FOREWORD

TOYOTA MOTOR CORPORATION

This repair manual has been prepared to provide information covering general service repairs for the 2ZZ-GE engine equipped on the TOYOTA COROLLA.

Applicable models: ZZE123 series

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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	RM925E

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 a good understanding of 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.

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HOW TO USE THIS ENGINE REPAIR MANUAL (2ZZ-GE)

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GENERAL INFORMATION

1. GENERAL DESCRIPTION

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

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

(c) This manual explains "Removing and Installing, Replacing, Disassembling, Installing and Checking, Adjusting", but "Final Inspection" is omitted.

(d) The following essential operations are not written in this manual, however these operations must be done in the practical situation.
(1) Operation with a jack or 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 of this manual.

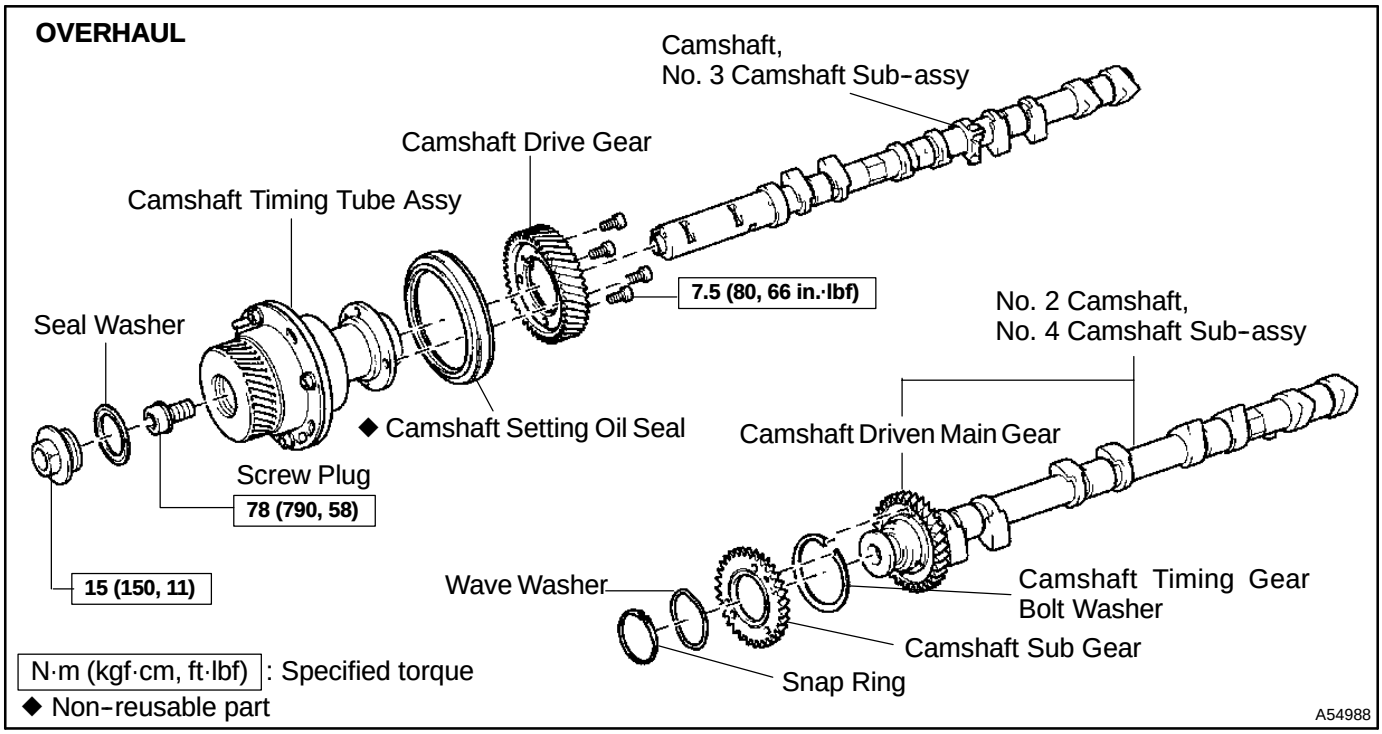
4. REPAIR PROCEDURES

(a) Component drawing is placed as the section or title when necessary.

(b) Illustrations of the parts catalog are placed as the "disassembled parts drawing" so that it enables you to understand the fitting condition of the components.

(c) Non-reusable parts, grease applied parts, precoated parts and tightening torque are specified in the components drawing.

Example:



CONTINUED

(d) Tightening torque, oil applying position, and non–reusable parts are described as important points in the procedure.

NOTICE:

There are cases where such information can only be indicated by an illustration. In that case, all the information such as torque, oil, etc. are described in the illustration.

(e) Installing procedure of operation items is performed in the reverse order of the removing, and only the important points are described.

(f) 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.

(g) There may be a case where the illustrations of similar models are used. In that case the details may be different from the actual vehicle.

(h) The procedures are presented in a step–by–step format:

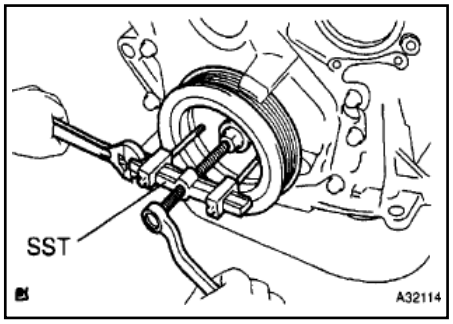
(1) The illustration shows what to do and where to do it.

(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:

Illustration: what to do and where



Task heading: what to do

5. REMOVE CRANKSHAFT PULLEY

(a) Using SST, remove the crankshaft pully.
SST 09950–50012 (09951–05010, 09952–05010, 09953–05020, 09954–05020, 09957–04010)

Set part No. *Component part No.* *Detailed text: how to do task*

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HINT:

This format provides an experienced technician with a FAST TRACK to the necessary information. The task heading can be read at a glance when necessary, and the text below 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 manual. You never have to leave the procedure to look up your specifications. The specifications 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.

CONTINUED

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)

CONTINUED

REPAIR INSTRUCTION FOR ENGINE REPAIR MANUAL (2ZZ-GE)

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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.

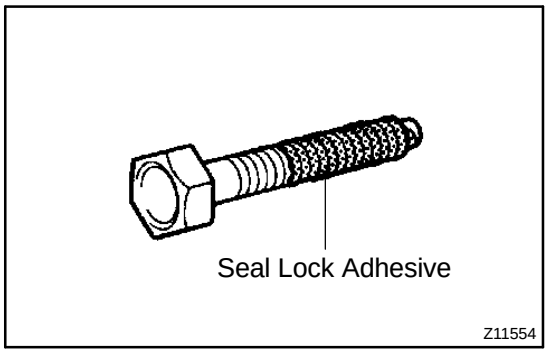
5. INSTALL ENGINE ASSEMBLY TO OVERHAUL STAND WHEN OVERHAUL THE ENGINE

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.

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NOTICE:

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

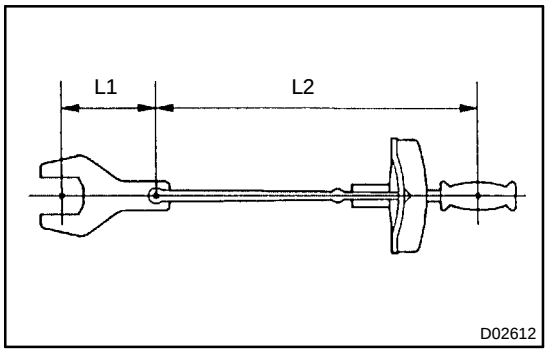
(4) Depending on the seal lock agent to apply, there may be a case where it is necessary to leave it for a specified time until it hardens.

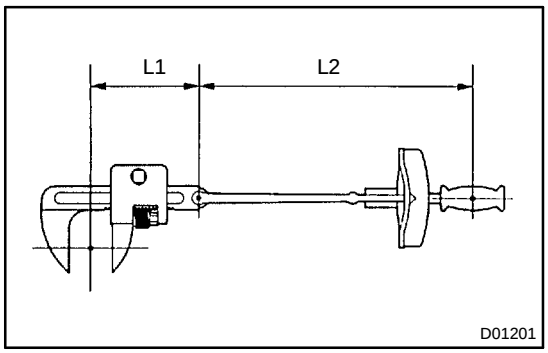
(b) Gaskets:

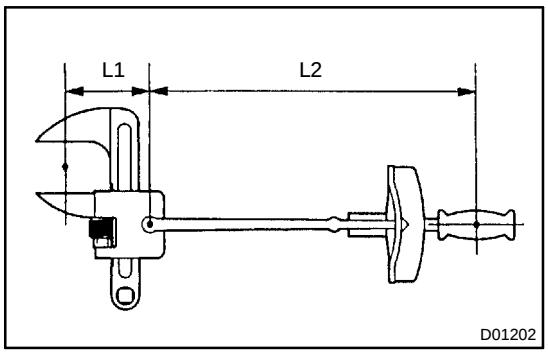
When necessary, use a sealer on gaskets to prevent leaks.

(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.

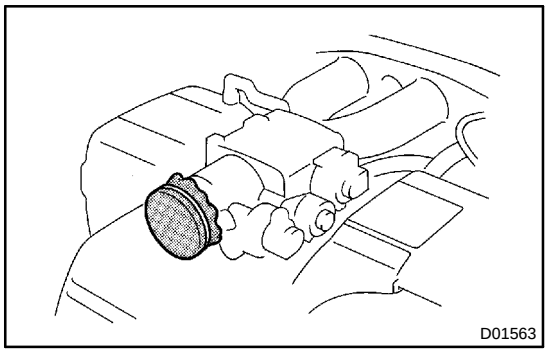
(b) Removing and Installing of Fuel System Parts:

(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.

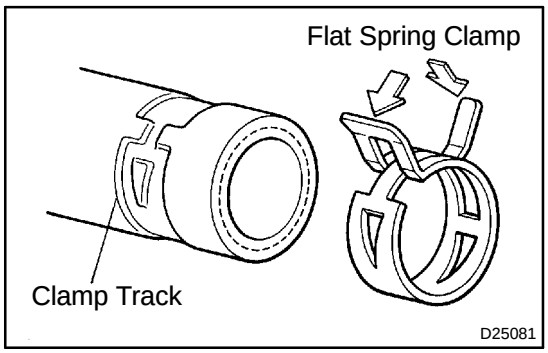
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(3) Never use any electric equipment like an electric motor or a working light as they may cause spark or high temperature.
(4) Never use an iron hammer as it may cause spark.
(5) Dispose the shop lag separately from any fuel deposit.



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.



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.

CONTINUED

TERMS FOR ENGINE REPAIR MANUAL (2ZZ–GE)

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ABBREVIATIONS USED IN THIS MANUAL

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

CONTINUED

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

CONTINUED

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

CONTINUED

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

CONTINUED

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

CONTINUED

010C9-01

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)

CONTINUED

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

CONTINUED

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	–

CONTINUED

PREPARATION

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STARTING & CHARGING 02–6
PREPARATION 02–6

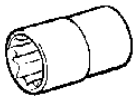
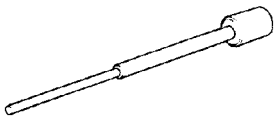
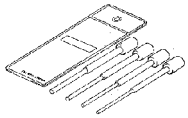
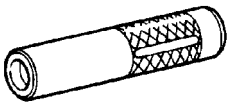
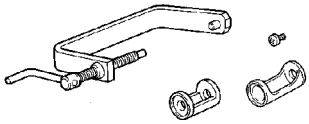
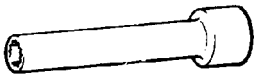
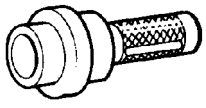
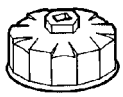
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ENGINE MECHANICAL

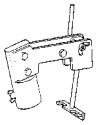
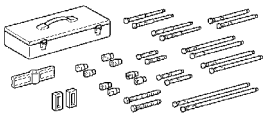
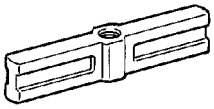
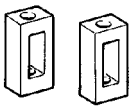
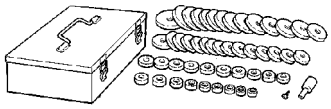
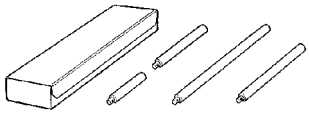
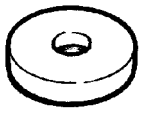
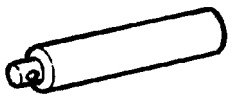
PREPARATION

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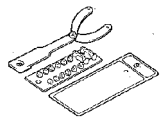
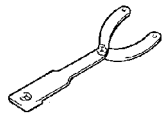
SST

	09011-38121	12 mm Socket Wrench for 12 Pointed Head	CYLINDER BLOCK(2ZZ-GE)
	09032-00100	Oil Pan Seal Cutter	PARTIAL ENGINE ASSY(2ZZ-GE)
	09201-01055	Valve Guide Bushing Remover & Replacer 5.5	CYLINDER HEAD ASSY(2ZZ-GE)
	09201-10000	Valve Guide Bushing Remover & Replacer Set	CYLINDER HEAD ASSY(2ZZ-GE)
	09201-41020	Valve Stem Oil Seal Replacer	CYLINDER HEAD ASSY(2ZZ-GE)
	09202-70020	Valve Spring Compressor	CYLINDER HEAD ASSY(2ZZ-GE)
	09205-16010	Cylinder Head Bolt Wrench	CYLINDER BLOCK(2ZZ-GE)
	09213-70011	Crankshaft Pully Holding Tool	PARTIAL ENGINE ASSY(2ZZ-GE)
	09223-15030	Oil Seal & Bearing Replacer	PARTIAL ENGINE ASSY(2ZZ-GE)
	09223-22010	Crankshaft Front Oil Seal Replacer	PARTIAL ENGINE ASSY(2ZZ-GE)
	09228-06501	Oil Filter Wrench	PARTIAL ENGINE ASSY(2ZZ-GE)
	09248-77010	Valve Clearance Adjusting Compressor Set	PARTIAL ENGINE ASSY(2ZZ-GE)

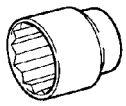
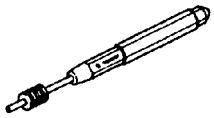
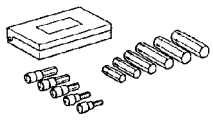
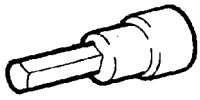
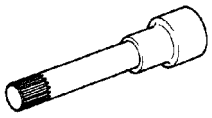
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	(09248-07010)	Valve Clearance Adjusting Compressor	PARTIAL ENGINE ASSY(2ZZ-GE)
	09330-00021	Companion Flange Holding Tool	PARTIAL ENGINE ASSY(2ZZ-GE)
	09950-50013	Puller C Set	PARTIAL ENGINE ASSY(2ZZ-GE)
	(09951-05010)	Hanger 150	PARTIAL ENGINE ASSY(2ZZ-GE)
	(09952-05010)	Slide Arm	PARTIAL ENGINE ASSY(2ZZ-GE)
	(09953-05020)	Center Bolt 150	PARTIAL ENGINE ASSY(2ZZ-GE)
	(09954-05021)	Claw No.2	PARTIAL ENGINE ASSY(2ZZ-GE)
	09950-60010	Replacer Set	CYLINDER HEAD ASSY(2ZZ-GE) CYLINDER BLOCK(2ZZ-GE)
	(09951-00250)	Replacer 25	CYLINDER BLOCK(2ZZ-GE)
	(09951-00350)	Replacer 35	CYLINDER HEAD ASSY(2ZZ-GE)
	09950-70010	Handle Set	PARTIAL ENGINE ASSY(2ZZ-GE) CYLINDER HEAD ASSY(2ZZ-GE) CYLINDER BLOCK(2ZZ-GE)
	(09951-00450)	Replacer 45	CYLINDER BLOCK(2ZZ-GE)
	(09951-07100)	Handle 100	PARTIAL ENGINE ASSY(2ZZ-GE) CYLINDER HEAD ASSY(2ZZ-GE) CYLINDER BLOCK(2ZZ-GE)

CONTINUED

	09960-10010	Variable Pin Wrench Set	PARTIAL ENGINE ASSY(2ZZ-GE)
	(09962-01000)	Variable Pin Wrench Arm Assy	PARTIAL ENGINE ASSY(2ZZ-GE)
	(09963-00600)	Pin 6	PARTIAL ENGINE ASSY(2ZZ-GE)

Recomended Tools

	09011-12301	Socket Wrench 30 mm	PARTIAL ENGINE ASSY(2ZZ-GE)
	09031-00040	Pin Punch .	CYLINDER HEAD ASSY(2ZZ-GE)
	09040-00011	Hexagon Wrench Set	CYLINDER HEAD ASSY(2ZZ-GE)
	(09043-20100)	Socket Hexagon Wrench 10	CYLINDER HEAD ASSY(2ZZ-GE)
	09043-50100	Bi-hexagon Wrench 10 mm	PARTIAL ENGINE ASSY(2ZZ-GE)

SSM

	08826-00080	Seal Packing Black or equivalent (FIPG)	PARTIAL ENGINE ASSY(2ZZ-GE) CYLINDER BLOCK(2ZZ-GE)
	08826-00100	"Seal Packing 1282B," THREE BOND 1282B or equivalent (FIPG)	PARTIAL ENGINE ASSY(2ZZ-GE)
	08833-00070	"Adhesive 1324," THREE BOND 1324 or equivalent	CYLINDER HEAD ASSY(2ZZ-GE) CYLINDER BLOCK(2ZZ-GE)

CONTINUED

Equipment

Slide calipers	
Plastigage	
Heater	
Reamer	
V-block	
Piston ring expander	
Valve seat cutter	
Cylinder gauge	
Dial indicator	
Feeler gauge	
Micrometer	
Precision straight edge	
Steel square	
Straight edge	
Torque wrench	
Vernier calipers	
Dial indicator with magnetic base	

CONTINUED

LUBRICATION

PREPARATION

0216Q-01

Equipment

Feeler gauge	
Precision straight edge	
Torque wrench	

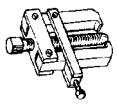
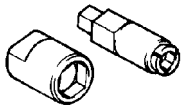
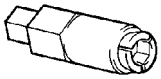
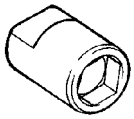
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STARTING & CHARGING

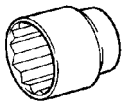
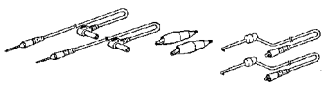
0216R-01

PREPARATION

SST

	09286-46011	Injection Pump Spline Shaft Puller	GENERATOR ASSY(2ZZ-GE)
	09820-63010	Alternator Pulley Set Nut Wrench Set	GENERATOR ASSY(2ZZ-GE)
	(09820-06010)	Alternator Rotor Shaft Wrench	GENERATOR ASSY(2ZZ-GE)
	(09820-06020)	Alternator Pulley Set Nut 22 mm Wrench	GENERATOR ASSY(2ZZ-GE)

Recomended Tools

	09011-12291	Socket Wrench for 29 mm .	GENERATOR ASSY(2ZZ-GE)
	09082-00040	TOYOTA Electrical Tester	STARTER ASSY(2ZZ-GE) GENERATOR ASSY(2ZZ-GE)
	(09083-00150)	Test Lead Set	STARTER ASSY(2ZZ-GE)

Equipment

Ohmmeter	
Sandpaper	
V-block	
Dial indicator	
Vernier calipers	
Plastic hammer	
Torque wrench	
Wooden block	

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SERVICE SPECIFICATIONS

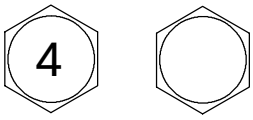
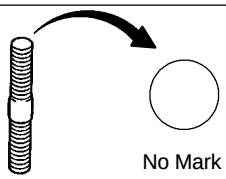
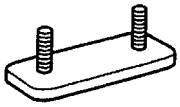
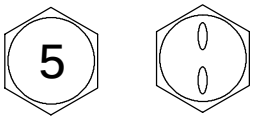
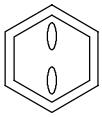
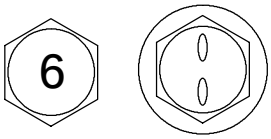
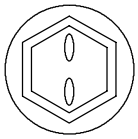
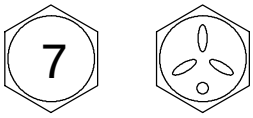
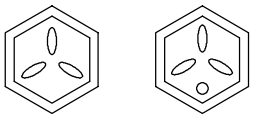
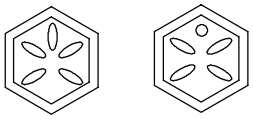
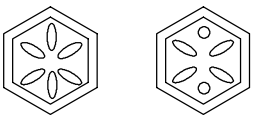
STANDARD BOLT 03–1
HOW TO DETERMINE BOLT STRENGTH 03–1
SPECIFIED TORQUE FOR STANDARD BOLTS 03–2
HOW TO DETERMINE NUT STRENGTH 03–3
ENGINE MECHANICAL 03–4
SERVICE DATA 03–4/5
TORQUE SPECIFICATION 03–6
LUBRICATION 03–7
SERVICE DATA 03–7
TORQUE SPECIFICATION 03–8
STARTING & CHARGING 03–9
SERVICE DATA 03–9
TORQUE SPECIFICATION 03–10

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STANDARD BOLT

HOW TO DETERMINE BOLT STRENGTH

030LK-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

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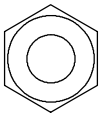
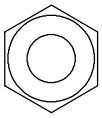
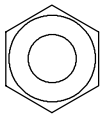
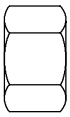
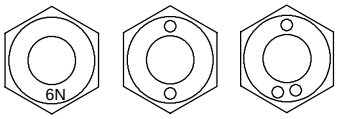
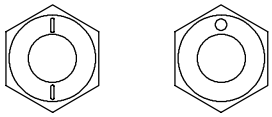
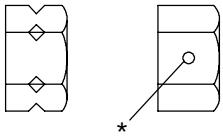
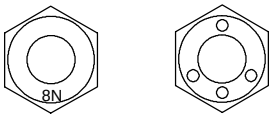
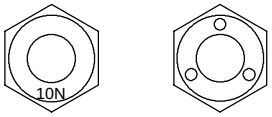
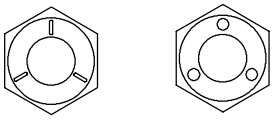
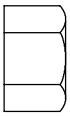
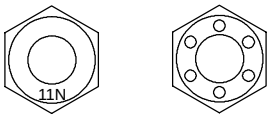
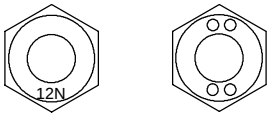
SPECIFIED TORQUE FOR STANDARD BOLTS

Class	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

CONTINUED

030LM-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

CONTINUED

ENGINE MECHANICAL

SERVICE DATA

03000-07

Chain length at 16 links	Maximum	122.6 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	146.8 - 148.2 mm (5.780-5.835 in.)
	Maximum	148.5 mm(5.846 in.)
Camshaft circle runout	Maximum	0.03 mm (0.0012 in.)
Camshaft lobe height	Standard	
	Intake No. 1	40.607 - 40.707 mm (1.59586 - 1.59979 in.)
	Intake No. 2	38.769 - 38.869 mm (1.52362 - 1.52755 in.)
	Exhaust No. 1	40.019 - 40.119 mm (1.57275 - 1.57668 in.)
	Exhaust No. 2	38.863 - 38.963 mm (1.52732 - 1.53125 in.)
	Minimum	
	Intake No. 1	40.45 mm (1.5925 in.)
	Intake No. 2	38.61 mm (1.520 in.)
	Exhaust No. 1	39.86 mm (1.5693 in.)
	Exhaust No. 2	38.71 mm (1.5240 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	0.08 - 0.18 mm (0.003 - 0.007 in.)
	Exhaust	0.22 - 0.32 mm (0.009 - 0.013in.)
Cylinder head warpage	Maximum Cylinder block side	0.2 mm (0.0080 in.)
	Intake manifold side	0.2 mm (0.0080 in.)
	Exhaust manifold side	0.3 mm (0.0120 in.)
Busing oil clearance inside diameter		5.500 - 5.518 mm (0.2165 - 0.2172 in.)
Valve stem diameter	Intake	5.460 - 5.475 mm (0.2145 - 0.2156 in.)
	Exhaust	5.445 - 5.470 mm (0.2144 - 0.2154 in.)
Valve stem oil clearance	Standard Intake	0.025 - 0.058 mm (0.0010 - 0.0023 in.)
	Exhaust	0.030 - 0.063 mm (0.0012 - 0.0025 in.)
	Maximum Intake	0.10 mm (0.0039 in.)
	Exhaust	0.10 mm (0.0039 in.)
Valve guide bush diameteruse	Use STD	10.448 - 10.506 mm (0.4129 - 0.4136 in.)
	Use O/S	10.538 - 10.556 mm (0.4149 - 0.4156 in.)
Valve spring free length	Intake	46.4 mm (1.830 in.)
	Exhaust	46.5 mm (1.831 in.)
Valve spring deviation	Maximum	1.6 mm (0.063 in.)
Valve spring angle (reference)	Maximum	2°
Valve overall length	Standard Intake	111.3 mm (4.382 in.)
	Exhaust	111.7 mm (4.392 in.)
	Minimum Intake	110.9 mm (4.366 in.)
	Exhaust	111.3 mm (4.382 in.)
Valve head margin thickness	Standard	1.0 mm (0.039 in.)
	Minimum	0.7 mm (0.028 in.)
Valve rocker shaft diameter		15.965 - 15.985 mm (0.6285 -0.6293 in.)
Camshaft thrust clearance	Standard	0.040 - 0.140 mm (0.0016 - 0.0055 in.)
	Maximum	0.15 mm (0.0059 in.)
Camshaft oil clearance	Standard	0.035 - 0.076 mm (0.0014 - 0.0030 in.)
	Maximum	0.010 mm (0.0039 in.)
Water hose union protrusion	Standard A	29 mm (1.14 in.)
	B	69.8 mm (2.748 in.)
	C	24 mm (0.95 in.)
Valve guide bush protrusion height		15.3 - 15.7 mm (0.602 - 0.618 in.)

CONTINUED

Connecting rod thrust clearance	Standard Maximum	0.160 - 0.342 mm (0.063 - 0.0135 in.) 0.342 mm (0.0135 in.)
Connecting rod oil clearance	Standard Maximum	0.028 - 0.060 mm (0.0011 - 0.0024 in.) 0.080 mm (0.0031 in.)
Connecting rod bearing center wall thickness Reference	 Mark 1 Mark 2 Mark 3	 1.482 - 1.486 mm (0.0584 - 0.0585 in.) 1.486 - 1.490 mm (0.0585 - 0.0587 in.) 1.490 - 1.494 mm (0.0587 - 0.0588 in.)
Crankshaft thrust clearance	Standard Maximum	0.04 - 0.24 mm (0.0016 - 0.0094 in.) 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 Maximum	82.000 - 82.013 mm (3.2284 - 3.2287 in.) 82.013 mm (3.2287 in.)
Piston diameter (at 12 mm (0.472 in.) from the piston head)		81.975 - 81.933 mm (3.2274 - 3.2281 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 Maximum	0.007 - 0.038 mm (0.0003 - 0.0015 in.) 0.10 mm (0.0039 in.)
Piston ring groove clearance		0.030 - 0.070 mm (0.0012 - 0.0028 in.)
Piston ring end gap	Standard No. 1 No. 2 Maximum No. 1 No. 2	0.25 - 0.35 mm (0.0098 - 0.0138 in.) 0.35 - 0.50 mm (0.0138 - 0.0197 in.) 1.05 mm (0.041 in.) 1.20 mm (0.047 in.)
Piston pin diameter		20.004 - 20.013 mm (0.7876 - 0.7879 in.)
Connecting rod bolt diameter	Standard Maximum	6.6 - 6.7 mm (0.260 - 0.264 in.) 6.4 mm (0.252 in.)
Crankshaft circle runout	Maximum	0.03 mm (0.0012 in.)
Crankshaft main journal diameter 	 Maximum taper and out-of-round	47.988 - 48.000 mm (1.8893 - 1.8898 in.) 0.02 mm (0.0008 in.)
Crank pin diameter 	 Maximum taper and out-of-round	44.992 - 45.000 mm (1.7713 - 1.7717 in.) 0.02 mm (0.0008 in.)
Crankshaft bearing cap set bolt diameter	Standard Minimum	7.3 - 7.5 mm (0.287 - 0.295 in.) 7.2 mm (0.287 in.)
Crankshaft main journal oil clearance	Standard Minimum	0.016 - 0.032 mm (0.0006 - 0.0013 in.) 0.08 mm (0.0032 in.)

CONTINUED

0300P-07

TORQUE SPECIFICATION

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		37	378	27
Oil filter union x Cylinder block		78.5	801	58
Cylinder head x Cylinder block	1st 2nd	35 Turn 90°	357 Turn 90°	26 Turn 90°
Oil control valve filter x Cylinder block		29	300	22
Camshaft timing oil control valve x Cylinder head		8.5	87	76 in.·lbf
Camshaft timing gear assembly x Camshaft		54	551	40
Camshaft timing gear x Camshaft		54	551	40
Camshaft x Cylinder head		19	194	7
Oil pump x Cylinder block		9.0	92	80 in.·lbf
Chain vibration damper No. 1 x Cylinder block		21	214	16
Chain tensioner slipper x Cylinder block		21	214	16
Timing chain cover x Cylinder block	M6 M8	21 11	214 112	16 8
Chain tensioner assy No. 1 x Cylinder block		9.0	92	80 in.·lbf
Crankshaft pulley x Crankshaft		118	1,203	87
Water pump assy x Cylinder block		9.0	92	80 in.·lbf
Cylinder head cover x Cylinder head		10	102	89 in.·lbf
Spark plug x Cylinder head		18	178	13
Connecting rod x Connecting rod cap	1st 2nd	30 Turn 90°	306 Turn 90°	22 Turn 90°
Crankshaft bearing cap sub-assembly x Cylinder block	1st 2nd 3rd 4th	22 44 Turn 45° Turn 45°	225 449 Turn 45° Turn 45°	16 32 Turn 45° Turn 45°
Water drain union x Cylinder block		25	255	13

CONTINUED

LUBRICATION

SERVICE DATA

030MI-01

Rotor tip clearance	Standard Maximum	0.060 – 0.180 mm (0.0024 – 0.0071 in.) 0.35 mm (0.0138 in.)
Body clearance	Standard Maximum	0.125 – 0.180 mm (0.0049 – 0.0021 in.) 0.325 mm (0.0128 in.)
Rotor side clearance	Standard Maximum	0.030 – 0.080 mm (0.0012 – 0.0032 in.) 0.160 mm (0.0063 in.)

CONTINUED

030MJ-01

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Oil pump relief valve plug x Oil pump body	49	500	36
Oil pump cover x Oil pump body	10	105	8

CONTINUED

STARTING & CHARGING

030MK-01

SERVICE DATA

Starter armature assy		
Circle runout	Standard	0.02 mm (0.0008 in.)
	Maximum	0.05 mm (0.0020 in.)
Commutator diameter	Standard	28 mm (1.102 in.)
	Minimum	27 mm (1.063 in.)
Undercut depth	Standard	0.6 mm (0.024 in.)
	Minimum	0.2 mm (0.008 in.)
Starter yoke assy		
Brush length	Standard	14 mm (0.551 in.)
	Minimum	9 mm (0.354 in.)
Starter brush holder assy		
Brush length	Standard	14 mm (0.551 in.)
	Minimum	9 mm (0.354 in.)
Generator rotor assy		
Coil resistance	at 20°C (68°F)	2.7 – 3.1 Ω
Slip ring diameter	Standard	14.2 – 14.4 mm (0.559 – 0.567 in.)
	Minimum	12.8 mm (0.504 in.)
Generator brush holder assy		
Exposed brush length	Standard	9.5 – 11.5 mm (0.374 – 0.453 in.)
	Minimum	1.5 mm (0.059 in.)

CONTINUED

030ML-01

TORQUE SPECIFICATION

Part Tightened		N·m	kgf·cm	ft·lbf
Starter commutator end frame assy x Starter brush holder assy		1.5	15	13 in.·lbf
Starter yoke assy x Starter drive housing assy		5.9	60	52 in.·lbf
Magnet starter switch assy x Starter drive housing assy		8.3	85	74 in.·lbf
Lead wire x Magnet starter switch assy		9.8	100	87 in.·lbf
Generator rectifier end frame x Generator drive end frame	w/o cord clip	4.5	46	40 in.·lbf
	w/ cord clip	5.4	55	48 in.·lbf
Generator holder w/ rectifier x Generator drive end frame		2.9	30	26 in.·lbf
Generator regulator x Generator holder w/ rectifier		2.0	20	18 in.·lbf
Generator brush holder assy x Generator holder w/ rectifier		2.0	20	18 in.·lbf
Generator rear end cover x Generator rectifier end frame		4.4	45	39 in.·lbf
Terminal plate x Generator rectifier end frame	Bolt	3.9	39	35 in.·lbf
	Nut	4.4	45	39 in.·lbf
Terminal insulator x Generator holder w/ rectifier		4.1	42	36 in.·lbf
Generator pulley x Generator rotor assy		111	1,125	82

CONTINUED

ENGINE MECHANICAL

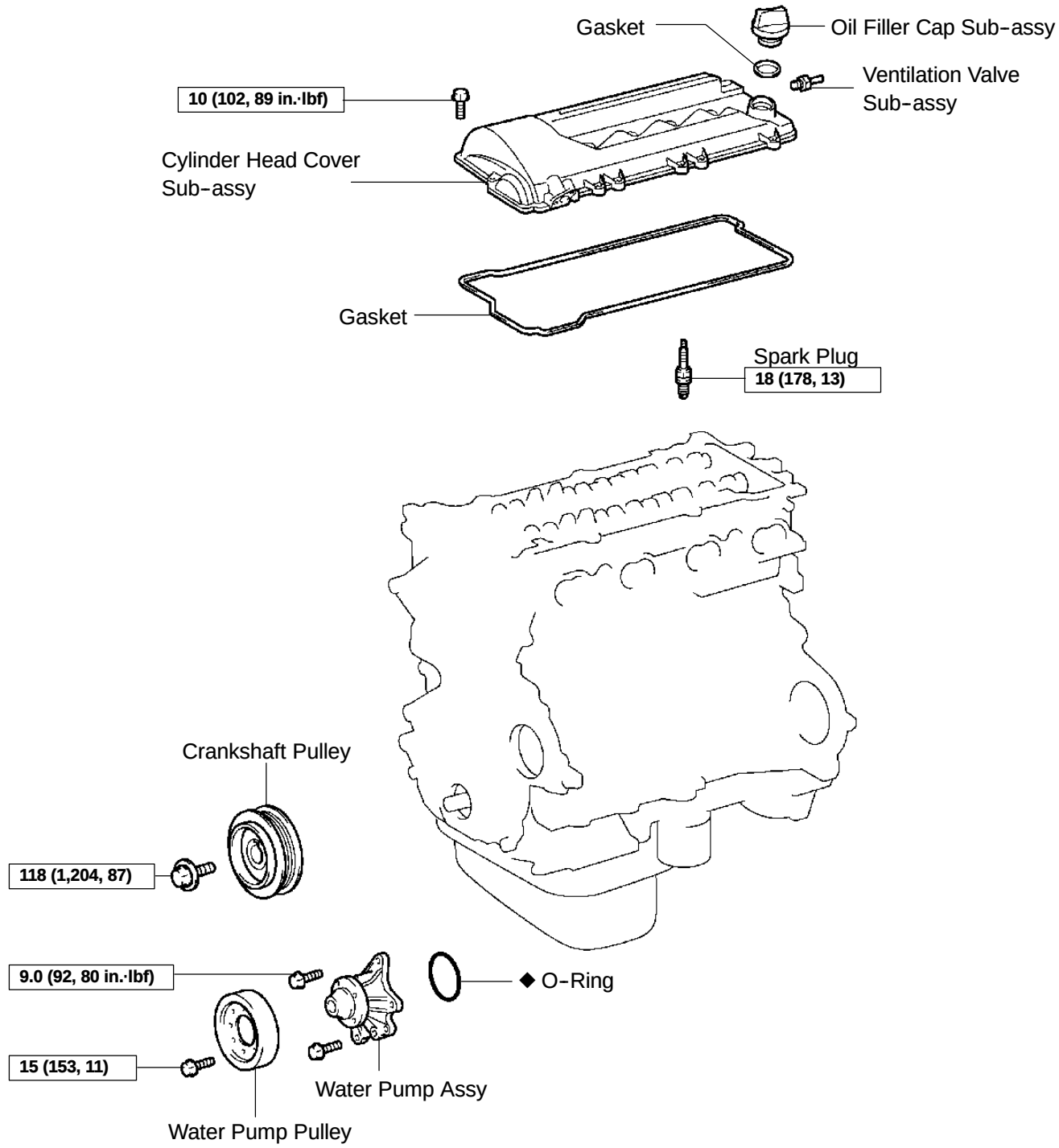
PARTIAL ENGINE ASSY (2ZZ-GE) 14-1
COMPONENTS 14-1/3
OVERHAUL 14-4/27
CYLINDER HEAD ASSY (2ZZ-GE) 14-28
COMPONENTS 14-28
OVERHAUL 14-29/41
CYLINDER BLOCK (2ZZ-GE) 14-42
COMPONENTS 14-42
OVERHAUL 14-43/62

CONTINUED

PARTIAL ENGINE ASSY (2ZZ-GE)

COMPONENTS

140N2-01

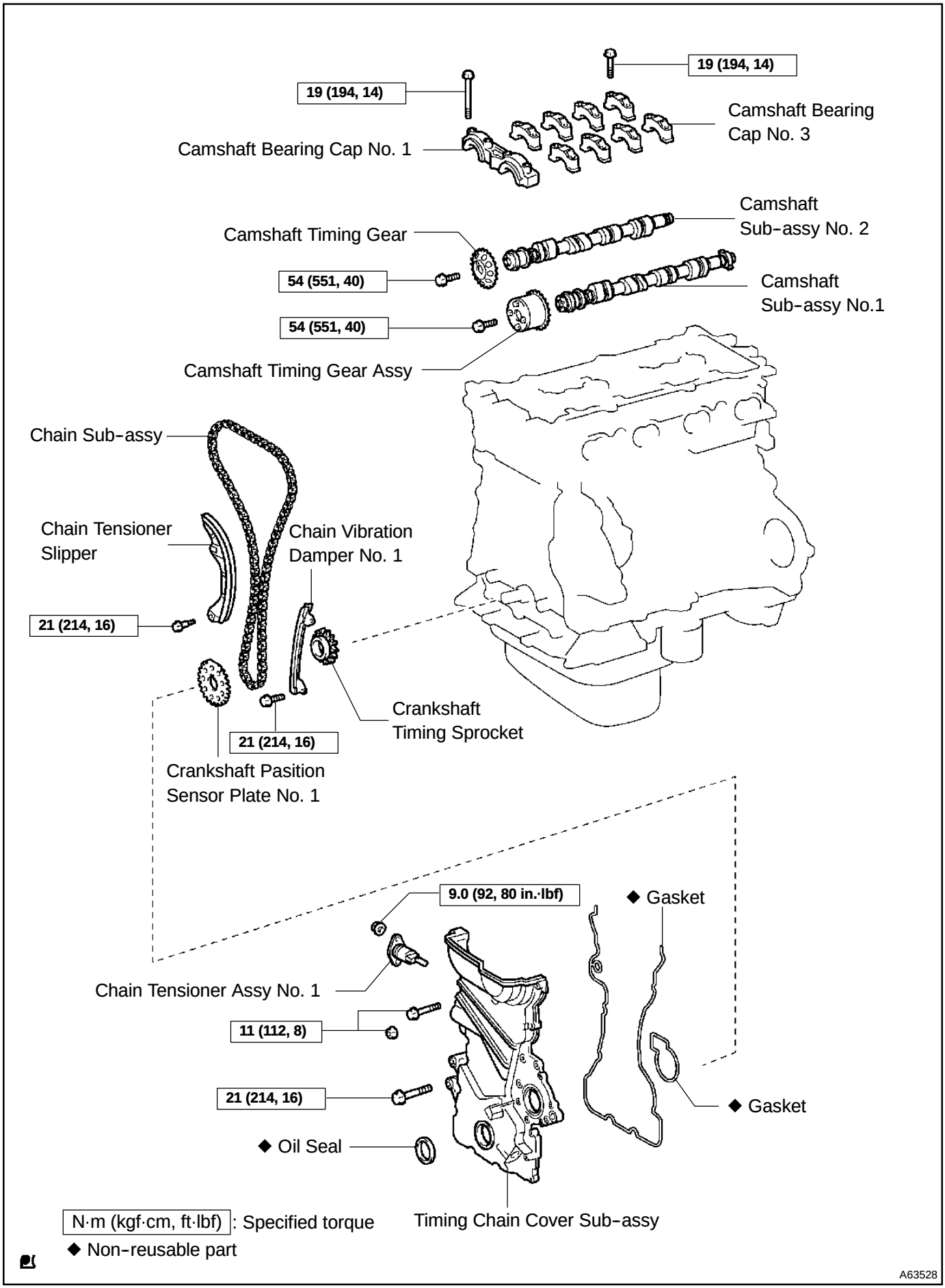


N·m (kgf·cm, ft·lbf): Specified torque

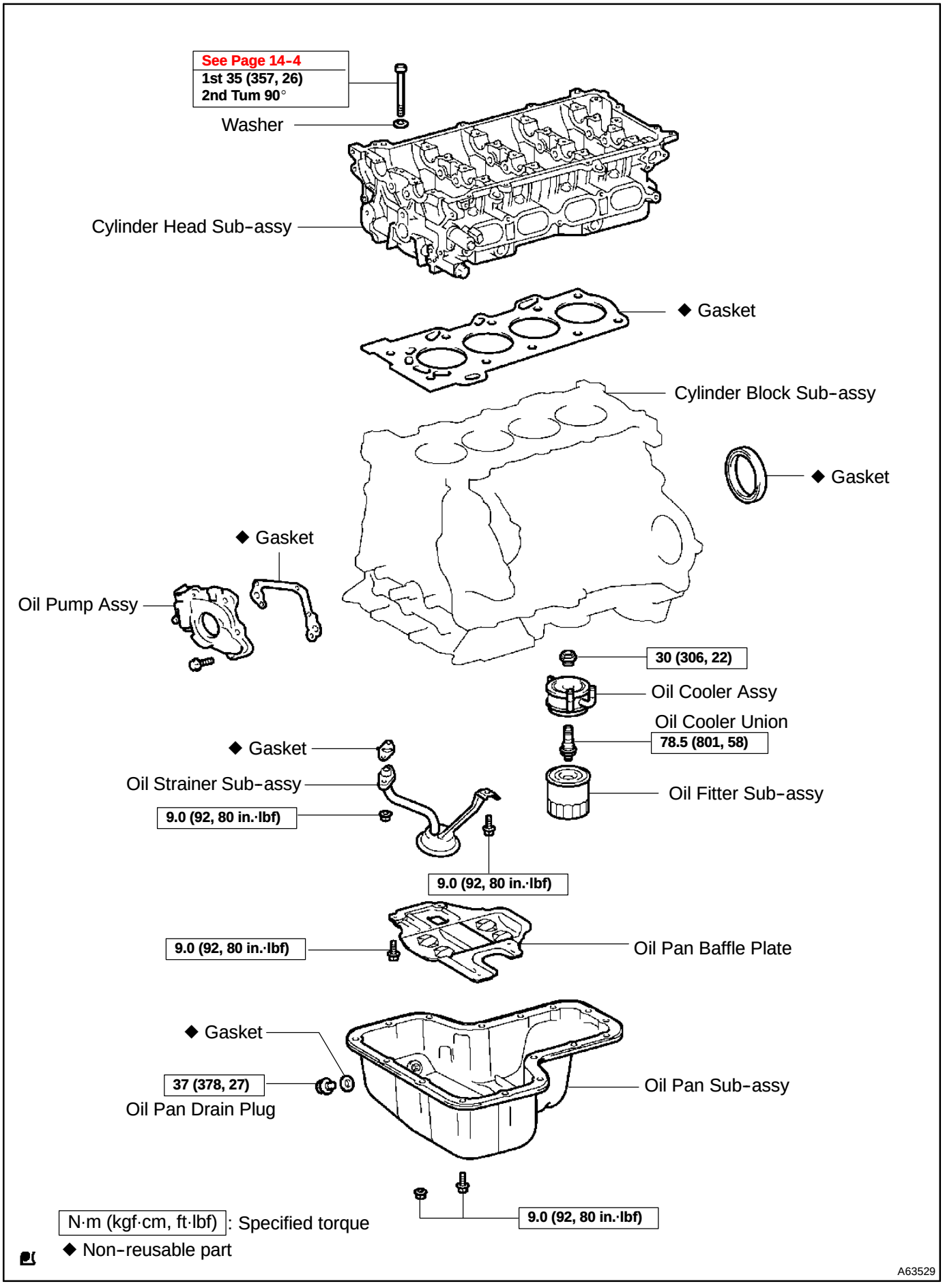
◆ Non-reusable part

A63527

CONTINUED


19 (194, 14)
19 (194, 14)
Camshaft Bearing Cap No. 3
Camshaft Bearing Cap No. 1
Camshaft Sub-assy No. 2
Camshaft Timing Gear
54 (551, 40)
Camshaft Sub-assy No.1
54 (551, 40)
Camshaft Timing Gear Assy
Chain Sub-assy
Chain Tensioner Slipper
Chain Vibration Damper No. 1
21 (214, 16)
Crankshaft Timing Sprocket
21 (214, 16)
Crankshaft Pasition Sensor Plate No. 1
9.0 (92, 80 in.·lbf)
◆ Gasket
Chain Tensioner Assy No. 1
11 (112, 8)
21 (214, 16)
◆ Gasket
◆ Oil Seal
Timing Chain Cover Sub-assy
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
A63528

CONTINUED


See Page 14-4
1st 35 (357, 26)
2nd Tum 90°
Washer
Cylinder Head Sub-assy
◆ Gasket
Cylinder Block Sub-assy
◆ Gasket
◆ Gasket
Oil Pump Assy
30 (306, 22)
Oil Cooler Assy
Oil Cooler Union
78.5 (801, 58)
◆ Gasket
Oil Strainer Sub-assy
9.0 (92, 80 in.·lbf)
Oil Fitter Sub-assy
9.0 (92, 80 in.·lbf)
9.0 (92, 80 in.·lbf)
Oil Pan Baffle Plate
◆ Gasket
37 (378, 27)
Oil Pan Drain Plug
Oil Pan Sub-assy
9.0 (92, 80 in.·lbf)
N·m (kgf·cm, ft·lbf): Specified torque
◆ Non-reusable part
A63529

OVERHAUL

1. REMOVE OIL FILLER CAP SUB-ASSY

2. REMOVE OIL FILLER CAP GASKET

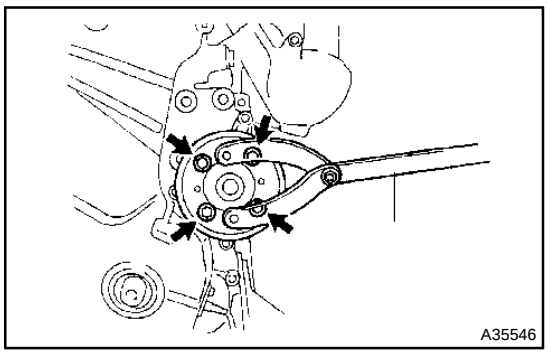
3. REMOVE VENTILATION VALVE SUB-ASSY

4. REMOVE SPARK PLUG

5. REMOVE CYLINDER HEAD COVER SUB-ASSY

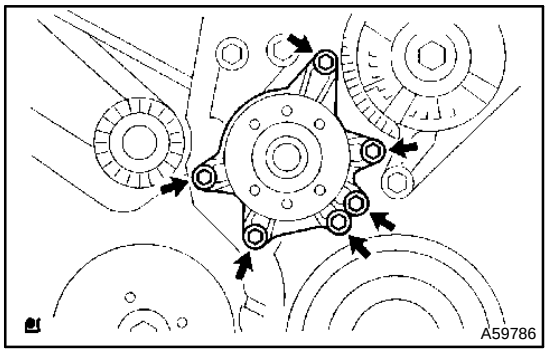
6. REMOVE CYLINDER HEAD COVER GASKET

7. REMOVE TRANSVERSE ENGINE ENGINE MOUNTING BRACKET



8. REMOVE WATER PUMP PULLEY

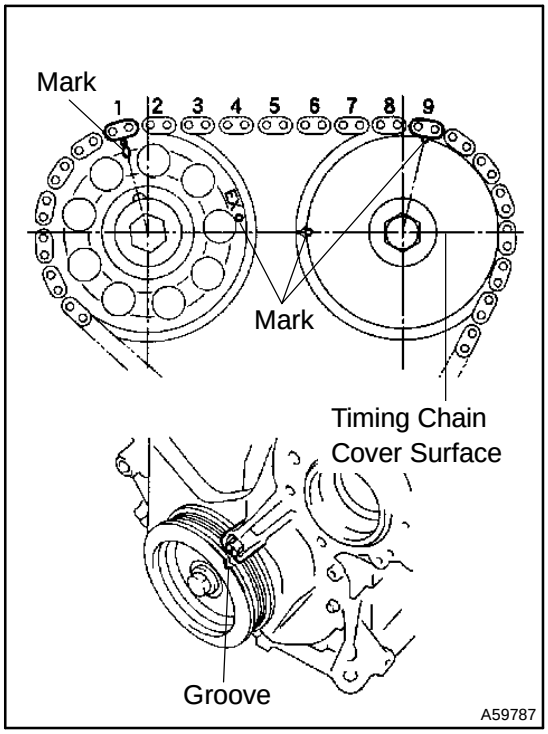
(a) Using SST, remove the water pump pully
SST 09960-10010 (09962-01000, 09963-00600)



9. REMOVE PUMP ASSY, WATER

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

CONTINUED



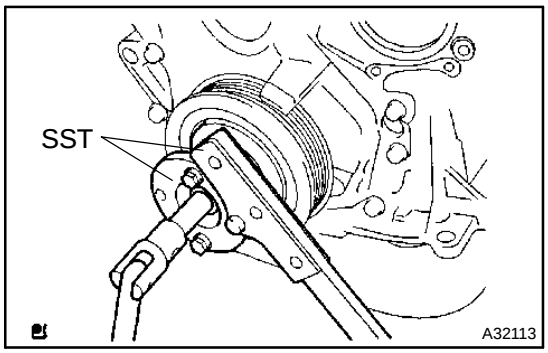
10. REMOVE CRANKSHAFT PULLEY

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

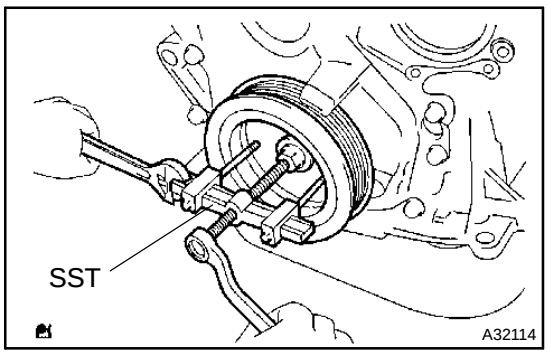
(1) Turn the crankshaft pulley, and align its groove with timing mark "0" of the timing chain cover.

(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

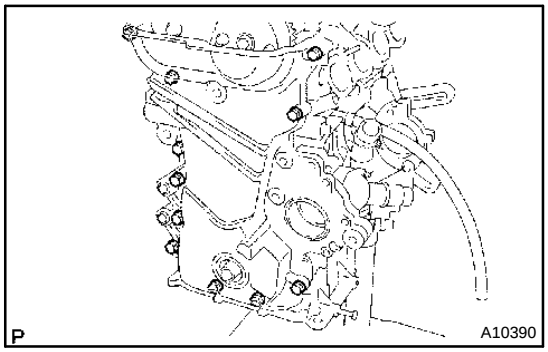


(c) Using SST, remove the crankshaft pulley.
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)

11. REMOVE CHAIN TENSIONER ASSY NO.1

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

CONTINUED



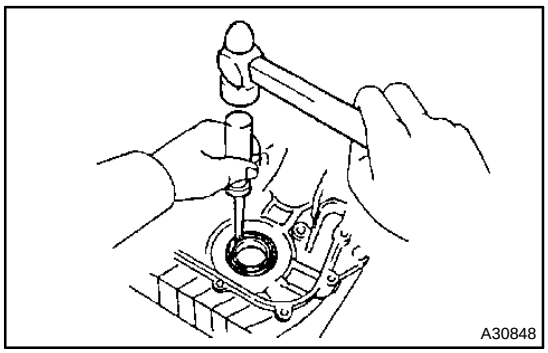
12. REMOVE TIMING CHAIN OR BELT COVER SUB-ASSY

(a) Remove the 12 bolts and nuts.
(b) Remove the stud bolt.

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

13. REMOVE TIMING GEAR (OR CHAIN) COVER GASKET

14. REMOVE TIMING CHAIN COVER GASKET NO.2



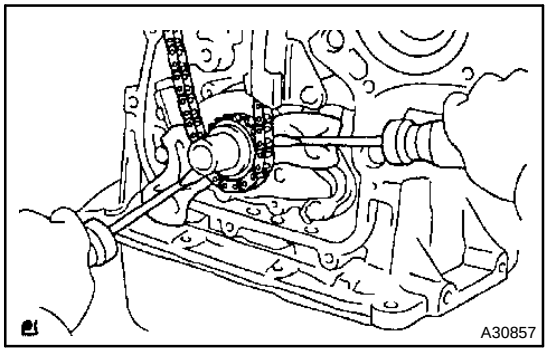
15. REMOVE TIMING GEAR COVER OIL SEAL

(a) Using a screwdriver remove the oil seal.

16. REMOVE CHAIN TENSIONER SLIPPER

17. REMOVE CHAIN VIBRATION DAMPER NO.1

18. REMOVE CRANKSHAFT POSITION SENSOR PLATE NO.1

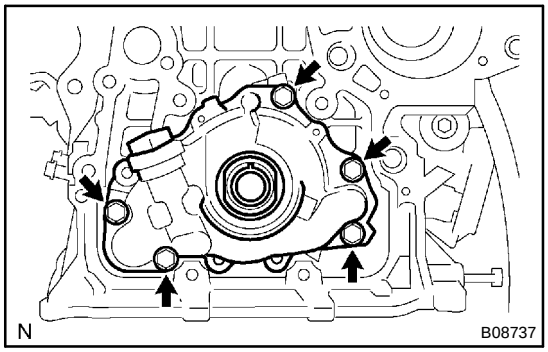


19. REMOVE CHAIN SUB-ASSY

(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.**

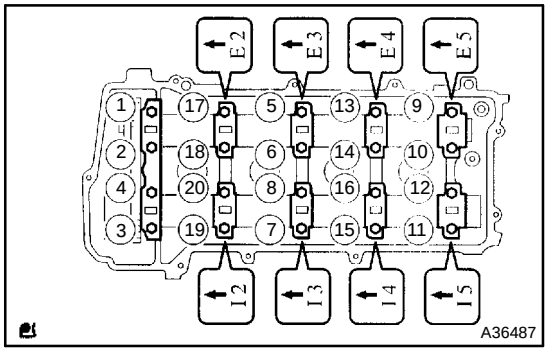
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20. REMOVE OIL PUMP ASSY

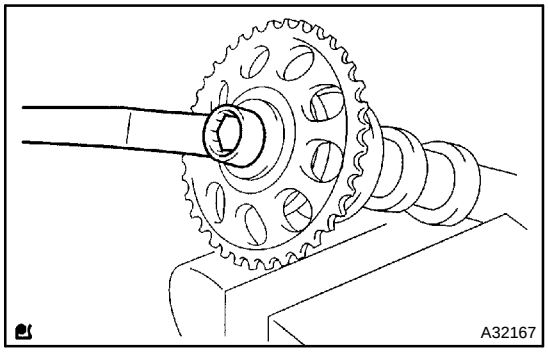
(a) Remove the 5 bolts and oil pump.

21. REMOVE OIL PUMP GASKET



22. REMOVE CAMSHAFT

(a) Uniformly loosen and remove the 20 bearing cap bolts, in several passes, in the sequence shown, and remove the 9 bearing caps, intake and exhaust camshafts.



23. REMOVE CAMSHAFT TIMING GEAR OR SPROCKET

(a) Grip the camshaft No.2 with a vice, and remove the camshaft timing gear.

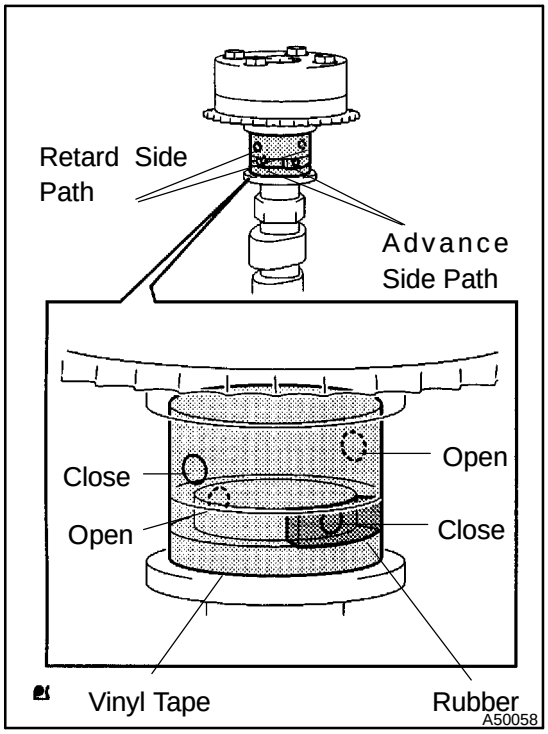
NOTICE:
Be careful not to damage the camshaft.

24. INSPECT CAMSHAFT TIMING GEAR ASSY

(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.

CONTINUED



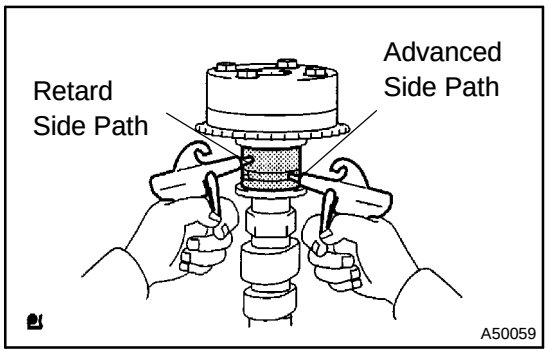
(b) Release lock pin.

(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.

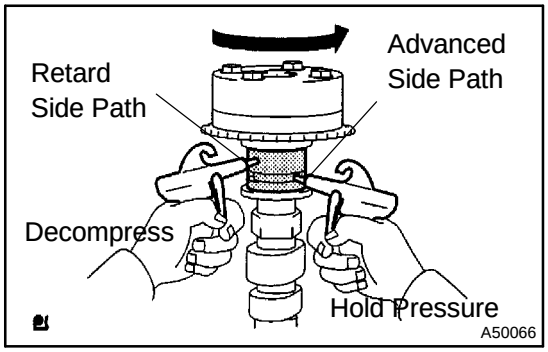
(2) Break through the tapes of the advance side path and the retard side path on the opposite side of the groove.



(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^2}.

CAUTION:

Cover the paths 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.

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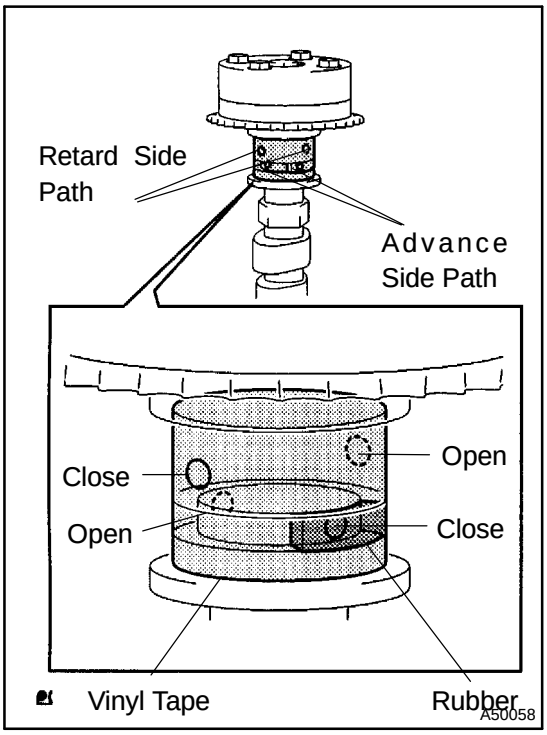
(c) Check smooth revolution

(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.



25. REMOVE CAMSHAFT TIMING GEAR ASSY

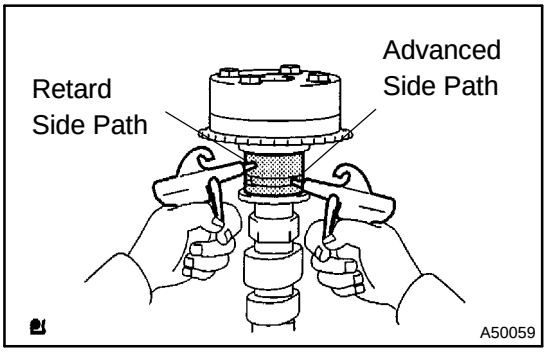
(a) Grip the camshaft with a vice, and confirm that the gear is locked.

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.

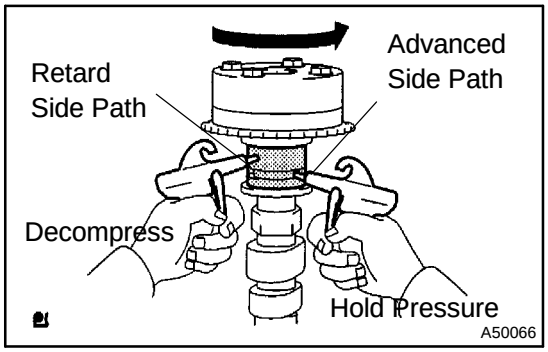
(c) Break through the tapes of the advance side path and the retard side path on the opposite side of the groove.



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

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

CONTINUED



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

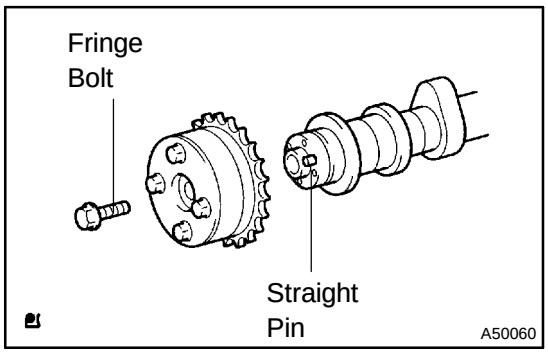
HINT:

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.

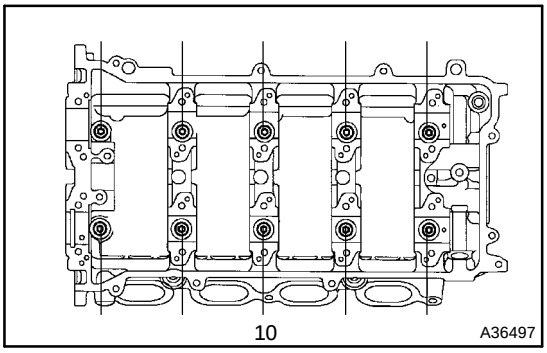


(g) Remove the fringe bolt of camshaft timing gear assembly.

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.**

26. REMOVE ENGINE HANGER NO.1



27. REMOVE HEAD SUB-ASSY, CYLINDER

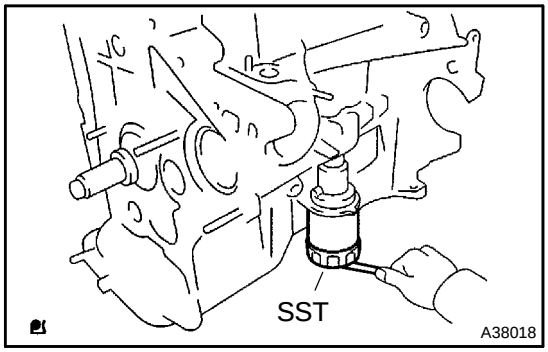
(a) Using a 10 mm bi-hexagon wrench, uniformly loosen an remove the 10 cylinder head bolts, in several passes, in the sequence shown. Remove the 10 cylinder head bolts and plate washers.

NOTICE:

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

28. REMOVE CYLINDER HEAD GASKET

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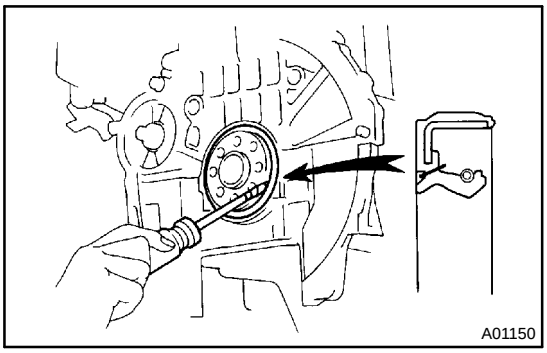


29. REMOVE OIL FILTER SUB-ASSY

(a) Using SST, remove the oil filter.
SST 09228-06501

30. REMOVE OIL COOLER ASSY

(a) Disconnect the 2 water by pass hoses.
(b) Using socket wrench (30mm), remove the oil cooler union.
(c) Remove the oil cooler and O-ring.
(d) Using socket wrench (30mm), remove the union.



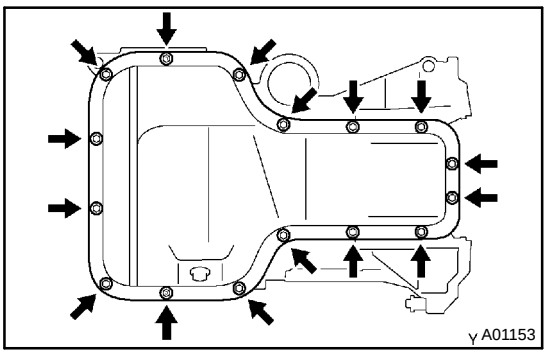
31. REMOVE ENGINE REAR OIL SEAL

(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).

32. REMOVE OIL PAN DRAIN PLUG

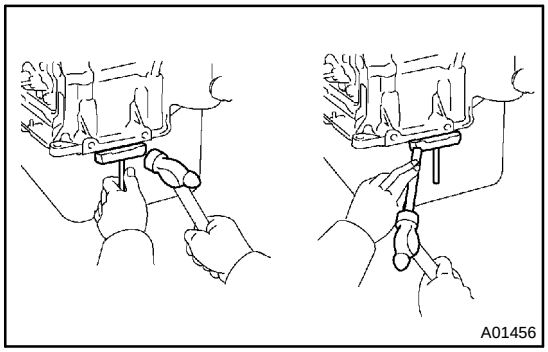
33. REMOVE OIL PAN DRAIN PLUG GASKET



34. REMOVE OIL PAN SUB-ASSY

(a) Remove the 14 bolts and 2 nuts.

CONTINUED



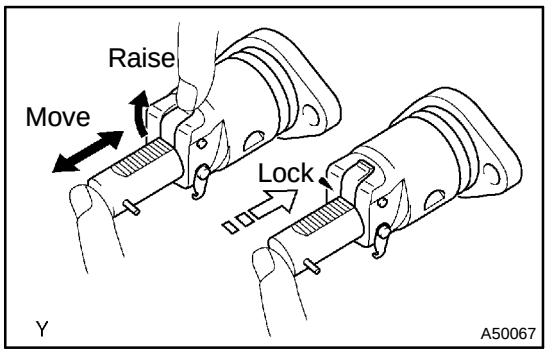
(b) Insert the blade of SST between the bearing cap sub-assembly and oil pan, and cut off applied sealer and remove the oil pan.
SST 09032-00100

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

35. REMOVE OIL STRAINER SUB-ASSY

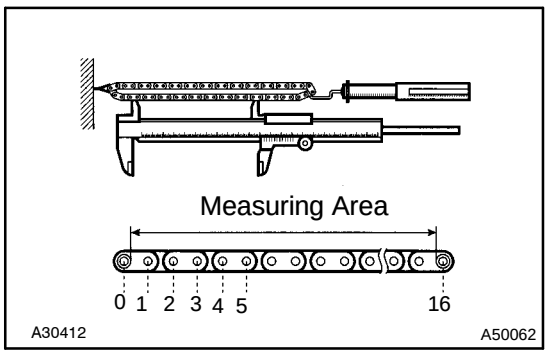
36. REMOVE OIL STRAINER FLANGE GASKET

37. REMOVE OIL PAN BAFFLE PLATE



38. INSPECT CHAIN TENSIONER ASSY NO.1

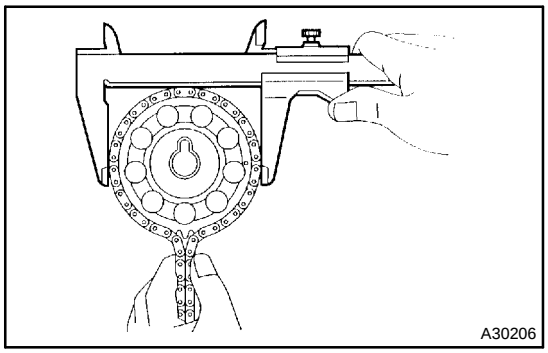
(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.
(b) Release the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.



39. INSPECT CHAIN SUB-ASSY

(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 : 122.6 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.

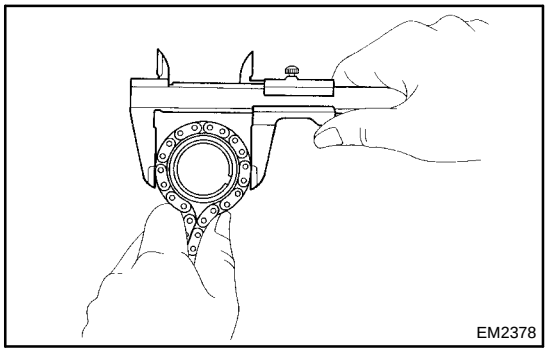


40. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET

(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.

CONTINUED



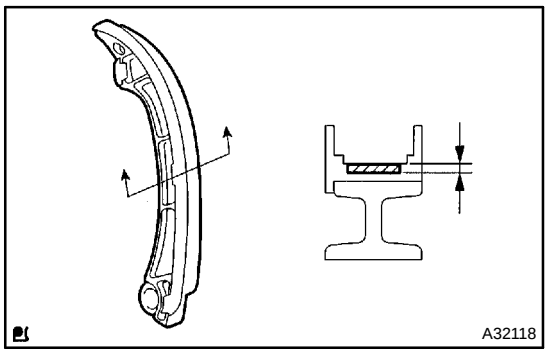
41. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET

(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.

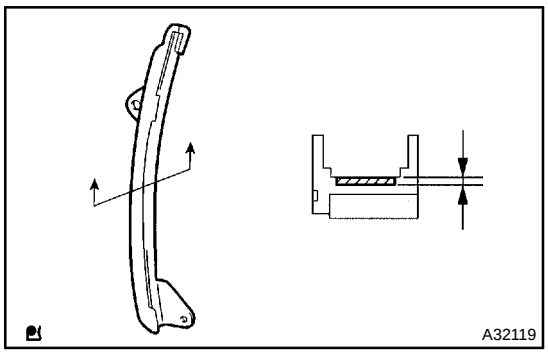
Minimum sprocket diameter (w / chain):
51.6mm (2.031in.)

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



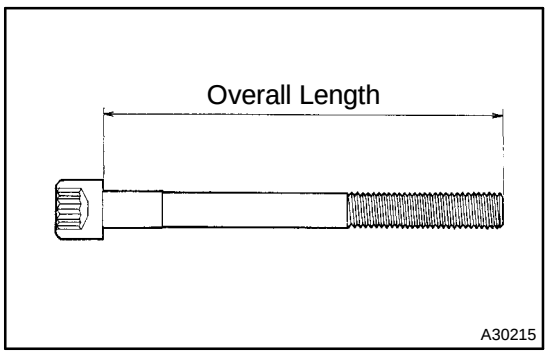
42. INSPECT CHAIN TENSIONER SLIPPER

(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

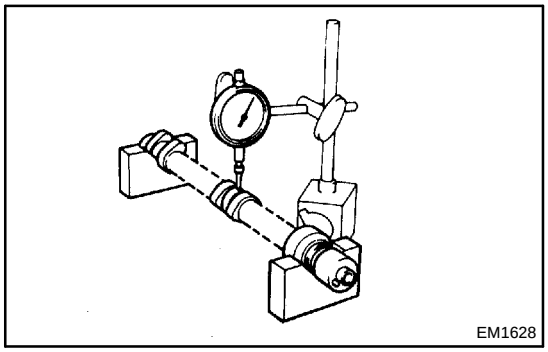
(a) Measure the vibration damper wears.
Maximum wear: 1.0 mm (0.039 in.)
(b) If the wear is greater than maximum, replace the damper.



44. INSPECT BOLT

(a) Using vernier calipers, measure the length of head bolts from the seat to the end.
Standard bolt length:
146.8 – 148.2 mm (5.780–5.835 in.)
Maximum bolt length: 148.5 mm(5.846 in.)
(b) If the length surpasses the maximum, replace the bolt.

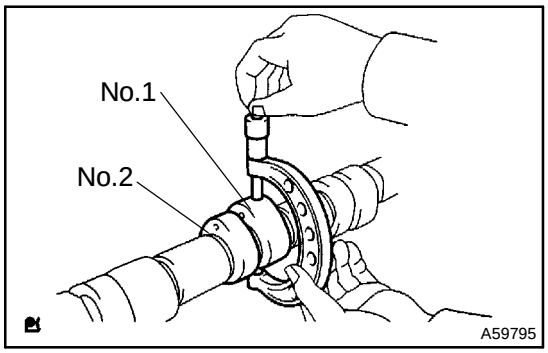
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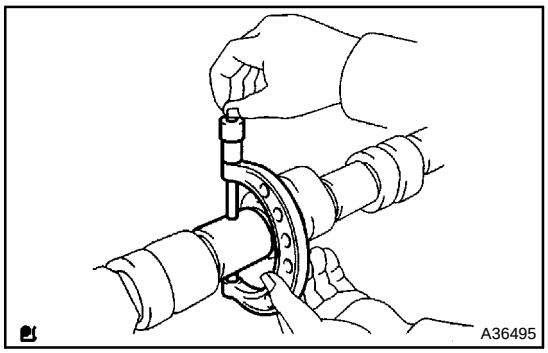
45. INSPECT CAMSHAFT

(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: 0.06 mm (0.0012 in.)

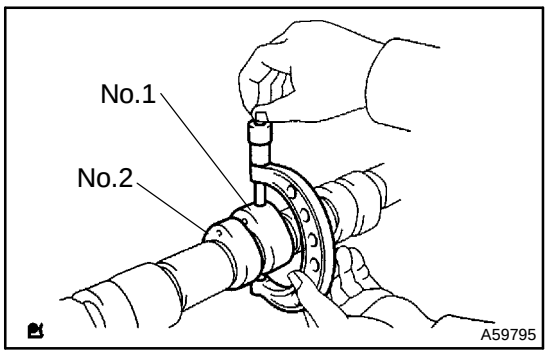
(b) If the circle runout is greater than maximum, replace the camshaft.



(c) Inspect cam lobes.
(1) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
No.1 40.607 - 40.707 mm (1.59586 - 1.59979 in.)
No.2 38.769 - 38.869 mm (1.52362 - 1.52755 in.)
Minimum cam lobe height:
No.1 40.45 mm (1.5925 in.)
No.2 38.61 mm (1.5201 in.)
(2) If the cam lobe height is less than minimum, replace the camshaft.



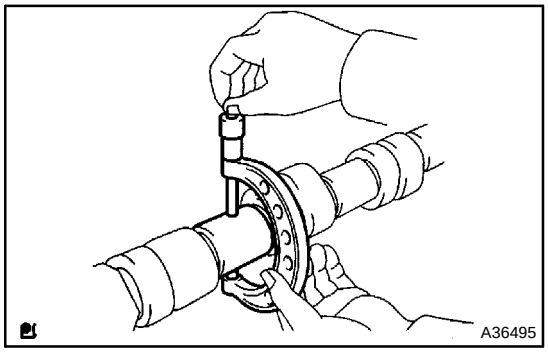
(d) Inspect camshaft journals.
(1) Using a micrometer, measure the journal diameter.
No. 1 journal diameter:
34.449 - 34.465 mm (1.3563 - 1.3569 in.)
Others journal diameter:
22.949 - 22.965 mm (0.9035 - 0.9041 in.)
(2) If the journal diameter is not as specified, check the oil clearance.



46. INSPECT NO.2 CAMSHAFT

(a) Inspect cam lobes.
(1) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
No.1 40.019 - 40.119 mm (1.57275 - 1.57668 in.)
No.2 38.863 - 38.963 mm (1.52732 - 1.53125 in.)
Minimum cam lobe height:
No.1 39.86 mm (1.5693 in.)
No.2 38.71 mm (1.5240 in.)
(2) If the cam lobe height is less than minimum, replace the camshaft.

CONTINUED



(b) 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.)

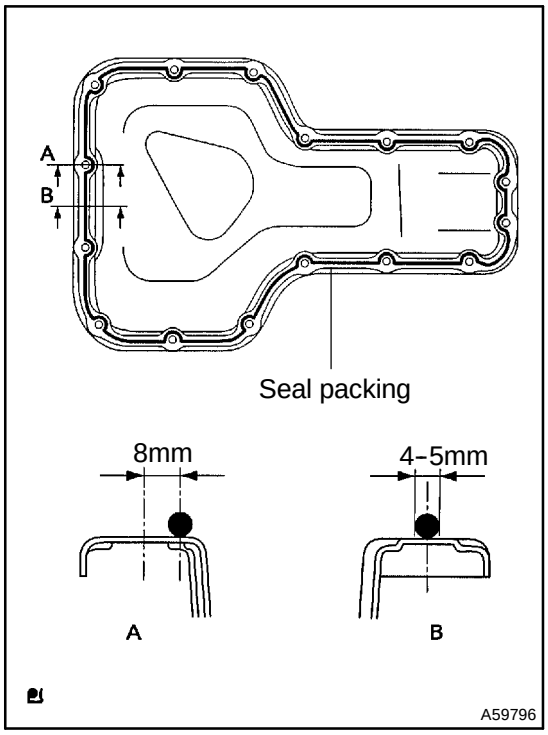
(2) If the journal diameter is not as specified, check the oil clearance.

47. INSTALL OIL STRAINER SUB-ASSY

(a) Install a new gasket and the oil strainer with the 2 nuts and a bolt.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

48. INSTALL OIL PAN BAFFLE PLATE

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



49. INSTALL OIL PAN SUB-ASSY

(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:

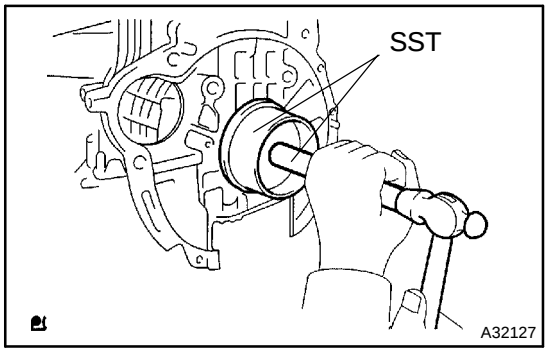
- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes after applying seal packing.**
- **Do not put into engine oil within 2 hours after installing.**

(c) Install the oil pan with the 14 bolts and 2 nuts.
Torque: 9 N·m (92 kgf·cm, 80 in.·lbf)

50. INSTALL OIL PAN DRAIN PLUG

(a) Place a new gasket on the drain plug and install the oil pan drain plug.
Torque: 37 N·m (378 kgf·cm, 27 ft·lbf)

CONTINUED



51. INSTALL ENGINE REAR OIL SEAL

(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.

52. INSTALL OIL COOLER ASSY

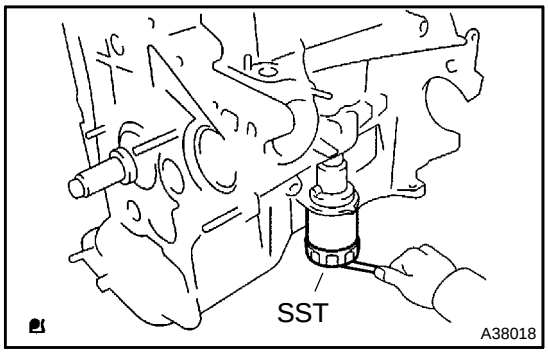
(a) Using socket wrench (30mm), install the union.
Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)

(b) Check and clean the oil cooler surfase.

(c) Install the new O-ring to oil cooler.

(d) Apply clean engine oil to the O-ring.

(e) Using socket wrench (30mm), install the oil cooler union and oil cooler.
Torque: 78.5 N·m (801 kgf·cm, 58 ft·lbf)



53. INSTALL OIL FILTER SUB-ASSY

(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.

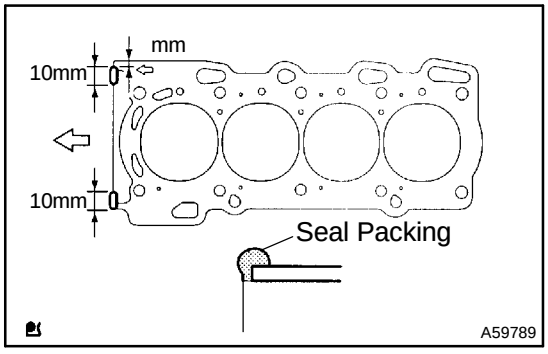
SST 09228-06501

54. INSTALL CYLINDER HEAD GASKET

(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.**



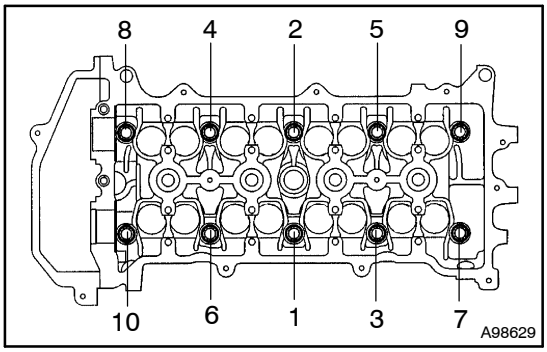
(b) Apply seal packing to the cylinder head gasket as shown in the illustration.
Seal packing:
Part No. 08826-00080 or equivalent

HINT:

avoid applying an excessive amount to the surface.

- Parts must be assembled with in 3 minutes of application. Otherwise the material must be removed and repplied.
- Immediately remove nozzle from the tube and reinstall cap.

CONTINUED



55. INSTALL HEAD SUB–ASSY, CYLINDER

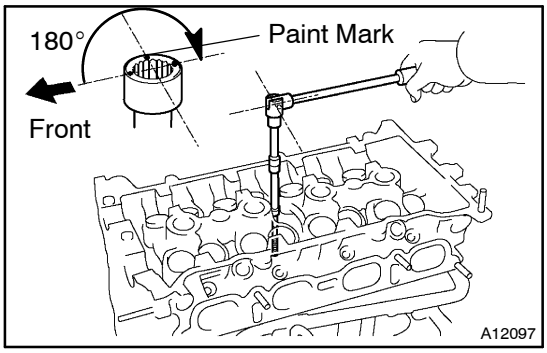
HINT:

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: 35 N·m (357 kgf·cm, 26 ft·lbf)



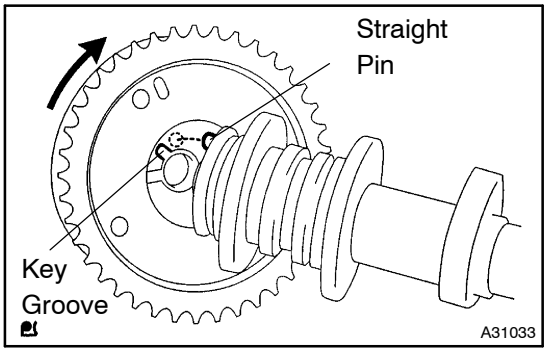
(c) Mark the front of the cylinder head bolt with paint.

(d) Retighten the cylinder head bolts 180 ° in the numerical order shown.

(e) Check that the point marked bolts are moved at 180 ° angle.

56. INSTALL ENGINE HANGER NO.1

Torque: 38 N·m (387 kgf·cm, 28 ft·lbf)



57. INSTALL CAMSHAFT TIMING GEAR ASSY

(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).

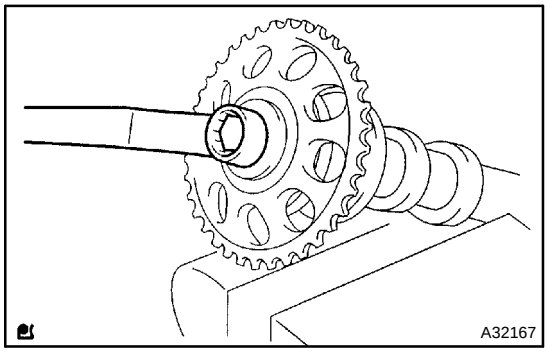
(c) Check that there is no clearance between the gear's fringe and the camshaft.

(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.

CONTINUED



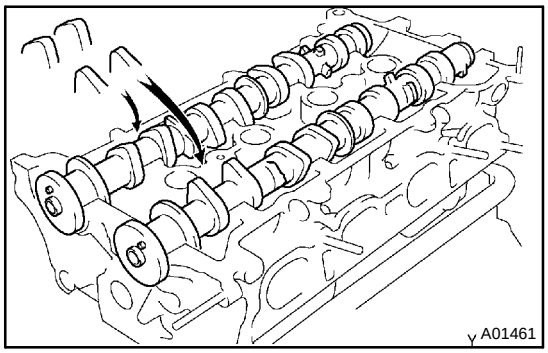
58. INSTALL CAMSHAFT TIMING GEAR OR SPROCKET

(a) Grip the camshaft with a vice, and install the camshaft timing gear.
Torque: 54 N·m (551 kgf·cm 40 ft·lbf)

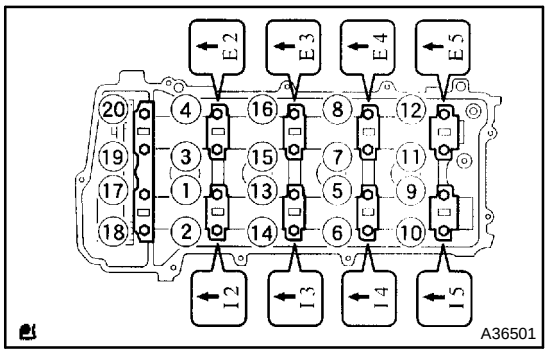
NOTICE:
Be careful not to damage the camshaft.

59. INSTALL CAMSHAFT

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



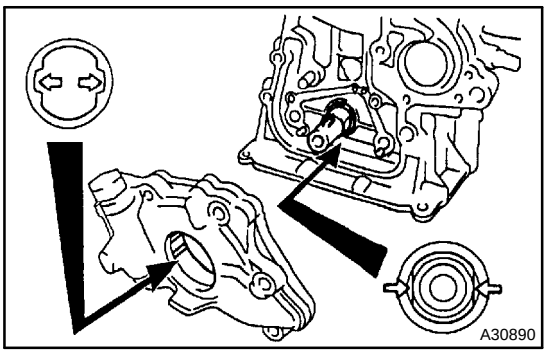
(b) Place the 2 camshafts on the cylinder head with the No. 1 cam lobes facing as shown the illustration.



(c) Examine the front marks and numbers and tighten the bolts in the order shown in the illustration.
Torque: 19 N·m (194 kgf·cm, 7 ft·lbf)

60. INSTALL OIL PUMP GASKET

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

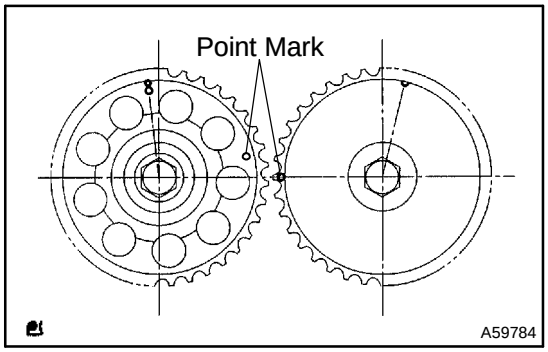


61. INSTALL OIL PUMP ASSY

(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)

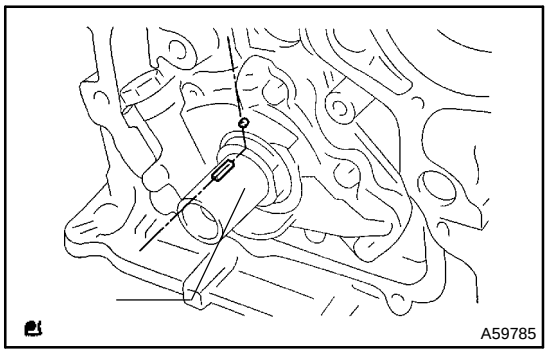
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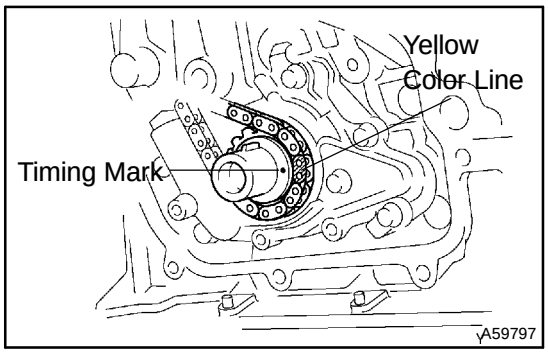
62. INSTALL CHAIN SUB-ASSY

(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.

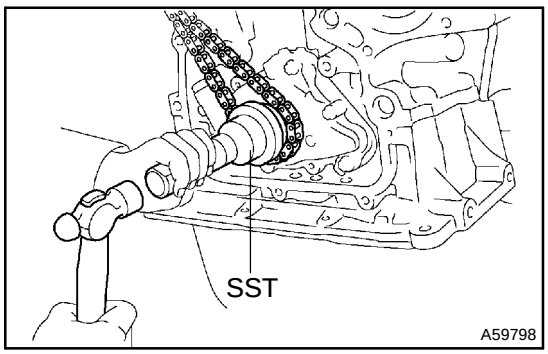


(2) Turn the crankshaft and set the set key on the crankshaft upward.

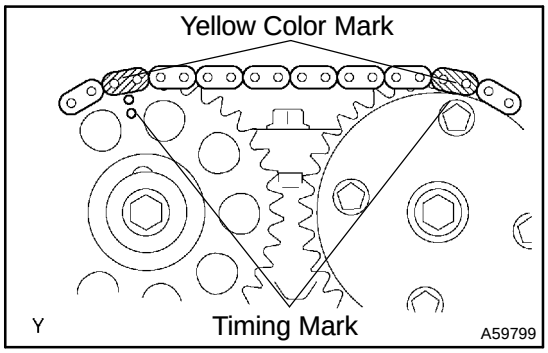


(b) Install the timing chain on the crankshaft timing sprocket with the yellow color link aligned with the timing mark on the crankshaft timing sprocket.

HINT:
Three yellow color links are on the chain.



(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.

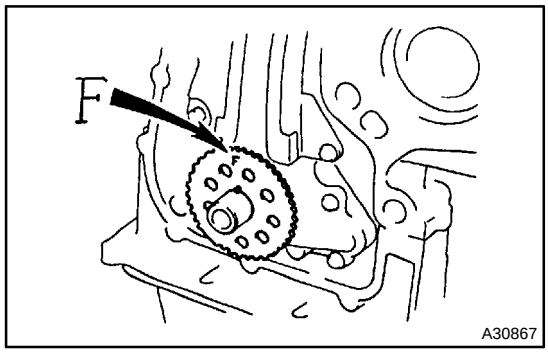
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63. INSTALL CHAIN VIBRATION DAMPER NO.1

Torque: 21 N·m (214 kgf·cm, 16 ft·lbf)

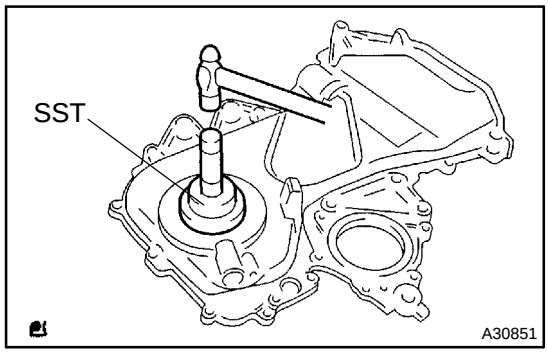
64. INSTALL CHAIN TENSIONER SLIPPER

Torque: 21 N·m (214 kgf·cm, 16 ft·lbf)



65. INSTALL CRANKSHAFT POSITION SENSOR PLATE NO.1

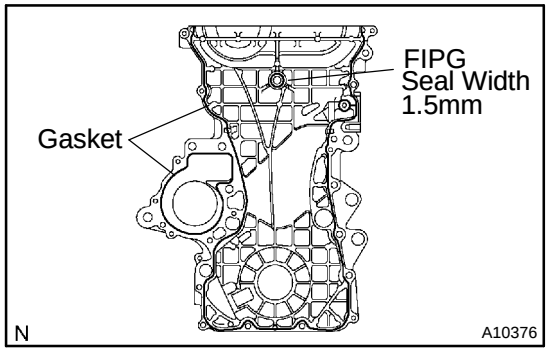
(a) Install the plate with the ”F” mark facing forward.



66. INSTALL TIMING GEAR COVER OIL SEAL

(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.



67. INSTALL TIMING CHAIN OR BELT COVER SUB–ASSY

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surface of the timing chain cover, cylinder head and cylinder block.
- Using a razor blade and a gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

CONTINUED

(b) Apply seal packing to the timing chain cover an shown in the illustration.

Seal packing:

Part No. 08826-00100 or equivalent

- Install a nozzle that has been cut to a 1.5 mm opening.

HINT:

Avoid applying an excessive amount to the surface.

- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the 2 gaskets to the timing chain cover an shown in the illustration.

(d) Apply seal packing to 4 locations an shown in the illustration.

Seal packing:

Part No. 08826-00080 or equivalent

- Install a nozzle that has been cut to a 4 - 5 mm (0.16 - 0.20 in.) opening.

HINT:

Avoid applying an excessive amount to the surface.

- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

NOTICE:

- **Do not put into engine oil within 2 hours after installing.**

(e) Install the timing chain cover, with the 12 bolts and nut.

Torque:

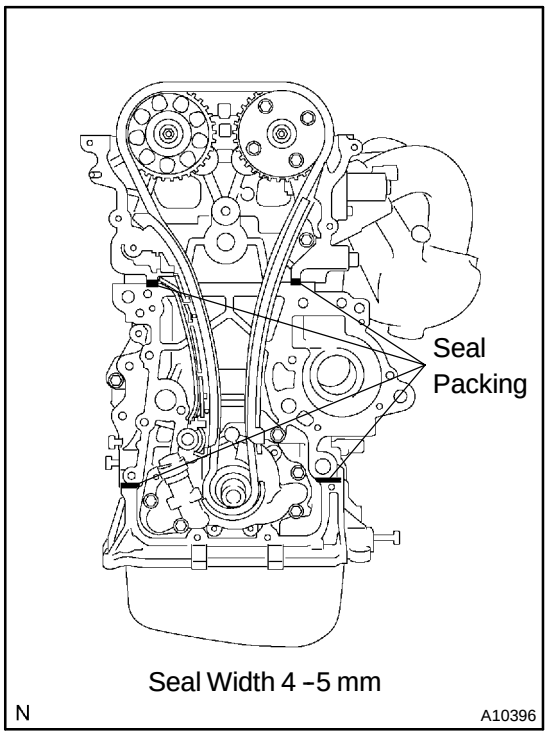
21 N·m (214 kgf·cm, 16 ft·lbf) (M8)

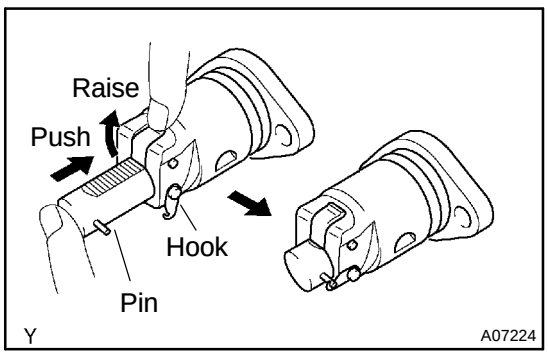
11 N·m (112 kgf·cm, 8 ft·lbf) (M6)

(f) Install the stud bolt.

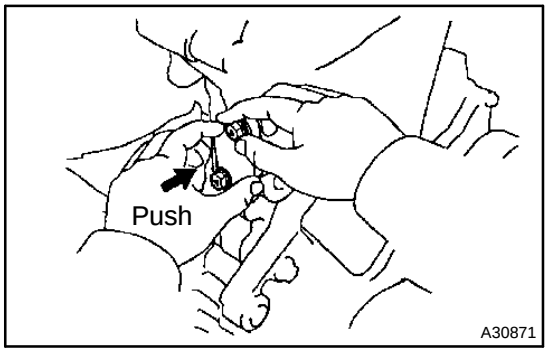
68. INSTALL CHAIN TENSIONER ASSY NO.1

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



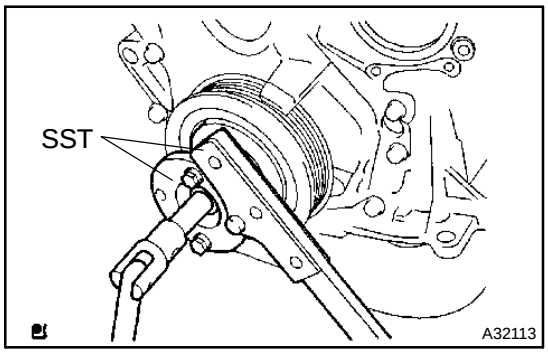


CONTINUED



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

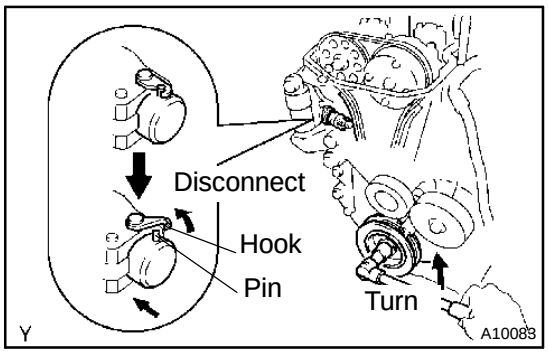
NOTICE:
When installing the tensioner, set the hook again if the hook releases the plunger.



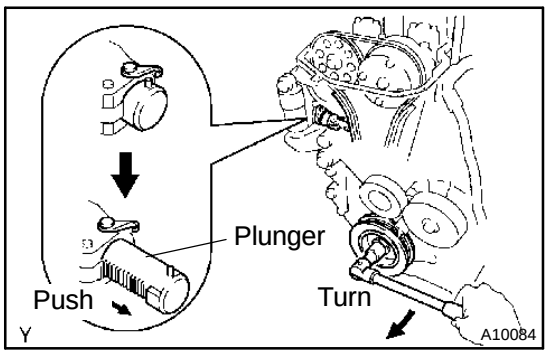
69. INSTALL CRANKSHAFT PULLEY

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

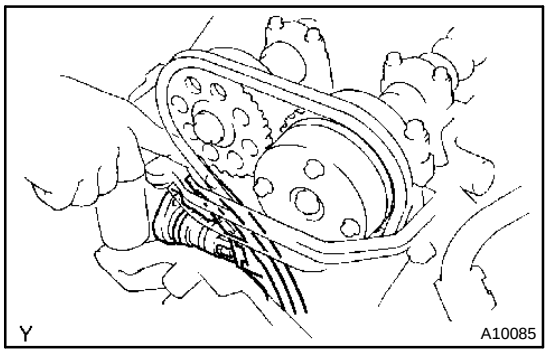
(b) Using SST, install the pulley bolt.
SST 09213-70011, 09330-00021
Torque: 118 N·m (1,203 kgf·cm, 87 ft·lbf)



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

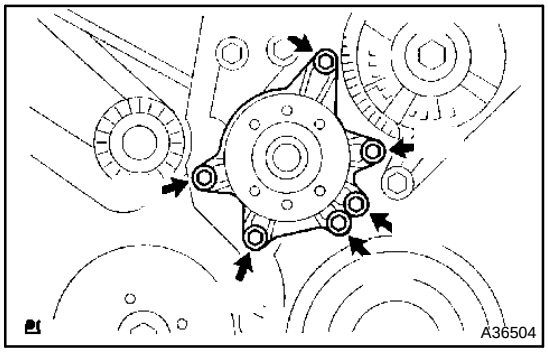


(d) Turn the crankshaft clockwise, and check that the slipper is pushed by the plunger.



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.

CONTINUED



70. INSTALL PUMP ASSY, WATER

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

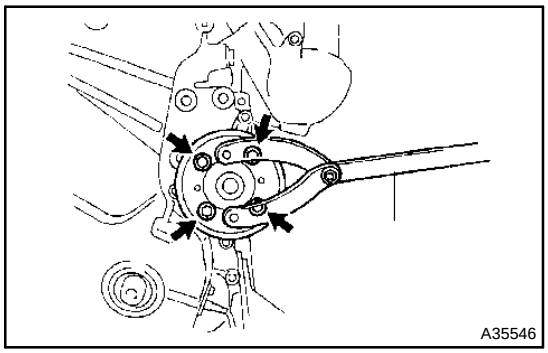
(b) Install the water pump with the 6 bolts.

Torque:9.0 N·m (92 kgf·cm, 80 in·lbf)

HINT:

Each bolt length is indicated in the illustration.

Bolt A	35 mm (1.38 in.)
Bolt B	28 mm (1.10 in.)



71. INSTALL WATER PUMP PULLEY

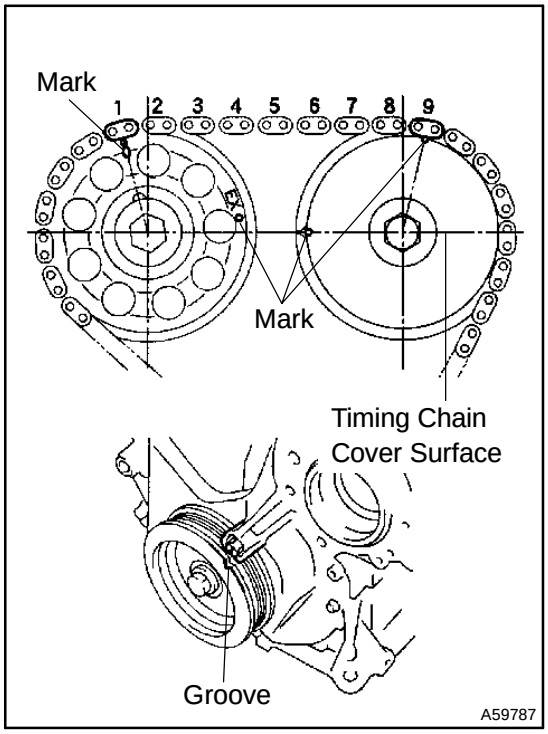
(a) Using SST the water pump pulley.

SST 09960–10010 (09962–01000, 09963–00600)

Torque: 15 N·m (153 kgf·cm, 11 ft·lbf)

72. INSTALL TRANSVERSE ENGINE ENGINE MOUNTING BRACKET

Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)



73. INSPECT VALVE CLEARANCE

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

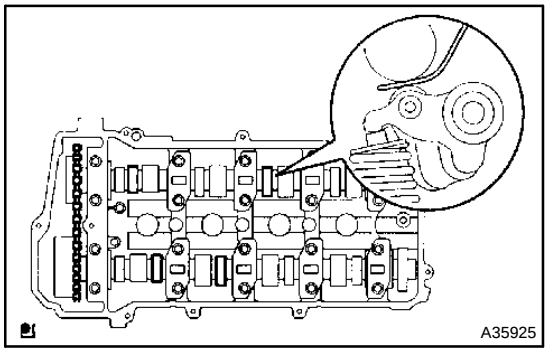
(1) Turn the crankshaft pulley, and align its groove with timing mark ”0” of the timing chain cover.

(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.

CONTINUED



(b) Check only the valves indicated.

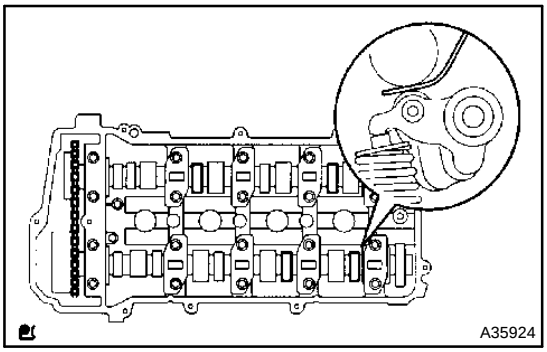
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

(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	0.08 - 0.18 mm (0.003 - 0.007 in.)
Exhaust	0.22 - 0.32 mm (0.009 - 0.013 in.)

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



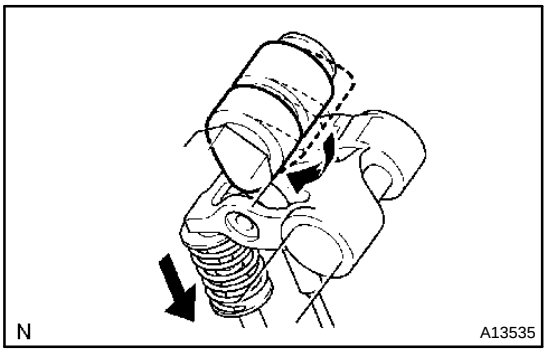
(d) Check only the valves indicated.

(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	0.08 - 0.18 mm (0.003 - 0.007 in.)
Exhaust	0.22 - 0.32 mm (0.009 - 0.012 in.)

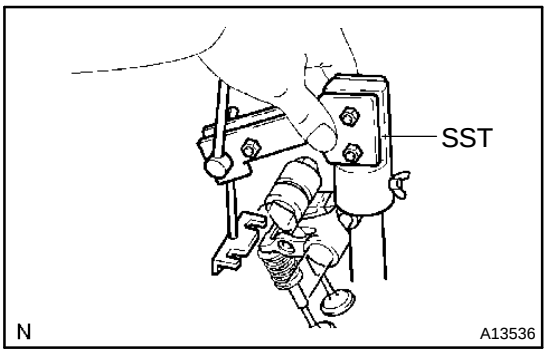


74. ADJUST VALVE CLEARANCE

(a) Set the SST.

NOTICE:

Remove the spark plug and take off the compression.



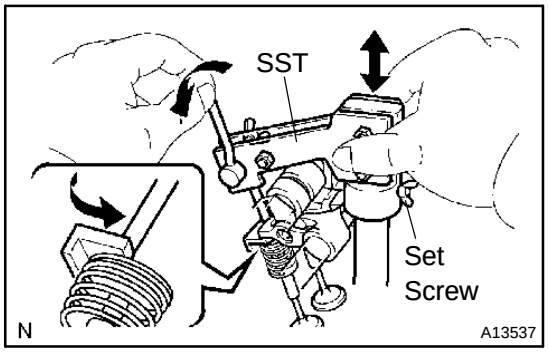
(1) Insert SST into the plug tube.

SST 09248-77010 (09248-07010)

NOTICE:

- **SST cannot be inserted unless the set screw is loosened.**
- **Make sure that the camshaft is in the same condition as step (1).**

CONTINUED



(2) Operate the lever so that SST's seat surfase comes to contact with the valve retainer and lock them with the set screw.

NOTICE:

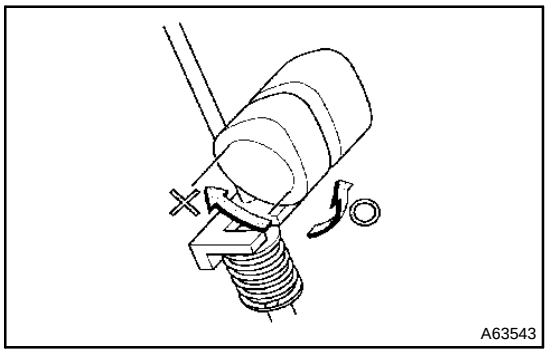
- **Clearance between the valve retainer and SST's seat surface is not allowed.**
- **Care should be taken not to make clearance when inserting SST, since a presence of clearance may unlock the keeper.**

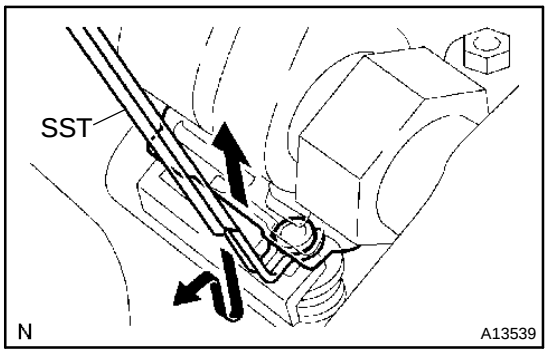
(3) lock the set screw on the plug tube side of SST.

(4) Rotate the crankshaft so that the camshaft is positioned as shown in the illustration.

NOTICE:

- **Pay attention to the direction of the rotation to prevent the nose of the camshaft from interfering with the SST's shaft.**
- **Do not rotate the crankshaft excessively.**





(b) Remove the adjusting shim.

(1) Lift the rocker arm to make a room and remove the adjusting shim using SST.

SST 09248–77010 (09248–07010)

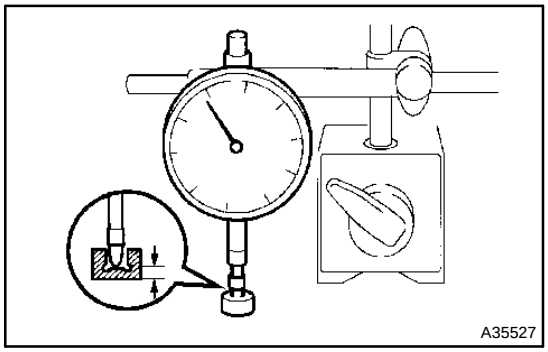
NOTICE:

Do not remove SST in the condition that adjusting shim is removed.

HINT:

- Setting SST from the right above makes the removal easy.
- If there is not enough room, reset SST.

CONTINUED



(2) Determine the size of the replaced shim according to there Formula or Charts:

- Using a dial indicator, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

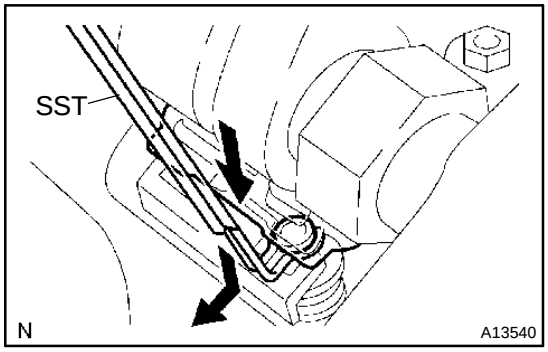
A	Thickness of new shim
B	Thickness of used shim
C	Measured valve clearance

Intake: A = B + (C - 0.13 mm (0.005 in.)) × 1.5

Exhaust: A = B + (C - 0.27 mm (0.011 in.)) × 1.5

HINT:

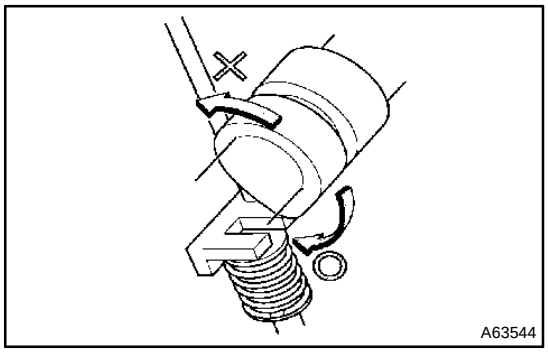
Shim are available in 41 sizes in increments of 0.020 mm (0.0008 in.), from 2.000 mm (0.0787 in.) to 2.800 mm (0.1102 in.).



(c) Lift the rocker arm to make a room and use SST, install the adjusting shim.

HINT:

- Setting SST from the right above makes the removal easy.
- To remove SST from the adjusting shim, it is advisable to push down the rocker arm.



(d) Turn the crankshaft so that the related rocker arm, where the valve clearance is adjusted, is fully pushed down.

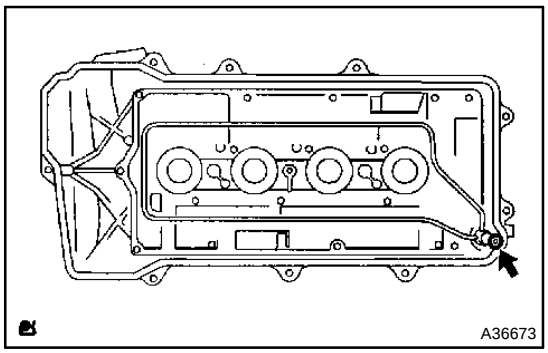
NOTICE:

- **Pay attention to the direction of the rotation to prevent the nose of the camshaft from interfering with the SST's shaft.**
- **Do not rotate the crankshaft excessively.**

(e) After loosening the 2 set screws of SST, remove SST itself.

SST 09248-77010 (09248-07010)

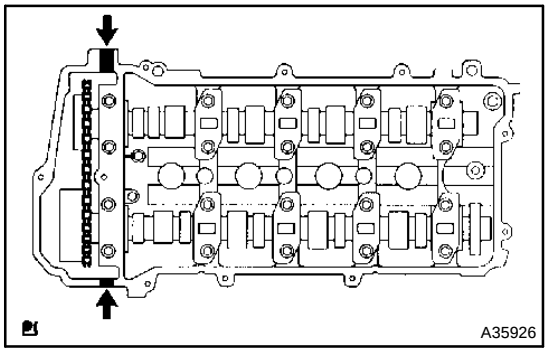
75. INSTALL CYLINDER HEAD COVER SUB-ASSY



(a) Install the gasket to the cylinder head cover.

(b) Remove any old packing (FIPG) material.

CONTINUED

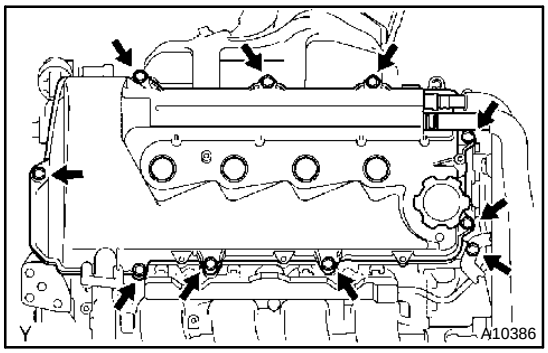


(c) Apply seal packing to 2 locations as shown in the illustration.

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 10 bolts.

Uniformly tighten the bolts, in the several passes,in the sequence shown.

Torque: 10 N·m (102 kgf·cm, 89 in·lbf)

76. INSTALL SPARK PLUG

Torque: 18 N·m (178 kgf·cm, 13 ft·lbf)

77. INSTALL VENTILATION VALVE SUB-ASSY

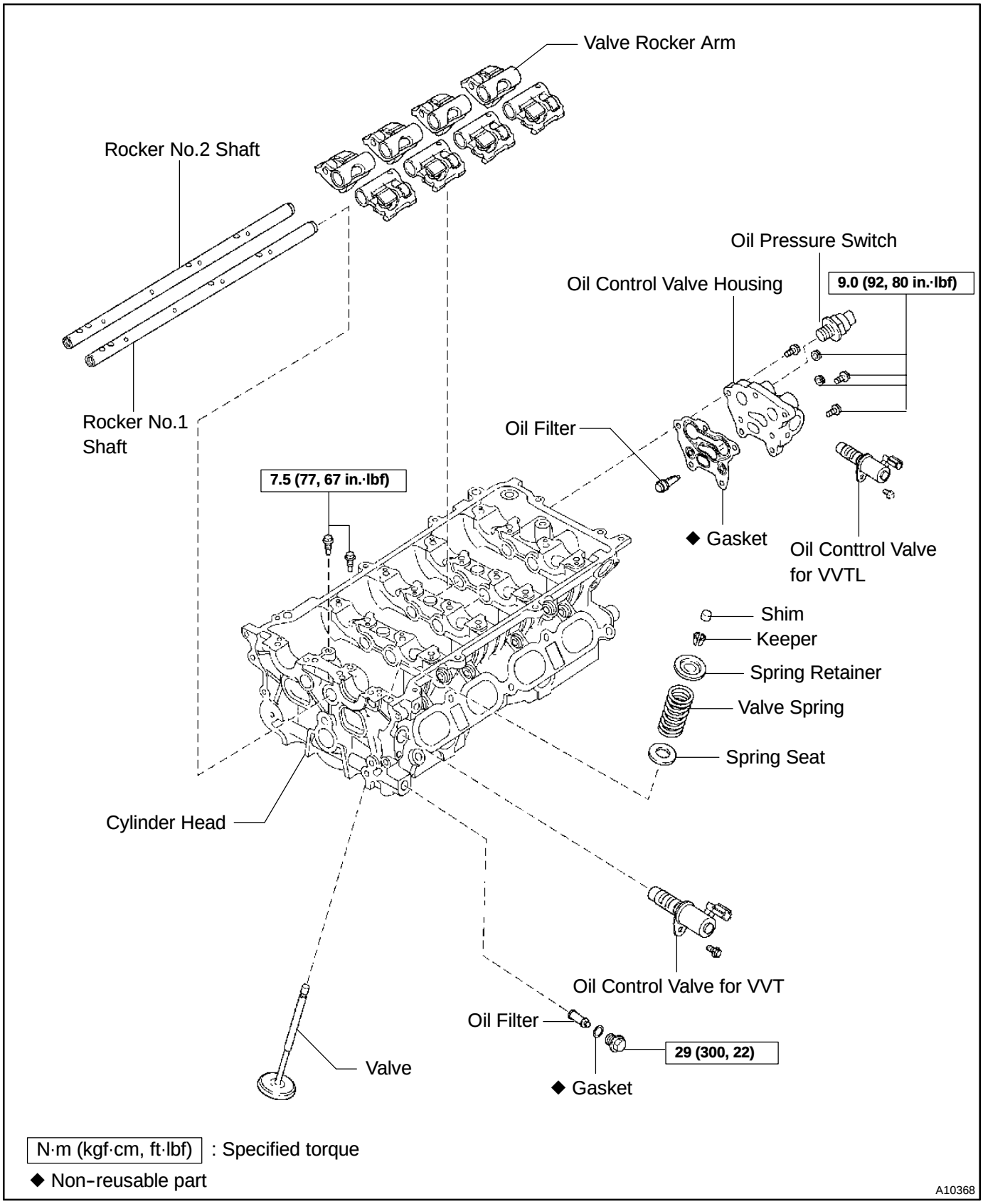
Torque: 27 N·m (276 kgf·cm, 20 ft·lbf)

CONTINUED

CYLINDER HEAD ASSY (2ZZ-GE)

COMPONENTS

140N4-01



N·m (kgf·cm, ft·lbf) : Specified torque

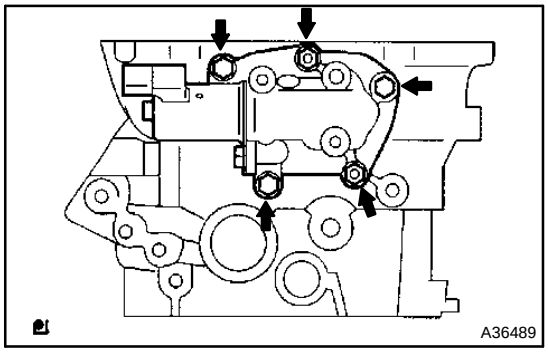
◆ Non-reusable part

A10368

CONTINUED

OVERHAUL

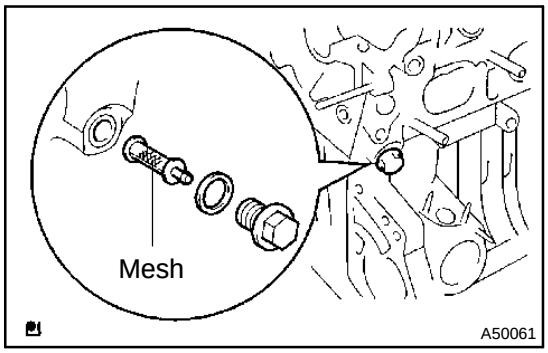
1. REMOVE CAM TIMING CONTROL VALVE HOUSING



(a) Remove the 3 bolts, 2 nuts and cam timing oil control valve housing.

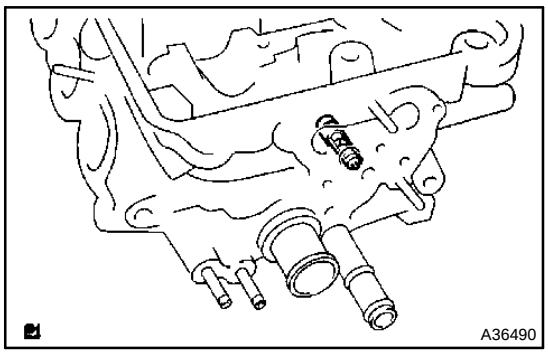
2. REMOVE CAM TIMING OIL CONTROL VALVE HOUSING GASKET

3. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY

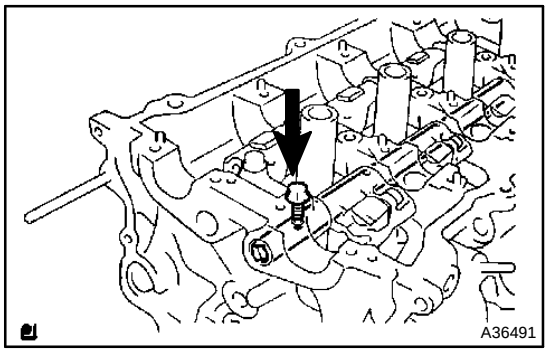


4. REMOVE OIL CONTROL VALVE FILTER

(a) Remove the plug and oil control valve filter.(Front side)



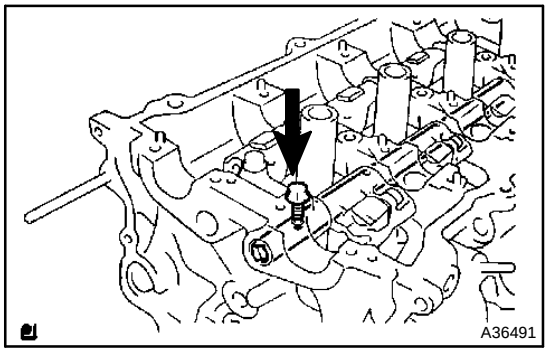
(b) Remove the oil control valve filter.(Rear side)



5. REMOVE VALVE ROCKER SHAFT SUB–ASSY NO.1

(a) Remove the bolt and the rocker shaft No.1.
(b) Remove the valve rocker arm.

CONTINUED



6. REMOVE VALVE ROCKER SHAFT SUB-ASSY NO.2

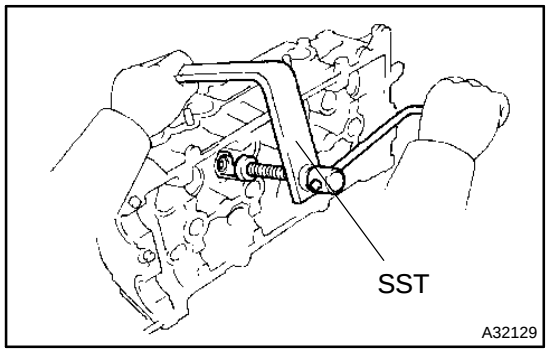
(a) Remove the bolt and the rocker shaft No.2.
(b) Remove the valve rocker arm.

7. REMOVE W/HEAD TAPER SCREW PLUG NO.1

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

8. REMOVE OIL FILLER CAP GASKET

9. REMOVE VALVE ADJUSTING SHIM



10. REMOVE INNER COMPRESSION SPRING

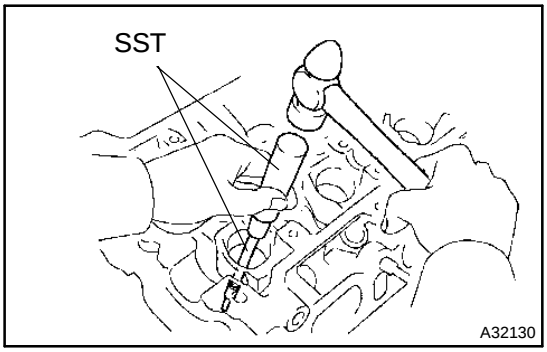
(a) Using SST, compress the valve spring and remove the 2 keepers, the retainer, and the spring seat.
SST 09202-70020

11. REMOVE VALVE STEM OIL O SEAL OR RING

12. REMOVE VALVE SPRING SEAT

13. REMOVE INTAKE VALVE

14. REMOVE EXHAUST VALVE

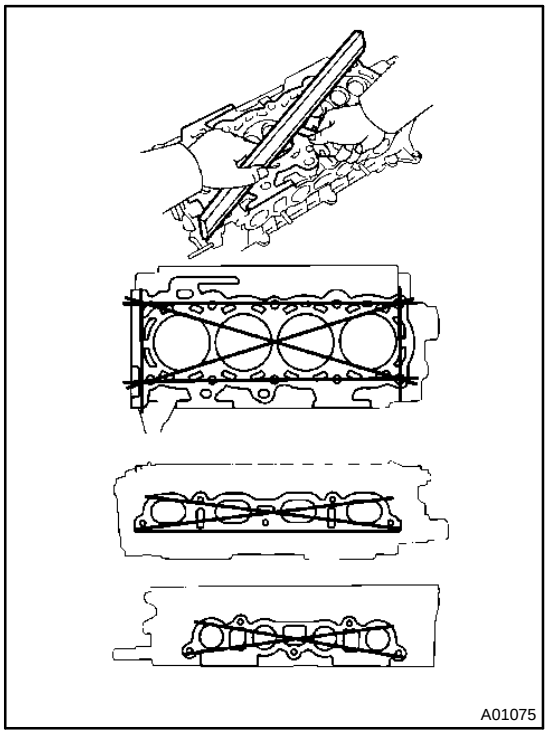


15. REMOVE VALVE GUIDE BUSH

(a) Heat the cylinder head to 110 - 130°C (230 - 266°F).
(b) Using SST and a hammer, tap out the guide bushing.
SST 09201-10000, 09201-01055, 09950-70010 (09951-07100)

CONTINUED

16. REMOVE STUD BOLT

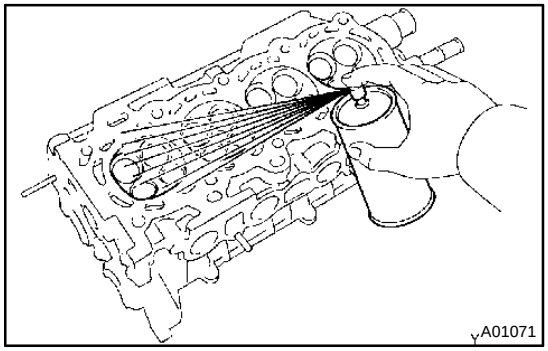


17. INSPECT CYLINDER HEAD FOR FLATNESS

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

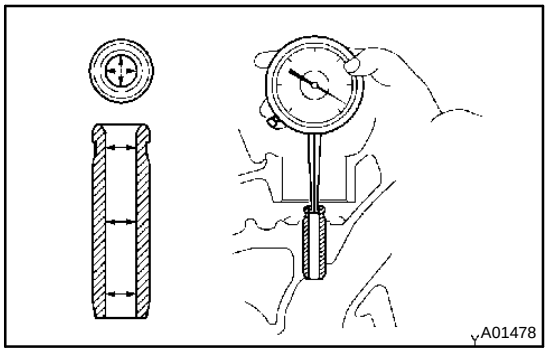
Maximum warpage:

Cylinder block side	0.2 mm (0.0080 in.)
Intake manifold side	0.2 mm (0.0080 in.)
Exhaust manifold side	0.3 mm (0.0120 in.)



18. INSPECT CYLINDER HEAD FOR CRACKS

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



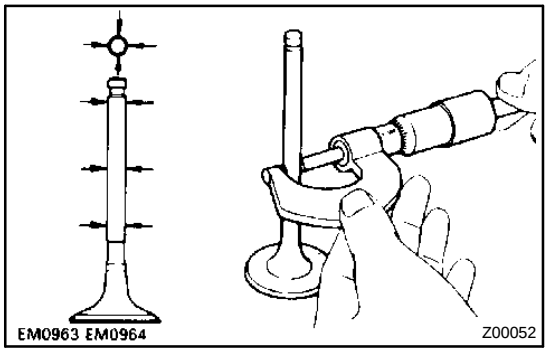
19. INSPECT VALVE GUIDE BUSHING OIL CLEARANCE

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

Busing inside diameter:

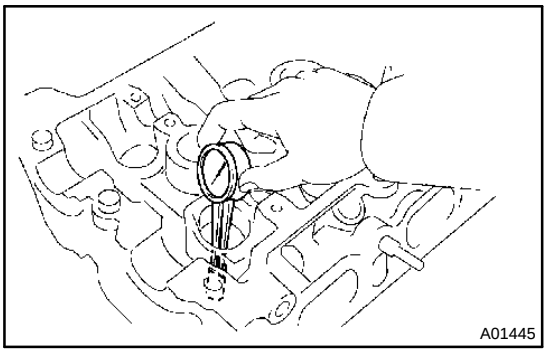
5.500 - 5.518 mm (0.2165 - 0.2172 in.)

CONTINUED



(b) Using a micrometer, measure the diameter of the valve stem.
Valve stem diameter:
Intake 5.460 - 5.475 mm (0.2145 - 0.2156 in.)
Exhaust 5.445 - 5.470 mm (0.2144 - 0.2154 in.)

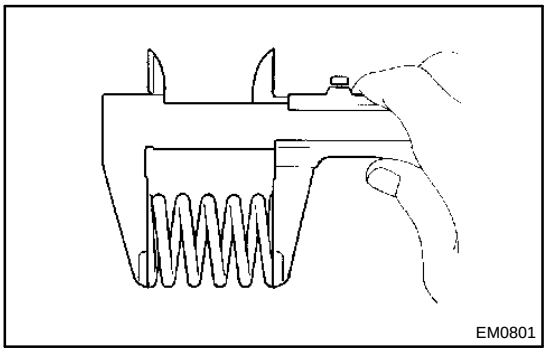
(c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.
Standard oil clearance:
Intake 0.025 - 0.058 mm (0.0010 - 0.0023 in.)
Exhaust 0.030 - 0.063 mm (0.0012 - 0.0025 in.)
Maximum oil clearance:
0.10 mm (0.0039 in.)



20. INSPECT VALVE GUIDE BUSH

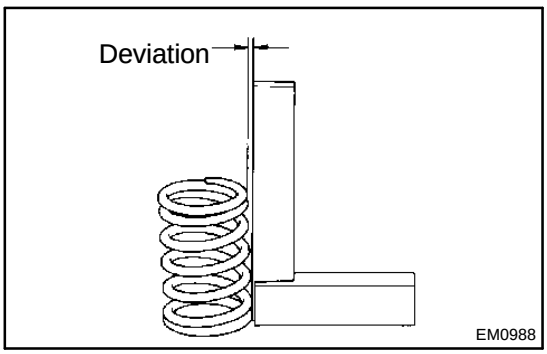
(a) If the bushing bore diameter of the cylinder head is greater than 10.506 mm (0.4136 in.), machine the bushing bore to the dimension of 10.538 – 10.556mm (0.4149 --0.4156 in.) to install a over size bushing.
Diameter: 10.538 - 10.556 mm(0.4149 - 0.4156 in.)

Bushing bore diameter mm (in.)	bushing size
10.448 – 10.506 (0.4129 – 0.4136)	Use STD
10.538 – 10.556 (0.4149 – 0.4156)	Use O/S 0.05



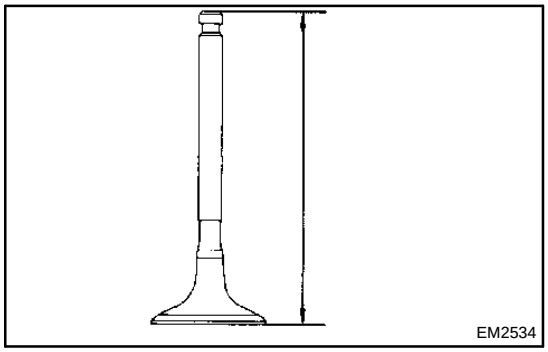
21. INSPECT INNER COMPRESSION SPRING

(a) Using a vernier caliper, measure the free length of the valve spring.
Free length:
Intake 46.4 mm (1.830 in.)
Exhaust : 46.5 mm (1.831 in.)



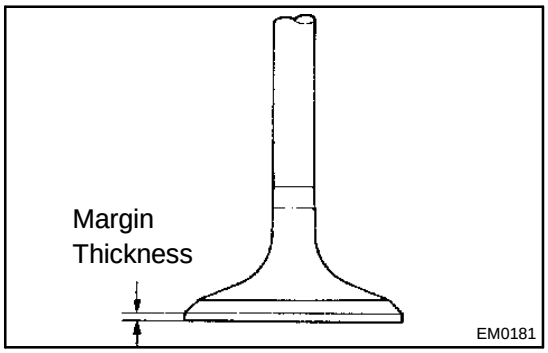
(b) Using a steel square, measure the deviation of the valve spring.
Maximum deviation: 1.6 mm (0.063 in.)
Maximum angle (reference) : 2°

CONTINUED

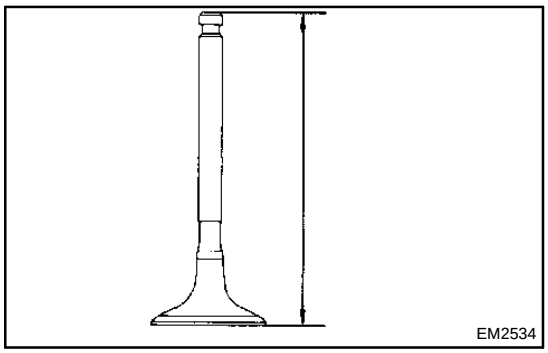


22. INSPECT INTAKE VALVE

(a) Check the valve overall length.
Standard overall length:111.3 mm (4.382 in.)
Minimum overall length:110.9 mm (4.366 in.)

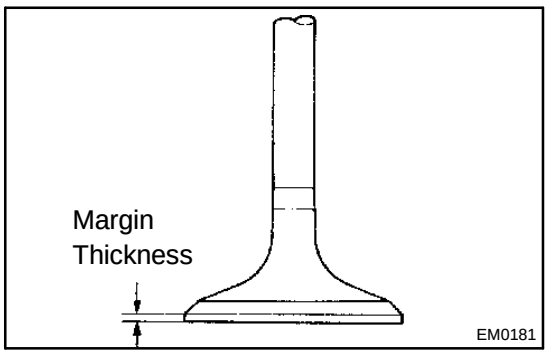


(b) Check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.7 mm (0.028 in.)



23. INSPECT EXHAUST VALVE

(a) Check the valve overall length.
Standard overall length:111.7 mm (4.392 in.)
Minimum overall length:111.3 mm (4.382 in.)



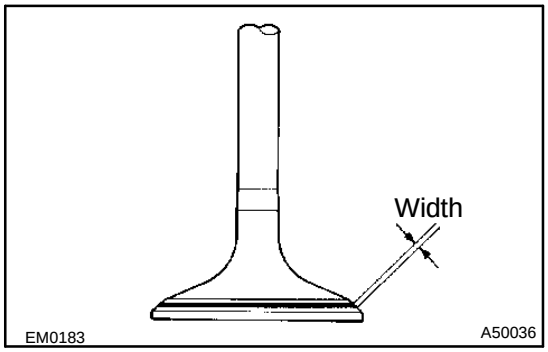
(b) Check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.7 mm (0.028 in.)

24. INSPECT VALVE SEATS

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

(b) Lightly press the valve against the seat.

CONTINUED

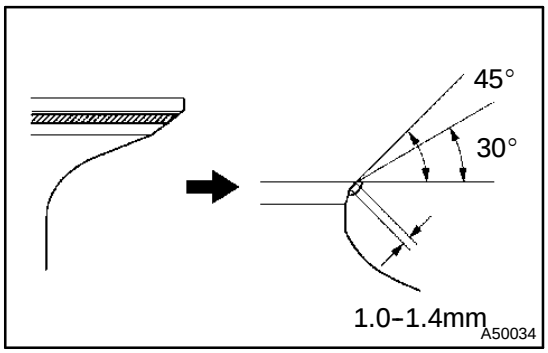


(c) Check the valve face and seat according to the following procedure.
(1) If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
(2) If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
(3) Check that the seat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

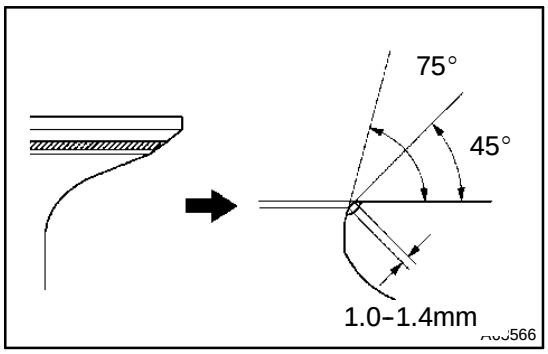
25. REPAIR VALVE SEATS

NOTICE:

Take off a cutter gradually to make smooth valve seats.

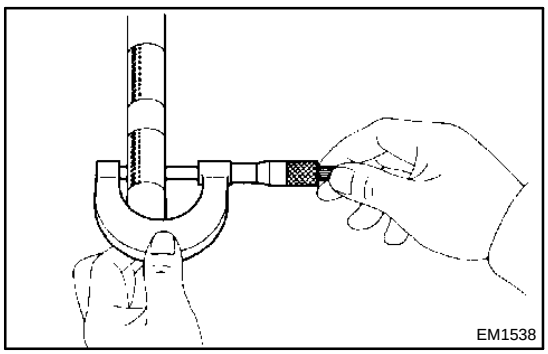


(a) If the seating is too high on the valve face, use 30 ° and 45 ° cutters to correct the seat.



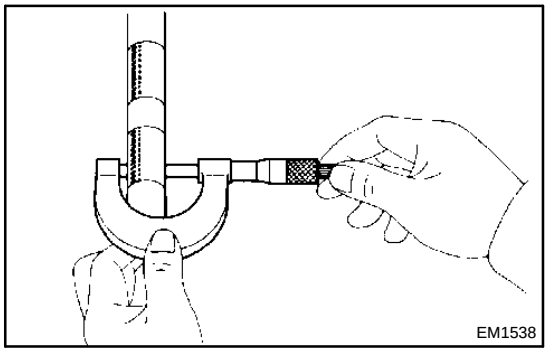
(b) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.
(c) Hand–lap the valve and valve seat with an abrasive compound.
(d) Check the valve seating position.

26. INSPECT VALVE ROCKER SHAFT SUB-ASSY NO.1



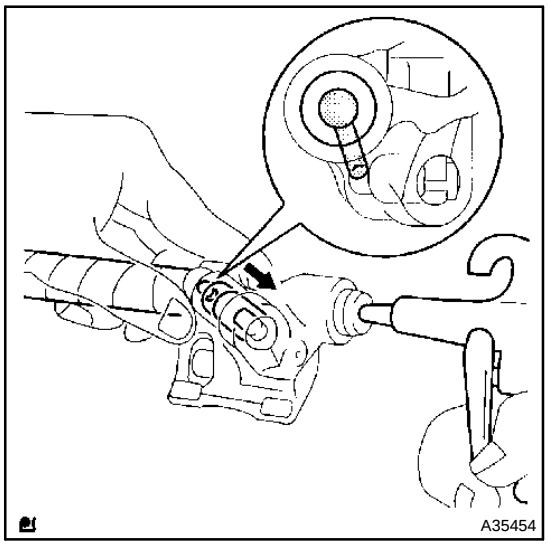
(a) Using a micrometer, measure the rocker No.1 shaft diameter.
Standard : 15.965 - 15.985 mm (0.6285 - 0.6293 in)

CONTINUED



27. INSPECT VALVE ROCKER SHAFT SUB-ASSY NO.2

(a) Using a micrometer, measure the rocker No.2 shaft diameter.
Standard : 15.965 - 15.985 mm (0.6285 - 0.6293 in)

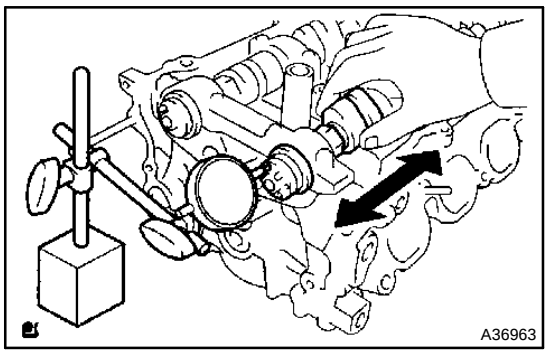


28. INSPECT VALVE ROCKER ARM

(a) Cover oil paths of the rocker arm shaft except 2 paths with vinyl type.

(b) Align the oil path of the rocker arm shaft to the oil path of the rocker arm.

(c) Check that the postion inside of the rocker arm moves when air pressure 150 kpa {1.5kgf/cm^2 } is put to the oil paths.



29. 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 - 0.140 mm (0.0016 - 0.0055 in.)
Maximum thrust clearance: 0.15 mm (0.0059 in.)

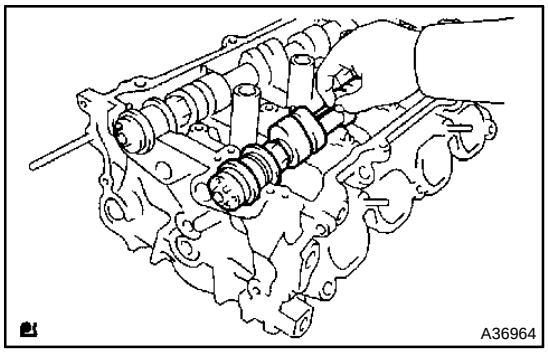
(c) If the thrust clearance is greater than maximum, replace the cylinder head. If damages are found on the camshaft thrust surfaces, the camshaft also has to be replaced.

CONTINUED

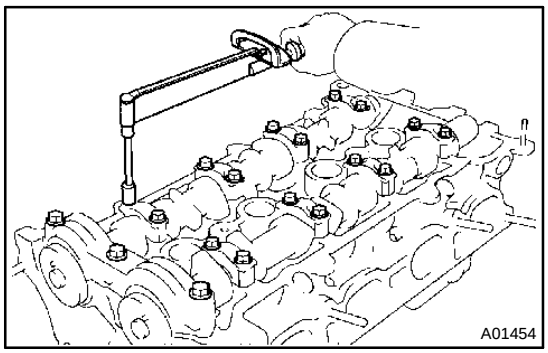
30. INSPECT CAMSHAFT OIL CLEARANCE

(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.



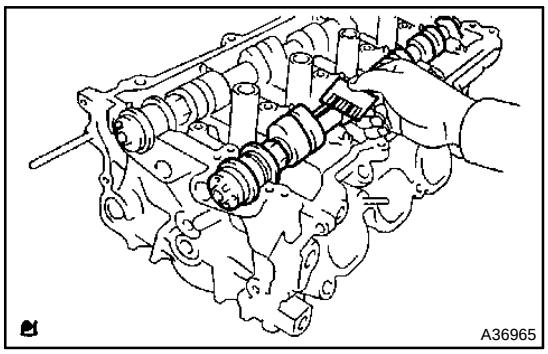
(d) Install the bearing caps (See page 14–4).

Torque:18.5 N·m (189 kgf·cm, 14 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 – 0.076 mm (0.0014 – 0.0030 in.)

Maximum oil clearance: 0.10 mm (0.039 in.)

NOTICE:

Completely remove the plastigage after the measuring.

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

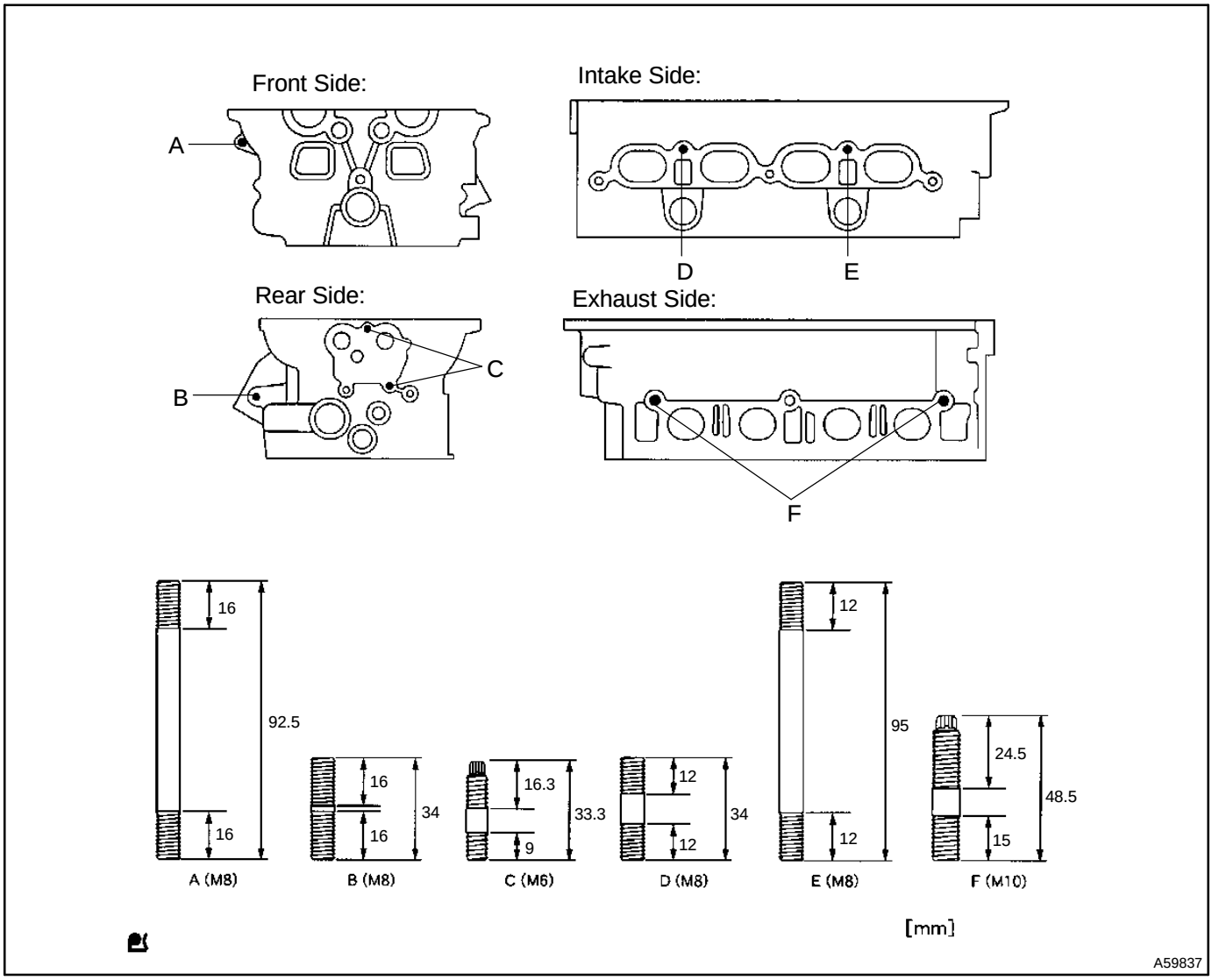
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31. INSTALL STUD BOLT

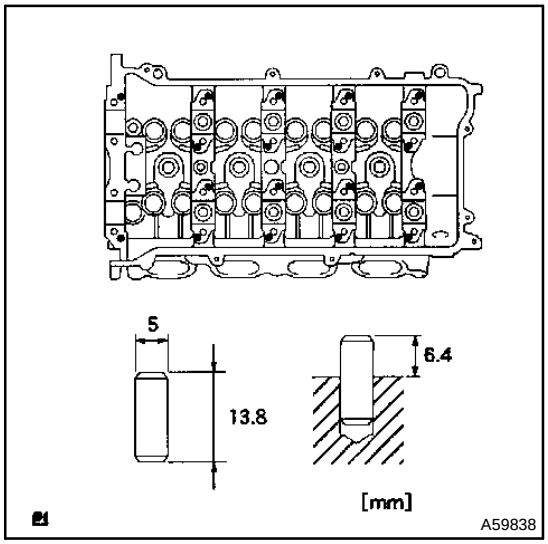
(a) Install the stud bolts as shown in the illustration.

Torque:

A: 9.5 N·m (97kgf·cm, 84in·lbf)
B: 9.5 N·m (97kgf·cm, 84in·lbf)
C: 5.0 N·m (51kgf·cm, 44in·lbf)
D: 9.5 N·m (97kgf·cm, 84in·lbf)
E: 9.5 N·m (97kgf·cm, 84in·lbf)
F: 19.0 N·m (194kgf·cm, 14ft·lbf)

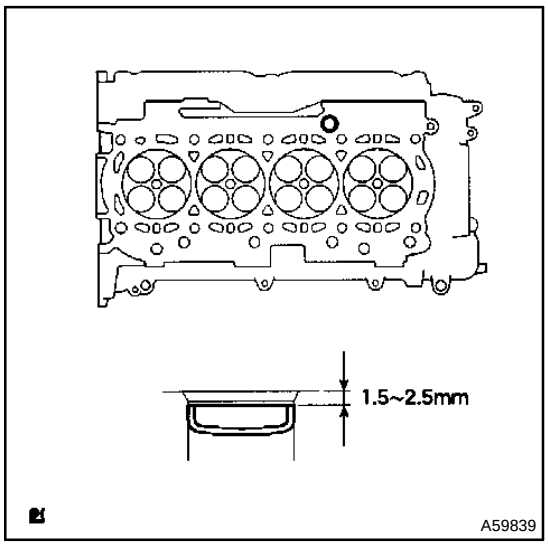


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32. INSTALL RING PIN

(a) Using a plastic-faced hammer, tap in the new ring pins to the specified protrusion height.



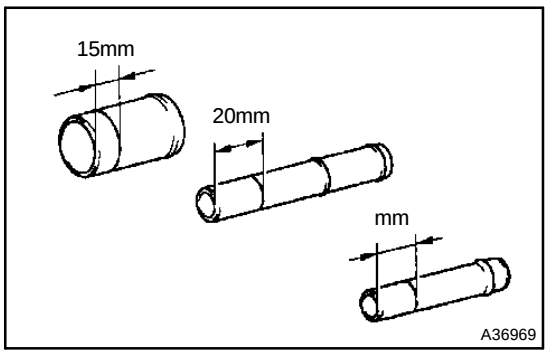
33. INSTALL TIGHT PLUG

(a) Apply adhesive around tight plugs.

Adhesive: part No.08833-00070, THREE BOND 1324 or equivalent.

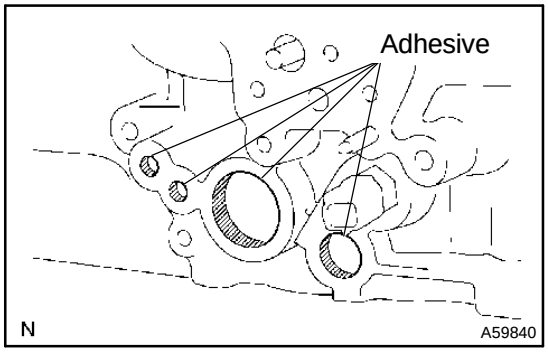
SST 09950-60010 (09951-00350), 09950-70010 (09951-07100)

Standard depth: 1.5-2.5 mm (0.0591-0.9843 in.)



34. INSTALL UNION

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

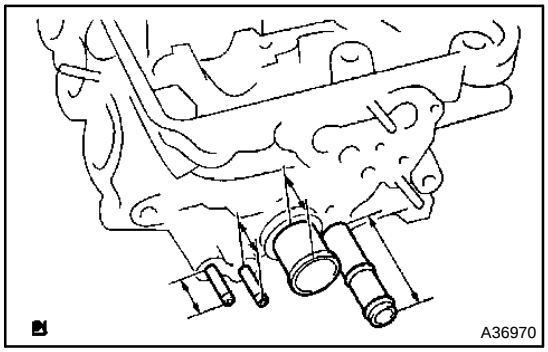


(b) Apply adhesive to the water hose union hole of the cylinder head.

Adhesive:

Part No. 08833-00070, THREE BOND 1324 or equivalent.

CONTINUED

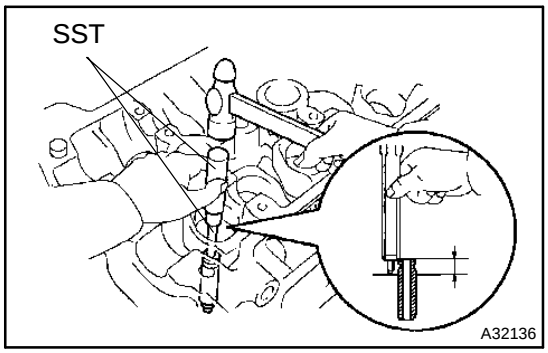


(c) Using a press, press in a new water hose union until the standard marks come to the level of the cylinder head surface.

Standard protrusion:
A 29 mm (1.14 in.)
B 68.9 mm (2.748 in.)
C 24 mm (0.95 in.)

NOTICE:

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



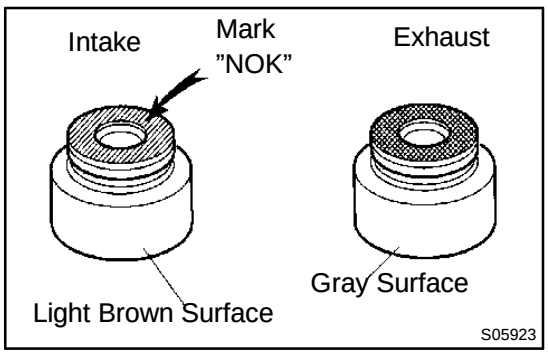
35. INSTALL VALVE GUIDE BUSH

(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, 09201-01055, 09950-70010 (09951-07100), 23801

Protrusion height: 15.3 - 15.7 mm (0.602 - 0.618 in.)

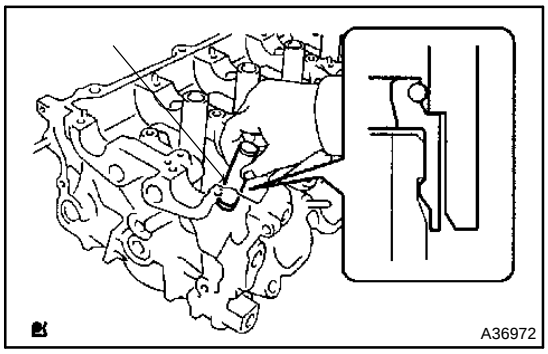


36. INSTALL VALVE STEM OIL O SEAL OR RING

(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.

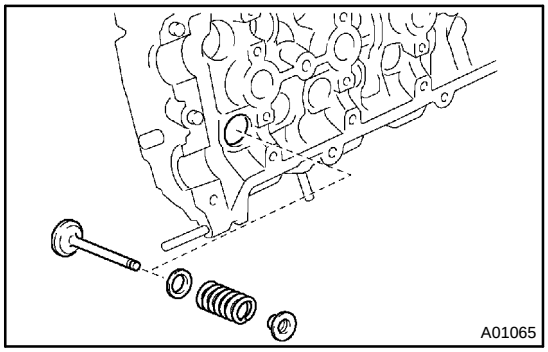
HINT:
The intake valve oil seal is light brown and the exhaust valve oil seal is gray.



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

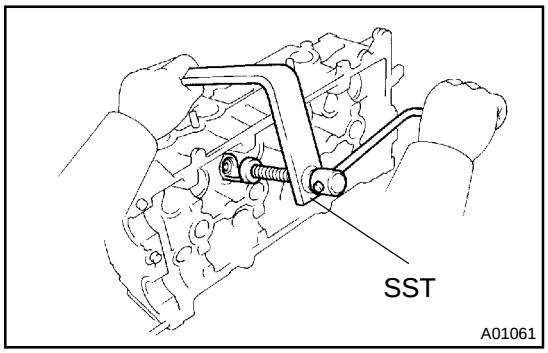
SST 09201-41020

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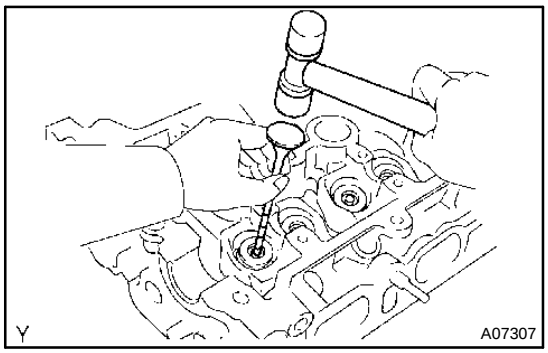


37. INSTALL INNER COMPRESSION SPRING

(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.

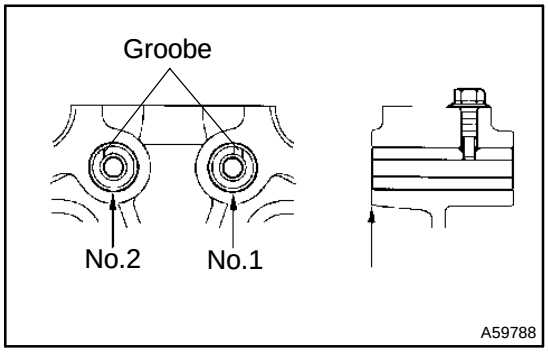
NOTICE:
Be careful not to damage the valve stem tip.

38. INSTALL VALVE ADJUSTING SHIM

(a) Apply a light coat of engine oil on the adjusting ahim, install the top of the valve stem.

39. INSTALL W/HEAD TAPER SCREW PLUG NO.1

(a) Using hexagon socket wrench (14), install the taper screw plug with a new gasket.
Torque: 78 N·m (796kgf·cm, 58ft·lbf)

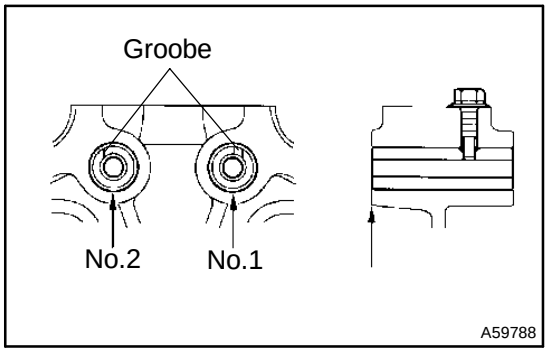


40. INSTALL VALVE ROCKER SHAFT SUB-ASSY NO.2

(a) Put the valve rocker shaft through the cylinder head and the hole of the valve rocker arm, and check the direction of the groove.

(b) Install a bolt to fix the rocker shaft No.2.
Torque: 9.0 N·m (92 kgf·cm 80 in.·lbf)

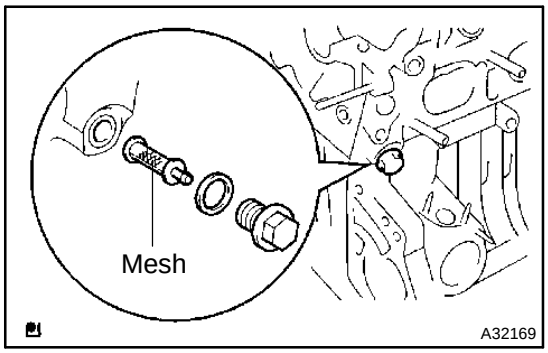
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41. INSTALL VALVE ROCKER SHAFT SUB–ASSY NO.1

(a) Put the valve rocker shaft through the cylinder head and the hole of the valve rocker arm, and check the direction of the groove.

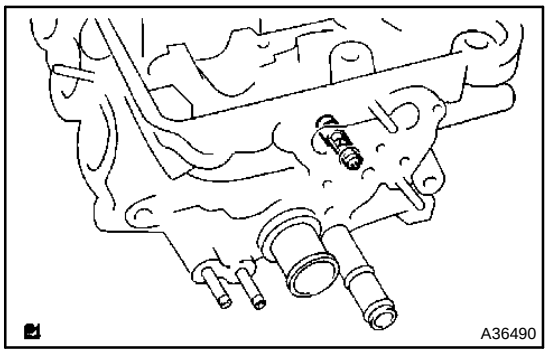
(b) Install a bolt to fix the rocker shaft No.1.
Torque: 9.0 N·m (92 kgf·cm 80 in.·lbf)



42. INSTALL OIL CONTROL VALVE FILTER

(a) Confirm that the filter is clear.

(b) Place a new gasket on the bolt and install the filter. (Front side)
Torque: 29 N·m (300 kgf·cm, 22 ft·lbfi)



(c) Install the oil control valve filter from the cylinder head.(Rear side)

43. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY

Torque: 8.5 N·m (87 kgf·cm, 76 in.·lbf)

44. INSTALL CAM TIMING CONTROL VALVE HOUSING

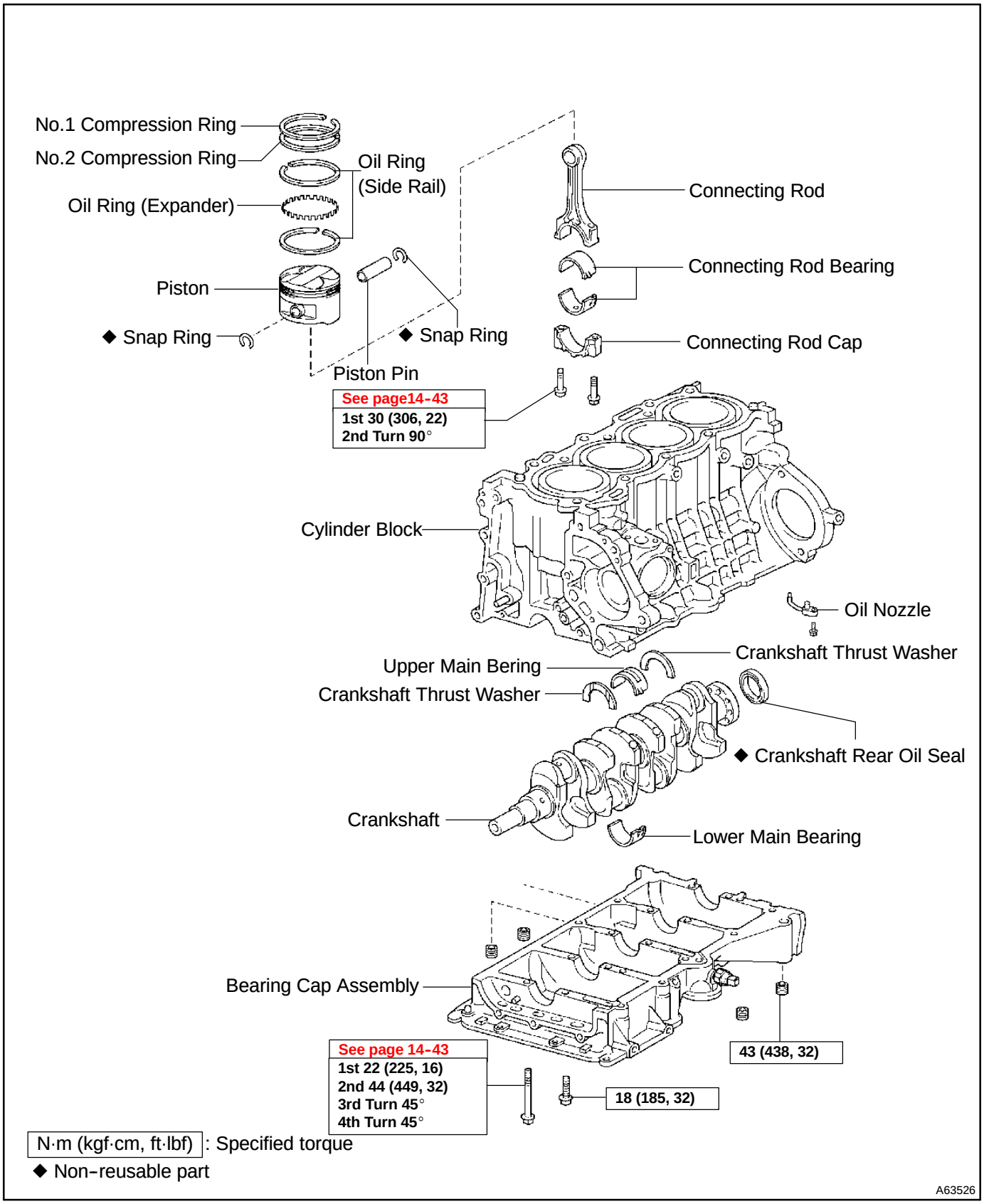
(a) Install the cam timing control valve housing with a new gasket.
Torque: 9.0 N·m (92 kgf·cm 80 in.·lbf)

CONTINUED

CYLINDER BLOCK (2ZZ-GE)

COMPONENTS

140N7-01



N·m (kgf·cm, ft·lbf) : Specified torque

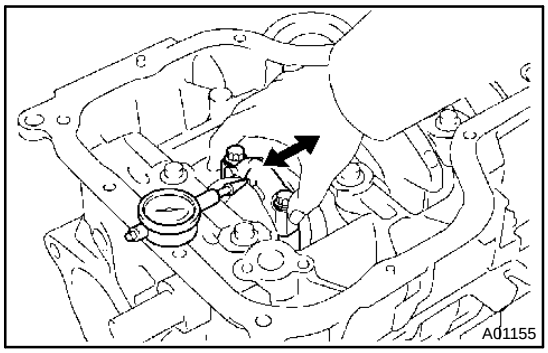
◆ Non-reusable part

A63526

CONTINUED

OVERHAUL

1. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY



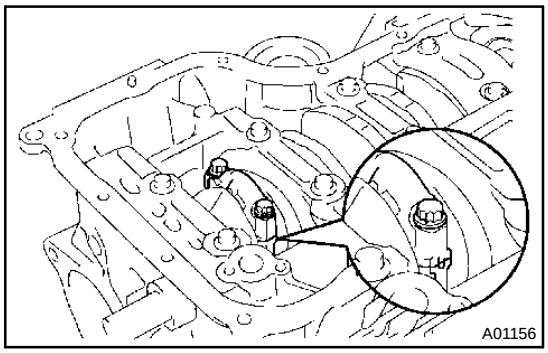
2. INSPECT CONNECTING ROD THRUST CLEARANCE

(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.



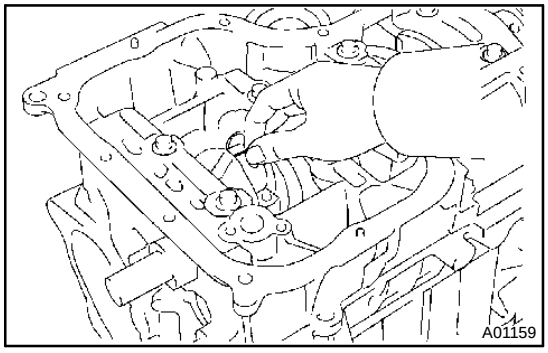
(a) Using marking paint, write the matched cylinder number on each connecting rod and cap.

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

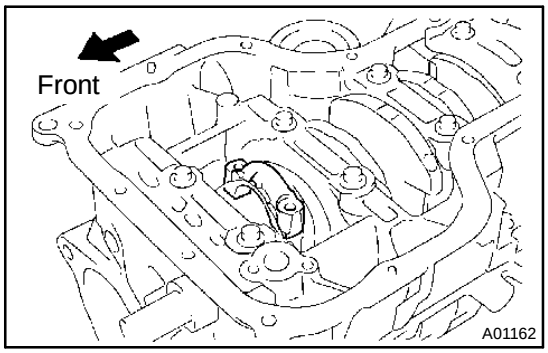
(b) Using SST, remove the 2 connecting rod cap bolts.
SST 09205-16010

(c) Clean the crank pin and bearing.

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

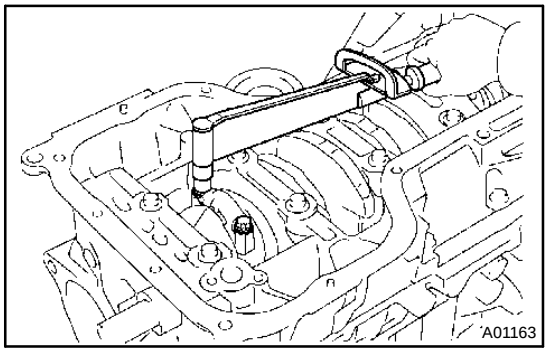


(e) Lay a strip of plastigage across the crank pin.



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

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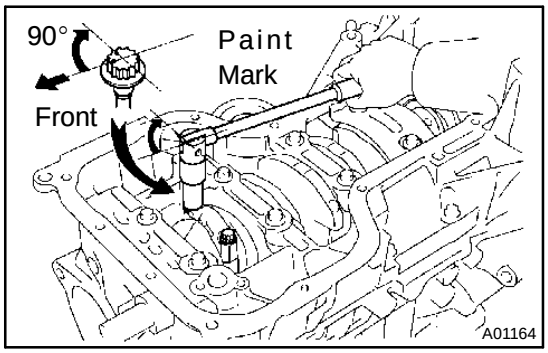


(g) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.

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

SST 09205-16010

Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)

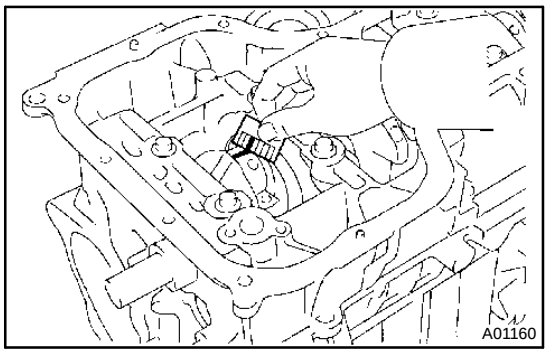


(i) Mark the front of the connecting cap bolts with paint.

(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.

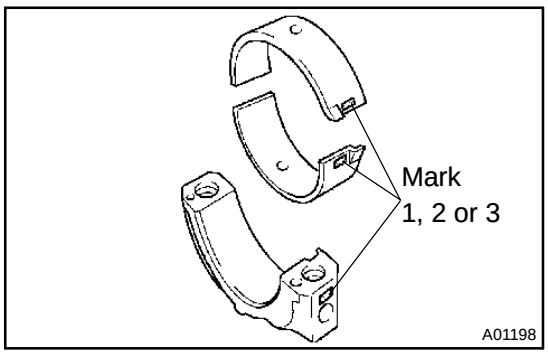
Standard oil clearance:

0.028 - 0.052 mm (0.0011 - 0.0021 in.)

Maximum oil clearance: 0.080 mm (0.0031 in.)

NOTICE:

Remove the plastigage completely after the measurement.



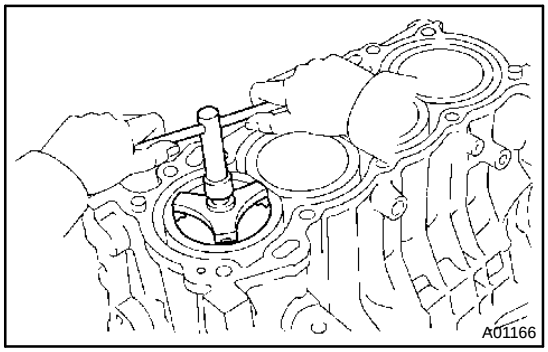
(n) If replacing a bearing, select a new one having the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

Reference:

Standard bearing center wall thickness

Mark	mm (in.)
1	1.482 - 1.486 (0.0584 - 0.0585)
2	1.486 - 1.490 (0.0585 - 0.0587)
3	1.490 - 1.494 (0.0587 - 0.0588)

CONTINUED



4. REMOVE PISTON SUB–ASSY W/CONNECTING ROD

(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.

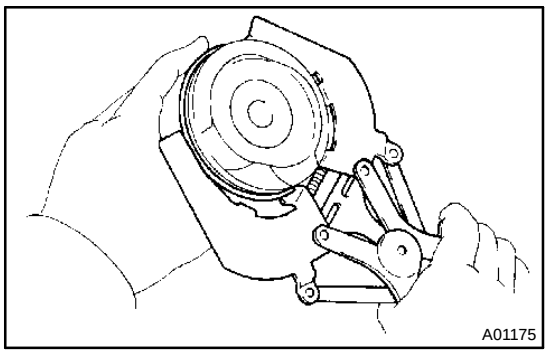
HINT:

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

5. REMOVE CONNECTING ROD BEARING

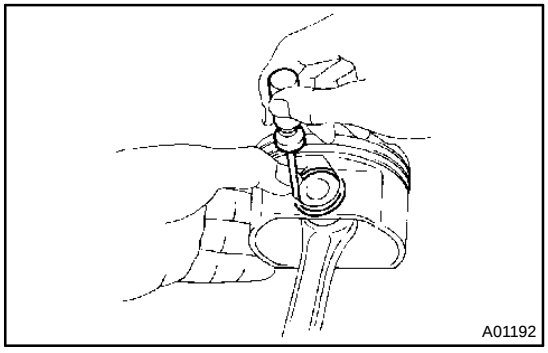
6. REMOVE PISTON RING SET

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.



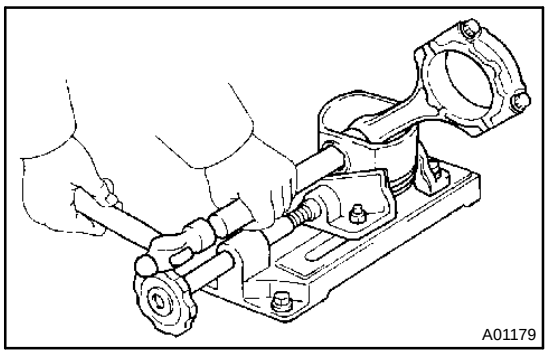
7. REMOVE PISTON PIN HOLE SNAP RING

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

CONTINUED

8. REMOVE W/PIN PISTON SUB-ASSY

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

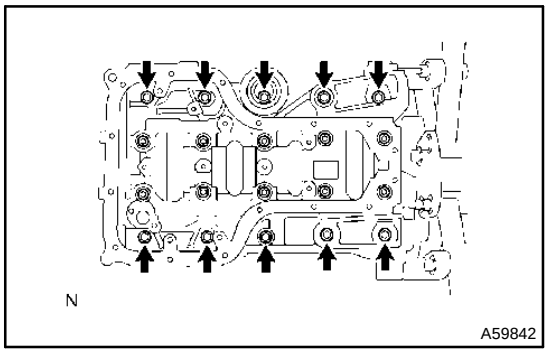


(b) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

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

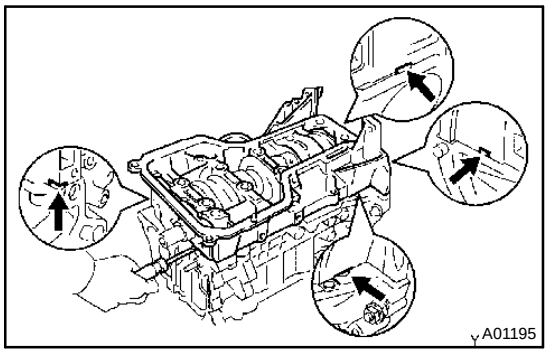
9. REMOVE CRANKSHAFT BEARING CAP SUB ASSY



(a) Remove the 4 screw plugs from the bearing cap sub-assembly.

(b) Remove the 10 hexagon head bearing cap sub-assembly bolts.

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

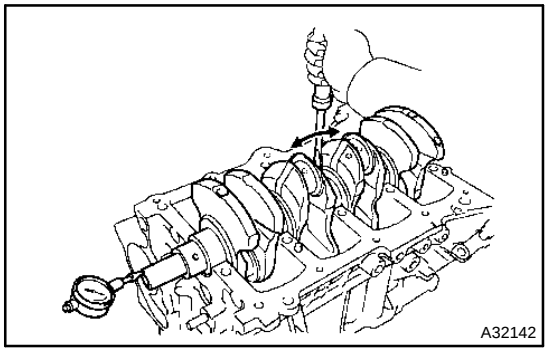


(d) Using a screwdriver, remove the bearing cap sub-assembly by prying the indicated portions between the cylinder block and bearing cap sub-assembly. Remove the 5 lower main bearings.

NOTICE:

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

10. 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 (0.0015 - 0.0095 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.)

CONTINUED

11. REMOVE CRANKSHAFT THRUST WASHER UPPER

12. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

(b) Remove the 5 upper main bearings and 2 thrust washers from the cylinder block.

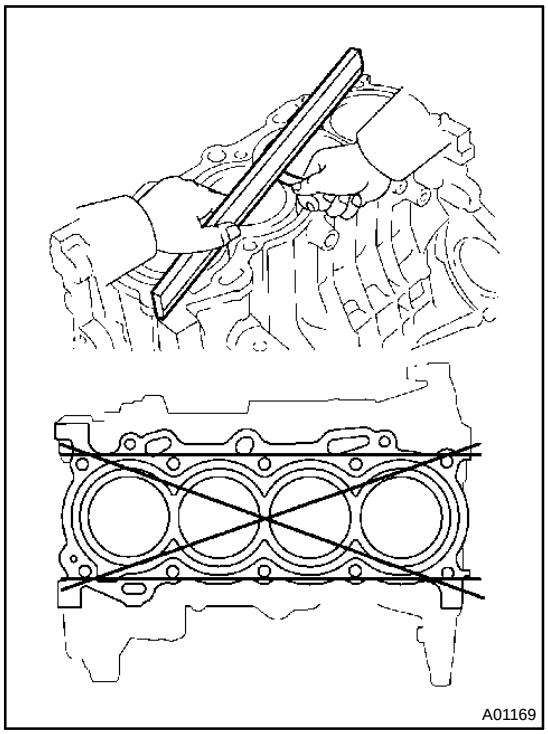
NOTICE:

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

13. REMOVE CRANKSHAFT BEARING

14. REMOVE STUD BOLT

15. REMOVE SUB–ASSY OIL NOZZLE NO.1

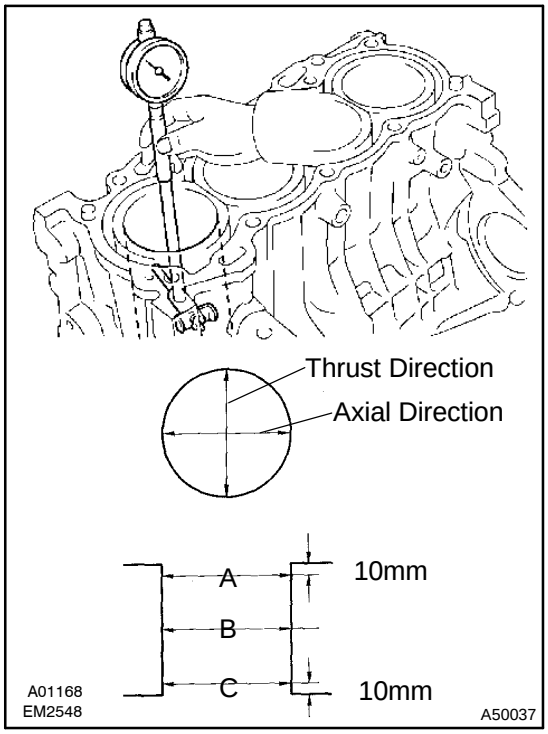


16. INSPECT CYLINDER BLOCK FOR FLATNESS

(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.)

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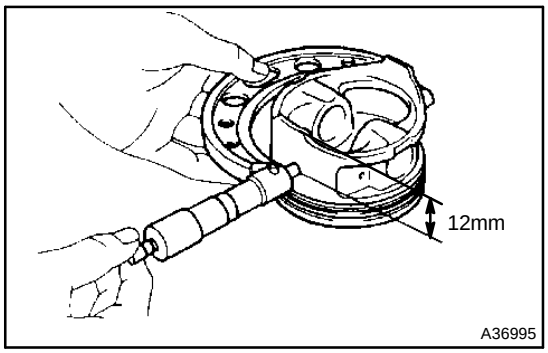


17. INSPECT CYLINDER BORE

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

Standard diameter:
82.000 - 82.013 mm (3.2284 - 3.2287 in.)
Maximum diameter: 82.013 mm (3.2287 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 12 mm (0.472 in.) from the piston skirt.

Piston diameter:
81.975 - 81.993 mm (3.2274 - 3.2281 in.)

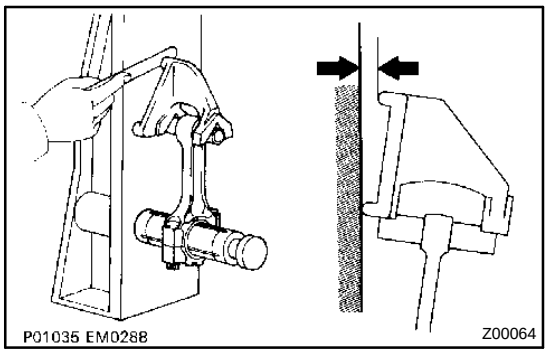
19. INSPECT CONNECTING ROD SUB-ASSY

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

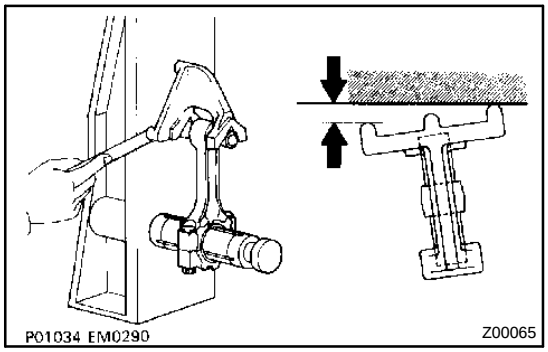
(1) Check for out-of-alignment.

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.



CONTINUED



(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.

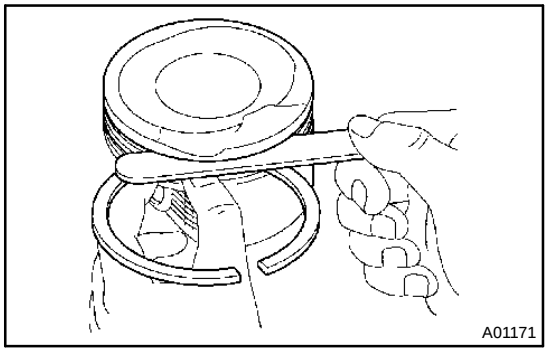
20. INSPECT PISTON CLEARANCE

(a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: 0.007 – 0.038 mm (0.0003 – 0.0015 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

(b) If the oil clearance is greater than maximum, replace all the 4 pistons. If necessary, replace the cylinder block.

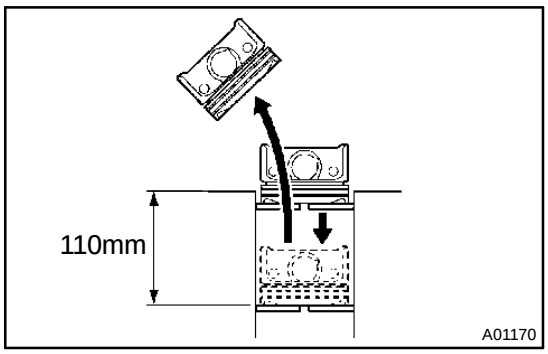


21. INSPECT RING GROOVE CLEARANCE

(a) Using a feeler gauge, measure the clearance between the new piston ring and the wall of the ring groove.

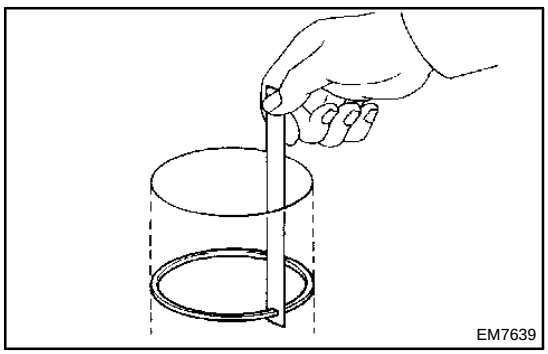
Ring groove clearance:

0.030 – 0.070 mm (0.0012 – 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 110 mm (4.33 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.)

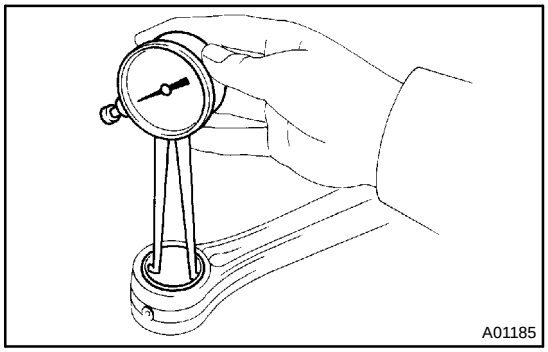
No. 2: 0.35 – 0.50 mm (0.0138 – 0.0197 in.)

Maximum end gap:

No. 1: 1.05 mm (0.041 in.)

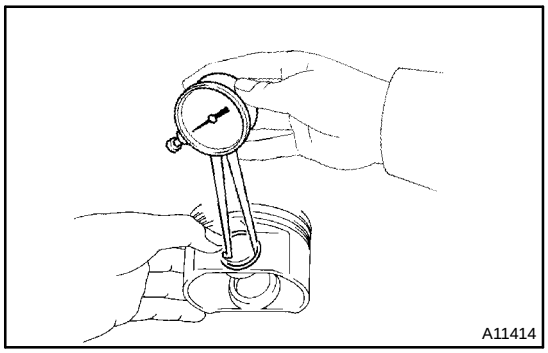
No. 2: 1.20 mm (0.047 in.)

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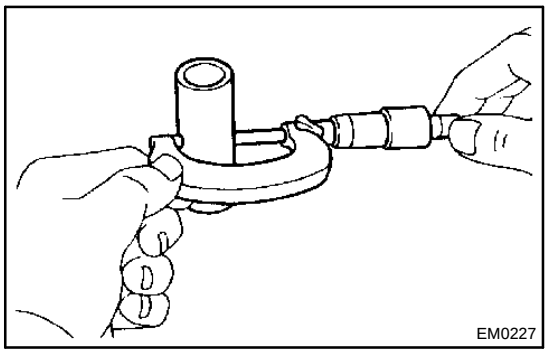


23. INSPECT PISTON PIN

(a) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.
Bushing inside diameter:
20.011–20.023 mm (0.7878 – 0.7883 in.)



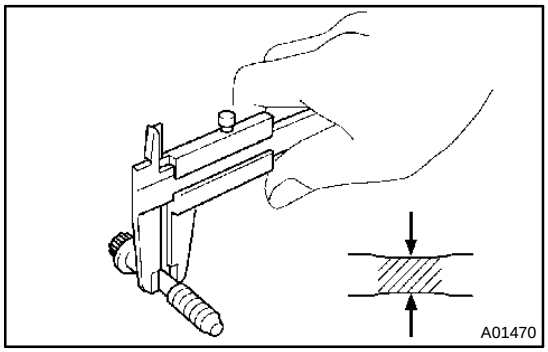
(b) Using a caliper gauge, measure the inside diameter of the piston bushing.
Bushing inside diameter:
20.013–20.025 mm (0.7879 – 0.7884 in.)



(c) Using a micrometer, measure the piston pin diameter.
Piston pin diameter:
20.004 – 20.016 mm (0.7876 – 0.7880 in)

(d) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.
Standard oil clearance:
Piston x Piston pin
0.005 – 0.013 mm (0.0002 – 0.0005 in.)
Piston x Connecting rod
0.005 – 0.009 mm (0.0002 – 0.0004 in.)

If the oil clearance is greater than maximum. replace the connecting rod assembly. If necessary, replace the piston and piston pin as a set.

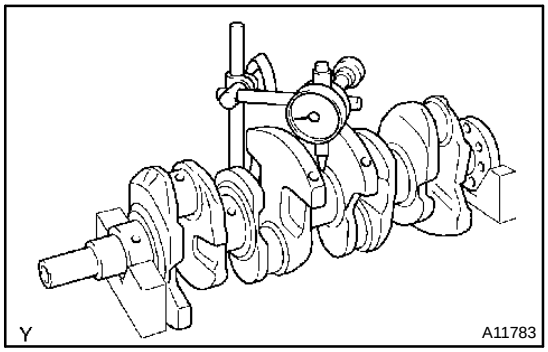


24. INSPECT CONNECTING ROD BOLT

(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.)

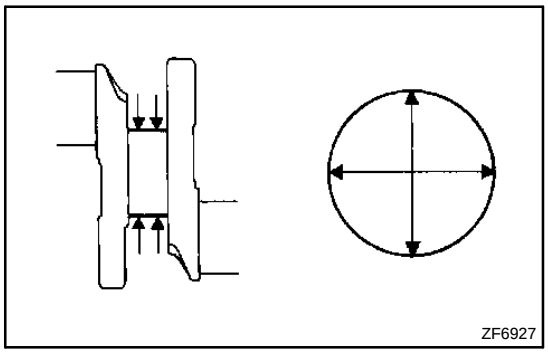
(b) If the diameter is less than minimum, replace the bolt.

CONTINUED



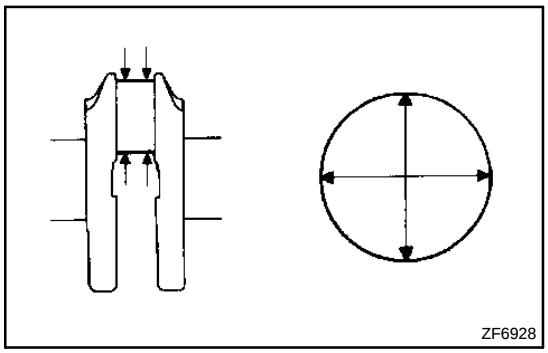
25. INSPECT CRANKSHAFT

(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.)



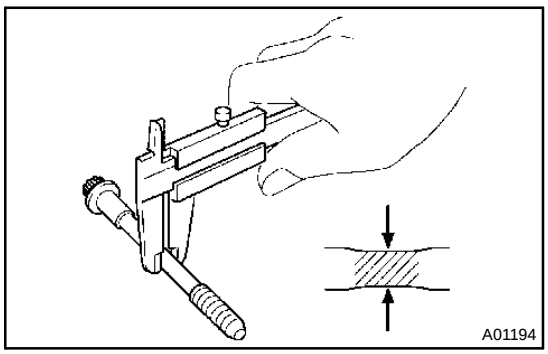
(b) Using a micrometer, measure the diameter of each main journal at the points shown in the illustration.
Diameter: 47.988 – 48.000 mm (1.8893 – 1.8898 in.)

(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: 44.992 – 45.000 mm (1.7713 – 1.7717 in.)

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



26. INSPECT BOLT, FLANGE

(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: 7.3 mm (0.287 in.)

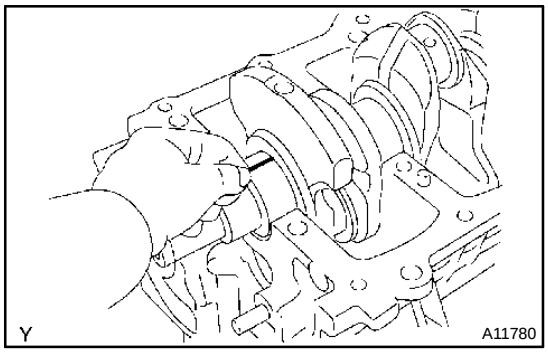
(b) If the diameter is less than minimum, replace the bolt.

CONTINUED

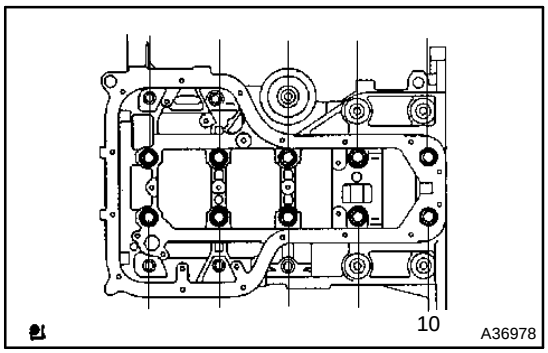
27. INSPECT CRANKSHAFT OIL CLEARANCE

(a) Clean each main journal and bearing.

(b) Place the crankshaft on the cylinder block.



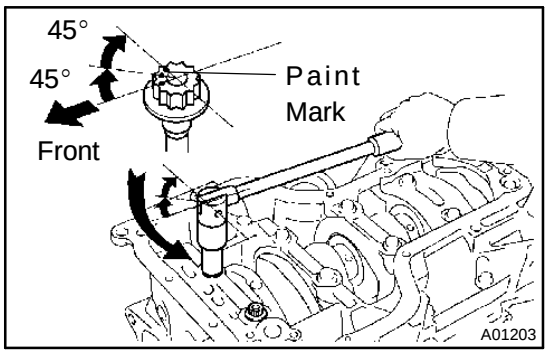
(c) Lay a strip of plastigage across each journal.



(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.

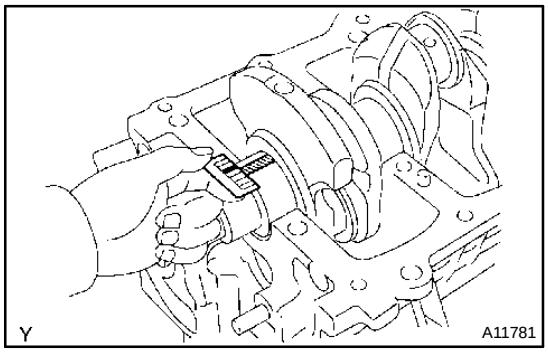


(g) Retighten the bearing cap sub-assembly bolts by 45 ° twice, in the numerical order shown.

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

NOTICE:
Do not turn the crankshaft.

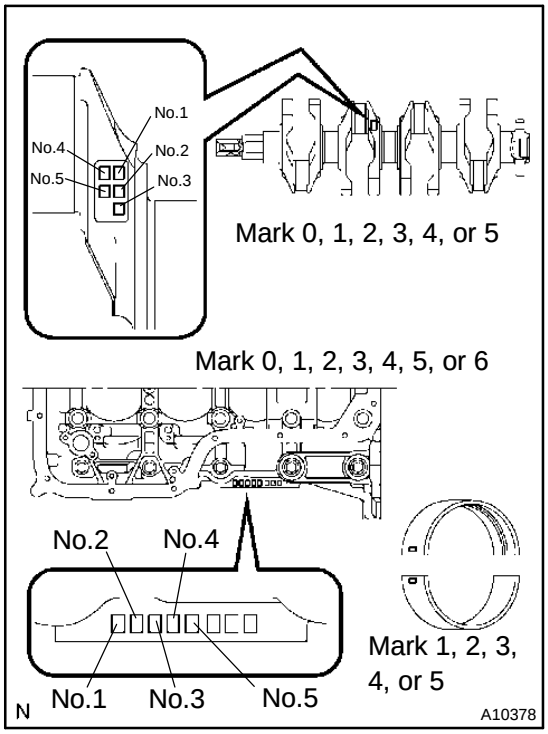
(i) Remove the bearing cap sub-assembly.



(j) Measure the plastigage at its widest point.
Standard oil clearance:
0.016 - 0.032 mm (0.0006 - 0.0013 in.)
Minimum oil clearance: 0.08 mm (0.0032 in.)
Maximum oil clearance: 0.05 mm (0.0020 in.)

NOTICE:
Completely remove the plastigage

CONTINUED



(k) If using standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, refer to the following table to select bearing.

Standard bearings selection chart

Cylinder block Number mark	Crank shaft number mark					
	0	1	2	3	4	5
0	1	1	1	2	2	2
1	1	1	2	2	2	3
2	1	2	2	2	3	3
3	2	2	2	3	3	3
4	2	3	3	3	4	4
5	3	3	3	4	4	4
6	3	3	4	4	4	5

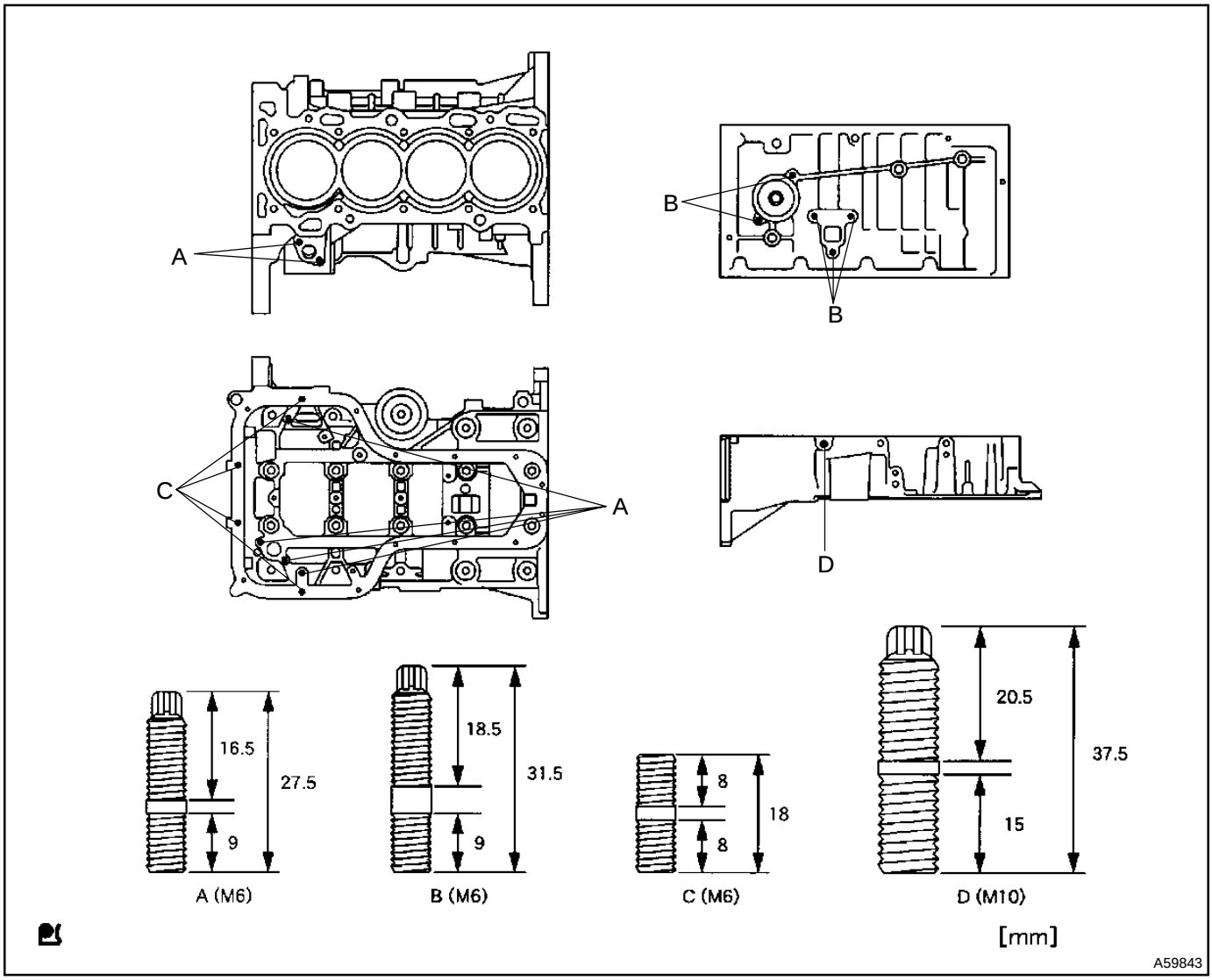
HINT:
Cylinder block ”4”, Crank shaft ”3”, Use bearing ”3”

Item	Mark	mm (in.)
Cylinder block main journal bore diameter	”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	”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 bearing center wall thickness	”1”	1.989 – 1.992 (0.0783 – 0.0784)
	”2”	1.992 – 1.995 (0.0784 – 0.0785)
	”3”	1.995 – 1.998 (0.0785 – 0.0787)
	”4”	1.998 – 2.001 (0.0787 – 0.0788)
	”5”	2.001 – 2.004 (0.0788 – 0.0789)

CONTINUED

28. INSTALL STUD BOLT

Torque:
A: 5.0 N·m (51 kgf·cm, 44 in·lbf)
B: 5.0 N·m (51 kgf·cm, 44 in·lbf)
C: 5.0 N·m (51 kgf·cm, 44 in·lbf)
D: 19.0 N·m (194 kgf·cm, 14 ft·lbf)



CONTINUED

29. INSTALL RING PIN

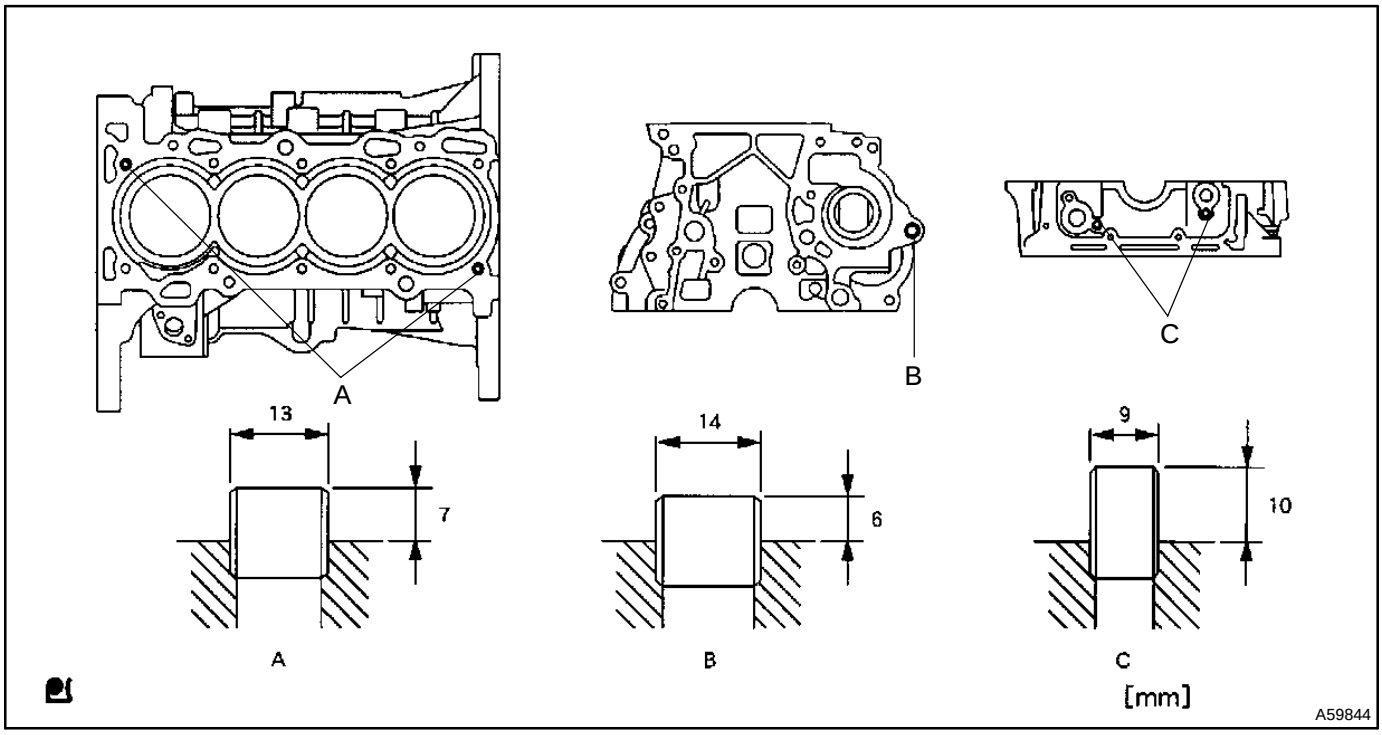
(a) Using a plastic–faced hammer, tap in the new ring pins to the specified protrusion height.

Protrusion height:

A: 7 mm (0.2756 in.)

B: 6 mm (0.2362 in.)

C: 10 mm (0.3973 in.)



CONTINUED

30. INSTALL STRAIGHT PIN

(a) Using a plastic–faced hammer, tap in the straight pins to the specified protrusion height.

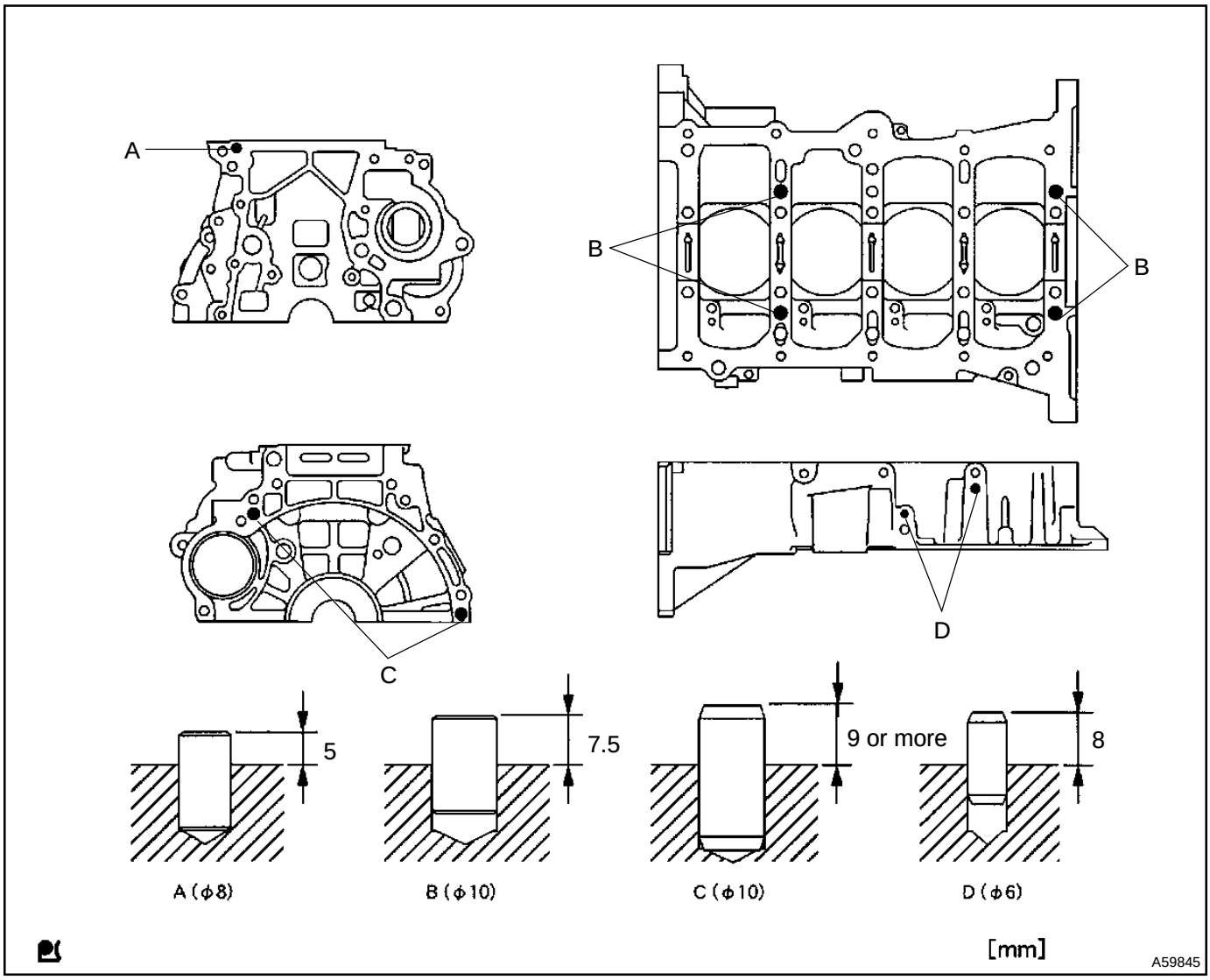
Protrusion height:

A: 5 mm (0.1969 in.)

B: 7.5 mm (0.2953 in.)

C: 9 mm (0.3543 in.) or more

D: 8 mm (0.3150 in.)



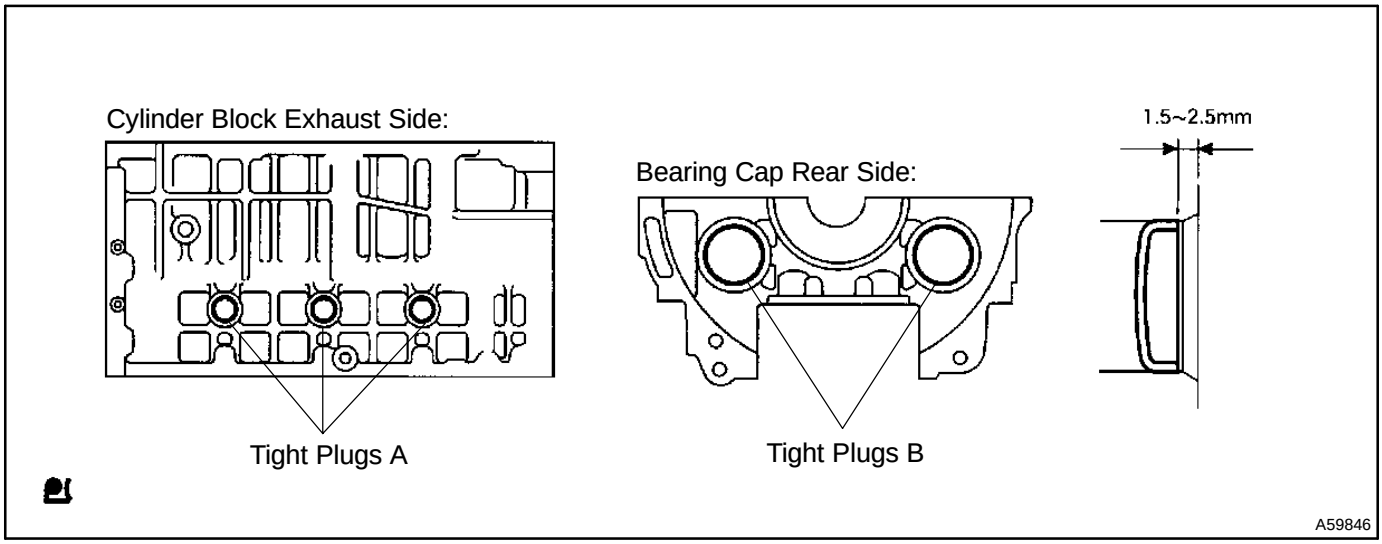
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31. INSTALL TIGHT PLUG

(a) Apply adhesive around tight plugs.
Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent

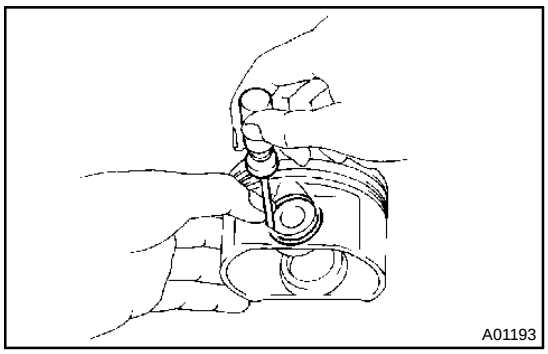
(b) Using SST, tap in the tight plugs A until its surface is flush with the cylinder block.

(c) Using SST, tap in the tight plugs B to the specified protrusion height.
Protrusion height:
B: 1.5 - 2.5 mm(0.0591 - 0.0984 in.)
SST 09950-60010 (09951-00250), 09950-70010 (09951-07100, 09951-00450)



32. INSTALL SUB-ASSY OIL NOZZLE NO.1

(a) Using a bi-hexagon wrench, install the oil nozzle No.1.
Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)



33. INSTALL PISTON PIN HOLE SNAP RING

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

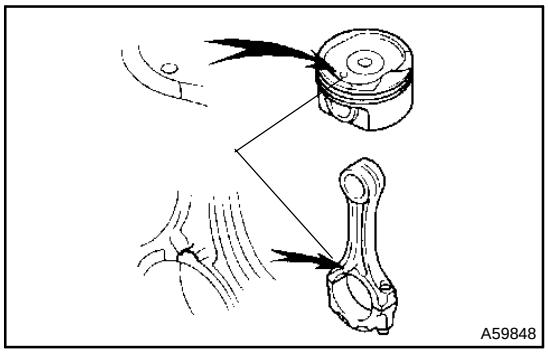
HINT:
Be sure that end gap of the snap ring is aligned with the pin hole cutout portion of the piston.

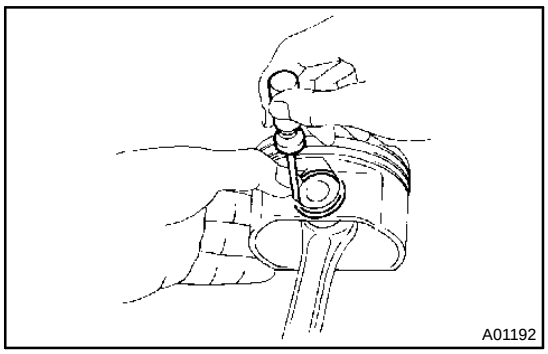
CONTINUED

34. INSTALL W/PIN PISTON SUB-ASSY

(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.





35. INSTALL PISTON PIN HOLE SNAP RING

(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.

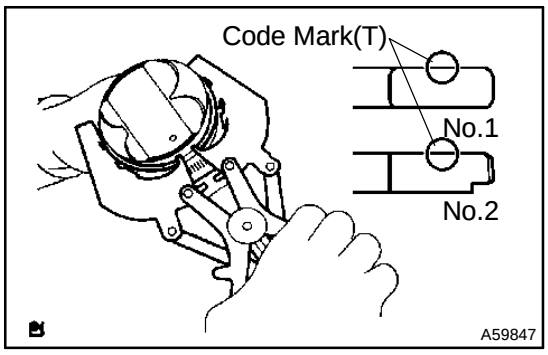
36. INSTALL PISTON RING SET

HINT:

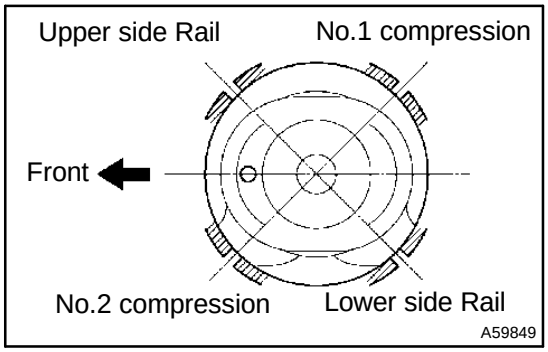
In case of reusing the piston rings, install them to the matched pistons with the surfaces faced correctly.

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

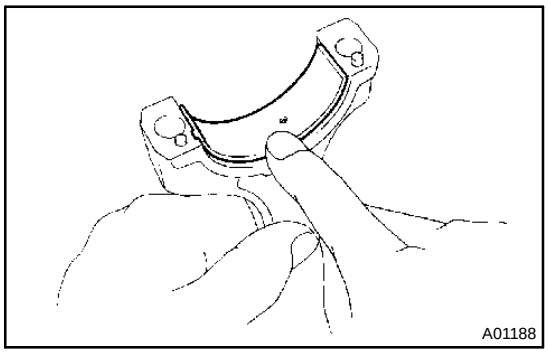
(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
Code mark : T



CONTINUED



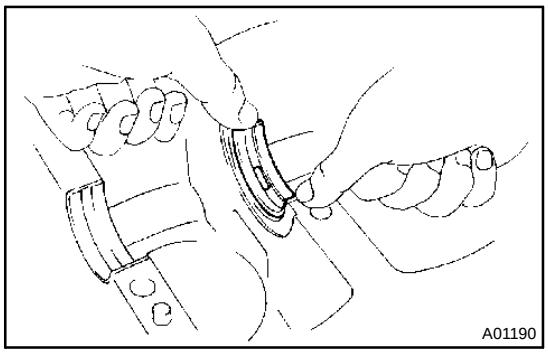
(c) Position the piston rings so that the ring ends are as shown.



37. INSTALL CONNECTING ROD BEARING

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

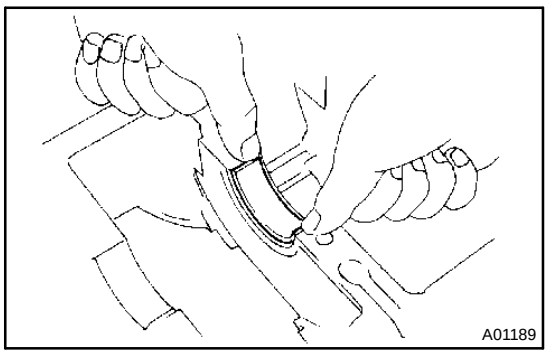
NOTICE:
Clean the backside of the bearing and the bearing surface of the connecting rod and let not stick the oils and fats.



38. INSTALL CRANKSHAFT

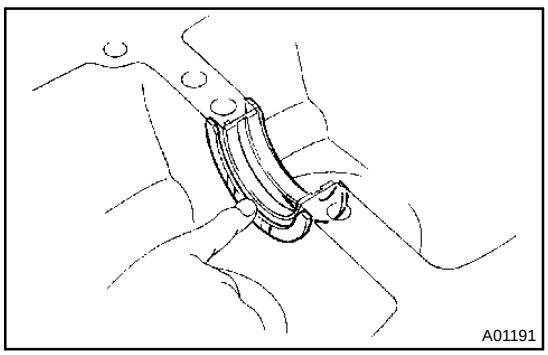
(a) Install the upper bearing with an oil groove on cylinder block.

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.

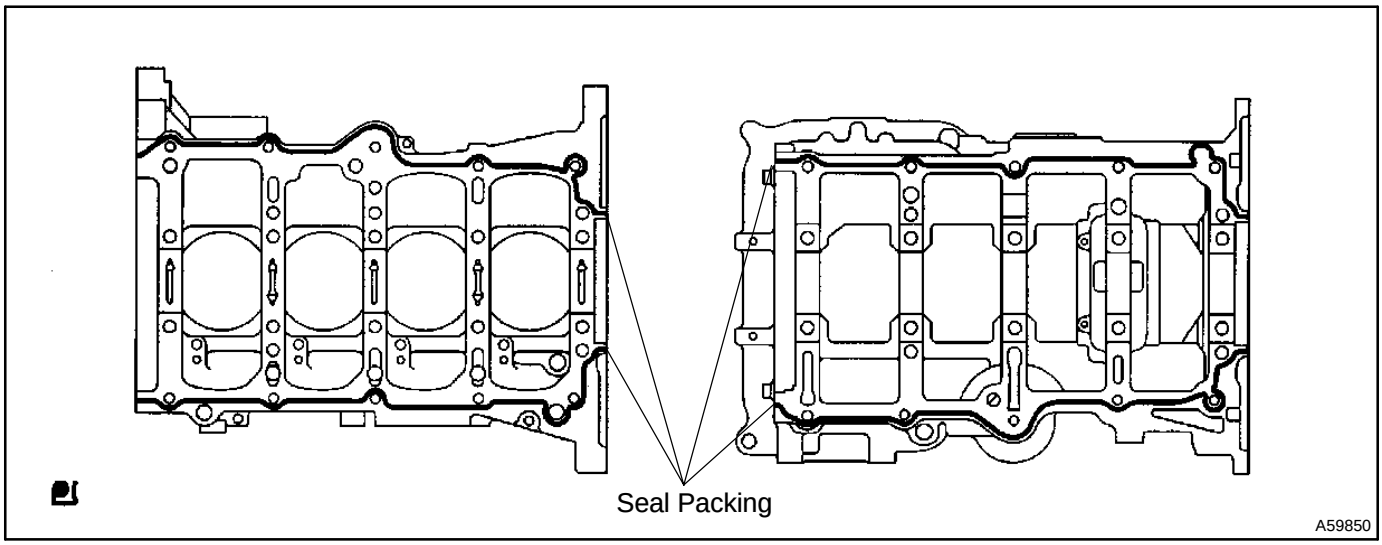
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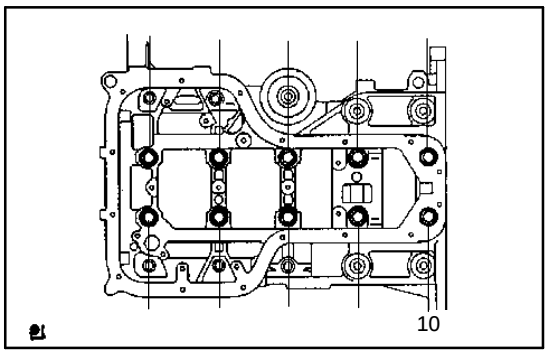
(f) Apply seal packing in the shape of bead (Diameter 2.5 – 3.5 mm (0.08 – 0.12 in.) consequently as shown in the illustration.

Seal packing: Part No. 08826-00080 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.**





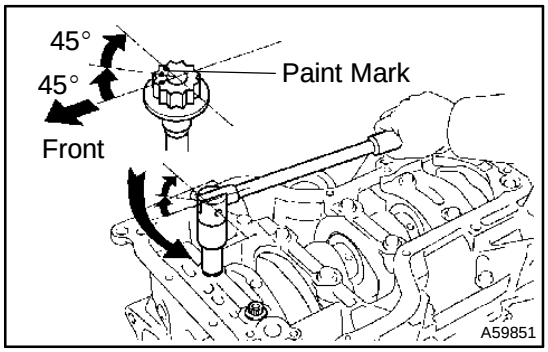
(g) Using socket wrench (12), tighten the bolts in several passes, in the sequence shown, by the specified torque.

Torque: 22 N·m (225 kgf·cm, 16 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.



(j) 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: 18 N·m (184 kgf·cm, 13 ft·lbf)

(m) apply adhesive to 2 or 3 threads, and install the 4 screw plugs.

Adhesive:
Part No. 08833-0070, THREE BOND 1324, or equivalent
Torque: 43 N·m (438 kgf·cm, 32 ft·lbf)

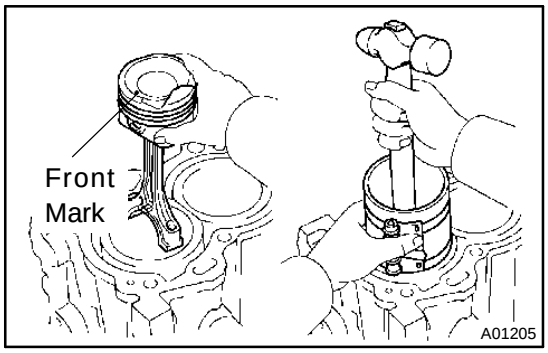
CONTINUED

39. INSTALL CONNECTING ROD SUB-ASSY

(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.

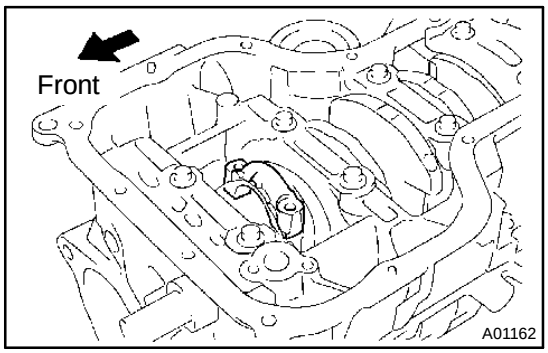


(d) Align the pin dowels of the connecting rod cap with the pins of the connecting rod, and install the connecting rod.

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.

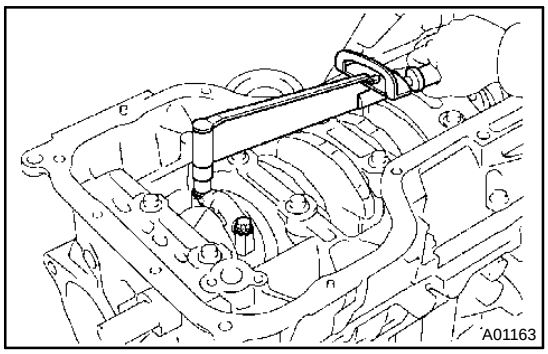


(f) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.

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

SST 09205-16010

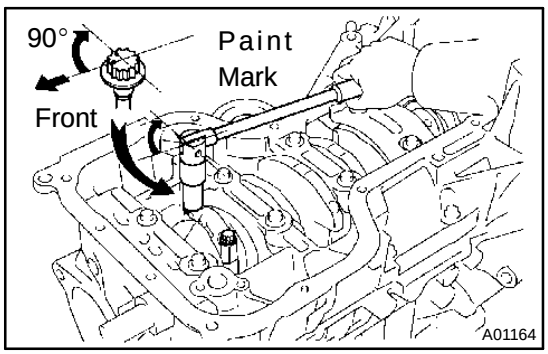
Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)



(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.



CONTINUED

40. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY

(a) Apply two or three threads of adhesive to the drain union, and install it within 3 minutes.
Torque: 25 N·m (255 kgf·cm 13 ft·lbf)

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

NOTICE:

- **Do not put in coolant within an hour after the installation.**
- **Do not rotate the drain union more than 360 ° in (b), and never loosen it after setting the union correctly.**

CONTINUED

COOLING

WATER PUMP ASSY (2ZZ–GE) 16–1
INSPECTION 16–1

CONTINUED

WATER PUMP ASSY (2ZZ-GE)

1600Q-03

INSPECTION

1. INSPECT WATER PUMP ASSY

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

CONTINUED

LUBRICATION

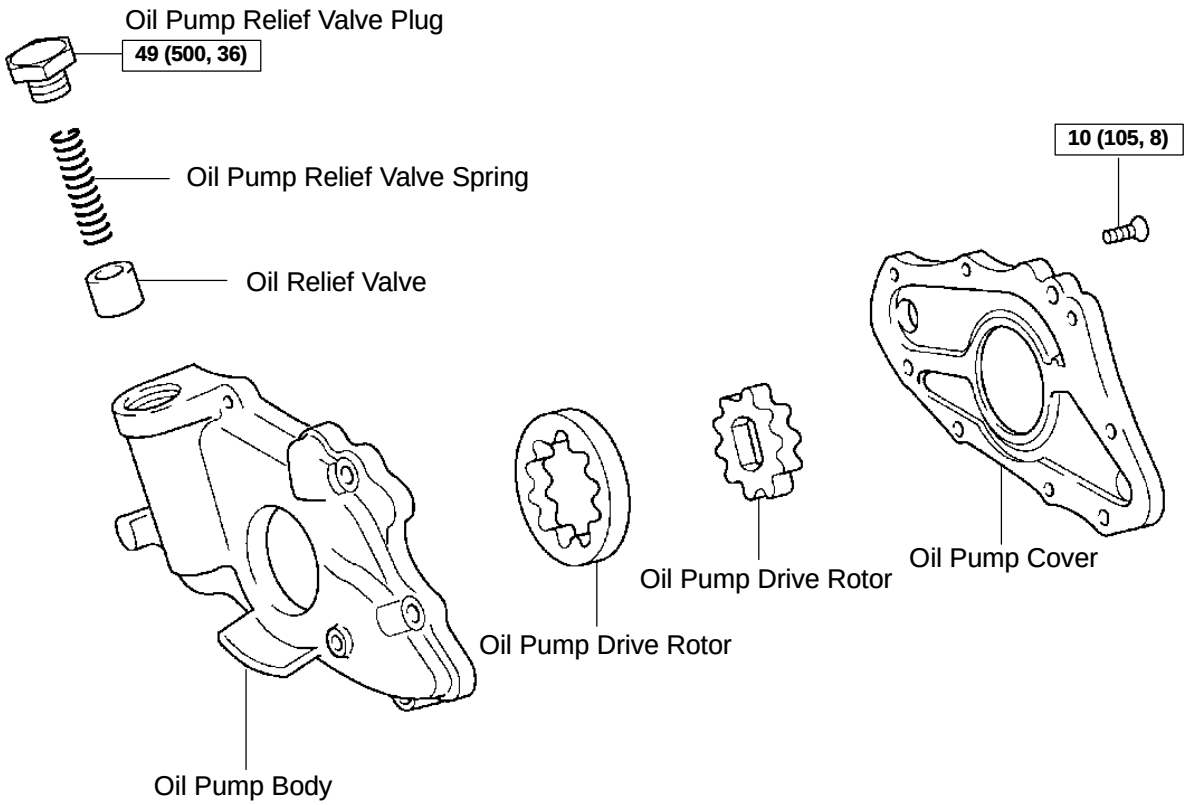
OIL PUMP ASSY (2ZZ–GE) 17–1
COMPONENTS 17–1
OVERHAUL 17–2/3

CONTINUED

OIL PUMP ASSY (2ZZ-GE)

COMPONENTS

1706W-01



N·m (kgf·cm, ft·lbf): Specified torque

A62218

CONTINUED

1706X-01

OVERHAUL

1. INSPECT PUMP ASSY, OIL

(a) Remove oil pump cover.

(1) Remove the 5 screws and the oil pump cover.

(b) Remove oil pump rotor sub-assembly.

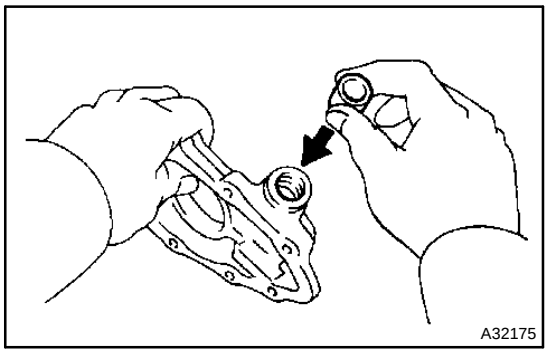
CAUTION:

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.

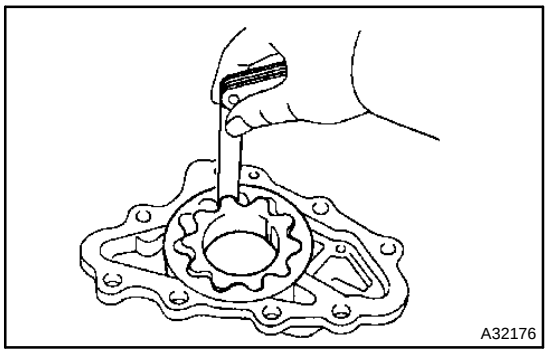


(f) Inspect oil pump relief valve.

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

(g) Inspect oil pump rotor sub-assembly.

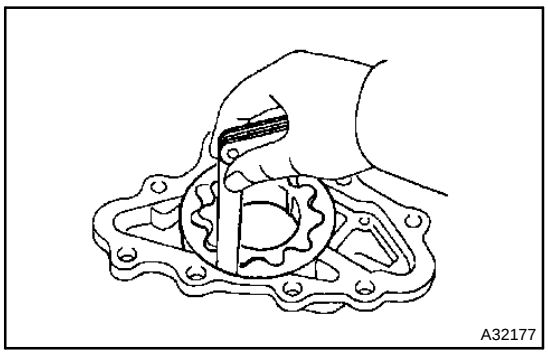
(1) Coat the oil pump gear set with engine oil and place them into the oil pump body. Check that the rotors revolves smoothly.



(h) Inspect rotor tip clearance.

(1) Using a feeler gauge, measure the clearance between the drive and driven rotor tips.

Standard tip clearance:
0.060 - 0.180 mm (0.0024 - 0.0071 in.)
Maximum tip clearance:
0.35 mm (0.0138 in.)

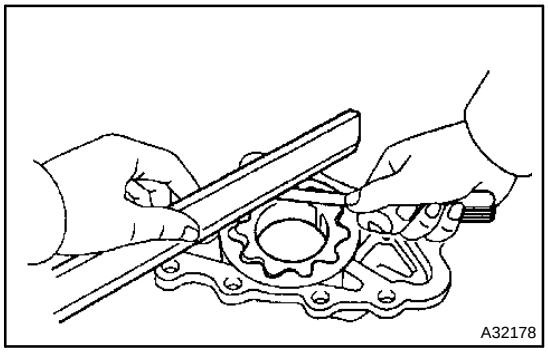


(i) Inspect body clearance.

(1) Using a feeler gauge, measure the clearance between the driven rotor and body.

Standard body clearance:
0.125 - 0.180 mm (0.0049 - 0.0021 in.)
Maximum body clearance:
0.325 mm (0.0128 in.)

CONTINUED



(j) Inspect rotor side clearance.

(1) Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

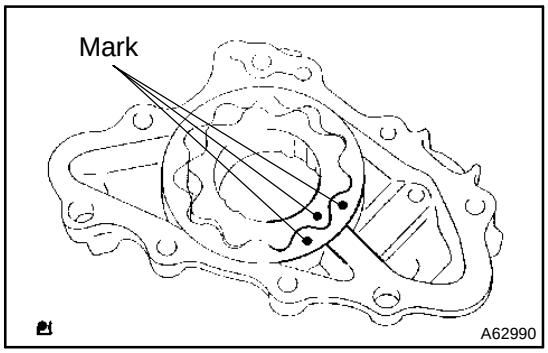
Standard side clearance:
0.030 -0.080 mm (0.0012 - 0.0032 in.)
Maximum side clearance:
0.16 mm (0.0063 in.)

(k) 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: 49 N·m (500 kgf·cm, 36 ft·lbf)



(l) 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.

(m) Install oil pump cover.

(1) Install the oil pump cover with 3 screws.

Torque: 10 N·m (105 kgf·cm, 8 ft·lbf)

CONTINUED

STARTING & CHARGING

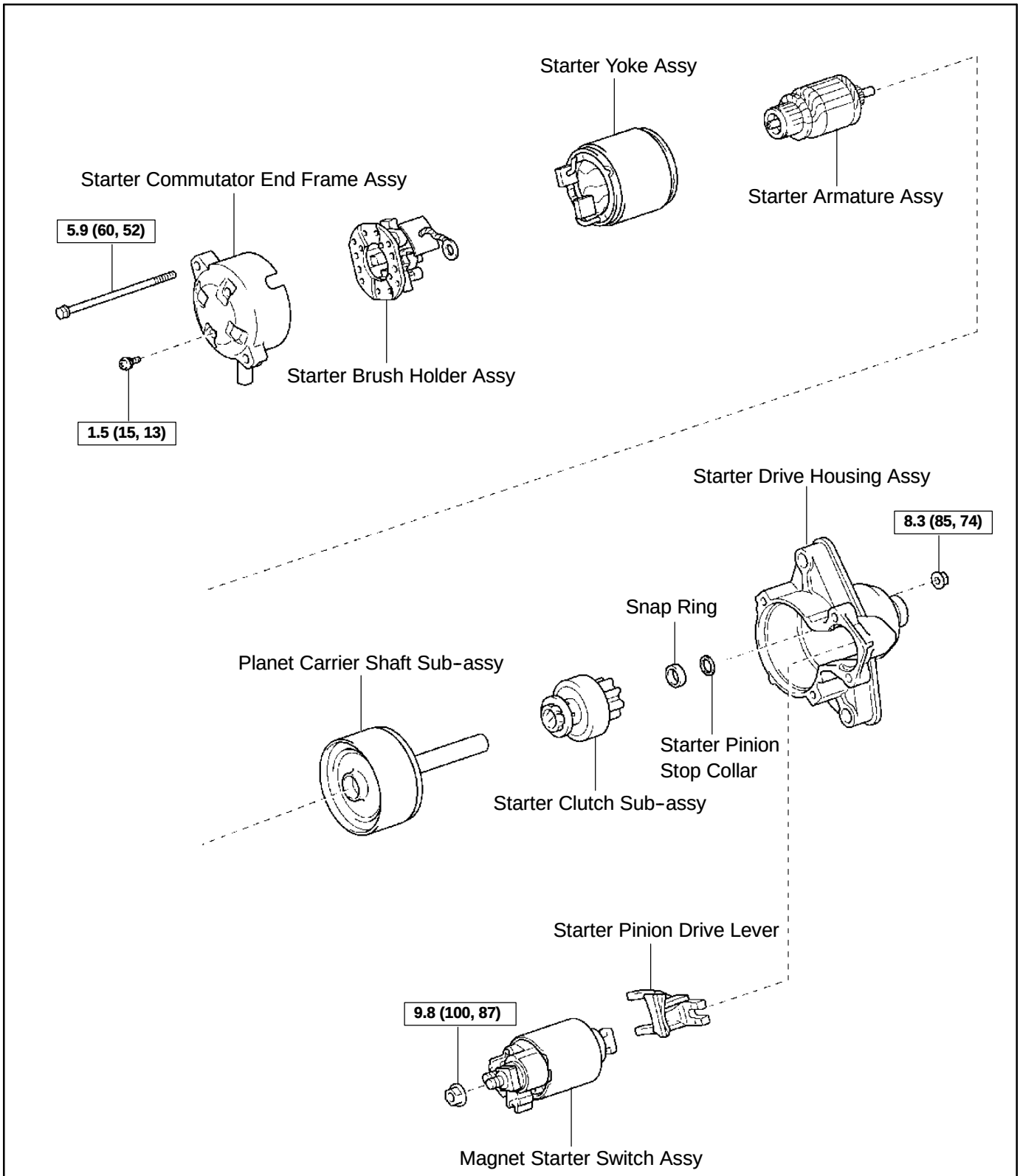
STARTER ASSY (2ZZ–GE) 19–1
COMPONENTS 19–1
OVERHAUL 19–2/8
GENERATOR ASSY (2ZZ–GE) 19–9
COMPONENTS 19–9
OVERHAUL 19–10/14

CONTINUED

STARTER ASSY (2ZZ-GE)

COMPONENTS

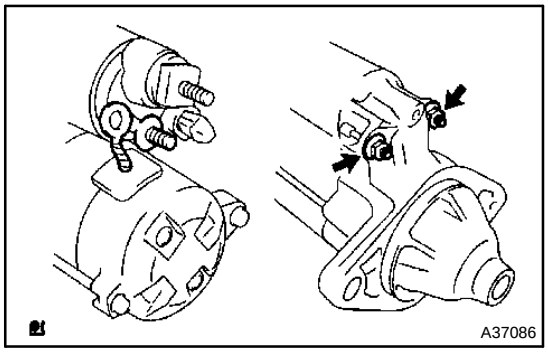
190BG-01



CONTINUED

1900P-03

OVERHAUL

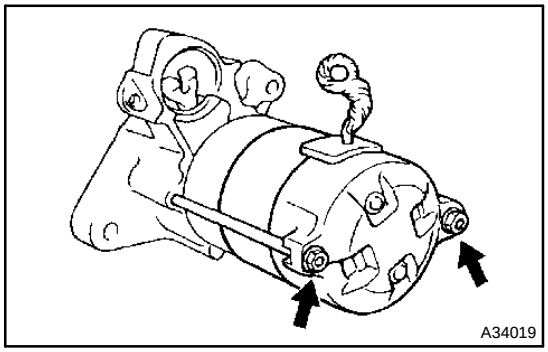


1. REMOVE MAGNET STARTER SWITCH ASSY

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

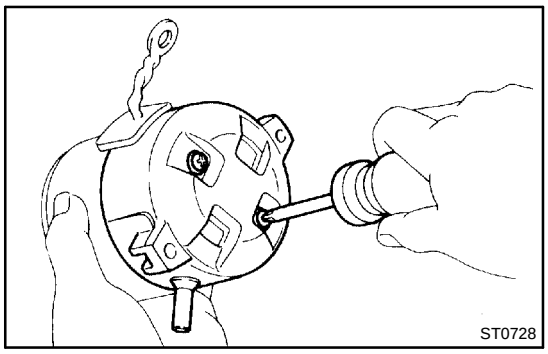
(b) Loosen the 2 nuts holding the magnetic switch to the starter housing.

(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

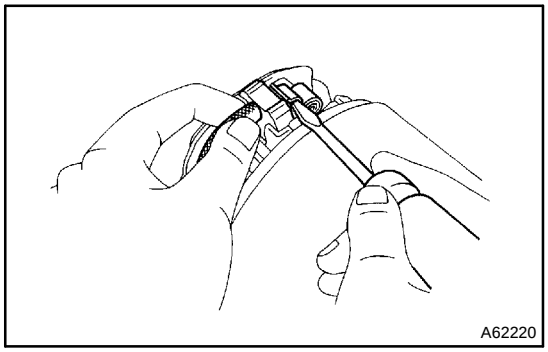
(a) Remove the 2 through bolts, and pull out the field frame together with the armature.



3. REMOVE STARTER BRUSH HOLDER ASSY

(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.



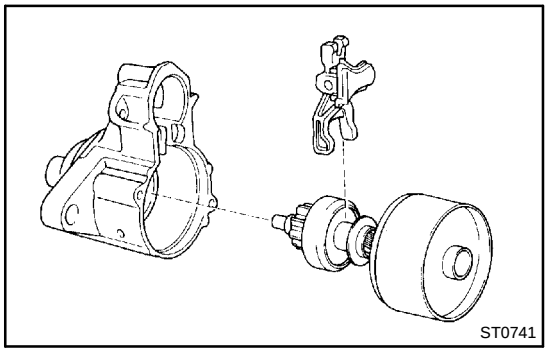
(b) Using a screwdriver, hold the spring back and disconnect the brush holder.

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

4. REMOVE STARTER ARMATURE ASSY

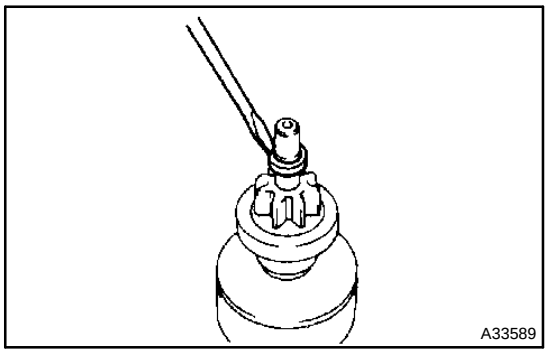
(a) Remove the starter armature from the starter yoke.

CONTINUED

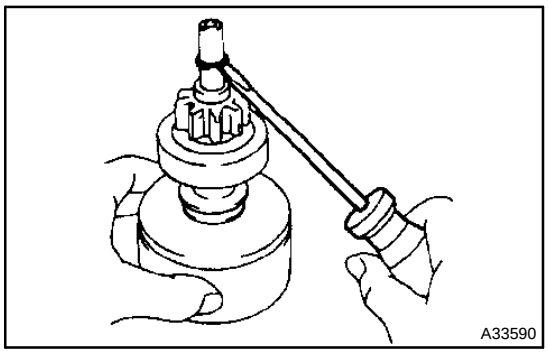


5. REMOVE STARTER CLUTCH SUB-ASSY

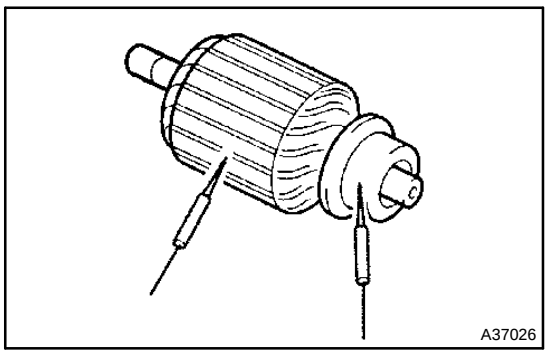
(a) Remove drive lever and starter clutch with shock absorber from starter housing.



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



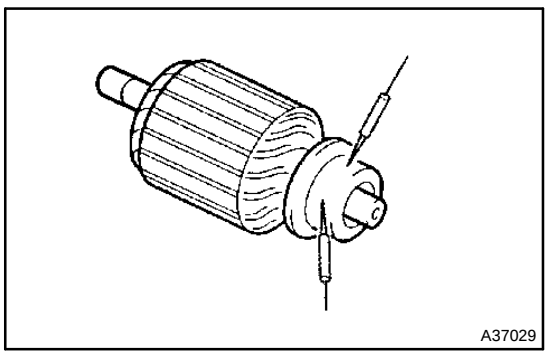
(c) Using a screwdriver, pry off the snap ring.
(d) Remove the stop collar and starter clutch from the planetary shaft.



6. INSPECT STARTER ARMATURE ASSY

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

If there is continuity, replace the armature.



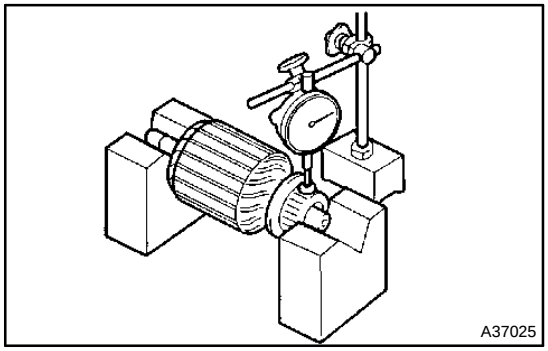
(b) Using an ohmmeter, check that there is continuity between the segments of the commutator.

If there is no continuity between any segments, replace the armature.

CONTINUED

(c) Check the commutator for dirty and burn on surface.

If the surface is dirty or burnt, correct it with sandpaper (No. 400) or a lathe.



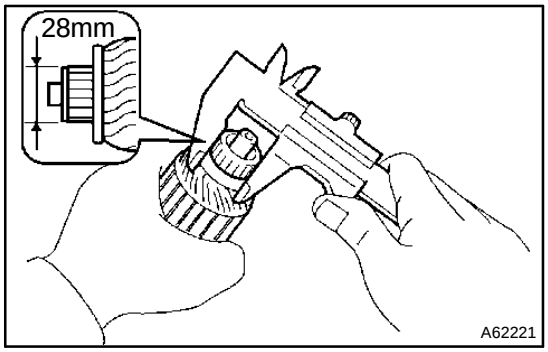
(d) Place the commutator on V - blocks.

(e) Using a dial gauge, measure the circle runout.

Standard circle runout: 0.02 mm (0.0008 in.)

Maximum circle runout: 0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.

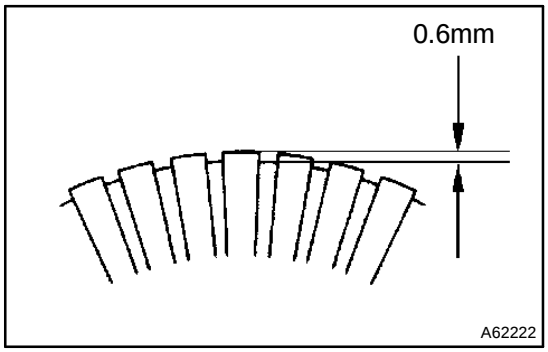


(f) Using vernier calipers, measure the commutator diameter.

Standard diameter: 28 mm (1.102 in.)

Minimum diameter: 27 mm (1.063 in.)

If the diameter is less than minimum, replace the armature.

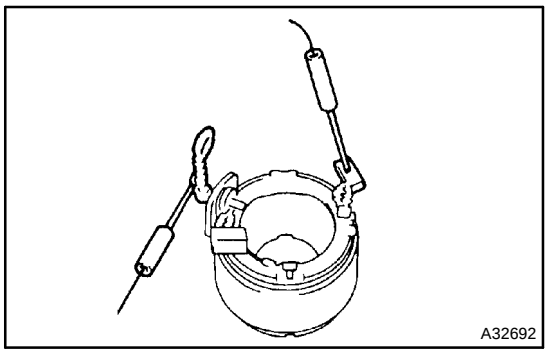


(g) Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth: 0.6 mm (0.024 in.)

Minimum undercut depth: 0.2 mm (0.008 in.)

If the depth is less than minimum, correct it with a hacksaw blade.

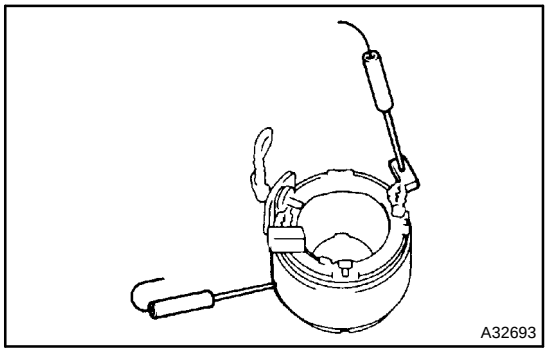


7. INSPECT FIELD COIL

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

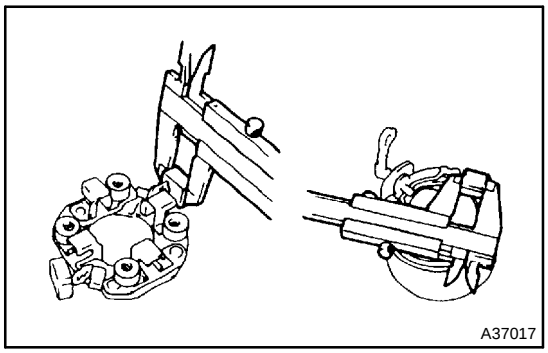
If there is no continuity, replace the field frame.

CONTINUED



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

If there is continuity, replace the field frame.



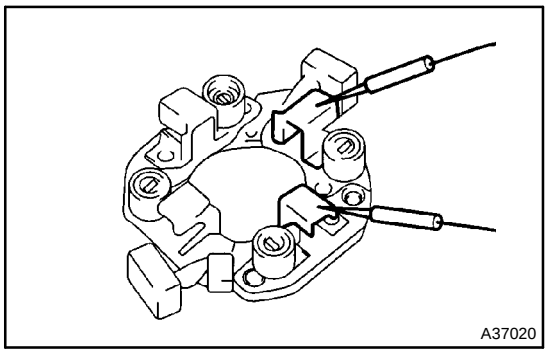
8. INSPECT BRUSH

(a) Using vernier calipers, measure the brush length.

Standard length: 14 mm (0.551 in.)

Minimum length: 9 mm (0.354 in.)

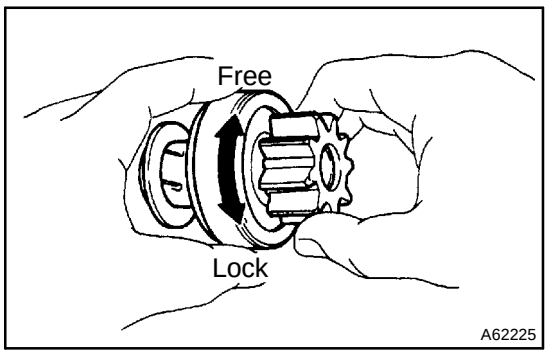
If the length is less than minimum, replace the brush and brush holder, and wipe it with an emery cloth.



9. INSPECT STARTER BRUSH HOLDER ASSY

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

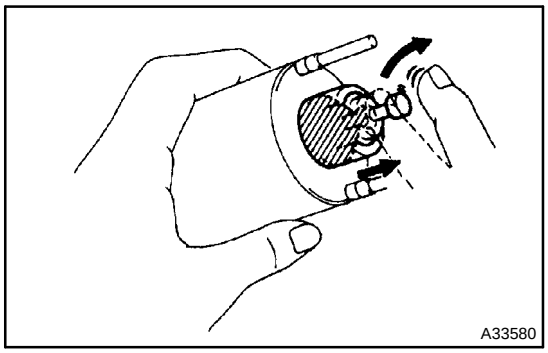
If there is continuity, repair or replace the brush holder.



10. INSPECT STARTER CLUTCH SUB-ASSY

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

If necessary, replace the starter clutch.

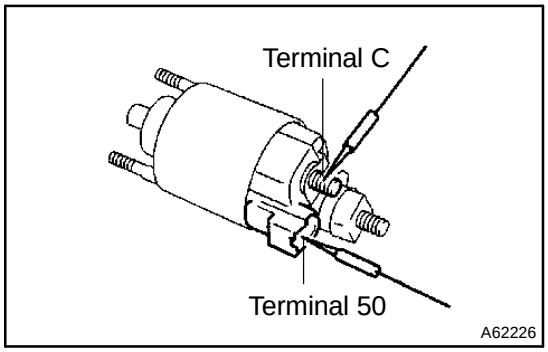


11. INSPECT MAGNET STARTER SWITCH ASSY

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

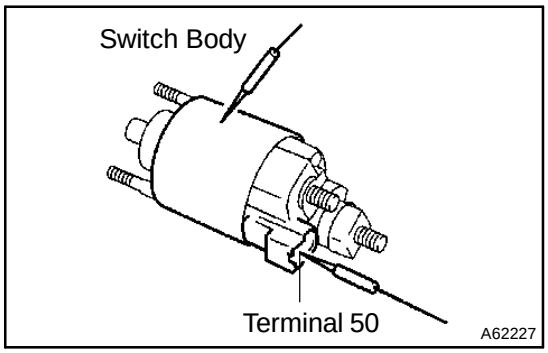
If necessary, replace the magnetic switch.

CONTINUED



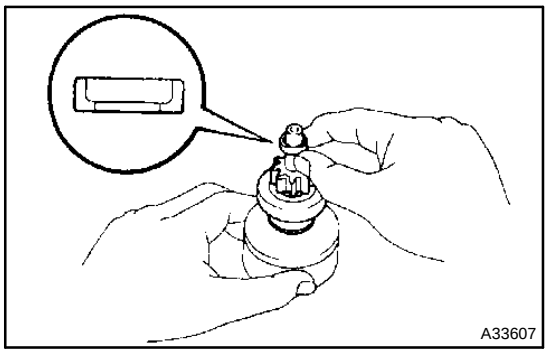
(b) Using an ohmmeter, check that there is continuity between terminals 50 and C.

If there is no continuity, replace the magnetic switch.



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

If there is no continuity, replace the magnetic switch.

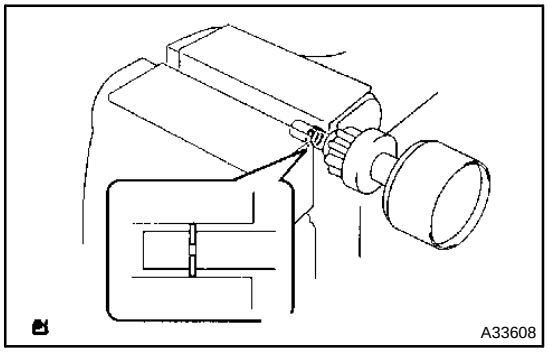


12. INSTALL STARTER CLUTCH SUB-ASSY

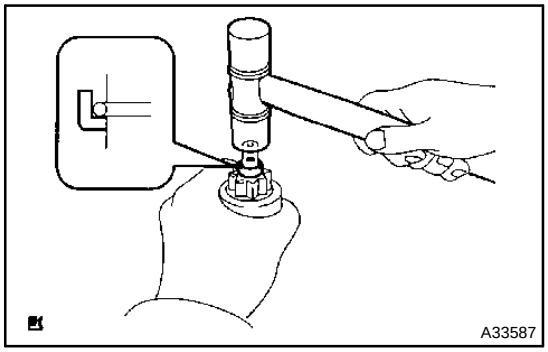
(a) Apply grease to the bushing and spline of the starter clutch and the starter pinion stop collar.

(b) Place the starter clutch sub-assy and the starter pinion stop collar on the planet carrier shaft sub-assy.

(c) Apply grease to the snap ring, and install it in the groove of the planet carrier shaft.

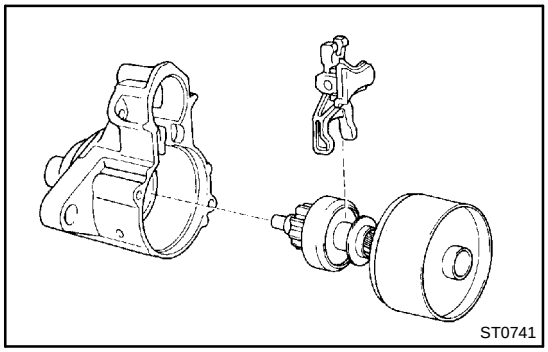


(d) Using a vise, compress the snap ring.



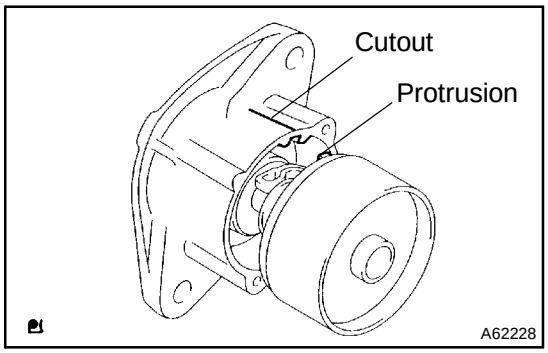
(e) Hold the starter clutch, tap the planetary shaft and install the stop collar onto the snap ring with a plastic hammer.

CONTINUED



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

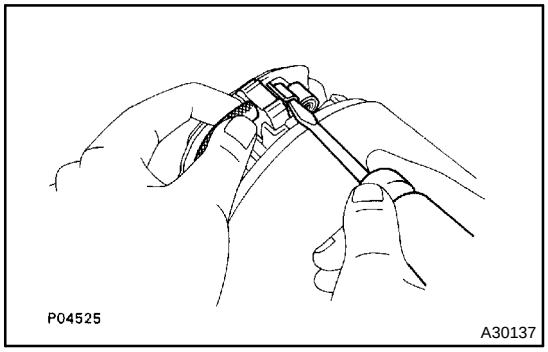
(g) Install the starter pinion drive lever to the starter clutch sub-assy.



(h) Align the protrusion of the planet carrier shaft sub-assy with the cutout of the starter drive housing assy and install them.

13. INSTALL STARTER ARMATURE ASSY

(a) Install the starter armature to the starter yoke.

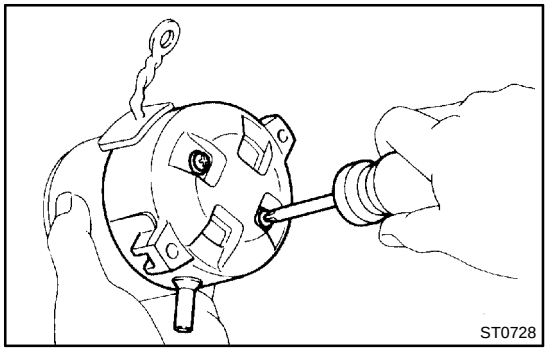


14. INSTALL STARTER BRUSH HOLDER ASSY

(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.

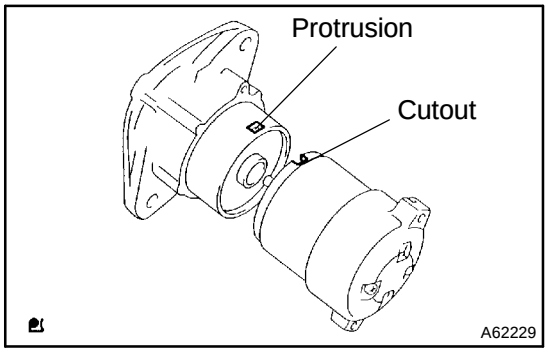
(c) Apply turbine oil with additives to the bearing of the end frame.



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

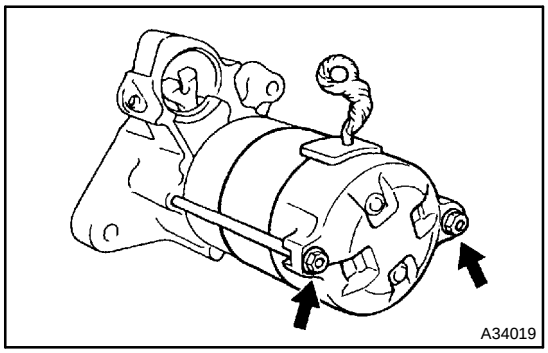
NOTICE:
To avoid interference between the brush holder and the dust protector push the commutator and frame away at an angle.

CONTINUED

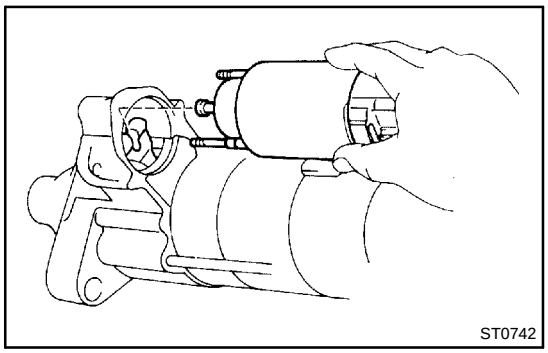


15. INSTALL STARTER YOKE ASSY

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

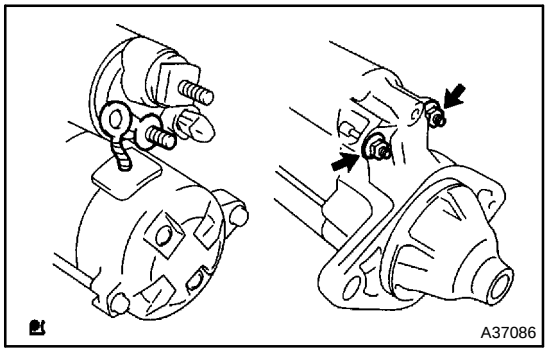


(b) Install the field frame and armature assembly with the 2 through bolts.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)



16. INSTALL MAGNET STARTER SWITCH ASSY

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



(b) Install the magnet starter switch assy with the 2 nuts.
Torque: 8.3 N·m (85 kgf·cm, 74 in.·lbf)

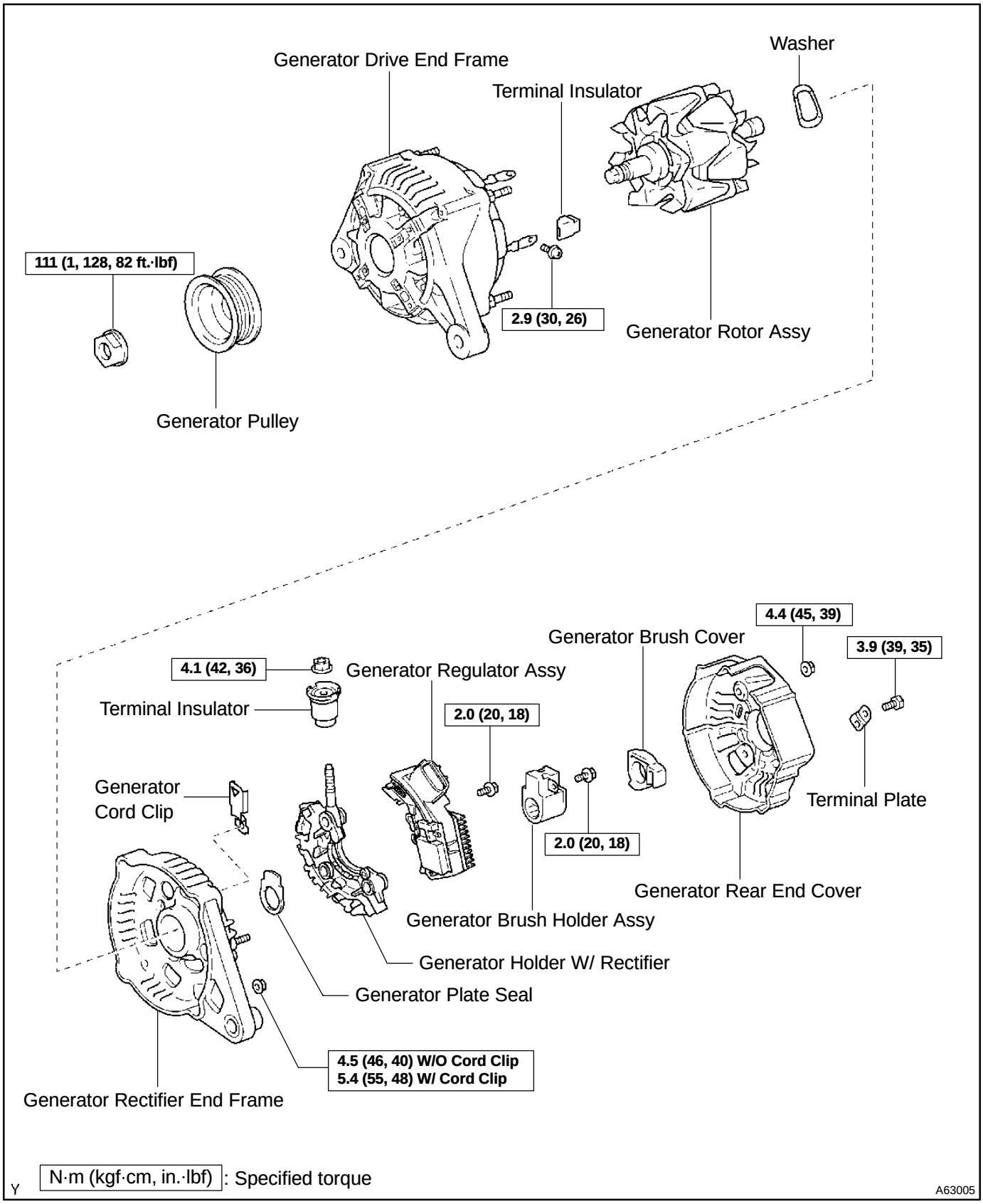
(c) Connect the lead wire to the terminal with the nut.
Torque: 9.8 N·m (100 kgf·cm, 87 in.·lbf)

CONTINUED

GENERATOR ASSY (2ZZ-GE)

COMPONENTS

190BH-01



Y N·m (kgf·cm, in.·lbf): Specified torque

A63005

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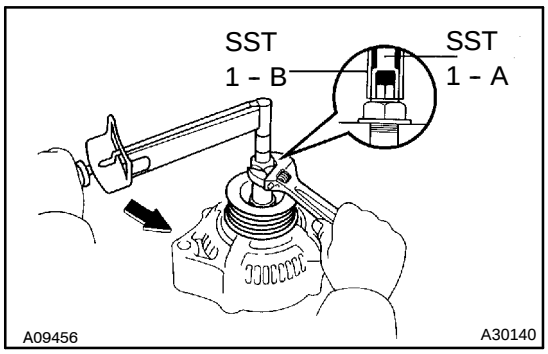
OVERHAUL

1. REMOVE GENERATOR PULLEY

SST 09820-63010 (09820-06010, 09820-06020)

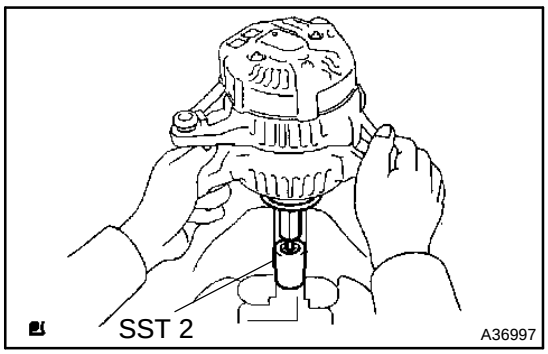
HINT:

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

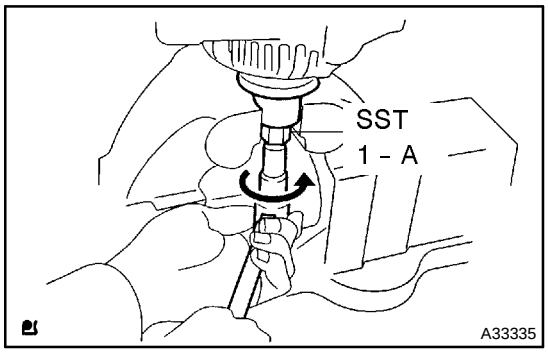


(a) Hold SST 1 - A with a torque wrench, and tighten SST 1 - B clockwise to the specified torque.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

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



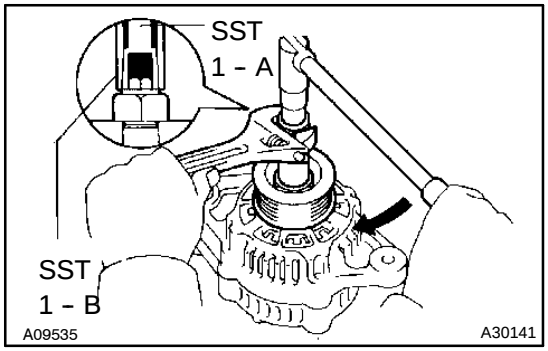
(b) Mount SST 2 in a vise.
(c) Insert SST 1 - A, B into SST 2, and attach the generator pulley nut to SST 2.



(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.

CONTINUED

2. REMOVE GENERATOR BRUSH HOLDER ASSY

(a) Remove the nut and the terminal insulator.
(b) Remove the bolt, nut and the terminal plate.
(c) Remove 2 bolts and the generator rear end cover.
(d) Remove the generator brush cover.
(e) Remove the generator brush holder.

3. REMOVE GENERATOR REGULATOR ASSY

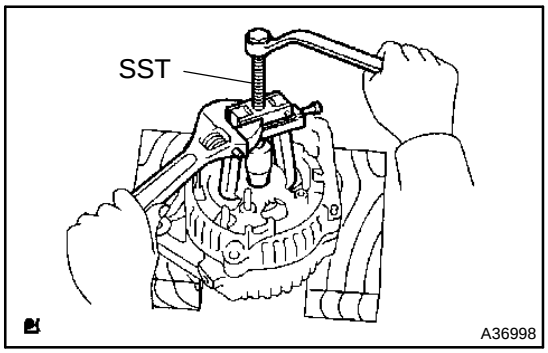
(a) Remove 2 nuts and the generator regulator assy.

4. REMOVE GENERATOR HOLDER W/RECTIFIER

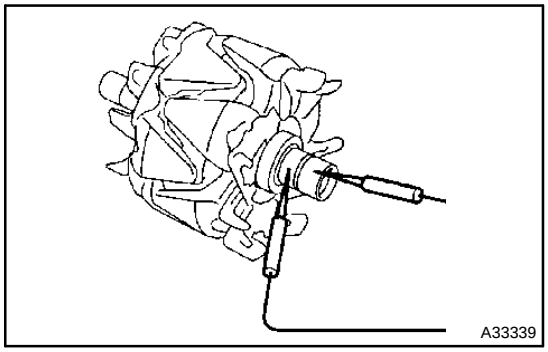
(a) Remove 4 bolts and the generator holder w/ rectifier.

5. REMOVE GENERATOR ROTOR ASSY

(a) Remove 4 nuts and wire clip.

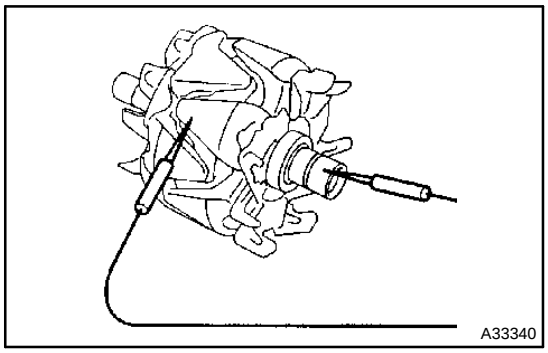


(b) Using SST, remove the rectifier end frame.
SST 09286-46011
(c) Remove the generator rotor assy from the generator drive end frame.



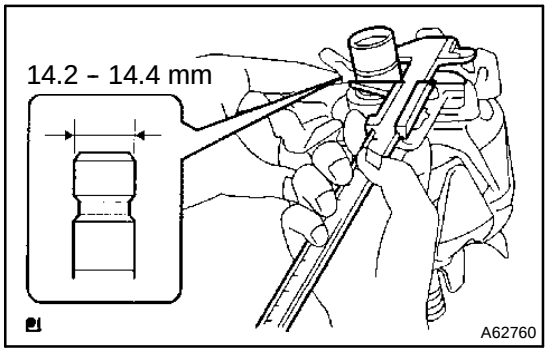
6. INSPECT GENERATOR ROTOR ASSY

(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)

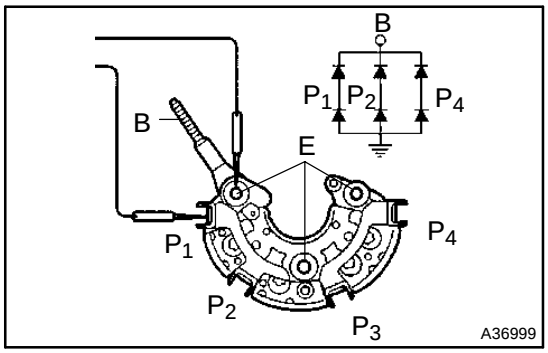


(b) Using an ohmmeter, check that there is no continuity between the slip ring and the generator rotor assy.

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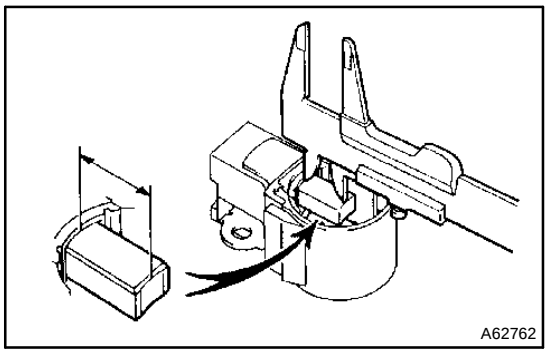


(c) Using vernier calipers, measure the slip ring diameter.
Standard diameter:
14.2 - 14.4 mm (0.559 - 0.567 in.)
Minimum diameter: 12.8 mm (0.504 in.)



7. INSPECT GENERATOR HOLDER W/RECTIFIER

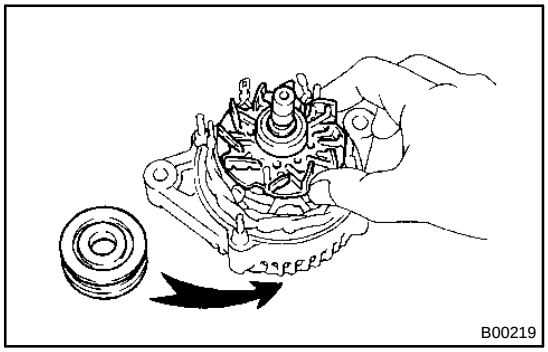
(a) Using an ohmmeter, connect one tester probe to the B or E terminal and the other to each rectifier terminal.
(b) Reverse the polarity of the tester probes and repeat step (a).
(c) Check that one shows continuity and the other shows no continuity.



8. INSPECT GENERATOR BRUSH HOLDER ASSY

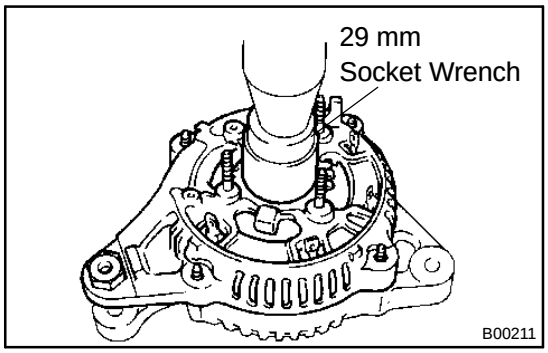
(a) Using vernier calipers, measure the exposed brush length.
Standard exposed length:
9.5 - 11.5 mm (0.374 - 0.453 in.)
Minimum exposed length: 1.5 mm (0.059 in.)

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



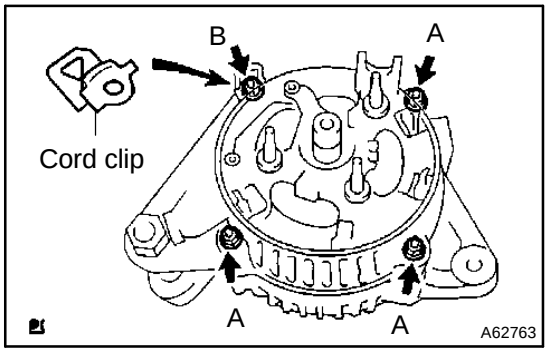
9. INSTALL GENERATOR ROTOR ASSY

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

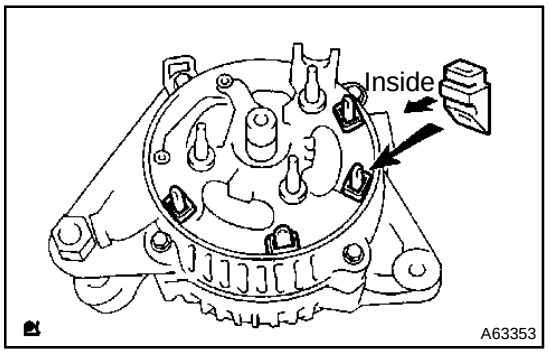


(b) Using a 29 mm socket wrench and press, slowly press in the generator rectifier end frame.

CONTINUED



(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)



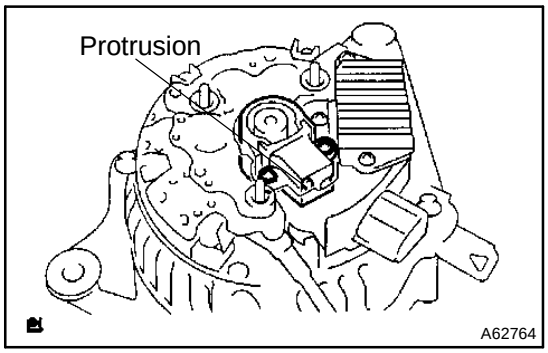
(d) Install the 4 terminal insulators, as shown in the illustration.

10. INSTALL GENERATOR HOLDER W/RECTIFIER

Torque: 2.9 N·m (30 kgf·cm, 26 in.·lbf)

11. INSTALL GENERATOR REGULATOR ASSY

Torque: 2.0 N·m (20 kgf·cm, 18 in.·lbf)



12. INSTALL GENERATOR BRUSH HOLDER ASSY

(a) Install the generator brush holder assy with the 2 screws.
Torque: 2.0 N·m (20 kgf·cm, 18 in.·lbf)

NOTICE:
Pay attention to the generator holder assy installation direction.

(b) Install the generator rear 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)

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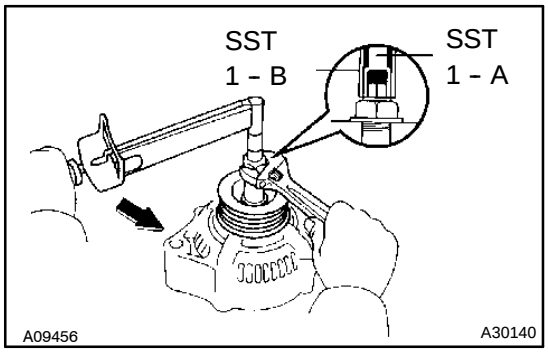
13. INSTALL GENERATOR PULLEY

SST 09820-63010 (09820-06010, 09820-06020)

HINT:

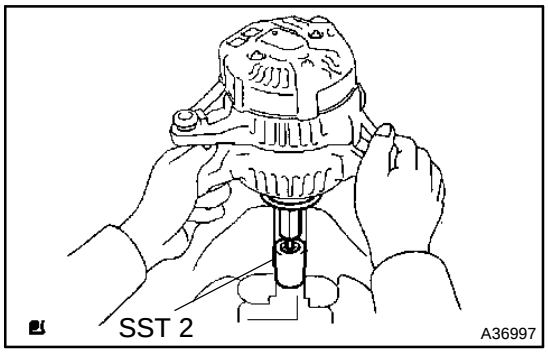
SST1 - A, B	09820-06010
SST2	09820-06020

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

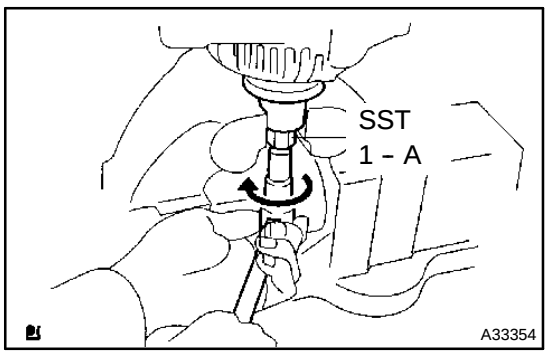


(b) Hold SST 1 - A with a torque wrench, and tighten SST 1 - B clockwise to the specified torque.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

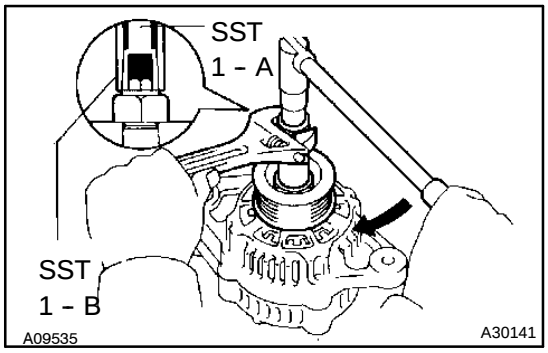
NOTICE:
Check that SST is secured to the rotor shaft.



(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, 82 ft·lbf)
(f) Remove the generator assy form SST 2.



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

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