



SERVICE MANUAL INFORMATION

**SB-18-037 XL DTC P24FE WORKSHOP MANUAL
CORRECTION**

**GROUP: SERVICE MANUAL UPDATE
BULLETIN NO: SB-18-037
DATE: 12-18-2018
REF: SB-A-11-093**

SUBJECT VEHICLES: 2020MY XL Trucks with an A09 engine.

The following is to inform you of the above caption. This service data should be attached to the relevant pages of the workshop manuals for maintenance and to use for servicing.

OVERVIEW:

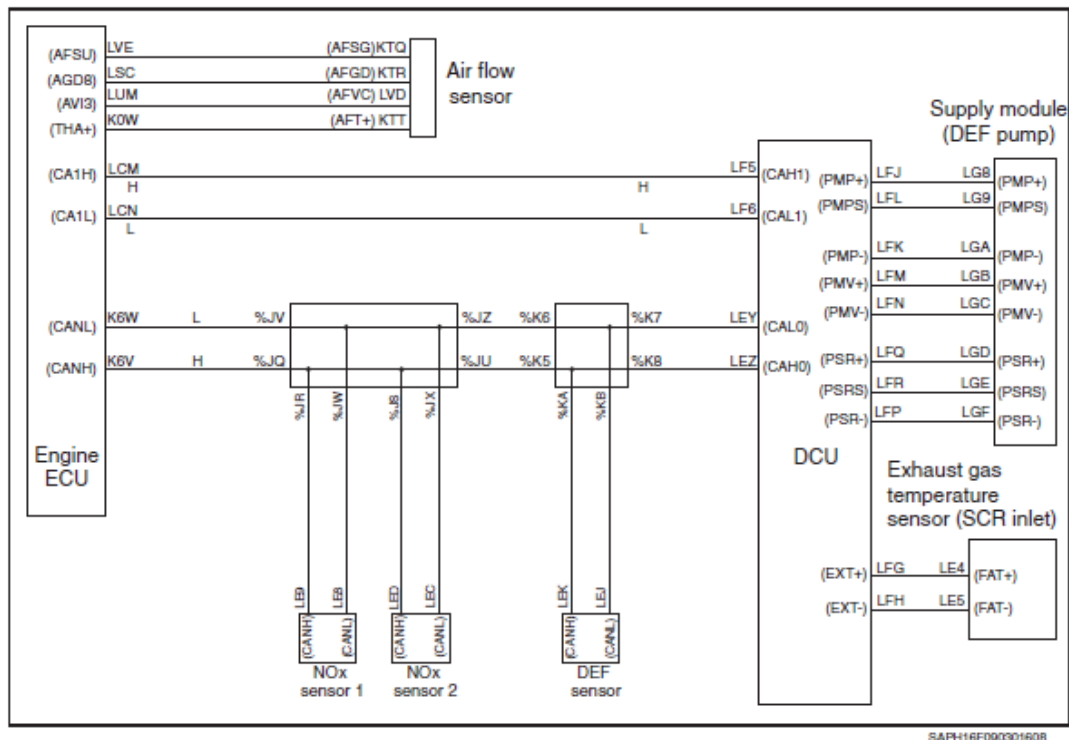
Workshop manual correction of DTC P24FE procedure.



DTC: P24FE

EN01H16F09030F03001217

P24FE Removal of DEF SCR catalyst



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1. Technical description

- Removal of the SCR catalyst will be judged if decrease in clarifying efficiency occurs.
- Conversion efficiency is calculated by upstream and downstream NOx sensors.
- Clarifying efficiency may decrease because of a decrease or increase in the added urea quantity caused by slip-page of the sensor, or because of a difference in the amount of adsorbed NH3 or deteriorated hardware.

<Description of malfunction>

- Removal of the urea SCR catalyst has been detected.

2. DTC set condition

(1) DTC detection condition

- Conditions below continue for 23 seconds.
- 1,000 r/min $\leq$ Engine speed $\leq$ 2,500 r/min
- 20 mm³/st. cyl. $\leq$ Fuel injection quantity $<$ 150 mm³/st. cyl.
- 210 °C [410 °F] $\leq$ SCR catalyst temperature $<$ 340 °C [644 °F]
- 50 ppm $\leq$ NOx (SCR upstream) $<$ 1,000 ppm
(NOx sensor 1 (SCR upstream) stable and NOx sensor 2 (SCR downstream) stable)
- Intake air temperature $>$ -20 °C [-4 °F]
- 60 % $\leq$ Ratio of actual NH₃ load $<$ 120 %
- Calculated HC load $<$ 0.1 g

- NOx sensor 1 (SCR upstream) and NOx sensor 2 (SCR downstream) are valid for 121 seconds.
- DPF active regeneration not in process.
- DEF injection volume ≥ 500 mg/sec
- $11\text{ V} < \text{Battery voltage} < 32\text{ V}$
- DEF quality sensor is valid and $35\% \geq \text{DEF quality concentration} \geq 30\%$.

(2) Judgment criteria

- Calculate Average NOx conversion efficiency from NOx sensor 1 (upstream) and 2 (downstream).
- Average NOx conversion efficiency ≤ 0.03

3. Reset condition

- Immediately after normal operation is restored and SCR-related memory is reset.

4. Indication, warning or system control regulation when the DTC is set.

- MIL: OFF
- SVS light: ON

5. Symptoms on the vehicle when the DTC is set

<Symptoms on the vehicle due to backup control (fail safe function)>

- –

<Symptoms on the vehicle due to malfunction>

- Engine output is insufficient.
- Vehicle does not speed up.

6. Pre-inspection work

- Check that the battery voltage is in the normal range.
- Check that no malfunction is found by conducting the failure diagnosis system check.

7. After-inspection work

- Clear all past DTCs.
- Reset "Urea SCR related memory".
- Check that no DTC is detected after test drive.

8. Estimated failure factors

- Removal of urea SCR catalyst
- NOx sensor failure
- Air flow sensor failure
- Exhaust gas temperature sensor (SCR inlet) failure
- DEF injector failure
- SCR catalyst: Difference from the calculated adsorbed amount; poisoning and deterioration due to HC

INSPECTION PROCEDURE: P24FE**1 Inspect the DEF**

1. Check the DEF concentration.

Standard values
Concentration: 32.5 ± 2.5 %

Do the measurements meet the standard value?

YES

Go to step 2.

NO

Replace the DEF.

If the DEF concentration is below the standard, drain the DEF solution through the tankdrain with the starter switch ON, and then refill the tank with at least 5 liters {1.3 gallons} of DEF solution. Afterward, drive the vehicle and confirm that the problem does not recur under driving conditions. Perform "After-inspection work" of INFORMATION section.

2 Perform a basic engine check

1. Perform a basic engine check using the Engine Basic Checksheet. Refer to "ENGINE BASIC INSPECTION SHEET (ENGINEINSPECTION CHECK SHEET)".

Was any failure found?

YES

Repair or replace faulty parts. Perform "After-inspection work" of INFORMATION section.

NO

Go to step 3.

3 Inspect the intake air temperature sensor (air flow sensor built-in)

1. Check the installation of the intake air temperature sensor (air flow sensor built-in).
2. Make sure there is no dirt or damage to intake air temperature sensor (air flow sensor built-in).

Was any failure found?

YES

If the intake air temperature sensor (air flow sensor built-in) is dirty, clogged, or damaged, replace the air flow sensor. Perform "After-inspection work" of INFORMATION section.

NO

Go to step 4.

4 Inspect the exhaust gas temperature sensor (SCR inlet) connector

1. Check the connection of the exhaust gas temperature sensor (SCR inlet) connector (Looseness and poor contact).

Was any failure found?

YES

Connect securely, repair it if needed.
Go to step 5.

NO

Go to step 5.

5 Inspect the exhaust gas temperature sensor (SCR inlet)

1. Check the installation of the exhaust gas temperature sensor (SCR inlet).
2. Make sure there is no dirt or damage to the sensing unit of the exhaust gas temperature sensor (SCR inlet).

Was any failure found?

YES

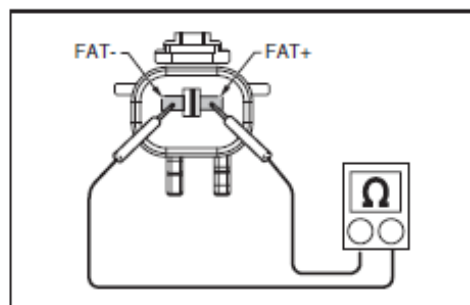
Clean the sensing unit of the exhaust gas temperature sensor (SCR inlet) and install it properly. If damaged, replace the exhaust gas temperature sensor (SCR inlet).
Go to step 6.

NO

Go to step 6.

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6 Inspect the exhaust gas temperature sensor (SCR inlet) unit

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1. Set the starter switch to the "LOCK" position.
2. Disconnect the exhaust gas temperature sensor (SCR inlet) connector.
3. Use the electrical tester, measure the resistance between the terminals of the exhaust gas temperature sensor (SCR inlet).

Measurement conditions	Tester connections	Standard values
Starter switch: LOCK	Exhaust gas temperature sensor (SCR inlet) FAT+ – FAT-	20°C (68°F): 220 Ω

Do the measurements meet the standard value?

YES

Go to step 7.

NO

Replace the exhaust gas temperature sensor (SCR inlet).
Go to step 7.

7 Check the DEF pipe (pump ↔ injector)

1. Check the DEF pipe (pressure line) and verify that there are no disconnections, clogging, corrosion, or cracks.

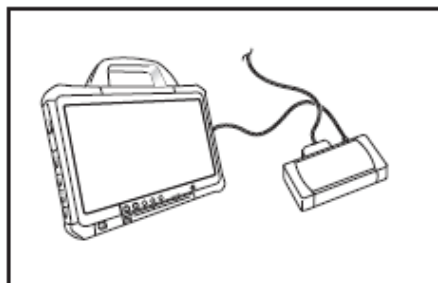
Was any failure found?

YES

Repair or replace the faulty part.
Perform "After-inspection work" of INFORMATION section.

NO

Go to step 8.

8 Inspect the DEF injector 1 [HINO DX II]

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NOTICE

Prepare a beaker or similar, plus a larger measuring vessel for measuring the DEF to be inject. (If the vessel is small, there is dispersion at the time of injection from the injector, and the measuring quantity decreases.)

1. Set the starter switch to the "LOCK" position.
2. Remove the DEF injector from the muffler.

HINT

Refer to the section "SELECTIVE CATALYTIC REDUCTION (SCR)" in the chapter "EMISSION CONTROL (A09C)" for removal and installation of the DEF injector.

3. Remove the DEF injector from the DEF pipe (pressure line).
4. Using the dropper, and the DEF in to the DEF injector is filled with the DEF and leave the DEF injector for approximately 1 minute. And then, install the DEF injector to the DEF pipe (pressure line).
5. Connect the vehicle to HINO DX II.
6. Set the starter switch to the "ON" position.
7. Select [DCU].
8. Select [Inspection Menu] on HINO DX II menu and check the operation of the DEF injector.

NOTICE

When the DEF tank temperature is -5°C (23°F) or lower, perform warm-up to raise it to 10°C (50°F) or higher.

<Inspection procedure>

- (1) Select [Inspection Menu].
- (2) Select [Start inspection].
- (3) Select [Leak test] and make sure that the pressure of the DEF pump is stable at 850 to 950 kPa for 1 minute.
- (4) Select [Exit] and make sure that the pressure of the DEF pump returns to the original level.
- (5) Repeat (3) and (4) for 3 times.
- (6) Make sure that the amount of DEF injected is as specified as step 8 patterns 1 to 3.

HINT

- The urea crystal is soluble in the DEF. Clogging may be eliminated by repeating injection several times. For this reason, even if there are the urea deposits on the tip of the DEF injector. It is not an abnormality as long as the above injection is possible.

Is operation normal?

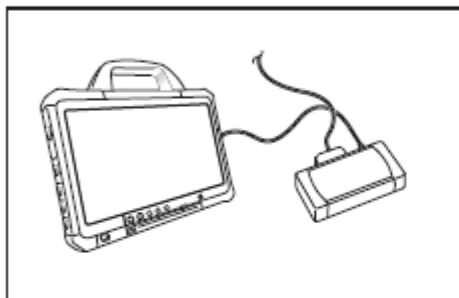
YES

Re-install the DEF injector on the muffler.
Go to step 10.

NO

Go to step 9.

9 Inspect the DEF injector 2 [HINO DX II]



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1. Set the starter switch to the "LOCK" position.
2. Replace the DEF injector with a new part. (Do not install it on the muffler.)
3. Set the starter switch to the "ON" position.
4. Select [DCU].
5. Select [Inspection Menu] on HINO DX II menu and check the operation of the DEF injector.
 <Inspection procedure>
 - (1) Select [Active test setting].
 - (2) Select [DEF injector opening].
 - (3) Enter the indicated value and execute it.
 - Check that DEF is injected from the DEF injector.

Is operation normal?

YES

Install the new injector on the muffler and complete the check.
After installing the injector, idle the engine (for about 10 min.) and on HINO DX II (Data Monitor) verify that the DEF solution is stable between 800 kPa {116 psi} and 1,051 kPa {152 psi}.
Perform "After-inspection work" of INFORMATION section.

NO

Re-install the DEF injector and replace the DEF pipe (pressure line).
After replacing the pipe, idle the engine (for about 10 min.) and on HINO DX II (Data Monitor) verify that the DEF solution is stable between 800 kPa {116 psi} and 1,051 kPa {152 psi}.
Perform "After-inspection work" of INFORMATION section.

10 Inspect the exhaust pipe

1. Make sure there is no soot leakage from the exhaust pipe outlet.

Was any failure found?

YES

- Replace the DPR filter and the PM sensor. After replacing the filter, execute a DPR manual regeneration and check if no DTC (P24FE) is detected.
- Perform the fuel injector test to check the fuel injector if DPR manual regeneration has failed.
- Perform "After-inspection work" of INFORMATION section.

If the DPR filter has been damaged, please run the new injector test.

NO

Go to step 11.

11 Check the DEF crystallized substance?

1. Remove the SCR catalyst.

HINT

- Refer to the workshop manual "DPR (DIESEL PARTICULATE ACTIVE REDUCTION SYSTEM)" in the chapter "EXHAUST SYSTEM (A09C)" (S5-CA09E01B or S5-UA09E01B) for removal and installation of the SCR catalyst.
2. Remove the outlet chamber sub assembly.
 3. Remove the monolithic converter assembly.
 4. Confirm the presence of DEF crystallized substance inside the outlet chamber sub assembly and monolithic converter assembly.
 5. Check for crystallized substance in NOx sensor 2 (SCR downstream).

Is there DEF crystallized substance?

YES

Remove the DEF crystallized substance. Perform "After-inspection work" of INFORMATION section.

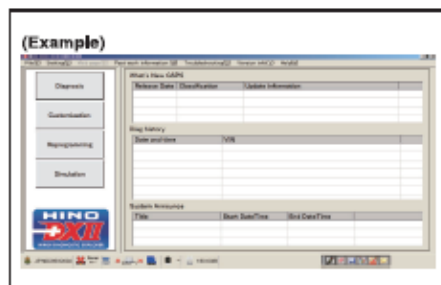
NO

Go to step 12.

12 Inspect the NOx sensor No.1 (SCR upstream) [HINO DX II]

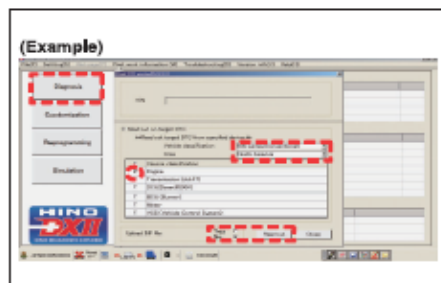
1. Set the starter switch to the "ON" position.

2. Start DX II.



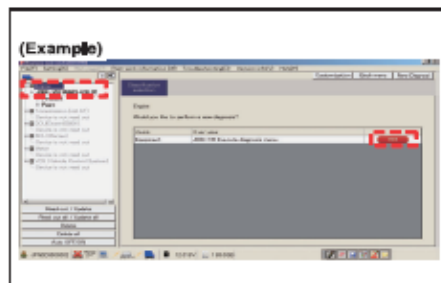
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3. On the DX II window, click [Customization].
Select the vehicle model and region, and check [Engine].
Select either Upload INF file and then [Read out] to read out.



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4. Select [Engine], and press the click button.

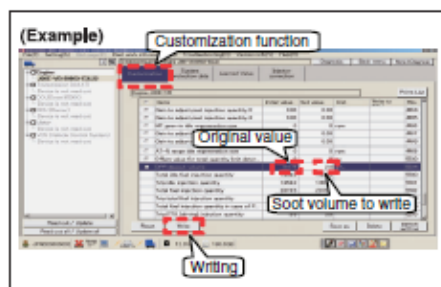


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5. Writing soot volume

HINT

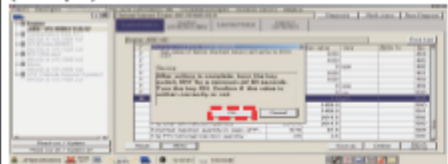
- As in the window on the left, write a soot volume [2.2] using the customization function. Record the original value not to forget. The example in the window is [0.674].
- If the soot volume is indicated between 2.2 to 5.0 from the beginning, press the DPR regeneration button in this state without rewriting the soot volume. In such a case, do not stop regeneration halfway.



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6. Set the starter switch "OFF" and then "ON" according to the instruction.
Then, click [OK].

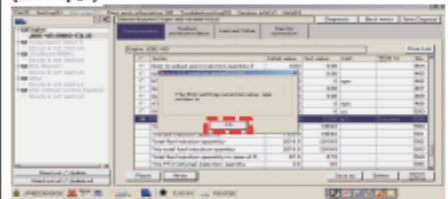
(Example)



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7. Check that ECU writing has been completed. Click [OK].
Refer to the window on the left.

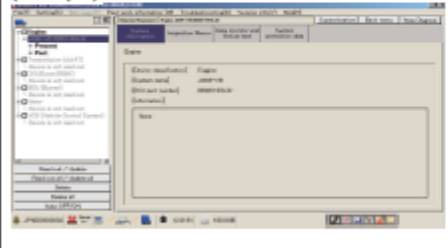
(Example)



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8. Start monitoring using the data monitoring function of DX II.
Check the output waveform of the NOx sensor on the monitor.

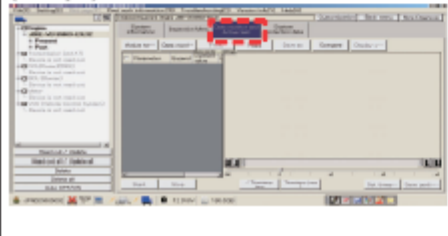
(Example)



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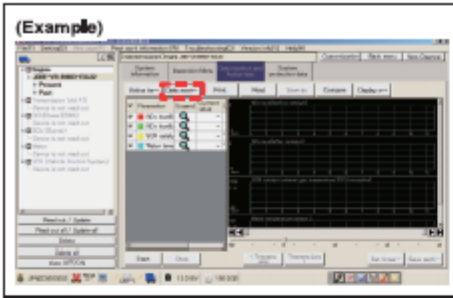
9. Select [Data monitor and Active test].

(Example)



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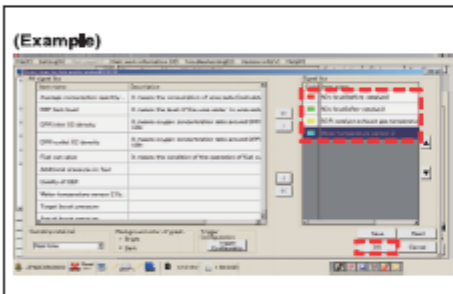
(Example)



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10. Select [Data monitor Setting].
Refer to the window on the left.

(Example)

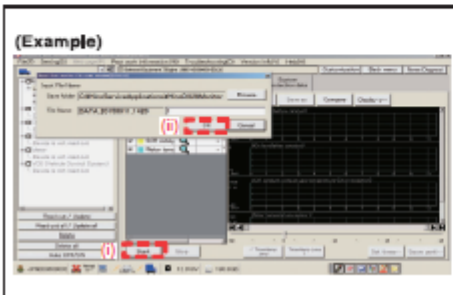


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11. From the selection window on the left, select the following 4 items.
Click OK.

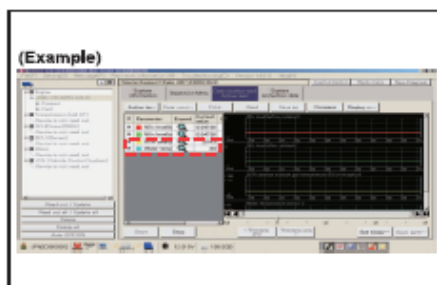
- NOx level (before catalyst)
- NOx level (after catalyst)
- SCR catalyst exhaust gas temperature (DCU reception)
- Water temperature sensor 2

(Example)



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12. (i) Click [Start] to display the window to check the data storage destination.
(ii) Click [OK] to start data monitoring.



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13. Start the engine.

14. Press the DPR manual regeneration switch of the vehicle.
Start regeneration.

HINT

- Since NOx sensor waveform is not detected until the exhaust gas temperature and coolant temperature reach the specified values or more, perform DPR regeneration to increase the exhaust gas temperature and coolant temperature.
- Specified values:
 - SCR catalyst temperature : over 250 °C {482 °F}
 - Coolant temperature : over 70 °C {158 °F}

15. On the DX II data monitor, monitor the SCR catalyst temperature, coolant temperature and NOx levels before and after.

16. Following the determination manual, determine the quality of the sensor according to the NOx sensor waveform data on the monitor.

HINT

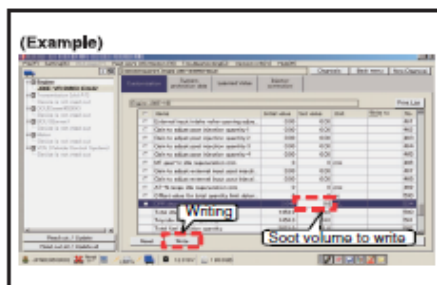
- NOx sensor reference value (During DPR manual regeneration)
 - NOx sensor 1 (SCR upstream): 0.052 or more
 This is the end of the trouble shooting.

17. After completing the trouble shooting, press the DPR switch (button) to stop the regeneration.

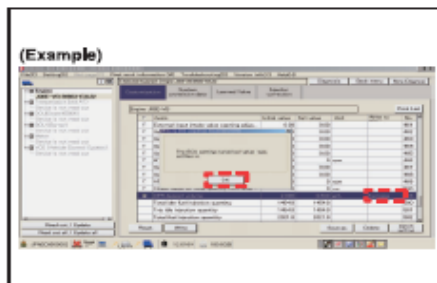
18. Set the starter switch OFF once to stop the engine. Set it ON again.

19. Rewrite the soot volume to the recorded original value.
Refer to the window on the left.

For the case of this window, the soot volume to write is [0.6].

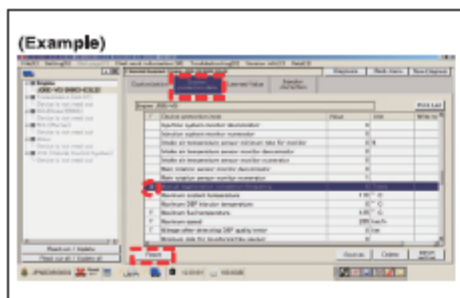


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SAPH16F090301626

20. Check that the original soot volume has been written, and click [OK].
Refer to the window on the left.

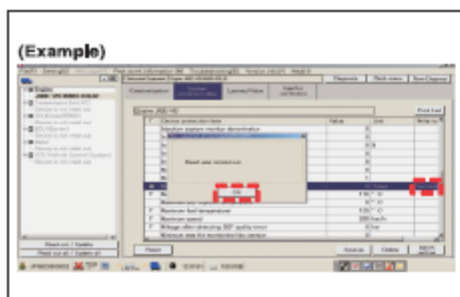


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21. Select [System protection data] to check [Manual regeneration completion frequency]. Click [Reset]. Refer to the window on the left.

NOTICE

Unless this memory reset is performed, the DTC of abnormal regeneration frequency would turn on.



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22. Check that the memory reset has been completed. Click [OK]. Refer to the window on the left.

Does the NOx controller operate properly?

YES

Go to step 13.

NO

Replace NOx sensor 1 (SCR downstream) that does not operate properly.

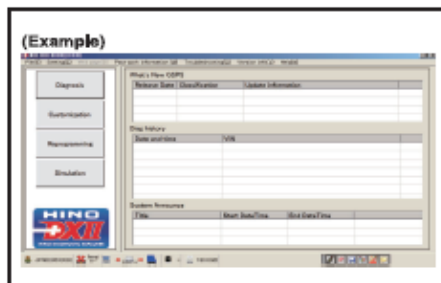


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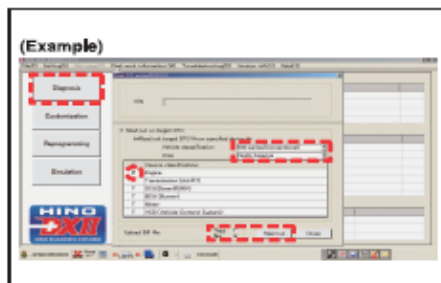
13 Inspect the NOx sensor No.2 (SCR downstream) [HINO DX II]

1. Set the starter switch to the "ON" position.
2. Start DX II.



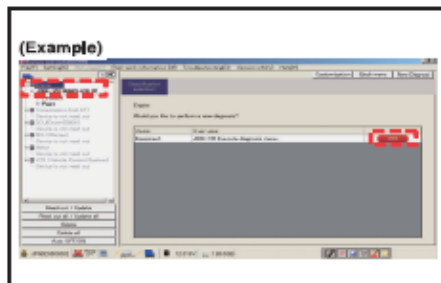
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3. On the DX II window, click [Diagnosis].
Select the vehicle model and region, and check [Engine].
Select either Upload INF file and then [Read out] to read out.



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4. Select [Engine], and press the click button.

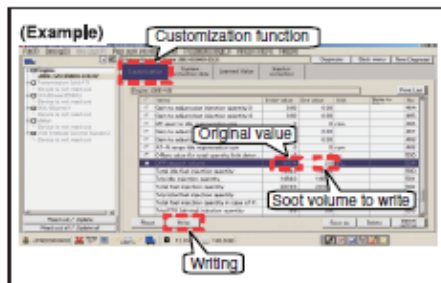


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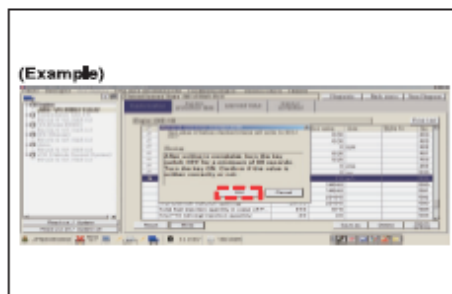
5. Writing soot volume

HINT

- As in the window on the left, write a soot volume [2.2] using the customization function. Record the original value not to forget. The example in the window is [0.674].
- If the soot volume is indicated between 2.2 to 5.0 from the beginning, press the DPR regeneration button in this state without rewriting the soot volume. In such a case, do not stop regeneration halfway.

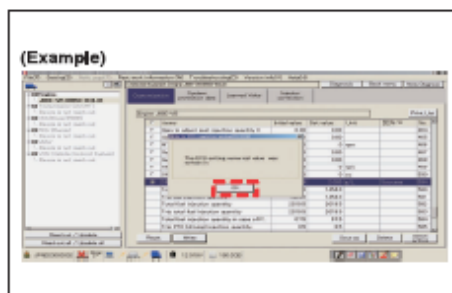


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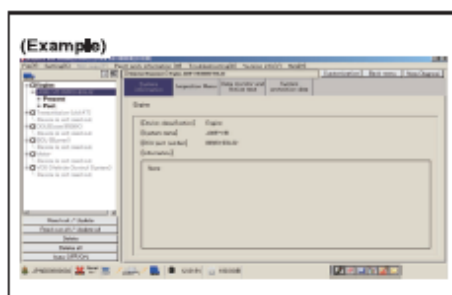
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6. Set the starter switch "OFF" and then "ON" according to the instruction.
Then, click [OK].



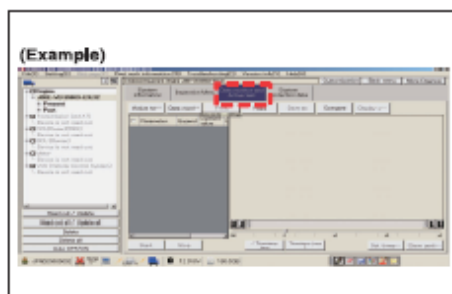
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7. Check that ECU writing has been completed. Click [OK].
Refer to the window on the left.



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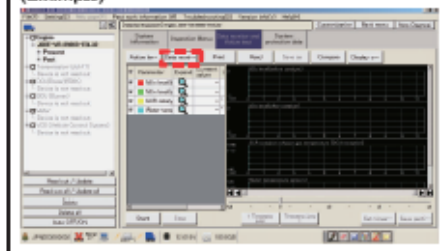
8. Start monitoring using the data monitoring function of DX II .
Check the output waveform of the NOx sensor on the monitor.



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9. Select [Data monitor and Active test].

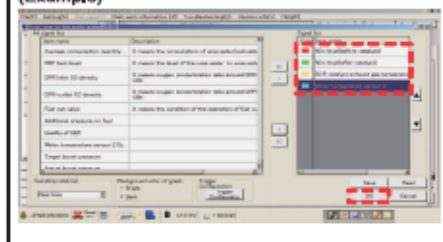
(Example)



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10. Select [Data monitor Setting].
Refer to the window on the left.

(Example)



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11. From the selection window on the left, select the following 4 items.
Click OK.

- NOx level (before catalyst)
- NOx level (after catalyst)
- SCR catalyst exhaust gas temperature (DCU reception)
- Water temperature sensor 2

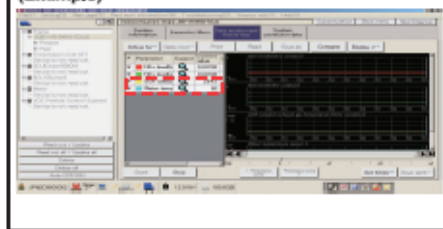
(Example)



SAPH16F00301639

12. (i) Click [Start] to display the window to check the data storage destination.
(ii) Click [OK] to start data monitoring.

(Example)



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13. Start the engine.
14. Press the DPR manual regeneration switch of the vehicle.
Start regeneration.

HINT

- Since NOx sensor waveform is not detected until the exhaust gas temperature and coolant temperature reach the specified values or more, perform DPR regeneration to increase the exhaust gas temperature and coolant temperature.
 - Specified values:
 - SCR catalyst temperature : over 250 °C {482 °F}
 - Coolant temperature : over 70 °C {158 °F}
15. On the DX II data monitor, monitor the SCR catalyst temperature, coolant temperature and NOx levels before and after.

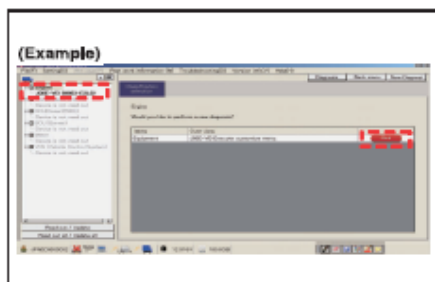
16. After completing the DPR manual regeneration, following the determination manual, determine the quality of the sensor according to the NOx sensor waveform data on the monitor.

HINT

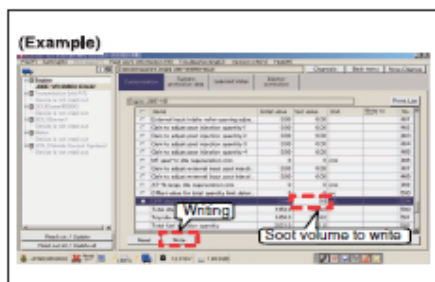
- NOx sensor reference value (after DPR manual regeneration): NOx sensor 2 (SCR downstream): -0.064 or less.
- Diagnosis timing: Diagnosis starts within 5 minutes after manual DPR regeneration is completed.
- If the value NOx sensor 2 (SCR downstream) is -0.064 or more, perform the above items 14 through 16 again. If the value of NOx sensor 2 (SCR downstream) is -0.064 or more for two consecutive times, the NOx sensor 2 (SCR downstream) is malfunctioning.

This is the end of the trouble shooting.

17. Set the starter switch OFF once to stop the engine. Set it ON again.
18. After completing the trouble shooting, rewrite the soot volume to the original value.
Select [Engine] as in the window on the left. Click the [Click] button.

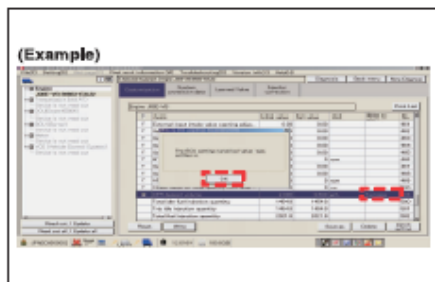


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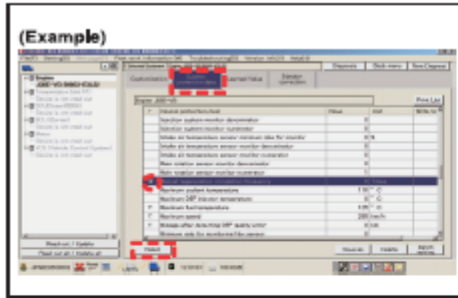
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19. Rewrite the soot volume to the recorded original value.
Refer to the window on the left.
For the case of this window, the soot volume to write is [0.6].



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20. Check that the original soot volume has been written, and click [OK].
Refer to the window on the left.

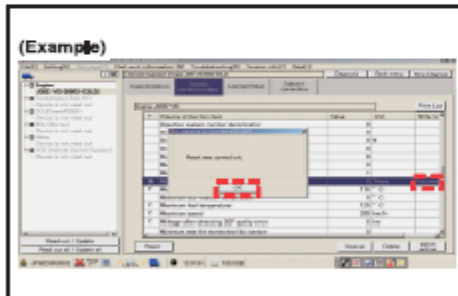


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21. Select [System protection data] to check [Manual regeneration completion frequency]. Click [Reset]. Refer to the window on the left.

NOTICE

Unless this memory reset is performed, the DTC of abnormal regeneration frequency would turn on.



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22. Check that the memory reset has been completed. Click [OK]. Refer to the window on the left.

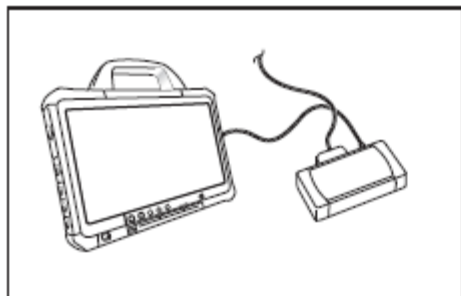
Does the NOx controller operate properly?

YES

Go to step 14.

NO

Replace NOx sensor 2 (SCR downstream) that does not operate properly.

14 Inspect the SCR catalyst [HINO DX II]

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1. Set the starter switch to the "LOCK" position.
2. Replace the SCR catalyst.
3. Set the starter switch to the "ON" position.
4. Erase the trouble history.
5. Perform SCR related memory reset.
6. Form the DTC detection condition.
7. Select [Engine] and check if P24FE has been detected.

Has DTC P24FE been detected?**YES**

Replace the engine ECU.
Perform "After-inspection work" of INFORMATION section.

NO

Procedure completed. (SCR catalyst is faulty.)
Perform "After-inspection work" of INFORMATION section.

**TRUCKS**

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