HOW TO USE THIS ENGINE REPAIR MANUAL (3ZZ-FE/4ZZ-FE)

010C1-01

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.

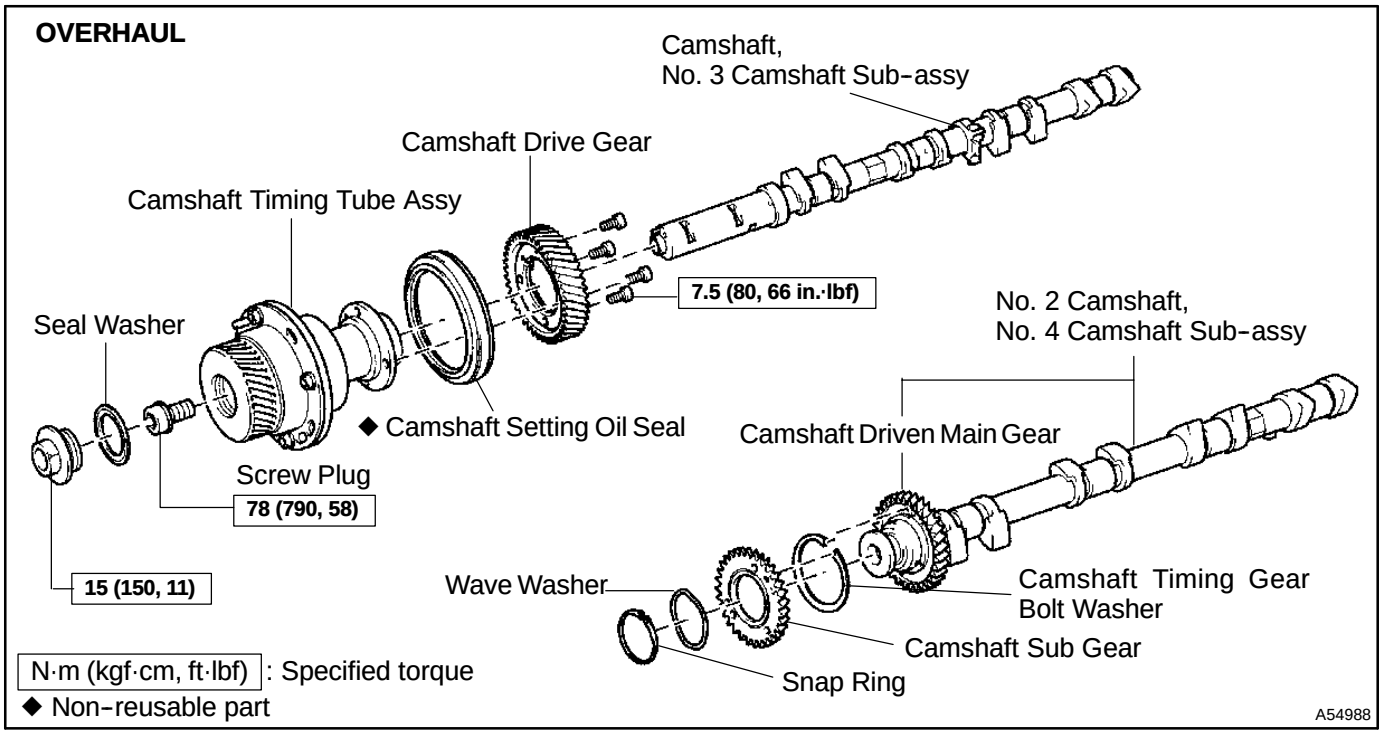
4. REPAIR PROCEDURES

(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:



REPAIR INSTRUCTION FOR ENGINE REPAIR MANUAL (3ZZ-FE/4ZZ-FE)

010C2-01

PRECAUTION

1. TO PREVENT FROM ENTERING FOREIGN SUBSTANCES

(a) When foreign substances such as dust, grain of sand or metallic dust enter inside of engine, it often causes functional failure of the engine.
  (1) Precaution before disassembly.
    - Remove adequately all sand and mud adhere to the outside of engine.
  (2) Precaution at reassembly.
    - Protect disassembled parts from dust by using vinyl sheet to cover.

2. TO PREVENT SCRATCHES ON THE PARTS

(a) The existence of scratches on the contact and revolving surfaces often causes oil leak and seisure.
  (1) Precautions at disassembly and reassembly.
    - When disassemble the contact surface of the parts, use plastic hammer 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.

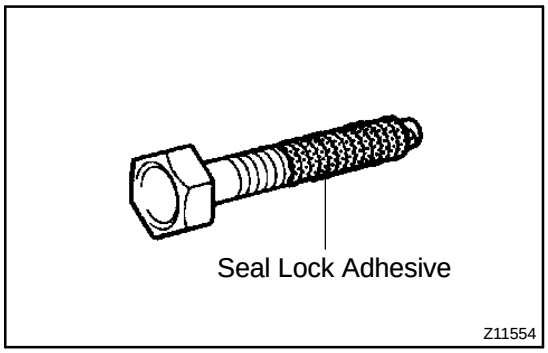
5. INSTALL ENGINE ASSEMBLY TO OVERHAUL STAND WHEN OVERHAUL THE ENGINE

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.

TERMS FOR ENGINE REPAIR MANUAL (3ZZ-FE/4ZZ-FE)

010C3-01

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

010C4-01

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.

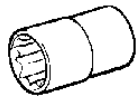
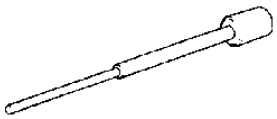
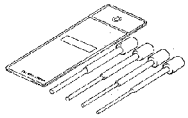
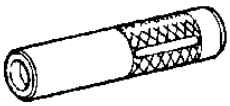
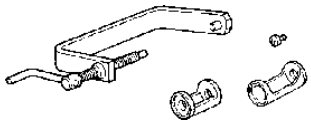
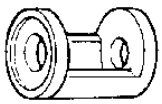
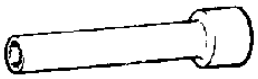
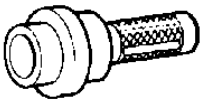
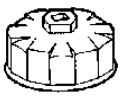
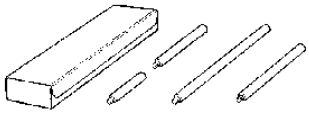
SAE ABBREVIATIONS	SAE TERMS	TOYOTA TERMS ( )––ABBREVIATIONS
A/C	Air Conditioning	Air Conditioner
ACL	Air Cleaner	Air Cleaner, A/CL
AIR	Secondary Air Injection	Air Injection (AI)
AP	Accelerator Pedal	–
B+	Battery Positive Voltage	+B, Battery Voltage
BARO	Barometric Pressure	HAC
CAC	Charge Air Cooler	Intercooler
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)

ENGINE MECHANICAL

PREPARATION

0216X-01

SST

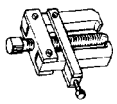
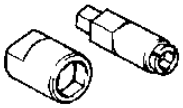
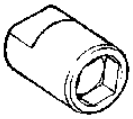
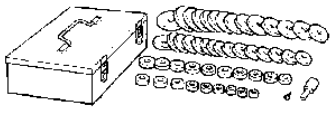
	09011-38121	12 mm Socket Wrench for 12 Pointed Head	CYLINDER BLOCK(3ZZ-FE/4ZZ-FE)
	09032-00100	Oil Pan Seal Cutter	PARTIAL ENGINE ASSY(3ZZ-FE/4ZZ-FE)
	09201-01055	Valve Guide Bushing Remover & Replacer 5.5	CYLINDER HEAD ASSY(3ZZ-FE/4ZZ-FE)
	09201-10000	Valve Guide Bushing Remover & Replacer Set	CYLINDER HEAD ASSY(3ZZ-FE/4ZZ-FE)
	09201-41020	Valve Stem Oil Seal Replacer	CYLINDER HEAD ASSY(3ZZ-FE/4ZZ-FE)
	09202-70020	Valve Spring Compressor	CYLINDER HEAD ASSY(3ZZ-FE/4ZZ-FE)
	(09202-00010)	Attachment	CYLINDER HEAD ASSY(3ZZ-FE/4ZZ-FE)
	09205-16010	Cylinder Head Bolt Wrench	CYLINDER BLOCK(3ZZ-FE/4ZZ-FE)
	09223-15030	Oil Seal & Bearing Replacer	PARTIAL ENGINE ASSY(3ZZ-FE/4ZZ-FE)
	09223-22010	Crankshaft Front Oil Seal Replacer	PARTIAL ENGINE ASSY(3ZZ-FE/4ZZ-FE)
	09228-06501	Oil Filter Wrench	PARTIAL ENGINE ASSY(3ZZ-FE/4ZZ-FE)
	09950-70010	Handle Set	PARTIAL ENGINE ASSY(3ZZ-FE/4ZZ-FE) CYLINDER HEAD ASSY(3ZZ-FE/4ZZ-FE)

STARTING & CHARGING

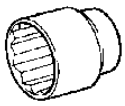
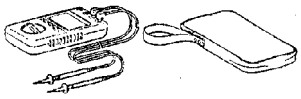
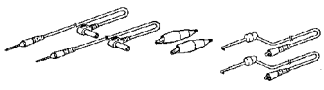
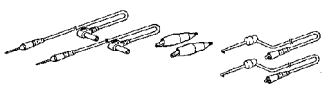
0216T-01

PREPARATION

SST

	09286-46011	Injection Pump Spline Shaft Puller	ALTERNATOR ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE)
	09820-63010	Alternator Pulley Set Nut Wrench Set	ALTERNATOR ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE)
	(09820-06010)	Alternator Rotor Shaft Wrench	ALTERNATOR ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE)
	(09820-06020)	Alternator Pulley Set Nut 22 mm Wrench	ALTERNATOR ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE)
	09285-76010	Injection Pump Camshaft Bearing Cone Replacer	ALTERNATOR ASSY (BOSCH MADE)(3ZZ-FE/4ZZ-FE)
	09950-60010	Replacer Set	STARTER ASSY (BOSCH MADE)(3ZZ-FE/4ZZ-FE)
	(09951-00340)	Replacer 34	STARTER ASSY (BOSCH MADE)(3ZZ-FE/4ZZ-FE)

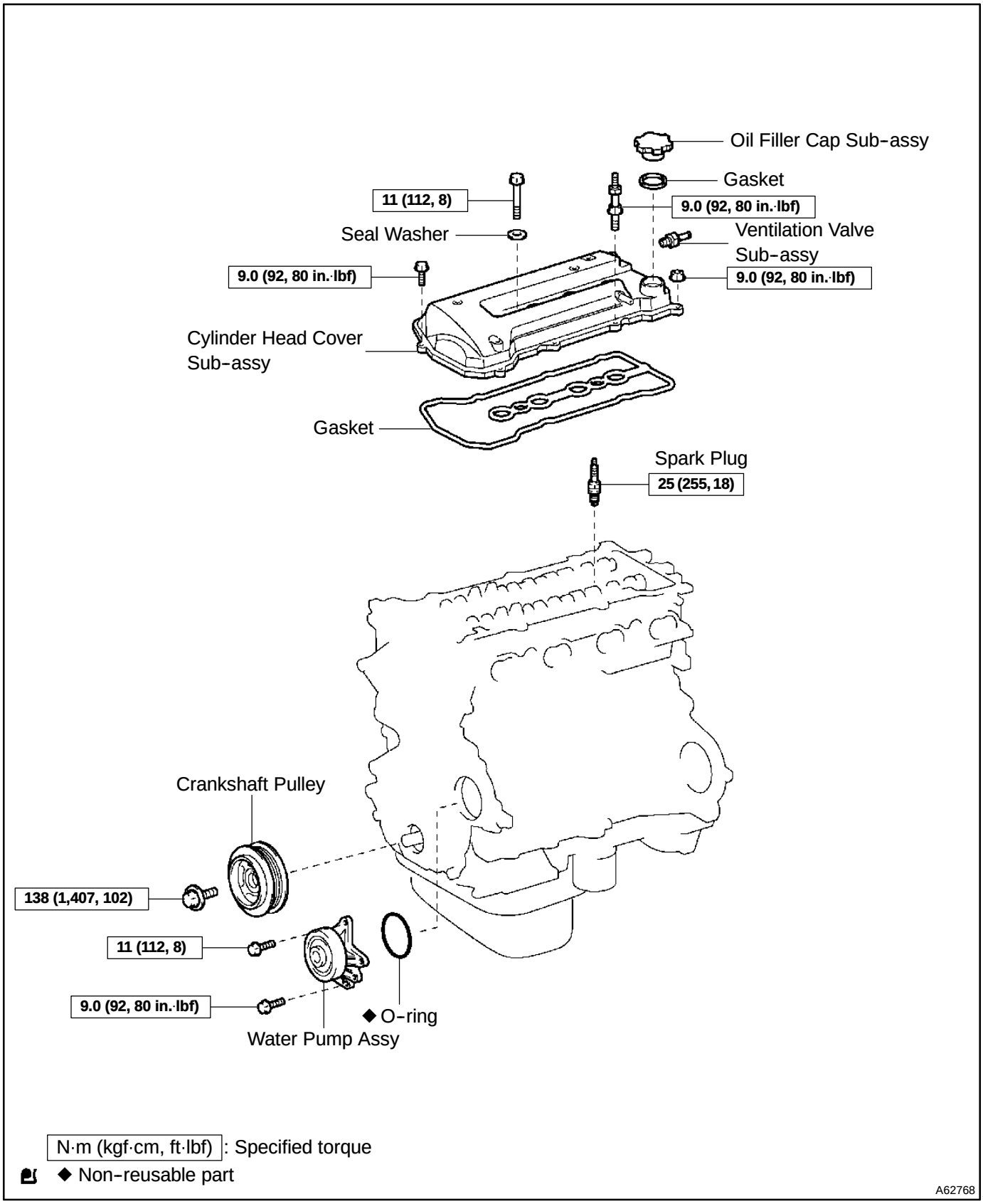
Recomended Tools

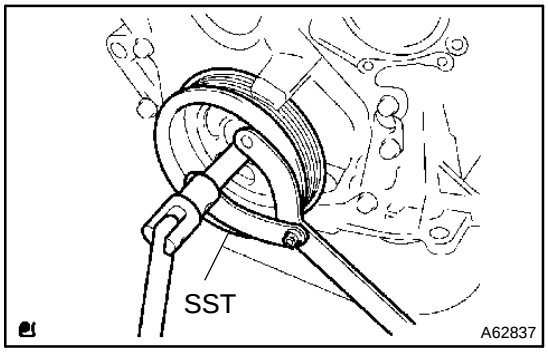
	09011-12291	Socket Wrench for 29 mm .	ALTERNATOR ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE)
	09082-00040	TOYOTA Electrical Tester	STARTER ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE) ALTERNATOR ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE)
	(09083-00150)	Test Lead Set	STARTER ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE) ALTERNATOR ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE)
	(09083-00150)	Test Lead Set	STARTER ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE) ALTERNATOR ASSY (DENSO MADE)(3ZZ-FE/4ZZ-FE)

PARTIAL ENGINE ASSY (3ZZ-FE/4ZZ-FE)

140KJ-02

COMPONENTS



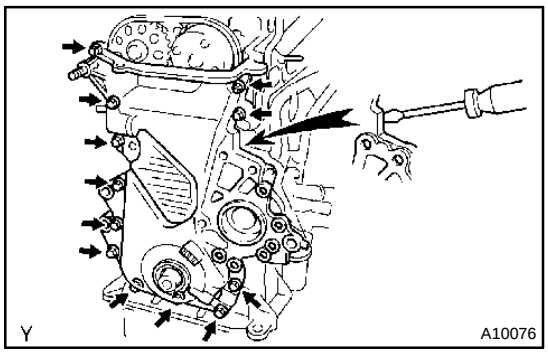


(b) Using SST, remove the pulley bolt.
SST 09960-10010 (09962-01000, 09963-01000)
(c) Remove the crankshaft pulley from the crankshaft.

9. REMOVE CHAIN TENSIONER ASSY NO.1

(a) Remove the 2 nuts and chain tensioner.

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

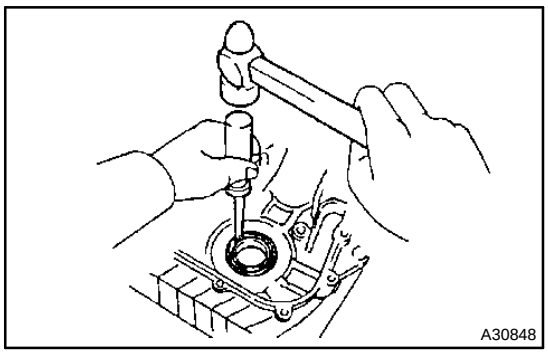


IN OR BELT C
SUB-ASSY

(a) Remove the 11 bolts and nuts.
(b) Remove the timing chain cover by prying the portions between the cylinder head and cylinder block with a screw-driver.

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

11. REMOVE TIMING GEAR COVER OIL SEAL



(a) Using a screwdriver remove the oil seal.

12. REMOVE CRANKSHAFT POSITION SENSOR PLATE NO.1

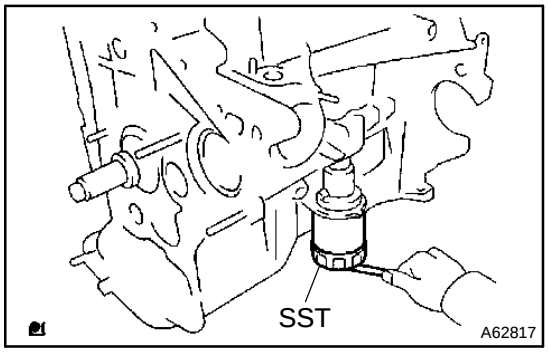
(a) Remove the crankshaft position sensor plate from the crankshaft.

13. REMOVE CHAIN TENSIONER SLIPPER

(a) Remove the bolt and chain tensioner slipper.

14. REMOVE CHAIN VIBRATION DAMPER NO.1

(a) Remove the 2 bolts and chain vibration damper.

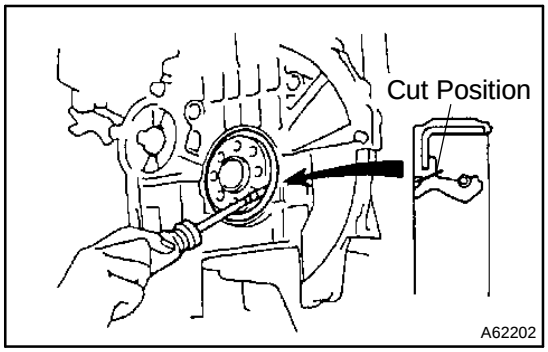


25. REMOVE OIL FILTER SUB-ASSY

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

26. REMOVE OIL FILTER UNION

(a) Using a socket hexagon wrench 12, remove the oil filter union.



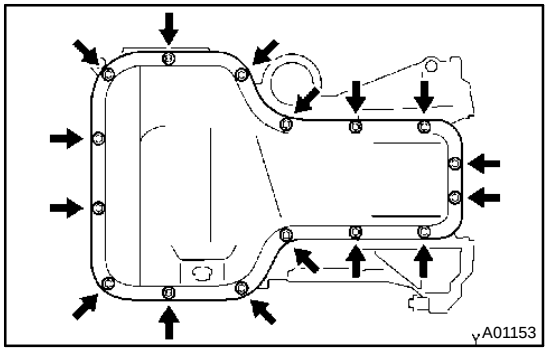
27. REMOVE ENGINE REAR OIL SEAL

(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).

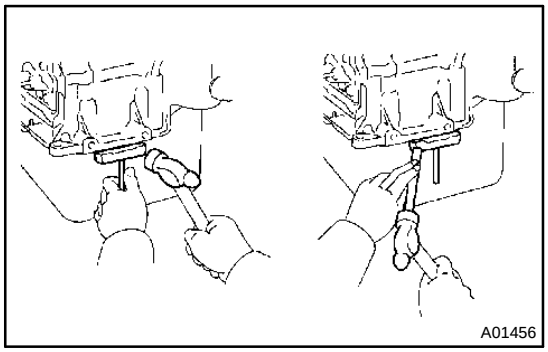
28. REMOVE OIL PAN DRAIN PLUG

(a) Remove the oil pan drain plug and gasket from the oil pan.



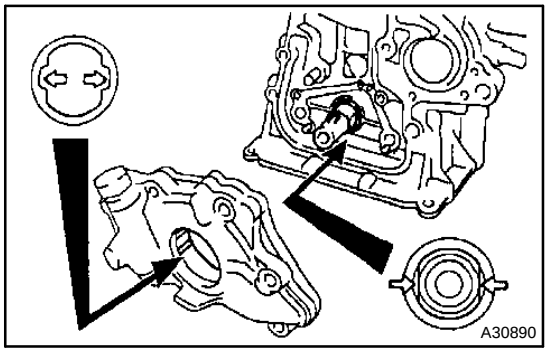
29. REMOVE OIL PAN SUB-ASSY

(a) Remove the 14 bolts and 2 nuts.



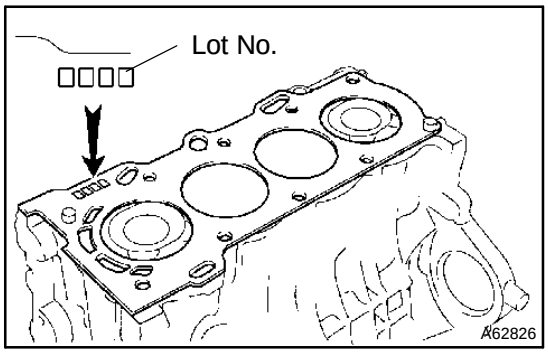
(b) Insert the blade of SST between the bearing cap sub-assembly and oil pan, and cut off applied sealer and remove the oil pan.
SST 09032-00100

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



47. INSTALL OIL PUMP ASSY

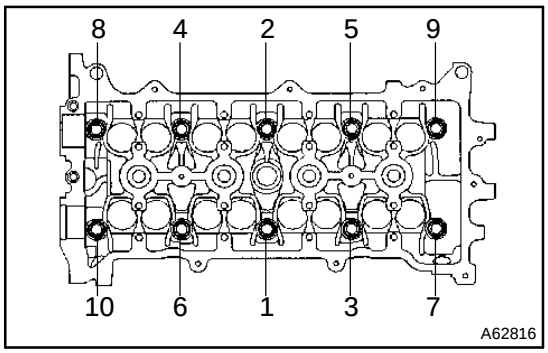
(a) Engage the spline teeth of the oil pump drive rotor with the large teeth of the crankshaft, and side the oil pump.
(b) Install the oil pump with the 5 bolts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



48. INSTALL CYLINDER HEAD GASKET

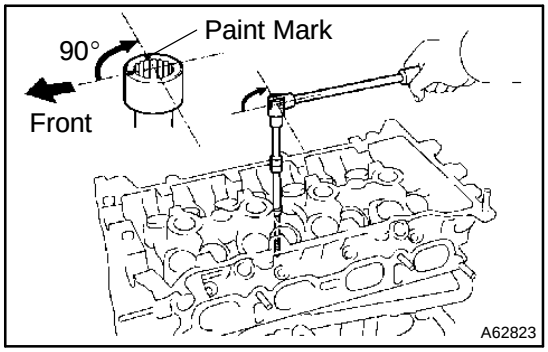
(a) Place a new cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

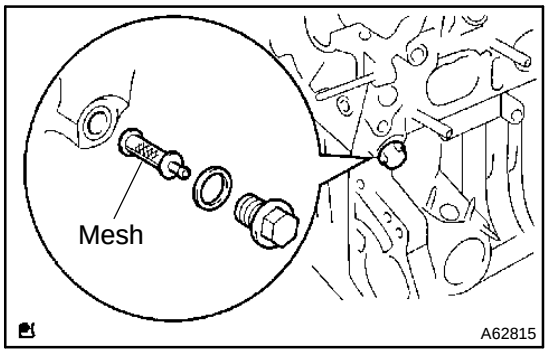
NOTICE:
- **Pay attention to the installation direction.**
- **Place the cylinder head quietly in order not to damage the gasket with the bottom part of the head.**



49. INSTALL CYLINDER HEAD SUB-ASSY

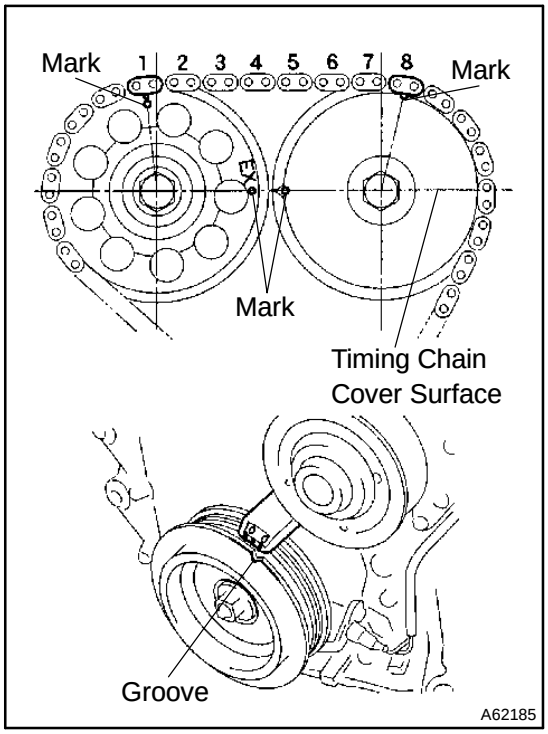
HINT:
The cylinder head bolts are tightened in 2 progressive steps.
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
(b) Using a bi–hexagon wrench 10, install and uniformly tighten the 10 cylinder head bolts with plate washers, in several passes, in the sequence shown.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)
(c) Mark the front of the cylinder head bolt with paint.
(d) Retighten the cylinder head bolts 90° in the numerical order shown.
(e) Check that the point marked bolts are moved at 90 ° angle.



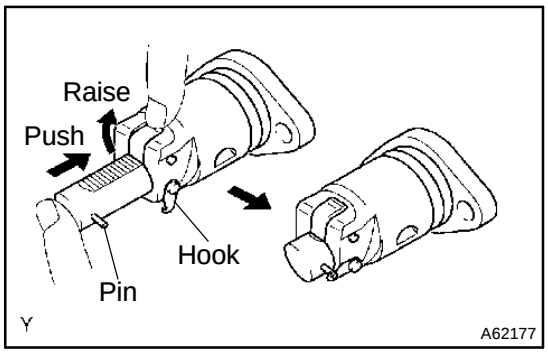


50. INSTALL OIL CONTROL VALVE FILTER

(a) Confirm that the filter is clear.
(b) Install the oil control valve filter to the cylinder head.
(c) Place a new gasket on the bolt, and install it.
Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)

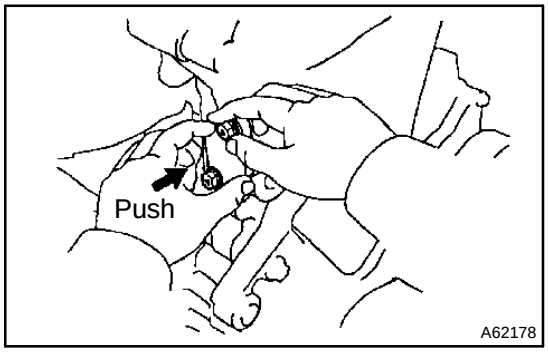


(t) Check the match marks on the timing chain and camshaft timing sprockets, and then the alignment of the pulley groove with timing mark of the chain cover as shown in the illustration.



(u) Install chain tensioner.

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

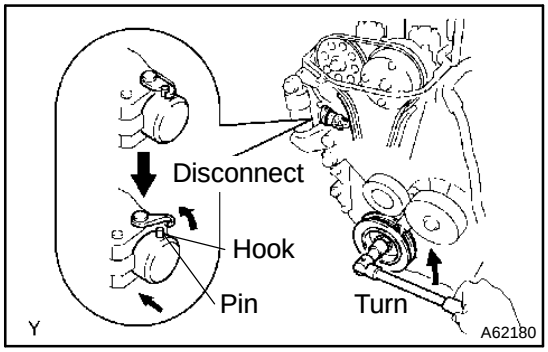


(2) Apply engine oil to the chain tensioner and install it.

Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)

NOTICE:

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

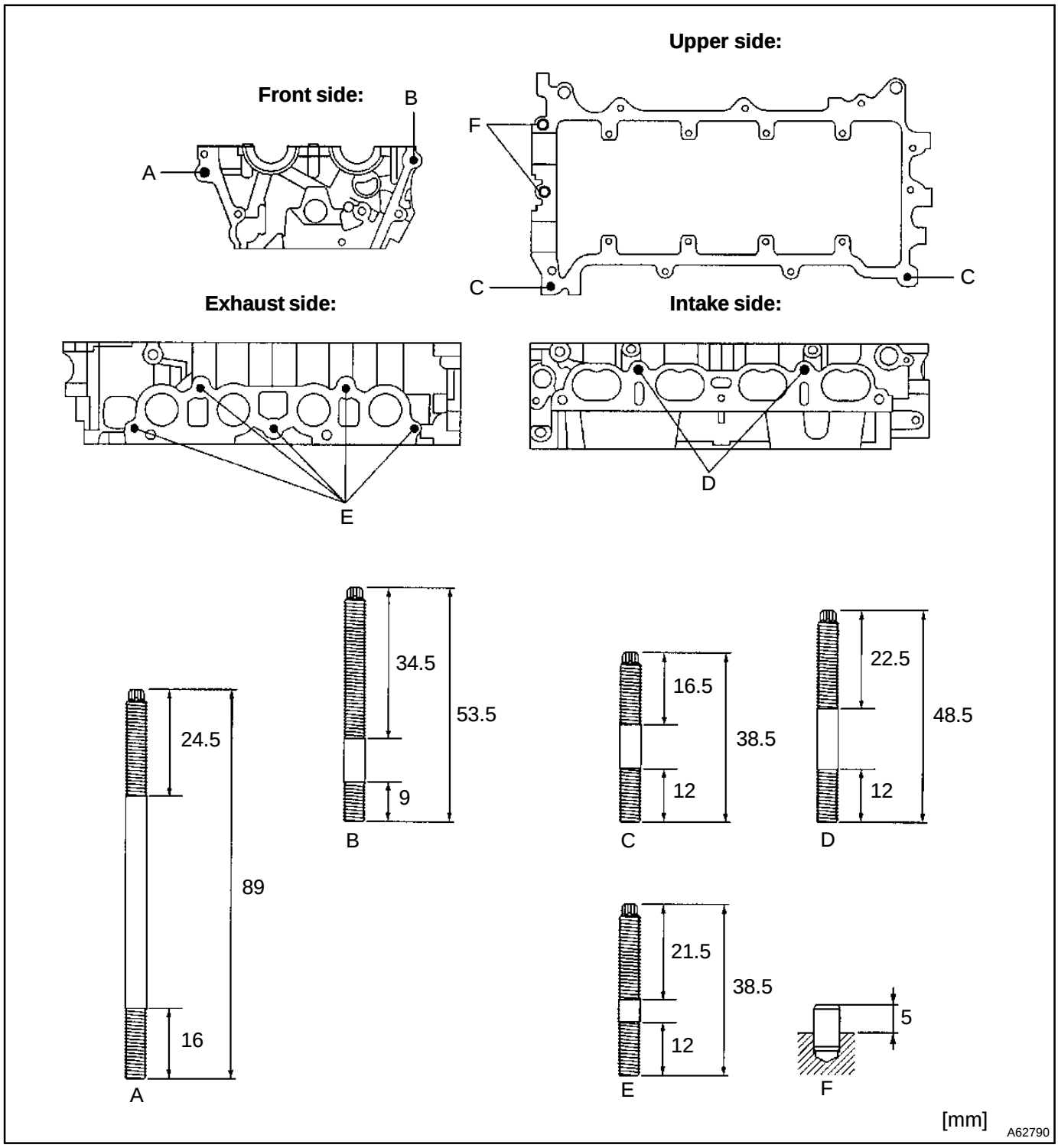


(3) Turn the crankshaft counterclockwise, and disconnect the plunger knock pin from the hook.

23. INSTALL STUD BOLT AND RING PIN

(a) Install the 11 stud bolts to cylinder head,
Torque:
Stud bolt A, D and E 9.5 N·m (97, 84 in.·lbf)
Stud bolt B and C 5.0 N·m (51, 44 in.·lbf)

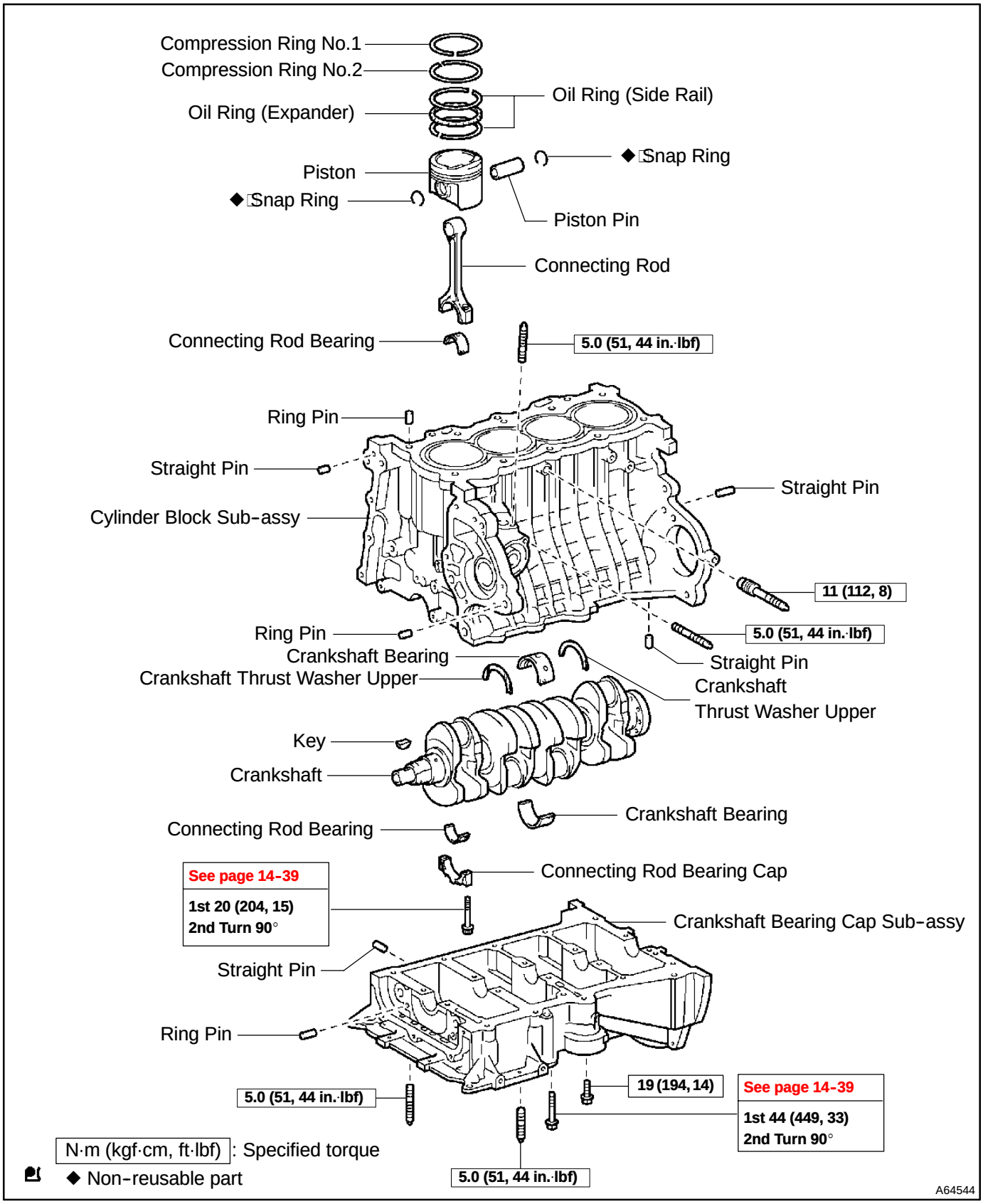
(b) Using a plastic hammer, install the new 2 ring pins to the cylinder head.
Standard protrusion: 5 mm (0.020 in.)



CYLINDER BLOCK (3ZZ-FE/4ZZ-FE)

COMPONENTS

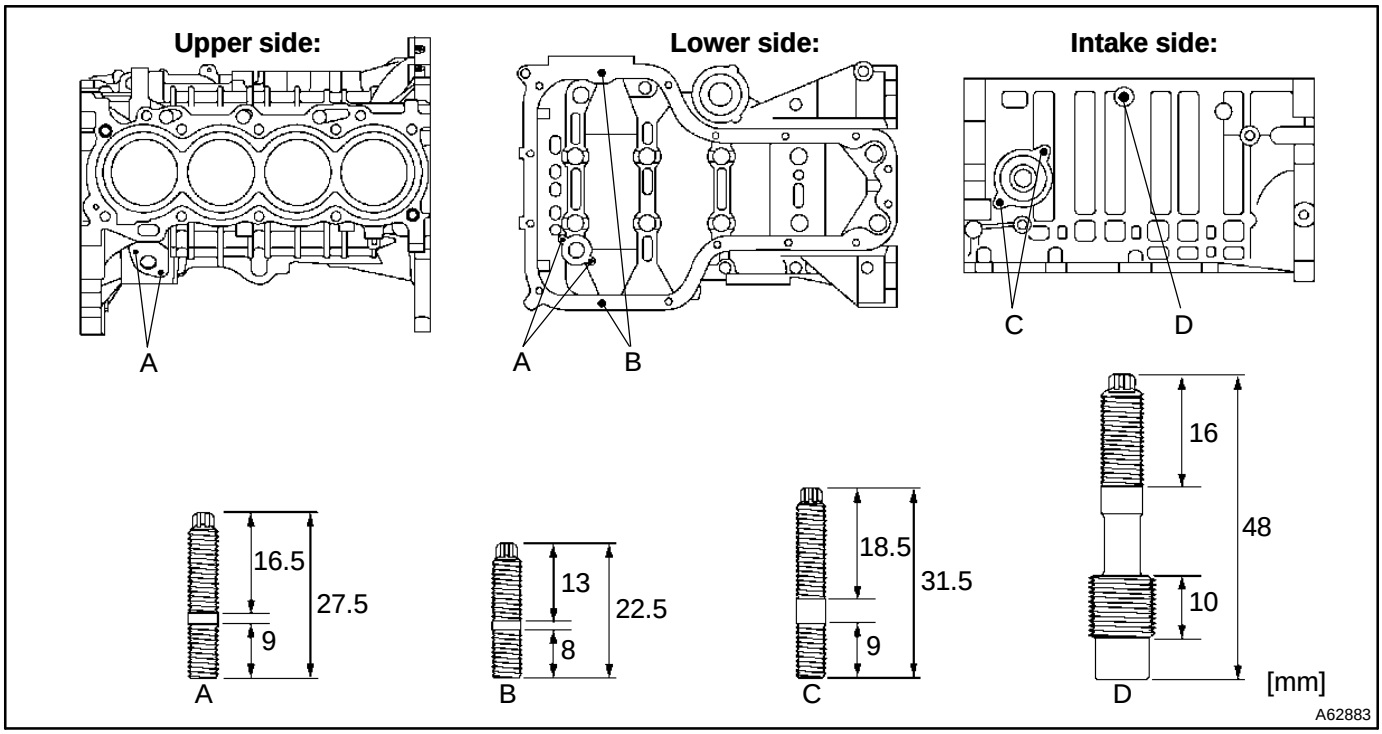
140KO-02



26. INSTALL STUD BOLT

(a) Install the 9 stud bolt to the cylinder block.

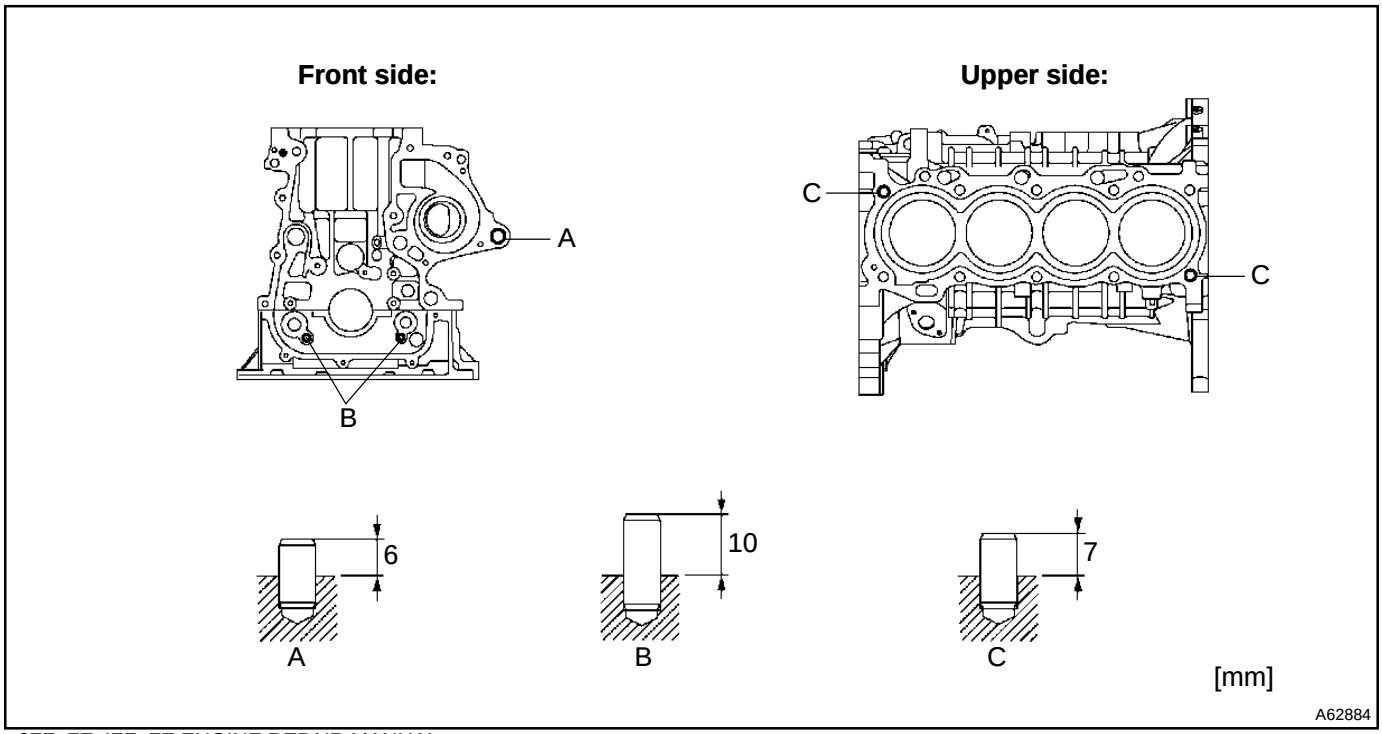
Torque:
Stud bolt A, B and C 5.0 N·m (51 kgf·cm, 44 in.·lbf)
Stud bolt D 11 N·m (112 kgf·cm, 8 ft·lbf)



27. INSTALL RING PIN

(a) Using a plastic hammer, install the 5 ring pins to the cylinder block.

Standard protrusion:
Ring pin A 6 mm (0.24 in.)
Ring pin B 10 mm (0.39 in.)
RIng pin C 7 mm (0.28 in.)



STARTER ASSY (DENSO MADE) (3ZZ-FE/4ZZ-FE)

COMPONENTS

190B7-01