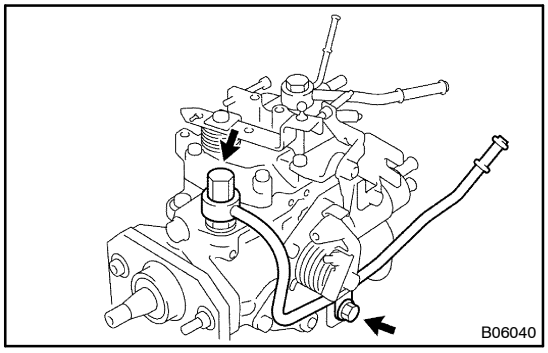
FU05U–02

ADJUSTMENT

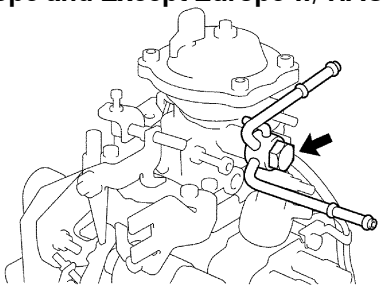
1. REMOVE FUEL PIPES

(a) Remove the cap nut, bolt, fuel inlet pipe and 2 gaskets.

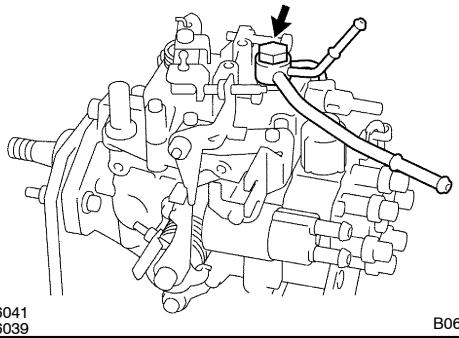


(b) Remove the union bolt,nozzle leakage pipe No.2 and 2 gaskets.

Europe and Except Europe w/ HAC

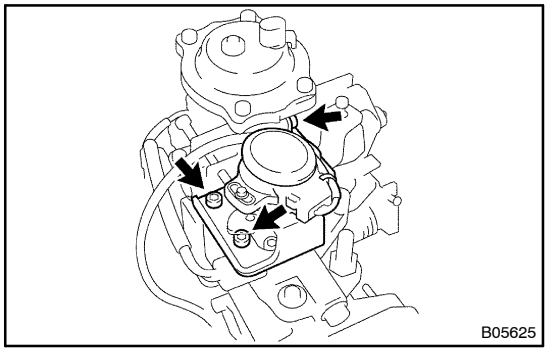


Except Europe w/o HAC



2. Europe:
REMOVE THROTTLE POSITION SENSOR AND BRACKET ASSEMBLY

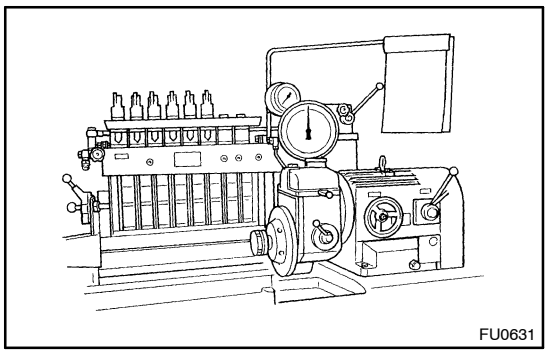
Using a 5 mm hexagon wrench, remove the 3 bolts, the throttle position sensor and bracket assembly.

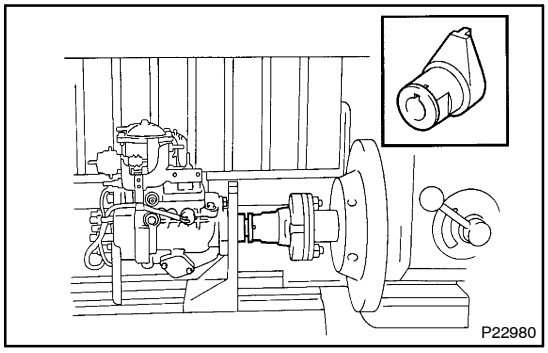


3. PRE–TEST CHECK AND PREPARATION

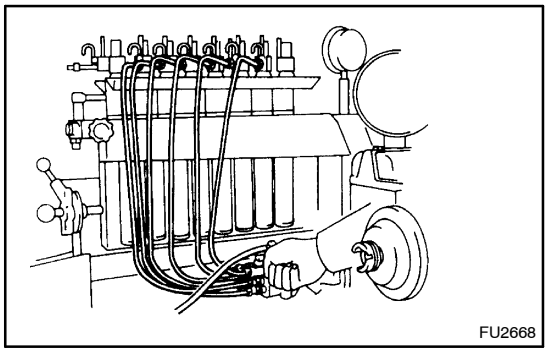
(a) The specifications for test nozzle and nozzle holders are as follows.

Test nozzle: DN12SD12 (DENSO)
Test nozzle opening pressure:
14,220 – 15,200 kPa
(145 – 155 kgf/cm^2, 2,062 – 2,205 psi)



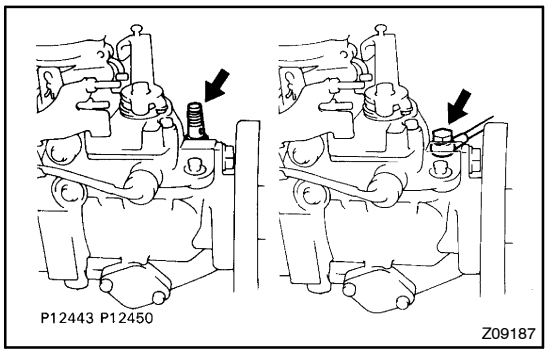


(b) Check the accuracy of the tachometer.
Allowable error: ± 40 rpm
(c) Install the angle gauge stand.
(d) Mount the injection pump body on the pump tester.
HINT:
Place a mark on the key groove portion of the couping.
NOTICE:
To prevent vibration or dislocation of the injection pump, fix in place the distributive head of the injection pump.

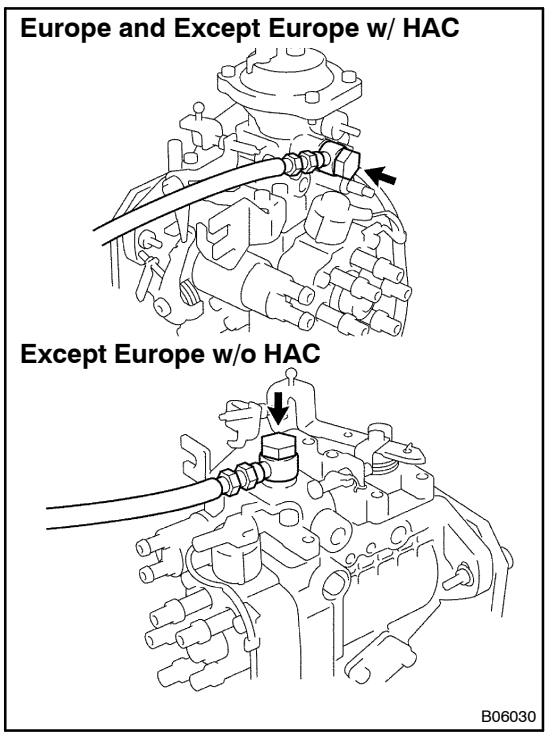


(e) Install an injection pipe with these specifications.

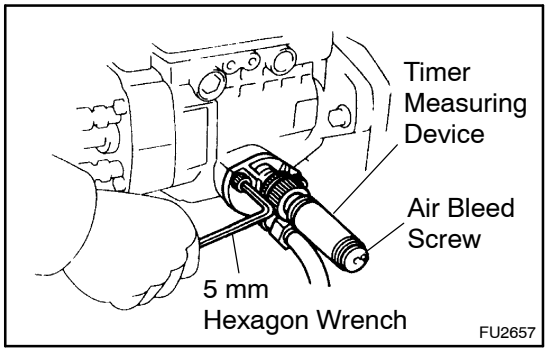
Outer diameter	6.0 mm (0.236 in.)
Inner diameter	2.0 mm (0.079 in.)
Length	840 mm (33.07 in.)
Minimum bending radius	25 mm (0.98 in.) or more



(f) Remove the fuel inlet hollow screw.
(g) Connect the fuel inlet pipe with an adapter.



(h) Install an overflow hose with 2 gaskets and union bolts.
HINT:
Always use the overflow screw installed on the pump to be adjusted.



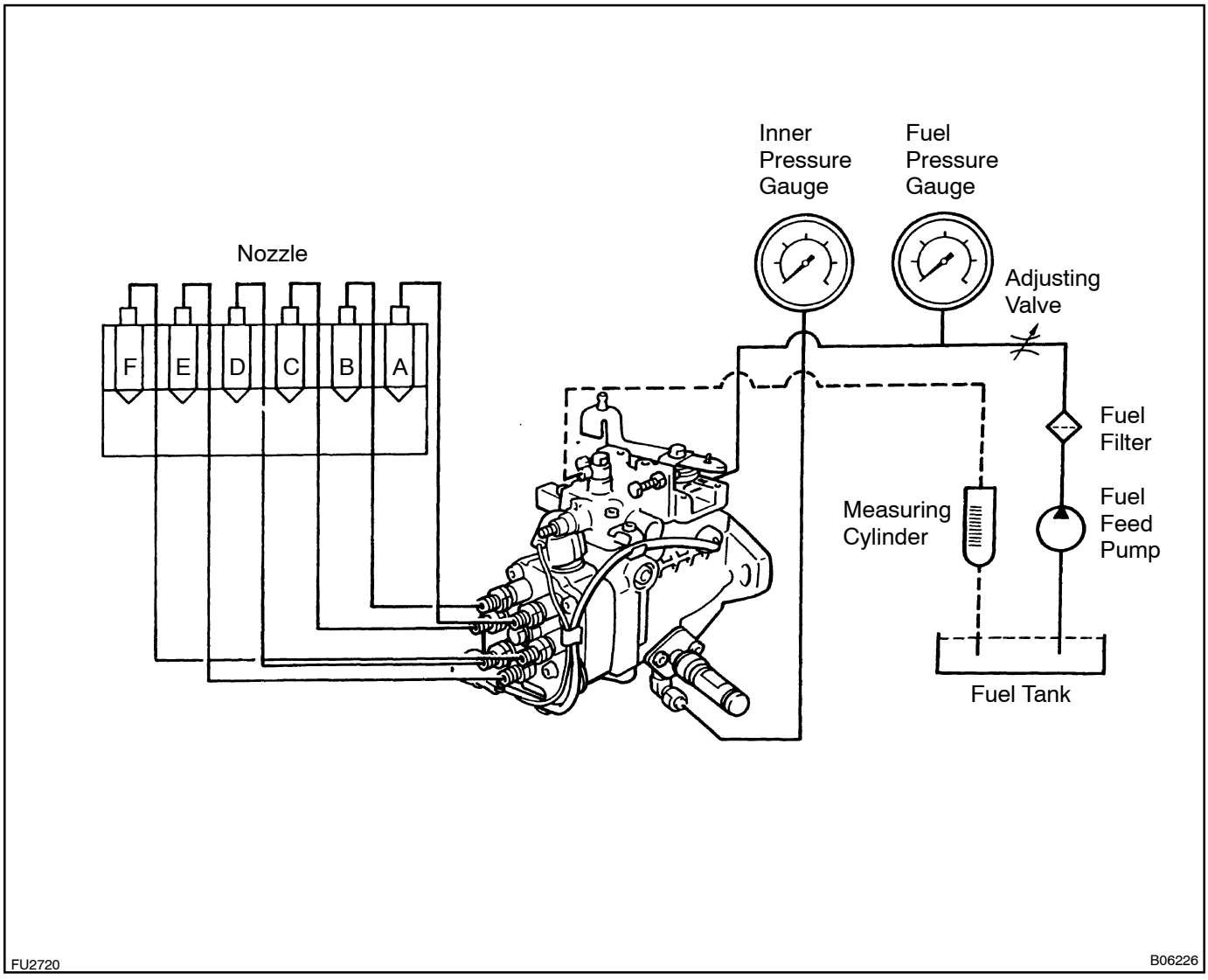
(i) Using a 5 mm hexagon wrench, remove the 2 bolts and RH timer cover.

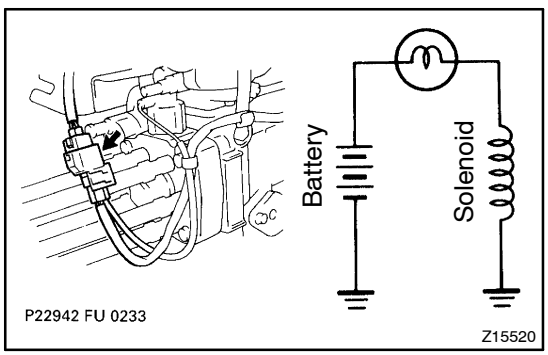
(j) Install the inner pressure gauge with the timer measuring device.

Part No. 95095–10231 and 95095–10480 (DENSO)

HINT:

Bleed the air by the air bleed screw.





(k) 12 V type:

Apply about 6 volts of DC power to the fuel cut solenoid.

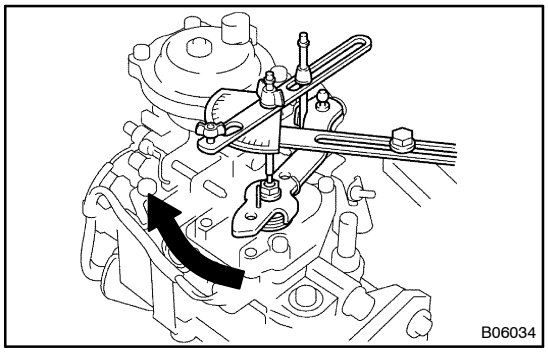
(l) 24 V type:

Apply about 12 volts of DC power to the fuel cut solenoid.

NOTICE:

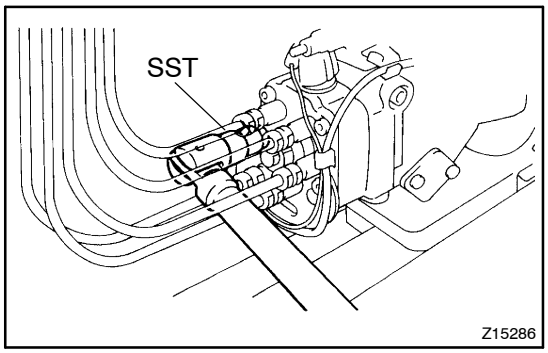
- **When applying voltage to the solenoid, position the battery as far away from the solenoid as possible so that a spark does not occur.**
- **When connecting the battery cable, connect the solenoid side first.**

(m) The pressure for feeding fuel to the injection pump should be 20 kPa (0.2 kgf/cm^2, 2.8 psi). The fuel temperature for pump testing should be 40 – 50°C (104 – 113°F).



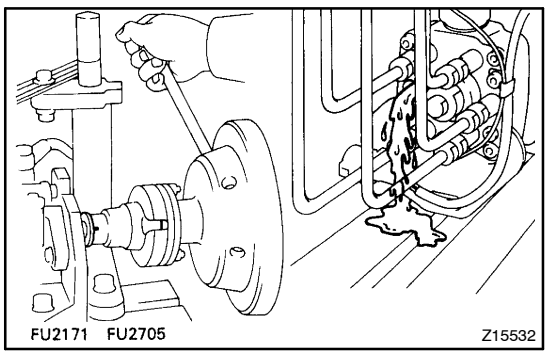
(n) Install an angle gauge to the stand and set it to the adjusting lever.
Part No. 95095–10360 (Stand w/ angle gauge)

(o) Secure the adjusting lever fully on the maximum speed side.



(p) Check the installation direction of the camplate as follow:
- Disconnect the injection pipe from the position marked ”C” on the distributive head.
- Using SST, remove the delivery valve holder assembly and gasket.

SST 09260–54012 (09269–54020)

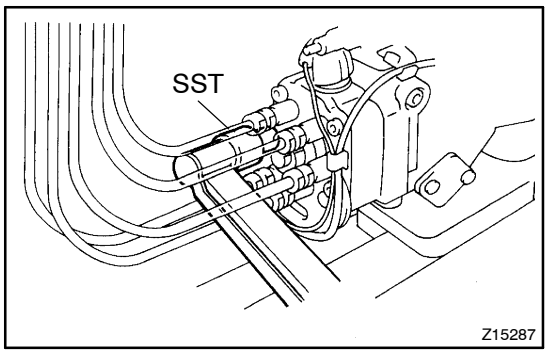


- Check that fuel is flowing out when the mark is in the position shown in the illustration.

If not, it is improperly assembled.

- Disassemble and change the camplate position 180° in the opposite direction.

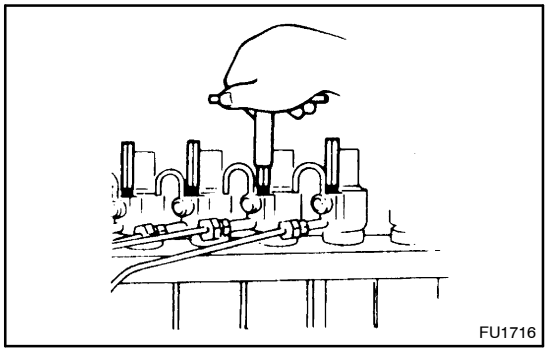
HINT:
At this time, disconnect the fuel cut solenoid wire harness.



- Using SST, install a new gasket and the delivery valve holder assembly.

SST 09260–54012 (09269–54020)
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)

- Connect the injection pipe.


FU1716

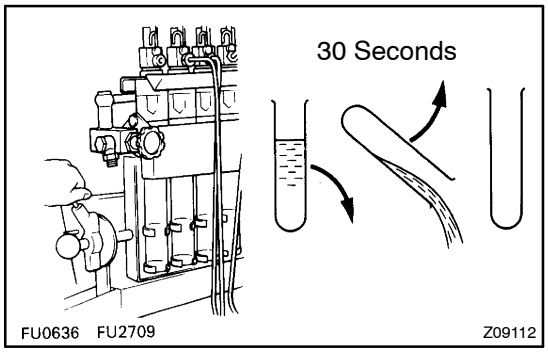
(q) Bleed the air from the injection pipes.
(r) Measure the injection volume.

Pump rpm	No. of measuring stroke	Each injection volume cc (cu in.)
1,080	200	14.92 – 16.52 (0.91 – 1.01)

(s) Race the injection pump for 5 minutes at 1,200 rpm.

NOTICE:

Check that there is no fuel leakage or abnormal noise.



FU0636 FU2709 Z09112

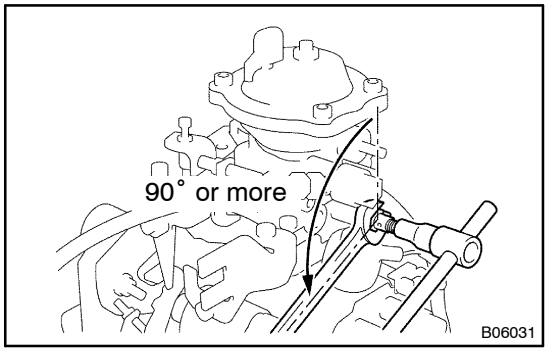
HINT:

- 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.

4. PRE–SET FULL LOAD INJECTION VOLUME

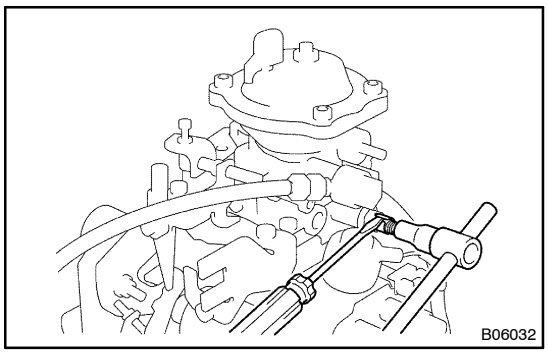
(a) Set the adjusting lever to maximum position.
(b) Europe:
Apply 80 kPa (0.81 kgf/cm^2, 11.5 psi) of pressure to the BACS union.
(c) Except Europe w/ HAC:
Apply 101.3 ± 0.2 kPa (760 ± 1.5 mmHg, 29.92 ± 0.06 in.Hg) absolute pressure.
(d) Measure the injection volume.

Item	Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
Europe	1,200	200	12.24 – 12.64 (0.75 – 0.78)
Except Europe			11.84 – 12.24 (0.72 – 0.75)

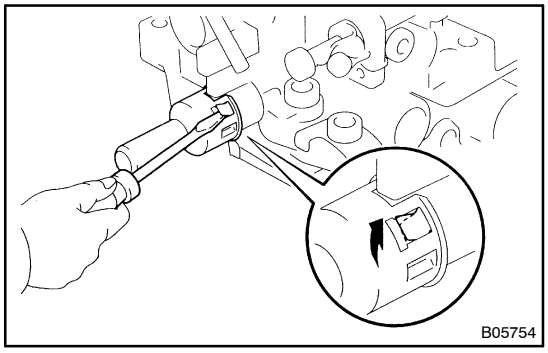


B06031

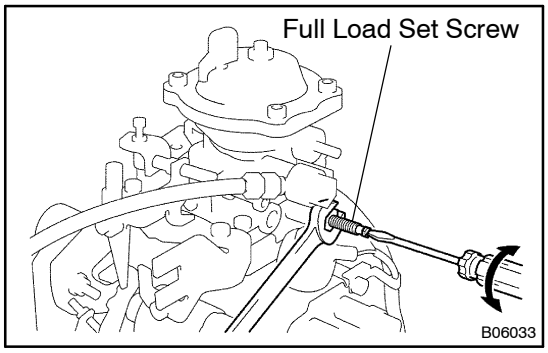
(e) Europe:
Remove the collar seal.
(1) Hold the full load set screw, and release the collar seal from the spot weld by turning the lock nut counterclockwise by 90° or more.


B06032

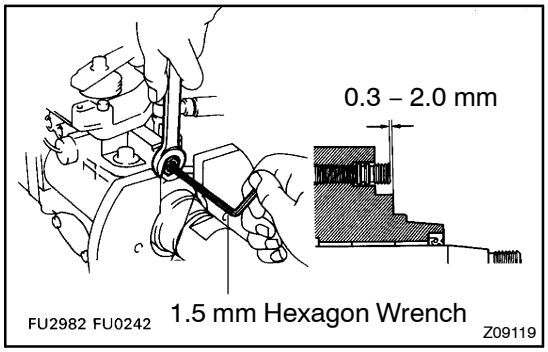
(2) Using a screwdriver, remove the collar seal.



(f) Except Europe:
Remove the cap seal.
(1) Using a small screwdriver, pry the claws.
(2) Remove the cap seal.



(g) 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.

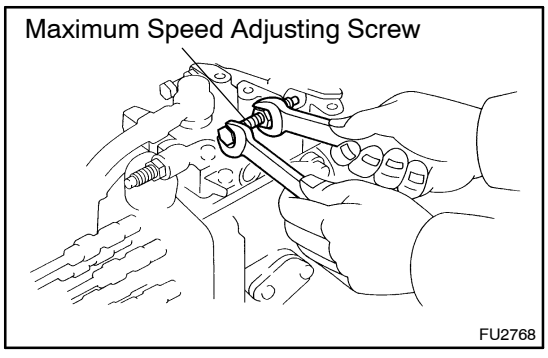


5. PRE–SETTING OF LOAD SENSING TIMER
Using a 5 mm hexagon wrench, adjust the protrusion of the governor shaft.
Protrusion: 0.3 – 2.0 mm (0.020 – 0.079 in.)

6. PRE–SET MAXIMUM SPEED
(a) Set the adjusting lever to maximum position.
(b) Europe:
Apply 80 kPa (0.81 kgf/cm^2, 11.5 psi) of pressure to the BACS union.
(c) Except Europe w/ HAC:
Apply 101.3 ± 0.2 kPa (760 ± 1.5 mmHg, 29.92 ± 0.06 in.Hg) absolute pressure.
(d) Measure the injection volume.

Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
2,300	200	4.6 – 6.6 (0.28 – 0.40)

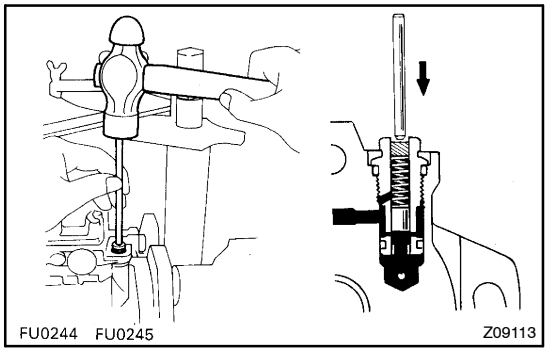
(e) Cut off the seal wire.



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

7. ADJUST PUMP INNER PRESSURE
(a) Measure the pump inner pressure at the below listed rpm.

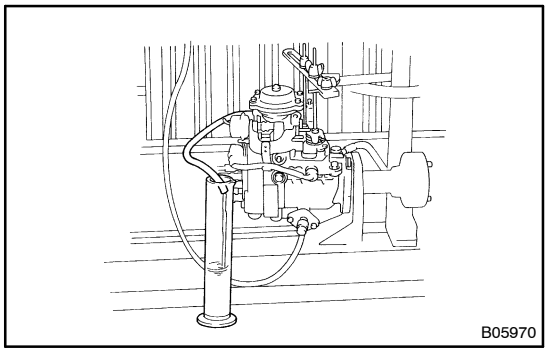
Pump rpm	Inner pressure kPa (kgf/cm^2, psi)
500	373 (3.8, 54)
1,900	794 (8.1, 115)



(b) 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.



8. CHECK OVERFLOW VOLUME

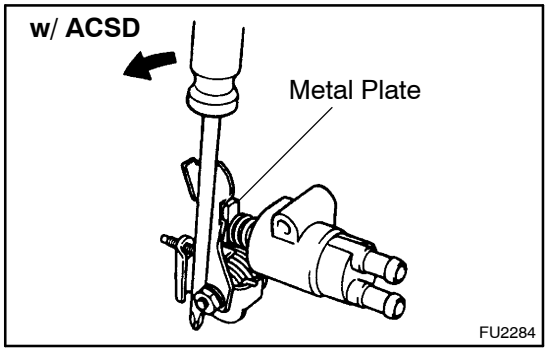
(a) Apply 80 kPa (0.81 kg/cm^2, 11.5 psi) of pressure to the BACS union.

(b) Measure the overflow volume at the below listed rpm.

Pump rpm	Overflow volume cc/min. (cu in./min.)
2,000	367 – 800 (22.4 – 48.8)

HINT:

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



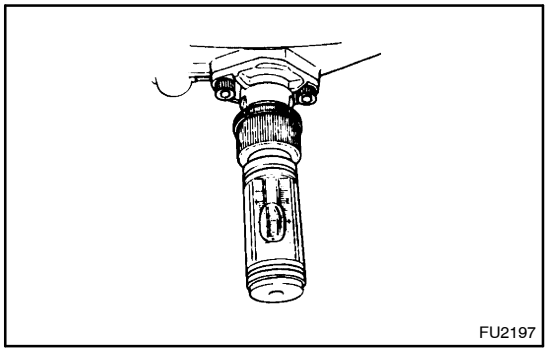
9. w/ ACSD:
RELEASE COLD STARTING SYSTEM FOR NEXT INSPECTIONS

(a) Using a screwdriver, turn the cold starting lever counterclockwise approx. 20°.

(b) Put a metal plate (thickness of 5.0 – 8.0 mm (0.21 – 0.31 in.)) between the cold starting lever and thermo wax plunger.

HINT:

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


FU2197

10. ADJUST TIMER

(a) Set the timer measuring device at zero.

(b) Measure the timer piston at the below listed rpm.

Europe and Malaysia:

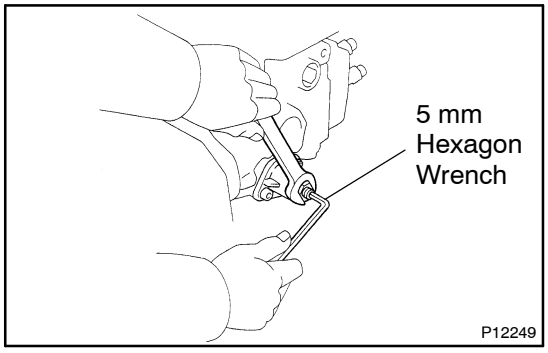
Pump rpm	Timer piston stroke mm (in.)
800	1.84 – 2.84 (0.0724 – 0.1118)
1,200	3.70 – 4.70 (0.1457 – 0.1850)
1,520	5.18 – 6.18 (0.2039 – 0.2433)
1,900	7.05 – 7.65 (0.2776 – 0.3012)

Others:

Pump rpm	Timer piston stroke mm (in.)
800	0.61 – 1.61 (0.0240 – 0.0634)
1,200	2.47 – 3.47 (0.0972 – 0.1366)
1,520	3.95 – 4.95 (0.1556 – 0.1949)
1,900	5.72 – 6.72 (0.2252 – 0.2647)

HINT:

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

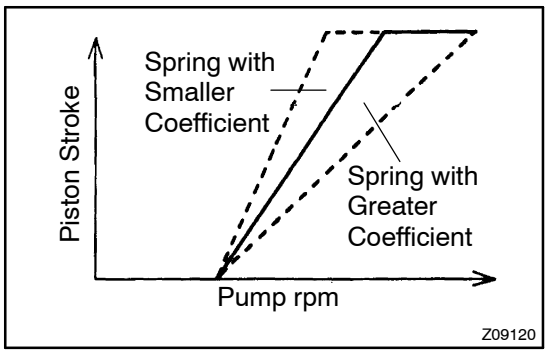


P12249

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

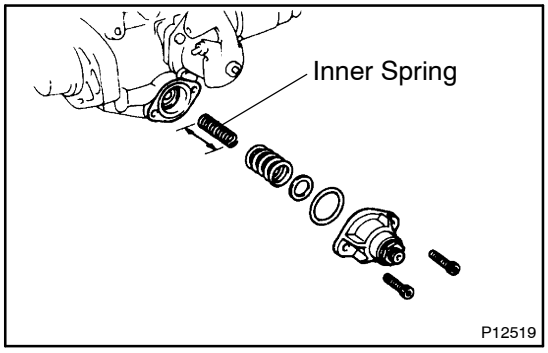
HINT:

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



Z09120

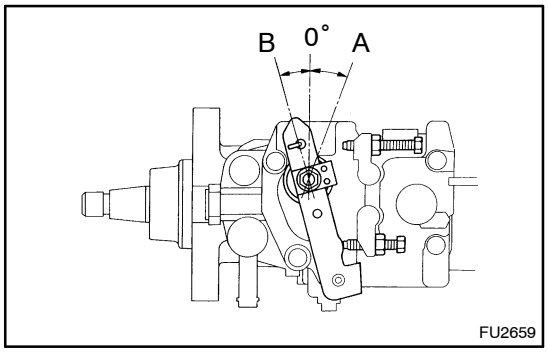
(d) Check the timer stroke for characteristic tendency.



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

Timer inner spring free length:
34.4 mm (1.35 in.)
34.0 mm (1.34 in.)
33.6 mm (1.32 in.)

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



11. ADJUST FULL LOAD INJECTION VOLUME

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

Adjusting lever angle:

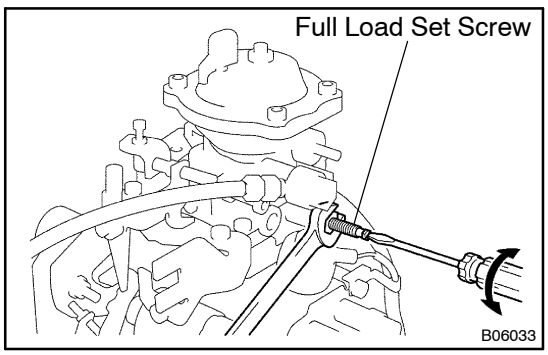
A (Maximum speed side)	B (Idle speed side)
Plus 21 – 31°	Minus 12 – 22°

(b) Europe:
Apply 80 kPa (0.81 kgf/cm^2, 11.5 psi) of pressure to the BACS union.

(c) Except Europe w/ HAC:
Apply 101.3 ± 0.2 kPa (760 ± 1.5 mmHg, 29.92 ± 0.06 in.Hg) absolute pressure.

(d) Measure the full load injection volume.

Item	Adjusting lever angle	Pump rpm	No. of measuring stroke	Each injection volume cc (cu in.)
Europe	Plus 21 – 31°	2,300	200	12.24 – 12.64 (0.75 – 0.78)
Except Europe				11.84 – 12.24 (0.72 – 0.75)



(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.

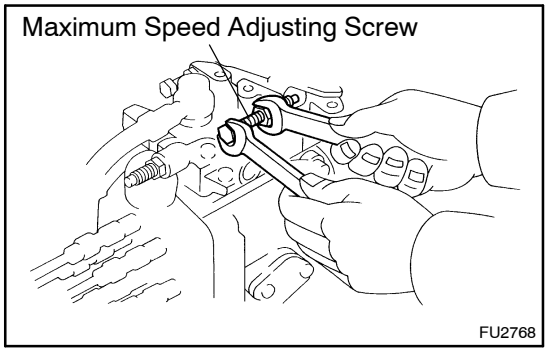
12. ADJUST MAXIMUM SPEED

(a) Europe:
Apply 80 kPa (0.81 kgf/cm^2, 11.5 psi) of pressure to the BACS union.

(b) Except Europe w/ HAC:
Apply 101.3 ± 0.2 kPa (760 ± 1.5 mmHg, 29.92 ± 0.06 in.Hg) absolute pressure.

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

Adjusting lever angle	Pump rpm	No. of measuring stroke	Each injection volume cc (cu in.)	Remarks
Plus 21 – 31°	2,300	200	4.6 – 6.6 (0.28 – 0.40)	Adjust
Minus 12 – 22°			2.0 (0.12) or less	–



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

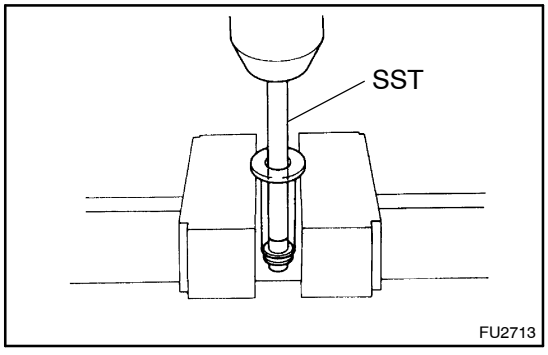
13. CHECK INJECTION VOLUME

(a) Europe:
Measure the injection volume at each pump rpm and BACS pressure.

Adjusting lever angle	Pump rpm	BACS pressure kPa (mmHg, in.Hg)	No. of measuring stroke	Each injection volume cc (cu in.)	Variation limit cc (cu in.)	Remarks
Plus 21 – 31°	1,200	80.0 (600, 23.62)	200	12.24 – 12.84 (0.75 – 0.78)	0.5 (0.03)	Basic full–load injection volume
		32.0 (240, 9.45)		11.40 – 12.20 (0.70 – 0.74)	–	–
		21.3 (160, 6.29)		10.52 – 11.32 (0.64 – 0.69)	–	–
	100	80.0 (600, 23.62)		10.00 – 14.00 (0.61 – 0.86)	1.4 (0.09)	Volume during starting
	500			10.90 – 11.90 (0.67 – 0.73)	0.6 (0.04)	–
	1,500			11.88 – 13.08 (0.72 – 0.80)	–	–
	1,900			10.88 – 12.08 (0.66 – 0.74)	0.6 (0.04)	–

(b) Except Europe:
Measure the injection volume at each pump rpm and absolute pressure.

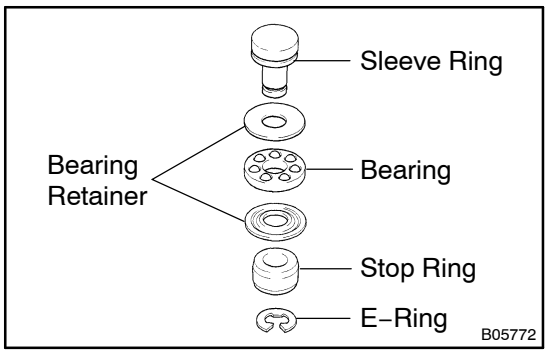
Item	Adjusting lever angle	Pump rpm	Absolute pressure kPa (mmHg, in.Hg)	No. of measuring stroke	Each injection volume cc (cu in.)	Variation limit cc (cu in.)	Remarks
w/ HAC	Plus 21 – 31°	1,200	101.3 (760, 29.92)	200	11.84 – 12.24 (0.72 – 0.75)	0.5 (0.03)	Basic full–load injection volume
			84.0 (630, 24.80)		10.78 – 11.38 (0.67 – 0.69)	–	–
			70.7 (760, 20.88)		9.82 – 10.24 (0.60 – 0.64)	–	–
		100	101.3 (760, 29.92)		10.00 – 14.00 (0.61 – 0.86)	1.4 (0.09)	Volume during starting
		500			10.48 – 11.48 (0.64 – 0.70)	0.6 (0.04)	–
		1,500			11.38 – 12.58 (0.69 – 0.77)	–	–
		1,900			10.42 – 11.62 (0.64 – 0.71)	0.6 (0.04)	–
w/o HAC	Plus 21 – 31°	1,200	101.3 (760, 29.92)	200	11.84 – 12.24 (0.72 – 0.75)	0.5 (0.03)	Basic full–load injection volume
		100			10.00 – 14.00 (0.61 – 0.86)	1.4 (0.09)	Volume during starting
		500			10.48 – 11.48 (0.64 – 0.70)	0.6 (0.04)	–
		1,500			11.38 – 12.58 (0.69 – 0.77)	–	–
		1,900			10.42 – 11.62 (0.64 – 0.71)	0.6 (0.04)	–



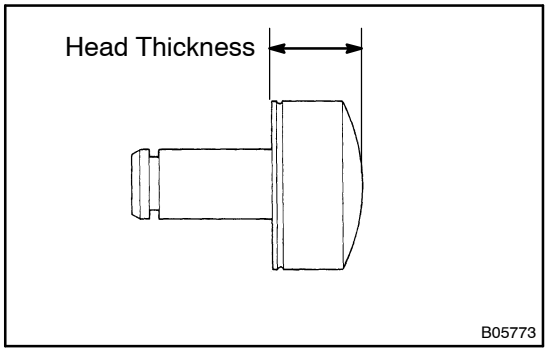
If the injection volume at 100 rpm is not as specified, replace the governor sleeve plug as follows:

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

SST 09236–00101 (09237–00070)



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

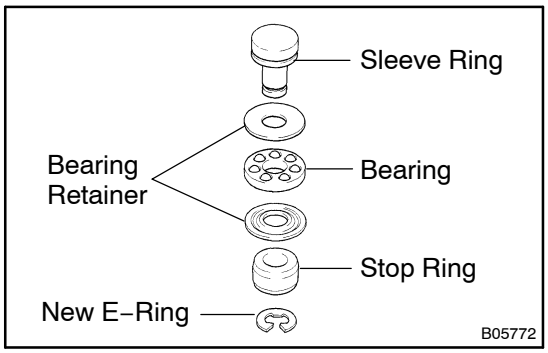


- Measure the head thickness of the sleeve plug, and select a new sleeve plug.

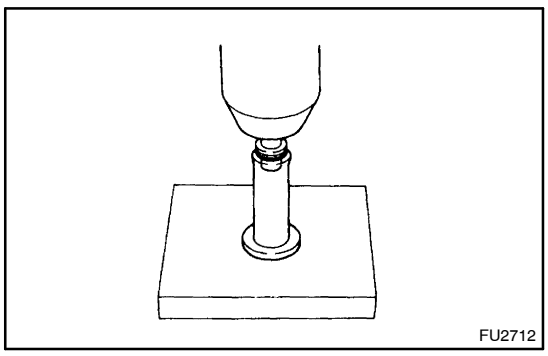
Sleeve plug head thickness: mm (in.)

3.0 (0.118)	3.5 (0.138)	4.0 (0.158)
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.



- Install the bearing, 2 bearing retainer and stop ring to the new sleeve plug with a new E–ring.



- Using a press, press in the sleeve plug assembly to the governor sleeve

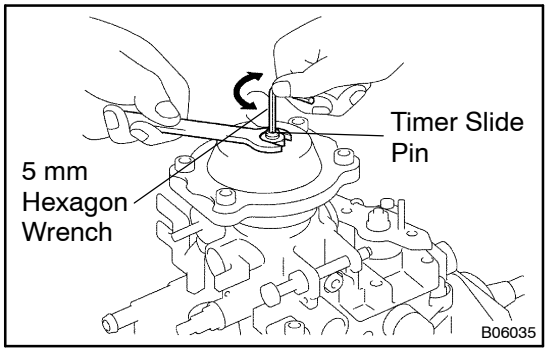
14. Europe:

ADJUST FULL LOAD MINIMUM INJECTION VOLUME

(a) Set the adjusting lever to maximum position.

(b) Measure the injection volume.

Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
500	200	10.90 – 11.90 (0.67 – 0.73)



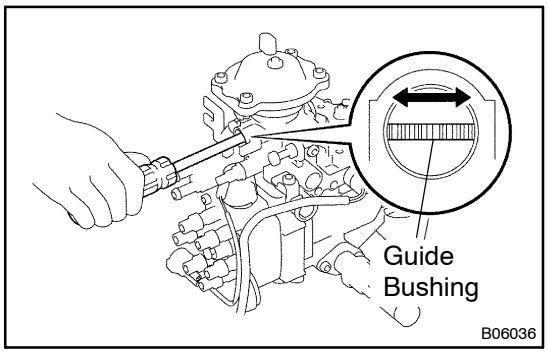
(c) Using a 5 mm hexagon wrench, adjust by turning the timer slide pin.

15. Europe:
ADJUST BACS CHARACTERISTIC

(a) Apply 21.3 kPa (0.22 kgf/cm^2, 3.1 psi) of pressure to the BACS union.

(b) Measure the injection volume.

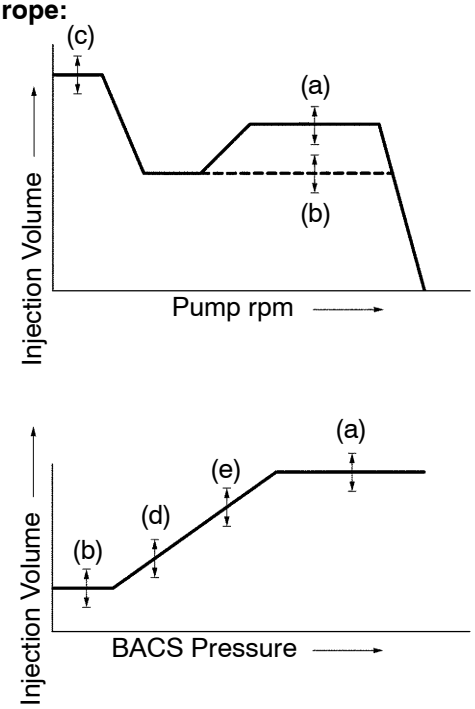
Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
1,200	200	10.52 – 11.32 (0.64 – 0.69)



(c) Using a screwdriver, adjust the injection volume by the guide bushing

HINT:
When the guide bushing is turned clockwise, as seen from above, the injection volume will increase.

Europe:



(a) Adjust full–load injection volume
(b) Adjust full–load minimum injection volume
(c) Adjust cold starting injection volume
(d) Adjust BACS characteristic
(e) Adjust BACS characteristic tendency

B00473
B00472
B00904

16. Europe:
CHECK FOR CHARACTERISTIC TENDENCY

(a) Apply 32.0 kPa (0.33 kgf/cm^2, 4.6 psi) of pressure to the BACS union.

(b) Measure the injection volume.

Pump rpm	No. of measuring stroke	Each injection volume cc cu in.)
1,200	200	11.40 – 12.20 (0.70 – 0.74)

17. Europe:
CHECK HYSTERESIS

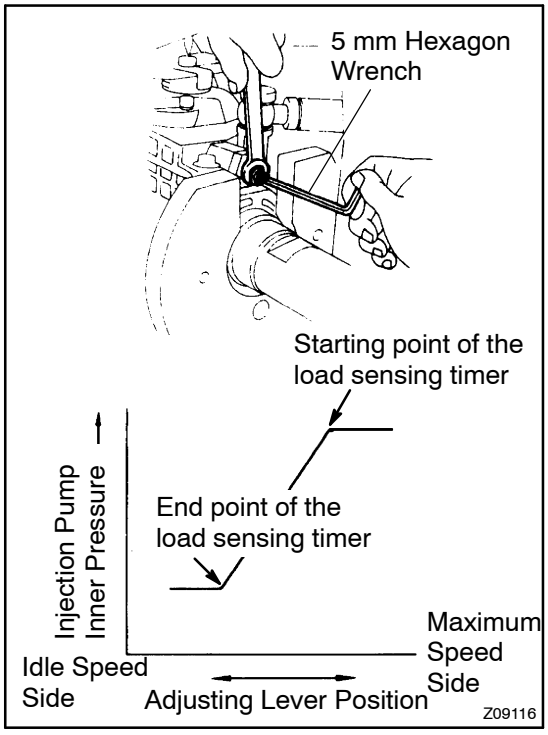
Compare the injection volume when the BACS pressure is lowered from 80 kPa (0.81 kgf/cm^2, 11.5 psi) to 0 kPa (0 kgf/cm^2, 0 psi) and conversely, when it is raised from zero.

HINT:

Make measurements after moving the adjusting lever between idle and maximum 3 times for each lowering of the pressure.

Pump rpm	BACS pressure kPa (mmHg, in.Hg)	No. of measuring stroke	Each injection volume cc (cu in.)	Hysteresis cc (cu in.)
1,200	80.0 (600, 23.62)	200	12.24 – 12.84 (0.75 – 0.78)	–
	32.0 (240, 9.45)		11.40 – 12.20 (0.70 – 0.74)	–
	21.3 (160, 6.29)		10.52 – 10.32 (0.64 – 0.69)	0.3 (0.02) or less
	0 (0, 0)		9.74 – 10.34 (0.59 – 0.63)	–

If not within standard value, check each sliding part of the BACS and check whether or not there is any oil.



18. 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.

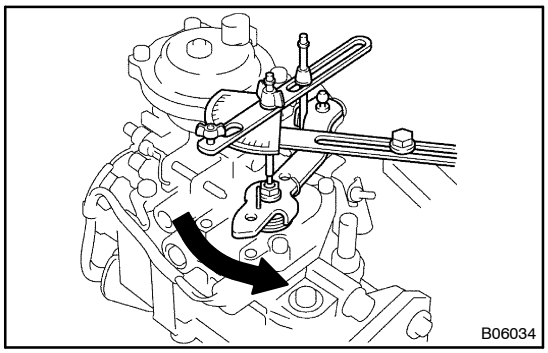
(b) Set the adjusting lever to maximum position.

(c) Europe:
Apply 80 kPa (0.81 kgf/cm^2, 11.5 psi) of pressure to the BACS union.

(d) Except Europe w/ HAC:
Apply 101.3 ± 0.2 kPa (760 ± 1.5 mmHg, 29.92 ± 0.06 in.Hg) absolute pressure.

(e) Measure the injection volume.

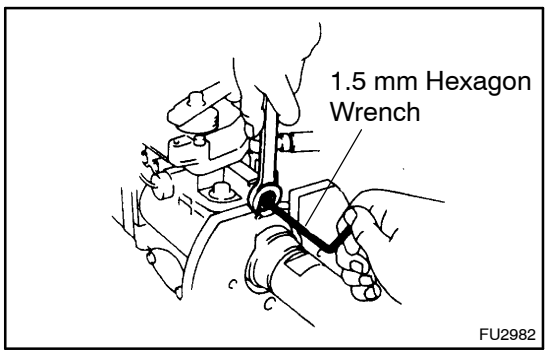
Adjusting lever position	Pump rpm	No. of measuring strokes
Maximum speed side	1,520	200



(f) 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.

(g) Measure the injection volume at the drop point (starting point).

Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
1,520	200	Measured value at step (f) minus 1.4 (0.09) ± 0.4 (0.02)



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

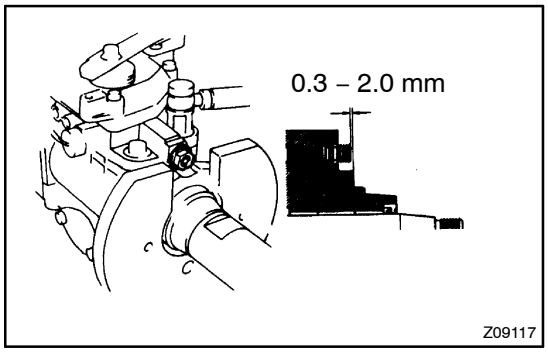
HINT:
The injection volume will increase approx. 3 cc (0.2 cu in.) with each1/2 turn of the governor shaft.

(i) 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 an the point where the pump inner pressure stops dropping.

pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
1,520	200	7.6 (0.46) or more

(j) When the adjusting lever is moved slowly from the maximum speed side to the idle speed side.

Item	Pump rpm	Timer piston fluctuation mm (in.)
Europe and Malaysia	1,520	3.86 – 4.66 (0.1520 – 0.1835)
Others		2.53 – 3.43 (0.0996 – 1.3503)

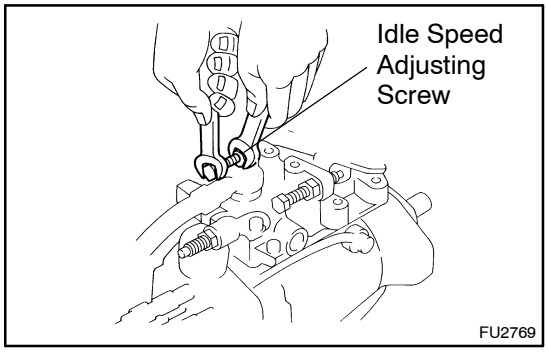


(k) Check the protrusion of the governor shaft.
Protrusion: 0.3 – 2.0 mm (0.020 – 0.079 in.)

19. ADJUST IDLE SPEED

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

Adjusting lever angle	Pump rpm	No. of measuring stroke	Each injection volume cc (cu in.)	Variation limit cc (cu in.)	Remarks
Minus 12 – 22°	375	200	q = 2.30 – 3.30 (0.14 – 0.20)	0.5 (0.03)	Pre–set
	350		More than q plus 0.5 (0.03)	–	–
	450		q Minus 1.2 – 2.4 (0.07 – 0.15)	–	
	325		3.36 – 4.36 (0.21 – 0.27)	0.5 (0.03)	Adjust



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

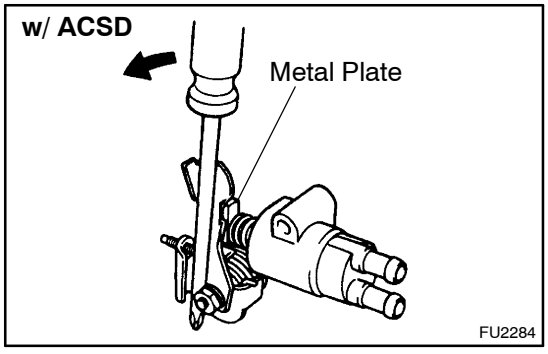
20. w/ACSD:
ADJUST COLD STARTING SYSTEM

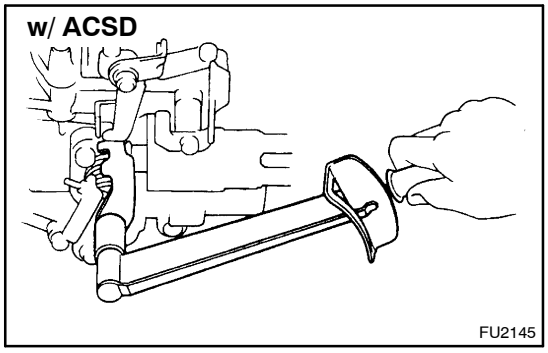
(a) Remove the overflow screw and check the fuel temperature in the fuel pump.
Fuel temperature: 15 – 35°C (59 – 95°F)

(b) Check that the cam part of the camplate is not on top of the roller ring.

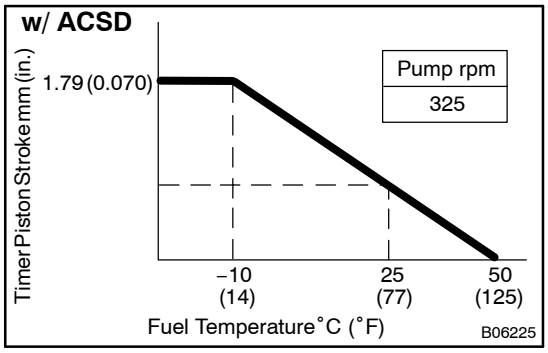
(c) Set the scale of the timer measuring device to zero.

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

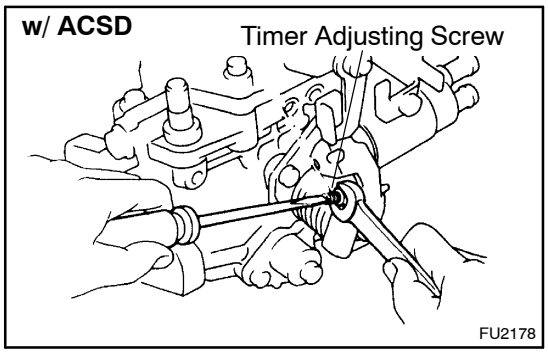




(e) Torque the cold starting lever clockwise to approx. and keep the lever tightened for about 10 seconds. Then release the torque.



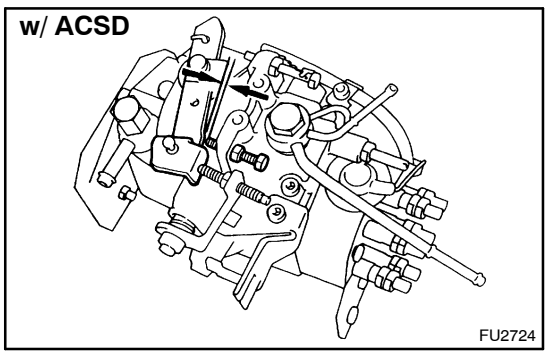
(f) Measure the timer piston stroke.



(g) Adjust by turning the timer adjusting screw.

HINT:

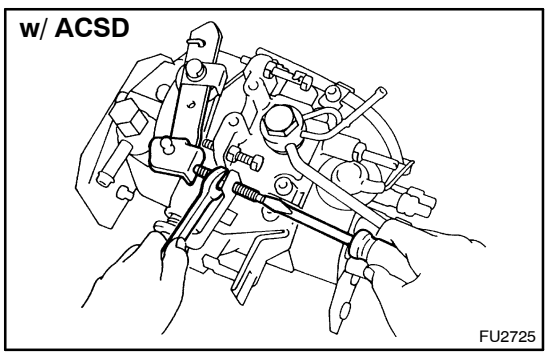
Screw in for stroke decrease.



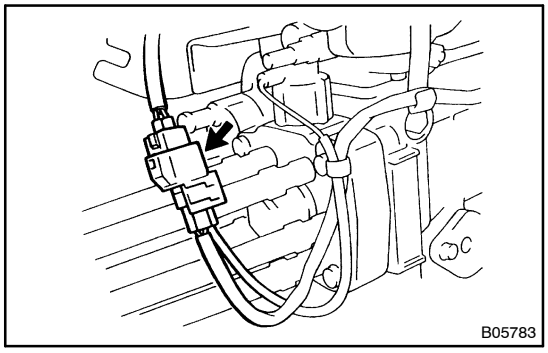
21. w/ACSD:
ADJUST FAST IDLE

(a) Measure the clearance between the adjusting lever and idle speed adjusting screw.

Fuel temperature ˚C (˚F)	Clearance mm (in.)
15 (59)	1.3 (0.051)
30 (86)	0 (0)

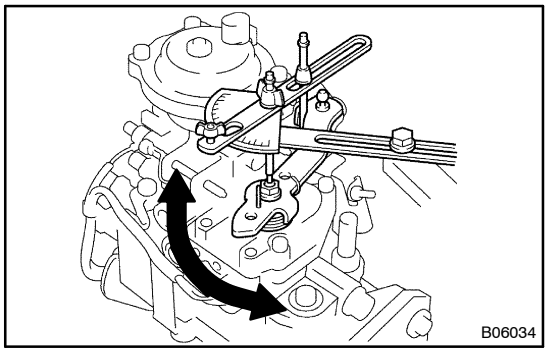


(b) Adjust by turning the fast idle adjusting screw.

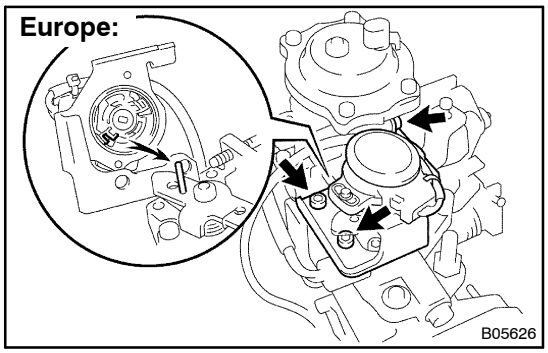


22. POST ADJUSTMENT CHECK

(a) Check that injection stops when the fuel cut solenoid harness is removed.
Pump revolution:
150 rpm
q = 3.1 cc (0.19 cu in.) or less



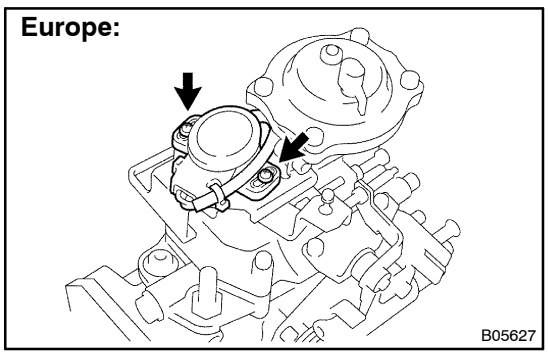
(b) Check the adjusting lever movement.
Adjusting lever angle: 38 – 48°



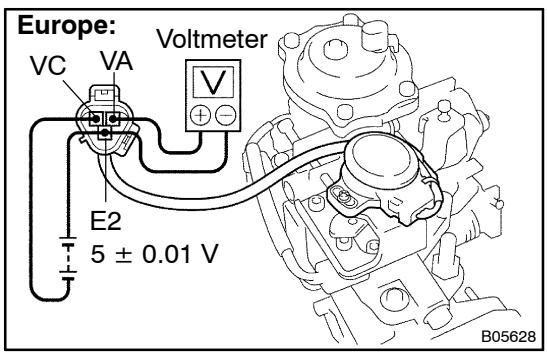
23. Europe:
INSTALL THROTTLE POSITION SENSOR AND BRACKET ASSEMBLY

(a) Attach the portions of the throttle position sensor and adjusting lever.

(b) Using a 5 mm hexagon wrench, install the throttle position sensor with the 3 bolts.



(c) Loosen the 2 screws holding the throttle position sensor to the bracket.



(d) Apply 5 ± 0.01 V across terminals VC and E2.

(e) Connect the tester probes of a voltmeter to terminals VA and E2 of the throttle position sensor.

(f) Secure the adjusting lever fully on the maximum speed side so that its output will be 0.6 ± 0.025 V.

(g) Tighten the 2 screws holding the throttle position sensor to the bracket.

24. SEAL PARTS

(a) Europe:
Seal the full load set screw and maximum speed adjusting screw with new lead seal.

(b) Except Europe:
(1) Seal the full load set screw with new cap seal.
(2) Seal the maximum speed adjusting screw with new lead seal.

25. INSTALL FUEL PIPES

(a) Install the nozzle leakage pipe No.2 and 2 new gaskets with the union bolt.
Torque: 22.1 N·m (225 kgf·cm, 16 ft·lbf)

(b) Install the fuel inlet pipe and 2 new gaskets with the cap nut and bolt.
Torque: 24.55 N·m (250 kgf·cm, 18 ft·lbf)