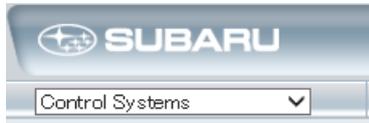
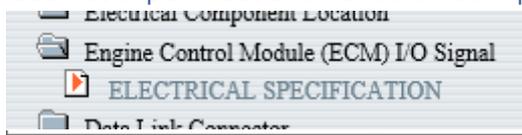


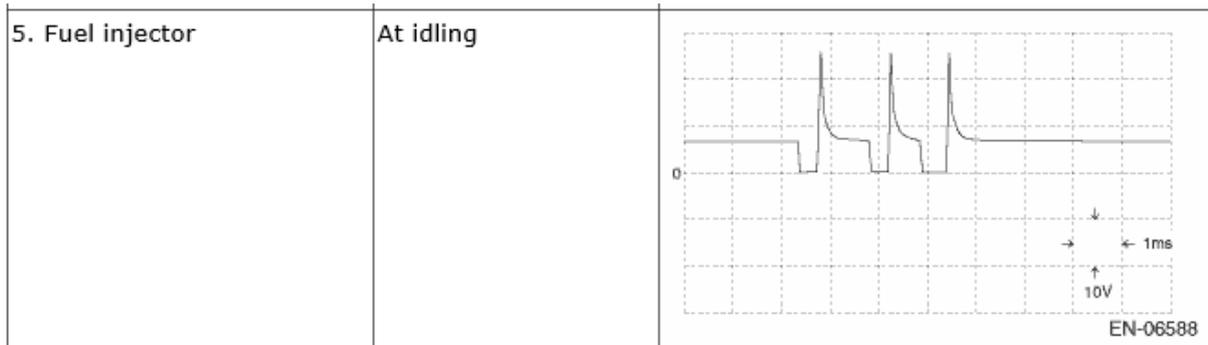
# EE20 Trouble Shooting Guide:



## Oscilloscope Measurements on Components:



Input/output name	Measuring condition	Waveform
1. Crankshaft position sensor	At idling	<p>EN-06519</p>
2. Camshaft position sensor	At idling	<p>EN-06520</p>
3. EGR control valve	At idling	<p>EN-06586</p>
4. Suction control valve	At idling	



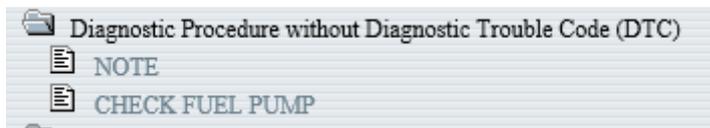
## Engine Parameters at Idle:



Contents	Display	Unit of measure	Note (at idling)
Engine coolant temperature signal	Coolant Temp.	°C or °F	80 – 100°C
Intake manifold absolute pressure	Mani. Absolute Pressure	kPa, mmHg, inHg or psig	70 – 110 kPa
Engine speed signal	Engine Speed	rpm	800 rpm
Meter vehicle speed signal	Vehicle Speed	km/h or MPH	0 km/h
Intake air temperature signal (intake manifold)	Intake Air Temp.	°C or °F	20 – 80°C
Intake air amount	Mass Air Flow	g/s or lb/m	5 – 12 g/s
Throttle opening angle signal	Throttle Opening Angle	%	70 – 80 %
Battery voltage	Battery Voltage	V	12 – 15 V
Mass air flow voltage	Air Flow Sensor Voltage	V	1 – 2 V
Atmospheric pressure	Atmosphere Pressure	kPa, mmHg, inHg or psig	(Atmospheric pressure)
Acceleration opening angle signal	Accel. Opening Angle	%	0%
Fuel temperature signal	Fuel Temp.	°C or °F	20 – 80°C
Primary supercharged pressure control signal	Primary Control	%	30 – 60%
Generator duty ratio	ALT Duty	%	0 – 100%
Throttle motor duty ratio	Throttle Motor Duty	%	5 – 25%
Main throttle sensor voltage	Main-Throttle Sensor	V	3 – 4.6 V
Sub accelerator sensor voltage	Sub-Accelerator Sensor	V	0.57 – 0.79 V
Main acceleration sensor voltage	Main-Accelerator Sensor	V	0.57 – 0.77 V
Memory vehicle speed	Memorized Cruise Speed	km/h or MPH	—
Main Injection Period	Main Injection Period	°CA	–7 – 3°CA
Final Injection Amount	Final Injection Amount	mm <sup>3</sup> /st	3 – 10 mm <sup>3</sup> /st
Number of Times Injected	Number of Times Injected	—	2 – 3
Target intake manifold pressure	Target Intake Manifold Pressure	kPa	70 – 110 kPa
Target intake air amount	Target Intake Air Amount	mg/cyl	300 – 400 mg/cyl
Intake air amount	Mass Air Flow	mg/cyl	300 – 400 mg/cyl
Target EGR Valve Opening Angle	Target EGR Valve Opening Angle	deg	20 – 40 deg
EGR Valve Opening Angle	EGR Valve Opening Angle	deg	20 – 40 deg
EGR duty ratio	EGR Duty	%	0 – 30%
Target Common Rail Pressure	Target Common Rail Pressure	MPa	20 – 30 MPa
Common rail pressure	Common rail pressure	MPa	20 – 30 MPa
Intake air temperature signal (air flow sensor)	Intake Air Temperature	°C or °F	20 – 60°C
Target engine speed	Target engine speed	rpm	800 rpm
Boost Pressure Feedback	Boost Pressure Feedback	%	0%
Electric power steering current value	Electric Power Steering Current Value	A	0A

Target Fuel Pump Current	Target Fuel Pump Current	mA	1500 — 2000 mA
Actual Fuel Pump Current	Actual Fuel Pump Current	mA	1500 — 2000 mA
Mileage after Injector Learning	Mileage after Injector Learning	km or mile	—
Mileage after Injector Replacement	Mileage after Injector Replacement	km or mile	—
Interior heater	Interior heater	Steps	—
Cylinder #1 quantity correction value	Cylinder #1 quantity correction value	ms	-0.4 — 0.4 ms
Cylinder #2 quantity correction value	Cylinder #2 quantity correction value	ms	-0.4 — 0.4 ms
Cylinder #3 quantity correction value	Cylinder #3 quantity correction value	ms	-0.4 — 0.4 ms
Cylinder #4 quantity correction value	Cylinder #4 quantity correction value	ms	-0.4 — 0.4 ms
Delivery (test) mode terminal	Test Mode Signal	—	OFF
D-check Require Flag	D-check Require Flag	—	OFF
Delivery (test) mode terminal	Delivery Mode Connector (Test Mode Connector)	—	OFF
Neutral position switch signal	Neutral Position Switch	—	ON
Soft idle switch signal	Idle Switch Signal	—	ON
Ignition switch signal	Ignition Switch	—	ON
Air conditioning switch signal	A/C Switch	—	OFF (when OFF)
Starter switch signal	Starter Switch	—	OFF
Crankshaft position sensor signal	Crankshaft Position Sig.	—	ON
Camshaft position sensor signal	Camshaft Position Sig.	—	ON
Rear defogger switch signal	Rear Defogger SW	—	OFF (when OFF)
Blower fan switch signal	Blower Fan SW	—	OFF (when OFF)
Light switch signal	Light Switch	—	OFF (when OFF)
Wiper switch signal	Wiper Switch	—	OFF (when OFF)
Air conditioner compressor relay output signal	A/C Compressor Signal	—	OFF (when OFF)
Radiator fan relay 1 signal	Radiator Fan Relay #1	—	OFF (when OFF)
Radiator fan relay 2 signal	Radiator Fan Relay #2	—	OFF (when OFF)
Vehicle dynamics control (VDC) torque down prohibition output	Ban of Torque Down	—	ON
Vehicle dynamics control (VDC) torque down demand	Request Torque Down VDC	—	OFF
Clutch switch signal	Clutch Switch	—	OFF (when OFF)
Stop light switch signal	Stop lamp SW	—	OFF (when OFF)
SET/COAST switch signal	SET/COAST Switch	—	OFF (when OFF)
RESUME/ACCEL switch signal	RESUME/ACCEL Switch	—	OFF (when OFF)
Brake switch signal	Brake Switch	—	OFF (when OFF)
Cruise control main switch signal	Main Switch	—	OFF (when OFF)
Body integrated unit data reception	Body Int. Unit Data	—	ON
Body integrated unit counter update	Body Int. Unit Count	—	ON
Cruise control cancel switch signal	CC Cancel SW	—	OFF (when OFF)
Malfunction indicator light signal	MIL On Flag	—	Light OFF
Boost Pressure Control Mode	Boost Pressure Control Mode	—	Open
EGR Control Mode	EGR Control Mode	—	Feedback
Glow relay signal	Glow Relay	—	OFF
Sub fuel pump relay signal	Sub Fuel Pump Relay	—	ON
Fuel Pump Learning	Fuel Pump Learning	—	Completed
Injector learning	Injector Learning	—	Completed
EGR Learning	EGR Learning	—	Completed
Fuel Cut Request	Fuel Cut Request	—	Without Request
Fuel Pump Mode	Fuel Pump Mode	—	Feedback
Clutch Switch for Smart	Clutch Switch for Smart	—	OFF
DPF Regeneration	DPF Regeneration	—	Regeneration not in progress
Cumulative ash ratio	Cumulative ash ratio	%	0 — 100%
Deviation between DPF inlet and outlet pressure	Deviation between DPF inlet and outlet pressure	kPa	0 — 3 kPa
Exhaust Gas Temperature at Catalyst Inlet	Exhaust Gas Temperature at Catalyst Inlet	°C	100 — 300°C
Exhaust Gas Temperature at DPF Inlet	Exhaust Gas Temperature at DPF Inlet	°C	100 — 300°C
Estimated Catalyst Temperature	Estimated Catalyst Temperature	°C	100 — 300°C
Estimated DPF Temperature	Estimated DPF Temperature	°C	100 — 300°C
Soot Accumulation Ratio	Soot Accumulation Ratio	%	0 — 100%
Oil Dilution Ratio	Oil Dilution Ratio	%	0 — 15%
Accumulated over-rev count (5,900 rpm or more)	Accumulated count of over-rev instance (very high RPM)	time	0
Accumulated over-rev count (5,500 rpm or more)	Accumulated count of over-rev instance (high RPM)	time	0
Actual Common Rail Pressure (Time Synchronized)	Actual Common Rail Pressure (Time Synchronized)	MPa	20 — 30 MPa
Estimated distance to oil change	Estimated distance to oil change	km	—
Running distance after last regeneration	Running distance after last regeneration	km	—
DPF regeneration count	DPF regeneration count	time	—
Marginal quantity final learning value 1_1	Marginal Q (quantity) Final learning Value 1_1	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 1_2	Marginal Q (quantity) Final learning Value 1_2	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 1_3	Marginal Q (quantity) Final learning Value 1_3	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 1_4	Marginal Q (quantity) Final learning Value 1_4	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 2_1	Marginal Q (quantity) Final learning Value 2_1	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 2_2	Marginal Q (quantity) Final learning Value 2_2	ms	-0.3 — 0.3 ms

Marginal quantity final learning value 2_2	Marginal Q (quantity) Final learning Value 2_2	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 2_3	Marginal Q (quantity) Final learning Value 2_3	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 2_4	Marginal Q (quantity) Final learning Value 2_4	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 3_1	Marginal Q (quantity) Final learning Value 3_1	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 3_2	Marginal Q (quantity) Final learning Value 3_2	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 3_3	Marginal Q (quantity) Final learning Value 3_3	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 3_4	Marginal Q (quantity) Final learning Value 3_4	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 4_1	Marginal Q (quantity) Final learning Value 4_1	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 4_2	Marginal Q (quantity) Final learning Value 4_2	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 4_3	Marginal Q (quantity) Final learning Value 4_3	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 4_4	Marginal Q (quantity) Final learning Value 4_4	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 5_1	Marginal Q (quantity) Final learning Value 5_1	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 5_2	Marginal Q (quantity) Final learning Value 5_2	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 5_3	Marginal Q (quantity) Final learning Value 5_3	ms	-0.3 — 0.3 ms
Marginal quantity final learning value 5_4	Marginal Q (quantity) Final learning Value 5_4	ms	-0.3 — 0.3 ms
Individual pump difference learning memory value	Individual Pump Difference Learning Memory Value	mA	-100 — 100 mA
Final main injection period	Final Main Injection period	ms	0.3 — 0.8 ms



## 1. COMMON RAIL PRESSURE INSPECTION PROCEDURE WHEN ENGINE IS COLD

### CAUTION:

**This inspection must be completed quickly before the engine coolant temperature reaches 60°C (140°F).**

1. Turn off all the electric load.
2. In "Current Data Display & Save" on the Subaru Select Monitor, display the following items using the "data select display".

Item	Unit
Coolant Temp.	°C or °F
Engine Speed	rpm
Common rail pressure	kPa, mmHg, inHg, or psig
Target Common Rail Pressure	kPa, mmHg, inHg, or psig

### NOTE:

- If the "data select display" is not used, the measurement accuracy is degraded and correct measurement results cannot be obtained.
- Perform the measurement on the "digital data screen".
- For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".

3. Start the engine when "Coolant Temp." is less than 60°C (140°F), and measure each engine speed in **Table 1** for approximately 10 seconds and save the measurement data. If the "Common rail pressure" data at each engine speed is within the range shown in **Table 1**, it is normal.

**NOTE:**

- Perform the measurement quickly so that the "Coolant Temp." does not become high.
- Examine the measurement data on the "Graph2 screen". When doing so, change the range as necessary in order to examine the data in more detail.
- In Table 1, the actual "Target Common Rail Pressure" measurement value at each engine speed is shown as A, B, or C respectively.

**Table 1 Common rail pressure change**

Item	Engine speed		
	Idling (Accelerator opening: 0%)	2,000 rpm (Accelerator opening: Constant)	4,000 rpm (Accelerator opening: Constant)
Common rail pressure (kPa)	A±3,000	B±3,000	C±3,000
Target Common Rail Pressure (kPa)	A	B	C

4. Start the engine when "Coolant Temp." is less than 60°C (140°F), and measure each engine speed range in **Table 2** three times consecutively and save the measurement data.

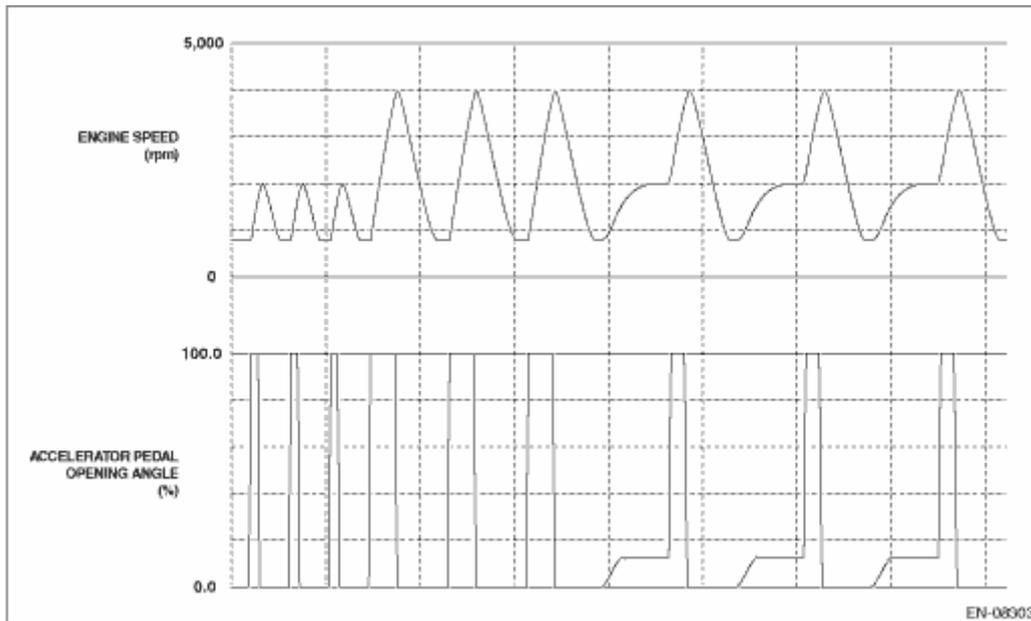
When the measurement is finished for all the engine speed ranges, repeat the measurement again and save the measurement data.

If the "Common rail pressure" data in each engine speed range is within the range shown in **Table 2**, it is normal.

**NOTE:**

- Perform the measurement quickly so that the "Coolant Temp." does not become high.
- After keeping the accelerator pedal in the released state, bring the engine speed to the target speed with the accelerator opened to 100%. When the target speed is reached, release the accelerator pedal.
- Except when keeping the 2,000 rpm state, operate the accelerator pedal rapidly.
- Examine the measurement data on the "Graph2 screen". When doing so, change the range as necessary in order to examine the data in more detail.
- In Table 2, the actual "Target Common Rail Pressure" measurement value in each engine speed range is shown as A, B, or C respectively.

## Measurement image



**Table 2 Common rail pressure following capacity**

Item	Engine speed range		
	Idling → 2,000 rpm (Accelerator opening: 0 → 100%)	Idling → 4,000 rpm (Accelerator opening: 0 → 100%)	2,000 → 4,000 rpm (Accelerator opening: Constant → 100%)
Common rail pressure (kPa)	$\geq 20,000$ and $\leq \text{max. of A} + 20,000$ $\geq \text{min. of A} - 15,000$	$\geq 20,000$ and $\leq \text{max. of B} + 20,000$ $\geq \text{min. of B} - 15,000$	$\geq 20,000$ and $\leq \text{max. of C} + 20,000$ $\geq \text{min. of C} - 15,000$
Target Common Rail Pressure (kPa)	A	B	C

## 2. COMMON RAIL PRESSURE INSPECTION PROCEDURE WHEN ENGINE IS WARM

1. Turn off all the electric load.
2. Perform the fuel pump compulsory learning mode. 
3. In "Current Data Display & Save" on the Subaru Select Monitor, display the following items using the "data select display".

Item	Unit
Coolant Temp.	°C or °F

Item	Unit
Engine Speed	rpm
Common rail pressure	kPa, mmHg, inHg, or psig
Target Common Rail Pressure	kPa, mmHg, inHg, or psig

**NOTE:**

- If the “data select display” is not used, the measurement accuracy is degraded and correct measurement results cannot be obtained.
- Perform the measurement on the “digital data screen”.
- For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

4. Measure each engine speed in **Table 3** for approximately 10 seconds and save the measurement data.

If the “Common rail pressure” data at each engine speed is within the range shown in **Table 3**, it is normal.

**NOTE:**

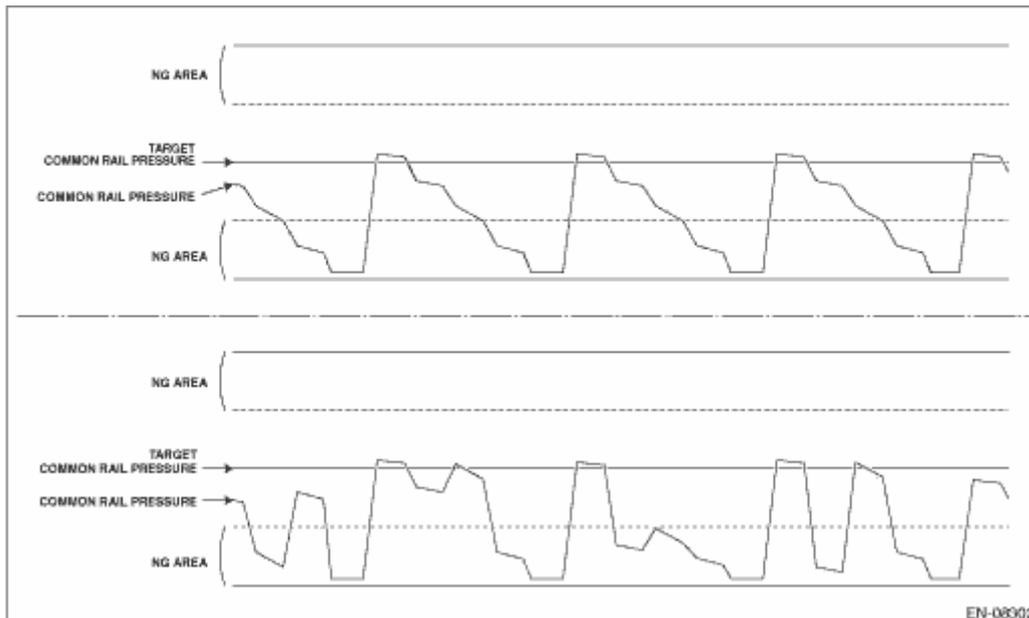
- Examine the measurement data on the “Graph2 screen”. When doing so, change the range as necessary in order to examine the data in more detail.
- In **Table 3**, the actual “Target Common Rail Pressure” measurement value at each engine speed is shown as A, B, or C respectively.

**Table 3 Common rail pressure change**

Item	Engine speed		
	Idling (Accelerator opening: 0%)	2,000 rpm (Accelerator opening: Constant)	4,000 rpm (Accelerator opening: Constant)
Common rail pressure (kPa)	A±3,000	B±3,000	C±3,000
Target Common Rail Pressure (kPa)	A	B	C

**NOTE:**

If the Common rail pressure is significantly below the lower limit of the Target Common Rail Pressure, with a waveform with cyclic down movements, the fuel pump needs to be replaced.



**5.** Measure each engine speed range in **Table 4** three times consecutively and save the measurement data.

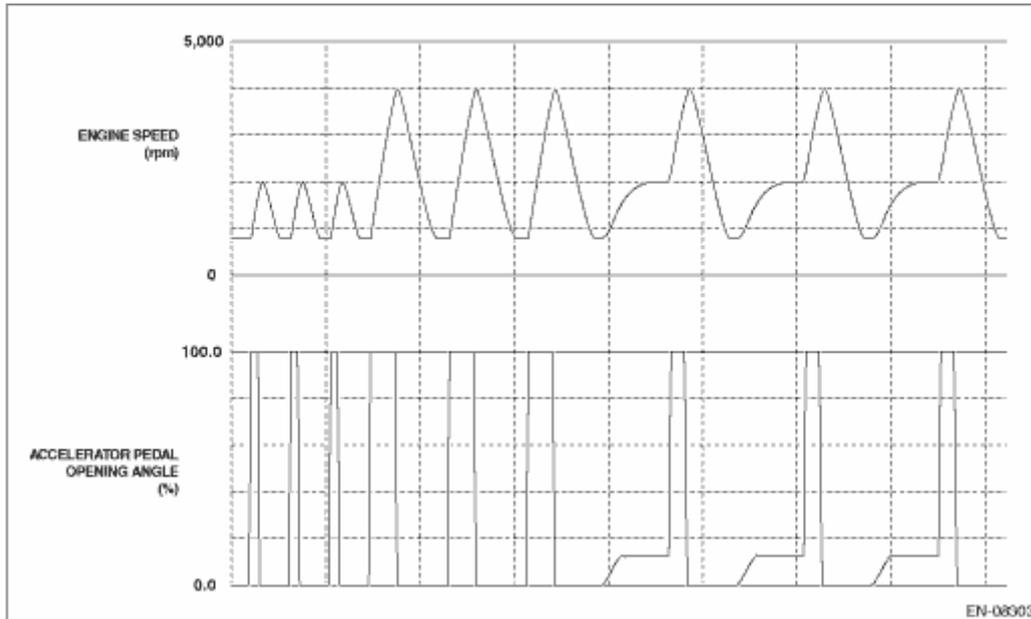
When the measurement is finished for all the engine speed ranges, repeat the measurement again and save the measurement data.

If the "Common rail pressure" data in each engine speed range is within the range shown in **Table 4**, it is normal.

**NOTE:**

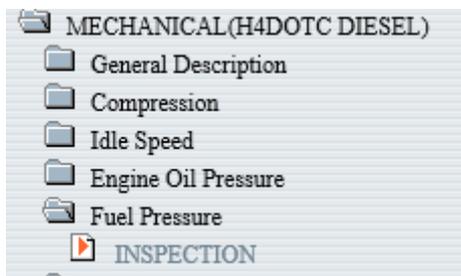
- After keeping the accelerator pedal in the released state, bring the engine speed to the target speed with the accelerator opened to 100%. When the target speed is reached, release the accelerator pedal.
- Except when keeping the 2,000 rpm state, operate the accelerator pedal rapidly.
- Examine the measurement data on the "Graph2 screen". When doing so, change the range as necessary in order to examine the data in more detail.
- In **Table 4**, the actual "Target Common Rail Pressure" measurement value in each engine speed range is shown as A, B, or C respectively.

**Measurement image**



**Table 4 Common rail pressure following capacity**

Item	Engine speed range		
	Idling → 2,000 rpm (Accelerator opening: 0 → 100%)	Idling → 4,000 rpm (Accelerator opening: 0 → 100%)	2,000 → 4,000 rpm (Accelerator opening: Constant → 100%)
Common rail pressure (kPa)	$\geq 20,000$ and $\leq \text{max. of A} + 20,000$ $\geq \text{min. of A} - 15,000$	$\geq 20,000$ and $\leq \text{max. of B} + 20,000$ $\geq \text{min. of B} - 15,000$	$\geq 20,000$ and $\leq \text{max. of C} + 20,000$ $\geq \text{min. of C} - 15,000$
Target Common Rail Pressure (kPa)	A	B	C



MECHANICAL(H4DOTC DIESEL) > Fuel Pressure

**INSPECTION**

1. Drive the vehicle for 5 – 10 km (3 – 6 miles) to warm up the engine coolant temperature to 85°C (185°F) or higher.

**NOTE:**

Connect the Subaru Select Monitor to the vehicle, and from the "READ CURRENT DATA FOR ENGINE", check the "Coolant Temp.".

2. Park the vehicle on a level surface and stop the engine.

3. Shift the manual transmission gear shift lever to neutral.

4. Place wheel chocks at the front and rear of all wheels and securely engage the parking brake.

5. Start the engine, and read the current data of the engine.

**NOTE:**

When performing fuel pressure measurement, always do so with the engine coolant temperature at 85°C (185°F) or higher.

Item names displayed on the Subaru Select Monitor	Inspection parameters	Reference value
Common rail pressure	800 rpm (During idling speed)	25 MPa ±5 Mpa
	2,000 rpm	51 MPa ±5 Mpa
	3,000 rpm	61 MPa ±5 Mpa
	4,000 rpm	79 MPa ±5 Mpa