ALTEZZA ENGINE MECHANICAL - (3S-GE)

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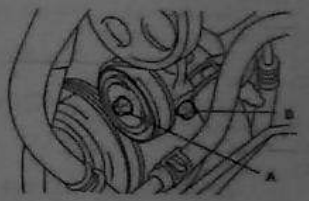
ENGINE ASSY

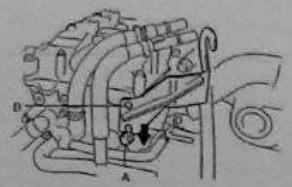
Removal and installation

Attention: When removing and installing engine ASSY, the vehicle's centre of gravity will move backward so take care when lifting it up. Install following the removal procedure in reverse. However, steps for installation only will be shown.

1. Carry out procedure to prevent fuel spills.
2. Remove engine hood.
(a) Detach washer hose then remove engine hood.
3. Remove engine under cover No.1.
4. Drain coolant.
5. Detach air cleaner inlet No.2.
6. Detach ventilation hose No.2.
7. Remove air cleaner ASSY.
(a) Remove intake airflow sensor connector.
(b) Remove vacuum hose.
(c) Remove air cleaner ASSY.
8. Remove air cleaner hose No.1.
9. Remove radiator inlet hose.
10. Remove radiator outlet hose.
11. Detach oil cooler inlet (A/T vehicles).
12. Detach oil cooler outlet (A/T vehicles).
13. Remove radiator ASSY.
Note: Remove radiator ASSY with fan motor attached.
(a) Detach cooling fan motor connector.
(b) Detach condenser fan motor connector.
(c) Detach temperature detect switch connector.
(d) Remove radiator support UPR.
(e) Remove radiator ASSY.
14. Remove engine wire harness.
(a) Remove engine control computer side connector, then remove together with engine ASSY.
15. Remove engine room ECU box.
16. Remove cooler V belt No.1.
(a) Loosen idler fixing nut A.
(b) Tighten adjusting bolt B.
(c) Remove cooler V belt No.1.
17. Remove alternator V belt.
(a) Loosen fixing bolts A and B.
(b) Loosen adjusting bolt C.
(c) Remove alternator V belt.
18. Detach heat inlet hose.
19. Detach heat outlet hose.
20. Detach accelerator control cable ASSY.
21. Detach starter B terminal.
22. Detach vacuum hose.
(a) Detach vacuum hose from vacuum transmitting pipe.
(b) Detach vacuum hose from manifold side vacuum hose union.
23. Detach fuel hose.
Attention: Cover with a cloth to prevent fuel leaks as the fuel pipe line has a little residual pressure.
24. Remove vane pump ASSY.
Rope or wire [52014]
Note: Hang with wire or rope without detaching P/S hose.
25. Remove idler pulley bracket No.1.
26. Remove pump bracket.
27. Remove water inlet.
Attention: Cover with a cloth as water will spill inside the engine.
28. Remove cooler compressor.
Rope or wire [52014]
Note: Remove with high/low pressure hose attached and hang with wire or rope.



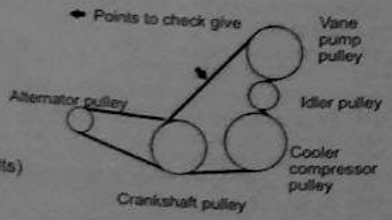
29. Remove engine hanger No.3.
    Engine hanger No.3 [12281-88570]
    Bolt with washer [91651-41025]
30. Remove engine hanger.
    Engine hanger [12281-88570]
    Bolt with washer [91651-41025]



(a) Remove the earth wire mounting bolt and B terminal clamp mounting bolt.
(b) Lightly tighten the A bolt and push in while sliding engine hanger.
(c) Tighten the bolts on parts A and B.
31. Remove and install automatic transmission.
32. Remove and install manual transmission.
33. Remove engine ASSY
(a) Detach engine mount from cross member.
(b) Lift out the engine ASSY from the vehicle using a chain block and engine sling device.
    Chain block [55801]
    Engine sling device [09090-04020]
34. Install engine ASSY
(a) Place engine ASSY in the vehicle using chain block and engine sling device.
    Chain block [55801]
    Engine sling device [09090-04020]
(b) Tighten engine mount.
    Standard value: T=53Nm {541kgf/cm}
35. Install fuel hose.
(a) Using a new gasket, match up the stopper on the fuel delivery pipe and the stopper on the fuel hose and tighten.
    Standard value: T=29Nm {296kgf/cm}
36. Install starter B terminal.
    Standard value: T=9.8Nm {100kgf/cm}
37. Install cooler compressor.
    Standard value: T=24.5Nm {250kgf/cm}
38. Install water inlet.
    Standard value: T-9.0Nm {92kgf/cm}
39. Install pump bracket.
    Standard value: T-39.2Nm {400kgf/cm}
40. Install vane pump ASSY.
    Standard value: T-42.1Nm {430kgf/cm}
41. Install alternator V belt.
42. Install cooler V belt No.1.
43. Install radiator ASSY
    Standard value: T-12.5Nm {128kgf/cm}
44. Fill with coolant and remove air.
45. Check for coolant leaks.

Checks, adjustments

1. Check coolant.
2. Check engine oil.
3. Check battery fluid level and density.
    Standard: Density 1.25~1.29 (temperature 20°C)
4. Check and clean air cleaner element.
5. Check cooler V belt No.1 tension and give.
    Straight rule, push-pull gauge [22102]
    Belt tension gauge [95506-00090]
    Standard values: 10~13mm (give when fitting new belts)
    13~16mm (give when checking)
    686~785N {70~80kgf} (tension when fitting new belts)
    196~343N {20~35kgf} (tension when checking)



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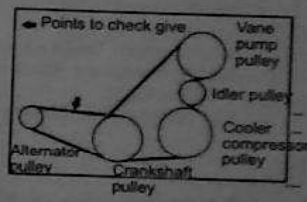
Attention:
- The give of belts should be measured at the specified points between pulleys.
- When replacing belts with new ones, adjust to the medium value of standard values in the [when fitting new] section.
- Checks on belts that have been used for more than five minutes should be verified by the standard values in the [when checking] section.
- When re-installing belts that have been used for more then five minutes, adjust to the medium value of standard values in the [when checking] section.

Note: Either the give standard values or the tension standard values may be used. When measuring give, pressure should be 98N {10kgf}.

6. Adjust cooler V belt No.1 tension.
(a) Loosen idler pulley fixing nut A.
(b) Adjust standard tension by turning adjusting bolt B.
    Straight rule, push-pull gauge [22102]
    Belt tension gauge [95506-00090]
(c) Tighten fixing nut A.
    Standard value: T=42Nm {429kgf/cm}
(d) Confirm belt tension or give.
    Straight rule, push-pull gauge [22102]
    Belt tension gauge [95506-00090]

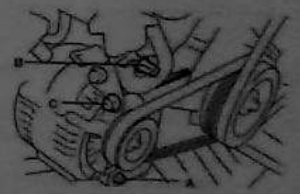
7. Check alternator V belt tension and give.
    Straight rule, push-pull gauge [22102]
    Belt tension gauge [95506-00090]
    Standard values: 10~10mm (give when fitting new belts)
    10~13mm (give when checking)
    588~784N {60~80kgf} (tension when fitting new belts)
    343~539N {35~55kgf} (tension when checking)



Attention:
- The give of belts should be measured at the specified points between pulleys.
- When replacing belts with new ones, adjust to the medium value of standard values in the [when fitting new] section.
- Checks on belts that have been used for more than five minutes should be verified by the standard values in the [when checking] section.
- When re-installing belts that have been used for more then five minutes, adjust to the medium value of standard values in the [when checking] section.

Note: Either the give standard values or the tension standard values may be used. When measuring give, pressure should be 98N {10kgf}.

8. Adjust alternator V belt tension
(a) Loosen fixing bolts A and B.
(b) Adjust standard tension by turning adjusting bolt C.
    Straight rule, push-pull gauge [22102]
    Belt tension gauge [95506-00090]
(c) Tighten fixing bolt A and B.
    Standard value: T=52Nm {531kgf/cm} (bolt A)
    T=28Nm {286kgf/cm} (bolt B)



(d) Confirm belt tension or give.
    Straight rule, push-pull gauge [22102]
    Belt tension gauge [95506-00090]
9. Check spark plugs.
(a) Remove oil filler cap.
(b) Remove cylinder head cover No.2.
    (1) Remove cylinder head cover No.2, using 5mm width hexagonal wrench to remove bolts
    Hexagonal pin wrench (5mm width) [10510]

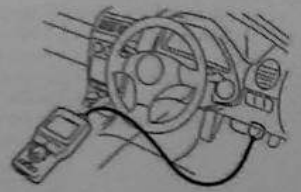
Attention: Do not drop bolts inside timing belt cover.

(c) Remove ignition coil ASSY
Attention: Take care when handling ignition coil as it contains igniter.

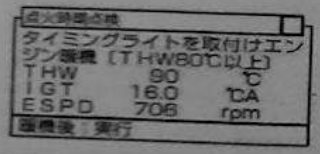
(d) Remove spark plugs.
(e) Check spark plug cap.
Attention: As platinum plugs are used, do not adjust caps unless they are new (less than 1000km driving). Do not damage platinum tips. As the platinum tips wear out when the limit is exceeded, replace the plugs.
Standard values

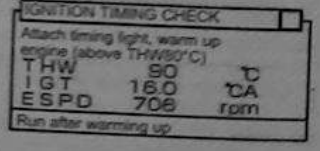
Manufacturer	Type	Standard value [mm]	Limit [mm]
Denso	PKR20R11	1.0 – 1.1	1.3

(f) Clean spark plugs.
Spark plug cleaner [54101]
Attention: Spark plugs should not be cleaned as this may damage platinum tips. However, if they are extremely dirty they may be cleaned in plug cleaner for a short time (less than 20 seconds) to protect the electrodes.
(g) Install spark plugs.
Standard value: T=17.5Nm {179kgf/cm}
(h) Install ignition coil ASSY
Standard value: T=8.5Nm {87kgf/cm}
10. Warm up engine.
11. Check for abnormal tappet sound.
12. Check idling revolutions (check with diagnostic tool S2000).
(a) Attach SST to DLC3
SST 09991-60100 (09991-60200)

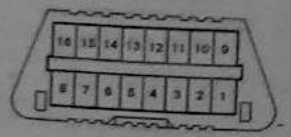


(b) Follow the instructions on the screen to display 点火時期点検 [IGNITION TIMING CHECK] and measure idling speed.
Attention: Ensure A/C and electric fan are off when doing this.
Standard value: 650~750 r/min (M/T)
700~800r/min (A/T)
Attention: Ensure electric fan is off when doing this.

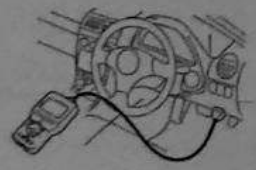




13. Check idling revolutions (check with primary current detecting revolution indicator)
(a) Attach tacho pulse pick up wire No.2 to the 9 TAC terminals on the DLC3 and connect the revolution indicator.
SST 09843-18030
Standard value: 650~750 r/min (M/T)
700~800r/min (A/T)
Attention: Ensure electric fan is off when doing this.



14. Check ignition timing (check with diagnostic tool S2000).
(a) Attach SST to DLC3
SST 09991-60100 (09991-60200)



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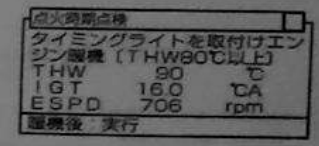
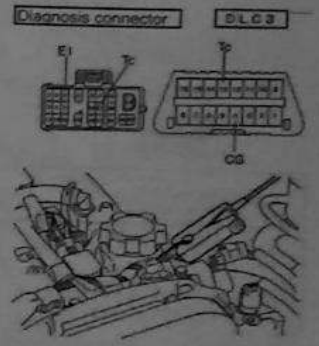
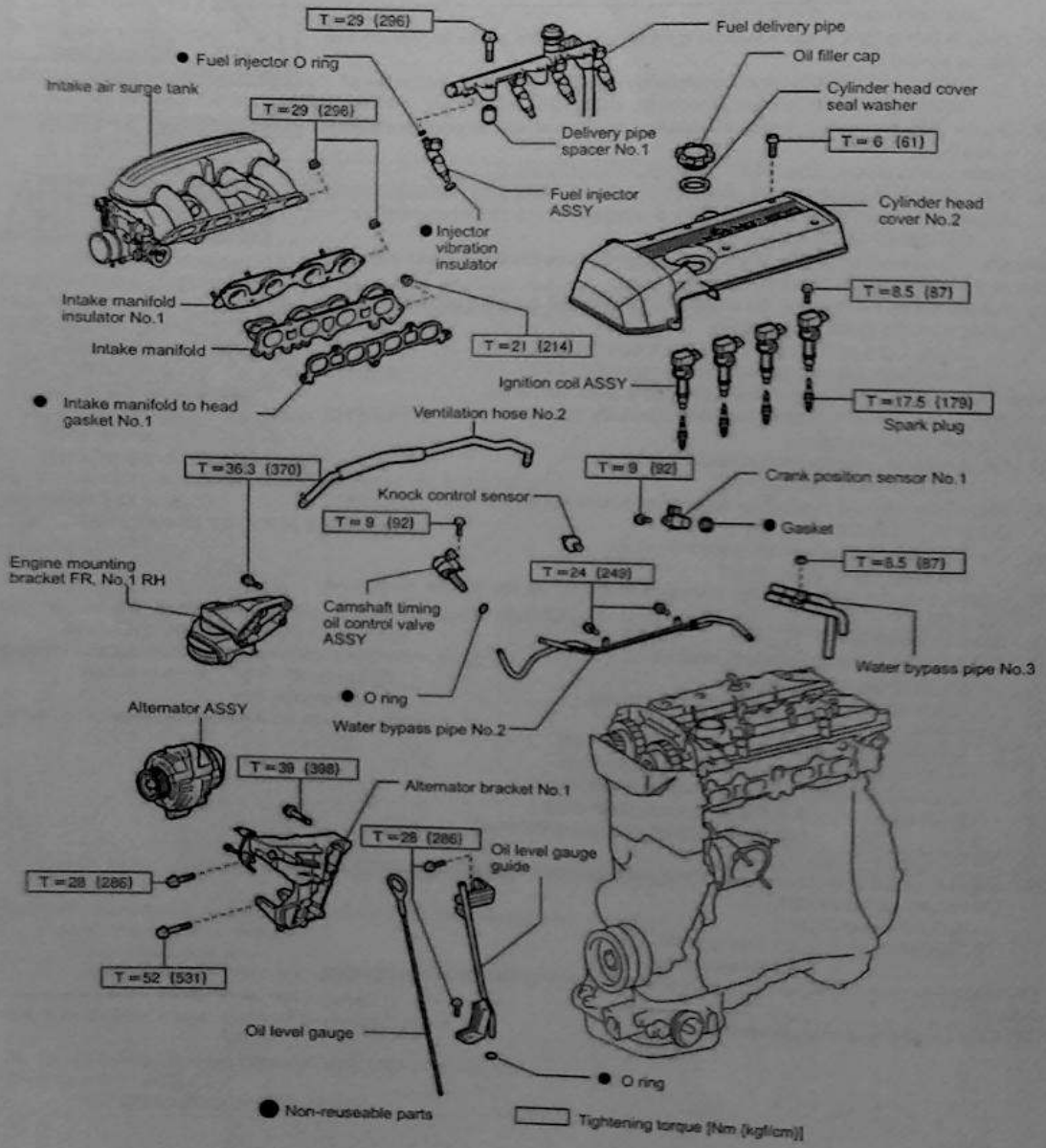
(b) Follow the instructions on the screen to display 点火時期点検 [IGNITION TIMING CHECK] and measure ignition timing.
Standard value: BTDC 9~24°
(c) Using a timing light, ensure that the ignition timing is the same as that on the display screen.
Timing Light (electric current detector type) [KTL-12C]
Timing light (electric current detector type) [TL-12C]
(d) Ensure that the ignition timing increases smoothly as the engine revolutions increase.
15. Check ignition timing (check with Tc terminal short circuit)
(a) Using diagnosis check wire or diagnosis check wire No.2, short circuit between diagnosis connector 11 (Tc) and 3 (E1), or between DLC3 13 (Tc) and 4 (Cg).
SST 09843-18020, 09843-18040
Attention: Be sure not to mistake the short circuit position as this could cause damage. Ensure the electric fan is off when doing this
(b) Pull out the wire harness in the position marked on the diagram, and connect the timing light clip to the wire harness.
Timing Light (electric current detector type) [KTL-12C]
Timing light (electric current detector type) [TL-12C]
Note: The colour of the wire harness pulled out is black and white.
Attention: Use a timing light which can detect primary light. After checking, be sure to tape the wire harness properly.
(c) Check ignition timing is within standard values.
Standard value: BTDC 8~12°
(b) Detach the diagnosis connector between terminals 11 (Tc) and 3 (E1), or between DLC3 13 (Tc) and 4 (Cg).
(e) Check ignition timing is within standard values.
Standard value: BTDC 9~24°
(f) Ensure that the ignition timing increases smoothly as the engine revolutions increase.
(g) Remove timing light.
16. Check intake manifold negative pressure.
Manifold gauge [21501]
Standard value: Above 53kPa {400mmHg}
17. Compression check
Gasoline compression gauge set [TBGCG-100]
Gasoline compression gauge set [TIGCG-100]
Standard value: 1.2MPa {12.2kgf/cm²} (250r/min)
Limit value: 1.1MPa {11kgf/cm²} (250r/min)
0.1MPa {1kgf/cm²} (cylinder differential)
18. CO HC density check
(a) After keeping engine revolutions at 2500r/min for around two minutes, check the CO HC density while idling.
CO HC meter [22201]
Standard value: CO density below 1.0%
HC density below 300ppm
Attention: If levels are in excess of standard values, check air-fuel ratio compensating device.
19. Check and adjust valve clearance.





PARTIAL ENGINE ASSY



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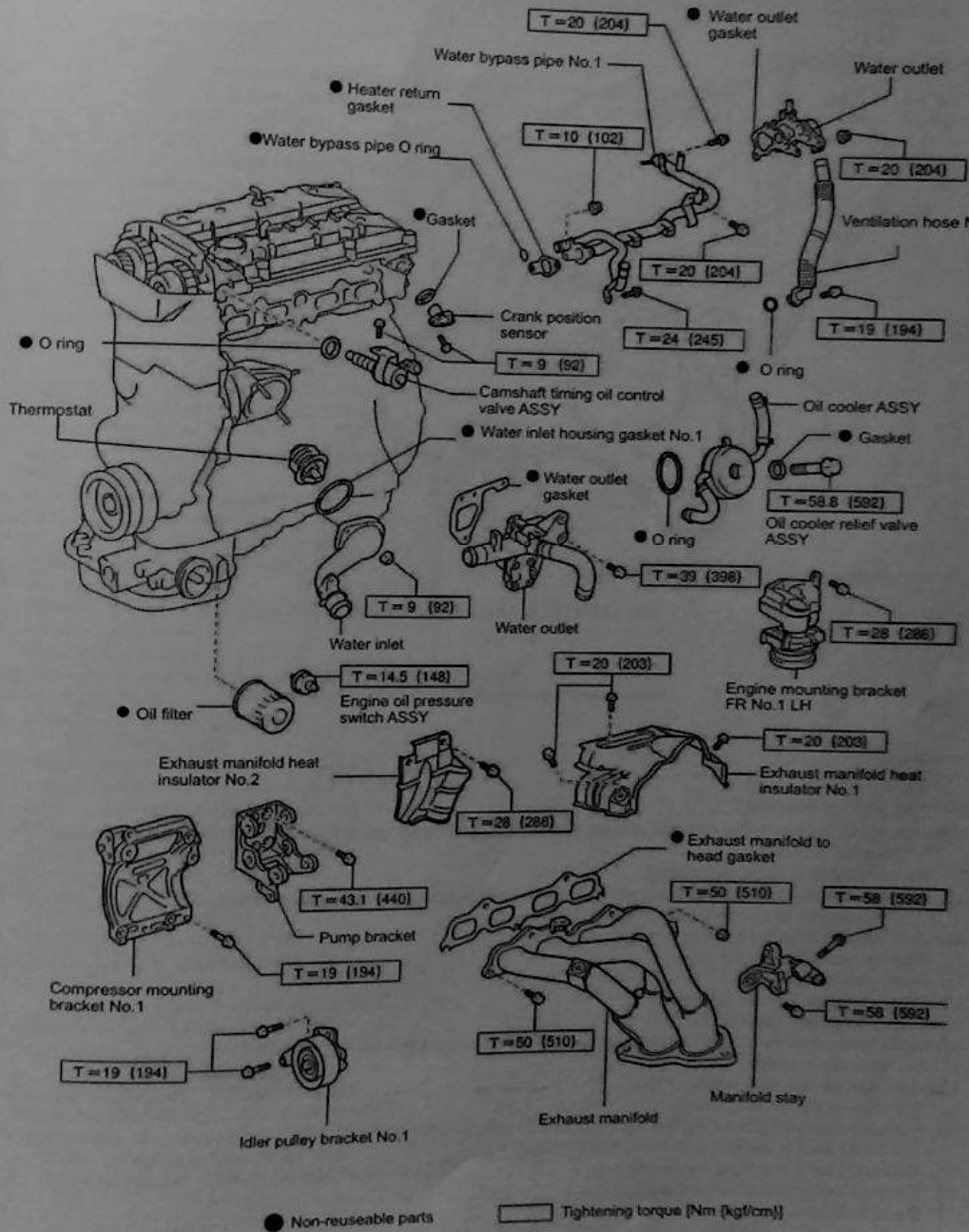
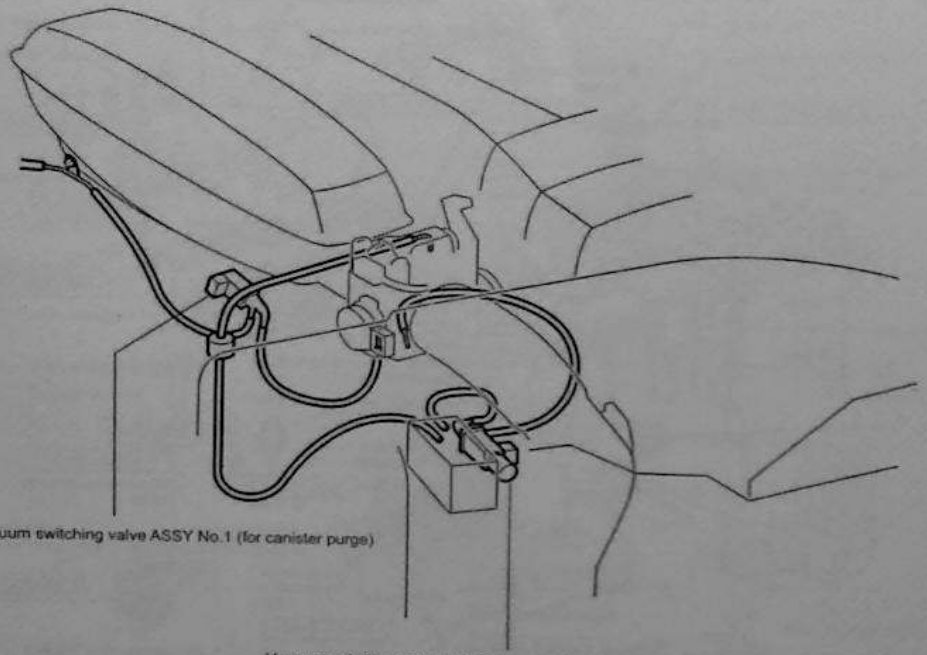


VACUUM PIPE



Removal and installation

Attention: Install following the removal procedure in reverse. However, steps for installation only will be shown.

1. Remove oil filler cap.
2. Remove cylinder head cover No.2.
(a) Remove cylinder head cover No.2, using 5mm width hexagonal wrench to remove bolts
Hexagonal pin wrench (5mm width) [10510]

Attention: Do not drop bolts inside timing belt cover.

3. Remove ventilation hose No.2.
4. Remove wire harness.
5. Remove water bypass pipe No.3.
6. Remove ignition coil ASSY.

Attention: Take care when handling ignition coil as it contains igniter.

7. Remove spark plugs.

Attention: Do not damage platinum tips.

8. Remove intake air surge tank.
(a) Remove using a 12mm deep socket wrench.
Deep socket wrench (12mm) [09017-38120]
9. Remove intake manifold insulator No.1.
10. Remove water bypass pipe No.2.
11. Remove intake manifold.

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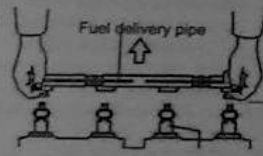
12. Remove fuel injector ASSY.
(a) Remove three bolts, lift up fuel delivery pipe at both ends and remove fuel delivery pipe.
(b) Remove delivery pipe spacer.
(c) Remove fuel injector ASSY.

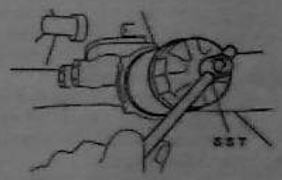


Attention: If the injector O ring is stuck and cannot be removed, do not apply excessive pressure to the injector in a lateral direction. If it cannot be removed, pull it out slowly while turning the injector left and right.

(d) Remove injector vibration insulator.
13. Remove engine mounting bracket FR No.1 RH.
14. Remove oil level gauge.
15. Remove oil level gauge guide.
16. Remove alternator ASSY.
17. Remove alternator bracket.
18. Remove exhaust manifold heat insulator No.1.
19. Remove manifold stay.
20. Remove exhaust manifold ASSY.
(a) Remove using 14mm deep socket wrench.
Deep socket wrench (14mm) [09017-3814]
21. Remove exhaust manifold heat insulator No. 2.
22. Remove engine mounting bracket FR No. 1 LH.
23. Remove idler pulley bracket No. 1.
24. Remove compressor mounting bracket No. 1.
25. Remove pump bracket.
26. Remove water outlet (engine LH side).
27. Remove ventilation hose No. 3.
28. Remove water outlet (engine RR side).
29. Remove water bypass pipe No.1.
30. Remove oil cooler ASSY.
(a) Remove oil cooler relief valve ASSY, then remove oil cooler ASSY with hose.
31. Remove water inlet.
32. Remove thermostat.

Note: As water may spill in the engine room, catch it with a cloth.

33. Remove oil filter.
(a) Remove oil filter using SST
SST 09228-06501



34. Remove engine oil pressure switch ASSY.
35. Remove camshaft timing oil control valve ASSY RH.
36. Remove camshaft timing oil control valve ASSY LH.
37. Remove crank position sensor No.1 RH.
38. Remove crank position sensor No.1 LH.
39. Remove knock control sensor.
(a) Remove knock control sensor using SST.
SST 09816-30010
40. Install knock control sensor SST.
(a) Install knock control sensor using SST.
SST 09816-30010
Standard value: T=44Nm {450kgf/cm}
41. Install crank position sensor.
(a) Apply engine oil to a new O ring, and install crank position sensor.
Genuine Toyota engine oil [32103]
Standard value: T=9Nm {92kgf/cm}
42. Install camshaft timing oil control valve ASSY.
(a) Apply engine oil to a new O ring, and install camshaft timing oil control valve ASSY.
Genuine Toyota engine oil [32103]
Standard value: T=9Nm {92kgf/cm}

43. Install engine oil pressure switch ASSY.
(a) Remove oil from the screw area of engine oil pressure switch ASSY.
(b) Apply adhesive 1324 to screw part of engine oil pressure switch ASSY.
Adhesive 1324 [50412]
(c) Install engine oil pressure switch ASSY.
Standard value: T=14.5 Nm {148kgf/cm}
Attention: After installation, do not operate the engine for one hour.
44. Install thermostat.
45. Install oil cooler ASSY.
(a) Make sure there is no dirt on the O ring or mounting surfaces.
(b) Apply engine oil to the mounting surfaces of the O ring, and install oil cooler ASSY.
Genuine Toyota engine oil [32103]
46. Install water bypass pipe No.1.
(a) Install water pump using new O ring and gasket.
Standard value: T=20 Nm {204kgf/cm}
(Water bypass pipe No. 1 & cylinder head)
T=10 Nm {102kgf/cm}
(Water bypass pipe No.1 & water pump)
T=24Nm {245kgf/cm}
(Water bypass pipe No.1 & pump bracket)
47. Install water outlet (engine RR side).
(a) Install using a new gasket.
Standard value: T=20Nm {204kgf/cm}
48. Install ventilation hose No.3.
Standard value: T=19Nm {194kgf/cm}
49. Install water outlet (engine LH side).
(a) Install using a new gasket.
Standard value: T=39Nm {398kgf/cm}
50. Install pump bracket.
Standard value: T=39.2Nm {400kgf/cm}
51. Install compressor mounting bracket No.1
Standard value: T=19Nm {194kgf/cm}
52. Install idler pulley bracket No.1
Standard value: T=19Nm {194kgf/cm}
53. Install engine mounting bracket FR No.1 LH.
Standard value: T=36.3Nm {370kgf/cm}
54. Install exhaust manifold heat insulator No.2.
Standard value: T=20Nm {204kgf/cm}
55. Install exhaust manifold.
(a) Install a new exhaust manifold to head gasket, using a 14 mm deep socket wrench.
Deep socket wrench (14 mm) [09017-38140]
Standard value: T=50Nm {510kgf/cm}
56. Install manifold stay.
Standard value: T=58Nm {592kgf/cm}
(Manifold stay & cylinder block)
57. Install exhaust manifold heat insulator No.1
Standard value: T=20Nm {204kgf/cm}
58. Install alternator bracket.
Standard value: T=39Nm {398kgf/cm}
59. Install oil level gauge guide.
(a) Install using a new O ring.
Standard value: T=28Nm {286kgf/cm}
60. Install engine mounting bracket FR No.1 RH.
Standard value: T=36.3Nm {370kgf/cm}
61. Install fuel delivery pipe.
Standard value: T=29Nm {296kgf/cm}
62. Install intake manifold.
(a) Install a new intake manifold to gasket head
Standard value: T=21Nm {214kgf/cm}

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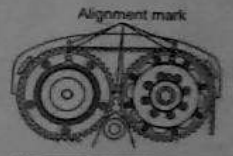
63. Install water bypass pipe No.2
Standard value: T=24Nm {245kgf/cm}
64. Install intake manifold insulator No.1
Standard value: T=29Nm {296kgf/cm}
65. Install intake air surge tank.
(a) Install using a 12 mm deep socket wrench
Deep socket wrench (12 mm) [09017-38120]
Standard value: T=29Nm {296kgf/cm}
66. Install spark plugs.
Standard value: T=17.5Nm {179kgf/cm}
67. Install ignition coil ASSY.
Standard value: T=8.5Nm {87kgf/cm}
68. Install water bypass pipe No.3
Standard value: T=8.5Nm {87kgf/cm}
69. Install cylinder head cover No.2.
(a) Install using 5 mm width hexagonal wrench.
Hexagonal pin wrench (5 mm width) [10510]
Standard value: T=6Nm {61kgf/cm}

VALVE CLEARANCE

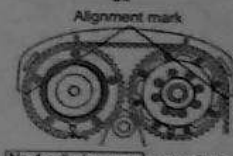
Checks and adjustments

Attention: Install following the removal procedure in reverse. However, steps for installation only will be shown.
1. Remove battery minus terminal.
2. Remove oil filler cap.
3. Remove cylinder head cover No.2.
(a) Remove cylinder head cover No.2 using 5 mm width hexagonal wrench.
Hexagonal pin wrench (5 mm width) [10510]
4. Detach ventilation hose.
5. Detach ventilation hose No.2.
6. Detach wire harness
7. Remove ignition coil ASSY
8. Remove cylinder head cover.
(a) Remove water bypass pipe No.3 mounting nut.
(b) Remove 9 bolts, then remove cylinder head cover.
9. Check valve clearance.
Attention: Conduct valve clearance checks when engine is cold.
(a) Rotate crankshaft and set No.1 cylinder at compression top dead center.
Attention: Never allow the crankshaft to rotate in reverse.



(b) Using an SST measure the valve clearance at the points marked on the diagram.
SST 09203-00020
Standard value: IN 0.17~0.27 mm (When cold)
EX 0.32~0.42 mm [A/T] (When cold)
EX 0.25~0.35 mm [M/T] (When cold)
(c) If outside of standard values, measure clearance and make a note.

(d) Rotate crankshaft once and set No.4 cylinder at compression top dead center.
Attention: Never allow the crankshaft to rotate in reverse.



(e) Using an SST measure the valve clearance at the points marked on the diagram.
SST 09203-00020
Standard value: IN 0.17~0.27 mm (When cold)
EX 0.32~0.42 mm [A/T] (When cold)
EX 0.25~0.35 mm [M/T] (When cold)
(c) If outside of standard values, measure clearance and make a note.

10. Camshaft installation and removal
11. Adjust valve clearance

Attention: Conduct valve clearance adjustment when engine is cold.

(a) Remove valve lifter or valve adjusting shim from cylinder head.

Attention: When removing valve adjusting shim, be sure not to drop it in the cylinder head.

(b) Using a micrometer, measure the thickness of the removed valve adjusting shim.
Micrometer [20301]

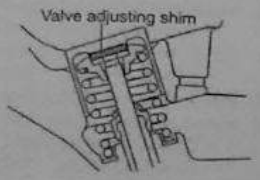
(c) Select valve adjusting shim.

Shim = removed shim thickness + (measured valve clearance - standard valve clearance)

Note: There are 17 different types of shim ranging from 2.550~3.350 mm, and the largest is 3.390 mm.

(d) Install the selected valve adjusting shim or valve lifter.

(e) Check the valve clearance at the point where shim was changed.



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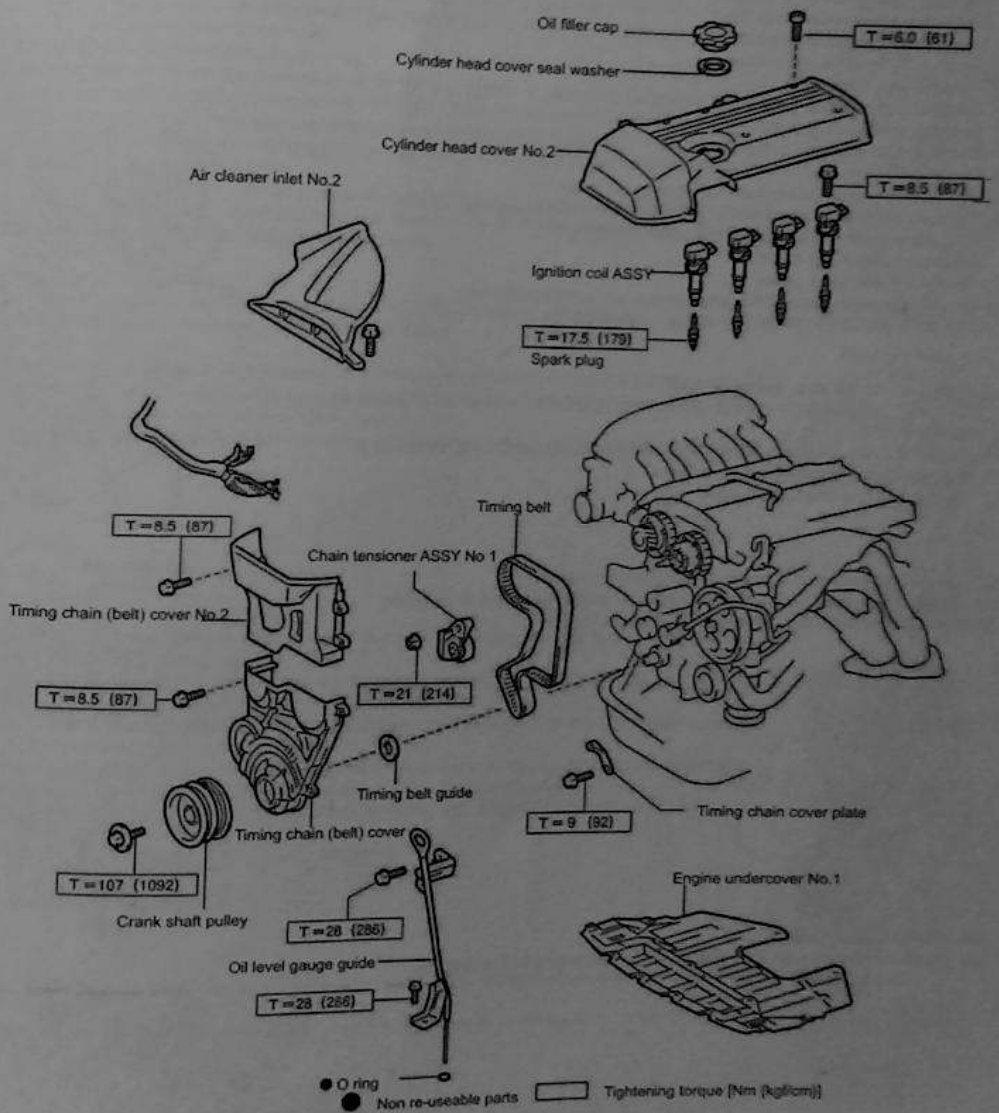
TIMING BELT



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Removal and installation

Attention: Install following the removal procedure in reverse. However, steps for installation only will be shown.

1. Remove battery minus terminal.
2. Remove engine undercover No.1.
3. Remove air cleaner inlet No.2.
4. Remove oil level gauge guide.
5. Remove wire harness.
6. Remove cooler V belt No.1.
7. Remove alternator V belt.
8. Remove cylinder head cover No.2.

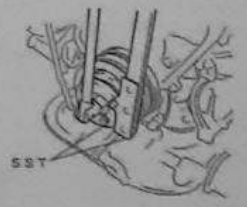
(a) Remove oil filler cap.

Attention: Be sure not to drop bolts inside cylinder head.

(b) Remove cylinder head cover No.2 using 5 mm width hexagonal wrench.
Hexagonal pin wrench (5 mm width) [10510]

9. Remove ignition coil ASSY.
10. Remove crank shaft pulley.

(a) Secure the pulley using SST, and remove crankshaft pulley bolt.
SST 09213-54015 (91651-60855), 09330-00021



(b) Remove crankshaft pulley using SST
SST 09950-50010 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05030)

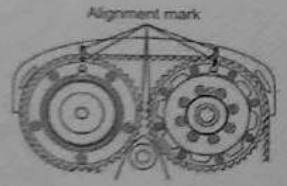
Attention: Apply grease to the screw area and end of centre bolt 100 before use.

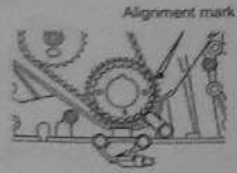
11. Remove timing chain (belt) cover No.2.
12. Remove timing chain (belt) cover.

13. Set No.1 cylinder at compression top dead center.

(a) Rotate crankshaft and set No.1 cylinder at compression top dead center.

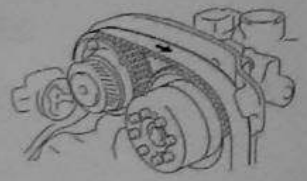
Attention: Never allow the crankshaft to rotate in reverse.





14. Remove timing belt.

(a) Mark the direction on the reverse side of the timing belt with chalk.
Chalk [52802]



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(b) Remove chain tensioner ASSY No.1.

(1) Apply load to chain tensioner ASSY No.1 for around 2 minutes, match up the openings in the rod and cylinder, and insert 3 mm L-type hexagonal pin wrench.
L-type hexagonal pin wrench (3 mm) [AW-0300]

Attention: Do not apply a load of more than 60Nm {6.1kgf/cm} the nuts.

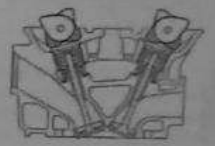
(2) Remove timing belt idler shaft from chain tensioner ASSY No.1

(c) Remove timing chain cover plate.

(d) Remove timing belt from each pulley

Attention: Never rotate the crankshaft while the timing belt is removed. (Damage may be caused by friction between the piston and the valve) If the camshaft is rotated while the timing belt is removed, rotate the crankshaft timing pulley left 90°. When installing timing belt, always return the camshaft to the alignment mark position before rotating the crankshaft timing pulley to the right to its original position.

Note: By setting the No.1 cylinder in a position at 90° before the top dead centre, there will be no friction with the piston even if the valve is opened fully. By turning the cams on either side alternately, there will be no friction between valves.



15. Timing belt idler check.

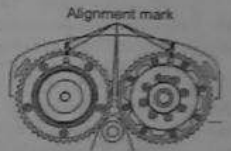
(a) Turn the timing belt idler by hand, and ensure that it rotates smoothly.

(b) Ensure grease does not spatter on the seal area.

16. Install timing belt

Attention: If any water or oil is found on the timing belt or pulleys, repair the leaking area and install a new timing belt. Always wipe any dirt from pulleys with a cloth before installing. Do not wash pulleys. Tighten the four spark plugs by hand.

(a) Ensure the assembly marks on each pulley match the alignment marks on the body side.



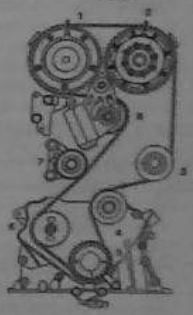
(b) Check the rotation direction of the timing belt, then hang the timing belt following the order shown in the diagram.

Note: Ensure there is enough slack on the loose side of the belt where the tensioner is fitted.

(c) Hang the belt on the tensioner idler, and insert the tensioner into the shaft while twisting it in an anticlockwise direction.

Attention: Tighten the nuts after ensuring that the tensioner rod does not hit the pins inside the bracket. Be sure never to push in the tensioner when tightening the nuts.

(d) Ensure the movement of the tensioner by hand, and install chain tensioner ASSY No.1 by hand.
Standard value: T=21Nm {214kgf/cm}

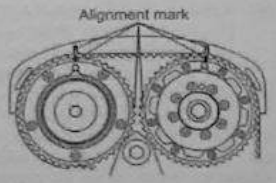


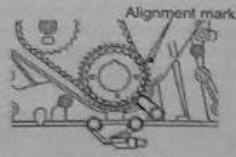
(e) Apply load to chain tensioner ASSY No.1, pull out rod-fixing hexagonal pin wrench and remove.

Attention: Do not apply a load of more than 60NM {6.1kgf/cm} to the nuts.

(f) Turn the crankshaft two revolutions in the correct direction and confirm that when the marks on the crankshaft timing pulley and the oil pump are aligned, the marks on the camshaft timing pulleys and camshaft bearing cap No.1 are also aligned.

Attention: If the crankshaft is turned too far, turn it two times in the correct direction again and align marks once more. Never allow the crankshaft to turn in the reverse direction.





17. Install timing belt guide

Attention: Install belt guide in direction shown in diagram.

18. Install timing chain (belt) cover.
(a) Using a new timing belt cover gasket, install timing chain (belt) cover.
Standard value: T=8.5Nm {87kgf/cm}
19. Install timing chain (belt) cover No.2.
(b) Using a new timing belt cover gasket, install timing chain (belt) cover No.2.
Standard value: T=8.5Nm {87kgf/cm}

20. Install crankshaft pulley.
(a) Install crankshaft pulley using SST.
SST 09213-54015 (91651-60855), 09330-00021
Standard value: T=107Nm {1092kgf/cm}
21. Install spark plugs.
Standard value: T=17.5Nm {179kgf/cm}
22. Install ignition coil ASSY.
Standard value: T=8.5Nm {87kgf/cm}
23. Install cylinder head cover No.2.
(a) Install cylinder head cover No.2 using 5 mm width hexagonal wrench.
Hexagonal pin wrench (5 mm width) [10510]
Standard value: T=6Nm {61kgf/cm}

Attention: Be sure not to drop bolts inside cylinder head.

24. Install alternator V belt.
25. Install cooler V belt No.1

TIMING BELT COVER GASKET

Removal and installation

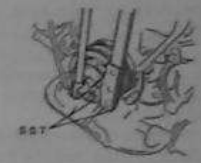
Attention: Install following the removal procedure in reverse. However, steps for installation only will be shown.

1. Remove battery minus terminal.
2. Remove engine undercover No.1.
3. Remove air cleaner inlet No.2.
4. Remove oil level gauge guide.
5. Remove wire harness.
6. Remove cooler V belt No.1.
7. Remove alternator V belt.
8. Remove cylinder head cover No.2.
(a) Remove oil filler cap.

Attention: Be sure not to drop bolts inside cylinder head.

(b) Remove cylinder head cover No.2 using 5 mm width hexagonal wrench.
Hexagonal pin wrench (5 mm width) [10510]

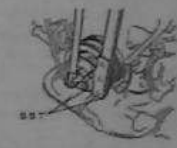
9. Remove crank shaft pulley.
(a) Secure the pulley using SST, and remove crankshaft pulley bolt.
SST 09213-54015 (91651-60855), 09330-00021
(b) Remove crankshaft pulley using SST.
SST 09950-50010 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05030)



Attention: Apply grease to the screw area and end of centre bolt 100 before use.

10. Remove timing chain (belt) cover No.2.
11. Remove timing belt cover gasket.
12. Remove timing chain (belt) cover.
13. Remove timing belt cover gasket.
14. Install timing chain (belt) cover.
(a) Using a new timing belt cover gasket, install timing chain (belt) cover.
Standard value: T=8.5Nm {87kgf/cm}
15. Install timing chain (belt) cover No.2.
(b) Using a new timing belt cover gasket, install timing chain (belt) cover No.2.
Standard value: T=8.5Nm {87kgf/cm}

16. Install crankshaft pulley.
(a) Install crankshaft pulley using SST.
SST 09213-54015 (91651-60855), 09330-00021
Standard value: T=107Nm {1092kgf/cm}
17. Install cylinder head cover No.2.
(a) Remove oil filler cap.
(b) Install cylinder head cover No.2 using 5 mm width hexagonal wrench.
Hexagonal pin wrench (5 mm width) [10510]
18. Install alternator V belt.
19. Install cooler V belt No.1



CAMSHAFT

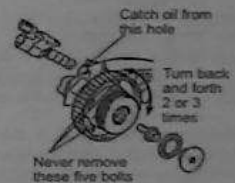
Removal and installation

Attention: Install following the removal procedure in reverse. However, steps for installation only will be shown.

1. Remove and install timing belt.
2. Detach ventilation hose.
3. Detach ventilation hose No.2.
4. Remove ignition coil ASSY.
5. Remove cylinder head cover.
(a) Remove water bypass pipe No.3 mounting nut.
(b) Remove nine bolts, then remove cylinder head cover.
6. Remove camshaft timing gear ASSY.

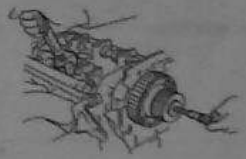
Attention: Never remove the timing gear set bolts shown in the diagram. As the camshaft timing gear ASSY is assembled using a jig in line with valve timing, if it is disassembled, replace from camshaft timing gear ASSY. When removing straight screw plugs there is a danger that oil will spill on timing parts so be sure to carry out work following the procedure.

(a) Remove bolts and remove camshaft timing oil control valve.
(b) Turn the camshaft timing gear ASSY periphery left and right 2 or 3 times within the possible range [25°~28° (50°~56°C A)], and catch the oil out of the inside of the camshaft timing gear from the camshaft timing oil control valve mounting hole with a cloth.



Note: Around 20 ml of oil will be discharged.

(c) Using a 10mm hexagonal socket wrench, remove straight screw plugs and seal washers.
Hexagonal wrench set [09040-00010]
Hexagonal socket wrench 10 [09043-20100]



Attention: As a small amount of oil may spill out, carry out the procedure with a cloth under the plugs.

(d) Secure the hexagonal servicing part of the camshaft, and use a 10mm hexagonal socket wrench to remove the set bolts, then remove the camshaft timing gear ASSY.
Hexagonal wrench set [09040-00010]
Hexagonal socket wrench 10 [09043-20100]

Note: If the camshaft timing gear ASSY is too tight, tap it lightly with a brass bar or other tool to remove it.

7. Remove camshaft timing pulley ASSY.

Attention: Never remove the timing pulley set bolts and exhaust piston cover set bolts marked on the diagram. As the camshaft timing pulley ASSY is assembled using a jig in line with valve timing, if it is disassembled, replace from camshaft timing pulley ASSY. When removing straight screw plugs there is a danger that oil will spill on timing parts so be sure to carry out work following the procedure.

Warning: If the timing pulley set bolts are removed, the flange may burst out due to the force of the spring inside the timing pulley, which may result in injury.

(a) Remove bolts and remove camshaft timing oil control valve.
(b) Using straight hexagonal wrench 14, remove straight screw plugs and washers.
Hexagonal wrench set [09040-00010]
Hexagonal socket wrench 14 (09043-30140)

Attention: As oil may spill out and build up on camshaft timing pulley ASSY wipe with a cloth immediately.

(c) Secure the hexagonal servicing part of the camshaft, and use a 10mm hexagonal socket wrench to remove the set bolts, then remove the camshaft timing pulley ASSY.
Hexagonal wrench set [09040-00010]
Hexagonal socket wrench 10 [09043-20100]

Note: If the camshaft timing pulley ASSY is too tight, tap it lightly with a brass bar or other tool to remove it.

8. Remove camshaft (A/T)

(a) Loosen the camshaft bearing cap set bolts on the left and right evenly in instalments in the order shown in the diagram, then remove camshaft bearing cap No.1 and camshaft bearing cap No.2.
(b) Remove camshaft.

9. Remove camshaft (M/T).

(a) Loosen the camshaft bearing cap set bolts on the left and right evenly in instalments in the order shown in the diagram, then remove camshaft bearing cap No.1 and camshaft bearing cap No.2.
(b) Remove camshaft.

10. Remove camshaft oil seal.

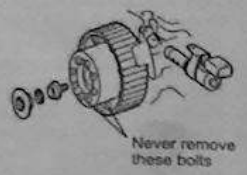
11. Remove camshaft.

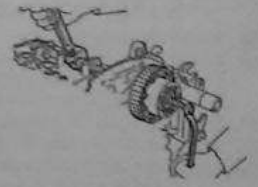
(a) Apply a small amount of engine oil to journal part of camshaft and bearing.
Genuine Toyota engine oil [32103]
(b) Set the camshaft on the cylinder head, putting the camshaft pin in the position shown in the diagram.

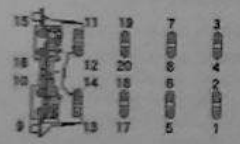
Attention: Assemble as in the diagram, with the camshaft positioned in the most stable rotation direction. After tightening the cam cap, always stabilize the position of other cams as in the diagram before turning the camshaft (To prevent friction between suction valves).

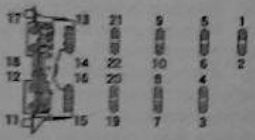
(c) Remove any grease from camshaft bearing cap No.1.
(d) Insert oil control valve filter from the lower surface of camshaft bearing cap No.1. Push in until filter seal part is around the same height as camshaft bearing cap lower surface.

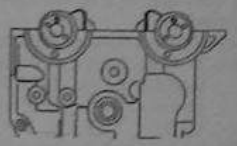
Attention: Be sure not to touch filter mesh area.

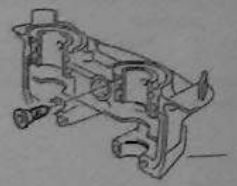












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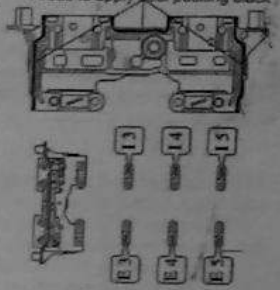
(e) Apply seal packing black in 2mm diameter beads to the areas on camshaft bearing cap No.1 shown in the diagram.
Seal packing black [50907]

Attention: Remove any grease from the mounting face and areas where the seal packing will be applied. Install within five minutes of applying seal packing. Do not start the engine for two hours after installing. Do not apply more than 2 mm of seal packing.

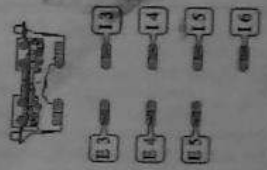
(f) Set the camshaft bearing cap in the direction shown in the diagram (A/T).



(g) Tighten camshaft bearing caps No.1 and No.2 in instalments in the order shown in the diagram. (A/T)
Standard value: T=18.5Nm {189kgf/cm}

Attention: Tightening should be separated into light tightening and full tightening. (In full tightening, specified torque should be applied)

(h) Set the camshaft bearing cap in the direction shown in the diagram (M/T).

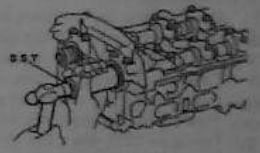


(i) Tighten camshaft bearing caps No.1 and No.2 in instalments in the order shown in the diagram. (A/T)
Standard value: T=18.5Nm {189kgf/cm}

Attention: Tightening should be separated into light tightening and full tightening. (In full tightening, specified torque should be applied)

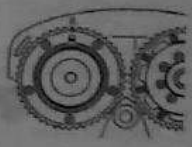
(j) Using an SST, push the oil seal into the deepest part of the cylinder head.
SST 09223-00010

Attention: Do not hit the SST too hard.



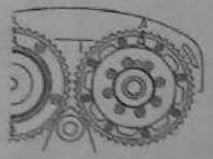
12 Install camshaft timing gear ASSY.

(a) Match up the camshaft straight pin and camshaft timing gear ASSY mounting hole, and push it into the camshaft timing gear ASSY by hand until you feel it hit the bottom.
(b) Secure the camshaft using the hexagonal servicing part of the camshaft, and install the set bolt using a 10 mm hexagonal socket wrench.
Hexagonal wrench set [09040-00010]
Hexagonal socket wrench 10 [09043-20100]
Standard value: T=75Nm {765kgf/cm}
(c) Ensure that the circumference of the camshaft timing gear ASSY turns within a range of 25~28°.



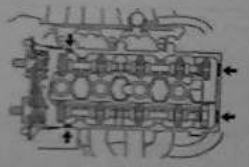
(d) Install straight screw plug with seal washer using 10 mm hexagonal wrench.
Hexagonal wrench set [09040-00010]
Hexagonal socket wrench 10 [09043-20100]
Standard value: T=23Nm {235kgf/cm}

13. Install camshaft timing pulley ASSY.
(a) Match up the camshaft straight pin and camshaft timing pulley mounting hole, and push it into the camshaft timing gear ASSY by hand until you feel it hit the bottom.
(b) Secure the camshaft using the hexagonal servicing part of the camshaft, and install the set bolt using a 10 mm hexagonal socket wrench.
Hexagonal wrench set [09040-00010]
Hexagonal socket wrench 10 [09043-20100]
Standard value: T=75Nm {765kgf/cm}



(c) Install straight screw plug with seal washer using 14 mm straight hexagonal wrench.
Hexagonal wrench set [09040-00010]
Straight hexagonal socket wrench 14 [09043-30140]
Standard value: T=30Nm {306kgf/cm}
14. Install camshaft timing oil control valve ASSY.
(a) Install the camshaft timing oil control valve using a new o ring.
Standard value: T=9Nm {92kgf/cm}

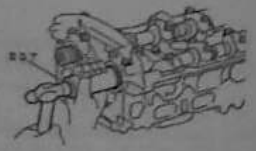
15. Install cylinder head cover.
(a) Apply seal packing black to the areas shown in the diagram and install.
Seal packing black [50907]
Standard value: T=11Nm {112kgf/cm}
Attention: Remove any grease from the mounting face and areas where the seal packing will be applied. Install within five minutes of applying seal packing. Do not start the engine for two hours after installing.
16. Install ignition coil ASSY.
Standard value: T=8.5Nm {87kgf/cm}



CAMSHAFT SETTING OIL SEAL

Removal and installation

Attention: Install following the removal procedure in reverse. However, steps for installation only will be shown.
1. Remove and install timing belt.
2. Remove camshaft timing gear ASSY.
3. Remove camshaft timing pulley ASSY.
4. Remove camshaft setting oil seal.
5. Install camshaft setting oil seal.
(a) Insert a new oil seal into camshaft from lip area.
(b) Using an SST, push the oil seal into the deepest part of the cylinder head.
SST 09223-00010
Attention: Do not hit the SST too hard.



6. Install camshaft timing pulley ASSY.
7. Install camshaft timing gear ASSY.
8. Install camshaft timing oil control valve ASSY.
(a) Install camshaft bearing cap No.1 to camshaft timing oil control valve ASSY.
Standard value: T=9Nm {92kgf/cm}

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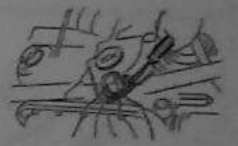
CRANKSHAFT SEAL

Removal and installation

Attention: Install following the removal procedure in reverse. However, steps for installation only will be shown.
1. Remove and install timing belt.
2. Remove crankshaft timing pulley
(a) Remove crankshaft timing pulley using SST.
SST 09950-50012 (09951-05010, 09952-05010, 09953-05020, 09953-05020, 09954-05060)
Attention: Apply oil to the screw part or point of the SST center bolt before using.

3. Replace crankshaft oil seal.
(a) Cut away from lip area using a utility knife.
Utility knife [50601]
(b) Remove oil seal using a flat-head screwdriver covered in plastic tape.
Plastic tape [53702]
Sandpaper [50801]
Attention: After removing oil seal, ensure that the bearing chamfer area of the crankshaft is not scratched. If there are any scratches, repair them with sandpaper (#400).



(c) Using an SST, drive a new oil seal in until it touches the oil pump housing.
SST 09316-60011 (09316-00011)
Attention: Ensure there is no dirt on the lip area. Do not hammer in oil seal at an angle.

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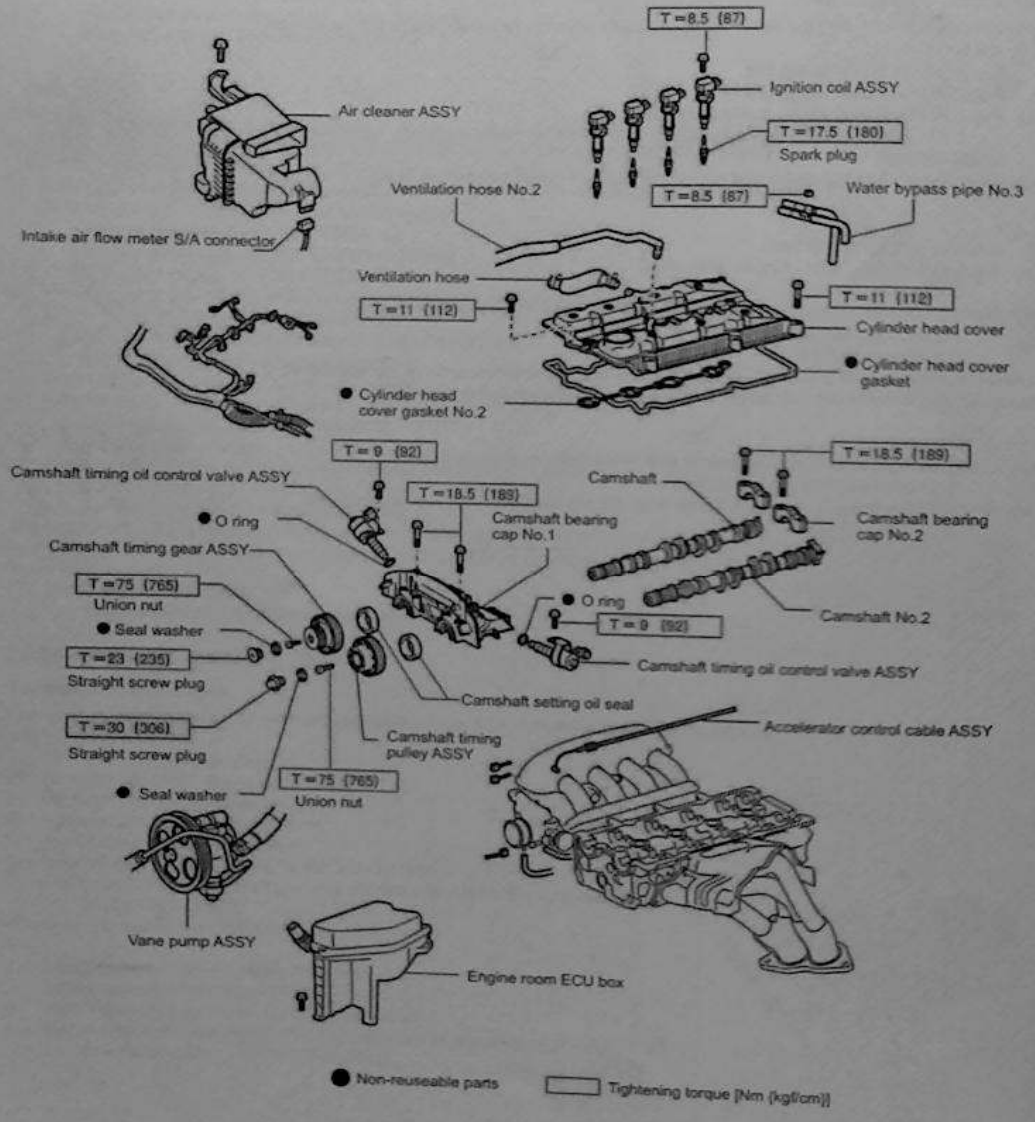
CYLINDER HEAD GASKET



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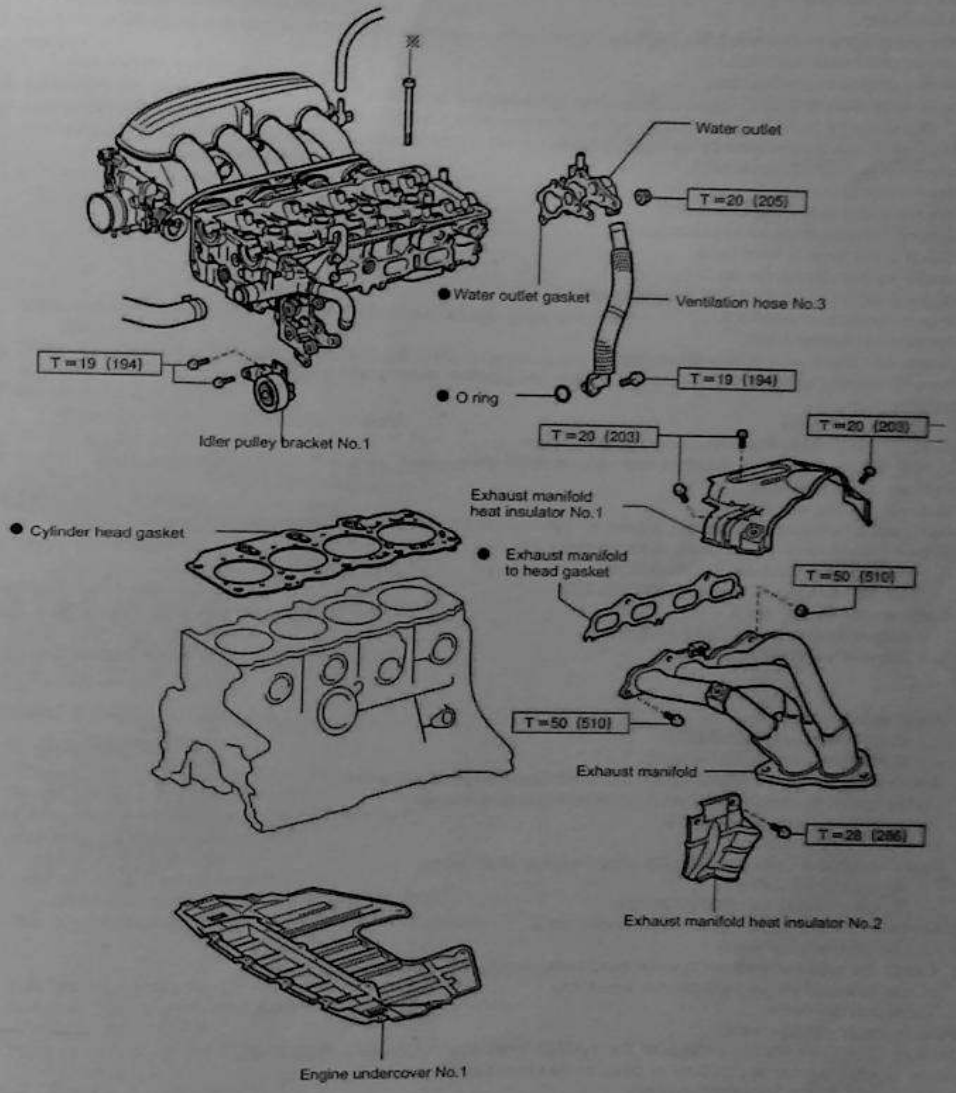

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Removal and installation

Attention: Install following the removal procedure in reverse. However, steps for installation only will be shown.

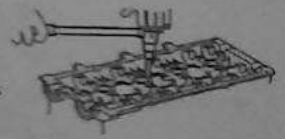
1. Carry out procedure to prevent fuel spills.
2. Remove and install camshaft.
3. Remove engine room ECU box.
4. Remove vane pump ASSY
   Rope or wire [52014]

Note: Hang with wire etc., without detaching P/S hose.

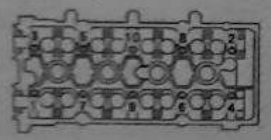
5. Remove idler pulley bracket No.1.
6. Remove pump bracket.
7. Remove and install exhaust manifold.
8. Remove exhaust manifold insulator No.2.
9. Detach water bypass hose No.5.
10. Detach water bypass pipe No.1.
(a) Remove two water pump ASSY mounting nuts.
11. Detach ventilation hose No.3.
12. Remove air cleaner ASSY.
13. Detach fuel pressure regulator return hose.

Attention: As there is a little residual pressure in the fuel pipeline, cover it with a cloth to avoid spilling fuel.

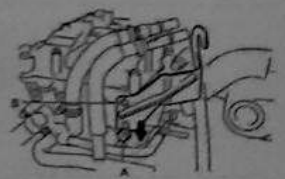
14. Detach vacuum hose.
(a) Detach vacuum hose from vacuum transmitting pipe.
(b) Detach vacuum hose from manifold side vacuum hose union.
15. Remove surge tank stay.
16. Remove cylinder head bolt.
(a) Using a double hexagon 10 wrench, loosen the cylinder head bolts evenly in instalments following the order in the diagram, then remove them.
   Hexagonal wrench set [09040-00010]
   Double hexagon 10 wrench [09043-50100]



17. Install engine hanger No.3.
   Engine hanger No.3 [12283-74060]
   Bolt with washer [91651-41025]



18. Install engine hanger.
   Engine hanger [12281-88570]
   Bolt with washer [91651-41025]
(a) Remove the earth wire mounting bolt and B terminal clamp mounting bolt.
(b) Lightly tighten the A bolt and push in while sliding engine hanger.
(c) Tighten the bolts on parts A and B.



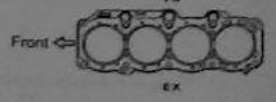
19. Remove cylinder head.
(a) Remove cylinder head using engine sling device or chain block.
   Chain block [55801]
   Engine sling device [09090-04020]
(b) Remove cylinder head gasket from cylinder block.
20. Check cylinder head bolts.
(a) Check the extent of wear on cylinder head bolts visually, and if the bolt shaft is narrow or has changed shape, replace with a new one.
21. Install cylinder head.

Attention: Install cylinder head.

Attention: Clean the bottom surface of the cylinder head and the upper surface of the cylinder block. Remove any coolant or other matter from head bolt hole. Tighten cylinder head bolts with plastic tightening method.

(a) Install new cylinder head gaskets to the cylinder block as shown in the diagram.

Attention: Ensure that the coating on the surface of the gasket is not damaged. Do not allow foreign matter to get in between the top or bottom of the gasket.



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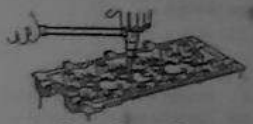
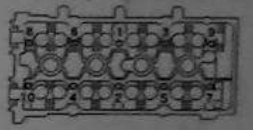
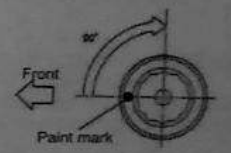
(b) Using an engine sling device and a chain block, install the cylinder head to the cylinder block.
   Chain block [55801]
   Engine sling device [09090-04020]
(c) Apply a small amount of engine oil to screw area and seating face of head bolt and the washer.
   Genuine Toyota engine oil [32103]
(d) Assemble the washers on top of the cylinder head and insert the cylinder head bolts.
(e) Using a double hexagon 10 wrench, lightly tighten the 10 head bolts in 2 or 3 instalments following the order in the diagram, then tighten them to the specified torque.
   Hexagonal wrench set [09040-00010]
   Double hexagon 10 wrench [09043-50100]
   Standard value: T=49Nm {500kgf/cm}





(f) Make a paint mark on the engine front side of the cylinder head bolt head.
   Paint [51102]
(g) Tighten each head bolt 90° following the order in the diagram, using the paint mark as a guide.



22. Install surge tank stay.
   Standard value: T=12.5Nm {128kgf/cm}
23. Install water bypass pipe No.1.
(a) Install to water pump using a new O ring and gasket.
   Standard value: T=10Nm {102kgf/cm}
24. Install exhaust manifold insulator No.2.
   Standard value: T=28Nm {286kgf/cm}
25. Install pump bracket.
   Standard value: T=39.2Nm {400kgf/cm}
26. Install idler pulley bracket No.1.
   Standard value: T=19Nm {194kgf/cm}
27. Install vane pump ASSY.
   Standard value: T=42.1Nm {430kgf/cm}

ENGINE REAR OIL SEAL

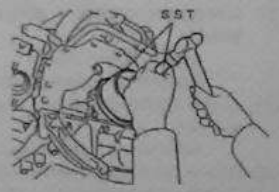
Removal and installation

1. Remove engine undercover No.1.
2. Remove engine undercover No.2.
3. Remove and install automatic transmission (A/T).
4. Remove and install fly wheel (M/T).
5. Remove drive plate (A/T).
(a) Hold the crank shaft using an SST.
   SST 09213-54015 (91651-60855), 09330-00021
(b) Remove 8 bolts, then remove drive plate and two spacers.

6. Replace engine oil seal.
(a) Cut away from lip area using a utility knife.
   Utility knife [50601]
(b) Remove oil seal using a flat-head screwdriver covered in plastic tape.
   Plastic tape [53702]
   Sandpaper (#400) [50801]

Attention: After removing oil seal, ensure that the crankshaft surface is not scratched. If there are any scratches, repair them with sandpaper.

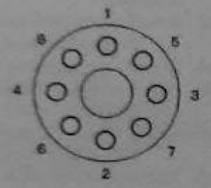
(c) Apply a small amount of MP grease No.2 to the lip part of a new oil seal.
Genuine Toyota MP grease No.2 [30204]
Attention: Ensure there is no dirt or dust on the lip part.
(d) Using an SST, knock in the oil seal.
SST 09223-15030, 09950-70010 (09951-07100)
Attention: Do not knock in the oil seal at an angle. Wipe off any grease on the crankshaft.



7. Install drive plate (A/T).
(a) Secure the crankshaft using SST.
SST 09213-54015 (91651-60855), 09330-00021

(b) Remove oil from the set bolts and bolt holes.
(c) Apply adhesive 1324 to two or three screw threads from the end of the set bolt.
Adhesive 1324 [50401]

(d) Tighten set bolts in the order shown in the diagram.
Standard value: T=83.4 Nm (850kgf/cm)
Attention: Remove any oil from bolts or bolt holes. After installation, do not operate the engine for one hour.



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