 in.)
Crankshaft timing sprocket diameter (w / chain)	Minimum	51.6mm (2.031in.)
Chain tensioner slipper wear	Maximum	1.0 mm (0.039 in.)
Chain tensioner vibration damper wear	Maximum	1.0 mm (0.039 in.)
Cylinder head bolt length	Standard	156.0 - 159.0 mm (6.142-6.260 in.)
	Maximum	159.5 mm(6.280 in.)
Camshaft circle runout	Maximum	0.02 mm (0.0007 in.)
Camshaft lobe height	Standard Intake	44.333 - 44.433 mm (1.7454 - 1.7493 in.)
	Exhaust	43.761 - 43.861 mm (1.7229 - 1.7268 in.)
	Minimum Intake	44.18 mm (1.7394 in.)
	Exhaust	43.61 mm (1.7169 in.)
Camshaft journal diameter	No. 1	34.449 - 34.465 mm (1.3563 - 1.3569 in.)
	Others	22.949 - 22.965 mm (0.9035 - 0.9041 in.)
Valve clearance (Cold)	Intake	0.15 - 0.25 mm (0.006 - 0.010 in.)
	Exhaust	0.25 - 0.35 mm (0.010 - 0.014in.)
Cylinder head warpage	Maximum Cylinder block side	0.05 mm (0.0020 in.)
	Intake manifold side	0.10 mm (0.0040 in.)
	Exhaust manifold side	0.10 mm (0.0040 in.)
Busing oil clearance inside diameter		5.510 - 5.530 mm (0.2169 - 0.2177 in.)
Valve stem diameter	Intake	5.470 - 5.485 mm (0.2154 - 0.2159 in.)
	Exhaust	5.465 - 5.480 mm (0.2152 - 0.2157 in.)
Valve stem oil clearance	Standard Intake	0.025 - 0.060 mm (0.0010 - 0.0024 in.)
	Exhaust	0.030 - 0.065 mm (0.0012 - 0.0026 in.)
	Maximum Intake	0.08 mm (0.0031 in.)
	Exhaust	0.01 mm (0.0039 in.)
Valve guide bush diameter		10.285 - 10.306 mm (0.4049 - 0.4057 in.)
Valve spring free length		43.40 mm (1.7087 in.)
Valve spring deviation	Maximum	2.0 mm (0.078 in.)
Valve spring angle (reference)	Maximum	2°
Valve overall length	Standard Intake	88.65 mm (34902 in.)
	Exhaust	88.69 mm (34917 in.)
	Minimum Intake	88.35 mm (34783 in.)
	Exhaust	88.39 mm (34799 in.)
Valve head margin thickness	Standard	1.0 mm (0.039 in.)
	Minimum	0.7 mm (0.028 in.)
Valve lifter diameter		30.966 - 30.976 mm (1.2191 -1.2195 in.)
Lifter bore diameter		31.000 - 31.025 mm (1.2205 - 1.2215 in.)
Valve lifter oil clearance	Standard	0.024 - 0.059 mm (0.0009 - 0.0023 in.)
	Maximum	0.1 mm (0.0039 in.)
Camshaft thrust clearance	Standard	0.040 - 0.095 mm (0.0016 - 0.0037 in.)
	Maximum	0.11 mm (0.0043 in.)
Camshaft oil clearance	Standard	0.035 - 0.072 mm (0.0014 - 0.0028 in.)
	Maximum	0.010 mm (0.0039 in.)
Water hose union protrusion	Standard A	29 mm (1.14 in.)
	B	66.5 mm (2.618 mm)
	C	24 mm (0.95 mm)
Valve guide bush protrusion height		8.7 - 9.1 mm (0.342 - 0.358 in.)
Connecting rod thrust clearance	Standard	0.160 - 0.342 mm (0.063 - 0.0135 in.)
	Maximum	0.342 mm (0.0135 in.)
Connecting rod oil clearance	Standard	0.028 - 0.060 mm (0.0011 - 0.0024 in.)
	Maximum	0.080 mm (0.0031 in.)

Connecting rod bearing center wall thickness		
Reference	Mark 1	1.486 - 1.490 mm (0.0585 - 0.0587 in.)
	Mark 2	1.490 - 1.494 mm (0.0587 - 0.0588 in.)
	Mark 3	1.494 - 1.498 mm (0.0588 - 0.0590 in.)
Crankshaft thrust clearance	Standard	0.04 - 0.24 mm (0.0016 - 0.0094 in.)
	Maximum	0.30 mm (0.0118 in.)
Crankshaft Thrust washer thickness		2.430 - 2.480 mm (0.0957 - 0.0976 in.)
Cylinder head surface warpage	Maximum	0.05 mm (0.0020 in.)
Cylinder bore diameter	Standard	79.000 - 79.013 mm (3.1102 - 3.1107 in.)
	Maximum	79.013 mm (3.1107 in.)
Piston diameter (at 29.8 mm (1.173 in.) from the piston head)	1ZZ-FE	78.925 - 78.935 mm (3.1073 - 3.1077 in.)
	3ZZ-FE	78.955 - 78.965 mm (3.1085 - 3.1089 in.)
Connecting rod out-of alignment	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
Connecting rod twist	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
Piston oil clearance	Standard	0.065 - 0.075 mm (0.0026 - 0.0029 in.)
	Maximum	0.75 mm (0.0029 in.)
Piston ring groove clearance		0.020 - 0.070 mm (0.0008 - 0.0028 in.)
Piston ring end gap	Standard No. 1	0.25 - 0.35 mm (0.0098 - 0.0138 in.)
	No. 2	0.35 - 0.50 mm (0.0138 - 0.0197 in.)
	Maximum No. 1	0.74 mm (0.029 in.)
	No. 2	0.89 mm (0.035 in.)
Piston pin diameter		20.004 - 20.013 mm (0.7876 - 0.7879 in.)
Connecting rod bolt diameter	Standard	6.6 - 6.7 mm (0.260 - 0.264 in.)
	Maximum	6.4 mm (0.252 in.)
Crankshaft circle runout	Maximum	0.03 mm (0.0012 in.)
Crankshaft main journal diameter		47.988 - 48.000 mm (1.8893 - 1.8898 in.)
	Maximum taper and out-of-round	0.02 mm (0.0008 in.)
Crank pin diameter		43.992 - 44.000 mm (1.7320 - 1.7328 in.)
	Maximum taper and out-of-round	0.02 mm (0.0008 in.)
Crankshaft bearing cap set bolt diameter	Standard	7.3 - 7.5 mm (0.287 - 0.295 in.)
	Minimum	7.2 mm (0.283 in.)
Crankshaft main journal oil clearance	Standard	0.013 - 0.030 mm (0.0005 - 0.0012 in.)
	Minimum	0.05 mm (0.0020 in.)
Connecting rod small end bush oil clearance		0.005 - 0.011 mm (0.0002 - 0.0004 in.)

ENGINE MECHANICAL

TORQUE SPECIFICATION

03009-01

Part Tightened		N·m	kgf·cm	ft·lbf
Oil strainer x Cylinder block		9.0	92	80 in.·lbf
Oil pan x Cylinder block		9.0	92	80 in.·lbf
Oil pan drain plug x Oil pan		38	382	28 in.·lbf
Oil filter union (w/o oil cooler) x Cylinder block		30	306	21 in.·lbf
Cylinder head x Cylinder block	1st	49	500	36
	2nd	Turn 90°	Turn 90°	Turn 90°
Engine hanger No. 1 x Cylinder head		38	387	28
Oil control valve filter x Cylinder block		30	306	22
Camshaft timing oil control valve x Cylinder head		7.8	80	69 in.·lbf
Camshaft timing gear assembly x Camshaft		54	551	40
Camshaft timing gear x Camshaft		54	551	40
Camshaft x Cylinder head	Bearing cap No. 1	23	235	17
	Bearing cap No. 3	13	133	10
Oil pump x Cylinder block		9.0	92	80 in.·lbf
Chain vibration damper No. 1 x Cylinder block		11	112	8
Chain tensioner slipper x Cylinder block		19	189	15
Timing chain cover x Cylinder block		13	133	10
	M8	19	189	14
Chain tensioner assy No. 1 x Cylinder block		9.0	92	80 in.·lbf
Crankshaft pulley x Crankshaft		138	1,407	102
Water pump assy x Cylinder block	Bolt A	9.0	92	80 in.·lbf
	Bolt B	11	112	8
Engine mounting bracket x Timing chain cover		47	479	35
Cylinder head cover x Cylinder head	w/o washer	11	112	8
	w/ washer	9.0	92	80 in.·lbf
Spark plug x Cylinder head		25	225	18
Taper screw plug x Cylinder head		44	450	33
Connecting rod x Connecting rod cap	1st	20	204	15
	2nd	Turn 90°	Turn 90°	Turn 90°
Crankshaft bearing cap sub-assembly x Cylinder block	1st	22	225	16
	2nd	44	449	32
	3rd	Turn 90°	Turn 90°	Turn 90°
	4th	Turn 90°	Turn 90°	Turn 90°
	Other bolt	19	189	14
Water drain union x Cylinder block	1ZZ-FE	38	383	28
	3ZZ-FE	20	200	15

LUBRICATION

SERVICE DATA

0300A-01

Oil pump rotor tip clearance	Standard	0.040 – 0.160 mm (0.0015 – 0.0062 in.)
	Maximum	0.35 mm (0.0138 in.)
Oil pump body clearance	Standard	0.260 – 0.325 mm (0.0102 – 0.0128 in.)
	Maximum	0.300 mm (0.01181 in.)
Oil pump side clearance	Standard	0.025 –0.071 mm (0.0010 – 0.0030 in.)
	Maximum	0.15 mm (0.0059 in.)

LUBRICATION

TORQUE SPECIFICATION

0300B-01

Part Tightened	N·m	kgf·cm	ft·lbf
Oil pump relief valve plug	37	375	27
Oil pump cover x Oil pump body	10	102	7

STARTING & CHARGING

SERVICE DATA

0300C-01

Starter armature assy	Maximum circle runout	0.05 mm (0.0020 in.)
	Standard diameter	28 mm (1.102 in.)
	Minimum diameter	27 mm (1.063 in.)
	Standard undercut depth	0.6 mm (0.024 in.)
	Minimum undercut depth	0.2 mm (0.008 in.)
Blush	Standard length	14 mm (0.551 in.)
	Minimum length	9 mm (0.354 in.)
Generator rotor assy	Standard resistance at 20°C (68°F) (A/T)	2.7 - 3.1 Ω
Generator rotor assy	Standard resistance at 20°C (68°F) (M/T)	2.1 - 2.5 Ω
Generator rotor assy	Standard diameter	14.2 - 14.4 mm (0.559 - 0.567 in.)
	Minimum diameter	12.8 mm (0.504 in.)
Brush holder assy	Standard exposed length	9.5 - 11.5 mm (0.374 - 0.453 in.)
	Minimum exposed length	1.5 mm (0.059 in.)

STARTING & CHARGING

TORQUE SPECIFICATION

0300D-01

Part Tightened		N·m	kgf·cm	ft·lbf
End frame x Brush holder		1.5	15	13 in.·lbf
Starter yoke x Starter housing		5.9	60	52 in.·lbf
Magnetic switch x starter housing		8.3	85	73 in.·lbf
Lead wire of field frame x Magnetic switch		9.8	100	87 in.·lbf
Rectifire end frame without wire clip x Drive end frame		4.5	46	40 in.·lbf
Rectifire end frame with wire clip x Drive end frame		5.4	55	48 in.·lbf
Rectifire holder x Lead wire on rectifire end frame		2.9	30	26 in.·lbf
Generator regulator x Rectifire holder		2.0	20	18 in.·lbf
Brush holder x Rectifire holder		2.0	20	18 in.·lbf
Rear end cover x Rectifier holder	Nut	4.4	45	39 in.·lbf
	Bolt	3.9	39	35 in.·lbf
Alternator pulley x Rotor		111	1,125	81

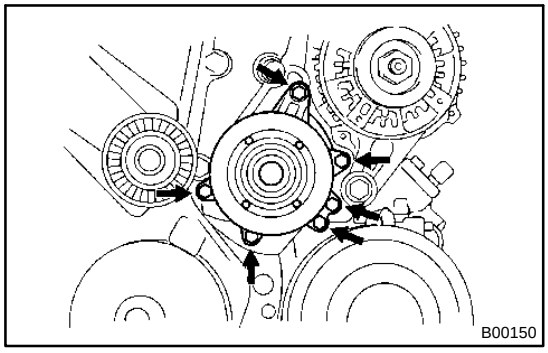
ENGINE MECHANICAL

PARTIAL ENGINE ASSY (1ZZ-FE/3ZZ-FE)

1400W-01

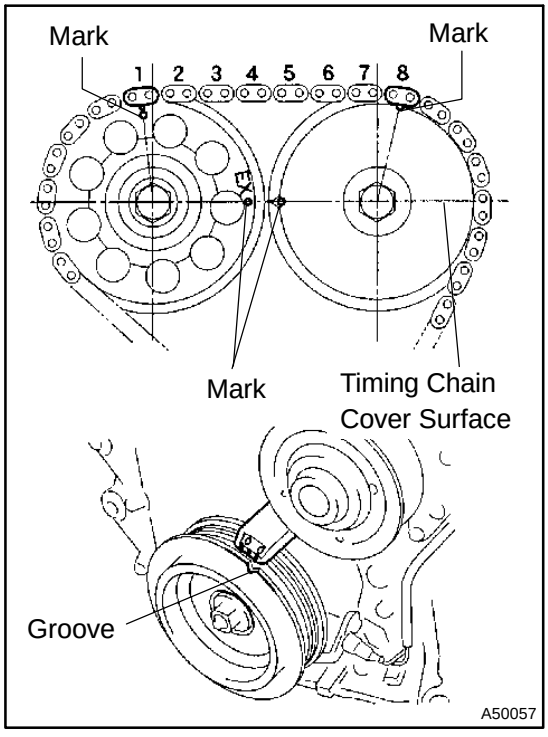
OVERHAUL

1. REMOVE OIL FILLER CAP SUB-ASSY
   [12108 / 1104]
2. REMOVE OIL FILLER CAP GASKET
   [12108A / 1104]
3. REMOVE VENTILATION VALVE SUB-ASSY
   [12204 / 1201]
4. REMOVE SPARK PLUG
   [19100P / 1901]
5. REMOVE CYLINDER HEAD COVER SUB-ASSY
   [11201 / 1104]
6. REMOVE CYLINDER HEAD COVER GASKET
   [11213 / 1104]
7. REMOVE TRANSVERSE ENGINE ENGINE MOUNTING BRACKET
   [12315A / 1107]



8. REMOVE WATER PUMP ASSY
   [16100 / 1601]

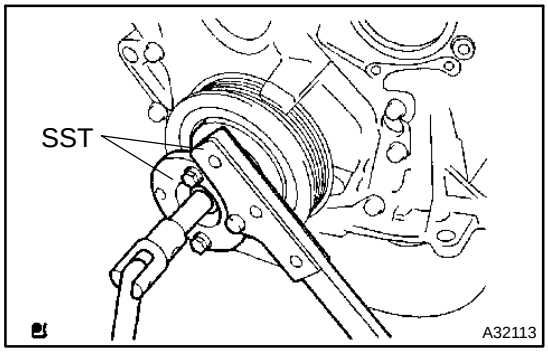
(a) Remove the 6 bolts, water pump and O-ring.



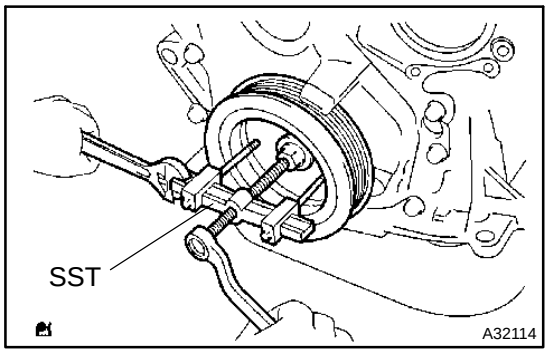
9. REMOVE CRANKSHAFT PULLEY
   [13471 / 1301]

(a) Set No. 1 cylinder to TDC/compression.
   (1) Turn the crankshaft pulley, and align its groove with timing mark "0" of the timing chain cover.
   (2) Check that the point marks of the camshaft timing sprocket and VVT timing sprocket are in straight line on the timing chain cover surface as shown in the illustration.

HINT:
If not, turn the crankshaft 1 revolution (360°) and align the marks as above.



(b) Using SST, remove the pulley bolt.
SST 09213-70011, 09330-00021



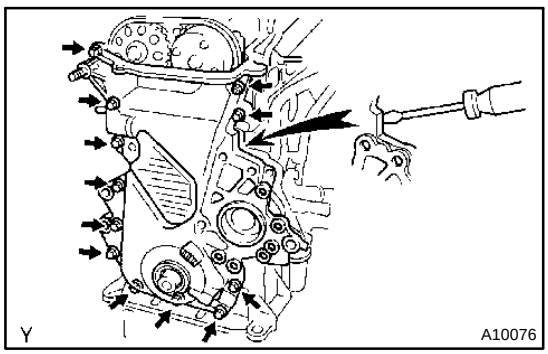
(c) Using SST, remove the crankshaft pully.
SST 09950-50012 (09951-05010, 09952-05010, 09953-05020, 09954-05020)

10. REMOVE CHAIN TENSIONER ASSY NO.1
[13540 / 1302]

NOTICE:
Be sure not to revolve the crank shaft without the chain tensioner.

11. REMOVE CRANK POSITION SENSOR NO.1
[11101W / 1104]

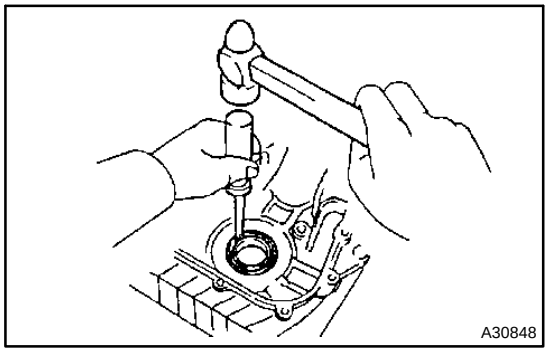
12. REMOVE TRANSVERSE ENGINE ENGINE MOUNTING BRACKET
[12315A / 1107]



13. REMOVE TIMING CHAIN OR BELT COVER SUB-ASSY
[11302 / 1106]

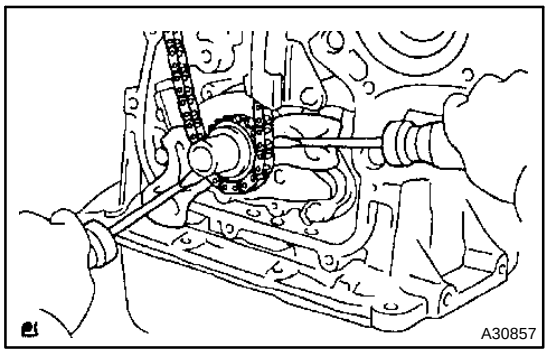
(a) Remove the 11 bolts and nuts.
(b) Using a torx wrench socket (E8), remove the stud bolt.
(c) Remove the timing chain cover by prying the portions between the cylinder head and cylinder block with a screwdriver.

NOTICE:
Be careful not to damage the contact surfaces of the timing chain cover, cylinder head and cylinder block.



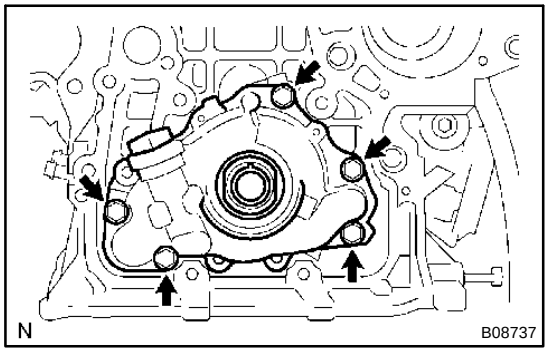
14. REMOVE TIMING GEAR COVER OIL SEAL
[11302A / 1106]
(a) Using a screwdriver remove the oil seal.

15. REMOVE CHAIN TENSIONER SLIPPER
[13559 / 1302]
16. REMOVE CHAIN VIBRATION DAMPER NO.1
[13561 / 1302]
17. REMOVE CRANKSHAFT POSITION SENSOR PLATE NO.1
[19315 / 1301]



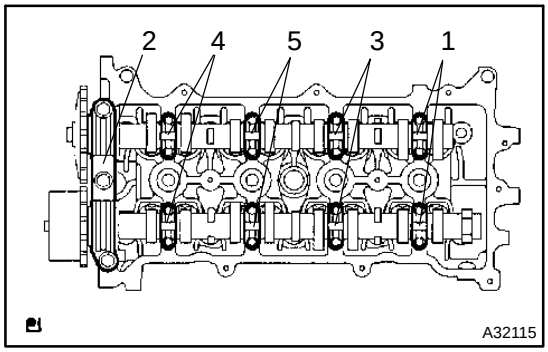
18. REMOVE CHAIN SUB-ASSY
[13506 / 1302]
(a) Using screwdrivers, ply out the timing chain with the crankshaft timing gear as shown in the illustration.

NOTICE:
- Put shop rag to protect the engine.
- In case of revolving the camshafts with the chain off the sprockets, turn the crankshaft 1/4 revolution for valves not to touch the pistons.



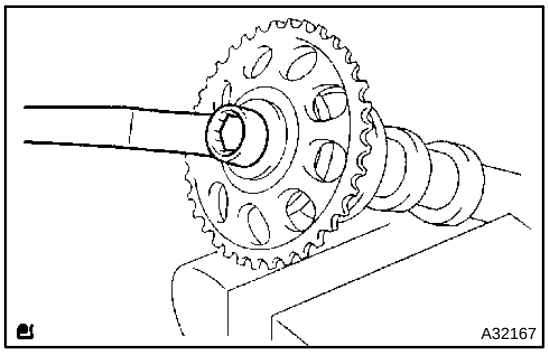
19. REMOVE OIL PUMP ASSY
[15100 / 1501]
(a) Remove the 5 bolts and oil pump.

20. REMOVE OIL PUMP GASKET
[15193 / 1501]



21. REMOVE CAMSHAFT

(a) Uniformly loosen and remove the 19 bearing cap bolts, in several passes, in the sequence shown, and remove the 9 bearing caps, intake and exhaust camshafts.



22. REMOVE CAMSHAFT TIMING GEAR OR SPROCKET [13523 / 1302]

(a) Grip the camshaft with a vice, and remove the camshaft timing gear.

NOTICE:

Be careful not to damage the camshaft.

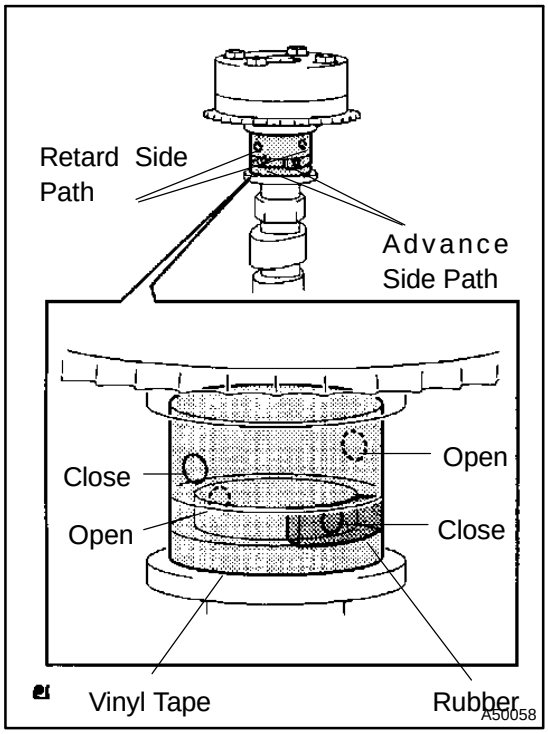
23. INSPECT CAMSHAFT TIMING GEAR ASSY [13050 / 1302]

(a) Check the lock of camshaft timing gear.

(1) Grip the camshaft with a vice, and confirm the camshaft timing gear is locked.

NOTICE:

Be careful not to damage the camshaft.



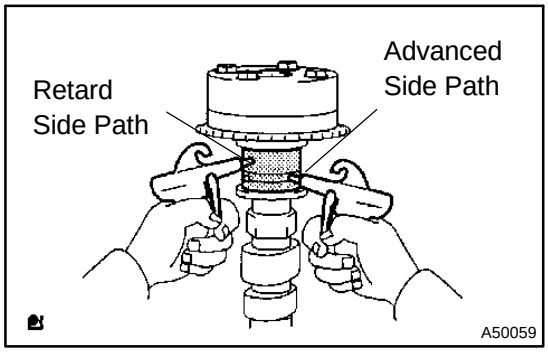
(b) Release lock pin.

(1) Cover 4 oil paths of cam journal with vinyl tape as shown in the illustration.

HINT:

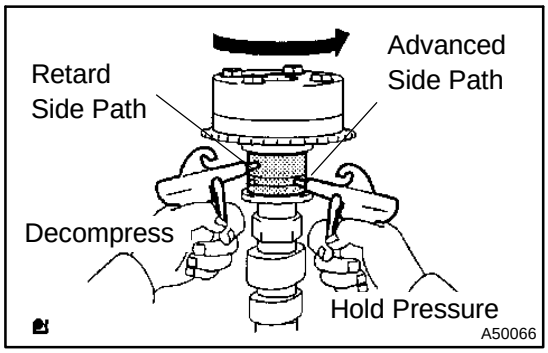
Two advance side paths are provided in the groove of the camshaft. Plug one of the path with a rubber piece.

(2) Break through the tapes of the advance side path and the retard side path on the opposite side of the groove.



(3) Put air pressure into two broken paths (the advance side path and the retard side path) with about 150 kPa {1.5 kgf·cm}.

CAUTION:
Cover the pathes with shop rag to avoid oil splashing.



(4) Confirm if the camshaft timing gear assembly revolves in the timing advance direction when weakening the air pressure of the timing retard path.

HINT:
The lock pin is released, and camshaft timing gear, revolves in the advance direction.

(5) When the camshaft timing gear comes to the most advanced position, take out the air pressure of the timing retard side path, and then, take out that of timing advance side path.

CAUTION:
Camshaft timing assembly gear occasionally shifts to the retard side abruptly, if the air compression of the advanced side path is released before retard side path. It often causes the breakage of the lock pin.

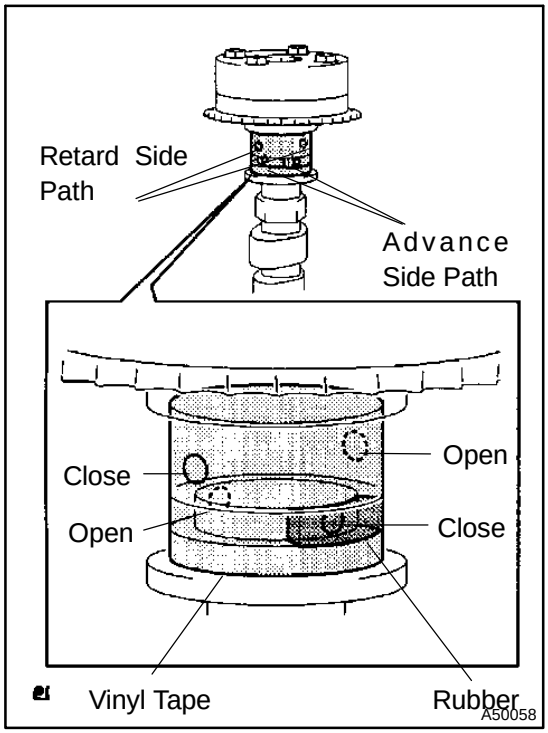
(c) Check smooth revolution

(1) Revolve the camshaft timing gear assembly within the movable range except for the most retarded position several times, and check the smooth revolution.

CAUTION:
Be sure to perform this check by hand, instead of air pressure.

(d) Check the lock in the most retarded position.

(1) Confirm that the camshaft timing gear assembly is locked at the most retarded position.



24. REMOVE CAMSHAFT TIMING GEAR ASSY
[13050 / 1302]

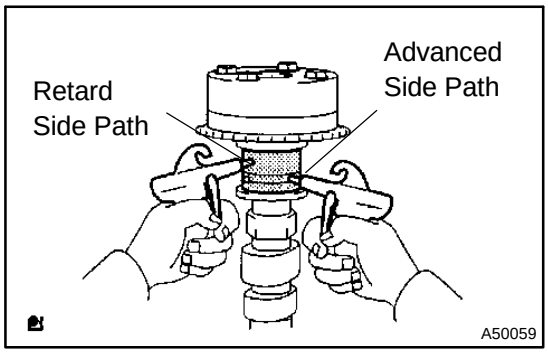
(a) Grip the camshaft with a vice, and confirm that the gear is locked.

CAUTION:
Be careful not to damage the camshaft.

(b) Cover 4 oil paths of cam journal with vinyl tape as shown in the illustration.

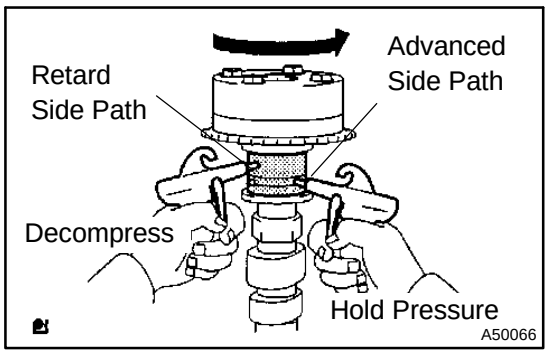
HINT:
Two advance side paths are provided in the groove of the camshaft. Plug one of the path with a rubber piece.

(c) Break through the tapes of the advance side path and the retard side path on the opposite side of the groove.



(d) Put air pressure into two broken paths (the advance side path and the retard side path) with about 150 kPa {1.5kgf/cm^2}.

CAUTION:
Cover the pathes with shop rag to avoid oil splashing.

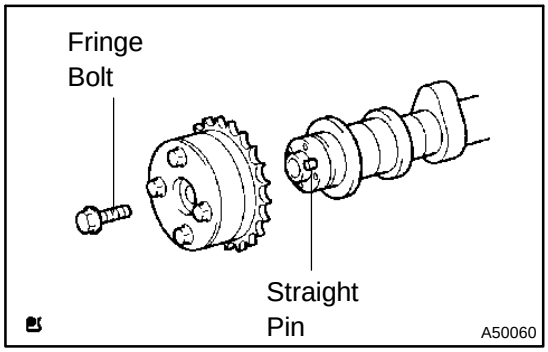


(e) Confirm if the camshaft timing gear assembly revolves in the timing advance direction when weakening the air pressure of the timing retard path.

HINT:
The lock pin is released, and camshaft timing gear revolves in the advance direction.

(f) When the camshaft timing gear comes to the most advanced position, take out the air pressure of the timing retard side path, and then, takeout that of timing advance side path.

CAUTION:
Camshaft timing gear assembly occasionally shifts to the retard side abruptly, if the air compression of the advanced side path is released before retard side paths. It often causes the breakage of the lock pin.

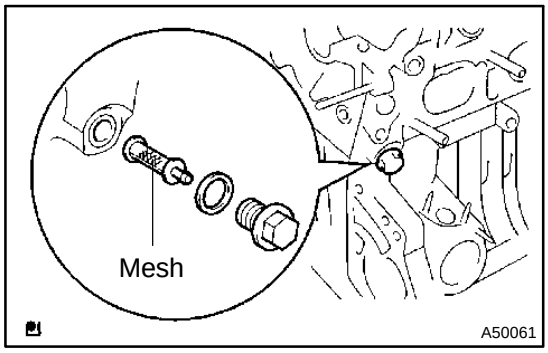


(g) Remove the fringe bolt of camshaft timing gear assembly.

NOTICE:

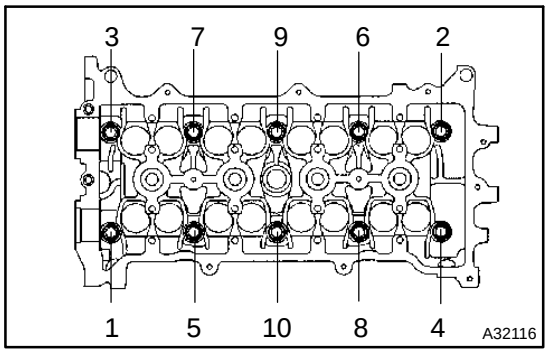
- Be sure not to remove the other 4 bolts.
- In case of reusing the camshaft timing gear, release the strait pin locking first, and then install the gear.

25. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY
[11101J / 1104]



26. REMOVE OIL CONTROL VALVE FILTER
[15678A / 1104]

27. REMOVE ENGINE HANGER NO.1
[12281A / 1104]



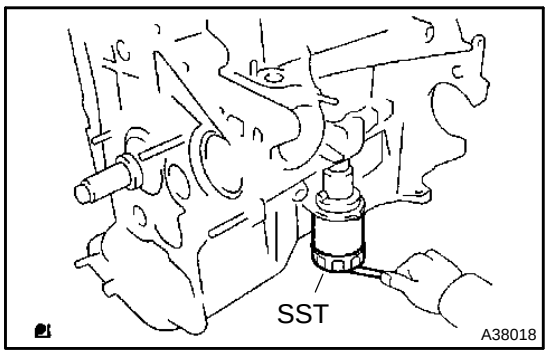
28. REMOVE CYLINDER HEAD SUB-ASSY
[11101 / 1104]

(a) Using a 10 mm bi-hexagon wrench, uniformly loosen an remove the 10cylinder head bolts, in several passes, in the sequence shown. Remove the 10 cylinder head bolts and plate washers.

NOTICE:

- Be careful not to drop washers into the cylinder head.
- Head warpage or cracking could result from removing bolts in an incorrect order.

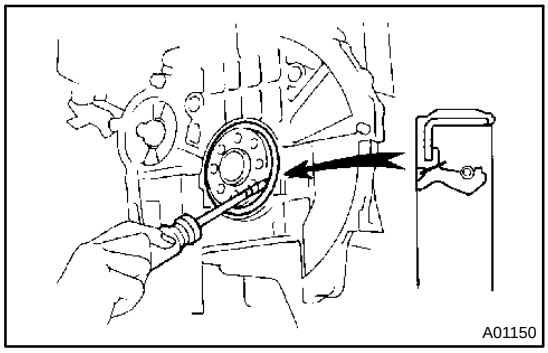
29. REMOVE CYLINDER HEAD GASKET
[11115 / 1104]



30. REMOVE OIL FILTER SUB-ASSY
[15601 / 1502]
(a) Using SST, remove the oil filter.
SST 09228-06501

31. REMOVE OIL FILTER UNION(W/O OIL COOLER)
[15600A / 1502]
(a) Using a 12mm hexagon wrench, remove the oil filter union.

32. REMOVE OIL COOLER ASSY(W/ OIL COOLER)
[15710 / 1503]
(a) Disconnect the 2 water by pass hoses.
(b) Using socket wrench (30mm), remove the union.
(c) Remove the oil cooler and O-ring.

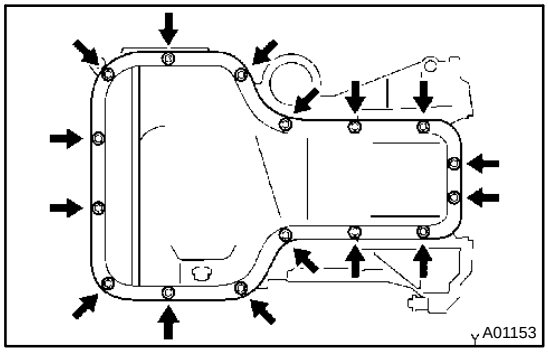


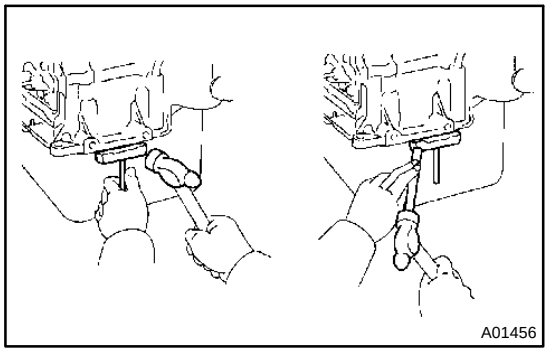
33. REMOVE ENGINE REAR OIL SEAL
[11401L / 1105]
(a) Using a knife, cut off the oil seal lip.
(b) Using a screwdriver with its tip taped, pry out the oil seal.
NOTICE:
After the removal, check if the crankshaft is not damaged. If there is, mend it with a sandpaper (# 400).

34. REMOVE OIL PAN DRAIN PLUG
[12101A / 1105]

35. REMOVE OIL PAN DRAIN PLUG GASKET
[12101B / 1105]

36. REMOVE OIL PAN SUB-ASSY
[12101 / 1105]
(a) Remove the 14 bolts and 2 nuts.

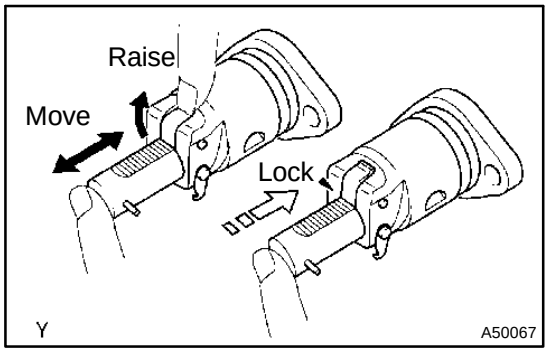




(b) Insert the blade of SST between the bearing cap sub-assembly and oil pan, and cut off applied sealer and remove the oil pan.
SST 09032-00100

NOTICE:
Be careful not to damage the oil pan contact surface of the bearing cap sub-assembly and the oil pan flange.

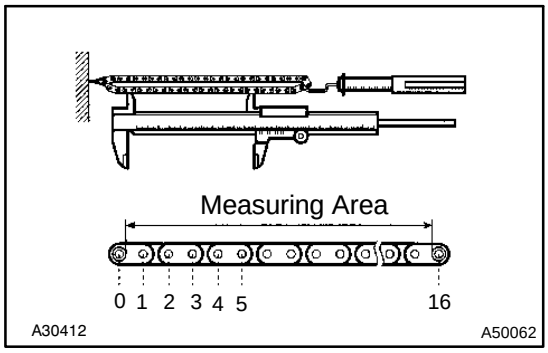
37. REMOVE OIL STRAINER SUB-ASSY
[15104 / 1501]



38. INSPECT CHAIN TENSIONER ASSY NO.1
[13540 / 1302]

(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.

(b) Release the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.

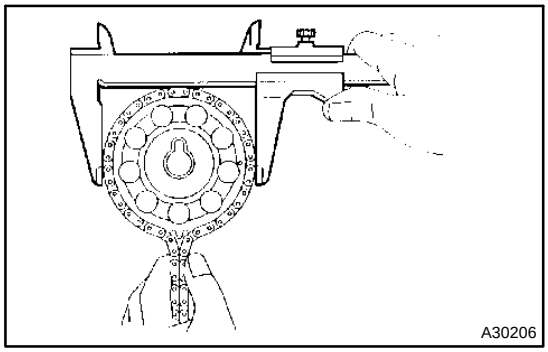


39. INSPECT CHAIN SUB-ASSY
[13506 / 1302]

(a) Using a spring scale, pull the timing chain with 140 N (4.3 kgf, 315 lb) and measure the length of it.
Maximum chain elongation : 112.6 mm (4.827 in.)

(b) If the elongation is greater than maximum, replace the chain.

HINT:
Make the same measurements pulling at 3 or more places selected at random.

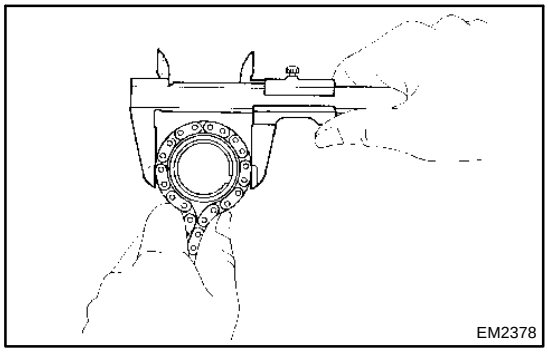


40. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET
[13523 / 1302]

(a) Wrap the chain around the timing sprocket.

(b) Using a vernier calipers, measure the timing sprocket diameter with the chain.
Minimum sprocket diameter (w / chain):
97.3mm (3.831 in.)

NOTICE:
Vernier calipers must contact the chain rollers for measuring.



41. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET
[13521 / 1301]

(a) Wrap the chain around the timing sprocket.

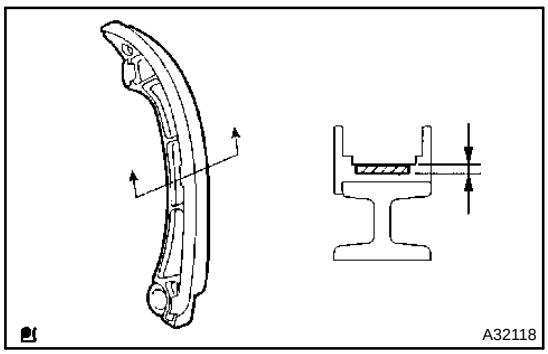
(b) Using a vernier calipers, measure the timing sprocket diameter with the chain.

NOTICE:

Vernier calipers must contact the chain rollers for the measuring.

Minimum sprocket diameter (w / chain):
51.6mm (2.031in.)

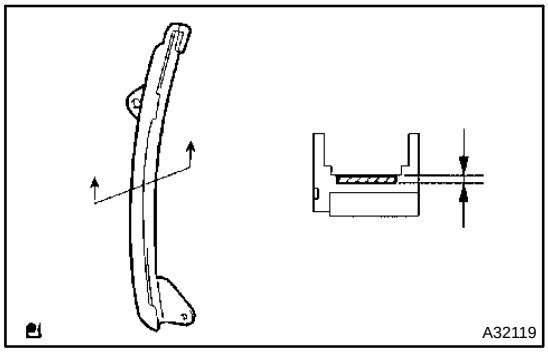
If the diameter is less than minimum, replace the chain and sprockets.



42. INSPECT CHAIN TENSIONER SLIPPER
[13559 / 1302]

(a) Measure the chain tensioner slipper wears.
Maximum wear: 1.0 mm (0.039 in.)

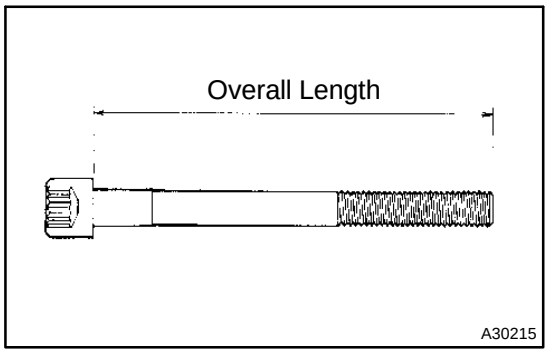
(b) If the wear is greater than maximum, replace the slipper.



43. INSPECT CHAIN VIBRATION DAMPER NO.1
[13561 / 1302]

(a) Measure the vibration damper wears.
Maximum wear: 1.0 mm (0.039 in.)

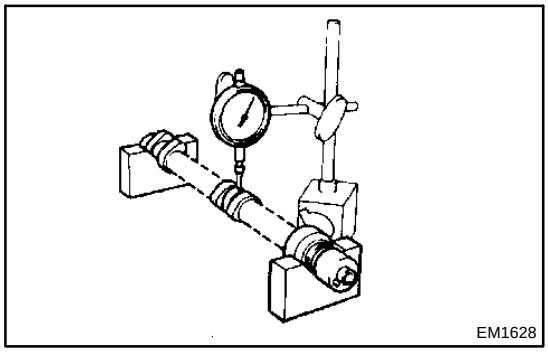
(b) If the wear is greater than maximum, replace the damper.



44. INSPECT CYLINDER HEAD SET BOLT
[11101A / 1104]

(a) Using vernier calipers, measure the length of head bolts from the seat to the end.
Standard bolt length:
156.0 - 159.0 mm (6.142-6.260 in.)
Maximum bolt length: 159.5 mm(6.280 in.)

(b) If the length surpasses the maximum, replace the bolt.

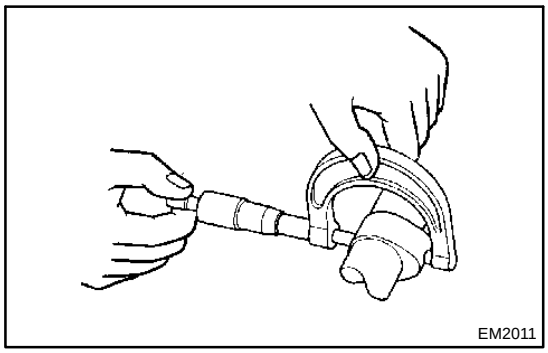

EM1628

45. INSPECT CAMSHAFT

(a) Inspect camshaft for runout.
   (1) Place the camshaft on V-blocks.
   (2) Using a dial indicator, measure the circle runout at the center journal.

   Maximum circle runout: 0.03 mm (0.0012 in.)

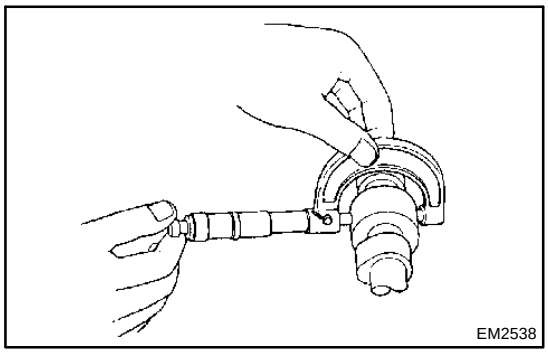
(b) If the circle runout is greater than maximum, replace the camshaft.


EM2011

(c) Inspect cam lobes.
   (1) Using a micrometer, measure the cam lobe height.

   Standard cam lobe height:
   Intake 44.333 - 44.433 mm (1.7454 - 1.7493 in.)
   Exhaust 43.761 - 43.861 mm (1.7229 - 1.7268 in.)
   Minimum cam lobe height:
   Intake 44.18 mm (1.7394 in.)
   Exhaust 43.61 mm (1.7169 in.)

   (2) If the cam lobe height is less than minimum, replace the camshaft.


EM2538

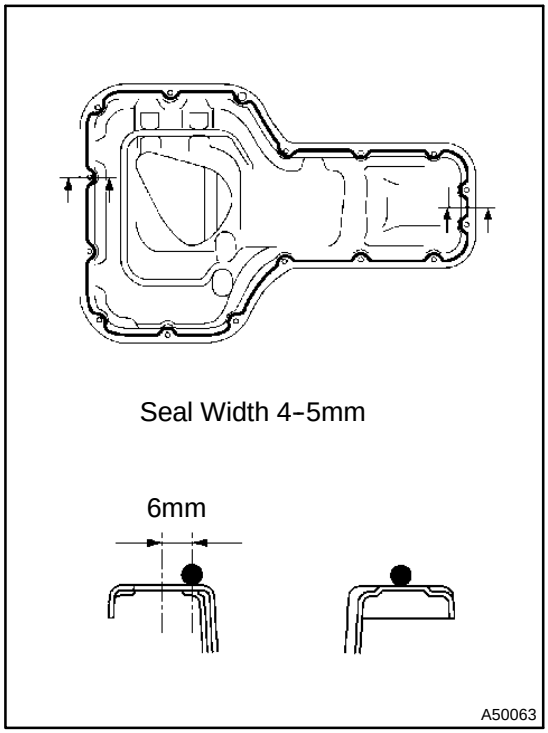
(d) Inspect camshaft journals.
   (1) Using a micrometer, measure the journal diameter.

   No. 1 journal diameter:
   34.449 - 34.465 mm (1.3563 - 1.3569 in.)
   Others journal diameter:
   22.949 - 22.965 mm (0.9035 - 0.9041 in.)

   (2) If the journal diameter is not as specified, check the oil clearance.

46. INSTALL OIL STRAINER SUB-ASSY
   [15104 / 1501]

(a) Install a new gasket and the oil strainer with the 2 nuts and a bolt.
   Torque: 9 N·m (92 kgf·cm, 80 in.·lbf)



47. INSTALL OIL PAN SUB–ASSY
[12101 / 1105]

(a) Remove any old packing material from the contact surface.

(b) Apply seal packing in the shape of bead (Diameter 3.5 mm – 4.5 mm(0.1379–0.177in)) consequently as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

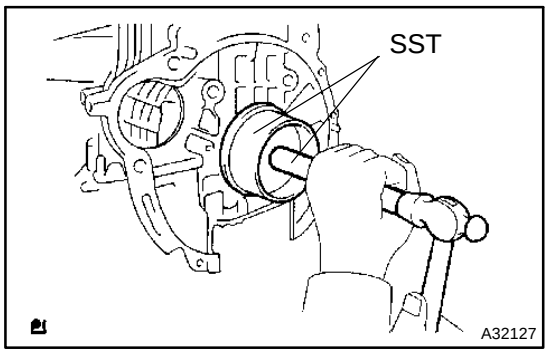
NOTICE:

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes after applying seal packing.
- Do not put into engine oil within 2 hours after installing.

(c) Install the oil pan with the 14 bolts and 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

48. INSTALL OIL PAN DRAIN PLUG
[12101A / 1105]

(a) Place a new gasket on the drain plug and install the oil pan drain plug.
Torque: 38 N·m (382 kgf·cm, 28 in.·lbf)



49. INSTALL ENGINE REAR OIL SEAL
[11401L / 1105]

(a) Apply MP grease to a new oil seal lip.

NOTICE:
Keep the lip off foreign materials.

(b) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–15030, 09950–70010 (09951–07100)

NOTICE:
Wipe off extra grease on the crank shaft.

50. INSTALL OIL COOLER ASSY(W/ OIL COOLER)
[15710 / 1503]

(a) Check and clean the oil cooler surface.

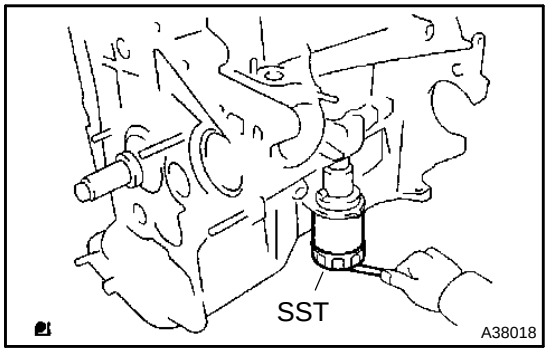
(b) Install the new O–ring to oil cooler.

(c) Apply clean engine oil to the O–ring.

(d) Using socket wrench (30mm), install the union and oil cooler.

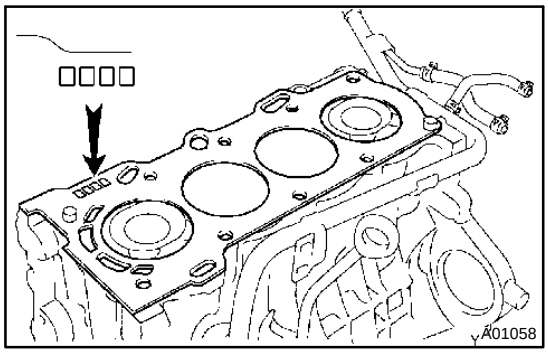
51. INSTALL OIL FILTER UNION(W/O OIL COOLER)
[15600A / 1502]

(a) Using a 12 mm hexagon wrench, install the oil filter union.
Torque: 30 N·m (306 kgf·cm, 21 in.·lbf)



52. INSTALL OIL FILTER SUB-ASSY
[15601 / 1502]

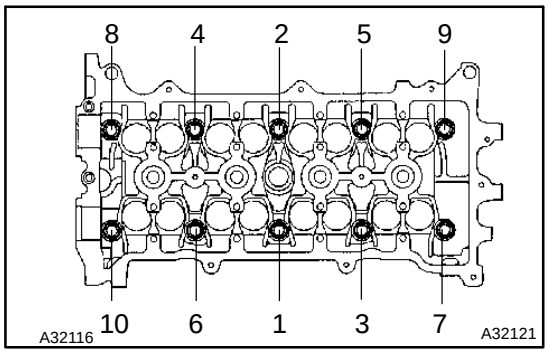
(a) Check and clean the oil filter installation surface.
(b) Apply clean engine oil to the gasket of a new oil filter.
(c) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
(d) Using SST, tighten it an additional 3/4 turn.
SST 09228-06501



53. INSTALL CYLINDER HEAD GASKET
[11115 / 1104]

(a) Place a new cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

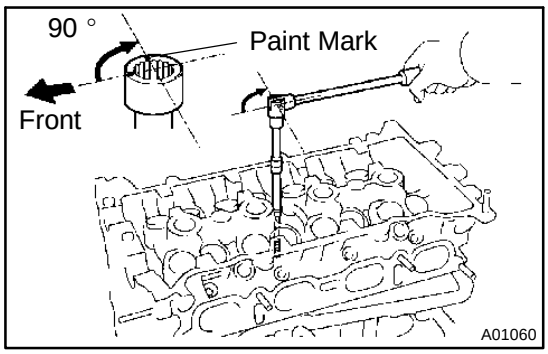
NOTICE:
- Pay attention to the installation direction.
- Place the cylinder head quietly in order not to damage the gasket with the bottom part of the head.



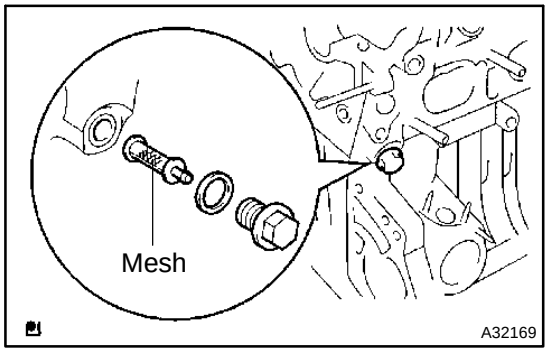
54. INSTALL CYLINDER HEAD SUB-ASSY
[11101 / 1104]

HINT:
The cylinder head bolts are tightened in 2 progressive steps.

(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
(b) Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 10 cylinder head bolts with plate washers, in several passes, in the sequence shown.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)
(c) Mark the front of the cylinder head bolt with paint.
(d) Retighten the cylinder head bolts 90 ° in the numerical order shown.
(e) Check that the point marked bolts are moved at 90 ° angle.

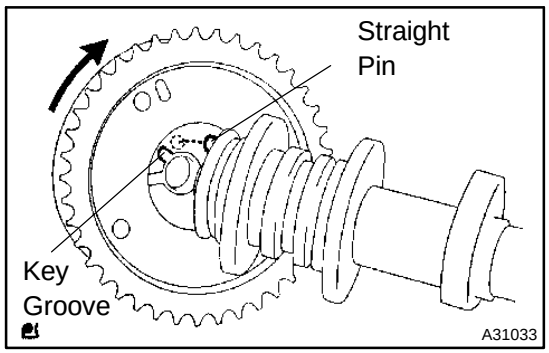


55. INSTALL ENGINE HANGER NO.1
[12281A / 1104]
Torque: 38 N·m (387 kgf·cm, 28 ft·lbf)



56. INSTALL OIL CONTROL VALVE FILTER
[15678A / 1104]
(a) Confirm that the filter is clear.
(b) Place a new gasket on the bolt and install the filter.
Torque: 30 N·m (306 kgf·cm, 22 ft·lbfi)

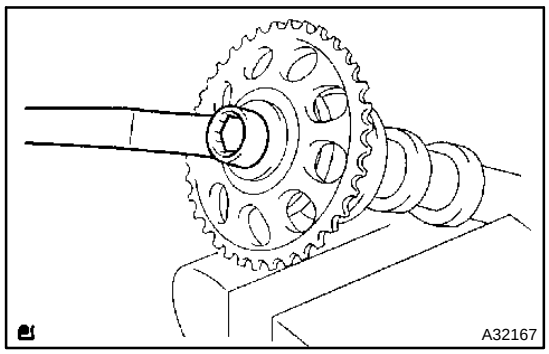
57. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY
[11101J / 1104]
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)



58. INSTALL CAMSHAFT TIMING GEAR ASSY
[13050 / 1302]
(a) Put the camshaft timing gear assembly and the camshaft together with the straight pin off the key groove.
(b) Turn the camshaft timing gear assembly to the left direction (as shown in the illustration) with pushing it lightly against the camshaft. Push further at the position where the pin gets into the groove.

CAUTION:
Be sure not to turn the camshaft timing gear to the retard angle side (to the right angle).

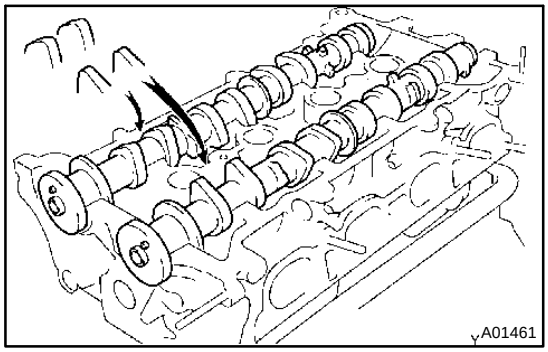
(c) Check that there is no clearance between the gear's fringe and the camshaft.
(d) Tighten the fringe bolt with the camshaft timing gear fixed.
Torque: 54 N·m (551 kgf·cm 40 ft·lbf)
(e) Check that the camshaft timing gear assembly can move to the retard angle side (the right angle), and is locked at the most retarded position.



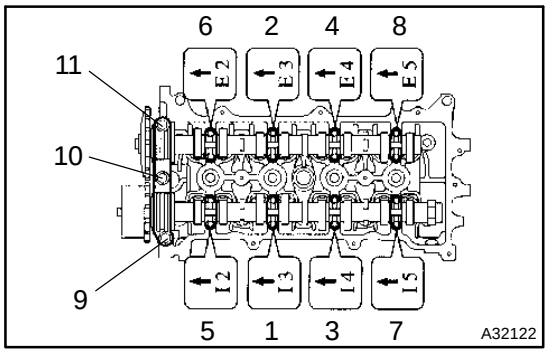
59. INSTALL CAMSHAFT TIMING GEAR OR SPROCKET
[13523 / 1302]
(a) Grip the camshaft with a vice, and install the camshaft timing gear.
Torque: 54 N·m (551 kgf·cm 40 ft·lbf)

NOTICE:
Be careful not to damage the camshaft.

60. INSTALL CAMSHAFT
(a) Apply light coat of engine oil on the camshaft journals.



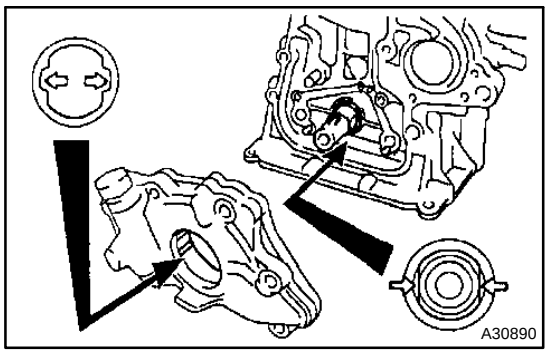
(b) Place the 2 camshafts on the cylinder head with the No. 1 cam lobes facing as shown the illustration.



(c) Examine the front marks and numbers and tighten the bolts in the order shown in the illustration.
Torque:
Bearing cap No. 1 23 N·m (235 kgf·cm, 17 ft·lbf)
Bearing cap No. 3 13 N·m (133 kgf·cm, 10 ft·lbf)

61. INSTALL OIL PUMP GASKET
[15193 / 1501]

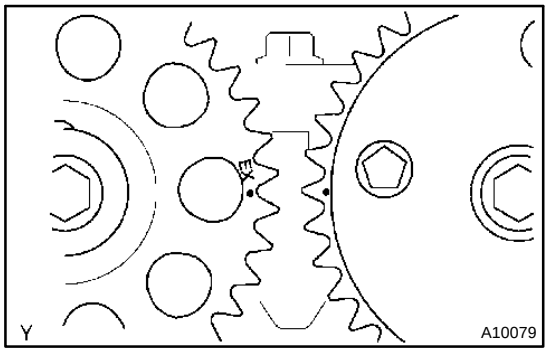
(a) Place a new gasket on the cylinder block.



62. INSTALL OIL PUMP ASSY
[15100 / 1501]

(a) Engage the spline teeth of the oil pump drive rotor with the large teeth of the crankshaft, and side the oil pump.

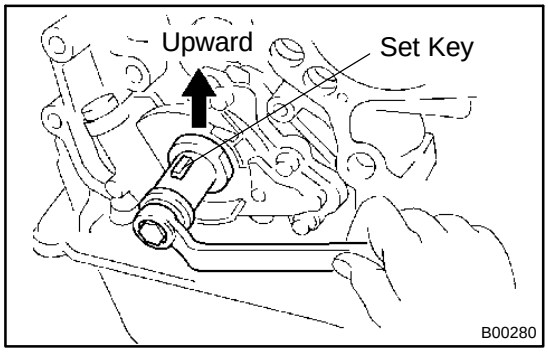
(b) Install the oil pump with the 5 bolts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



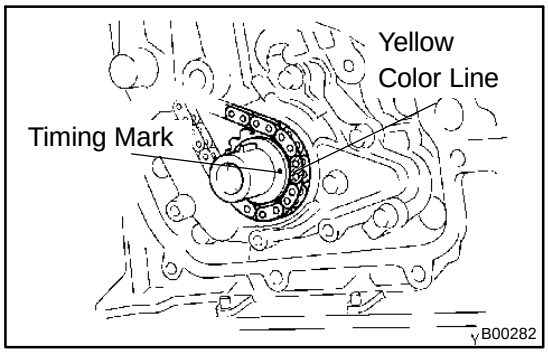
63. INSTALL CHAIN SUB-ASSY
[13506 / 1302]

(a) Set No. 1 cylinder to TDC/compression.

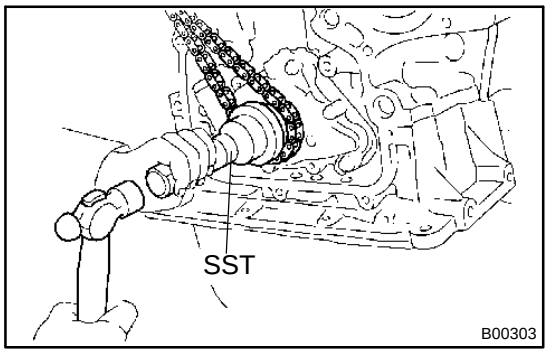
(1) Turn the hexagonal wrench head portion of the camshafts, and align the point marks of the camshaft timing sprockets.



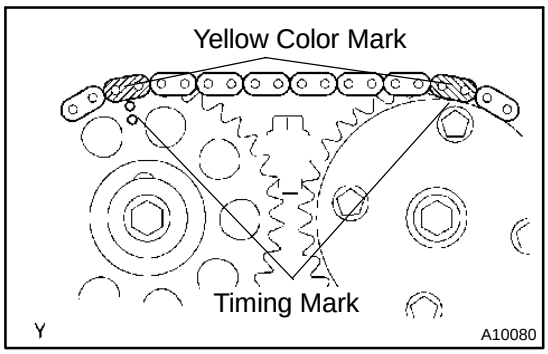
(2) Using a crankshaft pulley bolt, turn the crankshaft and set the set key on the crankshaft upward.



(b) Install the timing chain on the crankshaft timing sprocket with the yellow color link aligned with the timing mark on the crankshaft timing sprocket.



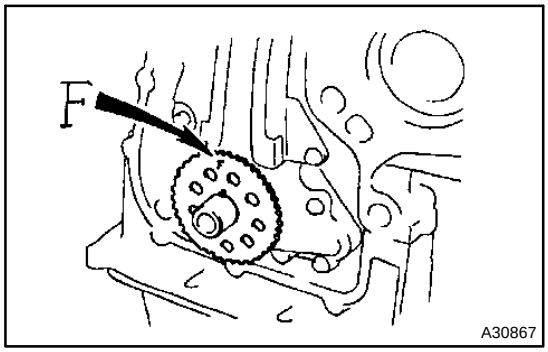
(c) Using a SST, install the sprocket.
SST 09223–22010



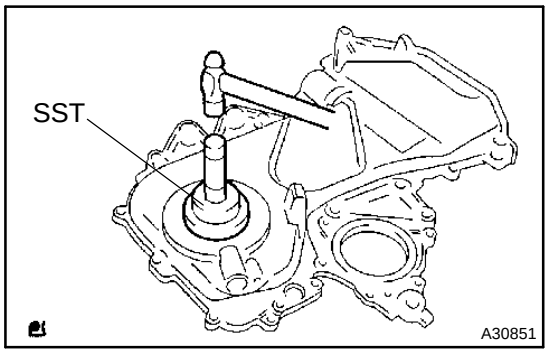
(d) Install the timing chain on the camshaft timing sprockets with the yellow color links aligned with the timing marks on the camshaft timing sprockets.

64. INSTALL CHAIN VIBRATION DAMPER NO.1
[13561 / 1302]
Torque: 11 N·m (112 kgf·cm, 8 ft·lbf)

65. INSTALL CHAIN TENSIONER SLIPPER
[13559 / 1302]
Torque: 19 N·m (189 kgf·cm, 15 ft·lbf)

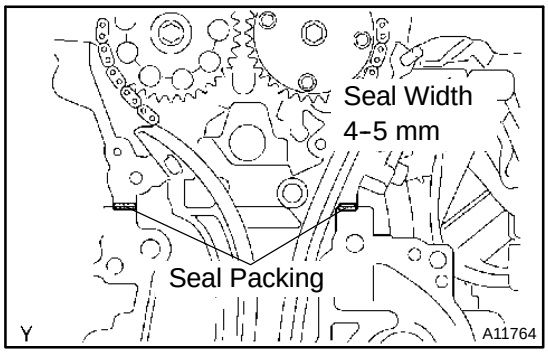


66. INSTALL CRANKSHAFT POSITION SENSOR PLATE NO.1
[19315 / 1301]
(a) Install the plate with the "F" mark facing forward.

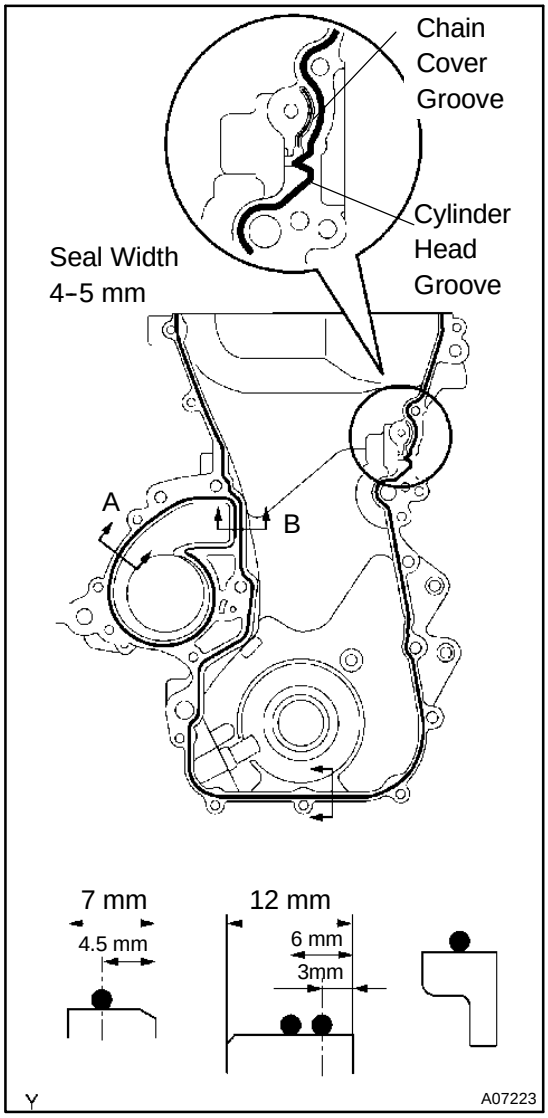


67. INSTALL TIMING GEAR COVER OIL SEAL
[11302A / 1106]
(a) Apply MP grease to the oil seal lip.
(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the timing chain cover edge.
SST 09223-22010

NOTICE:
Keep the lip off foreign materials.



68. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSY
[11302 / 1106]
(a) Remove any old packing material from the contact surface.



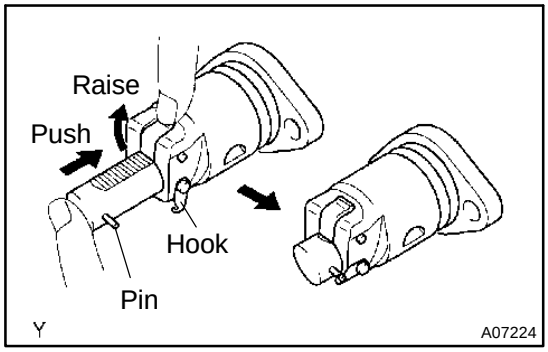
(b) Apply seal packing in the shape of bead (Diameter 3.5 mm – 4.5 mm(0.1379–0.177in)) consequently as shown in the illustration.
Seal packing:
Water pump part part No. 08826–00100 or equivalent
Other part part No. 08826–00080 or equivalent

(c) Install the timing chain cover, with the 12 bolts and nut.
Torque:
13 N·m (133 kgf·cm, 10 ft·lbf)
19 N·m (189 kgf·cm, 14 ft·lbf) (M8)

NOTICE:

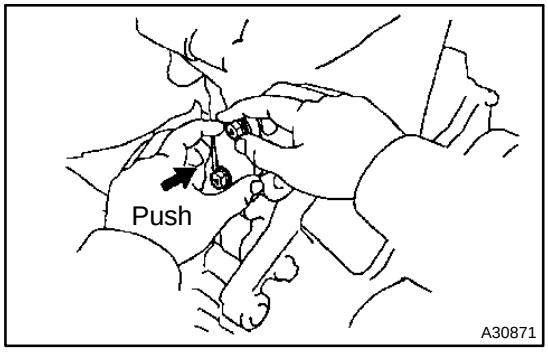
- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes after applying seal packing.
- Do not put into engine oil within 2 hours after installing.

(d) Using a torx wrench socket (E8), install the stud bolt.



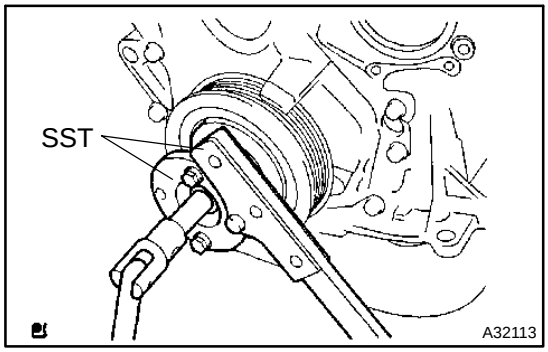
69. INSTALL CHAIN TENSIONER ASSY NO.1
[13540 / 1302]

(a) Check the O–ring is clean, and set the hook as shown in the illustration.



(b) Apply engine oil to the chain tensioner and install it.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

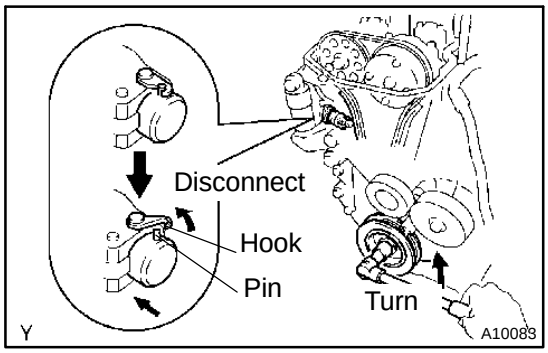
NOTICE:
When installing the tensioner, set the hook again if the hook releases the plunger.



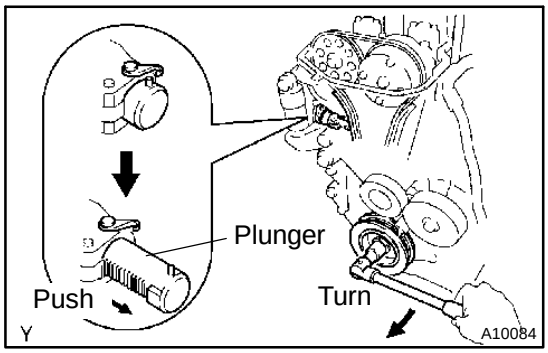
70. INSTALL CRANKSHAFT PULLEY
[13471 / 1301]

(a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.

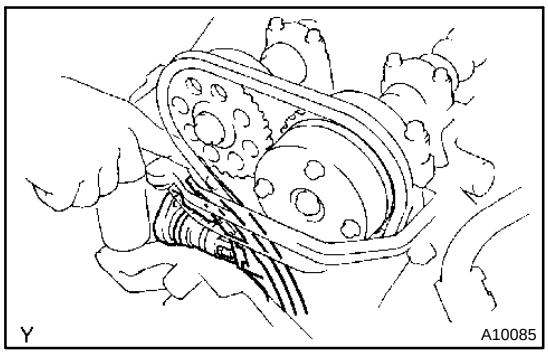
(b) Using SST, install the pulley bolt.
SST 09213-70011, 09330-00021
Torque: 138 N·m (1,407 kgf·cm, 102 ft·lbf)



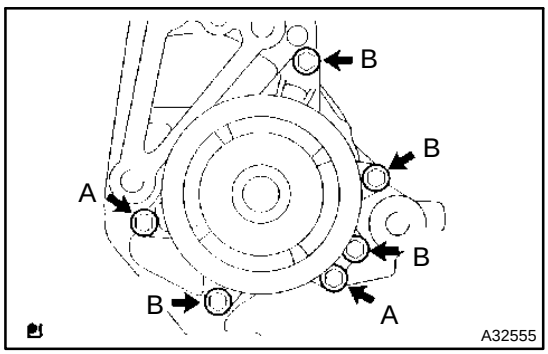
(c) Turn the crankshaft counterclockwise, and disconnect the plunger knock pin from the hook.



(d) Turn the crankshaft clockwise, and check that the slipper is pushed by the plunger.



HINT:
If the plunger does not spring out, press the slipper into the chain tensioner with a screwdriver or your finger so that the hook is released from the knock pin and the plunger springs out.



71. INSTALL WATER PUMP ASSY
[16100 / 1601]

(a) Place a new O-ring on the timing chain cover.

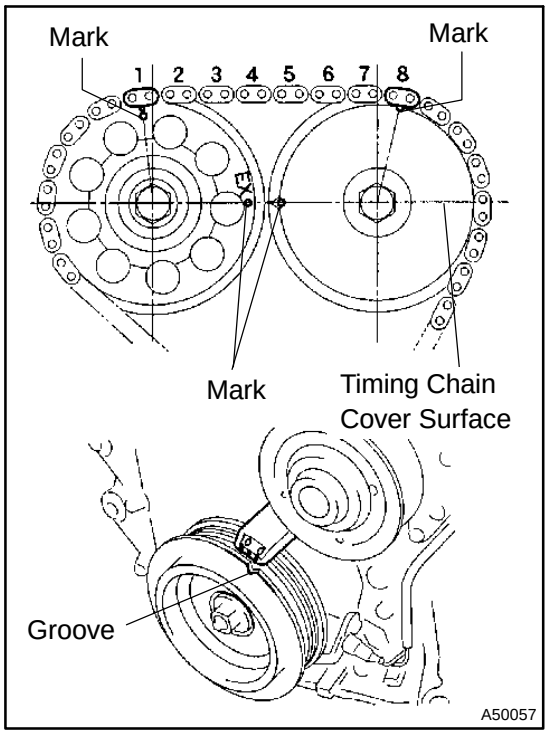
(b) Install the water pump with the 6 bolts.
Torque:
9.0 N·m (92 kgf·cm, 80 in·lbf) for Bolt A
11 N·m (112 kgf·cm, 8 ft·lbf) for Bolt B

HINT:
Each bolt length is indicated in the illustration.

Bolt A	30 mm (1.18 in.)
Bolt B	35 mm (1.38 in.)

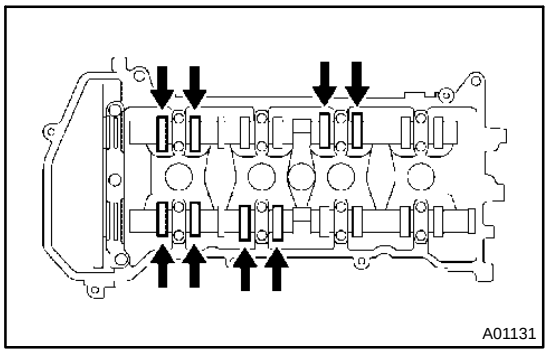
72. INSTALL TRANSVERSE ENGINE ENGINE MOUNTING BRACKET
[12315A / 1107]
Torque: 47 N·m (479 kgf·cm, 35 ft·lbf)

73. INSPECT VALVE CLEARANCE



(a) Set No. 1 cylinder to TDC/compression.
(1) Turn the crankshaft pulley, and align its groove with timing mark ”0” of the timing chain cover.
(2) Check that the point marks of the camshaft timing sprocket and VVT timing sprocket are in straight line on the timing chain cover surface as shown in the illustration.

HINT:
If not, turn the crankshaft 1 revolution (360°) and align the marks as above.

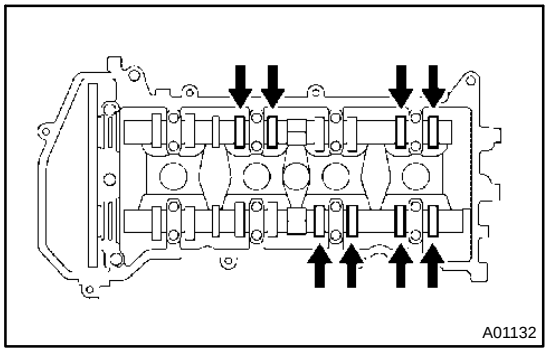


(b) Check only the valves indicated.
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
(2) Record the out-of specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold)

Intake	0.15 - 0.25 mm (0.006 - 0.010 in.)
Exhaust	0.25 - 0.35 mm (0.010 - 0.014in.)

(c) Turn the crankshaft 1 revolution (360 °) and set No. 4 cylinder to TDC/compression.



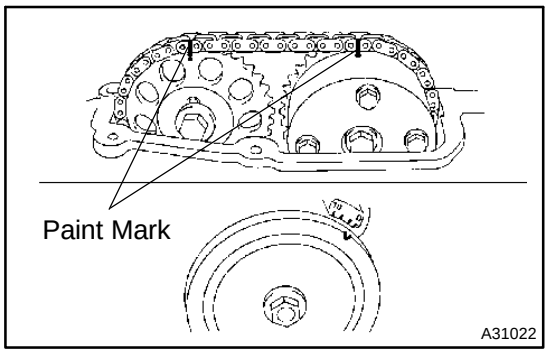
(d) Check only the valves indicated.
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
(2) Record the out-of specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold)

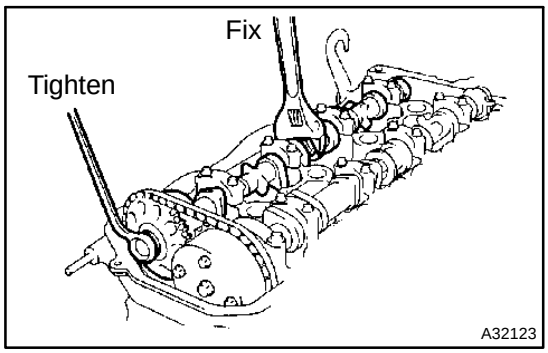
Intake	0.15 - 0.25 mm (0.006 - 0.010 in.)
Exhaust	0.25 - 0.35 mm (0.010 - 0.014in.)

74. ADJUST VALVE CLEARANCE

NOTICE:
Be sure not to revolve the crankshaft without the chain tensioner.

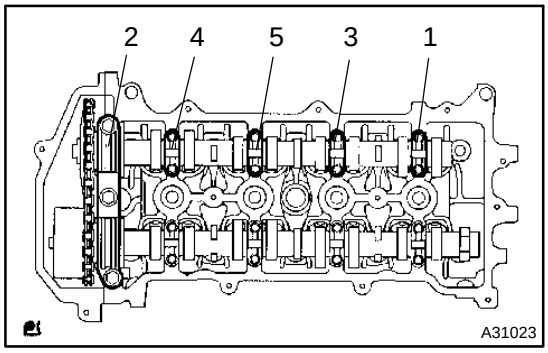


(a) Set the No. 1 cylinder to the TDC/compression.
(b) Place match marks on the timing chain and camshaft timing sprockets.
(c) Remove the 2 bolts and chain tensioner.

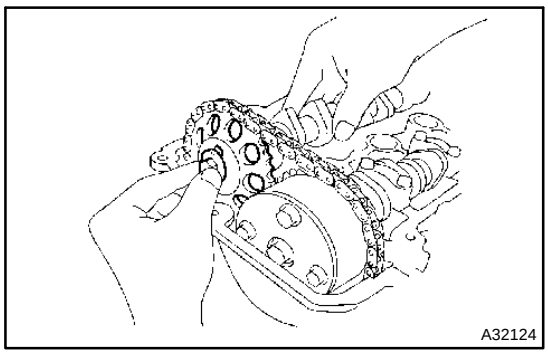


(d) Fix the camshaft with a spanner and so on, then loosen the camshaft timing gear set bolt.

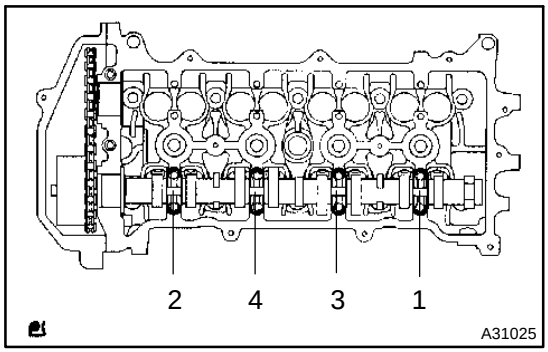
NOTICE:
Be careful not to damage the valve lifter.



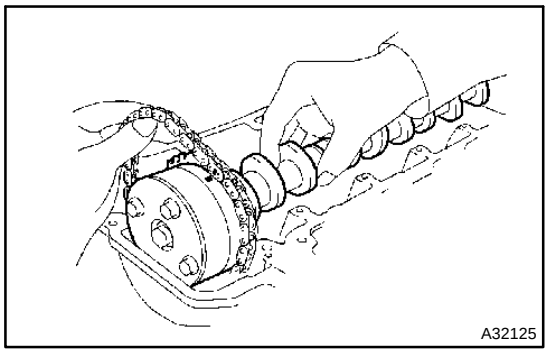
(e) Loosen the camshaft bearing cap bolts on No. 2 camshaft in the order as shown in the illustration in several passes, and remove the caps.



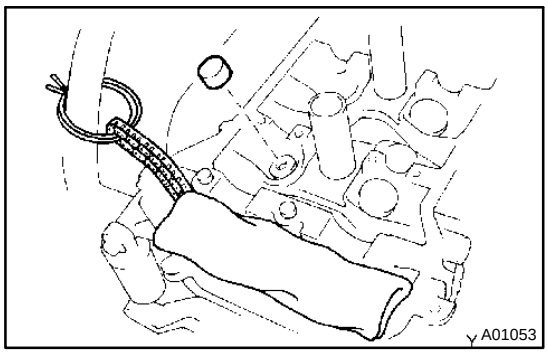
(f) Remove the camshaft timing gear as shown in the illustration.



(g) Loosen the camshaft bearing cap bolts on camshaft in the order as shown in the illustration in several passes, and remove the caps.



(h) Remove the camshaft with holding the timing chain.

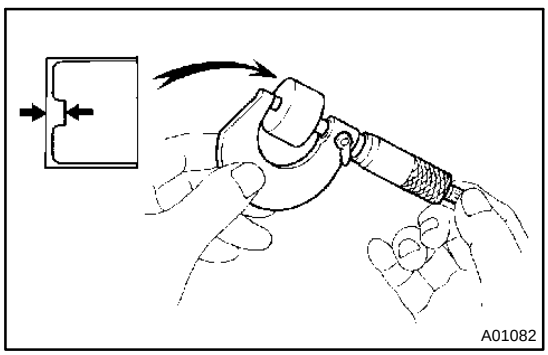


(i) Tie the timing chain with a string as shown in the illustration.

NOTICE:

Be careful not to drop anything inside the timing chain cover.

(j) Remove the valve lifters.



(k) Using a micrometer, measure the thickness of the removed lifters.

(l) Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

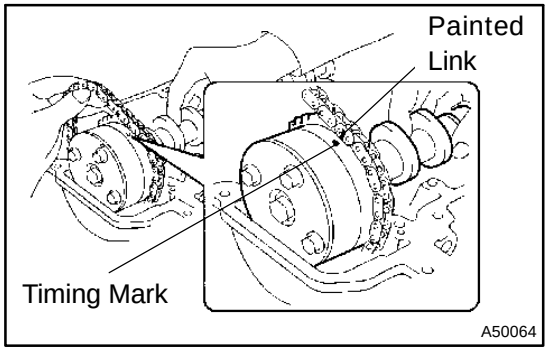
A	Thickness of new lifter
B	Thickness of used lifter
C	Measured valve clearance

Intake: A = B + (C - 0.20 mm (0.008 in.))

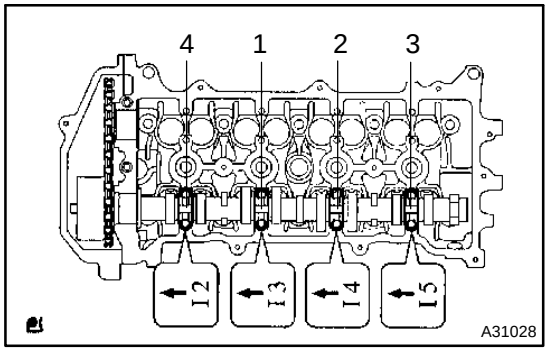
Exhaust: A = B + (C - 0.30 mm (0.012 in.))

HINT:

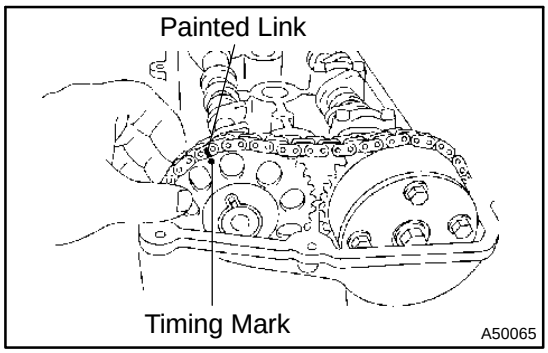
- Select a new lifter with a thickness as close as possible to the calculated values.
- Lifter are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 mm (0.1992 in.) to 5.740 mm (0.2260 in.).



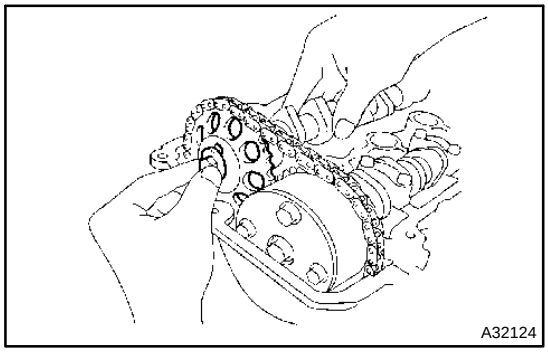
(m) As shown in the illustration, install the timing chain on the camshaft timing gear, with the painted links aligned with the timing marks on the camshaft timing sprockets.



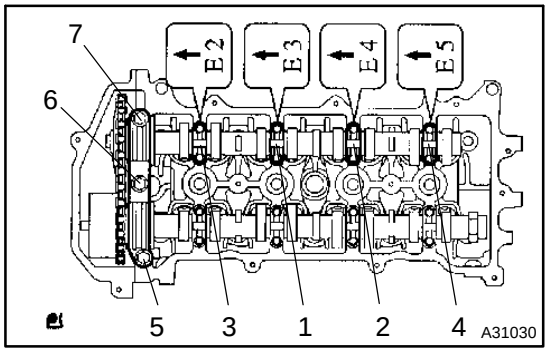
(n) Examine the front marks and numbers and tighten the bolts in the order shown in the illustration.
Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)



(o) Put the camshaft No.2 on the cylinder head with the painted links of the chain aligned with the timing mark on the camshaft timing sprockets.

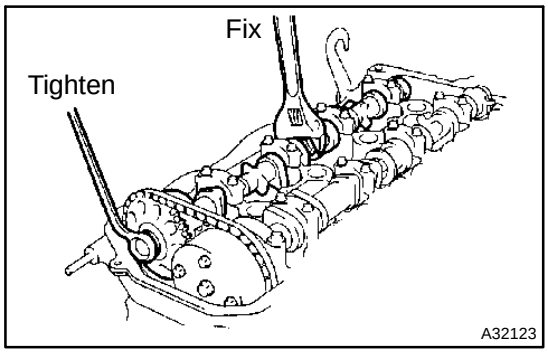


(p) Tighten the set bolt temporarily.



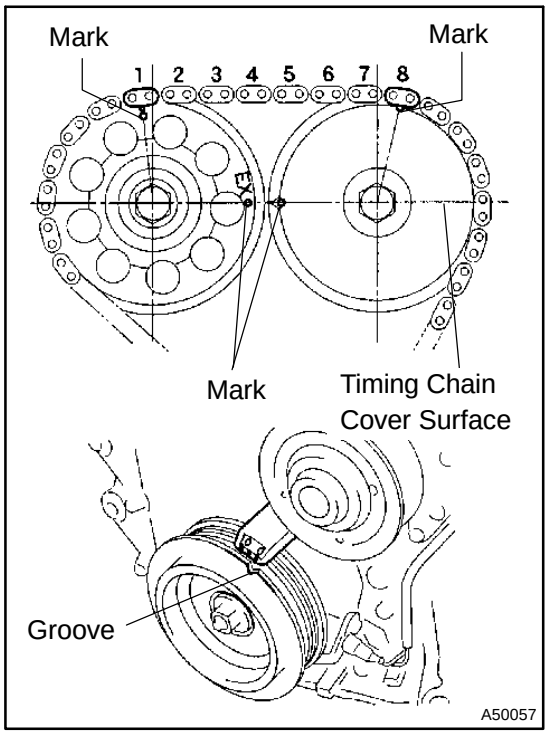
(q) Examine the front marks and numbers and tighten the bolts in the order shown in the illustration.
Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)

(r) Install the bearing cap No. 1.
Torque: 23 N·m (235 kgf·cm, 17 ft·lbf)



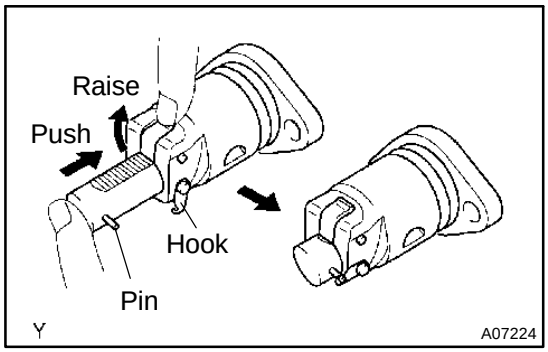
(s) Fix the camshaft with a spanner and so on, then tighten the camshaft timing gear set bolt.
Torque: 54 N·m (551 kgf·cm, 40 ft·lbf)

NOTICE:
Be careful not to damage the valve lifter.

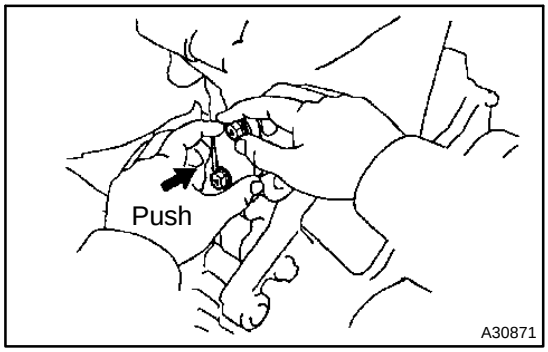


(t) Check the match marks on the timing chain and camshaft timing sprockets, and then the alignment of the pully groove with timing mark of the chain cover as shown in the illustration.

(u) Install chain tensioner.

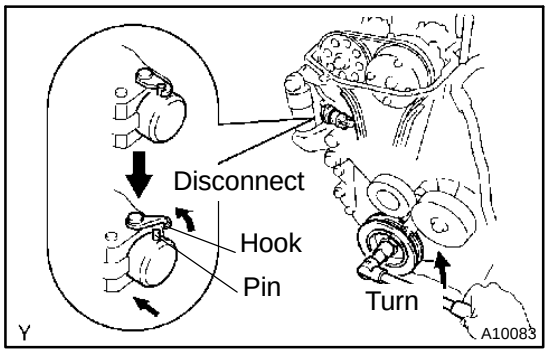


(1) Check the O-ring is clean, and set the hook as shown in the illustration.

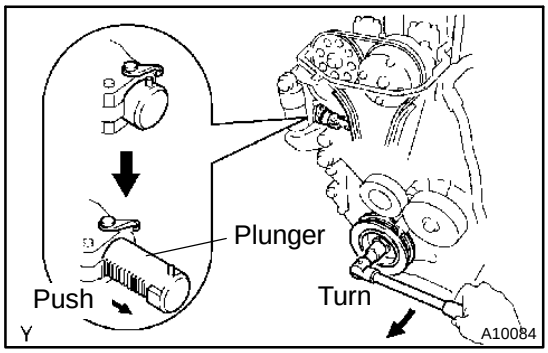


(2) Apply engine oil to the chain tensioner and install it.
Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)

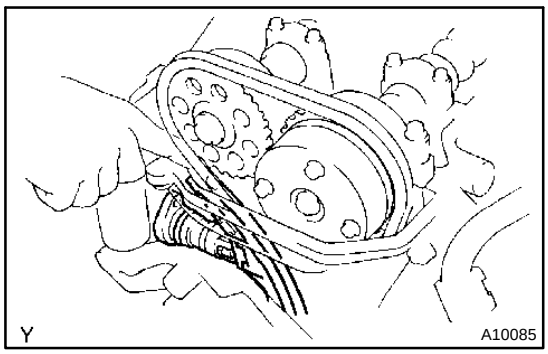
NOTICE:
When installing the tensioner, set the hook again if the hook release the plunger.



(3) Turn the crankshaft counterclockwise, and disconnect the plunger knock pin from the hook.



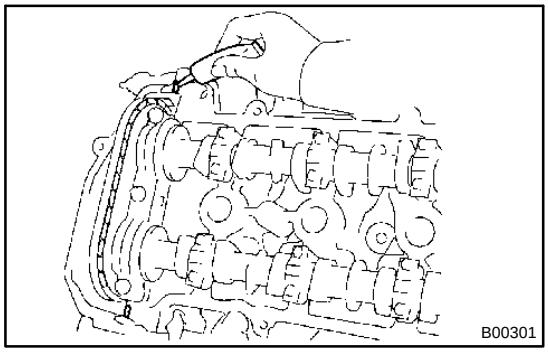
(4) Turn the crankshaft clockwise, and check that the slipper is pushed by the plunger.



HINT:
If the plunger does not spring out, press the slipper into the chain tensioner with a screwdriver or your finger so that the hook is released from the knock pin and the plunger springs out.

75. INSTALL CYLINDER HEAD COVER SUB-ASSY
[11201 / 1104]

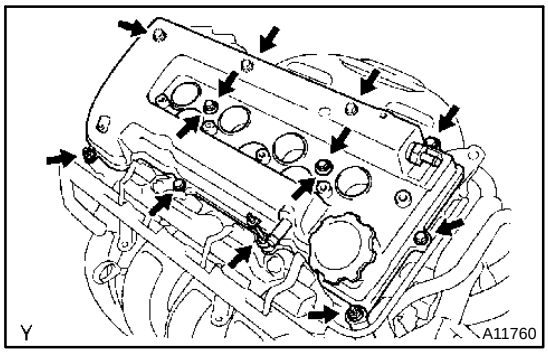
(a) Install the gasket to the cylinder head cover.
(b) Remove any old packing (FIPG) material.



(c) Apply seal packing to 2 locations as shown in the illustration.
Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

- Remove any oil from the contact surface.
- Install the cylinder head cover within 3 minutes after applying seal packing.
- Do not put into engine oil 2 hours after installing.



(d) Install the cylinder head cover and cable bracket with the 9 bolts, 2 seal washers and 2 nuts
Uniformly tighten the bolts and nuts, in the several passes.
Torque:
w/o washer: 11 N·m (112 kgf·cm, 8 ft·lbf)
Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)

76. INSTALL SPARK PLUG
[19100P / 1901]
Torque: 25 N·m (225 kgf·cm, 18 ft·lbf)

CYLINDER HEAD ASSY (1ZZ-FE/3ZZ-FE)

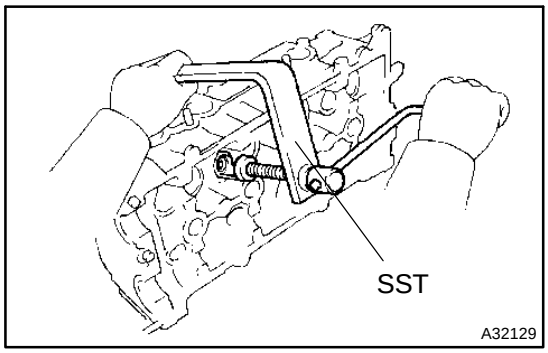
1400Y-01

OVERHAUL

1. REMOVE W/HEAD TAPER SCREW PLUG NO.2
   [11117B / 1104]

(a) Using hexagon socket wench (10), remove the taper screw plug.

2. REMOVE WATER HOLE GASKET
   [11117H / 1104]
3. REMOVE VALVE LIFTER
   [13751 / 1302]

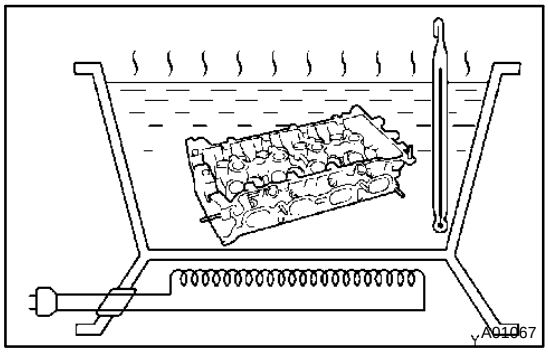


4. REMOVE INNER COMPRESSION SPRING
   [13711B / 1302]

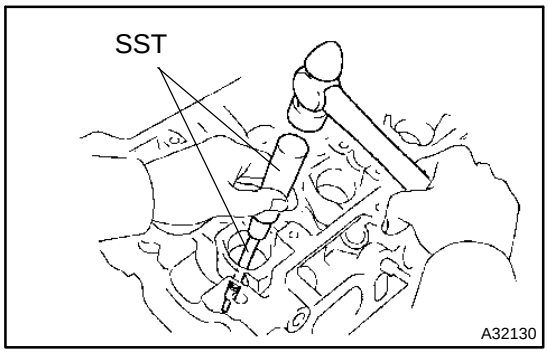
(a) Using SST, compress the valve spring and remove the 2 keepers, the retainer, and the spring seat.
SST 09202-70020

5. REMOVE VALVE STEM OIL O SEAL OR RING
   [13711A / 1302]
6. REMOVE INTAKE VALVE
   [13711 / 1302]

7. REMOVE INTAKE VALVE GUIDE BUSH
   [11122 / 1104]

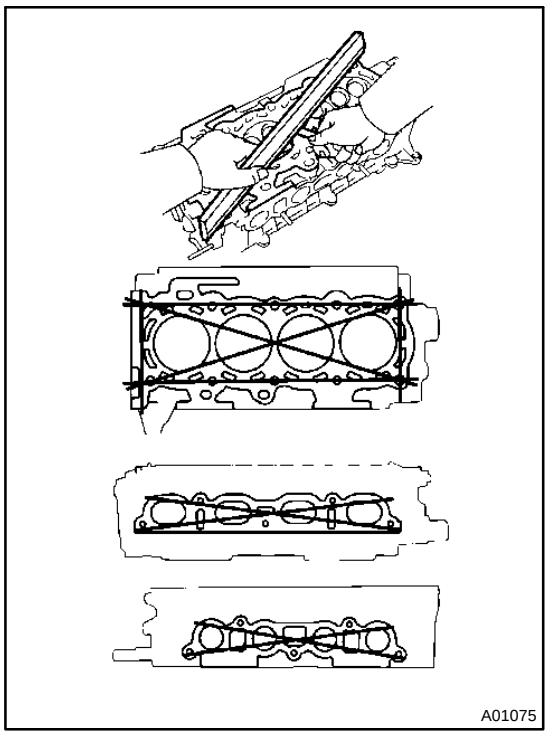


(a) Heat the cylinder head to 80 - 100°C (176 - 212°F).



(b) Using SST and a hammer, tap out the guide bushing.
SST 09201-10000, 09201-01055, 09950-70010 (09951-07100)

8. REMOVE STUD BOLT

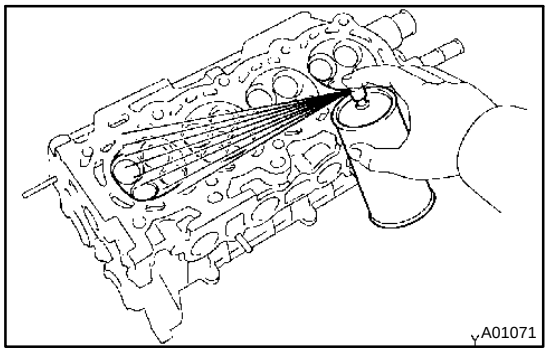


9. INSPECT CYLINDER HEAD FOR FLATNESS

(a) Using a precision straight edge and a feeler gauge, measure the surface contacting the cylinder block and the manifolds for warpage.

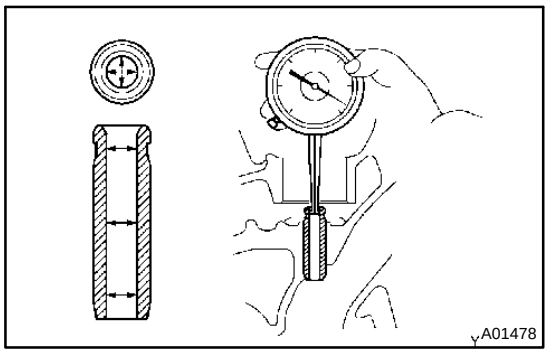
Maximum warpage:

Cylinder block side	0.05 mm (0.0020 in.)
Intake manifold side	0.10 mm (0.0040 in.)
Exhaust manifold side	0.10 mm (0.0040 in.)



10. INSPECT CYLINDER HEAD FOR CRACKS

(a) Using a dye penetrate, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

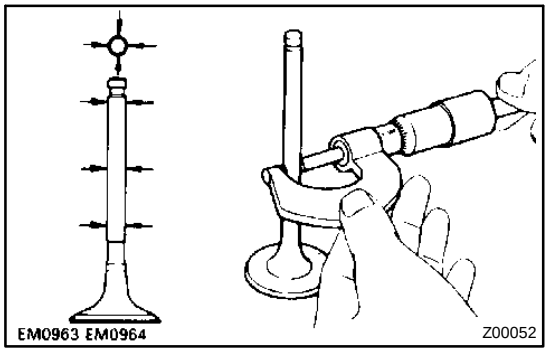


11. INSPECT VALVE GUIDE BUSHING OIL CLEARANCE

(a) Using a caliper gauge, measure the inside diameter of the guide bushing.

Busing inside diameter:

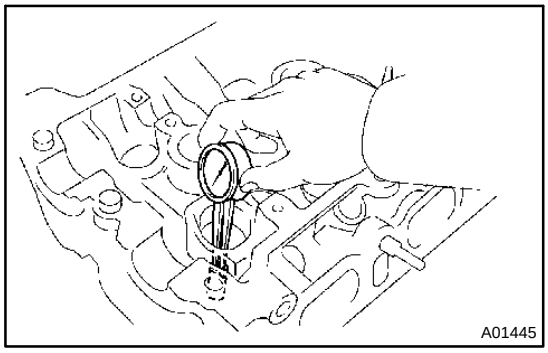
5.510 – 5.530 mm (0.2169 – 0.2177 in.)



(b) Using a micrometer, measure the diameter of the valve stem.
Valve stem diameter:
Intake 5.470 - 5.485 mm (0.2154 - 0.2159 in.)
Exhaust 5.465 - 5.480 mm (0.2152 - 0.2157 in.)

(c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.
Standard oil clearance:
Intake 0.025 - 0.060 mm (0.0010 - 0.0024 in.)
Exhaust 0.030 - 0.065 mm (0.0012 - 0.0026 in.)
Maximum oil clearance
Intake 0.08 mm (0.0031 in.)
Exhaust 0.01 mm (0.0039 in.)

12. INSPECT EXHAUST VALVE GUIDE BUSH
[11126 / 1104]



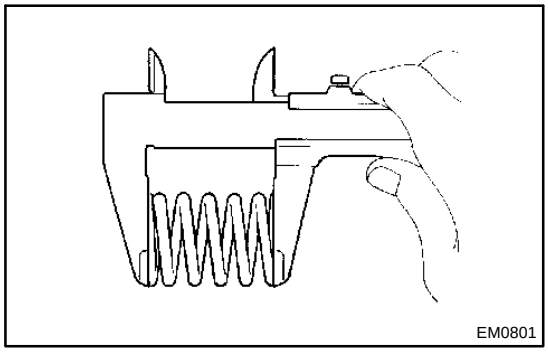
(a) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.
Diameter: 10.285 - 10.306 mm (0.4049 - 0.4057 in.)

(b) If the bushing bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bushing bore to the dimension of 10.335 - 10.356 mm (0.4068-0.4077 in.) to install a over size bushing.

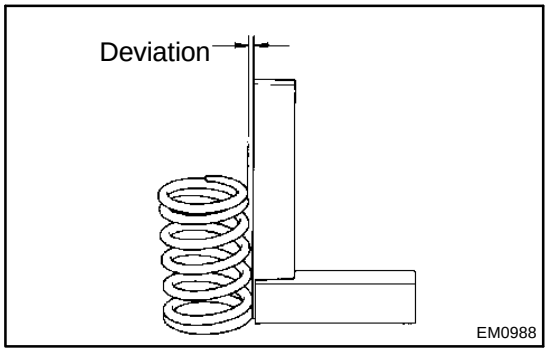
HINT:

bushing bore diameter mm (in.)	Bushing size
10.285 - 10.306 (0.4049 - 0.4057)	Use STD
10.335 - 10.356 (0.4068 - 0.4077)	Use O/S 0.05

13. INSPECT INNER COMPRESSION SPRING
[13711B / 1302]

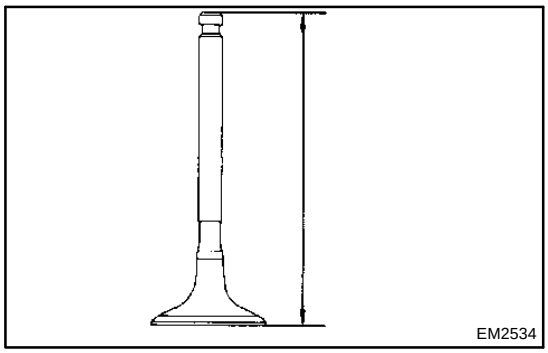


(a) Using a vernier caliper, measure the free length of the valve spring.
Free length: 43.40 mm (1.7087 in.)

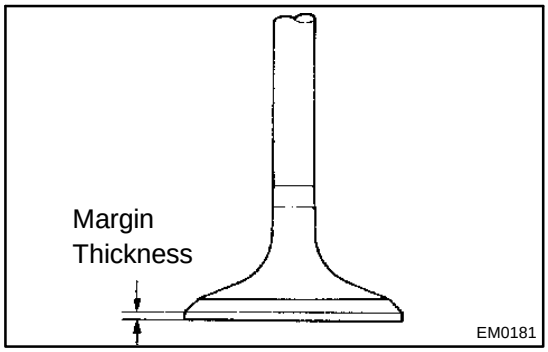


(b) Using a steel square, measure the deviation of the valve spring.
Maximum deviation: 2.0 mm (0.078 in.)
Maximum angle (reference) : 2°

14. INSPECT INTAKE VALVE
[13711 / 1302]



(a) Check the valve overall length.
Standard overall length:
Intake 88.65 mm (34902 in.)
Exhaust 88.69 mm (34917 in.)
Minimum overall length:
Intake 88.35 mm (34783 in.)
Exhaust 88.39 mm (34799 in.)

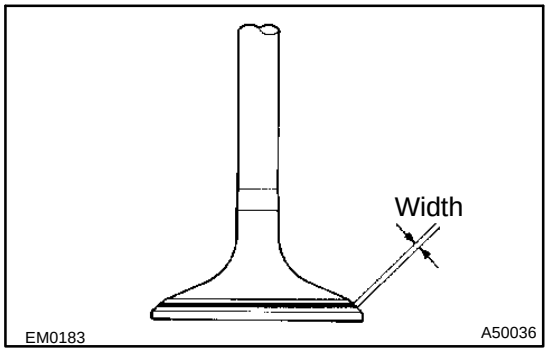


(b) Check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.7 mm (0.028 in.)

15. INSPECT VALVE SEATS
SST 99999-60014

(a) Apply a light coat of prussian blue (or white lead) to the valve face.

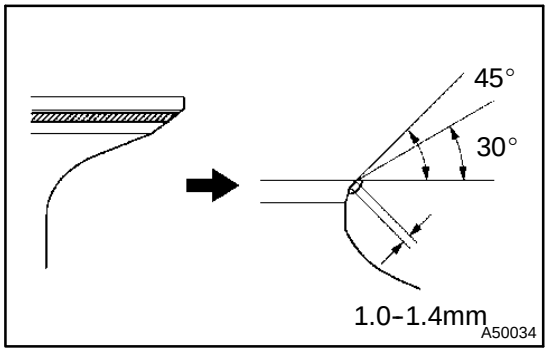
(b) Lightly press the valve against the seat.



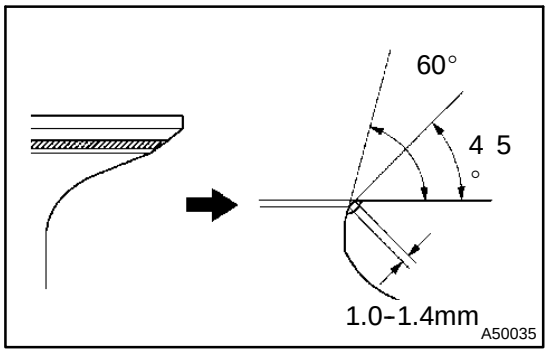
(c) Check the valve face and seat according to the following procedure.
(1) If blue appears 360 ° around the face, the valve is concentric. If not, replace the valve.
(2) If blue appears 360 ° around the valve seat, the guide and face are concentric. If not, resurface the seat.
(3) Check that the seat contact is in the middle of the valve face with the width between 1.0 – 1.4 mm (0.039 – 0.055 in.).

16. REPAIR VALVE SEATS

NOTICE:
Take off a cutter gradually to make smooth valve seats.



(a) If the seating is too high on the valve face, use 30 ° and 45 ° cutters to correct the seat.

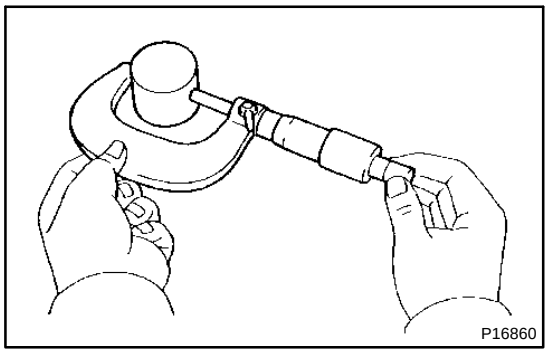


(b) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.

(c) Hand-lap the valve and valve seat with an abrasive compound.

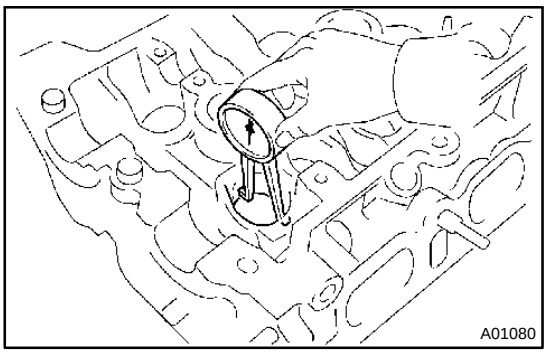
(d) Check the valve seating position.

17. INSPECT VALVE LIFTER
[13751 / 1302]



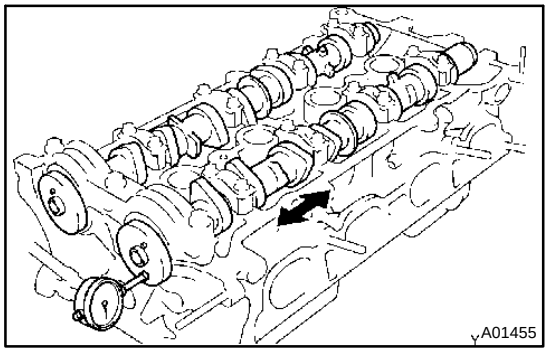
(a) Using a micrometer, measure the lifter diameter.
Lifter diameter:
30.966 - 30.976 mm (1.2191 -1.2195 in.)

18. INSPECT VALVE LIFTER OIL CLEARANCE



(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.
Lifter bore diameter:
31.000 - 31.025 mm (1.2205 - 1.2215 in.)

(b) Subtract the lifter diameter measurement from the lifter bore diameter measurement.
Standard oil clearance:
0.024 - 0.059 mm (0.0009 - 0.0023 in.)
Maximum oil clearance: 0.1 mm (0.0039 in.)



19. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshafts.

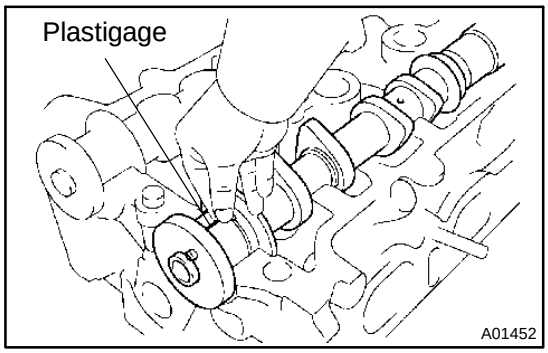
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
0.040 – 0.095 mm (0.0016 – 0.0037 in.)
Maximum thrust clearance: 0.11 mm (0.0043 in.)

(c) If the thrust clearance is greater than maximum, replace the cylinder head. If damages are found on the camshaft thrust surfaces, the camshaft also has to be replaced.

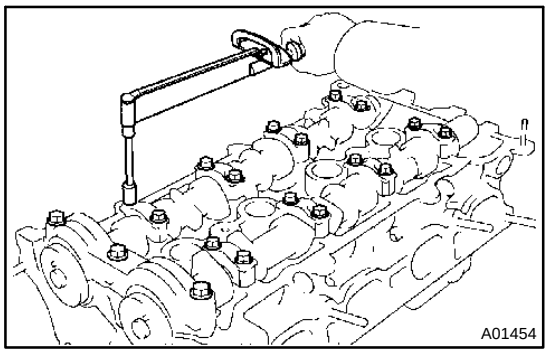
20. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.



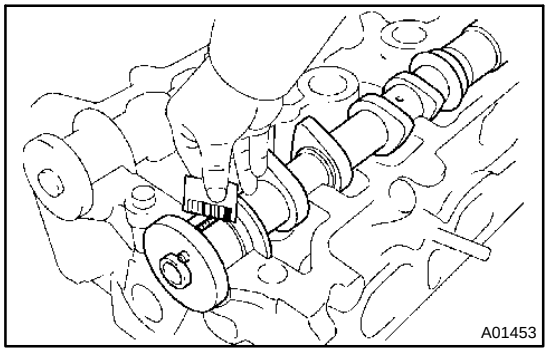
(c) Lay a strip of Plastigage across each of the camshaft journal.



(d) Install the bearing caps
Torque:
No. 1 23 N·m (235 kgf·cm, 17 ft·lbf)
No. 3 13 N·m (133 kgf·cm, 10 ft·lbf)

NOTICE:
Do not turn the camshaft.

(e) Remove the bearing caps.

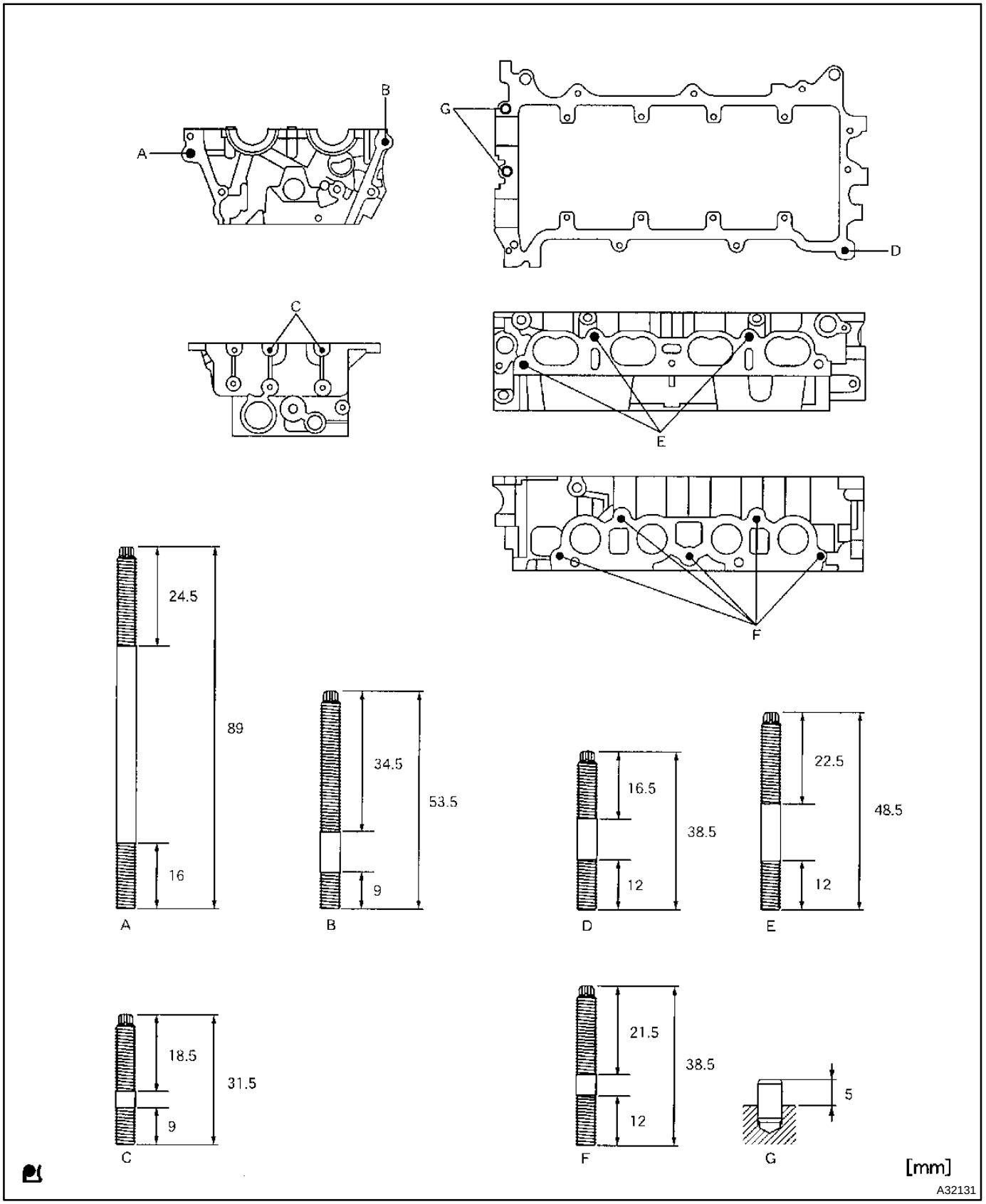


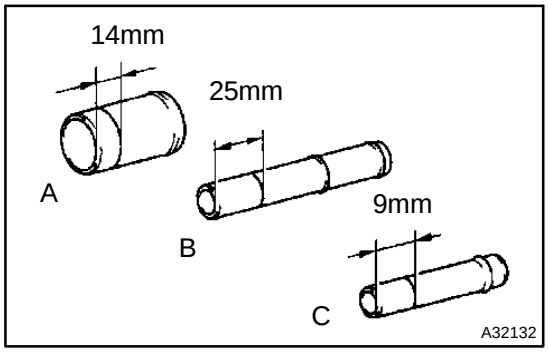
(f) Measure the plastigage at its widest point.
Standard oil clearance:
0.035 – 0.072 mm (0.0014 – 0.0028 in.)
Maximum oil clearance: 0.010 mm (0.0039 in.)

NOTICE:
Completely remove the Plastigage after the measuring.

(g) If the oil clearance is greater than maximum, replace the cylinder head.

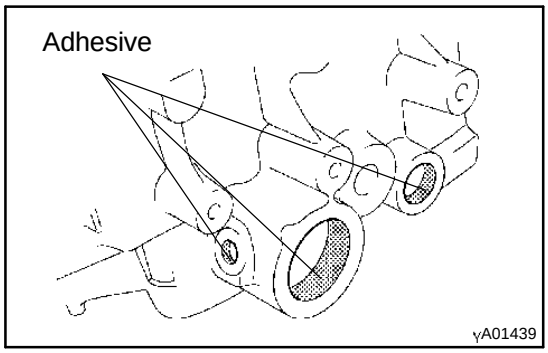
21. INSTALL STUD BOLT AND RING PIN



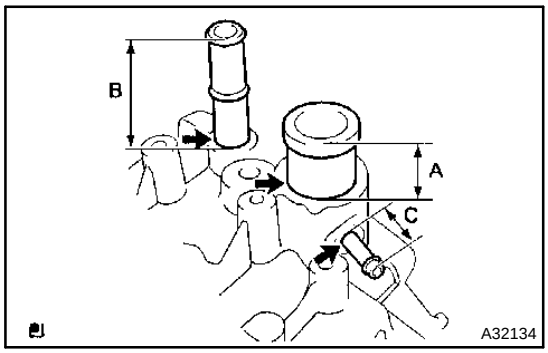


22. INSTALL UNION

(a) Mark the standard position away from the edge, onto the water hose union as shown in the illustration.



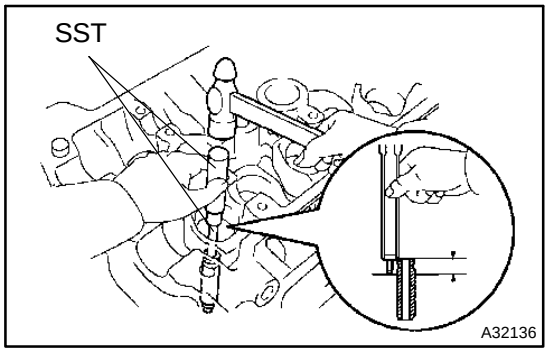
(b) Apply adhesive to the water hose union hole of the cylinder head.
Adhesive:
Part No. 08833-00070, THREE BOND 1324 or equivalent.



(c) Using a press, press in a new water hose union until the standard marks come to the level of the cylinder head surface.
Standard protrusion:
A 29 mm (1.14 in.)
B 66.5 mm (2.618 mm)
C 24 mm (0.95 mm)

NOTICE:

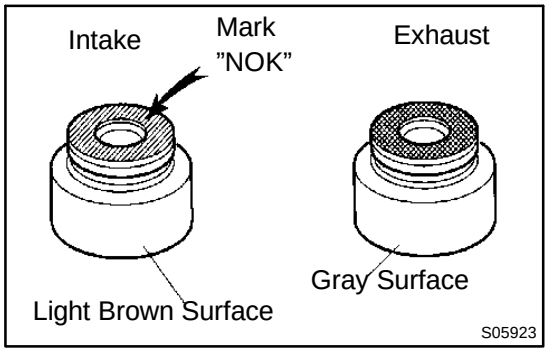
- Install the water hose union within 3 minutes after applying adhesive.
- Do not put into coolant within an hour after installing.



23. INSTALL EXHAUST VALVE GUIDE BUSH
[11126 / 1104]

(a) Gradually heat the cylinder head to 80 - 100 °C (176-212 °F).

(b) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)
Protrusion height: 8.7 - 9.1 mm (0.342 - 0.358 in.)

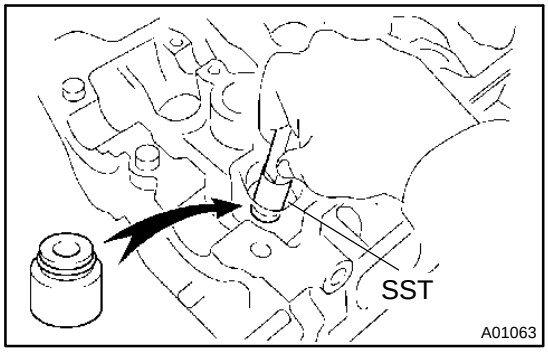


24. INSTALL VALVE STEM OIL O SEAL OR RING
[13711A / 1302]

(a) Apply a light coat of engine oil on the valve stemseals.

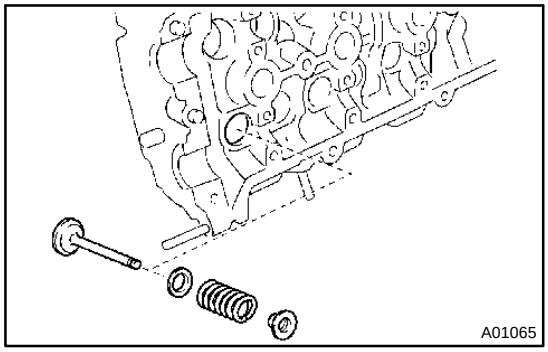
NOTICE:
Be very careful to assemble the oil seal for intake and exhaust. Assembling the wrong one may cause a failure.

HINT:
The intake valve oil seal is light brown and the exhaust valve oil seal is gray.

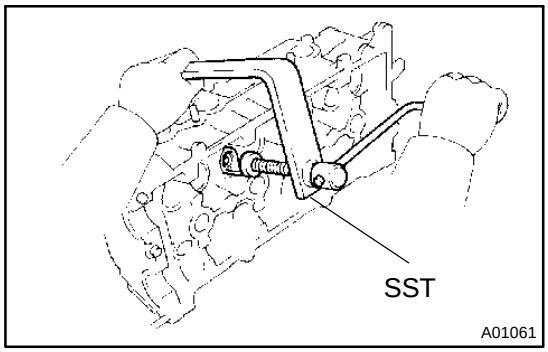


(b) Using SST, push in a new oil seal.
SST 09201-41020

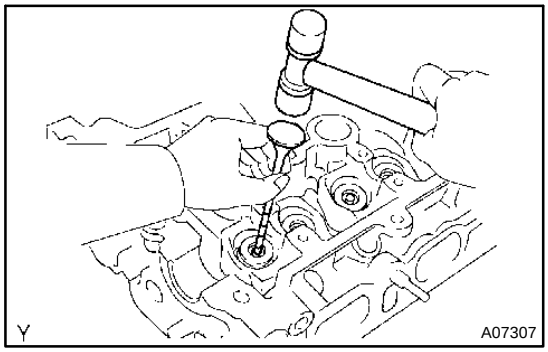
25. INSTALL INNER COMPRESSION SPRING
[13711B / 1302]



(a) Install the valve, spring seat, valve spring, and spring retainer.



(b) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202-70020



(c) Using a plastic-faced hammer and the valve stem (not in use) tip wound with vinyl tape, lightly tap the valve stem tip to ensure a proper fit.

NOTICE:
Be careful not to damage the valve stem tip.

26. INSTALL W/HEAD TAPER SCREW PLUG NO.2
[11117B / 1104]

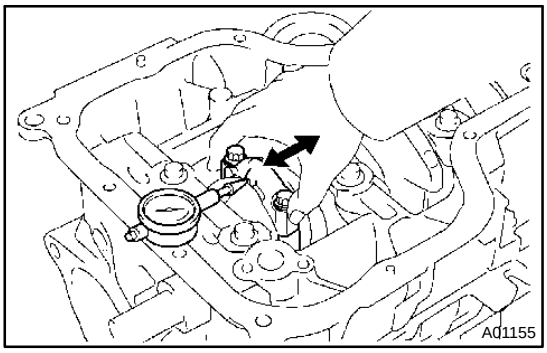
(a) Using hexagon socket wrench (10), install the taper screw plug with a new gasket.
Torque: 44 N·m (448kgf·cm, 32ft·lbf)

CYLINDER BLOCK (1ZZ-FE/3ZZ-FE)

1400X-01

OVERHAUL

1. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY
[11415 / 1105]

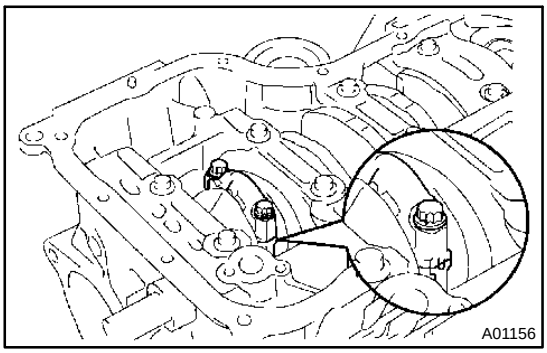


2. INSPECT CONNECTING ROD THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
Standard thrust clearance:
0.160 - 0.342 mm (0.063 - 0.0135 in.)
Maximum thrust clearance: 0.342 mm (0.0135 in.)

3. INSPECT CONNECTING ROD BEARING OIL CLEARANCE

NOTICE:
Do not turn the crankshaft.



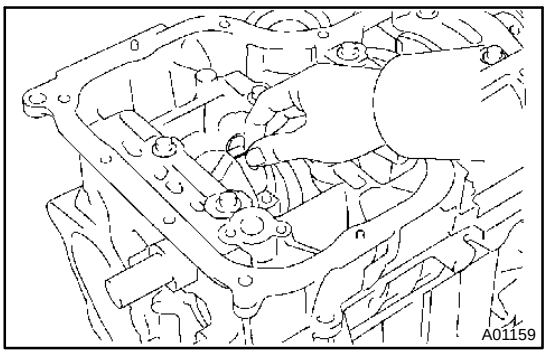
(a) Using marking paint, write the matched cylinder number on each connecting rod and cap.

HINT:
The match marks on the connecting rods and caps are for ensuring correct reassembly.

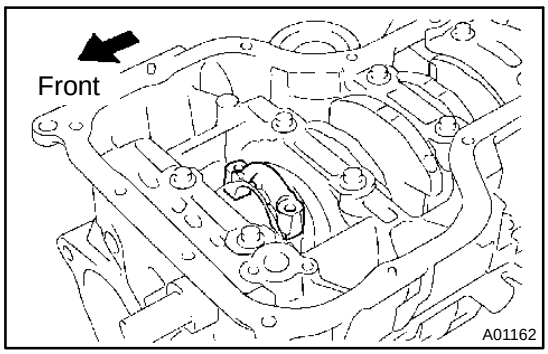
(b) Using SST, remove the 2 connecting rod cap bolts.
SST 09205-16010

(c) Clean the crank pin and bearing.

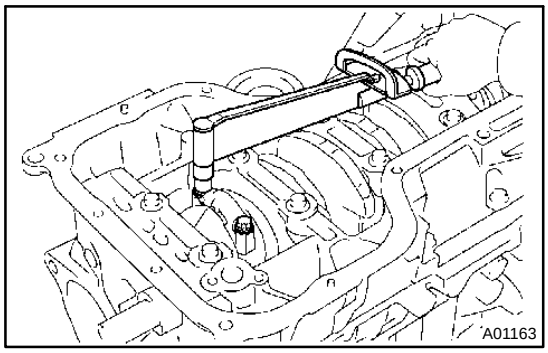
(d) Check the crank pin and bearing for pitting and scratches.



(e) Lay a strip of Plastigage across the crank pin.



(f) Check that the protrusion of the connecting rod cap is facing in the correct direction.

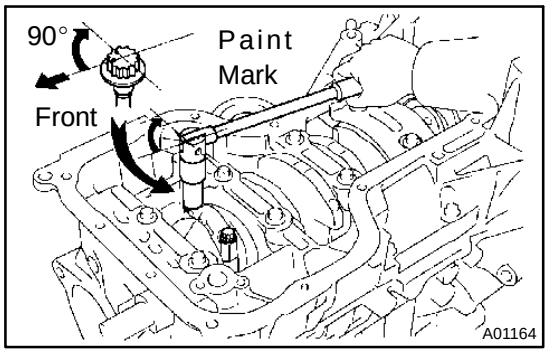


(g) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.

(h) Using SST, tighten the bolts in several passes by the specified torque.

SST 09205-16010

Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)

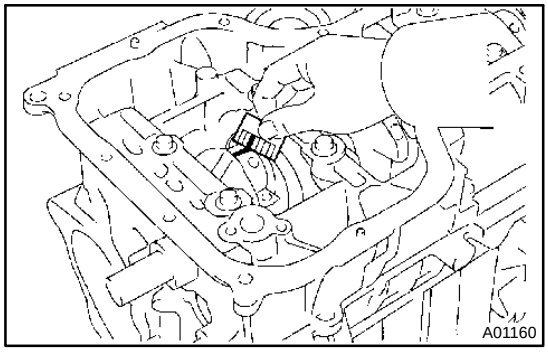


(i) Mark the front of the connecting cap bolts with paint.

(j) Retighten the cap bolts by 90 ° as shown in the illustration.

(k) Check that the crankshaft turns smoothly.

(l) Remove the 2 bolts, connecting rod cap and lower bearing.



(m) Measure the Plastigage at its widest point.

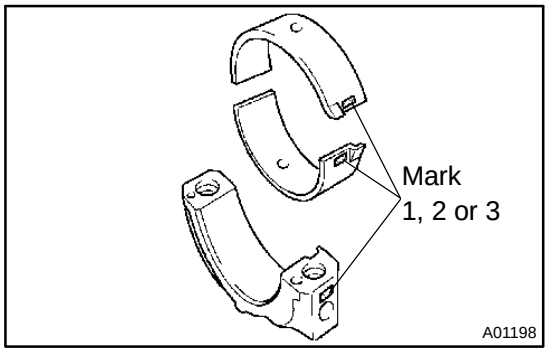
Standard oil clearance:

0.028 – 0.060 mm (0.0011 – 0.0024 in.)

Maximum oil clearance: 0.080 mm (0.0031 in.)

NOTICE:

Remove the Plastigage completely after the measurement.

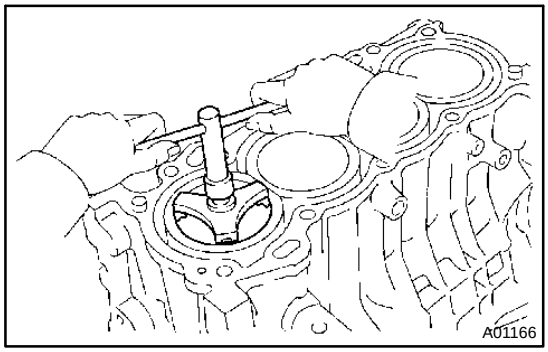


(n) If replacing a bearing, select a new one having the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked ”1”, ”2” and ”3” accordingly.

Reference:

Standard bearing center wall thickness

Mark	mm (in.)
1	1.486 – 1.490 (0.0585 – 0.0587)
2	1.490 – 1.494 (0.0587 - 0.0588)
3	1.494 – 1.498 (0.0588 - 0.0590)



4. REMOVE PISTON SUB-ASSY W/CONNECTING LOD

(a) Using a ride reamer, remove all the carbon from the top of the cylinder.

(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

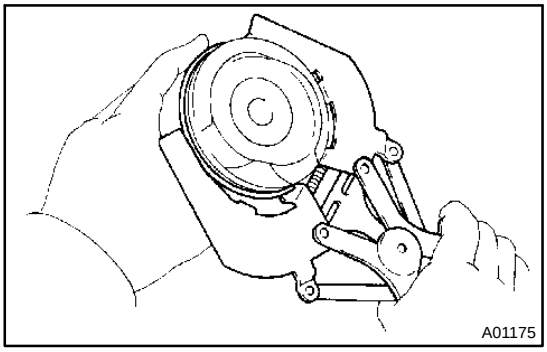
- Keep the bearing, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

5. REMOVE CONNECTING ROD BEARING
[13041 / 1301]

6. REMOVE PISTON RING SET
[13011 / 1301]

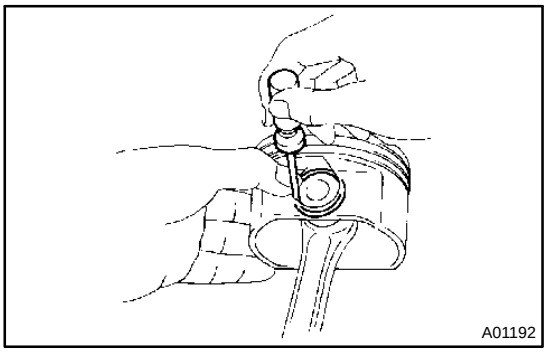
HINT:

Take care not to misplace the piston rings on both the match with the piston and the direction of the rings.



(a) Using a piston ring expander, remove the 2 compression rings.

(b) Remove the 2 side rails and oil ring by hand.

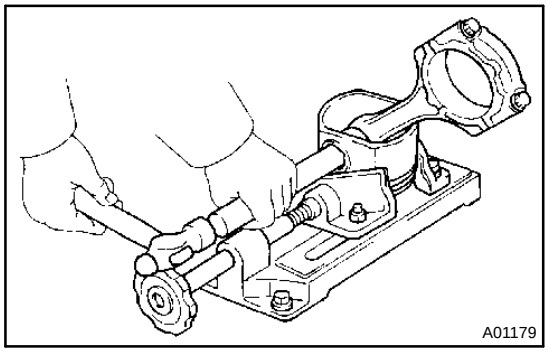


7. REMOVE PISTON PIN HOLE SNAP RING
[13101A / 1301]

(a) Using a small screwdriver, pry out the 2 snap rings.

8. REMOVE W/PIN PISTON SUB-ASSY
[13101 / 1301]

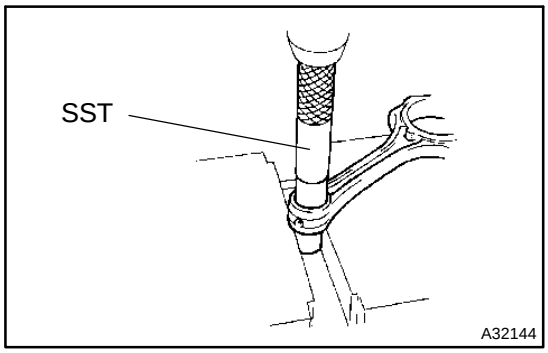
(a) Gradually heat the piston to 80 - 90 °C (176 - 194 °F).



(b) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

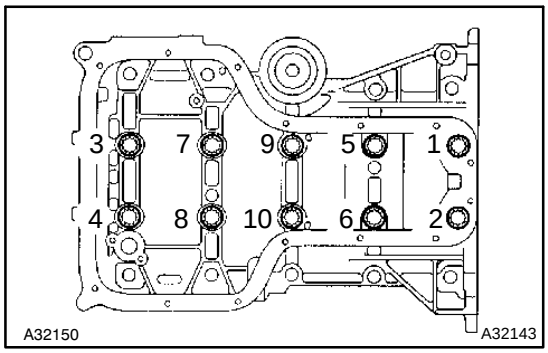
- The piston and pin are a matched set.
- Arrange the piston, pins, ring, connecting rod and bearings in the correct order.



9. REMOVE CONNECTING ROD SMALL END BUSH [13201A / 1301]

(a) Using SST and a press, press out the bushing.

SST 09222-30010

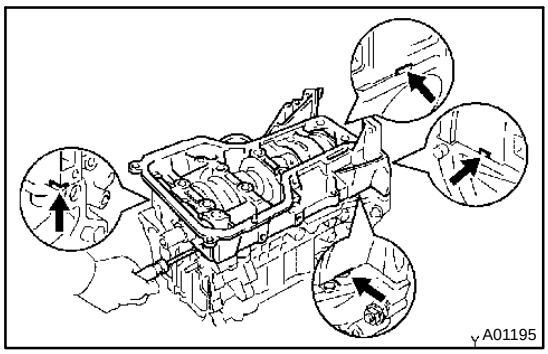


10. REMOVE CRANKSHAFT BEARING CAP SUB ASSY

(a) Remove the 10 bearing cap bolts.

(b) Uniformly loosen the 10 bearing cap sub-assembly bolts, in several passes, in the sequence shown in the illustration.

SST 09011-38121

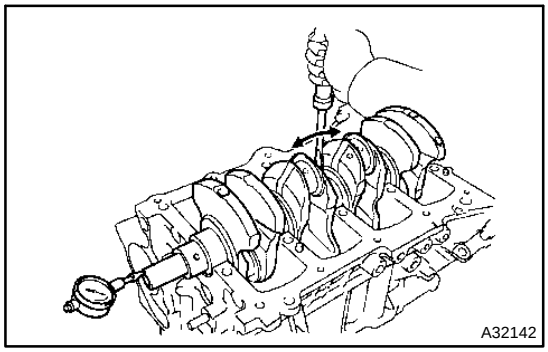


(c) Using a screwdriver, remove the bearing cap sub-assembly by prying the indicated portions between the cylinder block and bearing cap sub-assembly. Remove the 5 lower main bearings.

NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and bearing cap sub-assembly.

SST 09011-38121

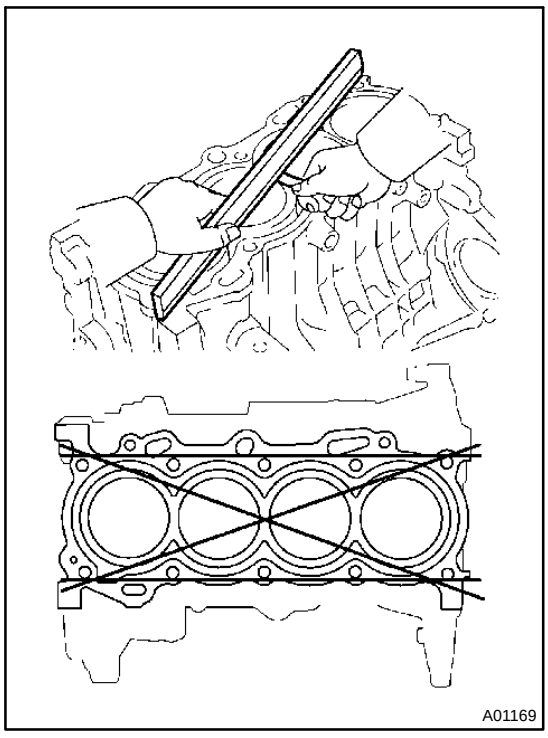

A32142

11. INSPECT CRANKSHAFT THRUST CLEARANCE
(a) Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.
Standard thrust clearance:
0.04 – 0.24 mm (0.0016 – 0.0094 in.)
Maximum thrust clearance: 0.30 mm (0.0118 in.)
(b) If the thrust clearance is greater than maximum, measure the thrust washer thickness. If the thickness is not specified, replace the thrust washer.
Thrust washer thickness:
2.430 – 2.480 mm (0.0957 – 0.0976 in.)

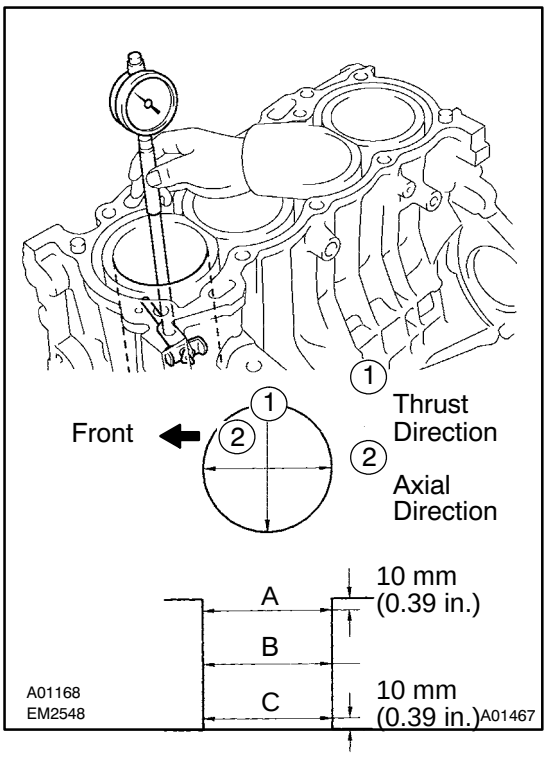
12. REMOVE CRANKSHAFT THRUST WASHER UPPER
[11791 / 1301]
13. REMOVE CRANKSHAFT
[13411 / 1301]
(a) Lift out the crankshaft.
(b) Remove the 5 upper main bearings and 2 thrust washers from the cylinder block.

NOTICE:
Arrange the main bearings and thrust washers in the correct order.

14. REMOVE CRANKSHAFT BEARING
[11711 / 1301]
15. REMOVE STUD BOLT


A01169

16. INSPECT CYLINDER BLOCK FOR FLATNESS
(a) Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.
Maximum warpage: 0.05 mm (0.0020 in.)



INSPECTION

INSPECT CYLINDER BORE DIAMETER

(a) Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and a ial directions.

(b) Calculate the difference between the ma imum diameter and the minimum diameter in the measured values.

Difference limit: 0.10 mm (0.0039 in.)

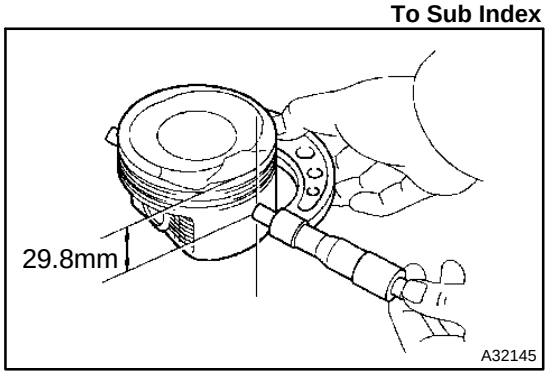
(Reference)

Standard diameter:

1NZ FE	75.00 0 75.013 mm (2.9527 5 2.95326 in.)
2NZ–FE	75.00 0 75.013 mm (2.9527 5 2.95326 in.)
1ZZ–FE	79.00 0 79.013 mm (3. 110 2 3. 1107 in,)
2ZZ–GE	82.00 0 82.013 mm (3.228 3 3.2289 in.)
3ZZ–FE	79.00 0 79.013 mm (3. 110 2 3. 1107 in,)
4ZZ–FE	79.00 0 79.013 mm (3. 110 2 3. 1107 in,)

If the difference is greater than limit, replace the cylinder block.

To Sub Index



18. INSPECT PISTON DIAMETER

(a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole, and at the piston of 29.8 mm (1.1 3 in.) from the piston head.

Piston diameter:

1ZZ-FE 8.925 - 8.935 mm (3.10 3 - 3.10 in.)

3ZZ-FE 8.955 - 8.9 5 mm (3.1085 - 3.1089 in.)

19. INSPECT CONNECTING ROD SUB-ASSY [13201 / 1301]

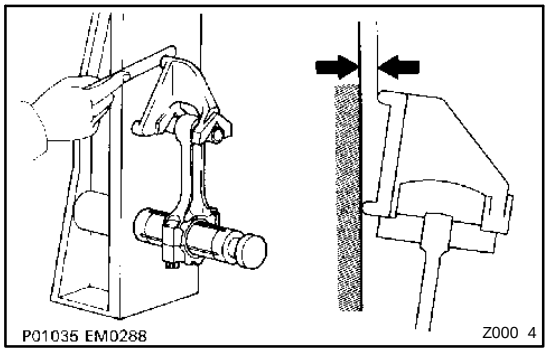
(a) Using a rod aligner and feeler gauge, check the connecting rod alignment.

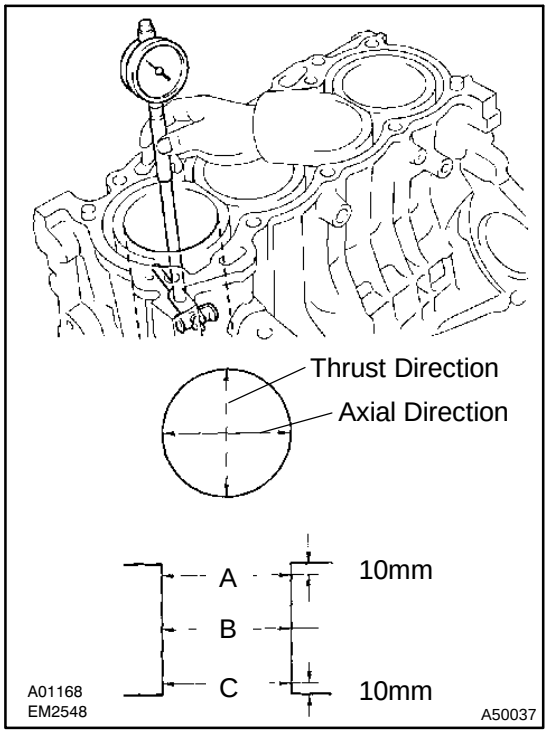
(1) Check for out-of-alignment.

Ma imum out-of alignment:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If out-of alignment is greater than ma imum, replace the connecting rod assembly.





17. INSPECT CYLINDER BORE

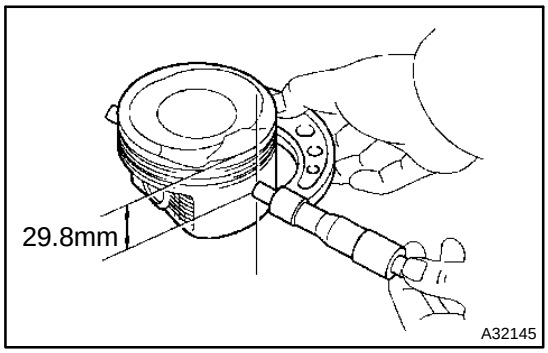
(a) Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

Standard diameter:

79.000 - 79.013 mm (3.1102 - 3.1107 in.)

Maximum diameter: 79.013 mm (3.1107 in.)

(b) If the diameter is greater than the maximum, replace the cylinder block.



18. INSPECT PISTON DIAMETER

(a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole, and at the piston of 29.8 mm (1.173 in.) from the piston head.

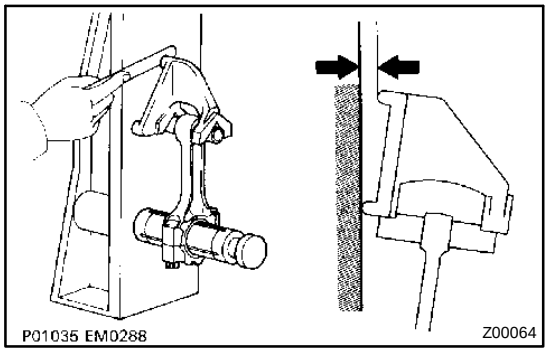
Piston diameter:

1ZZ-FE 78.925 - 78.935 mm (3.1073 - 3.1077 in.)

3ZZ-FE 78.955 - 78.965 mm (3.1085 - 3.1089 in.)

19. INSPECT CONNECTING ROD SUB-ASSY [13201 / 1301]

(a) Using a rod aligner and feeler gauge, check the connecting rod alignment.

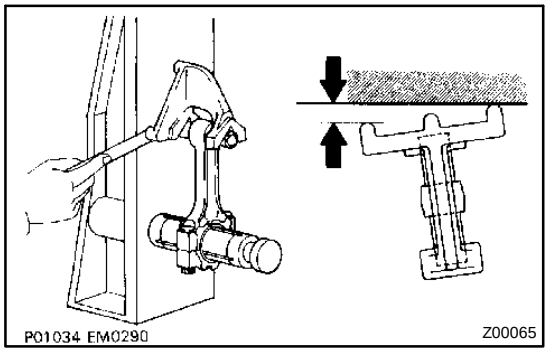


(1) Check for out-of-alignment.

Maximum out-of alignment:

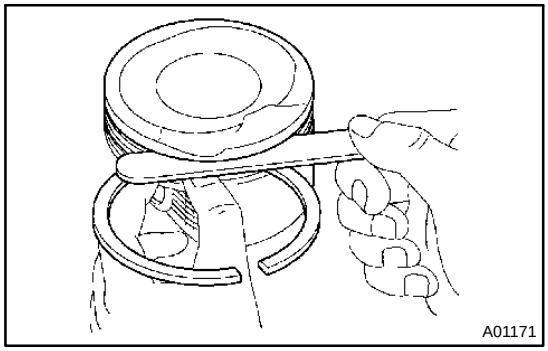
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If out-of alignment is greater than maximum, replace the connecting rod assembly.

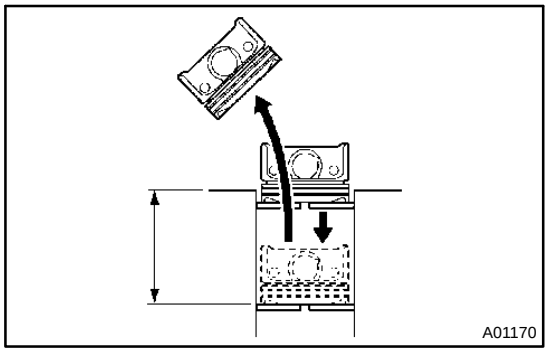


(2) Check for twist.
Maximum twist:
0.05mm (0.0020 in.) per 100 mm (3.94 in.)
If twist is greater than maximum, replace the connecting rod assembly.

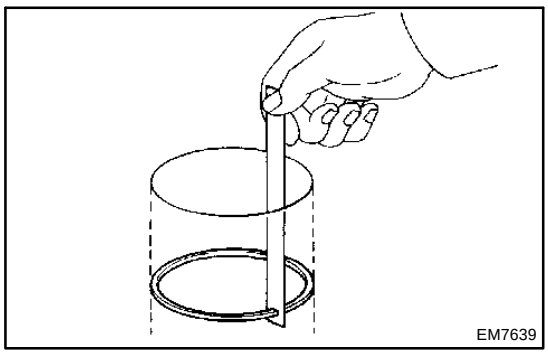
20. INSPECT PISTON CLEARANCE
(a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.
Standard oil clearance: 0.065 – 0.075 mm (0.0026 – 0.0029 in.)
Maximum oil clearance: 0.75 mm (0.0029 in.)
(b) If the oil clearance is greater than maximum, replace all the 4 pistons. If necessary, replace the cylinder block.



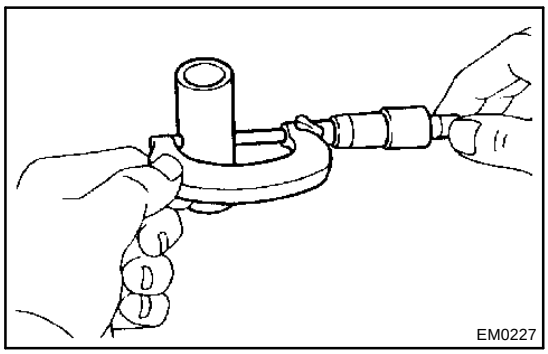
21. INSPECT RING GROOVE CLEARANCE
(a) Using a feeler gauge, measure the clearance between the new piston ring and the wall of the ring groove.
Ring groove clearance:
0.020 – 0.070 mm (0.0008 – 0.0028 in.)



22. INSPECT PISTON RING END GAP
(a) Using a piston, push the piston ring a little beyond the bottom of the ring travel, that means 100 mm (3.94 in.) from the top of the cylinder block.



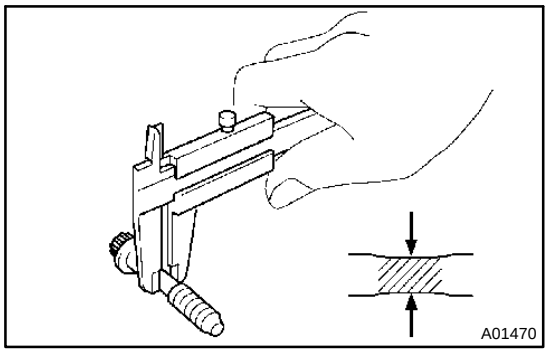
(b) Using a feeler gauge, measure the end gap.
Standard end gap:
No. 1 0.25 – 0.35 mm (0.0098 – 0.0138 in.)
No. 2 0.35 – 0.50 mm (0.0138 – 0.0197 in.)
Maximum end gap:
No. 1 0.74 mm (0.029 in.)
No. 2 0.89 mm (0.035 in.)



23. INSPECT PISTON PIN

(a) Using a micrometer, measure the piston pin diameter.
Piston pin diameter:
20.004 - 20.013 mm (0.7876 - 0.7879 in)

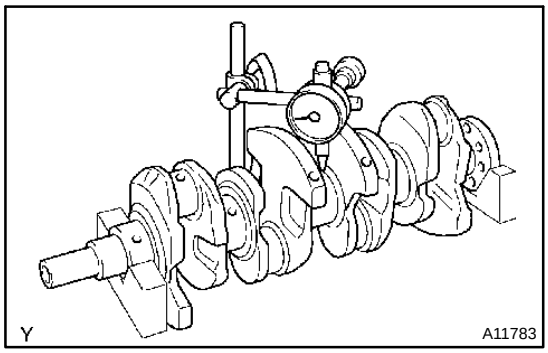
NOTICE:
Push the piston pin into the matched piston.



24. INSPECT CONNECTING ROD BOLT
[13265 / 1301]

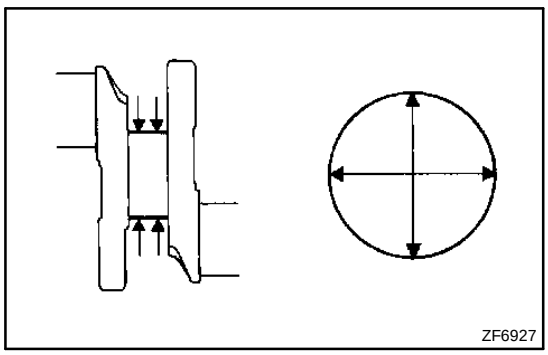
(a) Using a vernier caliper, measure the tension portion diameter of the bolts.
Standard diameter:
6.6 - 6.7 mm (0.260 - 0.264 in.)
Maximum diameter: 6.4 mm (0.252 in.)

(b) If the diameter is less than minimum, replace the bolt.



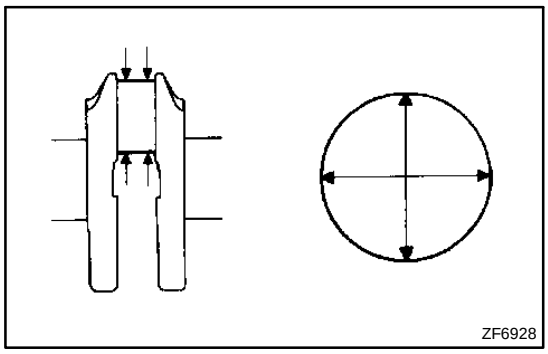
25. INSPECT CRANKSHAFT
[13411 / 1301]

(a) Using a dial indicator and V-blocks, measure the circle runout, as shown in the illustration.
Maximum circle runout: 0.03 mm (0.0012 in.)



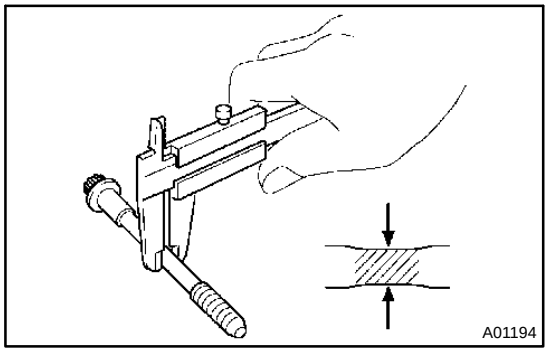
(b) Using a micrometer, measure the diameter of each main journal at the points shown in the illustration.
Diameter: 47.988 - 48.000 mm (1.8893 - 1.8898 in.)

(c) Check each main journal for taper and out-of-round as shown.
Maximum taper and out-of-round:
0.02 mm (0.0008 in.)



(d) Using a micrometer, measure the diameter of each crank pin at the points shown in the illustration.
Diameter: 43.992 - 44.000 mm (1.7320 - 1.7328 in.)

(e) Check each crank pin for taper and out-of-ruond as shown.
Maximum taper and out-of-round:
0.02 mm (0.0008 in.)



26. INSPECT CRANKSHAFT BEARING CAP SET BOLT
[11416 / 1105]

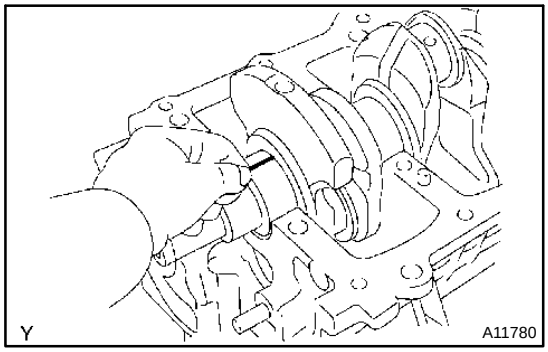
(a) Using vernier caliper, measure the tension portion diameter of the bolts.
Standard diameter: 7.3 - 7.5 mm (0.287 - 0.295 in.)
Minimum diameter: 7.2 mm (0.283 in.)

(b) If the diameter is less than minimum, replace the bolt.

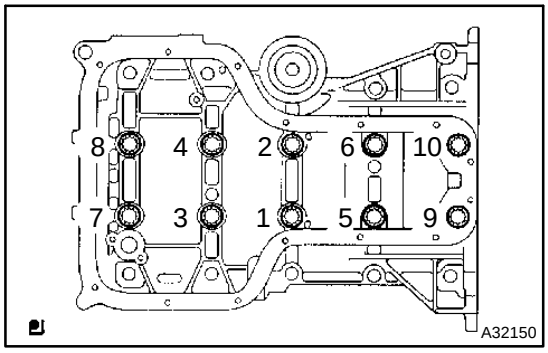
27. INSPECT CRANKSHAFT OIL CLEARANCE

(a) Clean each main journal and bearing.

(b) Place the crankshaft on the cylinder block.



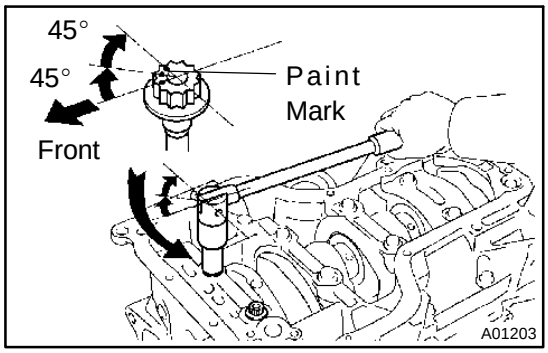
(c) Lay a strip of Plastigage across each journal.



(d) Using socket wrench (12), tighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)

(e) Using socket wrench (12), retighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)

(f) Mark the front of the bearing cap sub-assembly bolts with paint.

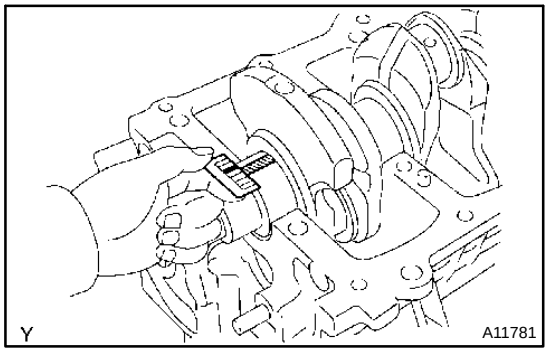


(g) Retighten the bearing cap sub-assembly bolts by 45 ° twice, in the numerical order shown.

(h) Check that the painted mark is now at a 90 ° angle to the front.

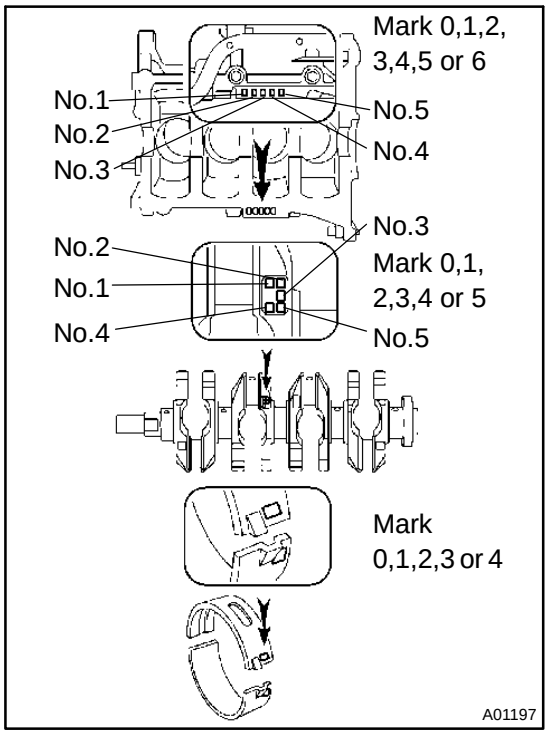
NOTICE:
Do not turn the crankshaft.

(i) Remove the bearing cap sub-assembly.



(j) Measure the Plastigage at its widest point.
Standard oil clearance:
0.013 – 0.030 mm (0.0005 – 0.0012 in.)
Minimum oil clearance: 0.05 mm (0.0020 in.)

NOTICE:
Completely remove the plastigage



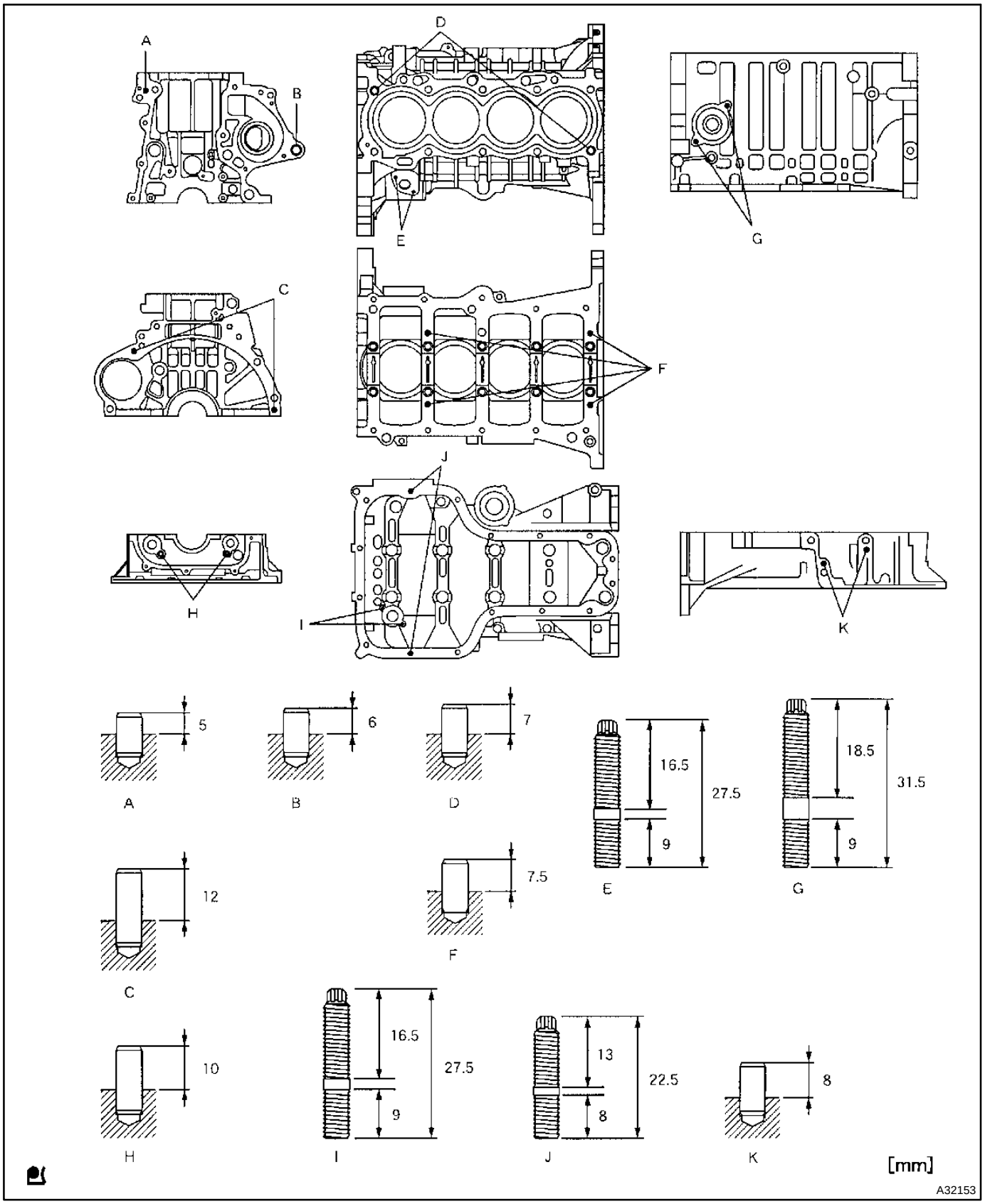
(k) If replacing a bearing, select a new one having the same number. If the number of the bearing cannot be determined, calculate the correct use bearing number by adding together the numbers imprinted on the cylinder block and crankshaft, then select a new bearing having the calculated number. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

Cylinder block (A) + Crankshaft (B)	0-2	3-5	6-8	9-11
Use bearing	"1"	"2"	"3"	"4"

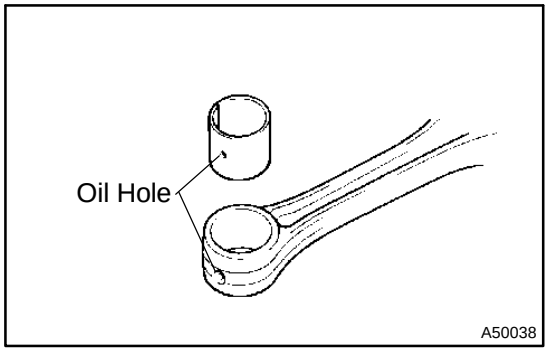
HINT:
EXAMPLE: Cylinder block "4" (A)
+ Crankshaft "3" (B)
= Total number 7 (Use bearing "3")

Item	Mark	mm (in.)
Cylinder block main journal bore diameter (A)	"0"	52.000 - 52.003 (2.0472 - 2.0473)
	"1"	52.003 - 52.005 (2.0473 - 2.0474)
	"2"	52.005 - 52.007 (2.0474 - 2.0475)
	"3"	52.007 - 52.010 (2.0475 - 2.0476)
	"4"	52.010 - 52.012 (2.0476 - 2.0477)
	"5"	52.012 - 52.014 (2.0477 - 2.0478)
	"6"	52.014 - 52.016 (2.0478 - 2.0479)
Crankshaft main journal diameter (B)	"0"	47.998 - 48.000 (1.8897 - 18898)
	"1"	47.996 - 47.998 (1.8896 - 18897)
	"2"	47.994 - 47.996 (1.8895 - 18896)
	"3"	47.992 - 47.994 (1.8894 - 18895)
	"4"	47.990 - 47.992 (1.8893 - 18894)
	"5"	47.988 - 47.990 (1.8892 - 18893)
Standard bering center wall thickness	"1"	1.993 - 1.996 (0.0785 - 0.0786)
	"2"	1.996 - 1.999 (0.0786 - 0.0787)
	"3"	1.999 - 2.002 (0.0787 - 0.0788)
	"4"	2.002 - 2.005 (0.0788 - 0.0789)

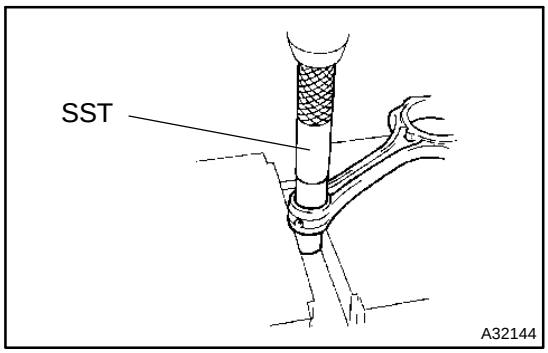
28. INSTALL STUD BOLT AND RING PIN



29. INSTALL CONNECTING ROD SMALL END BUSH
[13201A / 1301]

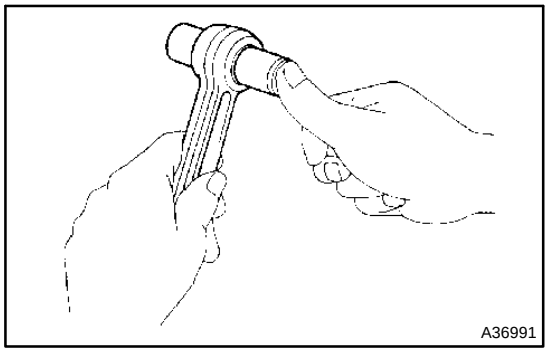


(a) Align the oil hole of a new bushing with the one of the connecting rod.



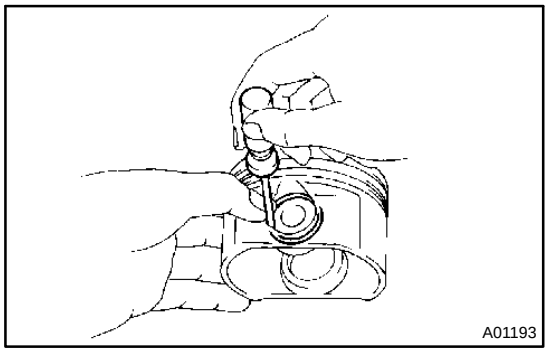
(b) Using SST and a press, press into the small end bushing.
SST 09222-30010

(c) After installing the bushing, check that the oil hole of the connecting rod is aligned with the hole of the small end bushing and that the oil clearance measured on both sides of connecting rod are equal.



(d) Horn the connecting rod end bushing to obtain the standard specified oil clearance.
Oil clearance: 0.005 - 0.011 mm (0.0002 - 0.0004 in.)

HINT:
When pusing the piston pin with engine oil applied into the connecting rod with thumb, the piston pin is supposed to have a little resistance to insert at nomal room temperature.



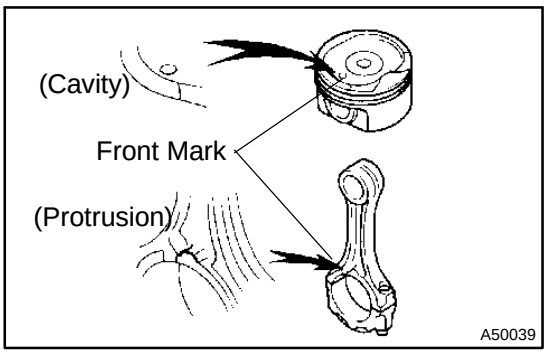
[13101A / 1301]

(a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.

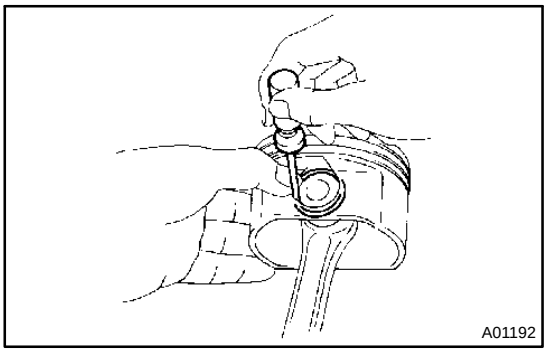
HINT:
Be sure that end gap of the snap ring is aligned with the pin hole cutout portion of the piston.

31. INSTALL W/PIN PISTON SUB–ASSY
[13101 / 1301]

(a) Gradually heat the piston to 80 – 90 °C (176–194 °F).



(b) Align the front marks on the piston with connecting rod, and push in the piston with your thumb.



32. INSTALL PISTON PIN HOLE SNAP RING
[13101A / 1301]

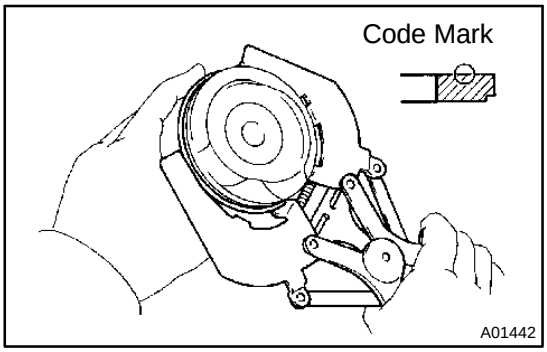
(a) Using a small screwdriver, install a new snap ring on the other end of the piston pin hole.

HINT:
Be sure that end gap of the snap ring is aligned with the pin hole cutout portion of the piston.

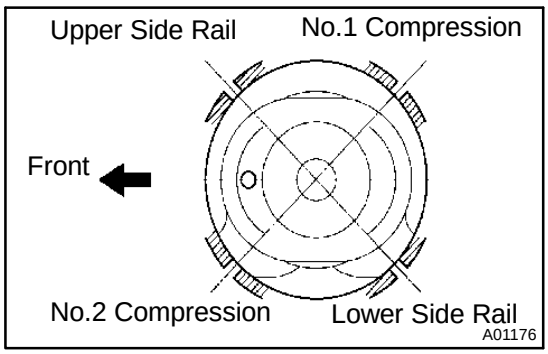
33. INSTALL PISTON RING SET
[13011 / 1301]

HINT:
In case of reusing the piston rings, install them to the matched pistons with the surfaces faced correctly.

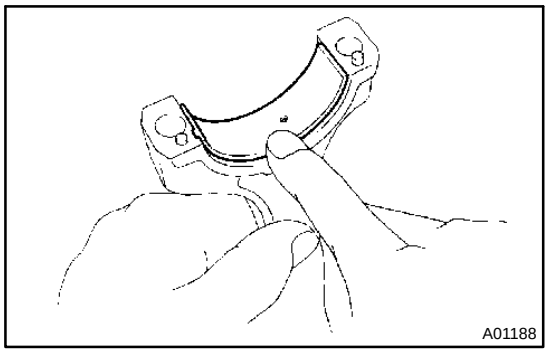
(a) Install the oil ring expander and 2 side rails by hand.



(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
Code mark (No.2 only): T or 2R



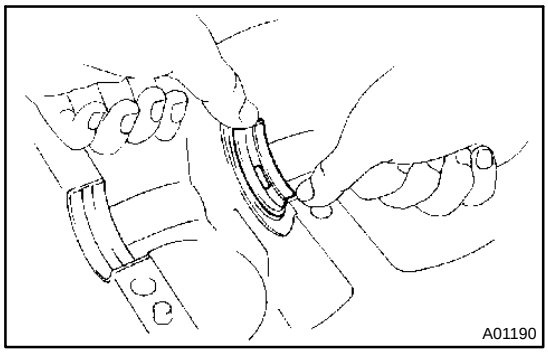
(c) Position the piston rings so that the ring ends are as shown.



34. INSTALL CONNECTING ROD BEARING
[13041 / 1301]

(a) Align the bearing claw with the groove of the connecting rod or connecting cap.

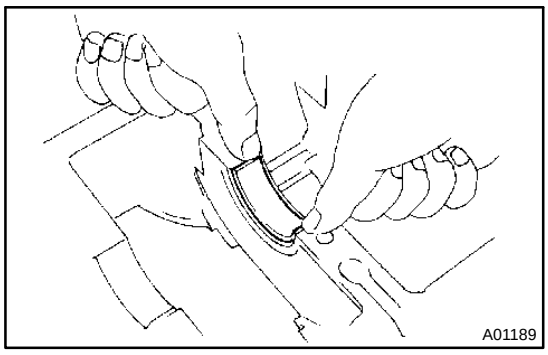
NOTICE:
Clean the backside of the bearing and the bearing surface of the connecting rod and let not stick the oils and fats.



35. INSTALL CRANKSHAFT
[13411 / 1301]

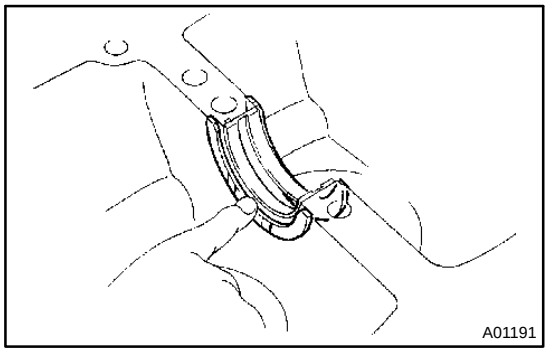
(a) Install the upper bearing with an oil groove on cylinder block.

NOTICE:
Clean the backside of the bearing and the bearing surface of the bearing cap and let not stick the oils and fats.



(b) Install the lower bearing on the bearing cap sub assembly.

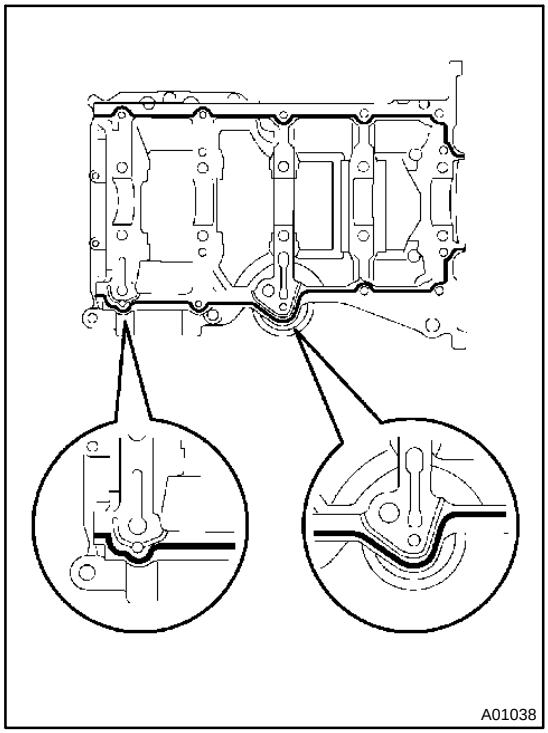
NOTICE:
Clean the backside of the bearing and the bearing surface of the bearing cap and let not stick the oils and fats.



(c) Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.

(d) Apply engine oil to upper bearing and install the crankshaft on the cylinder block.

(e) Apply a light coat of engine oil on the bolt threads, the bolt seats, and the bearings of the bearing cap sub assembly.

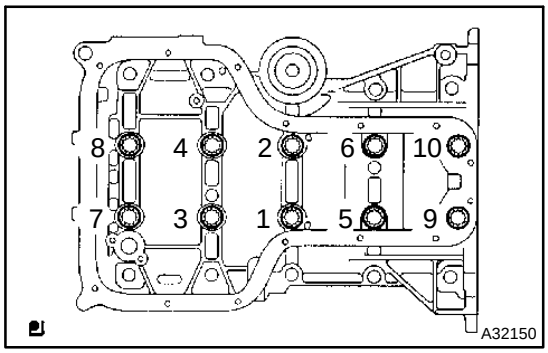


(f) Apply seal packing in the shape of bead (Diameter 2.5 – 3.5 mm (0.08 – 0.12 in.) consequently as shown in the illustration.

Seal packing: Part No. 0882 -00080 or equivalent

NOTICE:

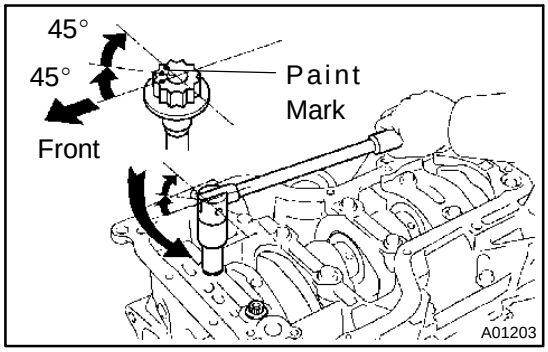
- Remove any oil from the contact surface.
- Install the bearing cap sub-assembly within 3 minutes after applying seal packing.
- Do not put into engine oil within 2 hours after the installation.



(g) Using socket wrench (12), tighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 22 N m (225 kgf cm, 1 ft lbf)

(h) Using socket wrench (12), retighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 44 N m (449 kgf cm, 32 ft lbf)

(i) Mark the front of the bearing cap sub-assembly bolts with paint.



( ) Retighten the bearing cap sub-assembly bolts by 45 _ twice, in the numerical order shown.

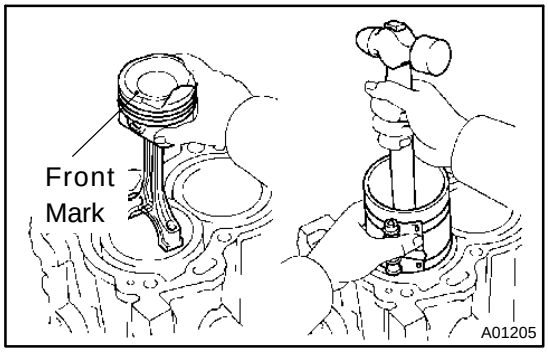
(k) Check that the painted mark is now at a 90 _ angle to the front.

(l) Tighten 10 other bolts for the bearing cap.
Torque: 19 N m (189 kgf cm, 14 ft lbf)

3 . INSTALL CONNECTING ROD SUB-ASSY
[13201 / 1301]

(a) Apply engine oil to the cylinder walls, the pistons, and the surfaces of connecting rod bearings.

(b) Check the position of the piston ring ends.

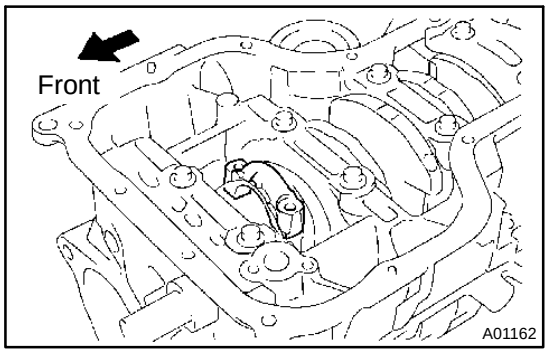


(c) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

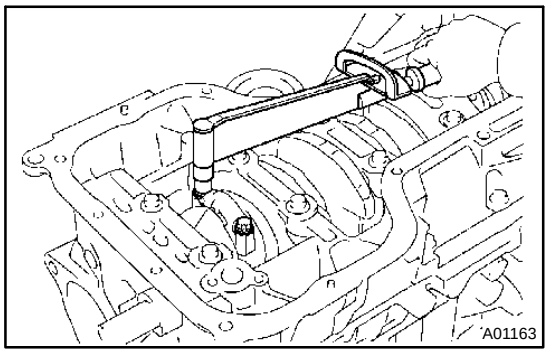
(d) Align the pin dowels of the connecting rod cap with the pins of the connecting rod, and install the connecting rod.

NOTICE:

- Clean the backside and the surface of the connecting rod cap bearing and let not stick the oils and fats.
- Match the numbered connecting rod cap with the same numbered connecting rod.



(e) Check that the protrusion of the connecting rod cap is facing in the correct direction.

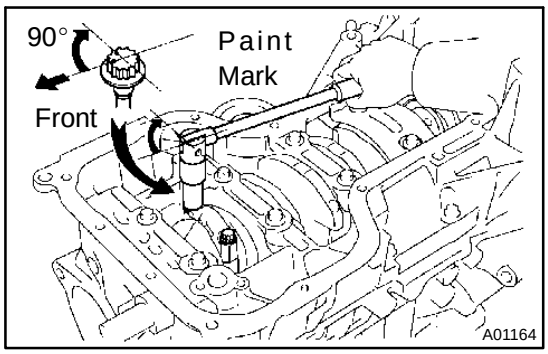


(f) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.

(g) Using SST, tighten the bolts in several passes by the specified torque.

SST 09205-16010

Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)



(h) Mark the front of the connecting cap bolts with paint.

(i) Retighten the cap bolts by 90 ° as shown in the illustration.

(j) Check that the crankshaft turns smoothly.

3 . INSTALL CYLINDER BLOC ATER DRAIN COC S B ASSY
11 1 110

(a) Apply two or three threads of adhesive to the drain union, and install it within 3 minutes.
T r e: 1 E: 3 N m (3 3 f cm ft l f)
T r e: 3 E: 0 N m (00 f cm1 ft l f)

(b) After applying the specified torque, rotate the drain union clockwise until its drain port faces downward.

NOTICE:

- **D n t t int c lant in an r after t e in tallati n.**
- **D n t r tate t e drain ni n m re t an 3 0 in ( ) and ne er l en it after ettin t e ni n c rrectl .**

COOLING

WATER PUMP ASSY (1ZZ-FE/3ZZ-FE)

1600Q-01

Inspection

1. WATER PUMP ASSY
[16100 / 1601]

(a) Visually check the drain hole for coolant leakage.

LUBRICATION

OIL PUMP ASSY (1ZZ-FE/3ZZ-FE)

1700D-02

OVERHAUL

1. INSPECT OIL PUMP ASSY
   [15100 / 1501]

(a) Remove oil pump cover.
   (1) Remove the 3 screws and the oil pump cover.

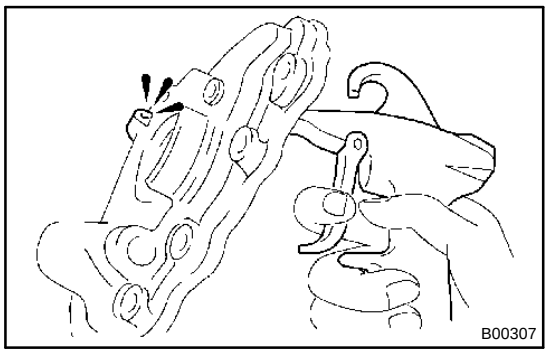
(b) Remove oil pump rotor sub-assembly.
   (1) Remove the oil pump gear set.

CAUTION:
Reserve the face, back and the install direction of the two rotors.

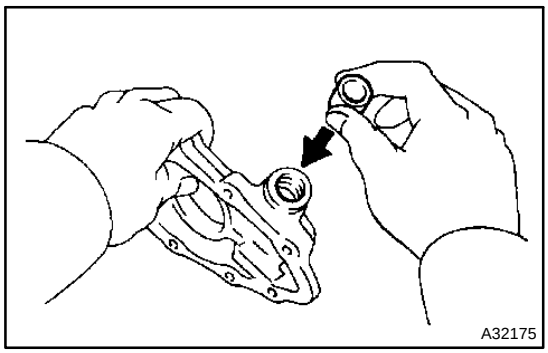
(c) Remove oil pump relief valve plug.

(d) Remove oil pump relief valve spring.

(e) Remove oil pump relief valve.

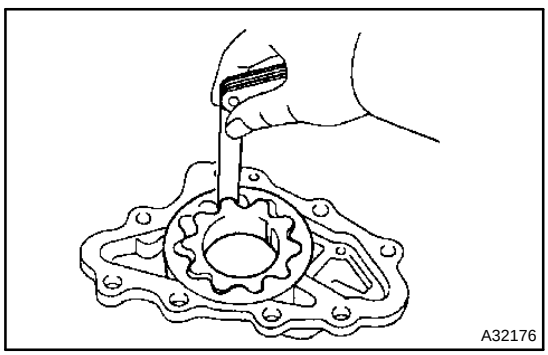


(f) Inspect oil jet.
   (1) Check the oil jet for damage or clogging.

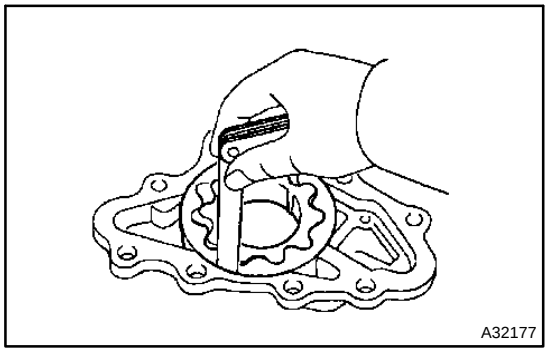


(g) Inspect oil pump relief valve.
   (1) Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

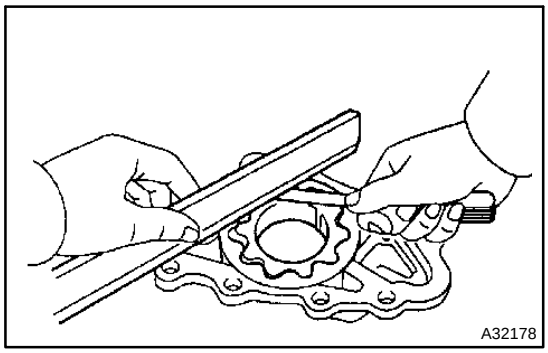
(h) Inspect oil pump rotor sub-assembly.
   (1) Coat the oil pump gear set with engine oil and place them into the oil pump body. Check that the rotors revolves smoothly.



(i) Inspect rotor tip clearance.
   (1) Using a feeler gauge, measure the clearance between the drive and driven rotor tips.
   Standard tip clearance:
   0.040 - 0.160 mm (0.0015 - 0.0062 in.)
   Maximum tip clearance:
   0.35 mm (0.0138 in.)

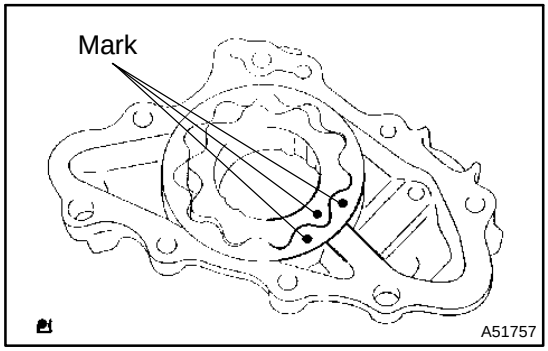


(j) Inspect body clearance.
(1) Using a feeler gauge, measure the clearance between the driven rotor and body.
Standard tip clearance:
0.260 – 0.325 mm (0.0102 – 0.0128 in.)
Maximum tip clearance:
0.300 mm (0.01181 in.)



(k) Inspect rotor side clearance.
(1) Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.
Standard tip clearance:
0.025 –0.071 mm (0.0010 – 0.0030 in.)
Maximum tip clearance:
0.15 mm (0.0059 in.)

(l) Install oil pump relief valve.
(1) Coat the relief valve with engine oil and insert the relief valve and spring into the pump body hole.
(2) Install the oil pump relief valve plug.
Torque: 37 N·m (375 kgf·cm, 27 ft·lbf)



(m) Install oil pump rotor sub–assembly.
(1) Coat the oil pump gear set with engine oil and place it into pump body with the marks facing the pump body cover side.

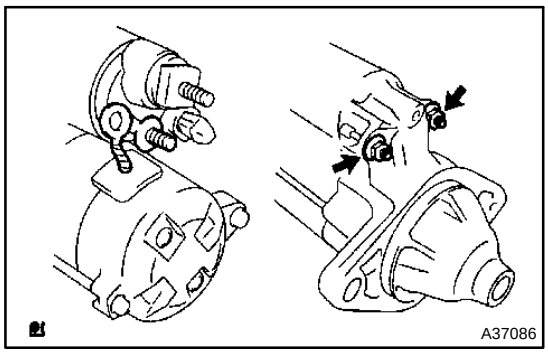
(n) Install oil pump cover.
(1) Install the oil pump cover with 3 screws.
Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)

STARTING & CHARGING

STARTER ASSY (1ZZ-FE/3ZZ-FE)

1900P-01

OVERHAUL



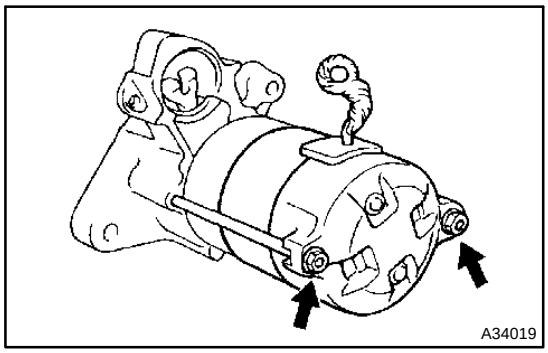
1. REMOVE MAGNET STARTER SWITCH ASSY
[28150 / 1904]

(a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.

(b) Loosen the 2 nuts holding the magnetic switch to the starter housing.

(c) Pull the magnetic switch and while lifting the front part of the magnetic switch, release the plunger hook from the driver lever, then release the magnetic switch.

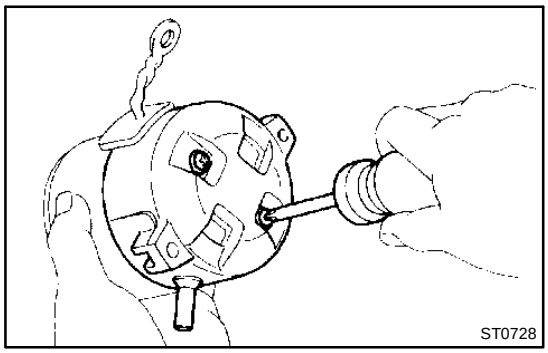
2. REMOVE STARTER YOKE ASSY
[28120 / 1904]



(a) Remove the 2 through bolts, and pull out the field frame together with the armature.

(b) Remove O-Ring from field frame.

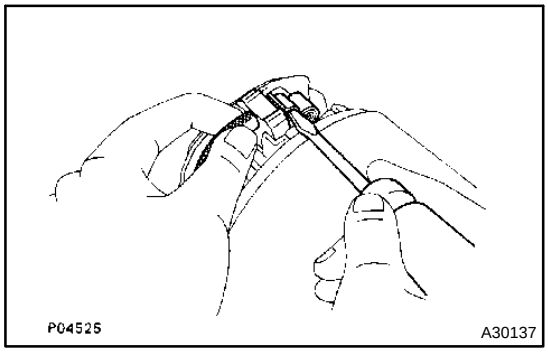
3. REMOVE STARTER BRUSH HOLDER ASSY
[28140 / 1904]



(a) Remove the 2 screws and commutator end frame, and hold down the lead wire while releasing the commutator end frame.

NOTICE:
To avoid interference between the brush holder and the dust protector pull the commutator end frame away at an angle.

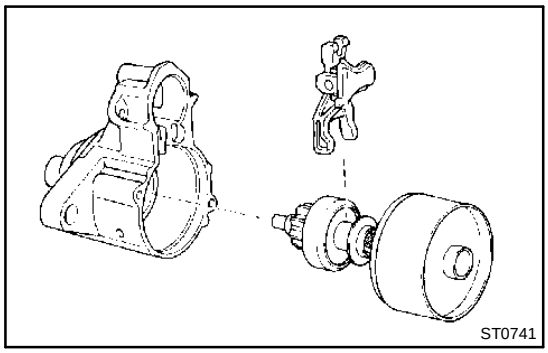
(b) Remove O-Ring from field frame.



(c) Using a screwdriver, hold the spring back and disconnect the brush holder.

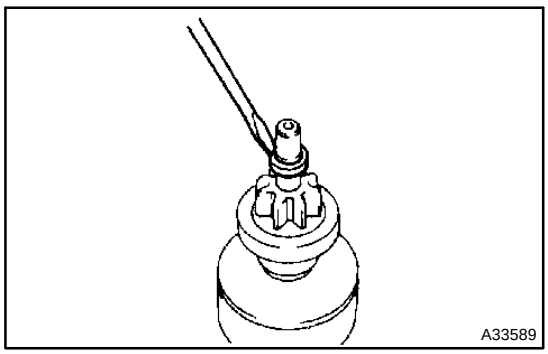
(d) Disconnect the 4 brushes, and remove the brush holder.

4. REMOVE STARTER ARMATURE ASSY
[28160 / 1904]

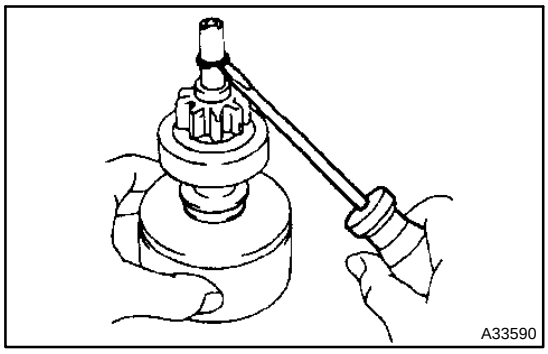


5. REMOVE STARTER CLUTCH SUB-ASSY
[28011 / 1904]

(a) Remove drive lever and starter clutch with shock absorber from starter housing.

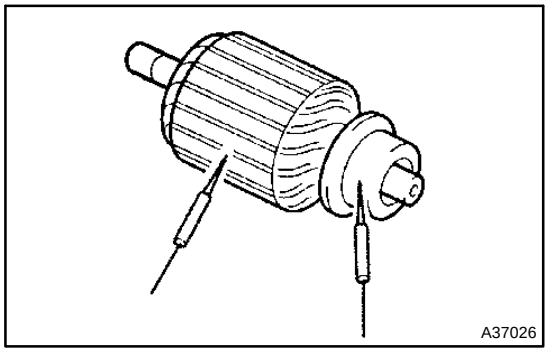


(b) Using a screwdriver, tap in the stop collar towards the starter clutch.



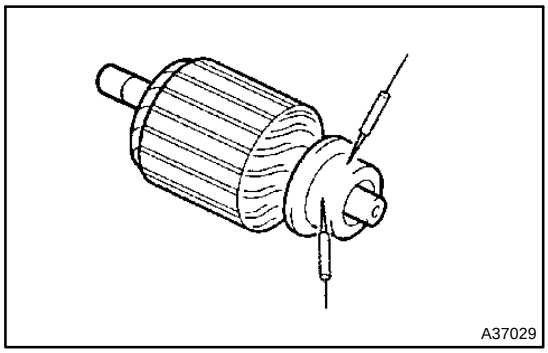
(c) Using a screwdriver, pry off the snap ring.

(d) Remove the rear collar and starter clutch from the planetary shaft.

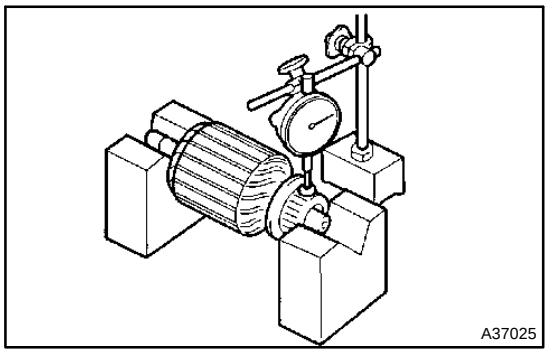


6. INSPECT STARTER ARMATURE ASSY
[28160 / 1904]

(a) Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

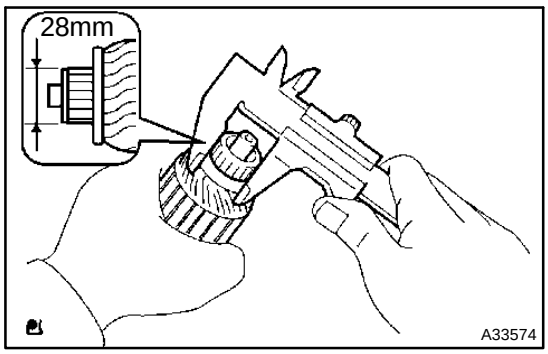


(b) Using an ohmmeter, check that there is continuity between the segments of the commutator.

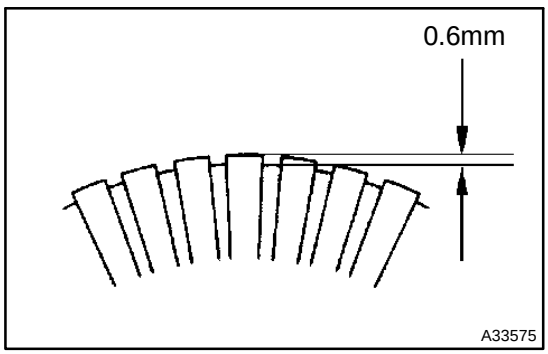


(c) Place the commutator on V - blocks.

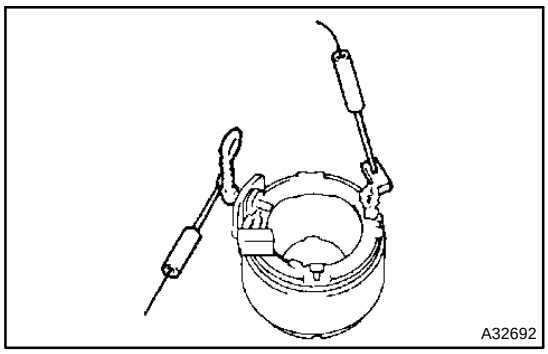
(d) Using a dial gauge, measure the circle runout.
Maximum circle runout: 0.05 mm (0.0020 in.)



(e) Using vernier calipers, measure the commutator diameter.
Standard diameter: 28 mm (1.102 in.)
Minimum diameter: 27 mm (1.063 in.)

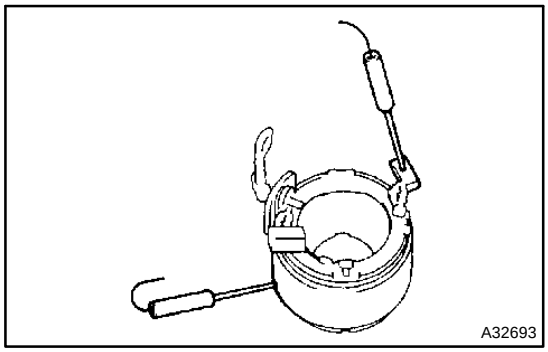


(f) Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.
Standard undercut depth: 0.6 mm (0.024 in.)
Minimum undercut depth: 0.2 mm (0.008 in.)

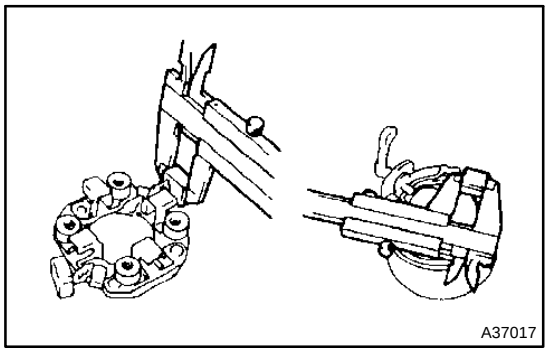


7. INSPECT FIELD COIL

(a) Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

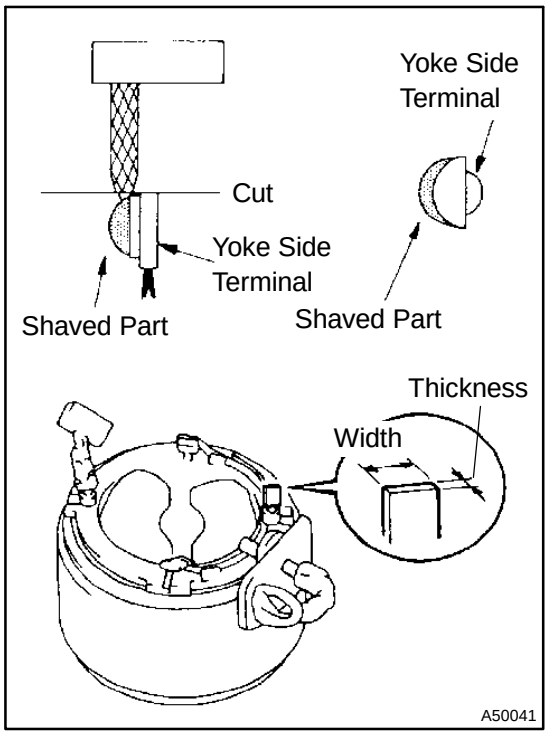


(b) Using an ohmmeter, check that there is no continuity between the field coil end and field frame.



8. INSPECT BRUSH

(a) Using vernier calipers, measure the brush length.
Standard length: 14 mm (0.551 in.)
Minimum length: 9 mm (0.354 in.)



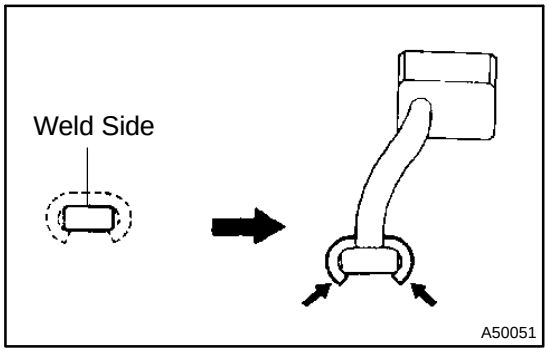
9. REMOVE BRUSH

HINT:
Only the 2 brushes of the positive (+) side (field frame side) are exchangeable, negative (–) side brush must be changed in the body with the brush holder.

(a) Cut the brush lead wire at the terminal side.

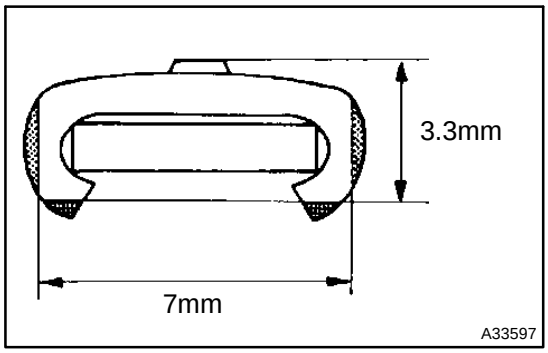
(b) Shave welded mark of the brush lead wire with sandpaper etc., and correct the terminal to the specified.
SST 55901
Specified thickness: 1.6 mm (0.063 in.)
Specified width: 5.0 mm (0.197 in.)

NOTICE:
The mark to be shaved is so narrow that you should take care not to harm the field coil.



10. INSTALL BRUSH

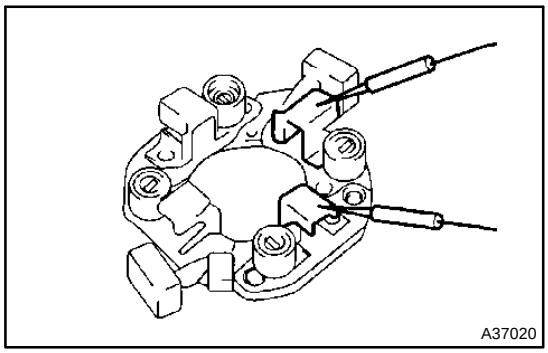
(a) Press the plate of the supply brush on the weld side of the terminal lead wire.



(b) Solder the pressed part, and shave to the specified measures with the sandpaper etc.
SST 54202, 55901
Specified thickness: 3.3 mm (0.130 in.)
Specified width: 7.0 mm (0.276 in.)

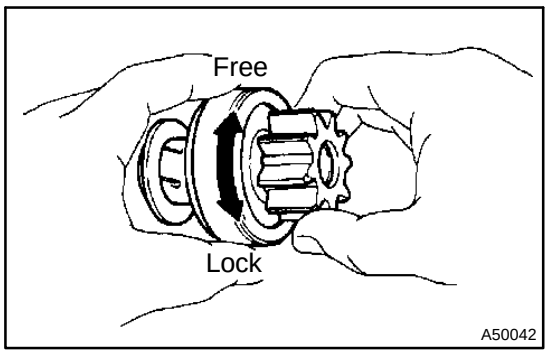
HINT:

- Heat the soldered part well, and flow the solder inside the plate, take care not to flow it into the inside of lead wire.
- Take care not to flow the solder into the field.



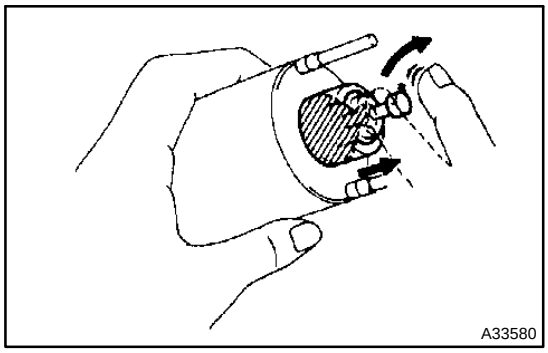
11. INSPECT STARTER BRUSH HOLDER ASSY
[28140 / 1904]

(a) Using an ohmmeter, check that there is no continuity between the positive (+) and negative (-) brush holders.



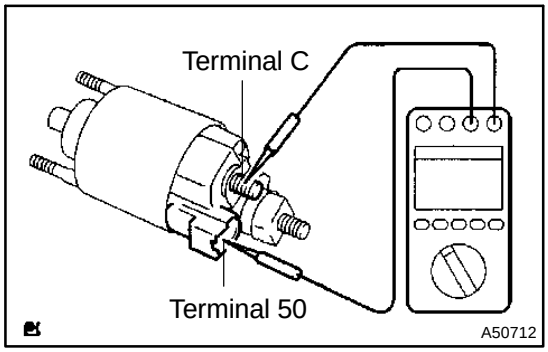
12. INSPECT STARTER CLUTCH SUB-ASSY
[28011 / 1904]

(a) Rotate the clutch pinion gear clockwise and check that it turns freely. Try to rotate the clutch pinion gear counter-clockwise and check that it locks.

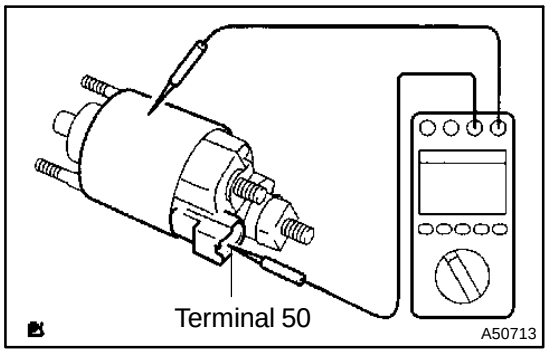


13. INSPECT MAGNET STARTER SWITCH ASSY
[28150 / 1904]

(a) Push in the plunger and check that it returns quickly to its original position.



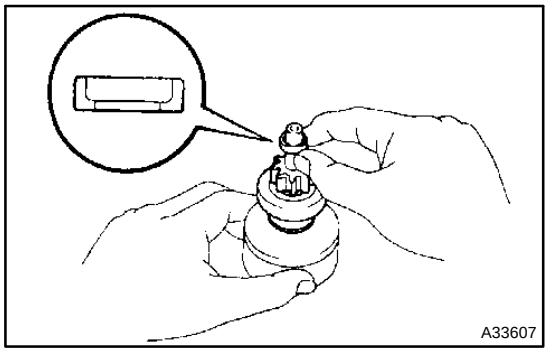
(b) Using an ohmmeter, check that there is continuity between terminals 50 and C.



(c) Using an ohmmeter, check that there is continuity between terminals 50 and the switch body.

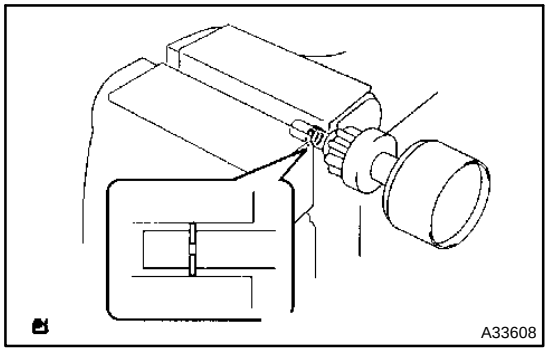
14. INSTALL STARTER CLUTCH SUB-ASSY
[28011 / 1904]

(a) Apply grease to the bushing and spline of the starter clutch and stop collar.

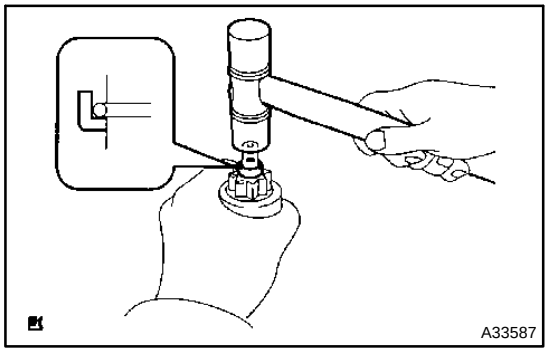


(b) Place the starter clutch and stop collar on the planetary shaft.

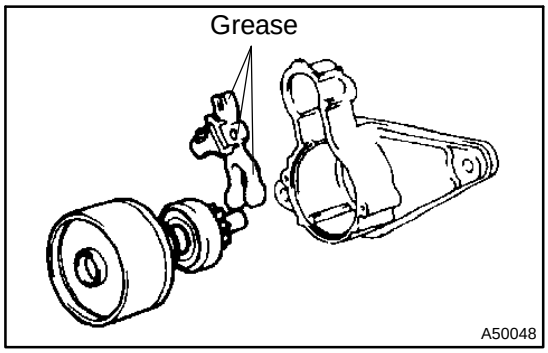
(c) Apply grease to the snap ring, and install it to the planetary shaft groove.



(d) Using a vise, compress the snap ring.

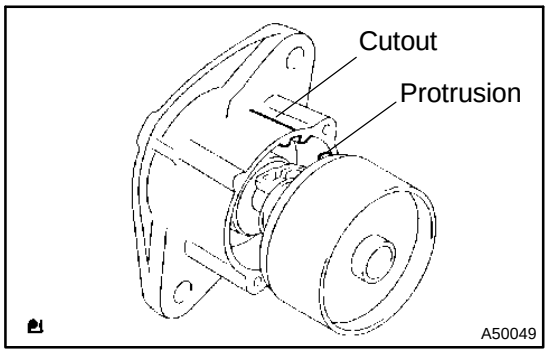


(e) Hold the starter clutch, tap the planetary shaft and install the stop collar onto the snap ring with a plastic-faced hammer.



(f) Apply grease to the drive lever touching the starter pivot part of the drive lever.

(g) Install the drive lever to the starter clutch.

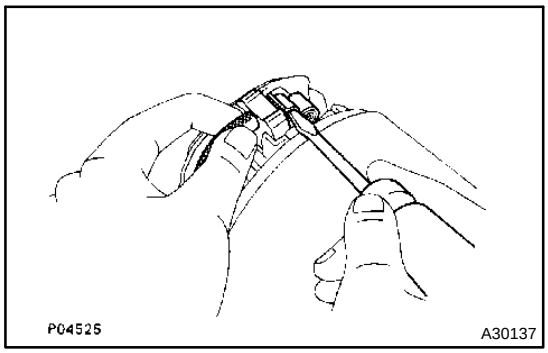


(h) Align the protrusion of the shock absorber with the cutout of the starter housing and install them.

15. INSTALL STARTER ARMATURE ASSY
[28160 / 1904]

16. INSTALL STARTER BRUSH HOLDER ASSY
[28140 / 1904]

(a) Install the brush holder.



(b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder.
Connect the 4 brushes.

(c) Apply turbine oil with additives to the bearing of the end frame.

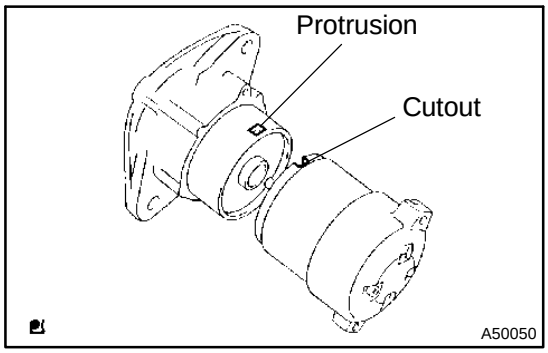
(d) Install a O-ring to the groove of the field frame.

(e) Install the end frame with 2 new screws.
Torque: 1.5 N·m (15 kgf·cm, 13 in.·lbf)

NOTICE:
To avoid interference between the brush holder and the dust protector push the commutator and frame away at an angle.

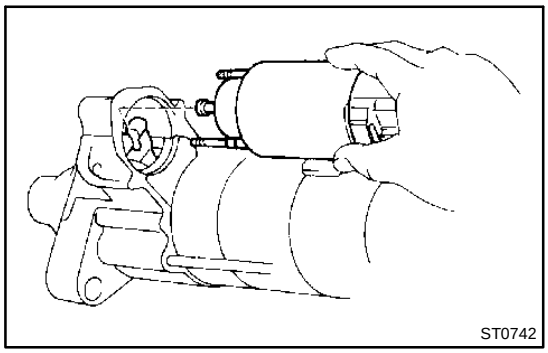
17. INSTALL STARTER YOKE ASSY
[28120 / 1904]

(a) Install a O-ring to the groove of the field frame.



(b) Align the cutout of the field frame with the protrusion of the shock absorber.

(c) Install the field frame and armature assembly with the 2 through bolts.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)



18. INSTALL MAGNET STARTER SWITCH ASSY
[28150 / 1904]

(a) Hang the plunger of the magnetic switch to the driver lever from the upper side.

(b) Install the magnetic switch with the 2 nuts.
Torque: 8.3 N·m (85 kgf·cm, 73 in.·lbf)

(c) Connect the lead wire to the terminal with the nut.
Torque: 9.8 N·m (100 kgf·cm, 87 in.·lbf)

GENERATOR ASSY (1ZZ-FE/3ZZ-FE)

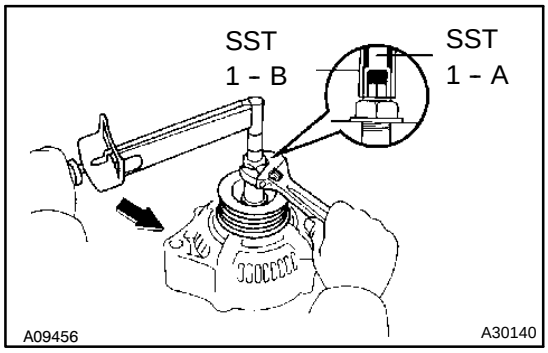
OVERHAUL

1900Q-01

1. REMOVE GENERATOR PULLEY
[27411 / 1903]
SST 09820-63010 (09820-06010, 09820-06020)

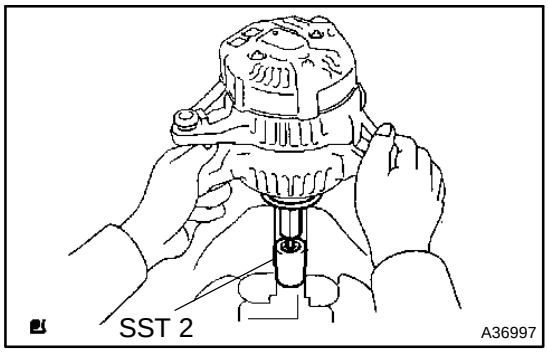
HINT:

SST1 - A, B	09820-06010
SST2	09820-06020

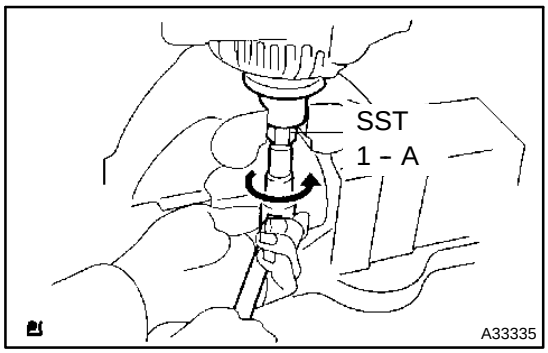


(a) Hold SST 1 - A with a torque wrench, and tighten SST 1 - B clockwise to the specified torque.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

NOTICE:
Check that SST is secured to the rotor shaft.



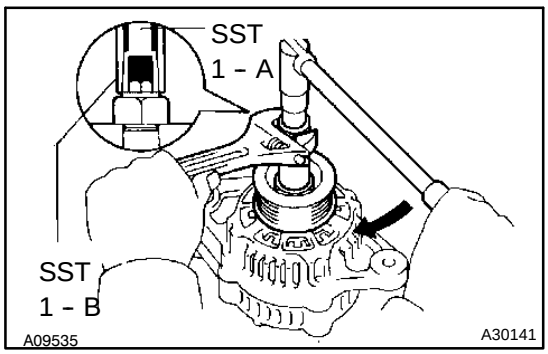
(b) Mount SST 2 in a vise.
(c) Insert SST 1 - A, B into SST 2, and attach the pulley nut to SST 2.



(d) To loosen the pulley nut, turn SST 1 - A in the direction shown in the illustration.

NOTICE:
To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half of a turn.

(e) Remove the alternator form SST 2.



(f) Turn SST 1 - B, and remove SST 1 - A, B.
(g) Remove the pully nut and pulley.

2. REMOVE GENERATOR BRUSH HOLDER ASSY
[27370 / 1903]

(a) Remove the rear end cover.

(b) Remove the brush cover.

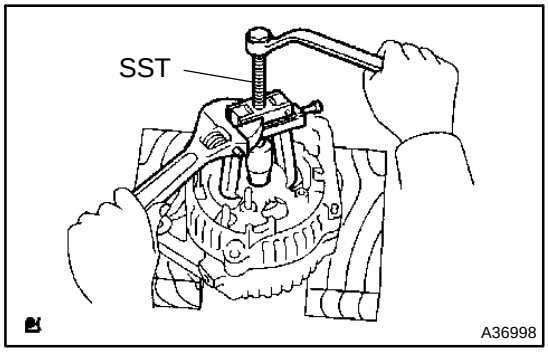
(c) Remove the brush holder.

3. REMOVE GENERATOR REGULATOR ASSY
[27700A / 1903]

4. REMOVE GENERATOR HOLDER W/RECTIFIER
[27357 / 1903]

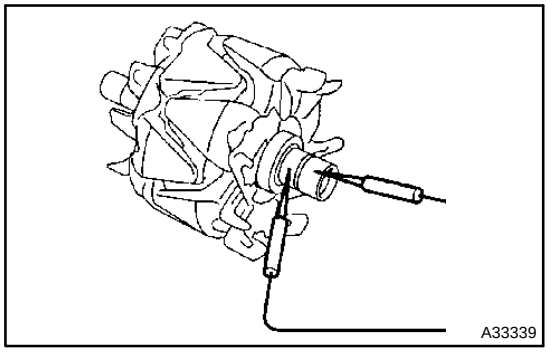
5. REMOVE GENERATOR ROTOR ASSY
[27330 / 1903]

(a) Remove the nuts and wire clip.



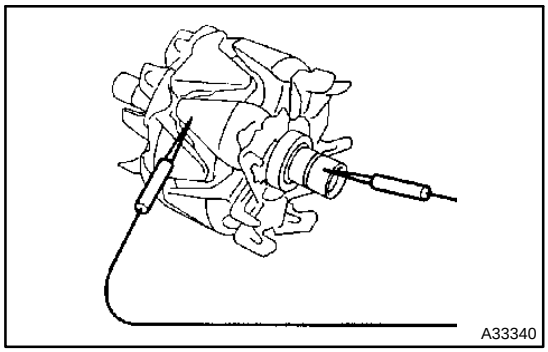
(b) Using SST, remove the rectifier end frame.
SST 09286-46011

(c) Remove rotor from drive end frame.

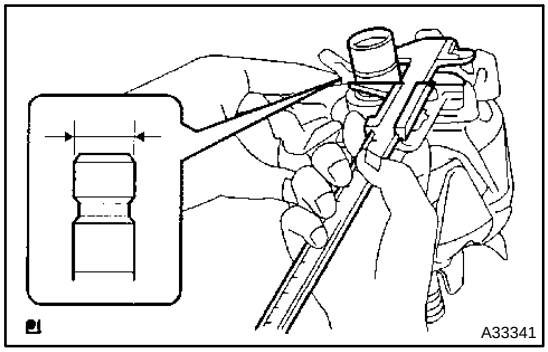


6. INSPECT GENERATOR ROTOR ASSY
[27330 / 1903]

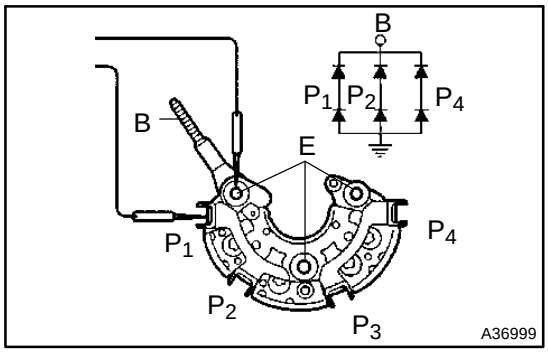
(a) Using an ohmmeter, check that there is continuity between the slip rings.
Standard resistance:
2.7 - 3.1 Ω at 20°C (68°F) (A/T)
2.1 - 2.5 Ω at 20°C (68°F) (M/T)



(b) Using an ohmmeter, check that there is no continuity between the slip ring and rotor.



(c) Using vernier calipers, measure the slip ring diameter.
Standard diameter:
14.2 – 14.4 mm (0.559 – 0.567 in.)
Minimum diameter: 12.8 mm (0.504 in.)

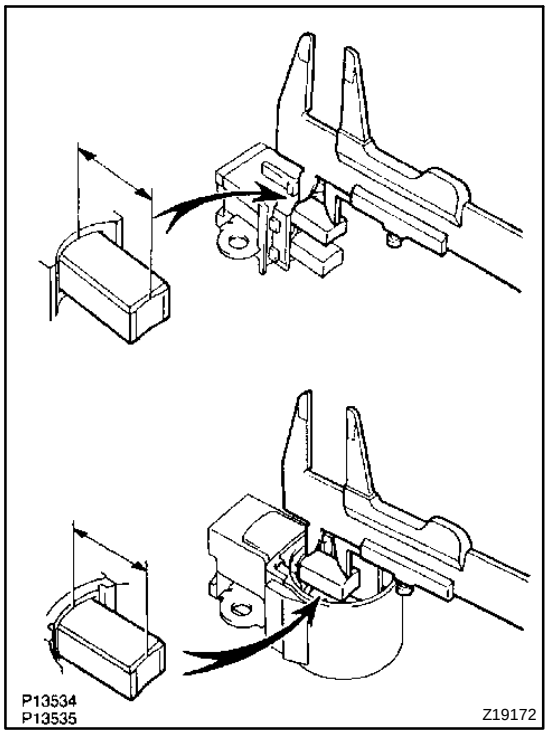


7. INSPECT GENERATOR HOLDER W/RECTIFIER
[27357 / 1903]

(a) Using an ohmmeter, connect one tester probe to the B or E terminal and the other to each rectifier terminal.

(b) Reverse the polarity of the tester probes and repeat step (a).

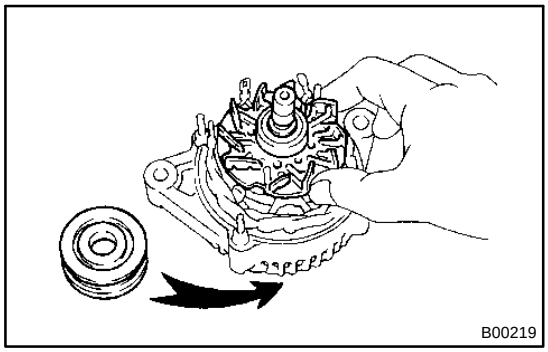
(c) Check that one shows continuity and the other shows no continuity.



8. INSPECT GENERATOR BRUSH HOLDER ASSY
[27370 / 1903]

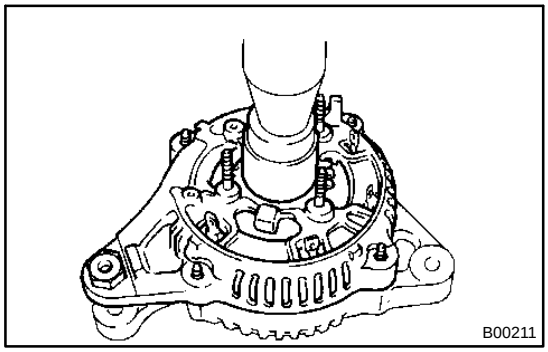
(a) Using vernier calipers, measure the exposed brush length.
Standard exposed length:
9.5 – 11.5 mm (0.374 – 0.453 in.)
Minimum exposed length: 1.5 mm (0.059 in.)

HINT:
If the exposed length is less than minimum, replace the brush holder assembly.

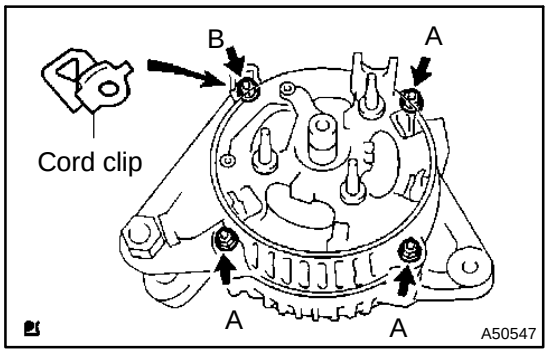


9. INSTALL GENERATOR ROTOR ASSY
[27330 / 1903]

(a) Install the rotor to the drive end frame.

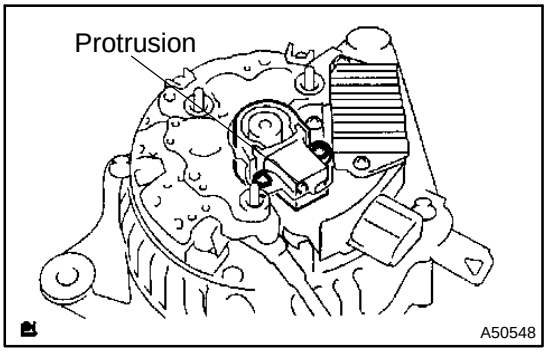


(b) Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.



(c) Install the cord clip and 4 nuts.
Torque:
Nut A 4.5 N·m (46 kgf·cm, 40 in.·lbf)
Nut B 5.4 N·m (55 kgf·cm, 48 in.·lbf)

10. INSTALL GENERATOR HOLDER W/RECTIFIER
[27357 / 1903]
Torque: 2.9 N·m (30 kgf·cm, 26 in.·lbf)
11. INSTALL GENERATOR REGULATOR ASSY
[27700A / 1903]
Torque: 2.0 N·m (20 kgf·cm, 18 in.·lbf)



12. INSTALL GENERATOR BRUSH HOLDER ASSY
[27370 / 1903]
(a) Install the brush holder with the 2 screws.
Torque: 2.0 N·m (20 kgf·cm, 18 in.·lbf)

NOTICE:
Pay attention to the holder installation direction.

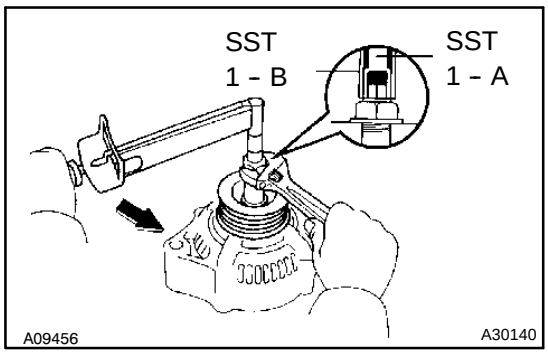
(b) Install the end cover with the bolt and 3 nuts.
Torque:
Nut 4.4 N·m (45 kgf·cm, 39 in.·lbf)
Bolt 3.9 N·m (39 kgf·cm, 35 in.·lbf)

13. INSTALL GENERATOR PULLEY
[27411 / 1903]
SST 09820-63010 (09820-06010, 09820-06020)

HINT:

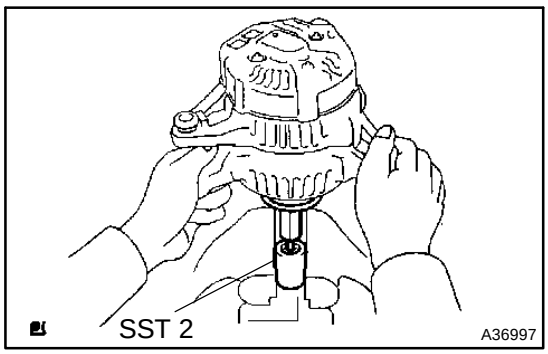
SST1 - A, B	09820-06010
SST2	09820-06020

(a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

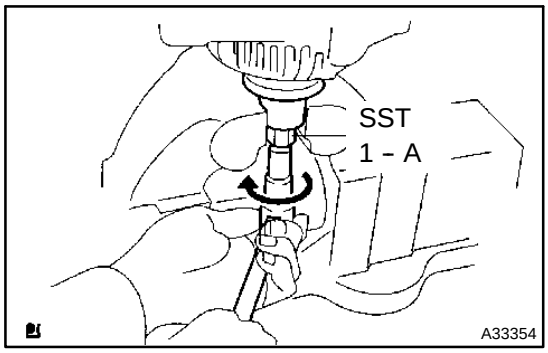


(b) Hold SST 1 - A with a torque wrench, and tighten SST 1 - B clockwise to the specified torque.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

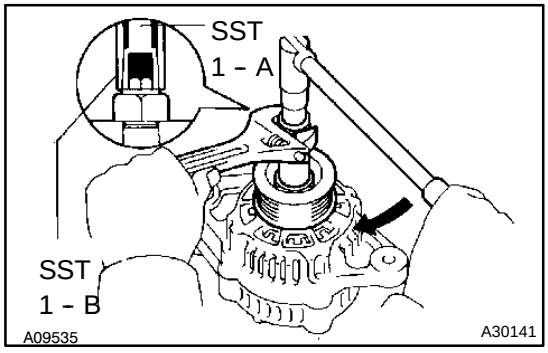
NOTICE:
Check that SST is secured to the pulley shaft.



(c) Mount SST 2 in a vise.
(d) Insert SST 1 - A, B into SST 2, and attach the pully nut to SST 2.



(e) Tighten the pully nut, turn SST 1 - A in the direction shown in the illustration.
Torque: 111 N·m (1,125 kgf·cm, 81 ft·lbf)
(f) Remove the alternator form SST 2.



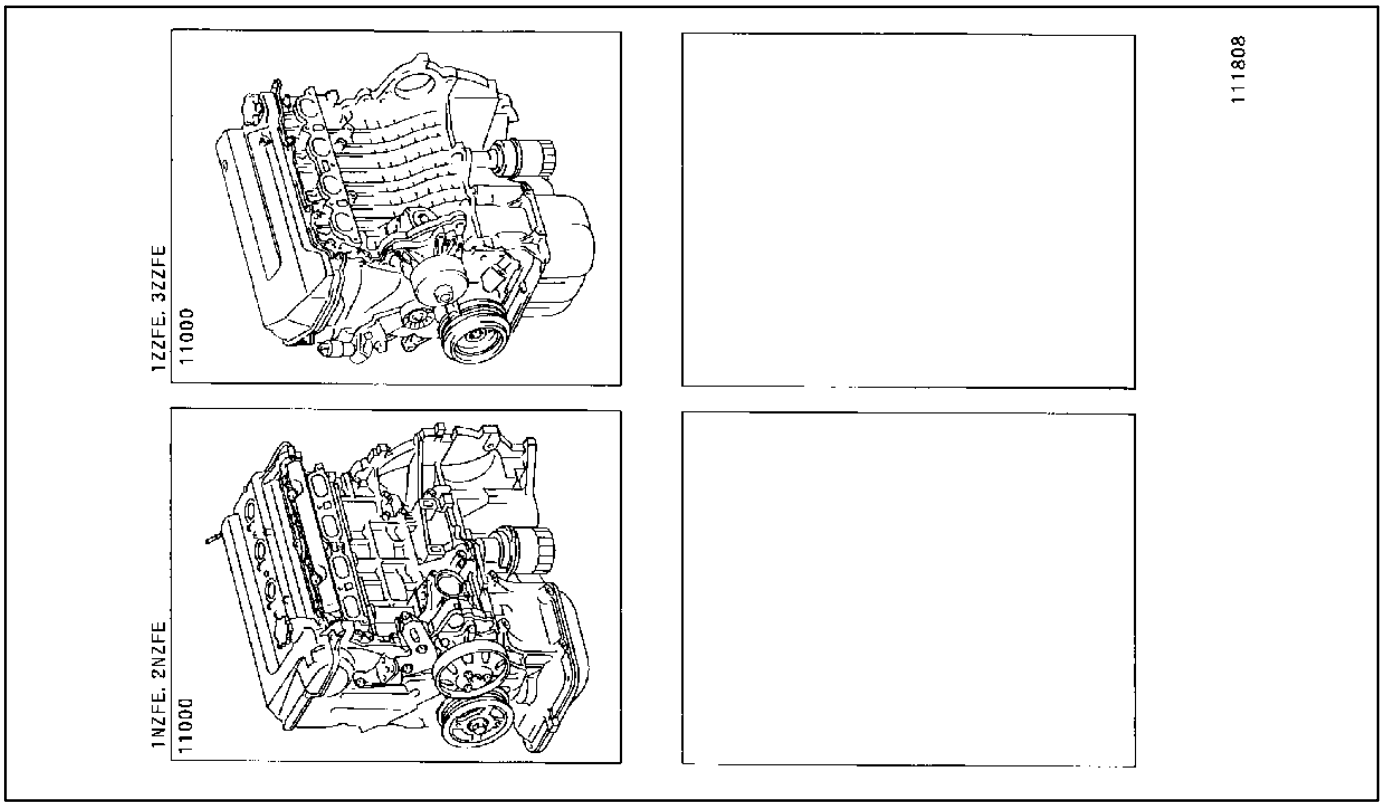
(g) Turn SST 1 - B, and remove SST 1 - A, B.
(h) Turn the pulley, and check that the pulley moves smoothly.

COMPONENTS

980AC-01

1101/PARTIAL ENGINE ASSEMBLY

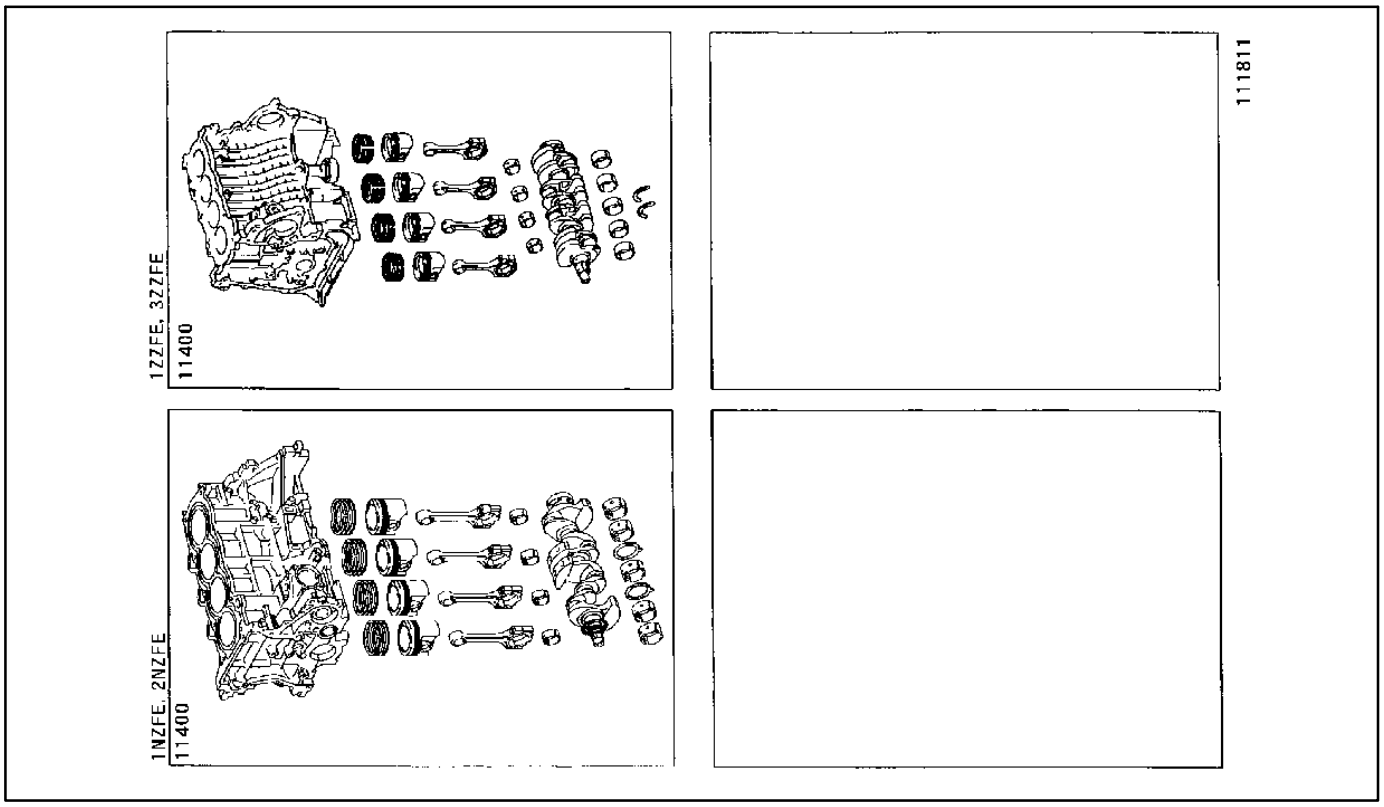
(0008-)



9809Y-01

1102/SHORT BLOCK ASSEMBLY

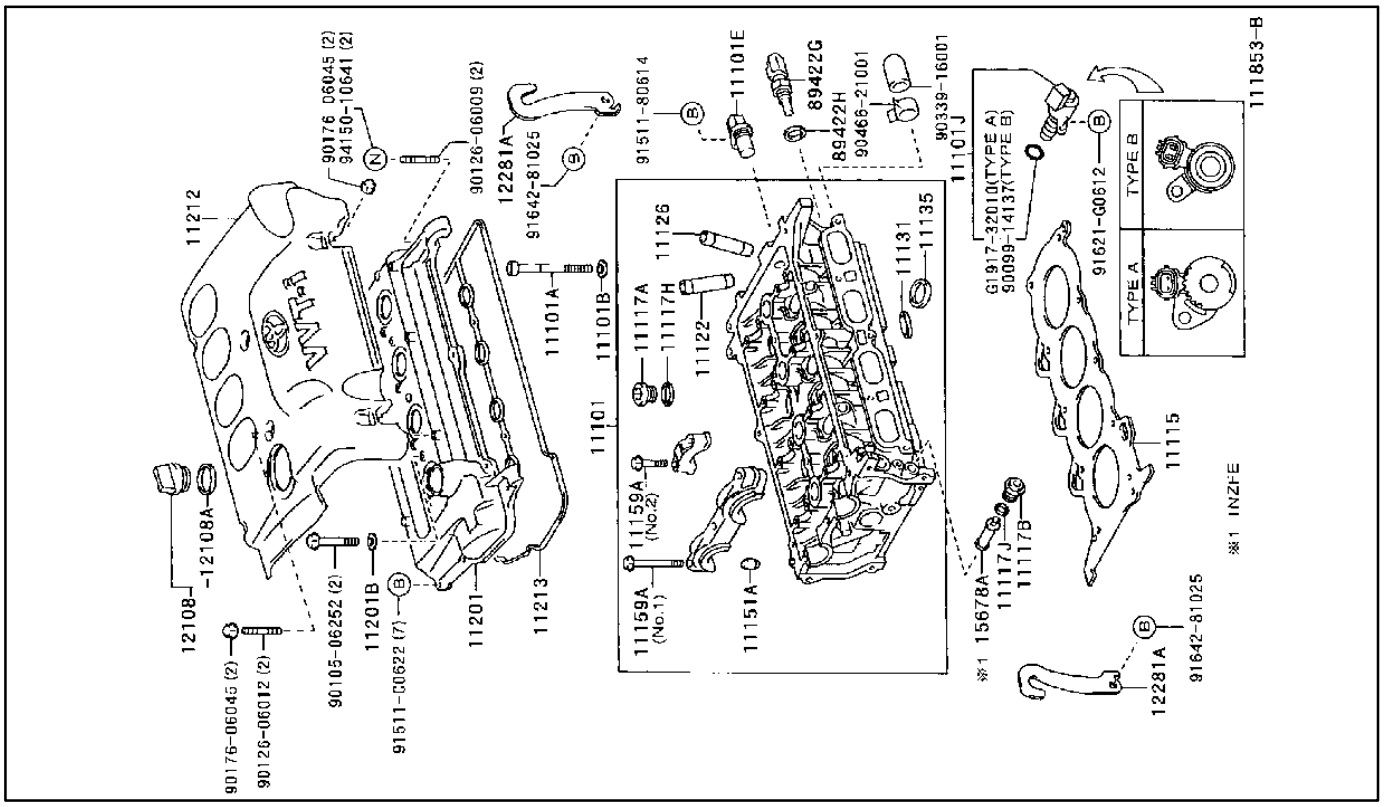
(0008-)



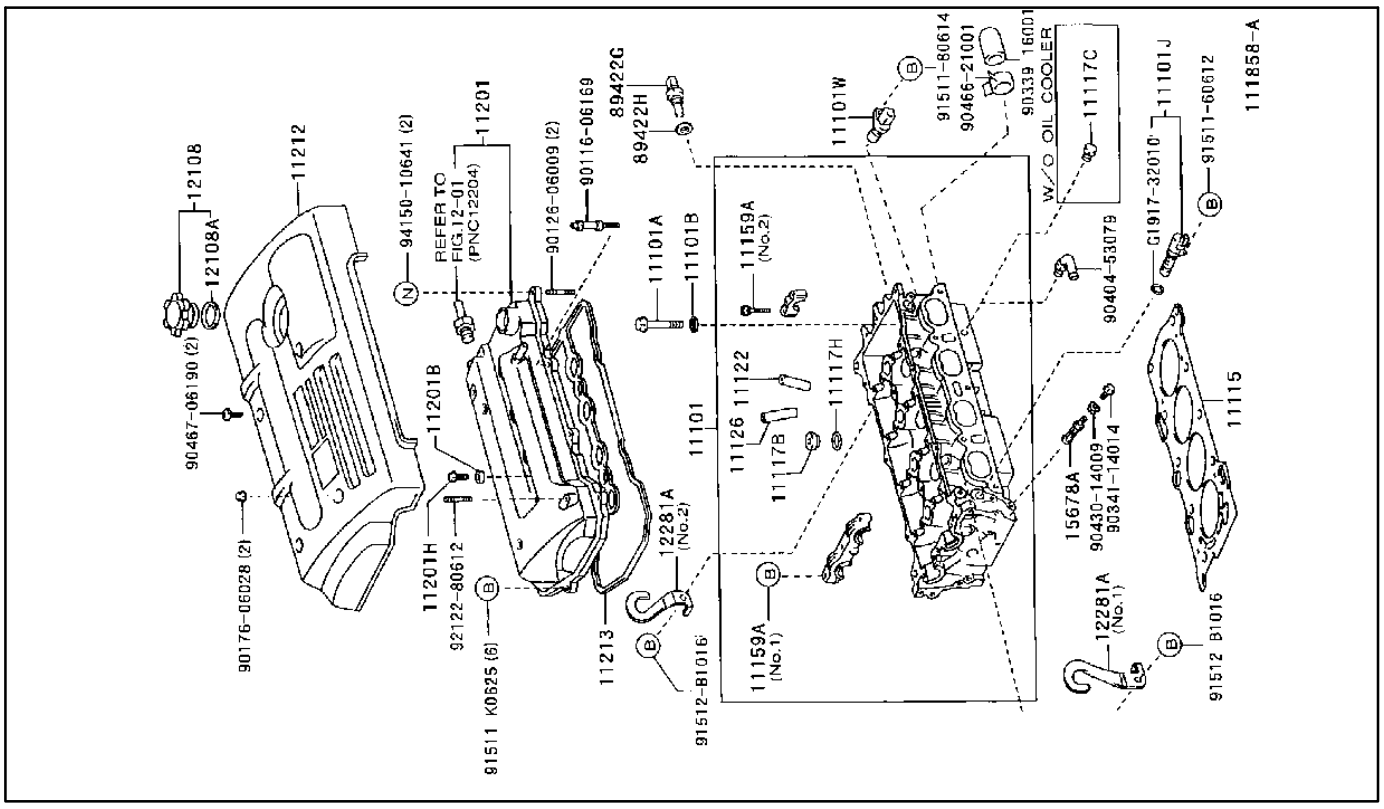
9809Z-01

1104/CYLINDER HEAD

(0008-)1NZFE,2NZFE



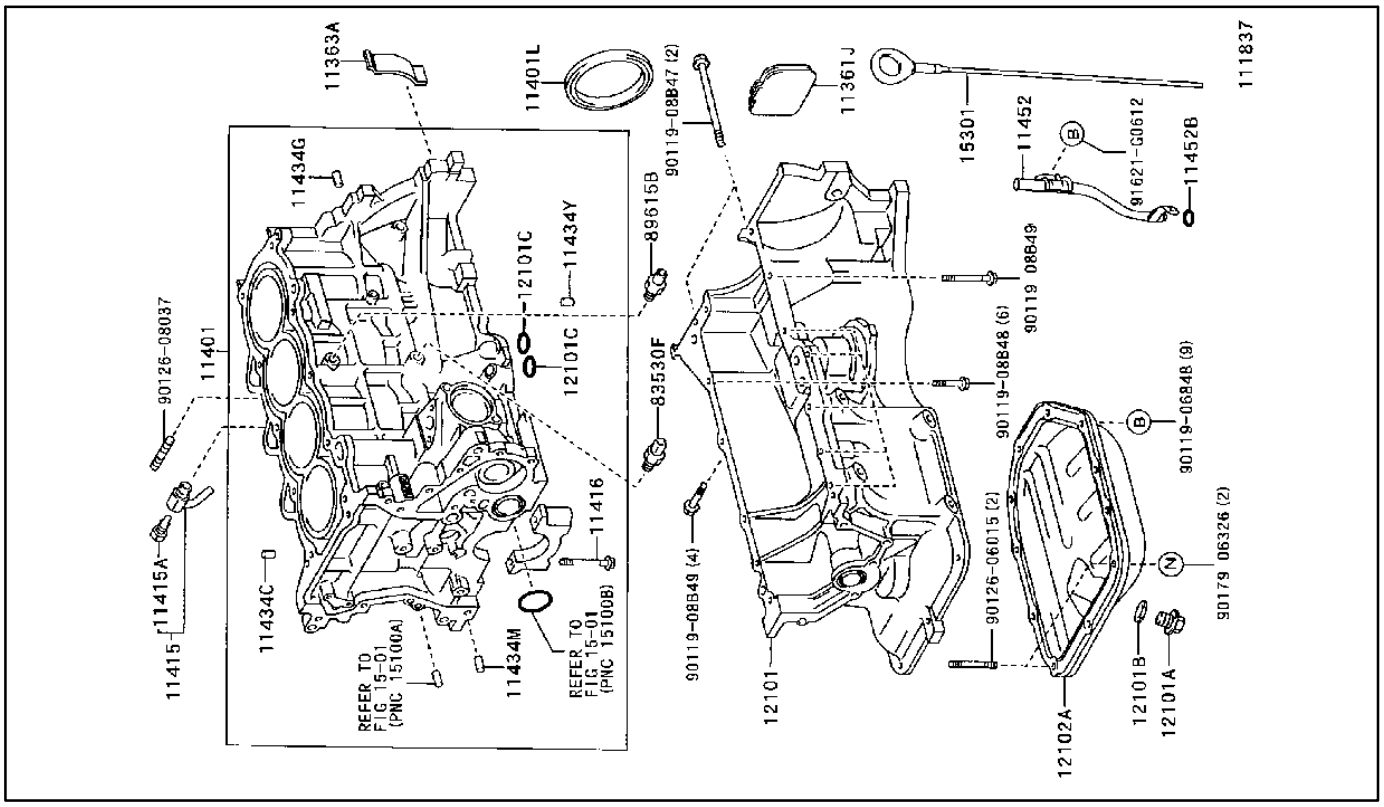
(0008-)1ZZFE,3ZZFE



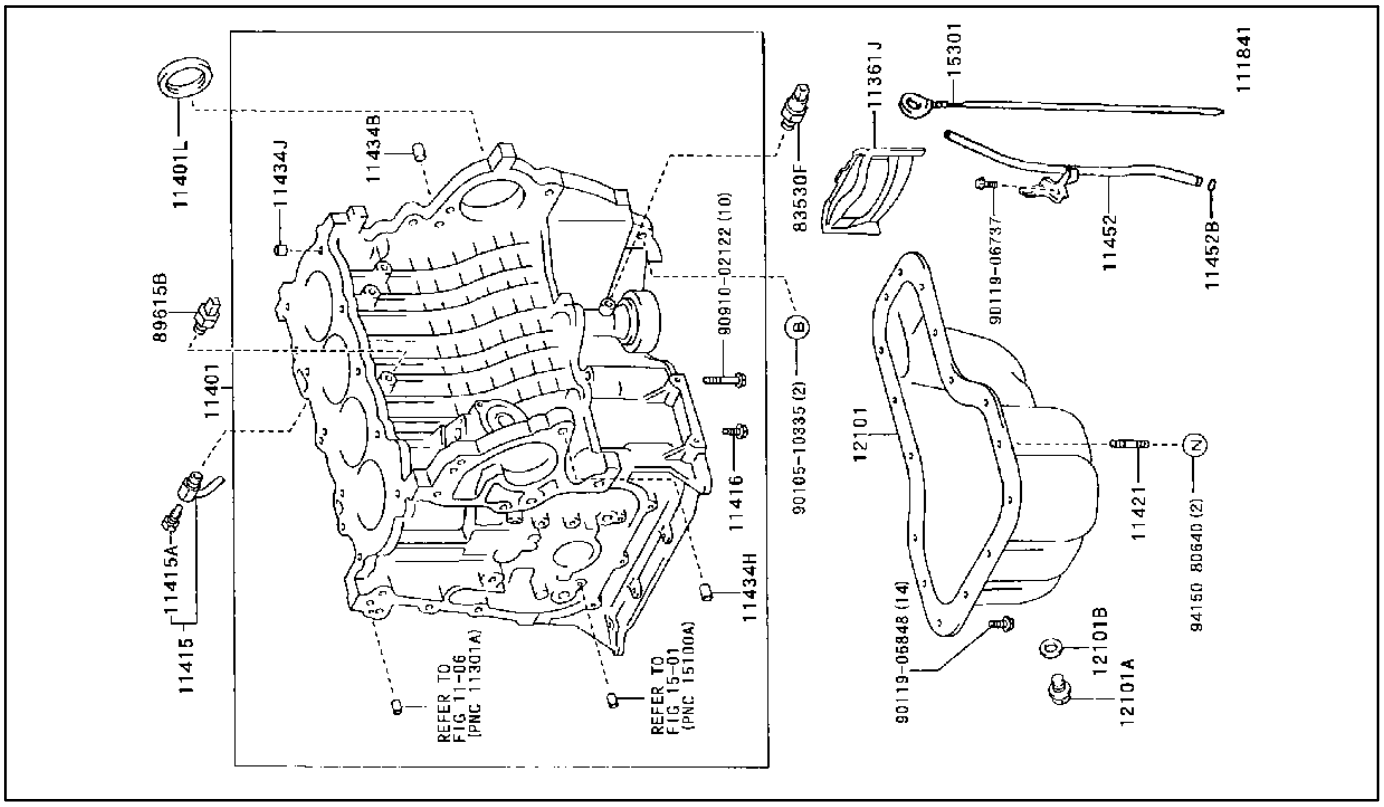
980A0-01

1105/CYLINDER BLOCK

(0008-)1NZFE,2NZFE



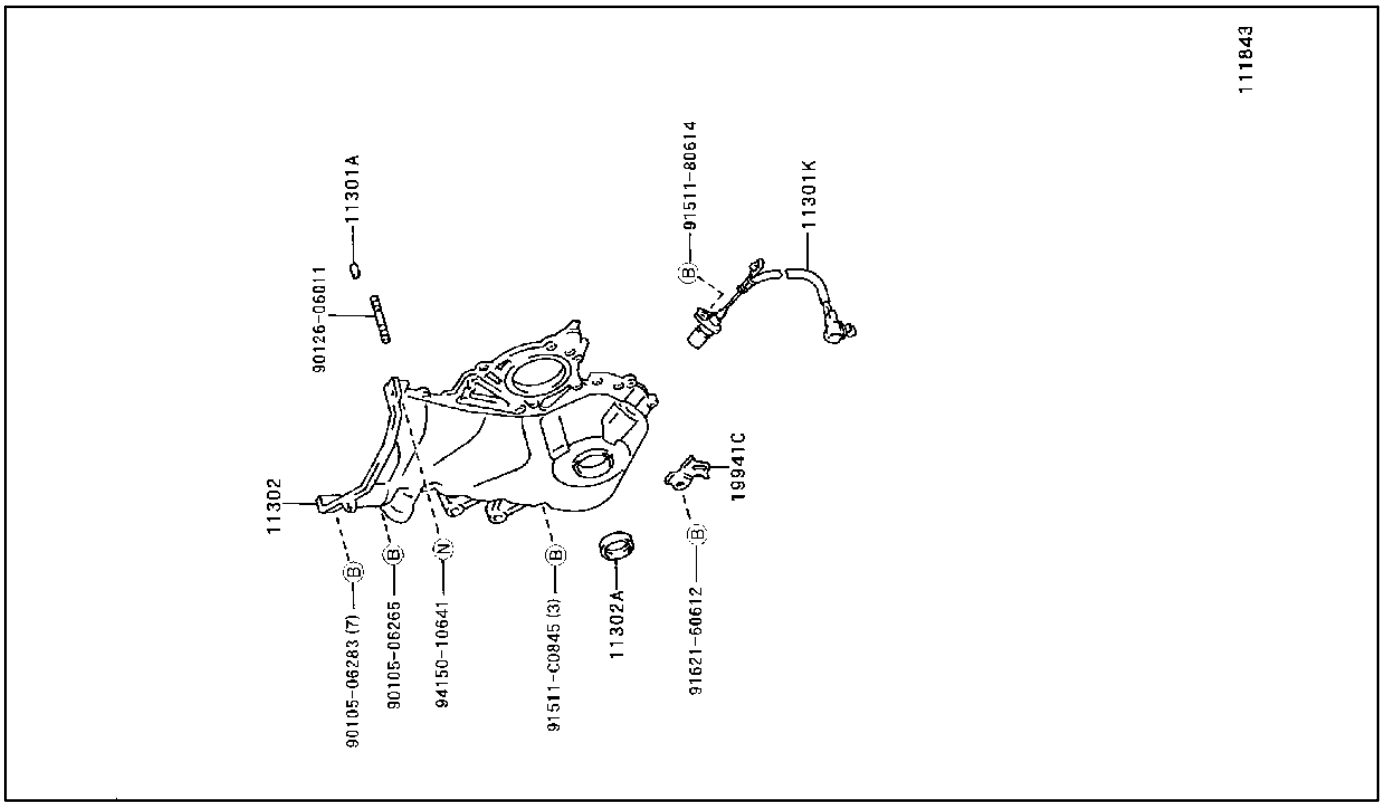
(0008-)1ZZFE,3ZZFE



980A1-01

1106/TIMING GEAR COVER & REAR END PLATE

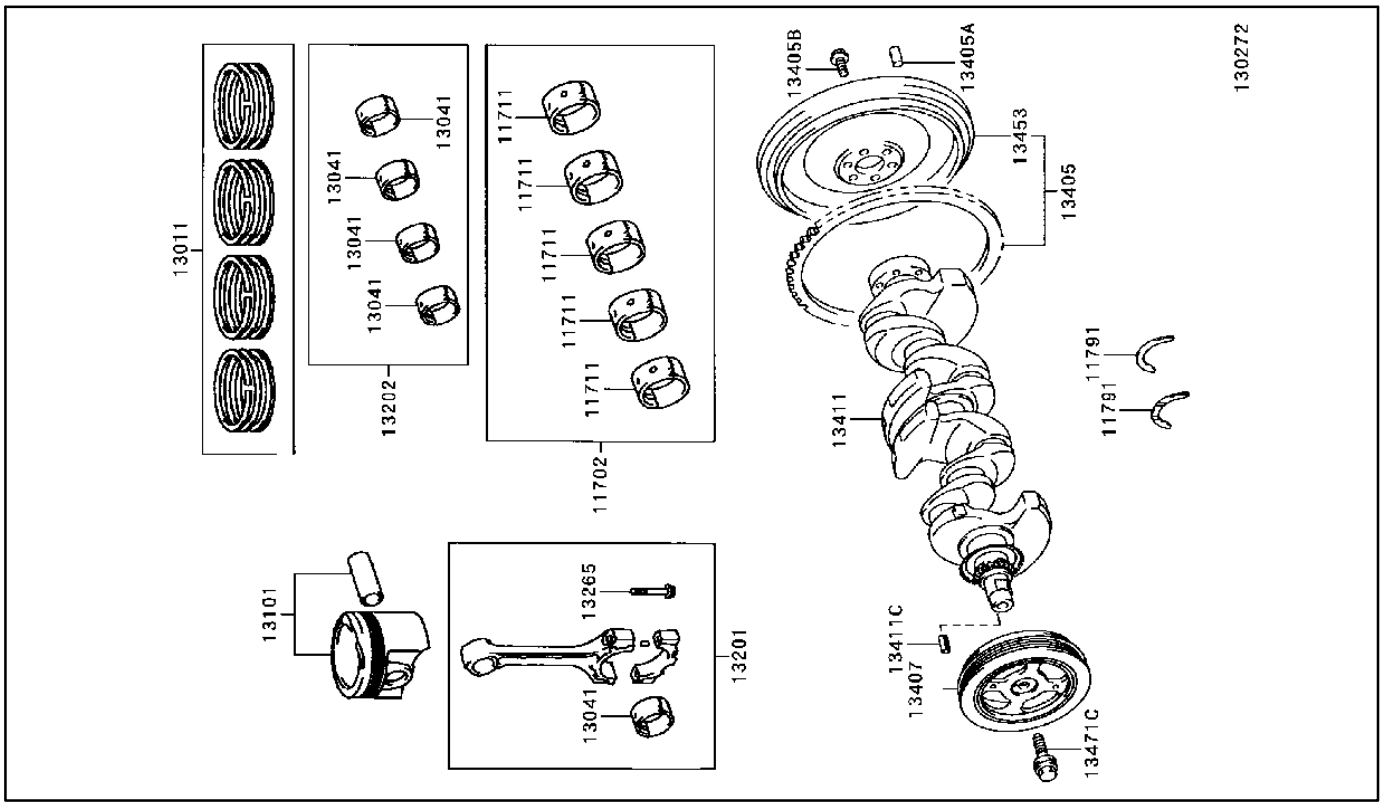
(0008-)1ZZFE,3ZZFE



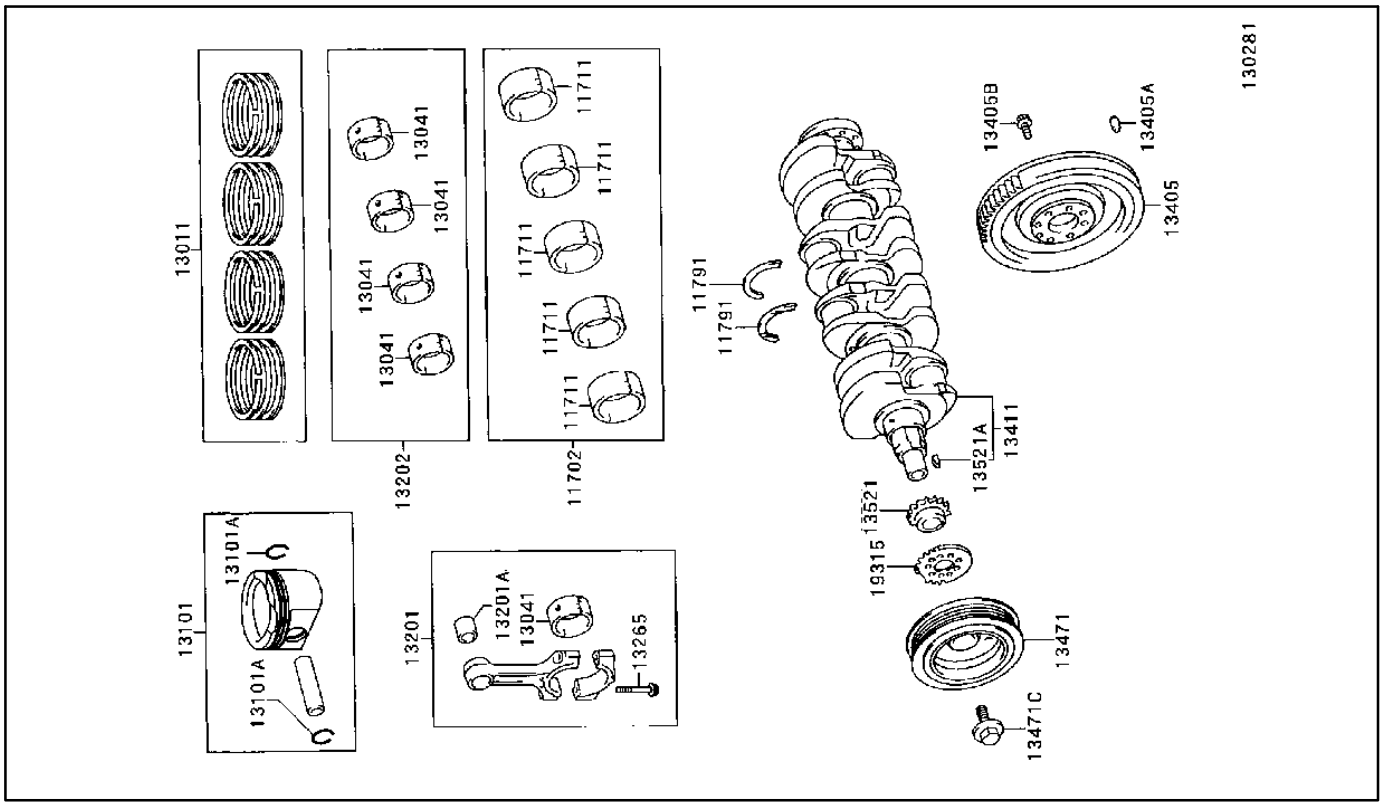
980A2-01

1301/CRANKSHAFT & PISTON

(0008-)1NZFE,2NZFE



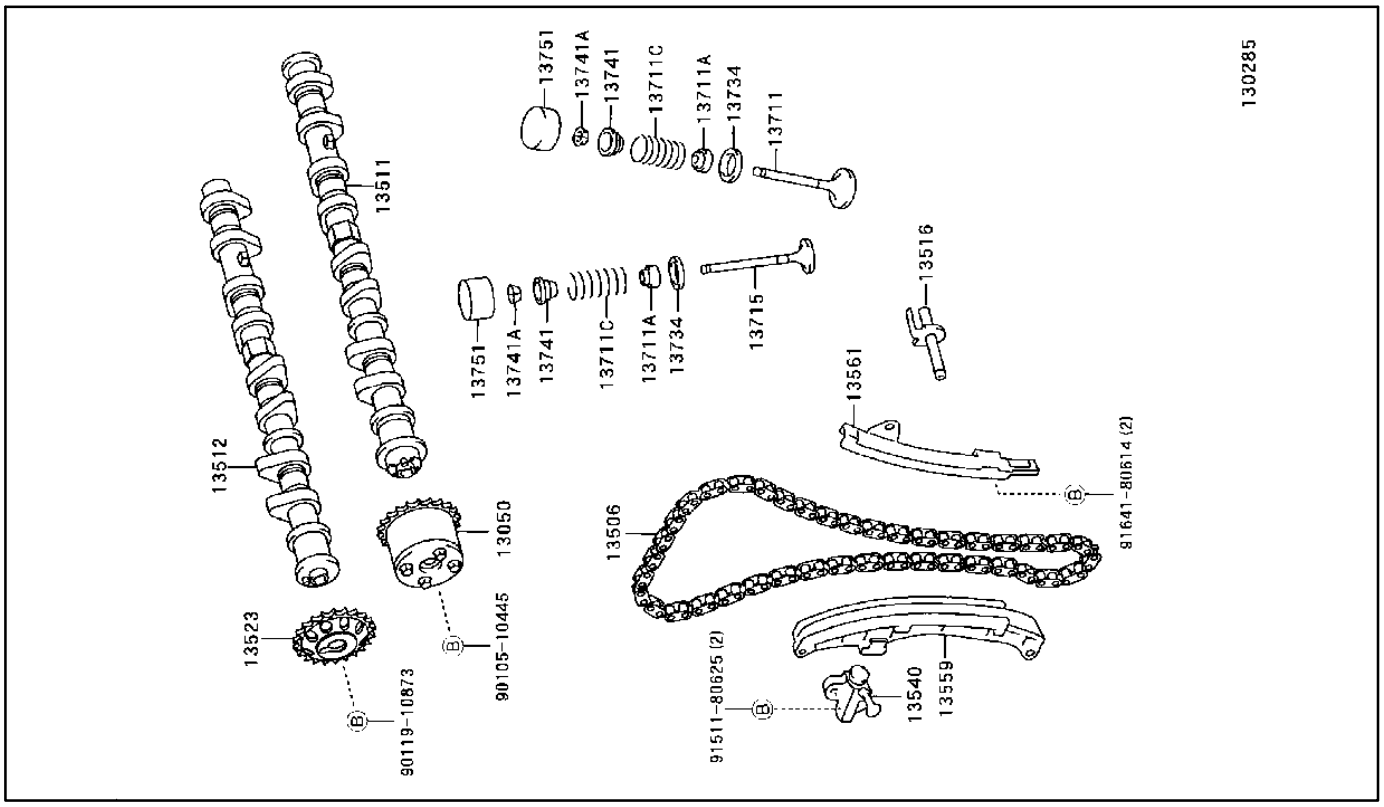
(0008-)1ZZFE,3ZZFE



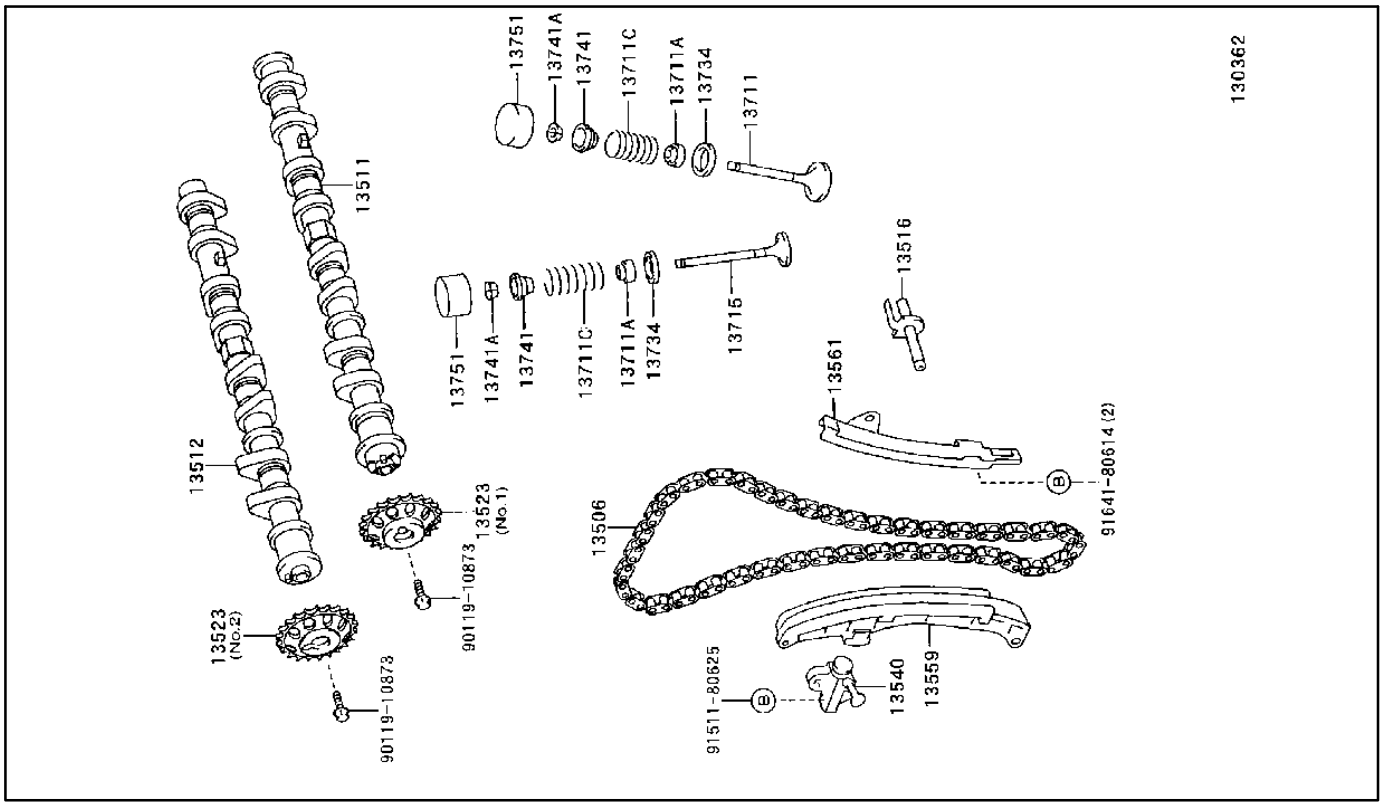
980A3-01

1302/CAMSHAFT & VALVE

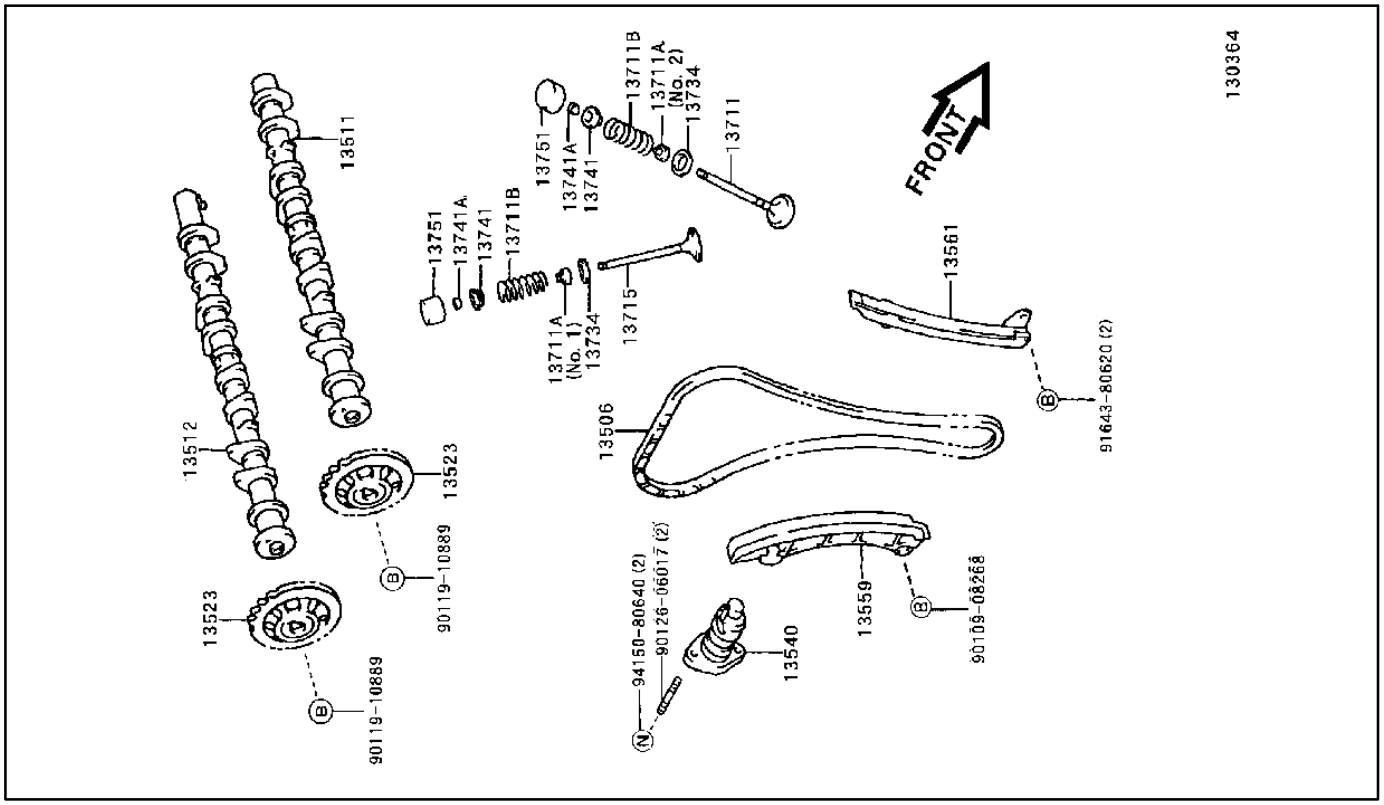
(0008-)1NZFE



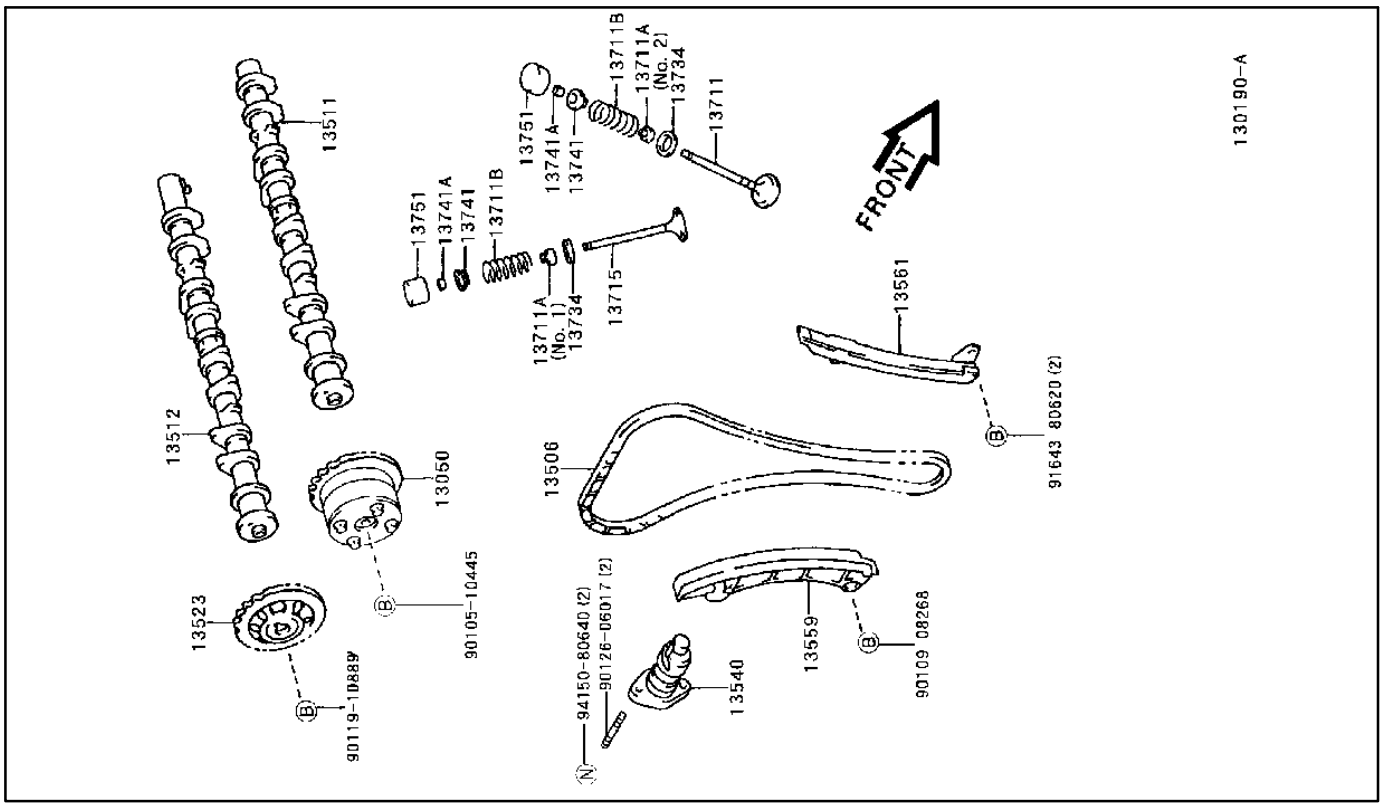
(0008-)2NZFE



(0008-)1ZZFE



(0008-)3ZZFE



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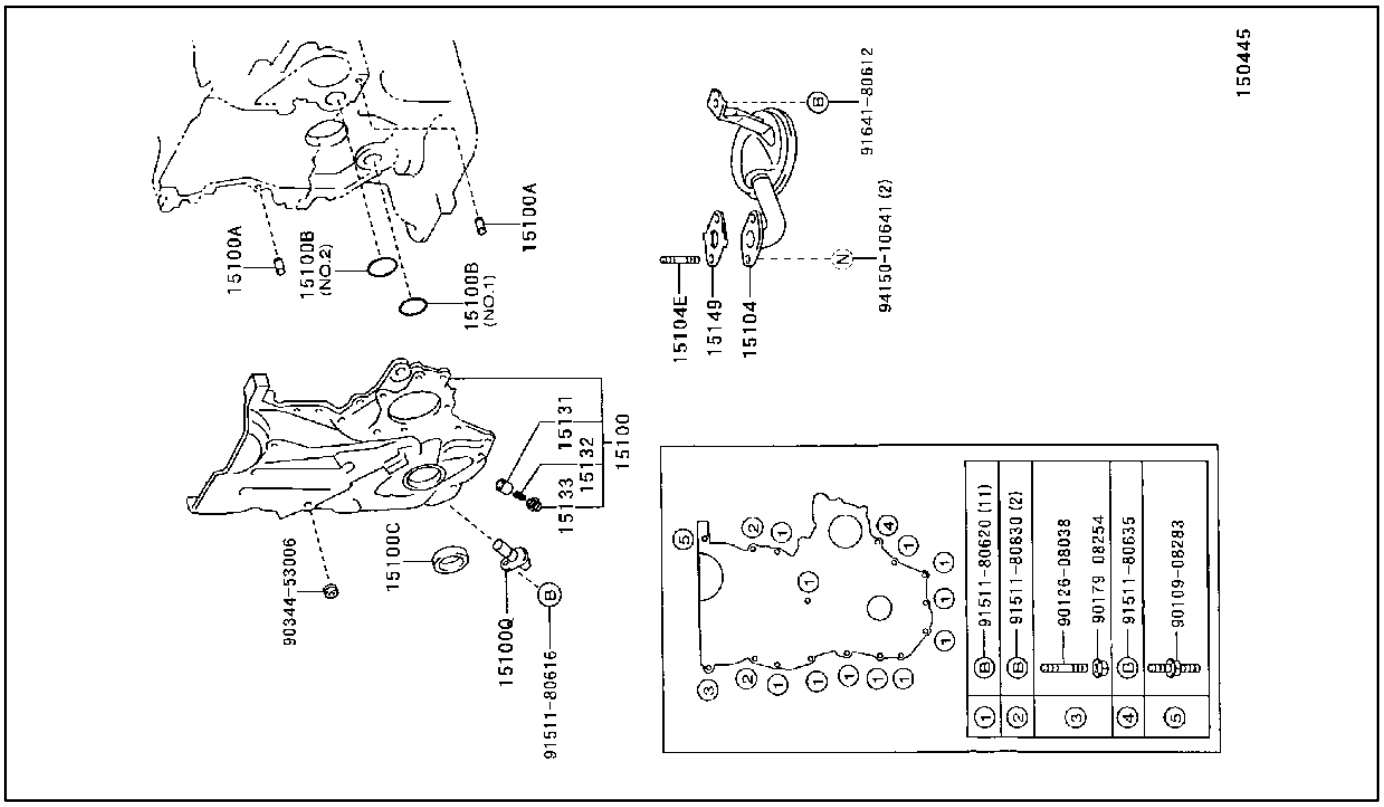
1501/OIL PUMP

(0008-)1NZFE,2NZFE



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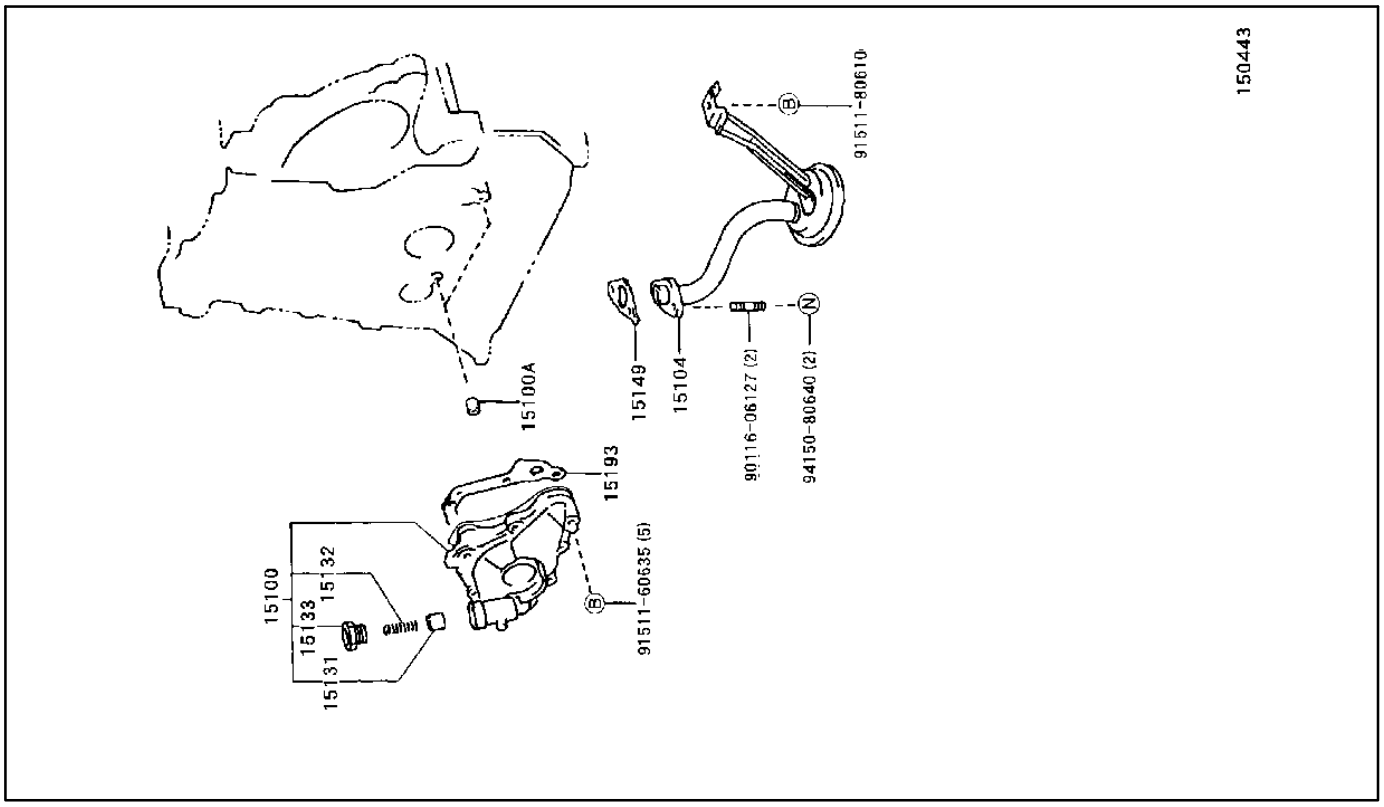
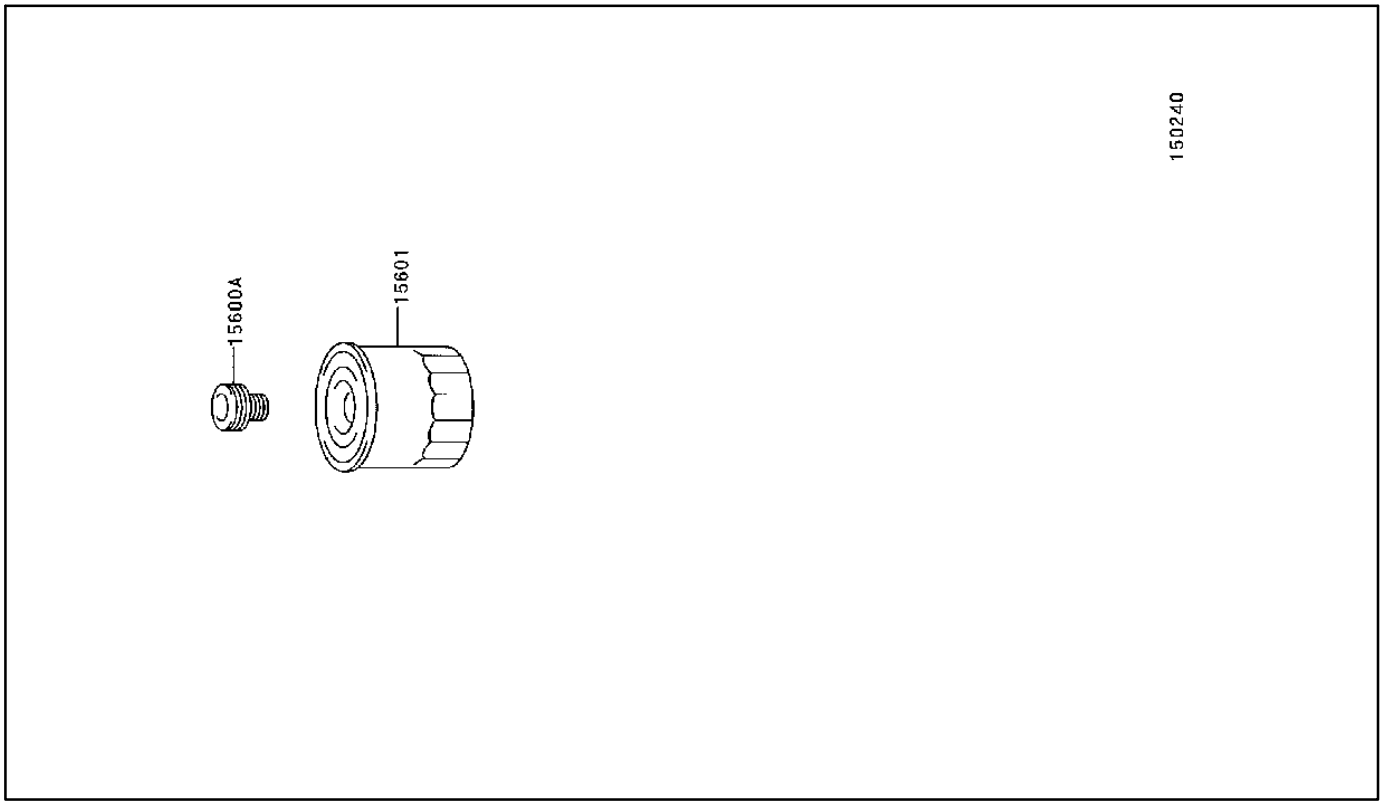


980A5-01

1502/OIL FILTER

(0008-)1NZFE,2NZFE



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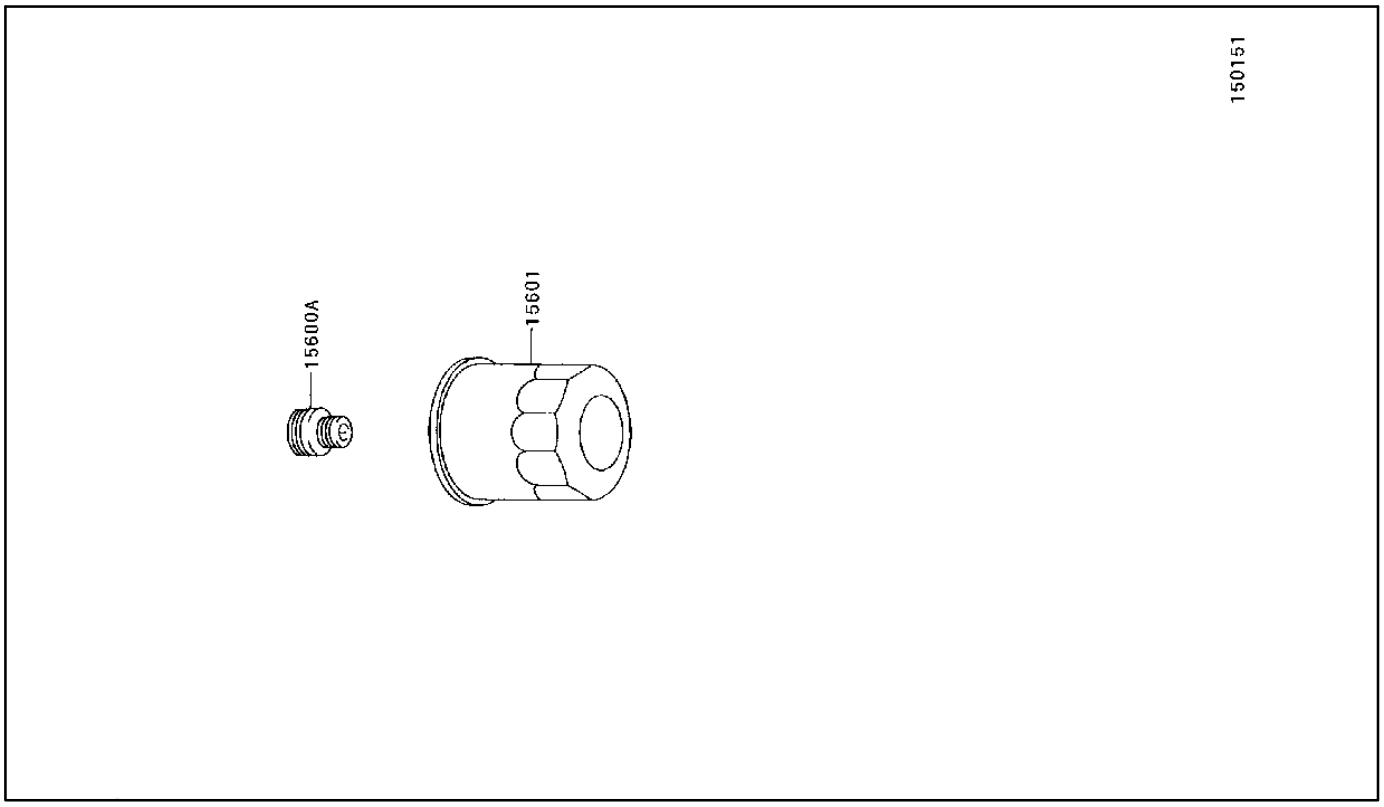
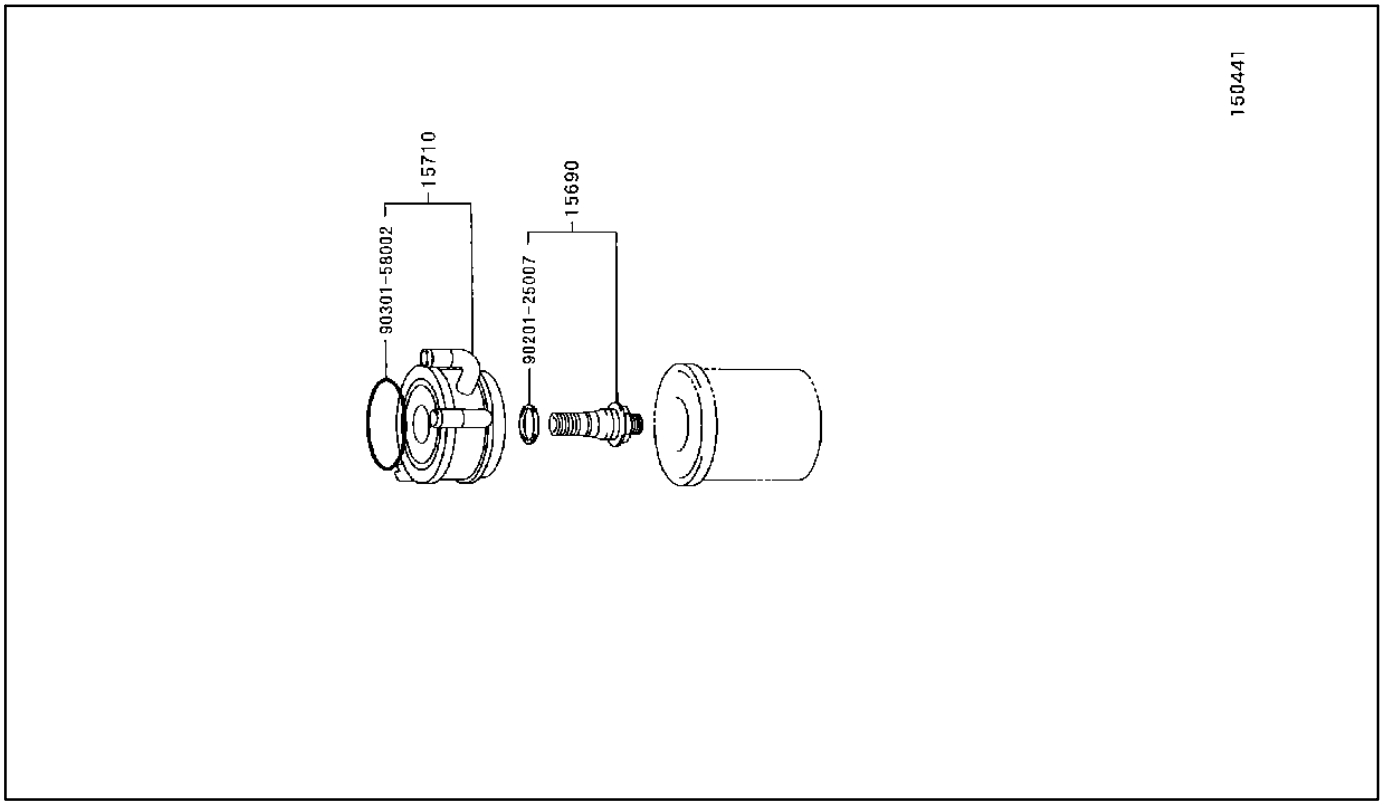


980A6-01

1503/OIL COOLER

(0008-)1ZZFE



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1601/WATER PUMP

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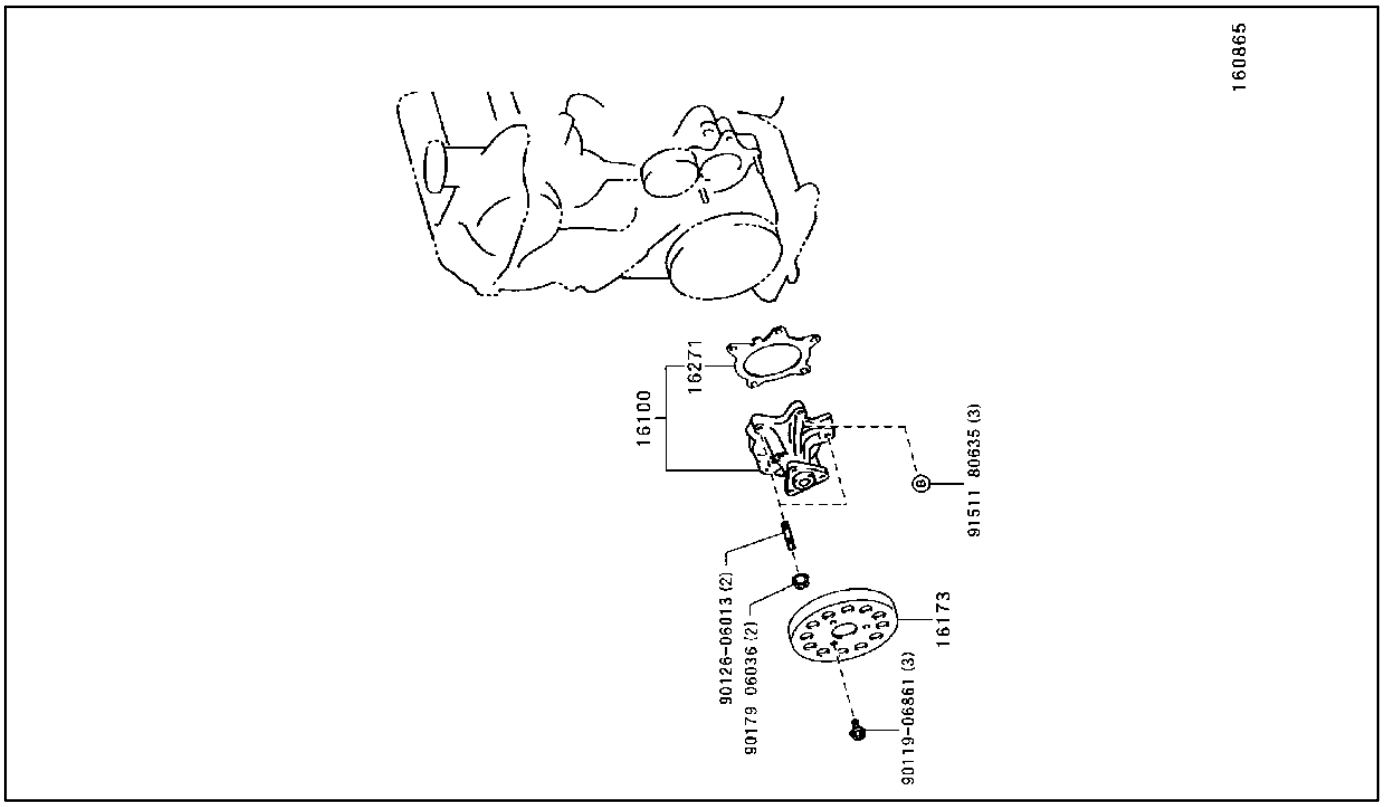

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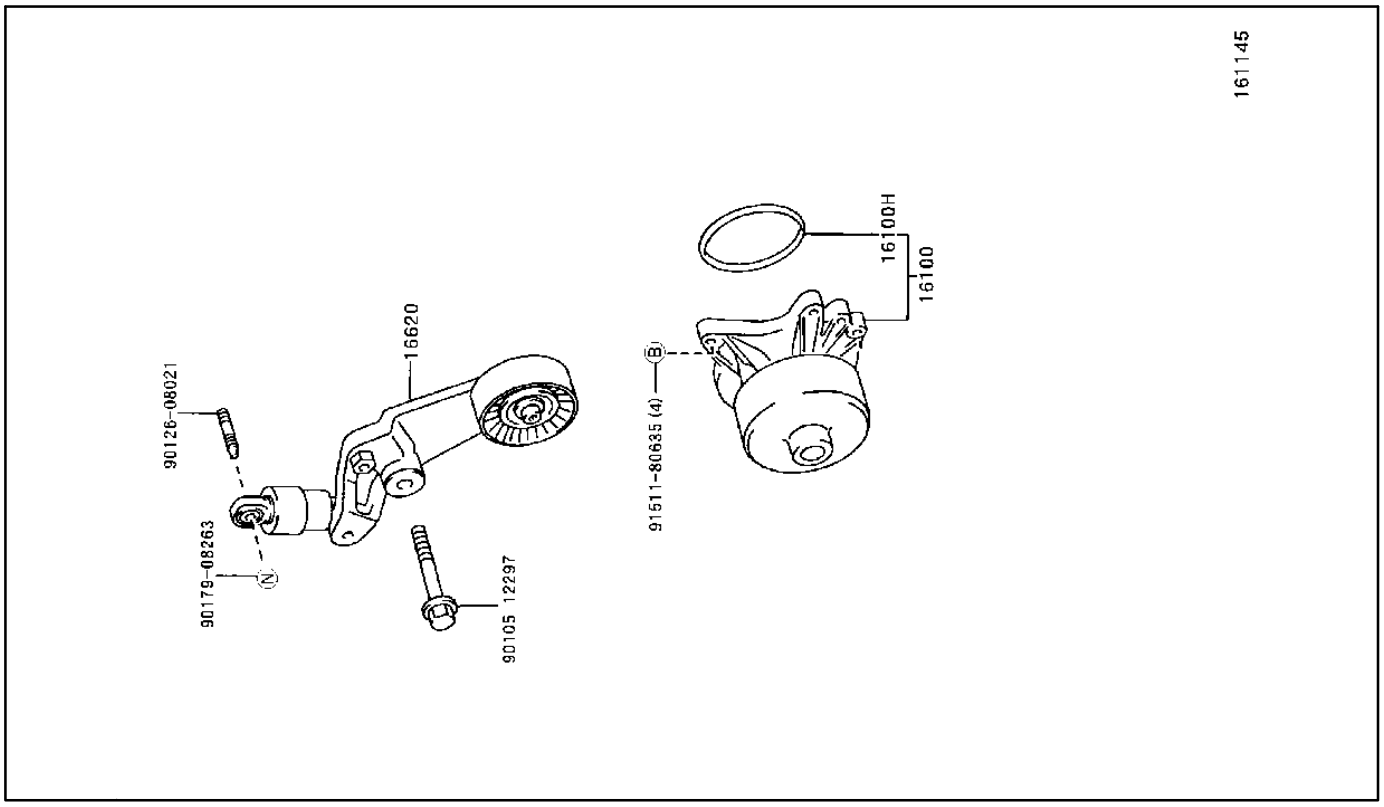

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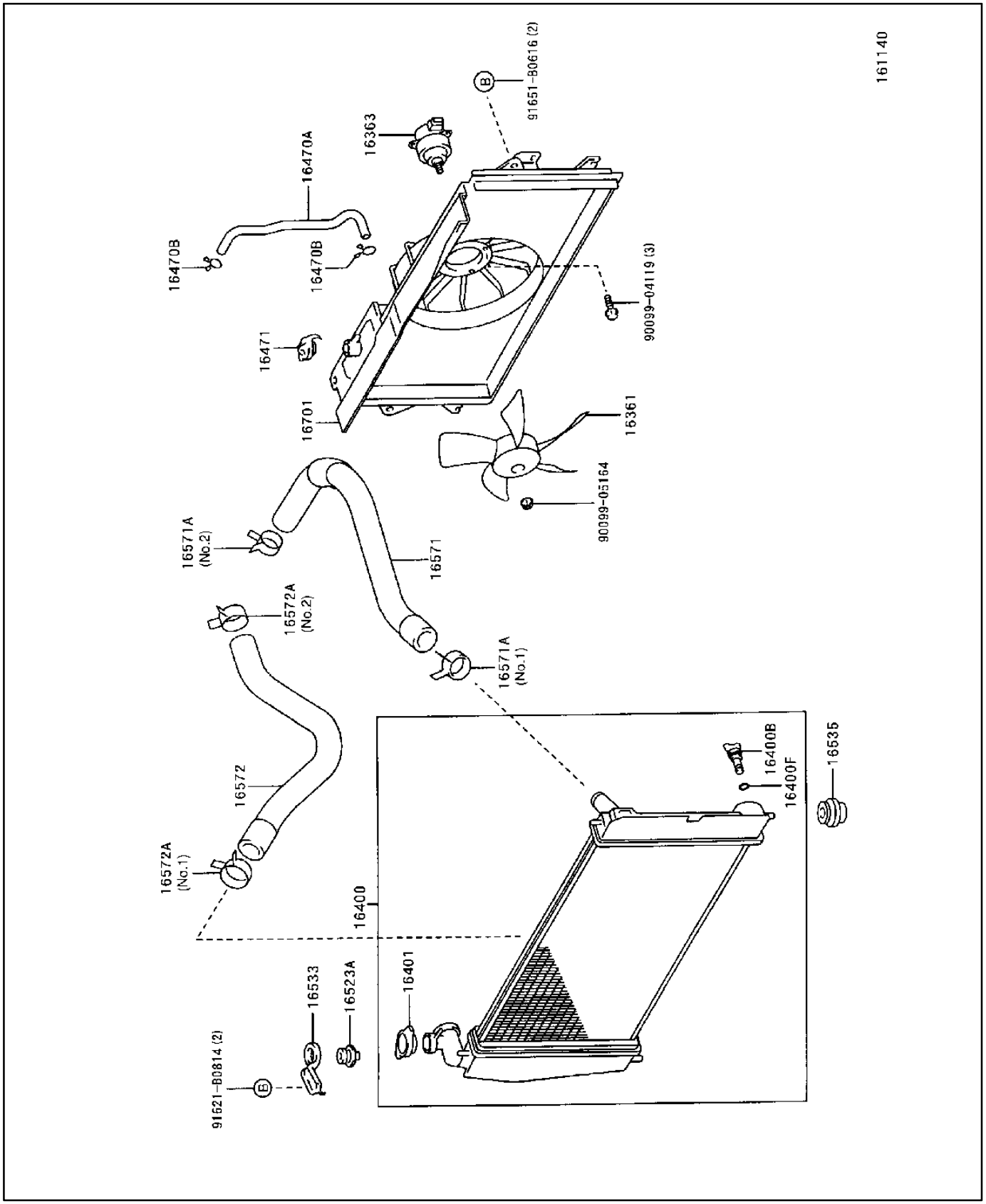
1 03/RADIATOR ATER OUTLET

(0008-)1NZFE,2NZFE

ILLUST NO. 1 OF 2



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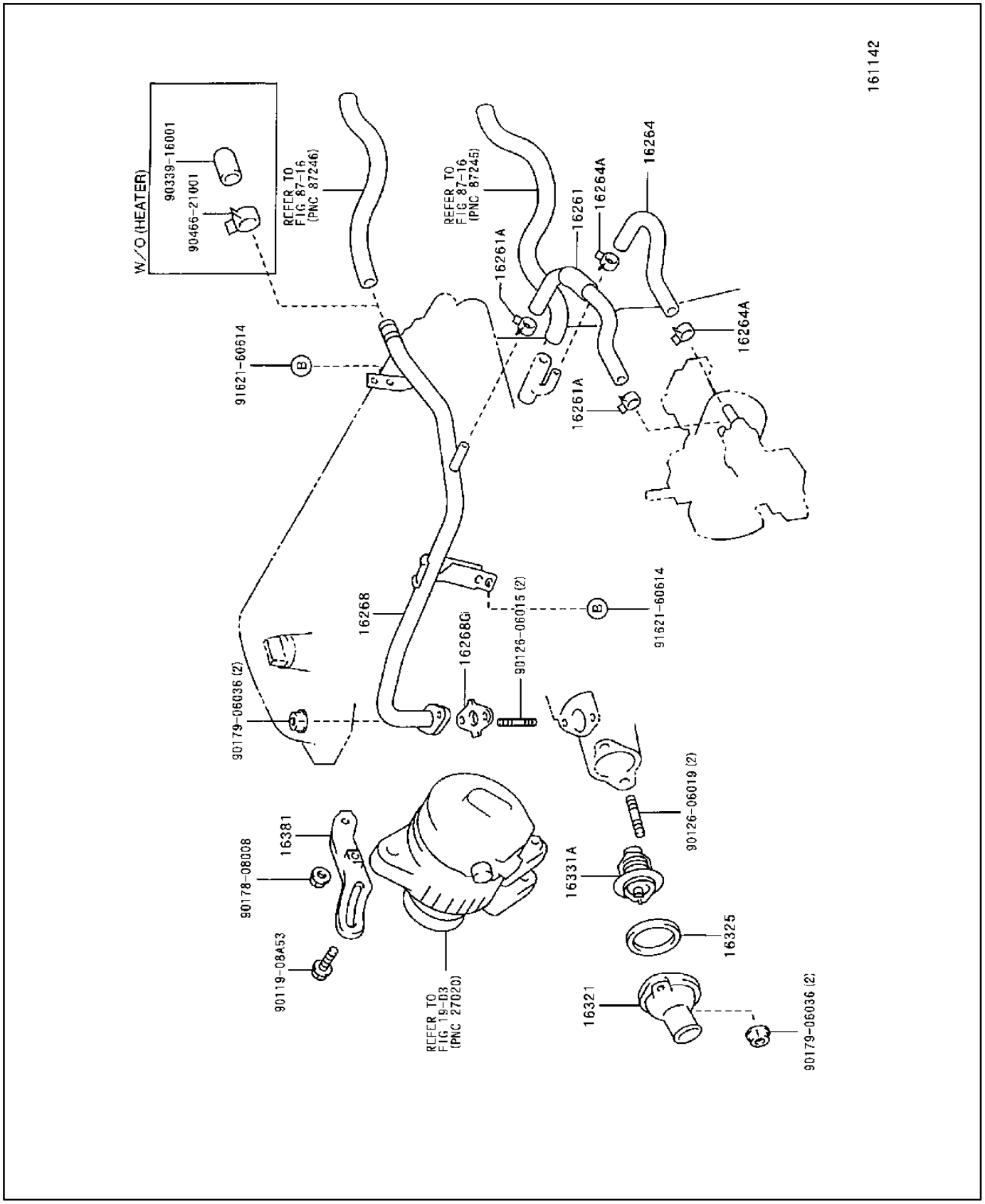
ILLUST NO. 2 OF 2



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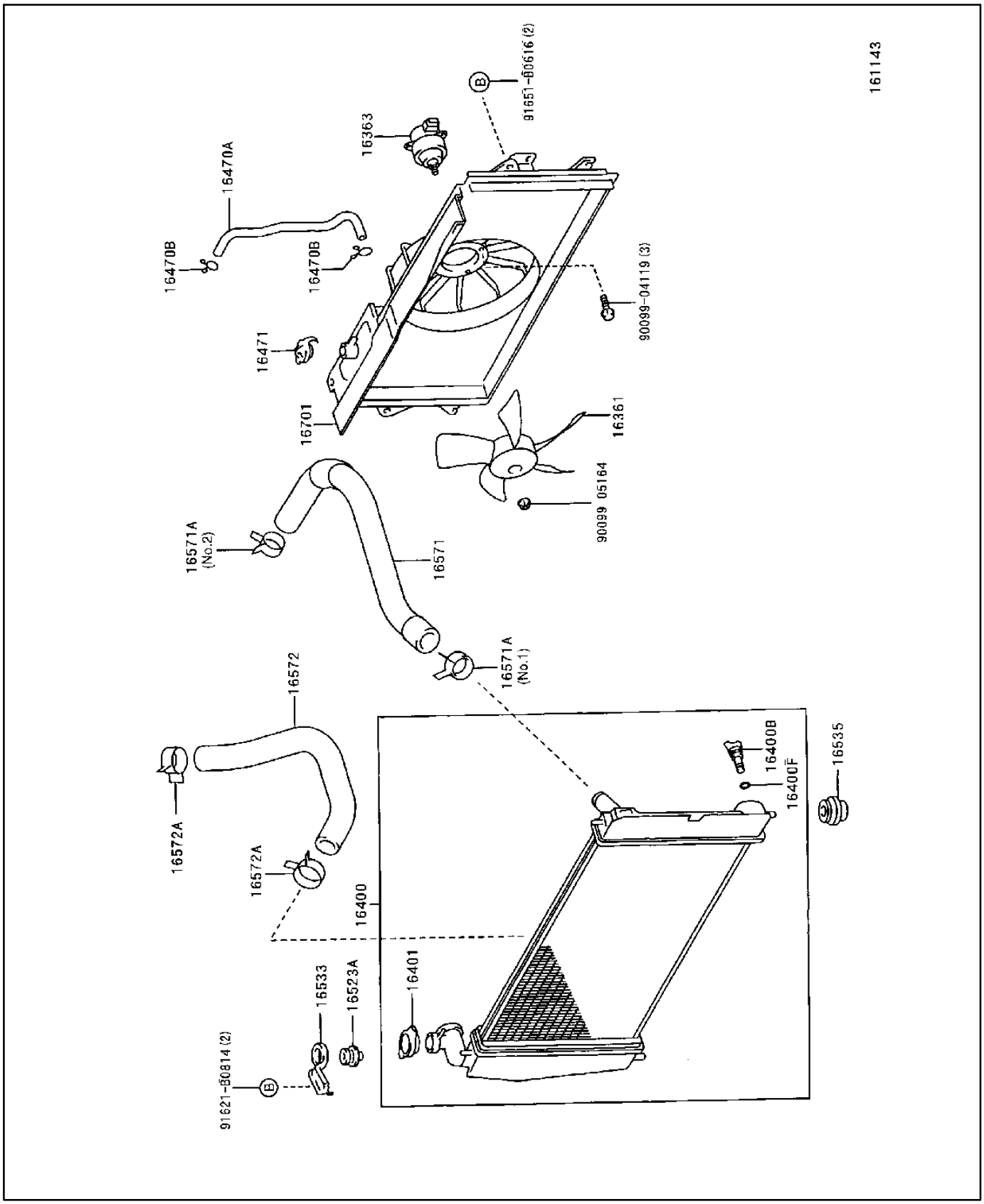
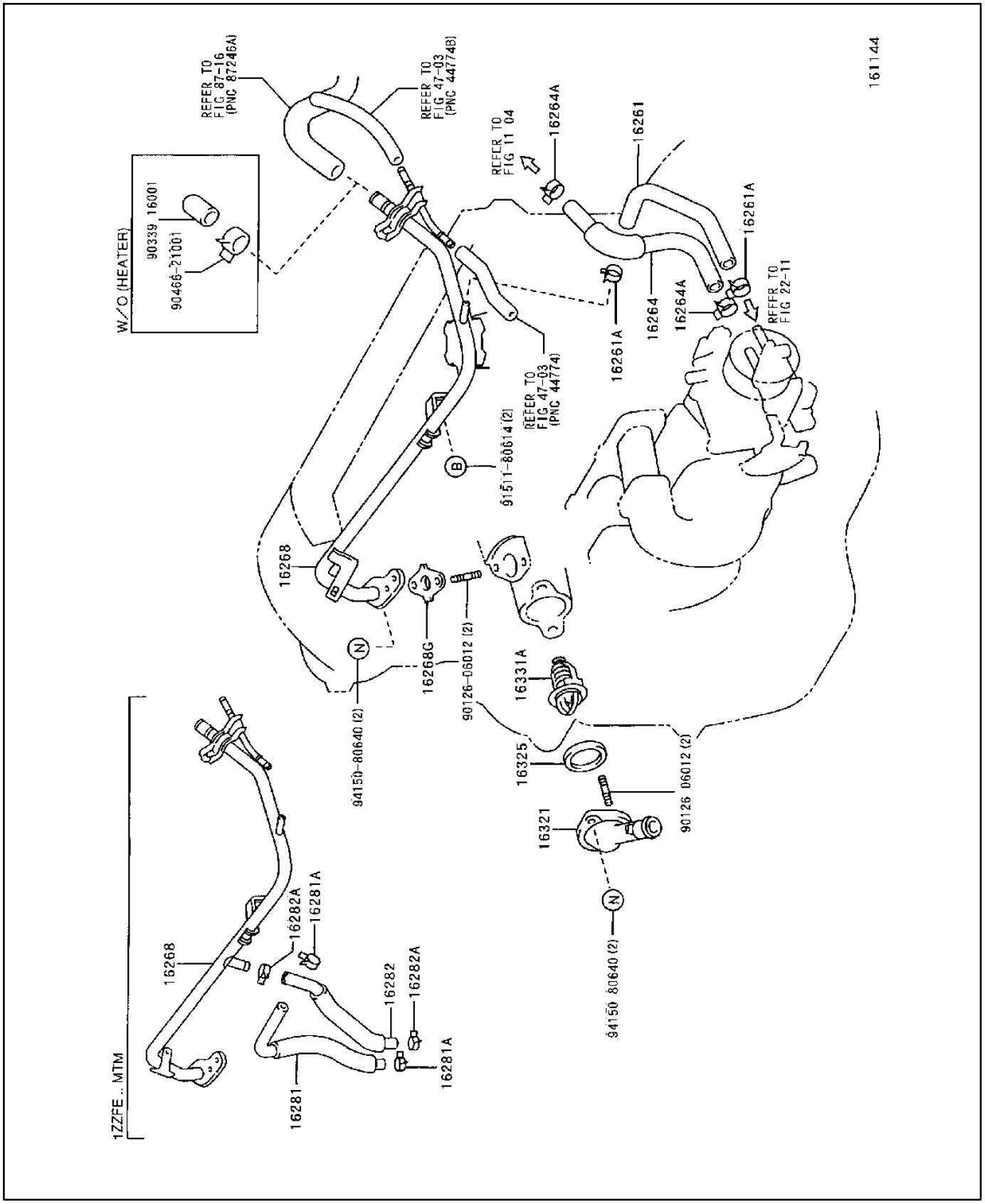
ILLUST NO. 1 OF 2



(0008-)1ZZFE,3ZZFE

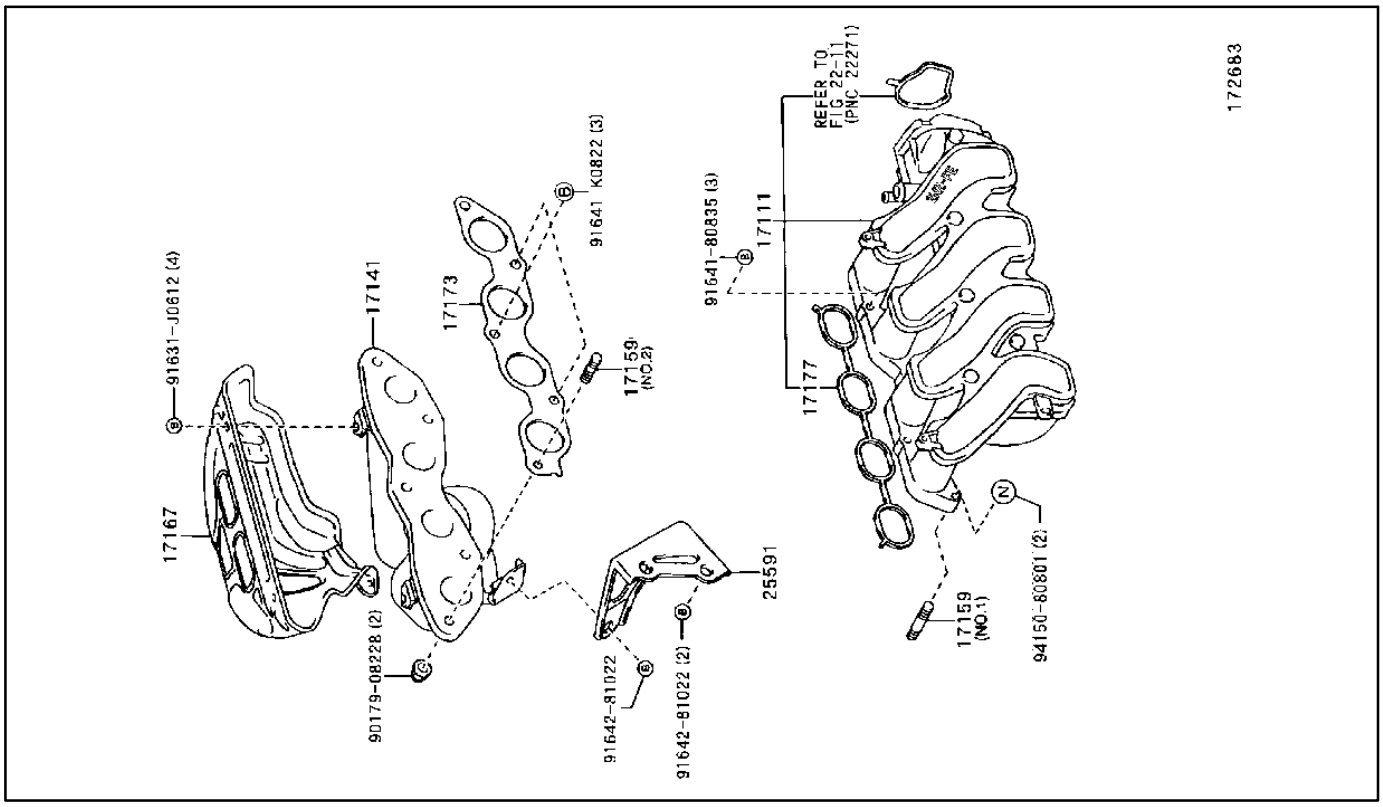
ILLUST NO. 2 OF 2



980A9-01

1701/MANIFOLD

(0008-)1NZFE,2NZFE



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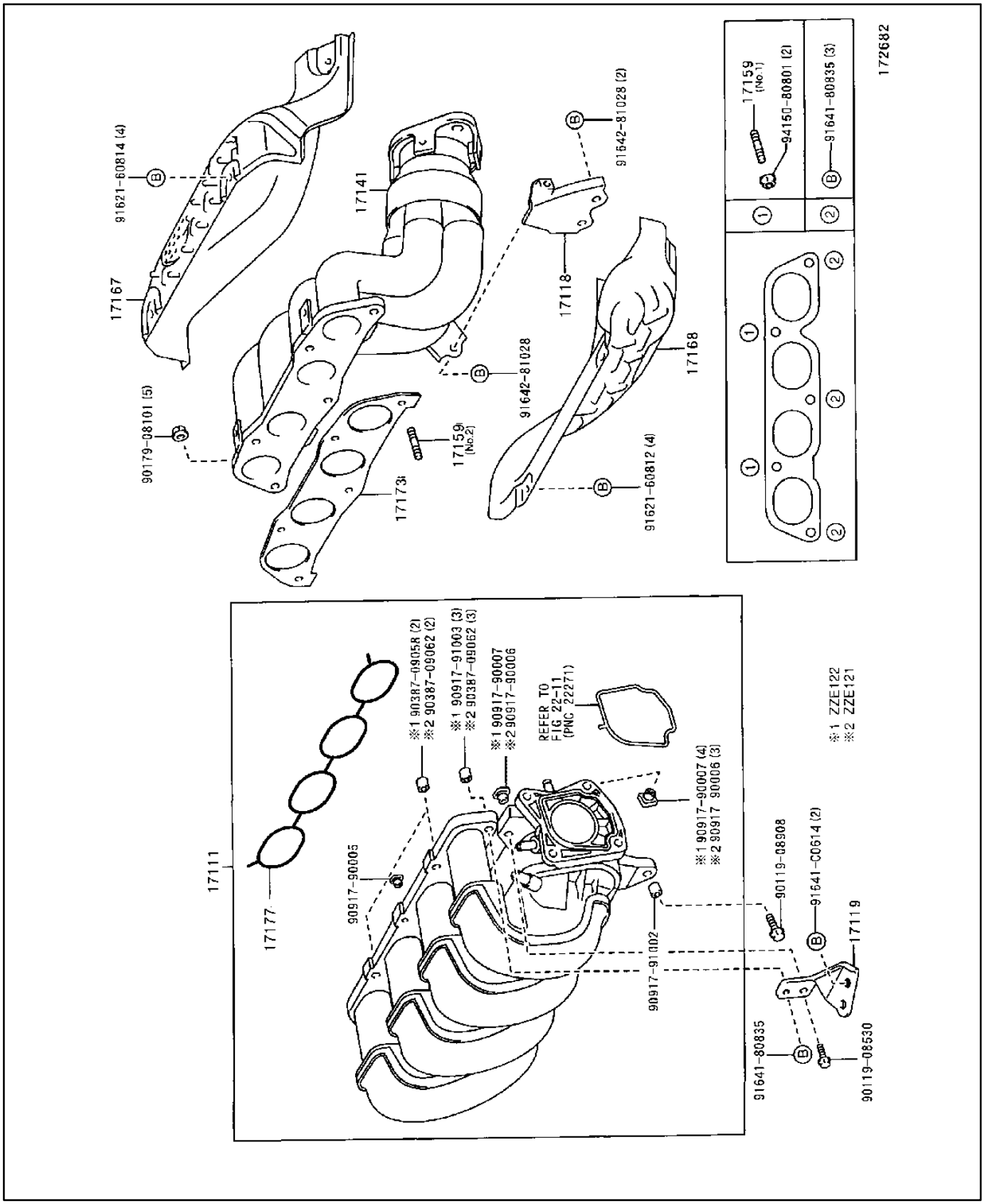

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1903/ALTERNATOR

(0008-)1NZFE,2NZFE..MTM

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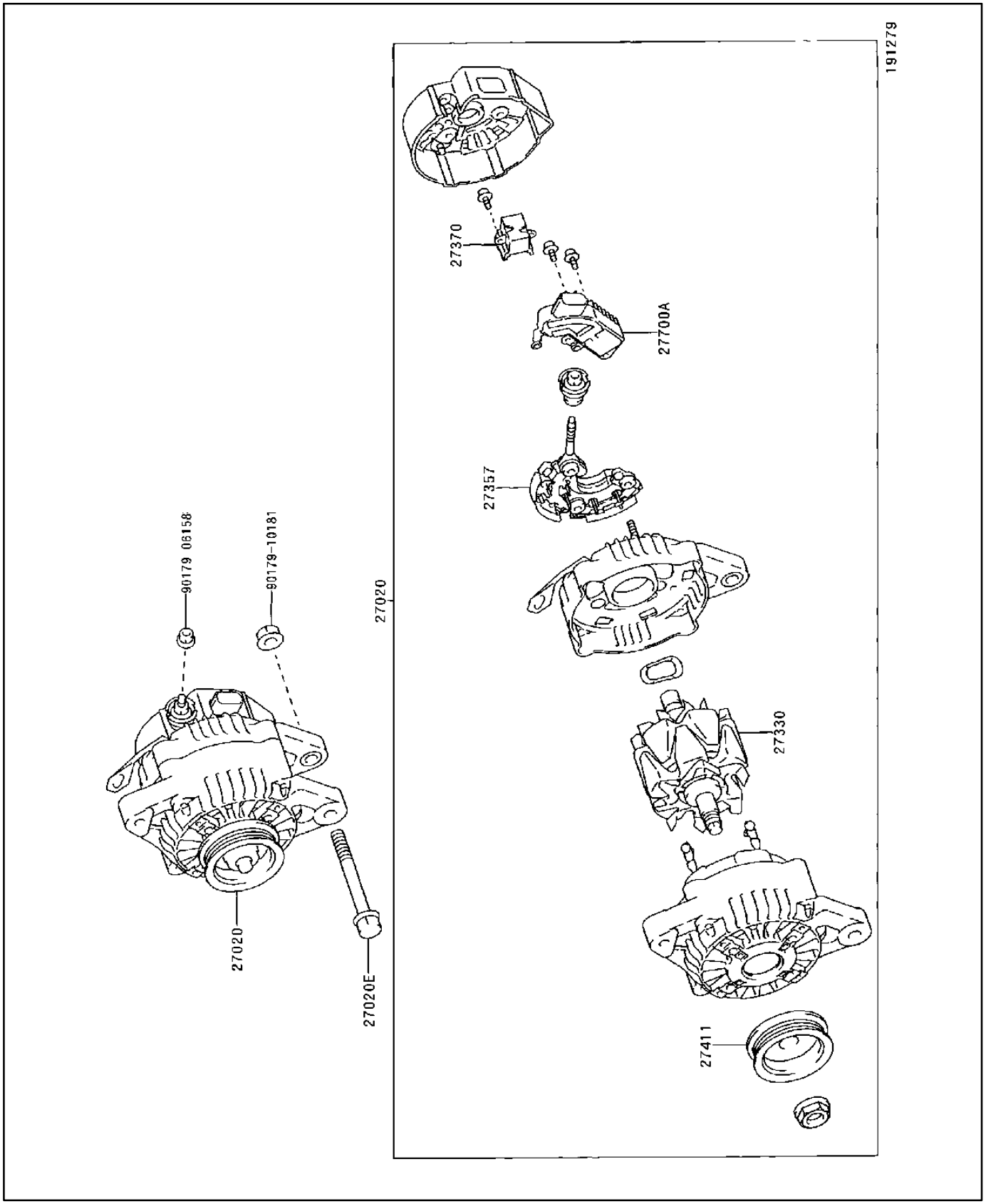
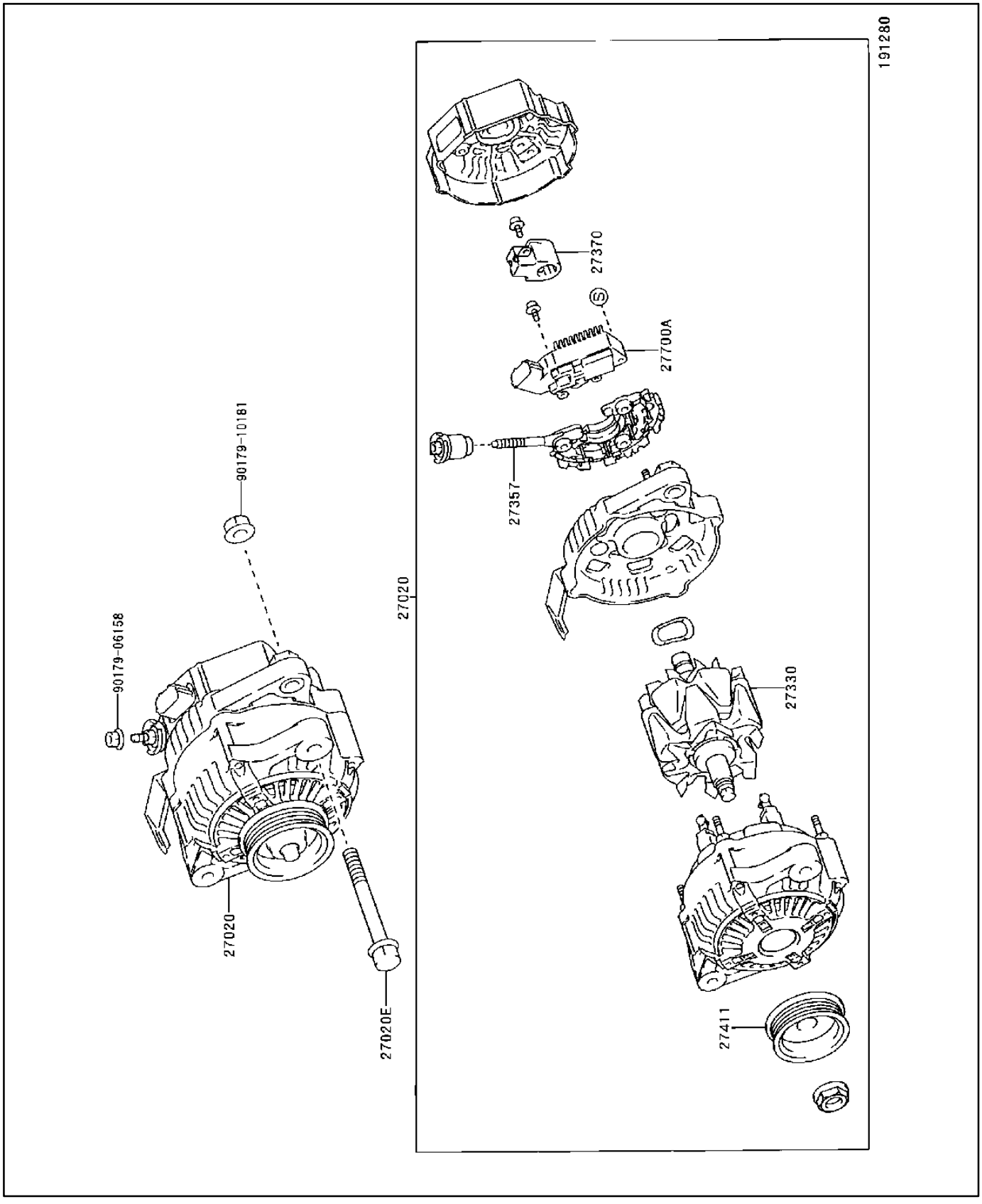


(0008-)1NZFE,2NZFE..ATM
12 80A



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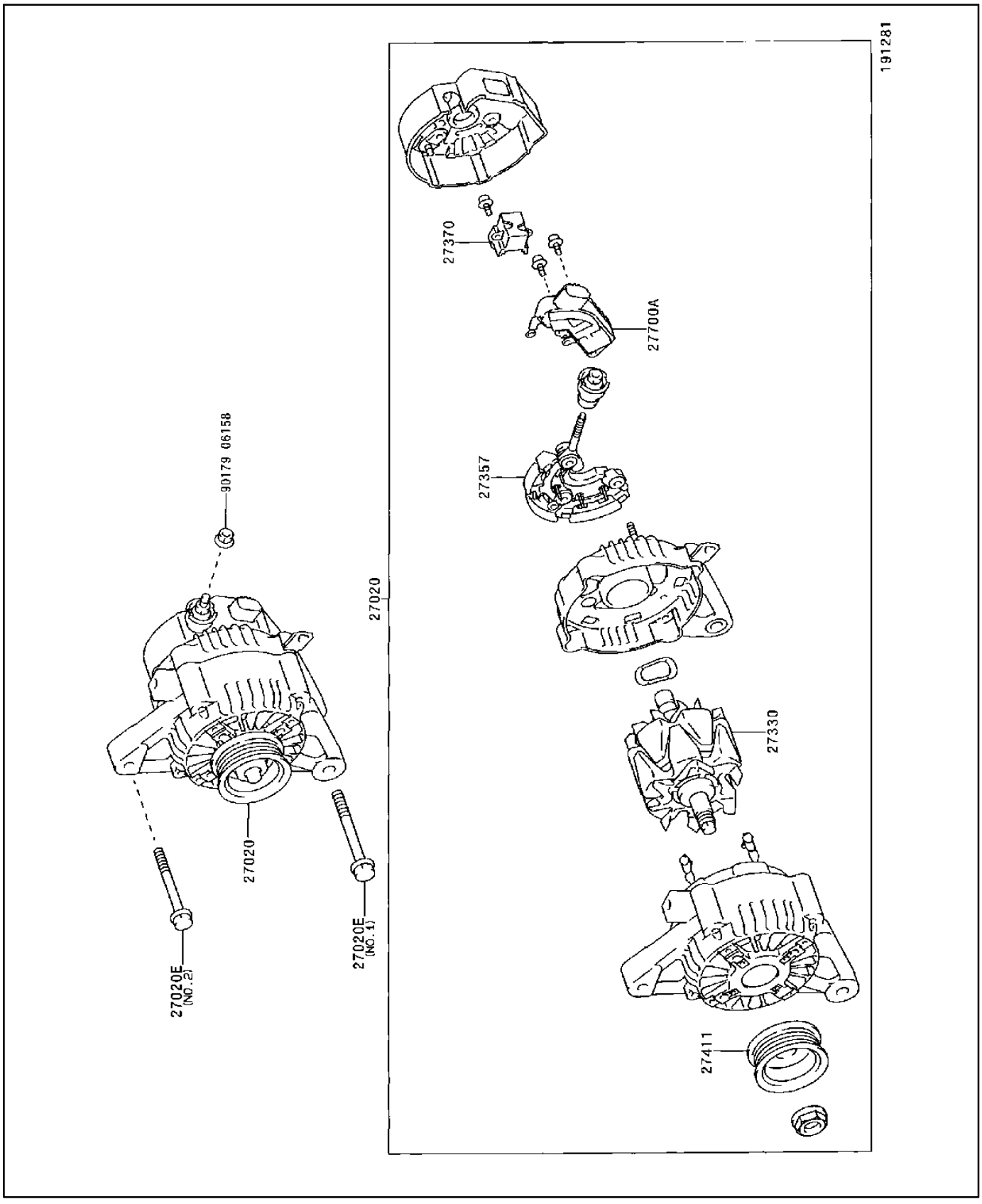

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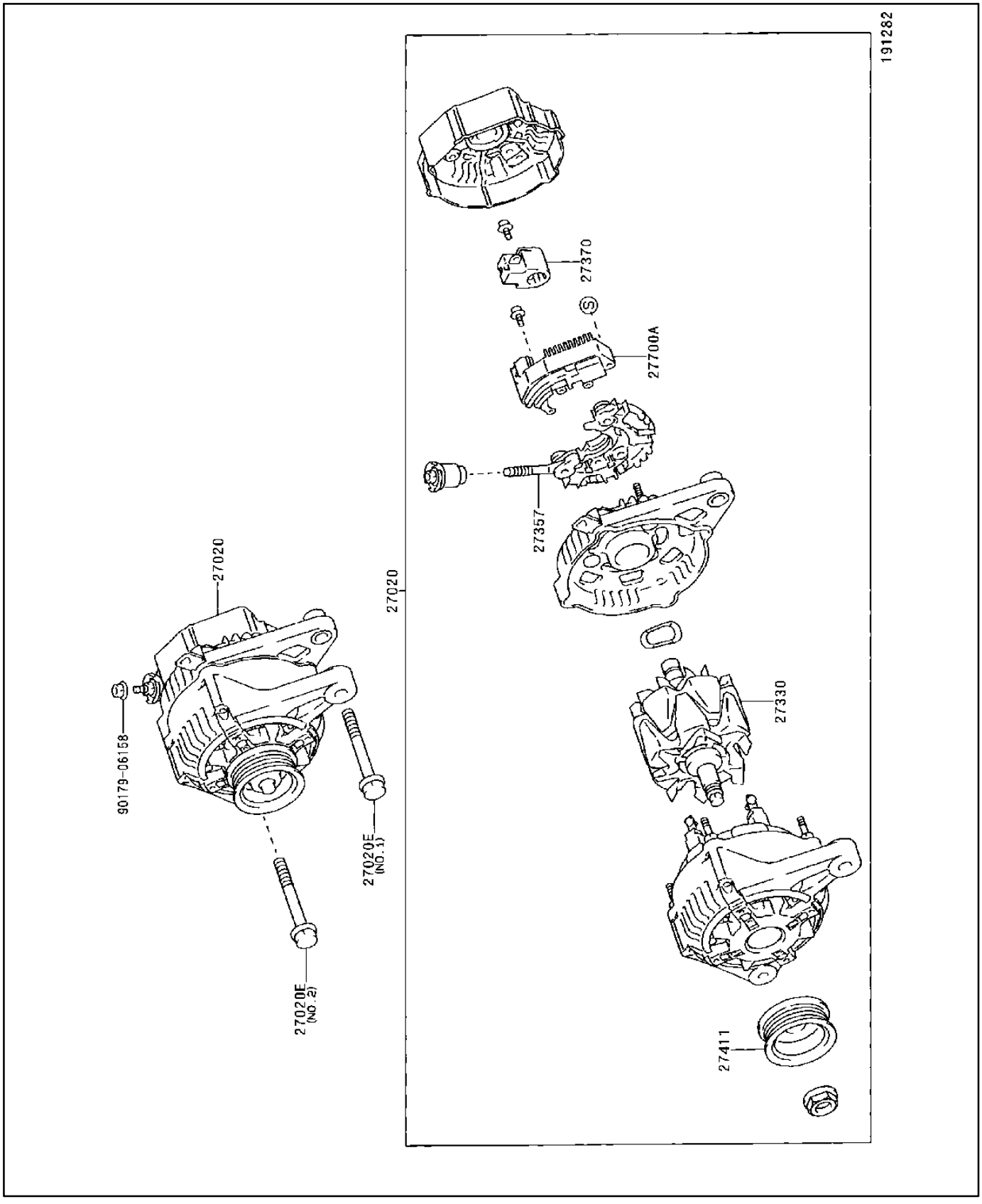

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1904/STARTER

(0008-)1NZFE,2NZFE

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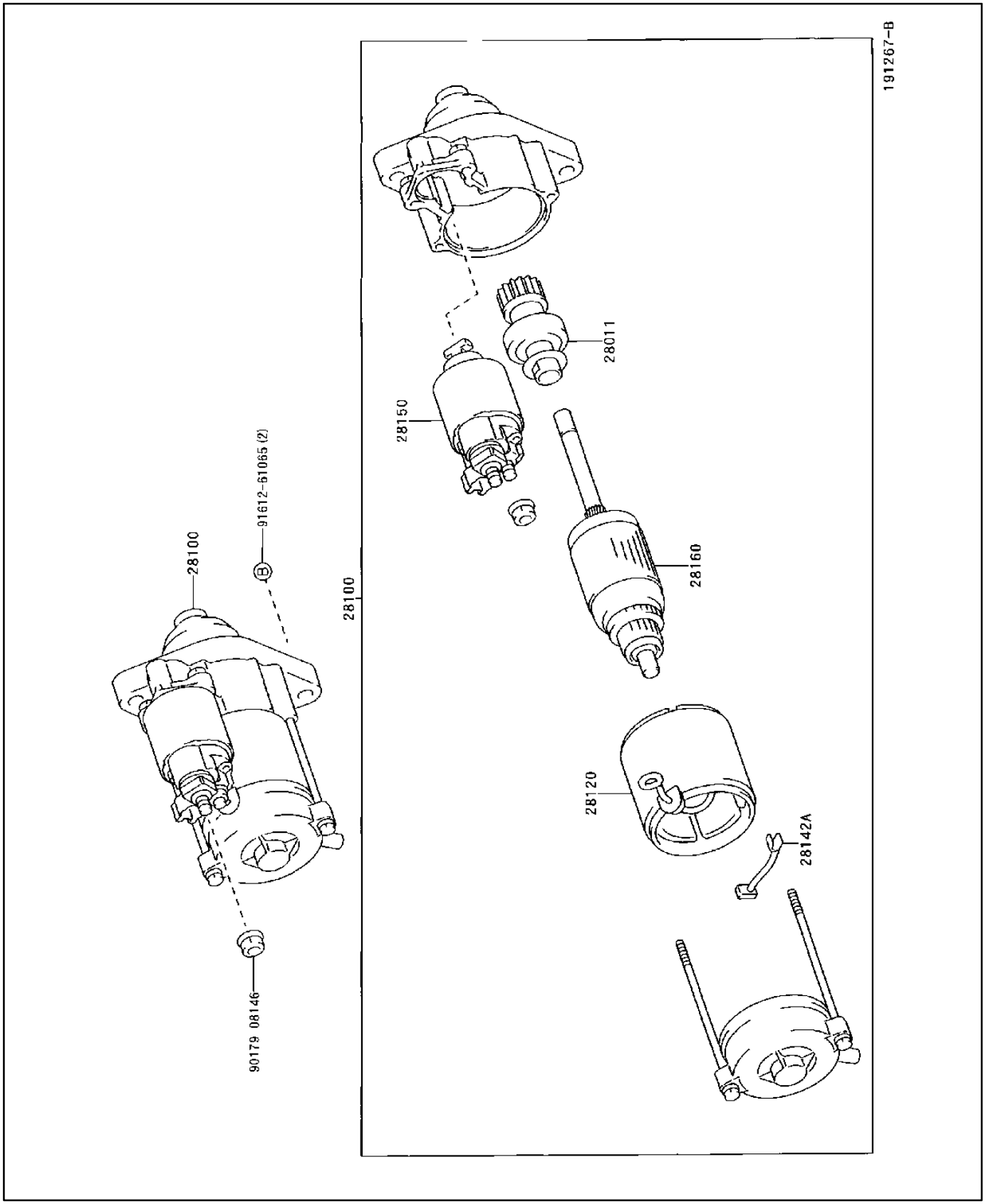
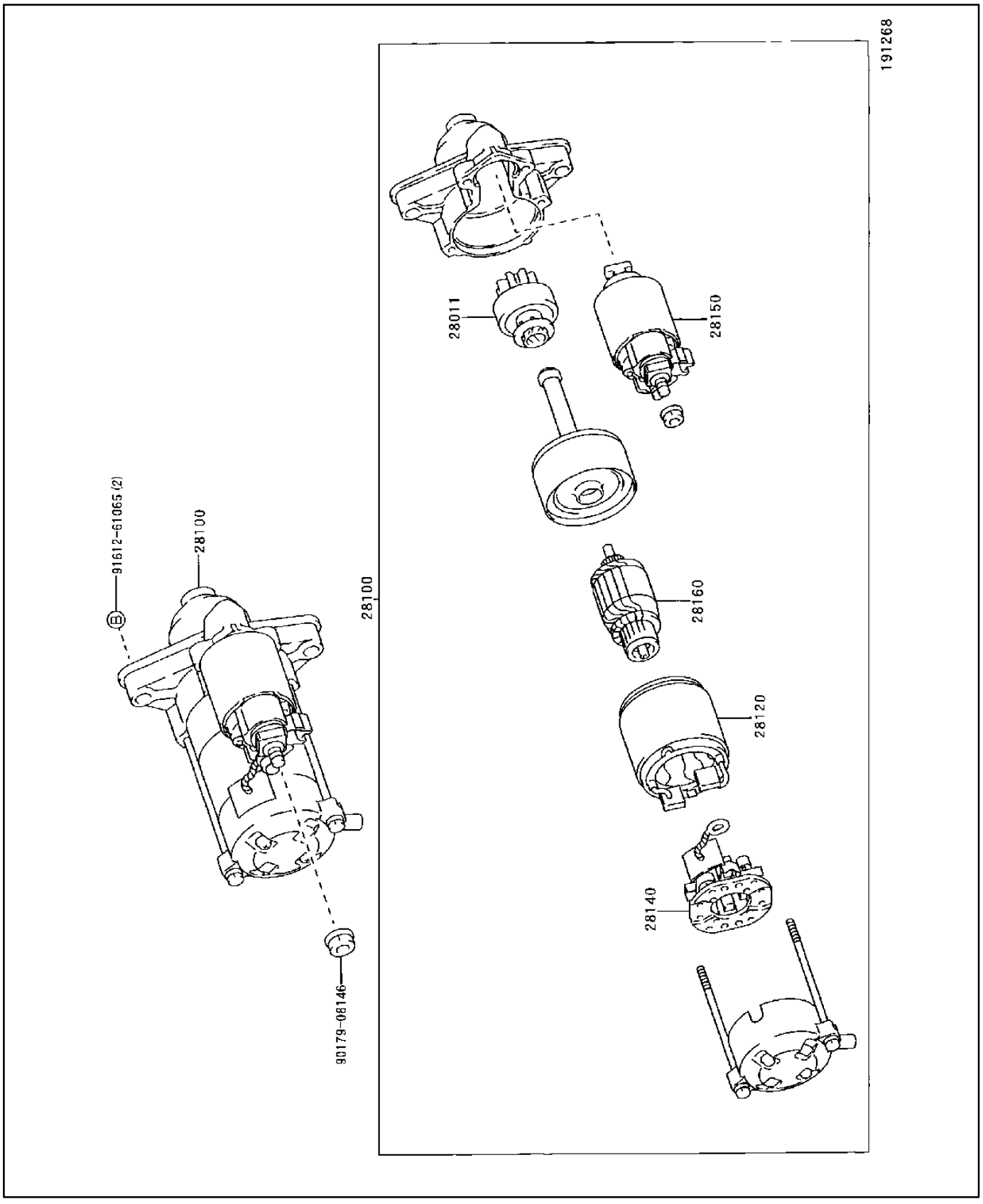


(0008-)1ZZFE,3ZZFE 12V
0.8KW



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