

ADJUSTMENT

1. PRE-TEST CHECK AND PREPARATION

- (a) The specifications for test nozzle and nozzle holders are as follows.

Test nozzle: DN12SD12 (DENSO)

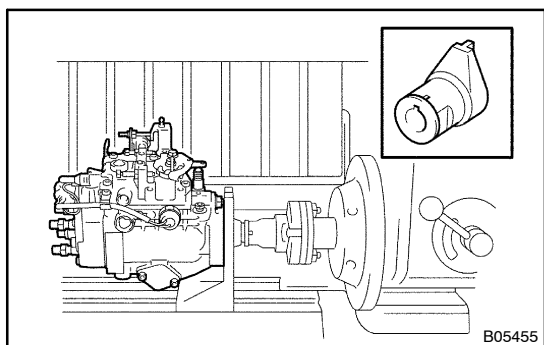
Test nozzle opening pressure:

14,220 – 15,200 kPa

(145 – 155 kgf/cm², 2,062 – 2,205 psi)

- (b) Check the accuracy of the tachometer.

Allowable error: ± 40 rpm

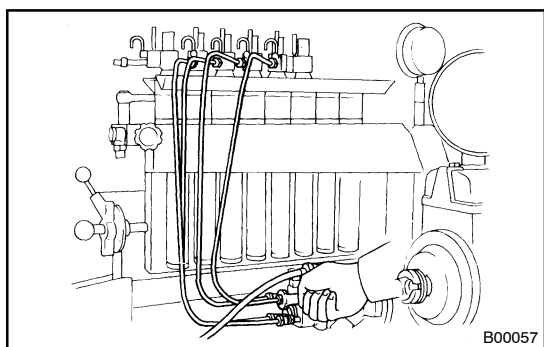


- (c) Install the angle gauge stand.

- (d) Mount the injection pump body on the pump tester.

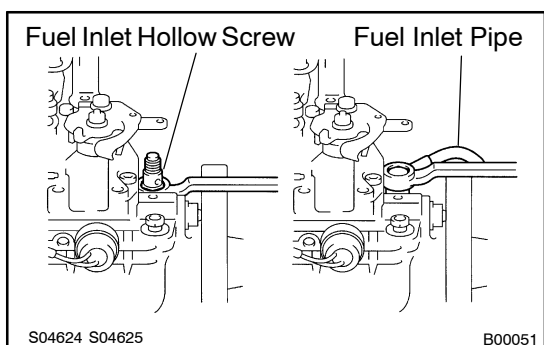
HINT:

Place a mark on the key groove portion of the coupling.



- (e) Install an injection pipe with these specifications:

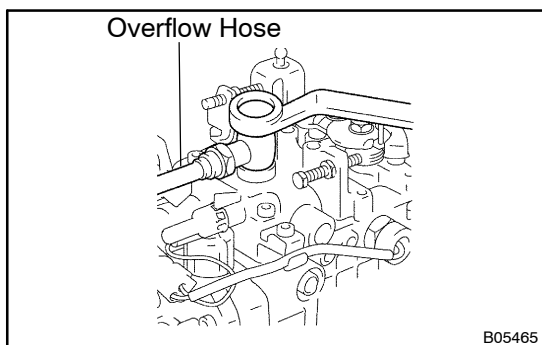
Outer diameter	6.0 mm (0.236 in.)
Inner diameter	2.0 mm (0.079 in.)
Length	840 mm (33.07 in.)
Minimum bending radius	25 mm (0.98 in.) or more



- (f) Remove the fuel inlet hollow screw.

- (g) Connect the fuel inlet pipe with an adapter.

Torque: 24.55 N·m (250 kgf·cm, 18 ft·lbf)



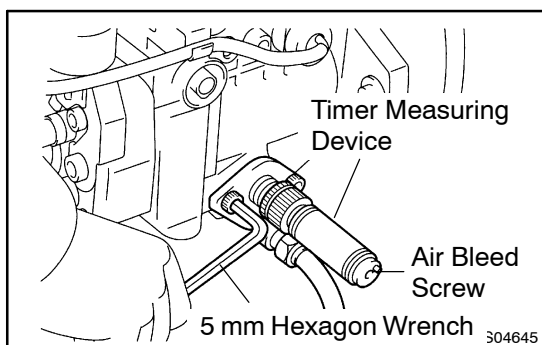
- (h) Install an overflow hose with the 2 gaskets and an overflow screw.

Torque: 24.55 N·m (250 kgf·cm, 18 ft·lbf)

HINT:

Always use the overflow screw installed on the pump to be adjusted.

- (i) Using a 5 mm hexagon wrench, remove the 2 bolts and RH timer cover.



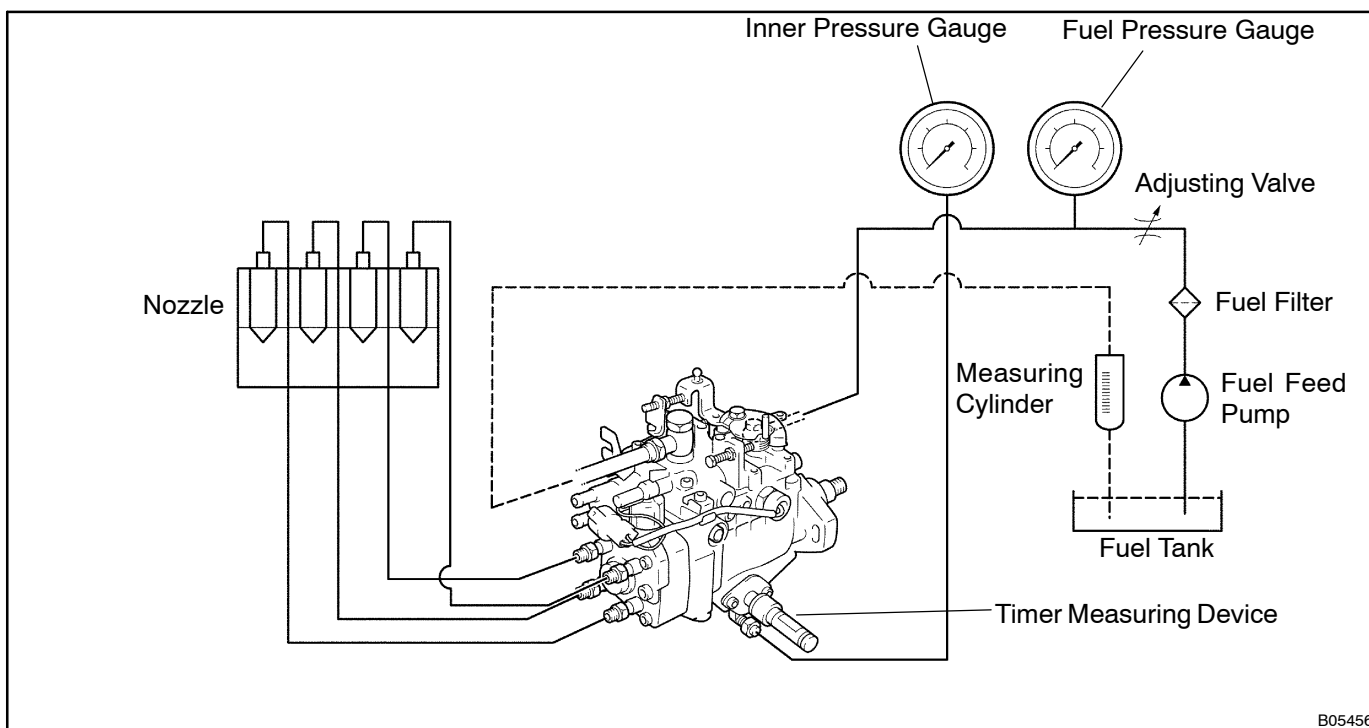
- (j) Install the inner pressure gauge with the timer measuring device.

Part No. 95095-10231, 95095-10480 (DENSO)

Torque: 8.35 N·m (85 kgf·cm, 74 in·lbf)

HINT:

Bleed the air by the air bleed screw.



- (k) Apply about 6 volts of DC power to the fuel cut solenoid.

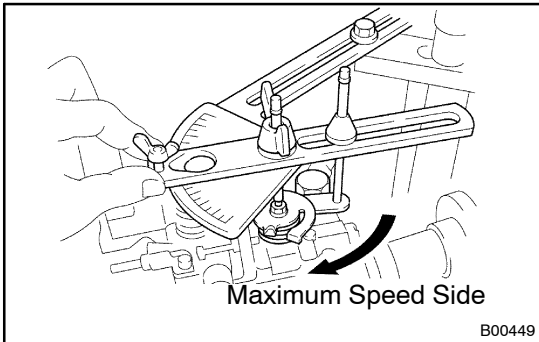
NOTICE:

- When applying voltage to the solenoid, position the battery as far away from the solenoid as possible so that a spark does not occur.
- When connecting the battery cable, connect the solenoid side first.

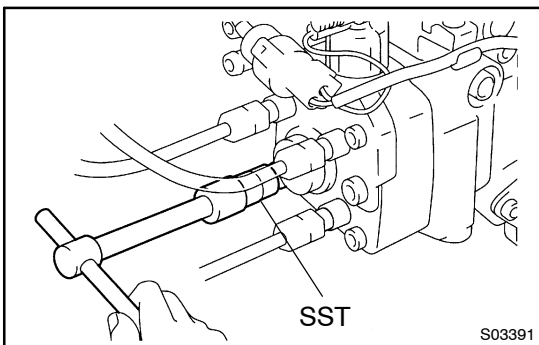
HINT:

Connect the battery through a 10 W bulb.

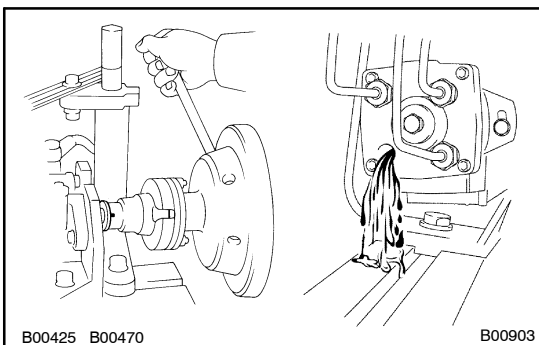
- (l) The pressure for feeding fuel to the injection pump should be 20 kPa (0.2 kgf/cm², 2.8 psi). The fuel temperature for pump testing should be 40 – 45 °C (104 – 113 °F).



- (m) Install an angle gauge to the stand, and set it to the adjusting lever.
Part No. 95095 – 10360 (Stand w/ angle gauge)
- (n) Secure the adjusting lever fully on the maximum speed side.



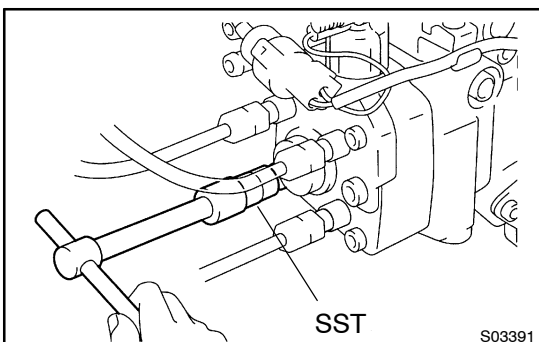
- (o) Check the installation direction of the camplate as follows:
- (1) Disconnect the injection pipe from the position marked "C" on the distributive head.
 - (2) Using SST, remove the delivery valve holder.
SST 09260–54012 (09269–54020)



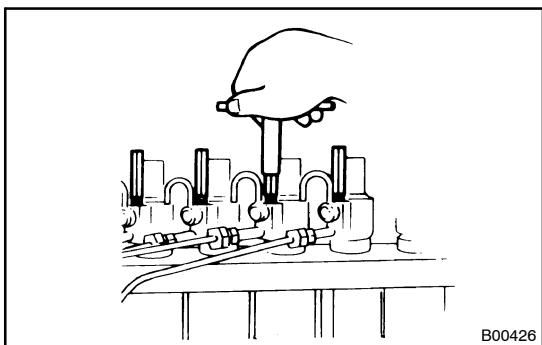
- (3) Check that fuel is flowing out when the mark is in the position shown in the illustration.
If not, it is improperly assembled.
- (4) Disassemble and change the camplate position 180° in the opposite direction.

HINT:

At this time, disconnect the fuel cut solenoid wire harness.



- (5) Using SST, install the delivery valve holder.
SST 09260–54012 (09269–54020)
Torque: 58.85 N·m (600 kgf·cm, 43 ft·lbf)
- (6) Connect the injection pipe.

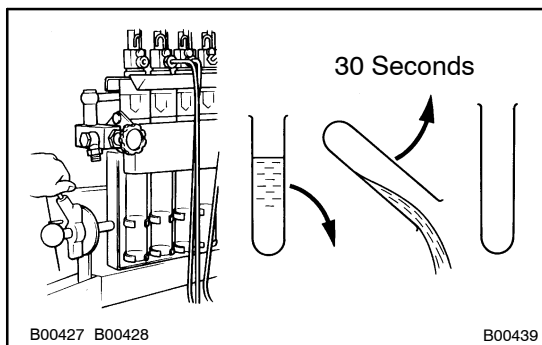


- (p) Bleed the air from the injection pipes.
 (q) Race the injection pump for 5 minutes at 2,000 rpm.
 HINT:

Do this operation by replacing the overflow screw to a hollow screw.

NOTICE:

Check that there is no fuel leakage or abnormal noise.



HINT:

- Measure the volume of each injection cylinder with a measuring cylinder.
- Before measuring the injection volume, first hold the cylinder tilted for at least 30 seconds to discard all the fuel.

2. PRE-SET FULL LOAD INJECTION VOLUME

- (a) Set the adjusting lever to maximum position.
 (b) Measure the injection volume.

2L:

(Part No. 22100-5B800)

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,200	200	10.02 – 10.34 (0.61 – 0.63)

3L:

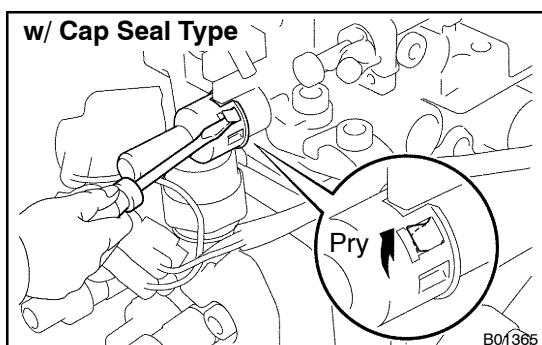
(Part No. 22100-5D050)

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,200	200	10.96 – 11.28 (0.67 – 0.69)

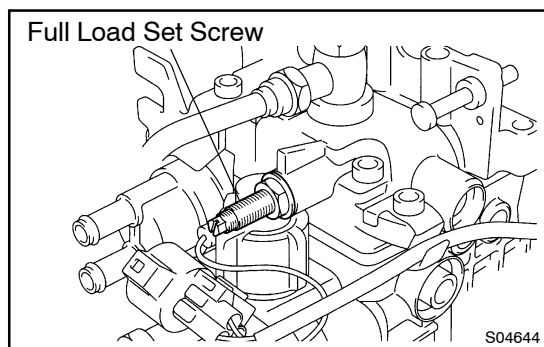
5L:

(Part No. 22100-5D060, 5D070)

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,200	200	12.18 – 12.50 (0.74 – 0.76)



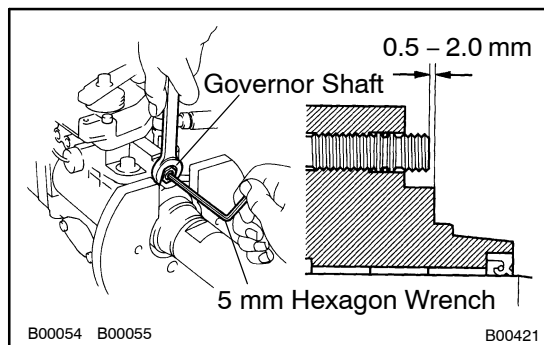
- (c) w/ Cap Seal Type:
 (1) Disconnect the dust cover from the fuel cut solenoid.
 (2) Using a small screwdriver, pry the 4 claws.
 (3) Remove the cap seal.
 (d) w/ Wire Seal Type:
 Cut off the wire seal.



(e) Adjust by turning the full load set screw.

HINT:

The injection volume will increase about 3 cc (0.18 cu in.) with each 1/2 turn of the screw.



3. PRE-SET LOAD SENSING TIMER

Using a 5 mm hexagon wrench, adjust the protrusion of the governor shaft.

Protrusion: 0.5 - 2.0 mm (0.020 - 0.079 in.)

4. PRE-SET MAXIMUM SPEED

- Set the adjusting lever to maximum position.
- Measure the injection volume.

2L:

(Part No. 22100-5B800)

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
2,450	200	4.0 - 5.6 (0.24 - 0.34)

3L:

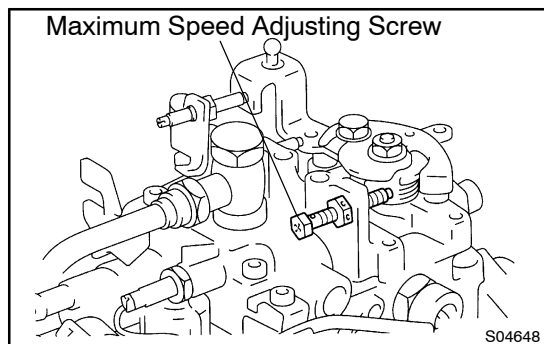
(Part No. 22100-5D050)

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
2,300	200	4.6 - 6.2 (0.28 - 0.38)

5L:

(Part No. 22100-5D060, 5D070)

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
2,450	200	4.6 - 6.2 (0.28 - 0.38)



(c) Cut off the seal wire.

(d) Adjust the injection volume with the maximum speed adjusting screw.

5. ADJUST PUMP INNER PRESSURE

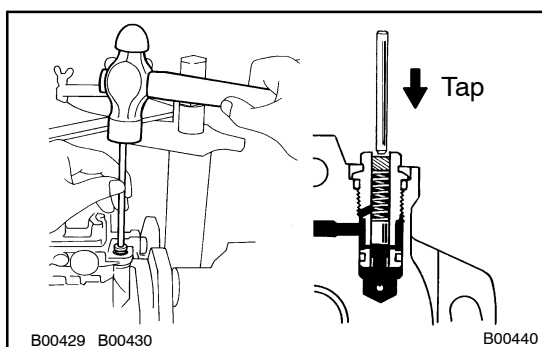
- Set the adjusting lever to the maximum position.
- Measure the pump inner pressure at the below listed rpm.

2L:

Pump rpm	Inner pressure	kPa (kgf/cm ² , psi)
500	343 (3.5, 50)	
2,100	667 (6.9, 98)	

3L, 5L:

Pump rpm	Inner pressure	kPa (kgf/cm ² , psi)
500	343 (3.5, 50)	
2,100	677 (6.9, 98)	



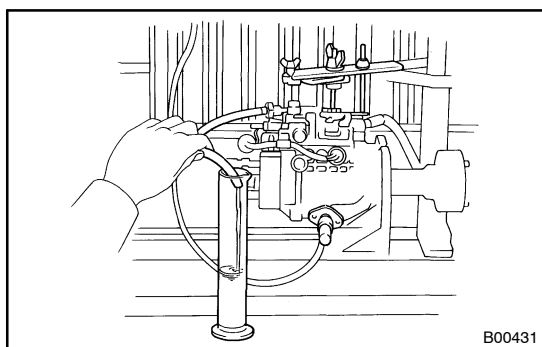
If the pressure is low, adjust by lightly tapping the regulator valve piston while watching the pressure gauge.

HINT:

If the pressure is too high or if the regulator valve was tapped in too far, the regulator valve must be replaced.

6. CHECK OVERFLOW VOLUME

- Set the adjusting lever to the maximum position.

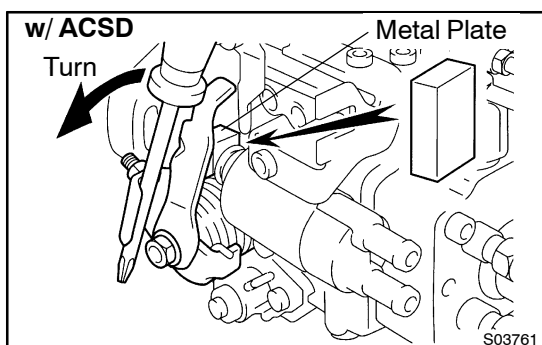


- Measure the overflow volume at the below listed rpm.

Pump rpm	Overflow volume	cc/min. (cu in./min.)
2,200	367 – 800 (22.4 – 48.8)	

HINT:

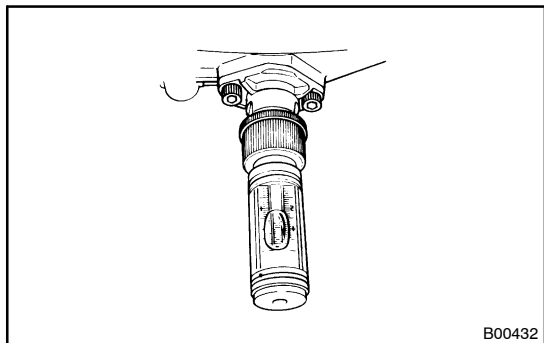
Always use the overflow screw installed on the pump to the adjusted.

**7. w/ACSD:****RELEASE COLD STARTING SYSTEM**

- Using a screwdriver, turn the cold starting lever counter-clockwise approx. 20°.
- Put a metal plate (thickness of 8.5 – 10.0 mm (0.335 – 0.394 in.)) between the cold starting lever and thermo wax plunger.

HINT:

Keep the cold starting system released until all measurements and adjustments are finished.

**8. ADJUST TIMER**

- (a) Set the timer measuring device at zero.
- (b) Measure the timer piston stroke at the below listed rpm.

2L:**(Part No. 22100-5B800)**

Pump rpm	Piston stroke	mm (in.)
800	0.70 – 1.50 (0.0276 – 0.0591)	
1,200	2.10 – 2.90 (0.0827 – 0.1142)	
2,000	4.90 – 5.70 (0.1929 – 0.2244)	
2,300	5.86 – 6.34 (0.2307 – 0.2496)	

3L w/ ACSD:**(Part No. 22100-5D050)**

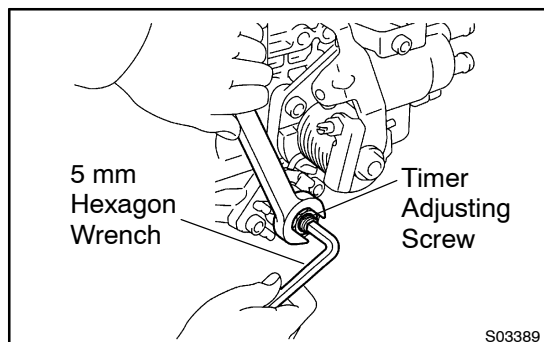
Pump rpm	Piston stroke	mm (in.)
800	Full TCV OFF 2.10 – 2.90 (0.0827 – 0.1142)	
1,200	Full TCV OFF 3.50 – 4.30 (0.1378 – 0.1693) Partial TCV OFF 1.76 – 2.76 (0.0693 – 0.1087)	
2,000	Full TCV OFF 6.40 – 7.20 (0.2520 – 0.2835)	
2,300	Full TCV OFF 7.06 – 7.54 (0.2780 – 0.2968)	

5L w/ ACSD:**(Part No. 22100-5D060, 5D070)**

Pump rpm	Piston stroke	mm (in.)
800	Full TCV OFF 1.65 – 2.45 (0.0650 – 0.0965)	
1,200	Full TCV OFF 3.41 – 4.21 (0.1343 – 0.1657) Partial TCV OFF 1.67 – 2.67 (0.0657 – 0.1051)	
1,900	Full TCV OFF 6.49 – 7.29 (0.2555 – 0.2870)	
2,200	Full TCV OFF 6.96 – 7.54 (0.2740 – 0.2968)	

HINT:

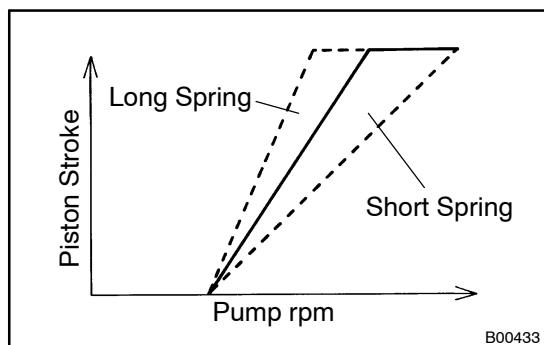
Check that the hysteresis is within 0.3 mm (0.012 in.).



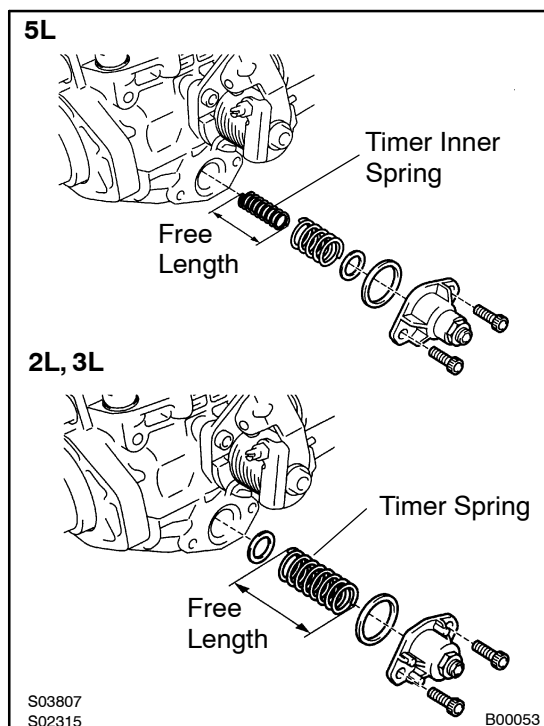
- (c) Using a 5 mm hexagon wrench, adjust by turning the timer adjusting screw.

HINT:

Turn clockwise to reduce the stroke, turn counterclockwise to increase the stroke.



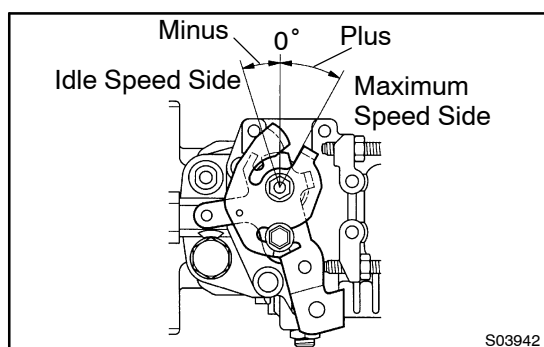
- (d) Check the timer stroke for characteristic tendency.



If tendency is not as specified, select and replace the timer (inner) spring.

HINT:

The timer stroke will increase with a long spring and decrease with a short spring.



9. ADJUST FULL LOAD INJECTION VOLUME

- (a) The adjusting lever angle for the adjustment below should be as shown in the illustration.

Adjusting lever angle:

Maximum speed side	Idle speed side
Plus 23.5 – 33.5°	Minus 12.5 – 22.5°

- (b) Measure the full load injection volume.

2L:

(Part No. 22100-5B800)

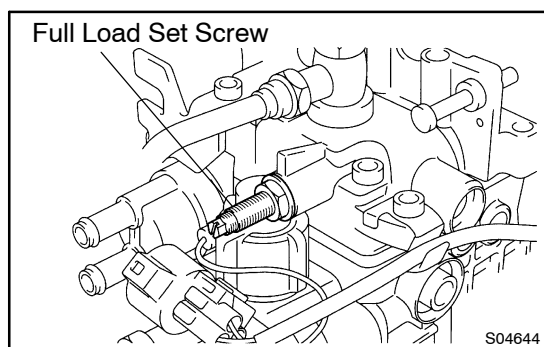
Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,200	200	10.02 – 10.34 (0.61 – 0.63)

3L:**(Part No. 22100-5D050)**

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,200	200	10.96 – 11.28 (0.67 – 0.69)

5L:**(Part No. 22100-5D060, 5D070)**

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,200	200	12.38 – 12.70 (0.76 – 0.78)



(c) Adjust by turning the full load set screw.

HINT:

The injection volume will increase about 3 cc (0.18 cu in.) with each 1/2 turn of the screw.

10. ADJUST MAXIMUM SPEED

(a) Measure the injection volume at each pump rpm.

2L:**(Part No. 22100-5B800)**

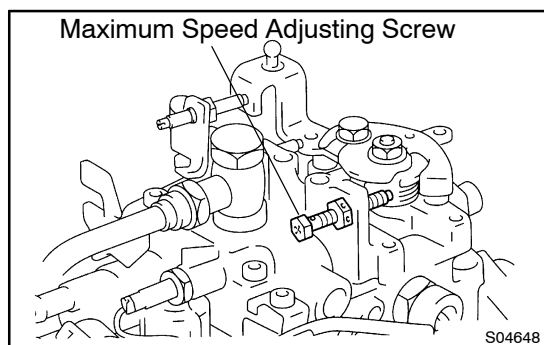
Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Remark
Plus 23.5 – 33.5°	2,250	200	6.9 – 8.5 (0.42 – 0.52)	–
	2,450		4.0 – 5.6 (0.24 – 0.34)	Adjust
	2,700		1.3 (0.08) or less	–

3L:**(Part No. 22100-5D050)**

Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Remark
Plus 23.5 – 33.5°	2,200	200	7.04 – 9.04 (0.43 – 0.55)	–
	2,300		4.6 – 6.2 (0.28 – 0.38)	Adjust
	2,550		1.3 (0.08) or less	–

5L:
(Part No. 22100-5D060, 5D070)

Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Remark
Plus 23.5 – 33.5°	2,300	200	7.46 – 9.46 (0.46 – 0.58)	–
	2,450		4.6 – 6.2 (0.28 – 0.38)	Adjust
	2,700		1.3 (0.08) or less	–



(b) Adjust by turning the maximum speed adjusting screw.

11. CHECK INJECTION VOLUME

Measure the injection volume at each pump rpm.

2L:
(Part No. 22100-5B800)

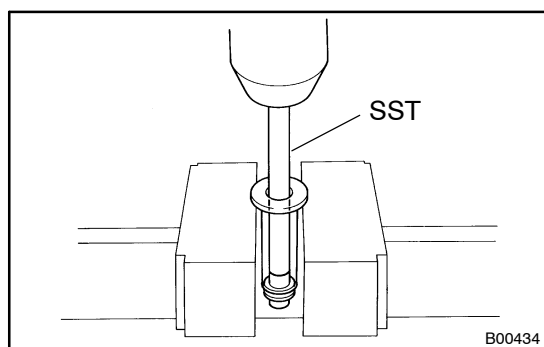
Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Variation limit cc (cu in.)	Remark
Plus 23.5 – 33.5°	100	200	10.6 – 15.4 (0.65 – 0.94)	1.2 (0.07)	Volume during starting
	350		11.2 – 13.8 (0.65 – 0.84)	–	–
	500		8.1 – 9.1 (0.49 – 0.56)	0.5 (0.03)	–
	1,200		10.02 – 10.34 (0.61 – 0.63)	0.4 (0.02)	Basic full load injection volume
	2,100		8.79 – 9.69 (0.54 – 0.59)	0.5 (0.03)	–

3L:
(Part No. 22100-5D050)

Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Variation limit cc (cu in.)	Remark
Plus 23.5 – 33.5°	100	200	11.6 – 16.4 (0.71 – 1.00)	1.2 (0.07)	Volume during starting
	350		11.4 – 14.0 (0.70 – 0.85)	–	–
	500		9.64 – 11.04 (0.59 – 0.67)	0.5 (0.03)	–
	1,200		10.96 – 11.28 (0.67 – 0.69)	0.4 (0.02)	Basic full load injection volume
	1,900		9.39 – 10.69 (0.57 – 0.65)	0.5 (0.03)	–

5L:
(Part No. 22100–5D060, 5D070)

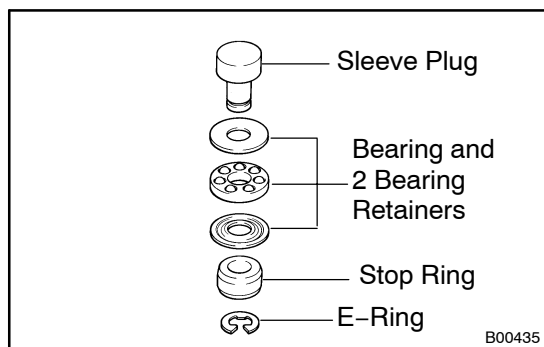
Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Variation limit cc (cu in.)	Remark
Plus 23.5 – 33.5°	100	200	13.6 – 18.4 (0.83 – 1.12)	1.4 (0.06)	Volume during starting
	500		10.18 – 11.18 (0.62 – 0.68)	0.5 (0.03)	–
	1,200		12.18 – 12.50 (0.74 – 0.76)	0.4 (0.02)	Basic full load injection volume
	2,000		11.19 – 12.09 (0.68 – 0.74)	0.5 (0.03)	–



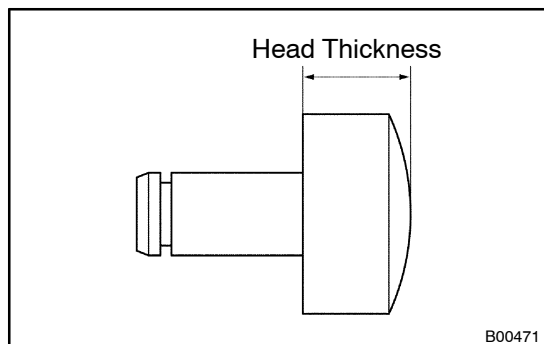
If the injection volume at 100 rpm is not as specified, replace the governor sleeve plug as follows:

- (1) Using SST and a press, press out the sleeve plug assembly from the governor sleeve.

SST 09236–00101 (09237–00070)



- (2) Remove the E-ring, stop ring, bearing and 2 bearing retainers from the sleeve plug.



- (3) Measure the head thickness of the sleeve plug, and select a new sleeve plug.

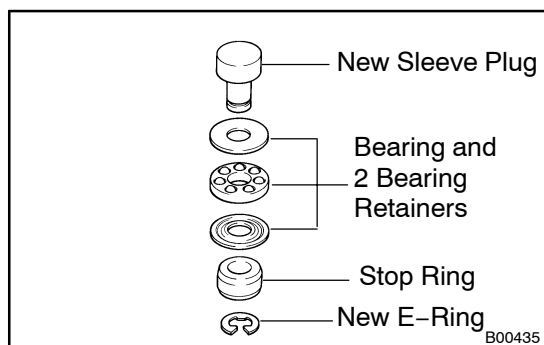
Governor sleeve plug head thickness: mm (in.)

3.0 (0.118)	3.5 (0.138)	4.0 (0.157)
3.1 (0.122)	3.6 (0.142)	4.1 (0.161)
3.2 (0.126)	3.7 (0.146)	4.2 (0.165)
3.3 (0.130)	3.8 (0.150)	–
3.4 (0.134)	3.9 (0.154)	–

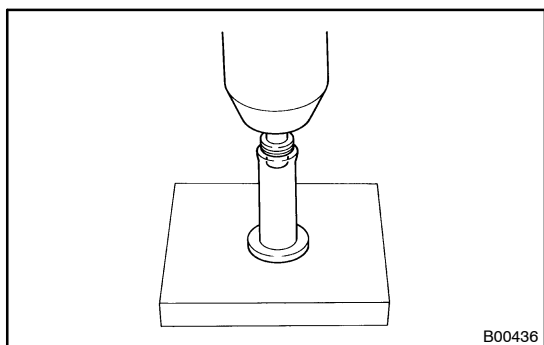
HINT:

Lengthening the plug by 0.1 mm (0.004 in.) will decrease injection volume by 0.6 cc (0.04 cu in.).

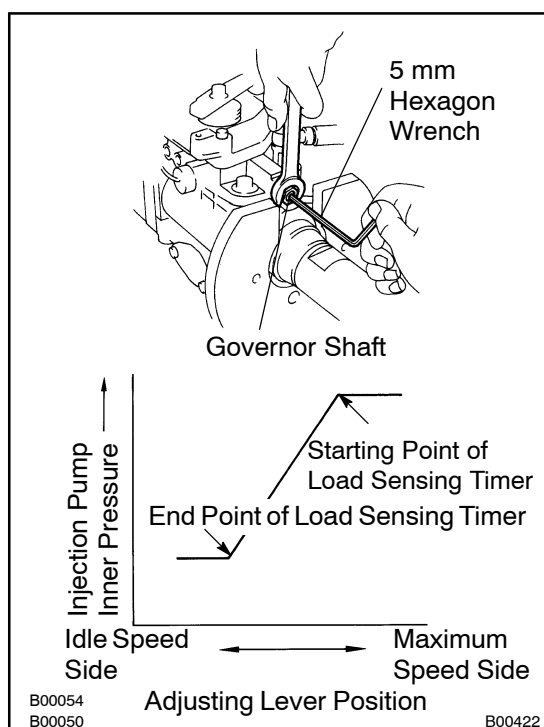
If the variation limit is greater than specified, replace the delivery valve.



- (1) Install the bearing, 2 retainers and stop ring to a new sleeve plug with a new E-ring.

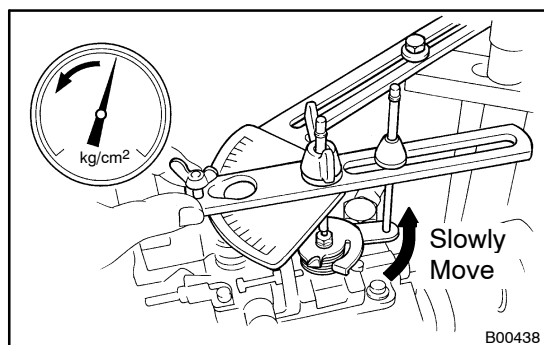


- (2) Using a press, press in the sleeve plug assembly to the governor sleeve.

**12. 3L, 5L:****ADJUST LOAD SENSING TIMER**

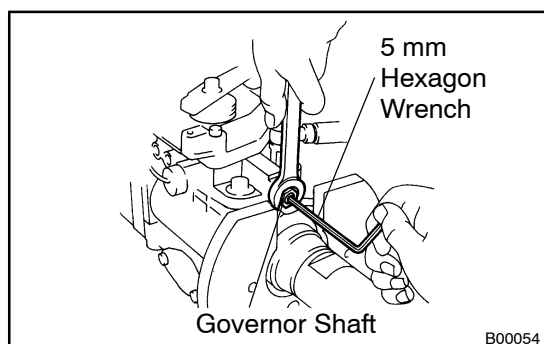
- (a) Using a 5 mm hexagon wrench, adjust the starting and end points of the load sensing timer by turning the governor shaft.
- (b) Set the adjusting lever to maximum position.
- (c) Measure the injection volume.

Adjusting lever position	Pump rpm	No. of measuring strokes
Maximum speed side	1,200	200



- (d) Slowly move the adjusting lever from the maximum speed side to the idle speed side, and secure it at the point where the pump inner pressure begins to drop.
- (e) Measure the injection volume at the drop point (starting point).

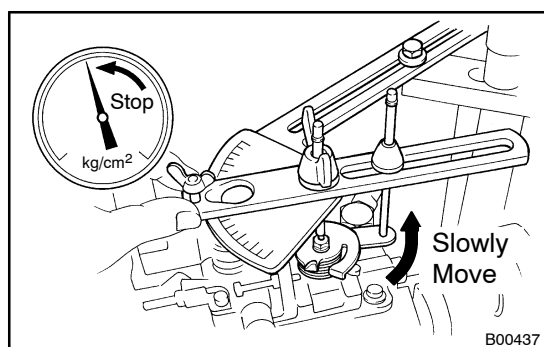
Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,200	200	Measured value at step (d) minus 1.0 (0.06) ± 0.4 (0.02)



- (f) Using a 5 mm hexagon wrench, adjust the load sensing timer by turning the governor shaft, and perform the measurement again as specified.

HINT:

The injection volume will increase approx. 3 cc (0.2 cu in.) with each 1/2 turn of the governor shaft.



- (g) Check the end point injection volume by slowly moving the adjusting lever from the maximum speed side to the idle speed side, and secure it at the point where the pump inner pressure stops dropping.

3L:

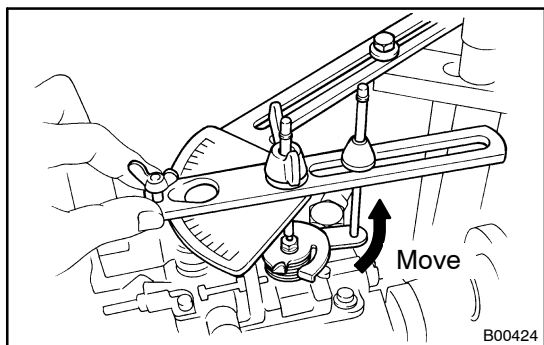
(Part No. 22100-5D050)

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,200	200	8.12 – 8.52 (0.50 – 0.52)

5L:

(Part No. 22100-5D060)

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,200	200	TCV OFF 8.34 – 8.74 (0.51 – 0.53)



- (h) Check the timer piston fluctuation when the adjusting lever is moved from the maximum speed side to the idle speed side.

3L:

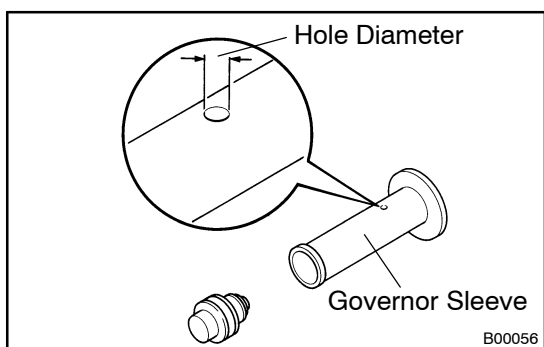
(Part No. 22100-5D050)

Pump rpm	Timer piston fluctuation	mm (in.)
1,200	1.44 – 1.84 (0.0567 – 0.0724)	

5L:

(Part No. 22100-5D060)

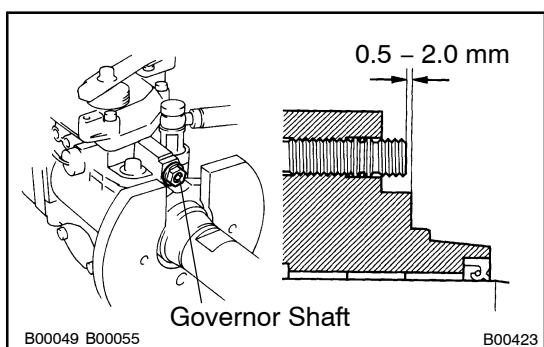
Pump rpm	Timer piston fluctuation	mm (in.)
1,200	TCV OFF 1.44 – 1.84 (0.0567 – 0.0724)	



If the timer stroke is not as specified when the load sensing is at maximum retard angle, select a new governor sleeve.

HINT:

A large hole diameter decreases the timer stroke and a smaller hole diameter increases the timer stroke.



- (i) Check the protrusion of the governor shaft.

Protrusion: 0.5 – 2.0 mm (0.020 – 0.079 in.)

13. ADJUST IDLE SPEED

- (a) Measure the injection volume for each pump rpm.

**2L:
(Part No. 22100-5B800)**

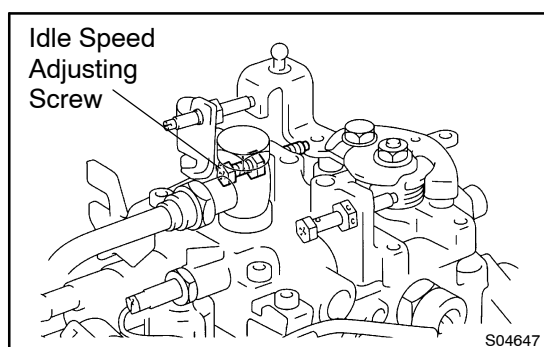
Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Variation limit cc (cu in.)	Remark
Minus 12.5 – 22.5°	350	200	2.98 – 3.98 (0.18 – 0.24)	0.34 (0.02)	Adjust
	525		2.48 (0.15) or less	–	–

**3L:
(Part No. 22100-5D050)**

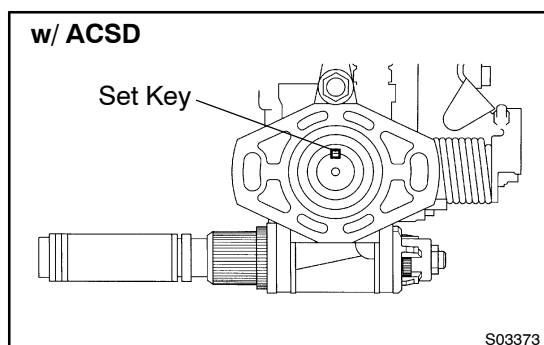
Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Variation limit cc (cu in.)	Remark
Minus 10.5 – 20.5°	350	200	3.42 – 4.42 (0.21 – 0.27)	0.34 (0.02)	Adjust
	525		2.8 (0.17) or less	–	–

**5L:
(Part No. 22100-5D060, 5D070)**

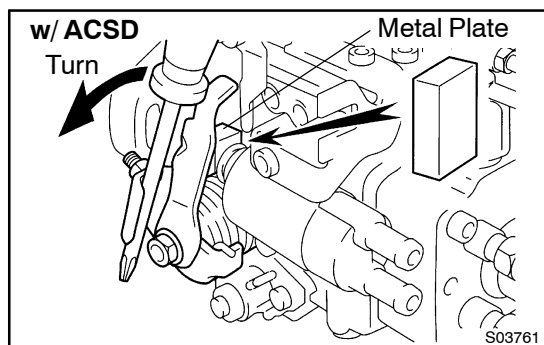
Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Variation limit cc (cu in.)	Remark
Minus 12.5 – 22.5°	350	200	2.54 – 3.54 (0.16 – 0.22)	0.34 (0.02)	Adjust
	575		1.2 (0.07) or less	–	–



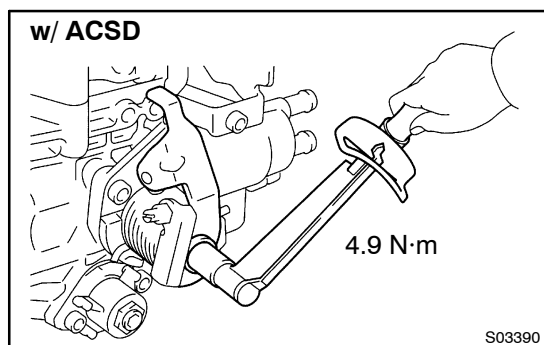
- (b) Adjust injection volume by turning the idle speed adjusting screw.

**14. w/ ACSD:
ADJUST COLD STARTING SYSTEM**

- (a) Remove the overflow screw and check the fuel temperature in the fuel pump.
Fuel temperature: 15 – 35°C (59 – 95°F)
- (b) Set the set key of the pump drive shaft in a vertical or horizontal position.
- (c) Set the scale of the timer measuring device to zero.



- (d) Check the adjusting lever opening angle and consider this angle as zero.
- (e) Remove the metal plate between the cold starting lever and thermo wax plunger.



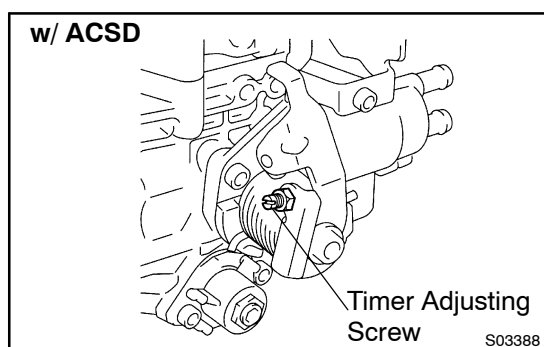
- (f) Torque the cold starting lever clockwise to approx. 4.9 N·m (50 kgf·cm, 43 in·lbf) and keep the lever tightened for about 10 seconds. Then release the torque.
- (g) Measure the timer piston stroke.

3L:**(Part No. 22100-5D050)**

Fuel temperature C (°F)	Pump rpm	Piston stroke mm (in.)
25 (77)	350	0.85 – 1.05 (0.0335 – 0.0413)

5L:**(Part No. 22100-5D060, 5D070)**

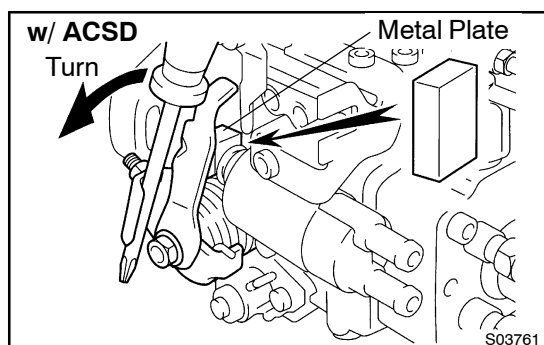
Fuel temperature C (°F)	Pump rpm	Piston stroke mm (in.)
25 (77)	350	1.8 – 2.0 (0.0709 – 0.0787)



- (h) Adjust by turning the timer adjusting screw.

HINT:

Screw in for stroke decrease.

**15. w/ ACSD:****ADJUST FAST IDLE SPEED**

- (a) Release the cold starting system.
 - (1) Using a screwdriver, turn the cold starting lever counterclockwise approx. 20°.
 - (2) Put a metal plate (thickness of 8.5 – 10.0 mm (0.335 – 0.394 in.)) between the cold starting lever and thermo wax plunger.
- (b) Set the adjusting lever to the idle position.
- (c) Measure the injection volume.

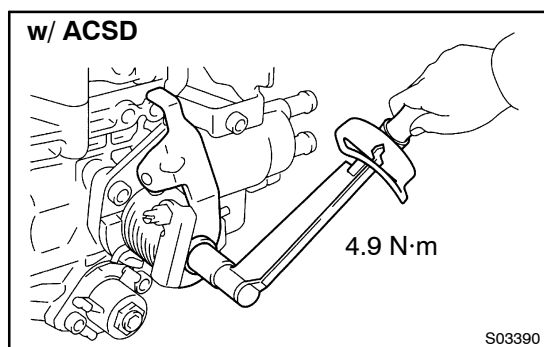
3L:**(Part No. 22100-5D050)**

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
350	1,000	$q = 1.9 - 2.9$ (0.12 - 0.18)

5L:**(Part No. 22100-5B710)**

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
350	1,000	$q = 4.2 - 5.2$ (0.26 - 0.32)

- (d) Remove the metal plate between the cold starting lever and thermo wax plunger.



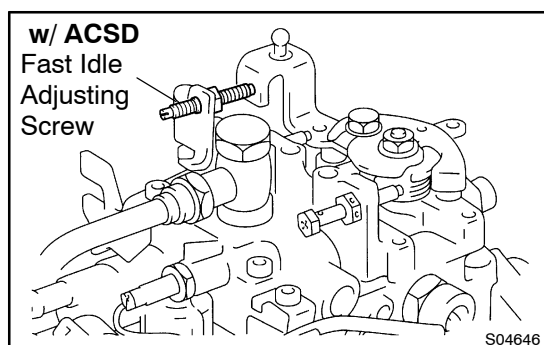
- (e) Torque the cold starting lever clockwise to approx. 4.9 N·m (50 kgf·cm, 43 in·lbf) and keep the lever tightened for about 10 seconds. Then release the torque.
- (f) Measure the injection volume.

3L:

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
350	1,000	$q \text{ plus } 1.0 - 1.2$ (0.06 - 0.07)

5L:

Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
400	1,000	$q \text{ plus } 1.24 - 1.44$ (0.08 - 0.09)

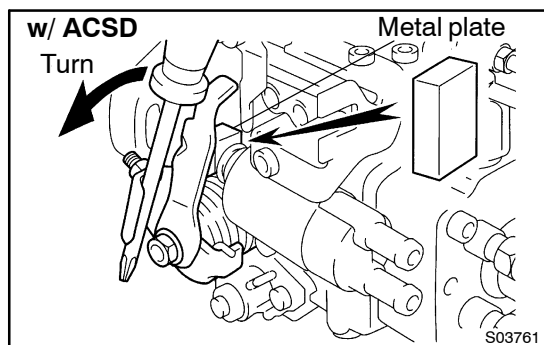


- (g) Adjust the injection volume by turning the fast idle adjusting screw.

16. POST ADJUSTMENT CHECK

- (a) Check the injection stops when the fuel cut solenoid harness is removed.

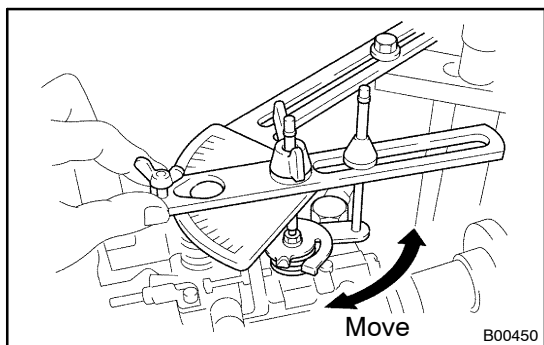
Pump revolution: 100 rpm



(b) w/ ACSD:

Release the cold starting system.

- (1) Using a screwdriver, turn the cold starting lever counterclockwise approx. 20°.
- (2) Put a metal plate (thickness of 8.5 – 10.0 mm (0.335 – 0.394 in.)) between the cold starting lever and thermo wax plunger.



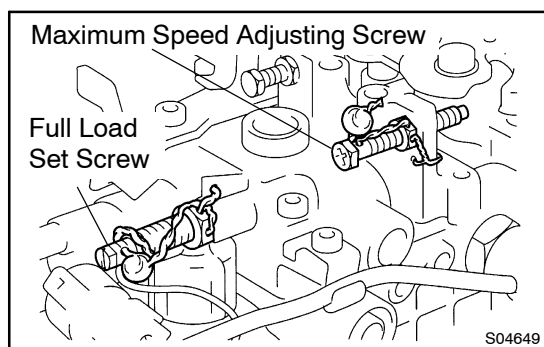
(c) Check the adjusting lever movement.

Adjusting lever angle:

2L	41.0° – 47.0°
3L	43.0° – 49.0°
5L	41.0° – 51.0°

(d) Remove the metal plate between the cold starting lever and thermo wax plunger.

17. REMOVE INJECTION PUMP FROM PUMP TESTER



18. SEAL PARTS

Seal the full load set screw and maximum speed adjusting screw with new lead seals.