

G2 Stage5(De-tier)

Trouble shooting guide

Ver. 1.74

Revision History

| Revision | Entered by | Date | Title or Description |
|----------|--------------|--------------|---|
| 1.10 | Chungmin Kim | Oct 15, 2018 | - Initial version for Stage V |
| 1.20 | Chungmin Kim | Oct 16, 2018 | - Fault list updated - Electric fault trouble shooting guide tip update |
| 1.21 | Chungmin Kim | Oct 17, 2018 | - Fault list updated |
| 1.22 | Chungmin Kim | Oct 25, 2018 | - Battery voltage Low/High (P1562/P1563) threshold - EGR/Throttle valve fault description update - Emergency engine stop by hardwire description update |
| 1.23 | Chungmin Kim | Oct 29, 2018 | - Fault list updated - DPF in temperature plausibility fault(P2034) and Turbine in temperature plausibility fault threshold update |
| 1.24 | Chungmin Kim | Oct 30, 2018 | - Fault list updated |
| 1.25 | Chungmin Kim | Nov 06, 2018 | - Fault list & description updated |
| 1.26 | Chungmin Kim | Nov 09, 2018 | - DEF Hose heater plausibility fault detection threshold update |
| 1.27 | Chungmin Kim | Nov 14, 2018 | - P106E (DEF Quality failure status too long fault) added |
| 1.28 | Chungmin Kim | Nov 19, 2018 | - Fault list updated |
| 1.29 | Chungmin Kim | Nov 21, 2018 | - Fault Description update |
| 1.30 | Chungmin Kim | Dec 05, 2018 | - Fault update (P1611/P0215/U1003) - Fault list update (P0335/P0336/P0338/P0339/P0373 Not used) |
| 1.31 | Chungmin Kim | Dec 05, 2018 | - Crank sensor fault torque de-rate strategy update (Mild → Severe) & engine speed limited |
| 1.32 | Chungmin Kim | Dec 11, 2018 | - Rail pressure jittering related fault added(P193A, P193B) |
| 1.33 | Chungmin Kim | Dec 14, 2018 | - Update based on CS feedback 1 st update |
| 1.34 | Chungmin Kim | Jan 02, 2019 | - Electric fault trouble shooting guide tip update - Sensor & actuator location picture update |
| 1.35 | Chungmin Kim | Jan 14, 2019 | - Description (Diagnosis threshold) update - Crank sensor pin description update |
| 1.36 | Chungmin Kim | Jan 15, 2019 | - CAM/Crank signal measurement tip with Oscilloscope added |
| 1.37 | Chungmin Kim | Jan 18, 2019 | - Fault list update (P1012, P1014, P1015, P1016, P1018, P1019, P101B, P101C, P101D, P1021, P1022 Not used) (P060C action change) |
| 1.38 | Chungmin Kim | Jan 31, 2019 | - P225D fault added, P1458 fault deleted |
| 1.39 | Chungmin Kim | Feb 15, 2019 | - P2032/2033 NCD inducement tampering added |
| 1.40 | Chungmin Kim | Mar 27, 2019 | - P1033/P1546 diagnosis threshold update - Oil Combination sensor(Level & Temp) related fault 2ea added (P0196, P350E) - P2034/P1460 diagnosis threshold update - “Call Hot line” to “Contact Helpdesk” - SCR function test description added - DPF regeneration by service tool description update |

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| 1.41 | Chungmin Kim | Apr 1, 2019 | <ul style="list-style-type: none"> - P246C diagnosis threshold update - P2455 fault description added - P246B, P2546, P2547 Fault added |
| 1.42 | Chungmin Kim | Apr 9, 2019 | <ul style="list-style-type: none"> - P1460 fault reused for different purpose - P02E4, P02E5, P042E, P042F Check list updated |
| 1.43 | Chungmin Kim | May 3, 2019 | <ul style="list-style-type: none"> - P106C diagnosis threshold update - P0640 fault description added - NCD group "EGR block" added (EGR system only) |
| 1.44 | Chungmin Kim | May 23, 2019 | <ul style="list-style-type: none"> - P0421 fault description added |
| 1.45 | Chungmin Kim | May 27, 2019 | <ul style="list-style-type: none"> - P202D (DEF leakage detection fault) fault added |
| 1.46 | Chungmin Kim | Jun 12, 2019 | <ul style="list-style-type: none"> - P0523 torque de-rate & max engine speed limit added - P011E description update - P0640 diagnosis threshold update - P01C3 fault code is changed to P01C6 - P018C, P018D are added for Fuel filter pressure. - P01C4, P01C5 diagnosis threshold update - P193A, P193B, P009C, P009D, P3506 are deleted - "Check continuity and electrical insulation Electrical problem?" Step is deleted |
| 1.47 | Chungmin Kim | Jun 27, 2019 | <ul style="list-style-type: none"> - P049B fault is added - "SCR inducement" → "NCD inducement" - "Rail pressure fault troubleshooting guide tip" is added. - P0408 diagnosis time update - "Manual DPF regeneration" → "Forced DPF regeneration" - P0107 diagnosis threshold update - Throttle valve & EGR valve H-bridge fault diagnosis condition update (P02E0, P02E2, P02E3, P2143, P2144, P2145) |
| 1.48 | Chungmin Kim | Jul 8, 2019 | <ul style="list-style-type: none"> - P1451 Reason description update - Service tool connector information update - "SCR state machine technical tip" is added. |
| 1.49 | Chungmin Kim | Sep 9, 2019 | <ul style="list-style-type: none"> - Starter pin information update (P0512, P0615, P0616, P0617, P26E4, P26E5, P26E6) - NCD inducement related fault description update (P12E5, P12E6, P12E7, P12E8, P12E9, P12EA, P12EB, P12EC, P12F2, P12F3, P12F4, P12F5, P12F6, P12F7, P12F8, P12F9, P1303, P1304, P1305) - Throttle valve related fault description update (P02E4, P02E5, P02E8, P02E9, P02EA, P02EB) - Fault reason update (P107D, P10AD, P1546, P20A0, P20A1, P20A2, P20A3, P108A, P108B, P108C, P204C, P204D, P208A, P208B, P208C, P208D, P304C, P304D) - "Change device" → "Change Pedal module" (P0121, P0122, P0123, P0124, P0221, P0222, P0223, P0224, P2135, P2136) - "NCD inducement fault group summary" added. - U1031 Fault is added.(CAN AUXIO1 Timeout fault) - P00BC Fault reason description is updated. - P0640, P106E, P2395, P2396, P23A7, P23A8 Fault are deleted. (Not used) - P009C, P009D, P2043 Fault are added. - P0102, P0103, P1452, P0615, P32EF, P32F1, P011E Fault |

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| | | | description are updated. |
| 1.50 | Chungmin Kim | Sep 25, 2019 | <ul style="list-style-type: none"> - P0669, P2635, P1565 diagnosis threshold are updated. - NCD inducement group is updated. (P202D, P205E are included in Dosing interrupt group.) - U0028, U0029 Fault description are updated. - U1039 Fault is deleted. (Not used) |
| 1.51 | Chungmin Kim | Oct 07, 2019 | <ul style="list-style-type: none"> - P26E4, P26E5, P26E6 Fault are deleted. (Not used) |
| 1.52 | Chungmin Kim | Oct 16, 2019 | <ul style="list-style-type: none"> - P05ED, P215E, P21DD, P221C, P221E, P0615, P0616, P0617 Fault description are updated. |
| 1.53 | Chungmin Kim | Nov 1, 2019 | <ul style="list-style-type: none"> - Effect description is updated. (U1003, P0215, P246B) "Service tool check only" → "Alarm only" - Forced DPF regeneration chart is updated. (P0421, P246B, P2463, P24A3, P20EE, P204A, P1453, P1450, P1451, P1452, P1457, P202D, P208E) - DPF regeneration strategy chart is updated. (P246B, P2463, P24A3) - EGR actuator test (Service tool) check process is added. (P0406, P0407, P042E, P042F, P0C17, P0C18, P0C19) - Throttle valve actuator test (Service tool) check process is added. (P02E4, P02E5, P02E7, P02E8, P02E9, P02EA, P02EB) - Check engine lamp (Service tool) check process is updated. (P192E, P192F, P1931) - Oil pressure lamp check process is updated. (P055B, P055C, P055D) - Glow plug lamp check process is updated. (P0381, P1904, P2381) - Fuel filter fault check process is updated. (P018C, P01C4, P01C5) - HP pump metering unit Service tool check function information is added. (P025A, P025B, P025C, P025D) - Electric fuel feed pump Service tool check function information is added. (P2632, P2633, P2634, P2635) - Rail pressure test by Service tool check function information is added. (P0002, P0003, P0004, P0087, P0252, P0254, P190B, P190C) - SCR related Input/Output function test by service tool information is added. (P05ED, P108C, P1227, P1450, P1451, P1452, P1453, P1457, P1459, P1460, P1461, P1893, P202D, P202E, P2047, P2048, P2049, P204A, P2050, P2051, P205E, P208A, P208B, P208C, P208D, P208E, P20A0, P20A1, P20A2, P20A3, P20A5, P20B1, P20B3, P20B4, P20B9, P20BA, P20BB, P20BC, P20BD, P20BE, P20BF, P20C0, P20C1, P20C2, P20C3, P20C4, P20C5, P20C6, P20C7, P20C8, P214F, P215E, P215F, P21DD, P221C, P221D, P221E, P221F, P23B2, P23B3, P23B4, P23B5, P23B6, P263D, P2C11, P30B1, P30B9, P30BD, P30C1, P30C5) |
| 1.54 | Chungmin Kim | Nov 5, 2019 | <ul style="list-style-type: none"> - Inducement Tampering group is changed. (P1454, P2454, P2455 faults are added.) , "7. NCD inducement fault group summary" is updated, too. |
| 1.55 | Chungmin Kim | Nov 21, 2019 | <ul style="list-style-type: none"> - SCR function test by service tool (Emptying, Leak, Complete test) SCR in temperature condition update. |

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| | | | (100degC → 300degC) |
| 1.56 | Chungmin Kim | Nov 28, 2019 | - NOx sensor pin information table is updated. (P20EE, P2202, P2203, P2215, P2216, P225D, P2383, P2384, P2397, P2398, U029D, U029E, U030D, U030E) |
| 1.57 | Chungmin Kim | Dec 19, 2019 | - P0617/P0616 Fault name and description are updated. |
| 1.58 | Chungmin Kim | Jan 14, 2020 | - DEF supply module pin information is updated. (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) - 47ea faults - EGR control demand range is updated 0~100% to 1/50/99% for "Input/Output Test (Actuator test of EGR)" function of the service tool. - 7ea faults - Throttle valve control demand range is updated 0~100% to 30/50/70% for "Input/Output Test (Actuator test of TVA)" function of the service tool. - 7ea faults |
| 1.59 | Chungmin Kim | Mar 9, 2020 | - Mis-typo of Reason of NOx sensor mounting fault is fixed. (P2383, P2384) - DEF supply module heating diagnostic condition description is updated. (P23B2/P23B3/P23B4/P23B5/P234B6) - DEF Tank Level Signal error fault setting condition is updated. (P1230) - DPF(SCR) inlet temperature Drift fault (P2035, SPN 3242-FMI 20) is added. - Inlet air temperature location description is updated. "If an air mass flow sensor is installed, it is integrated with the air mass flow sensor." (P007C, P007D, P107D) - P246C diagnosis threshold reference value is deleted. - Condition for running diagnostic of NOx sensor is updated. (P2202, P2203, P2216, P2397, P2398) |
| 1.60 | Chungmin Kim | Apr 7, 2020 | - "SCR system Heating condition technical tip" is added. - P225D SCRChk_rNOxDiffAvgMinUs_mp description is updated. - Fuel filter clogged fault description are updated. (P01C4, P01C5) - Electric fuel feed pump component location picture is updated. (P2632, P2633, P2634, P2635) - Water in fuel sensor specification is updated with variant option. (P2265, P2266, P2267, P2269) |
| 1.61 | Chungmin Kim | May 7, 2020 | - DPF definition for change is updated. "New or ash cleaned DPF" (P246C, P1454) - P190C Fault name and reason are changed. (Minimum rail pressure exceeded → Rail pressure too low fault) - P0252 Fault reason is changed. |
| 1.62 | Chungmin Kim | Sep 11, 2020 | - P0002/P0003/P0004/P0087 Fault reason is changed. - EGR H-bridge related fault related fault reason and check procedure are updated. (P2143, P2144, P2145) - The schematics of [5.2] AfterRun (Emptying) is updated in "SCR state machine technical tip". - NCD inducement table is updated. ("Torque 50% & RPM 60% reduced" → Torque limit 50% & 60% of |

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| | | | <p>Rated speed")</p> <p>: P12E5, P12E6, P12E7, P12E8, P12E9, P12EA, P12EB, P12EC, P12F2, P12F3, P12F4, P12F5, P12F6, P12F7, P12F8, P12F9, P1303, P1304, P1305, P203F</p> <p>- Oil pressure sensor ECU pin definition table is fixed. (A36 Signal, A35 GND) : P0522, P0523, P1522</p> <p>- DEF Dosing module ECU pin definition table is fixed. (A71 Low, A94 High) : P1450, P1451, P1452, P1453, P1457, P202E, P2047, P2048, P2049, P204A, P2050, P2051, P208E, P2C11</p> <p>- P246B(DPF regeneration failure) fault reason is added. : DPF system failure (Electric problem (Faulty DPF(SCRf) in temperature sensor, Leakage of turbine out to DOC in, DOC was poisoned by sulfur, Injector problem, Faulty DOC)</p> |
| 1.63 | Chungmin Kim | Dec 8, 2020 | <p>- P2506(Software reset fault) reason is added. : After ECU Map modified (reflash, IQA, SCANTOOL variant coding, Part replacement, etc...)</p> |
| 1.64 | Chungmin Kim | Feb 15, 2021 | <p>- Example repeat offense case of NCD inducement at repeat is added in "8. NCD inducement fault group summary & Repeat offense".</p> <p>- P204A(DEF Pressure check error at DETECTIONMODE) Fault clear condition is added.</p> <p>- P1893(DEF backflow Line plausibility error at DETECTIONMODE) Fault setting condition is updated.</p> <p>- P2034(DPF(SCRf) inlet temperature plausibility) Reason is updated.</p> <p>- "Condition for Running Diagnostic" are updated.</p> <p>- "3. Torque reduction by Coolant / Fuel / Inlet air temperature" example torque-derate graph is added.</p> <p>- P1118, P1183 torque de-rate is updated in Fault list summary (No → depend on temp.)</p> |
| 1.65 | Chungmin Kim | Mar 3, 2021 | <p>- P107D (Inlet air temperature High fault) EFFECT is updated. (Torque reduction comment is deleted.)</p> |
| 1.66 | Chungmin Kim | Mar 17, 2021 | <p>- P25BB, P25BC Fault name and fault diagnosis condition are updated.</p> |
| 1.67 | Chungmin Kim | Apr 6, 2021 | <p>- The description of PRV open related faults are updated. (P009B, P009C, P009D, P000F, P009F, P018F, P1934)</p> |
| 1.68 | Chungmin Kim | Apr 16, 2021 | <p>- DPF blocked related fault (P246C) is added in Tampering inducement group.</p> |
| 1.69 | Chungmin Kim | May 20, 2021 | <p>- P1044(DEF Tank Temperature sensor Low plausibility fault) diagnostic threshold is updated.</p> <p>- The reason and check list of fuel metering unit electric faults are updated. (P025A, P025B, P025C, P025D)</p> <p>- NCD inducement check list are updated. (P12E5, P12E6, P12E7, P12E8, P12E9, P12EA, P12EB, P12EC, P12F2, P12F3, P12F4, P12F5, P12F6, P12F7, P12F8, P12F9, P1303, P1304, P1305)</p> <p>- P2465 DPF differential pressure high fault (Warning) is added.</p> |
| 1.70 | Chungmin Kim | Aug 25, 2021 | <p>- P00BE, P042E CE lamp status are changed. (Blink → Blink or ON)</p> |
| 1.71 | Chungmin Kim | Sep 9, 2021 | <p>- NOx conversion efficiency variable (SCRChk_etaActAvrg1_mp) is added in P20EE (SCR Efficiency Too low fault).</p> |

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| | | | <ul style="list-style-type: none"> - DEF heater plausibility fault threshold(2.5~4.75V) are updated and related variable(UHtrBLDia_uRawDiag_MP, UHtrPLDia_uRawDiag_MP, UHtrSLDia_uRawDiag_MP, UHtrSMDia_uRawDiag_MP) are added. (P20C2, P20BE, P20C6, P20BA) - DPF differential pressure too low fault code is added. (P1454 or P244A) |
| 1.72 | Chungmin Kim | Nov 1, 2021 | <ul style="list-style-type: none"> - CI(Corporate Identity) is updated. - P02E7 Check list is updated. |
| 1.73 | Chungmin Kim | Jan 14, 2022 | <ul style="list-style-type: none"> - P246C, P2465 Fault threshold reference graph and related variables are added. - DPF regeneration inhibit fault list is updated. (Active : when automatically triggered by soot model) (Forced : when triggered by switch or service tool) - Starter relay fault(P0615/P0616/P0617) description is updated. |
| 1.74 | Chungmin Kim | Jun 8, 2022 | <ul style="list-style-type: none"> - P2463 fault reason is updated. - The connector pin definition of PWM control type FAN is updated. (P028A, P028D, P028E, P0527, P0528, P0529) - Starter relay fault(P0615/P0616/P0617) reason is updated. ("Poor battery" is added.) - Typo of P0545 SPN-FMI fault code is updated. (E002789-03 → E002789-04) |

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1. Fault code definition

The fault code is defined according to SAE J2012, J1939 standard.

1) SAE J2012

Example : P0002

P : Power train (Used)

C : Chassis (Not used)

B : Body (Not used)

U : Network (Used)

0002 : Fault numbers

2) SAE J1939

Example : E000027-01

E : Engine (Not visible)

000027 : SPN 6-digit (Suspect Parameter Numbers)

01 : FMI 2-digit (Failure Mode Identifier)

- The FMI defined in the standard is divided into the following types. But some faults that could not be defined or duplicated were used to similar or reserved number.

| No. | FMI Number Definition |
|-----|--|
| 0 | Data Valid but Above Normal Operational Range, Most Severe Level |
| 1 | Data Valid but Below Normal Operational Range, Most Severe Level |
| 2 | Data Erratic, Intermittent or Incorrect (rationality) |
| 3 | Voltage Above Normal, or Shorted to High Source |
| 4 | Voltage Below Normal, or Shorted to Low Source |
| 5 | Current Below Normal, or Open Circuit |
| 6 | Current Above Normal, or Grounded Circuit |
| 7 | Mechanical System not Responding or Out of Adjustment |
| 8 | Abnormal Frequency or Pulse Width or Period |
| 9 | Abnormal Update Rate |
| 10 | Abnormal Rate of Change |
| 11 | Failure Code not Identifiable / Root Cause not Known |
| 12 | Bad Intelligent Device or Component |
| 13 | Out of Calibration |
| 14 | Special Instructions |
| 15 | Data Valid but Above Normal Range : Least Severe Level |
| 16 | Data Valid but Above Normal Range : Moderately Severe Level |
| 17 | Data Valid but Below Normal Range : Least Severe Level |
| 18 | Data Valid but Below Normal Range : Moderately Severe Level |
| 19 | Received Network Data in Error : (Multiplexed Data) |
| 20 | Data Drifted High (rationality high) |
| 21 | Data Drifted Low (rationality low) |

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|----|-----------------------------|
| 22 | Reserved for SAE Assignment |
| 23 | Reserved for SAE Assignment |
| 24 | Reserved for SAE Assignment |
| 25 | Reserved for SAE Assignment |
| 26 | Reserved for SAE Assignment |
| 27 | Reserved for SAE Assignment |
| 28 | Reserved for SAE Assignment |
| 29 | Reserved for SAE Assignment |
| 30 | Reserved for SAE Assignment |
| 31 | Condition Exists |

2. Torque reduction by fault

Each monitored parameter that uses the de-rate function has its own de-rate trigger threshold. If the de-rate threshold is equal to or exceeded by any parameter for a de-rate protection will be set active, the engine will de-rate.

Each application has different engine full load. So following is the picture showing some example of engine torque de-rates.

- 1) Torque reduction level1 (Mild) – The maximum engine torque is limited by 70% of machine full load curve.
 - 2) Torque reduction level2 (Severe) – The maximum engine torque is limited by 50% of machine full load curve.
- The torque is not limited below 1300 rpm so that the machine can be slowly moved even when the torque is limited by the fault.

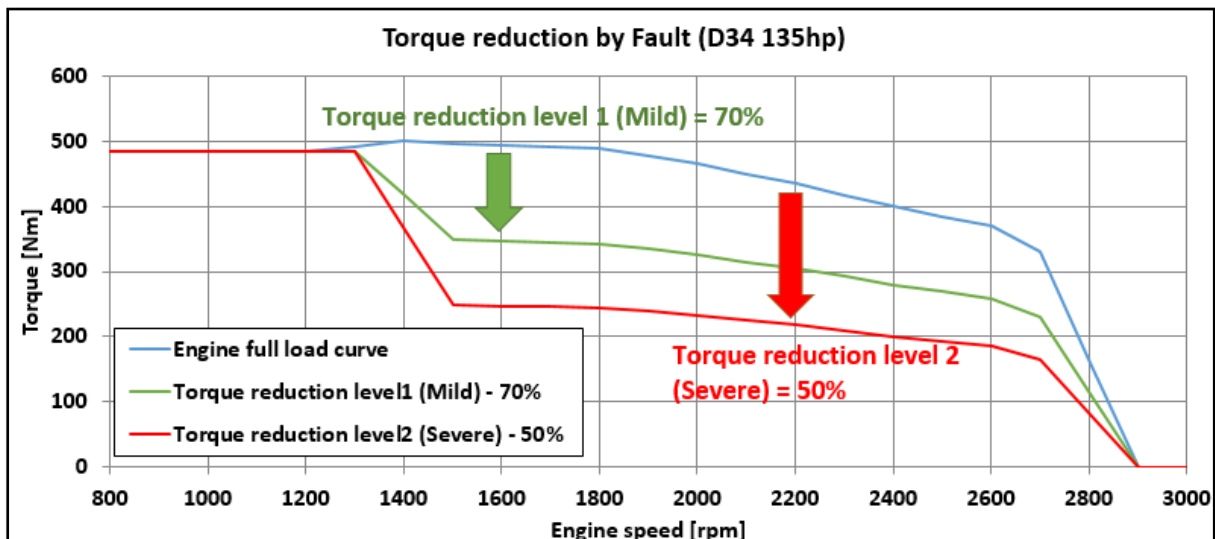


Figure.1 Example : Torque reduction by fault strategy

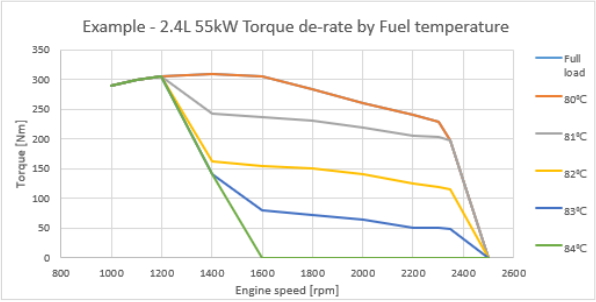
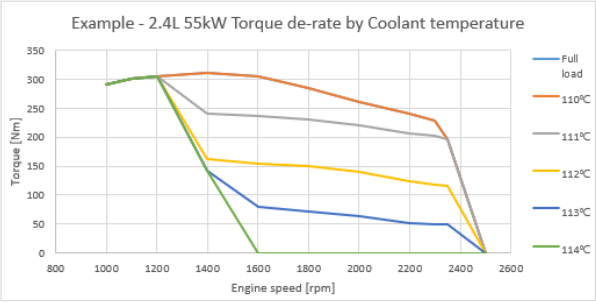
3. Torque reduction by Coolant / Fuel / Inlet air temperature

If the engine coolant temperature over the 110degC, the engine torque will be reduced progressively

If the engine fuel temperature at High pressure pump inlet(Fuel filter) over the 80degC, the engine torque will be reduced progressively

If the engine is on the high ambient temperature, the engine torque will be reduced progressively for anti-fouling of turbocharger.

- The torque is not limited below 1300 rpm so that the machine can be slowly moved even when the torque is limited by Coolant / Fuel / Inlet air temperature.



4. Electric fault trouble shooting guide tip

Electric problems can be caused by many causes. Therefore, it is not possible to list all the causes, but it is usually necessary to check the following items.

- 1) Check the battery
 - A. check Terminal tightening.
 - B. check absence of oxidation
 - C. check absence of consumers
 - Check if there is any device that is not supplied by the engine or machine company capable of generating dark current installed.
 - D. check battery capacity
 - E. check battery external damage
- 2) Check part's connection (ECU, VCU, sensor etc.)
 - A. check pin condition (bending, broken, breakaway)
 - B. check terminal condition (widening, broken, breakaway)
 - C. check absence of oxidation
 - D. check absence of contains water
 - E. check external damage
 - F. check looseness of assembly connection
 - Except some specific sensors(CAM, Crank, etc...), ECU can diagnosis the open circuit at Key on condition. Check if the open circuit fault is occurred due to contact failure when the wiring harness is wiggled by hands.
 - G. check cross-connect with another sensor



- 3) check sensor resistance
 - A. Resistance type sensor only (for example temperature sensor)
 - B. remove sensor connector and check sensor itself resistance
 - refer each resistance information
- 4) Check wire harness
 - A. check pin to pin. (sensor connector to ECU connector)
 - B. check damage of wire. (broken, cut)



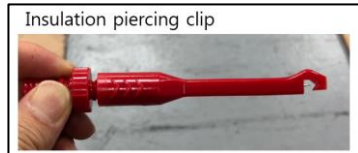
5) Check Network

- A. check the service tool connect ability
- B. resistance of CAN high and CAN low (CAN line has 120ohm resistors at both ends)
- C. check voltage by 2 channel oscilloscope
 - CAN High and CAN low signal are balanced when one is up, the other is down.
 - CAN High signal is 2.5~3.5V and CAN Low signal is 1.5~2.5V

* For the CAN pin number, refer to the Diagnostic connector.

6) Check CAM CRANK (Oscilloscope)

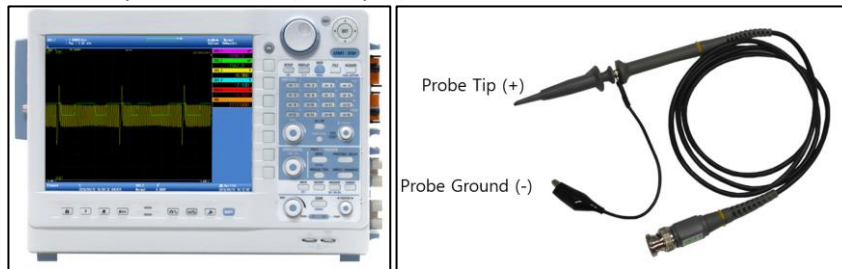
A. Preparing oscilloscope and Insulation piercing clip



i. Oscilloscope setting

1. Sampling interval: 2MHz, input signal voltage +/- 30V
2. Channel : at least 2 channel (CAM and CRANK)

ii. Oscilloscope and Probe (example)

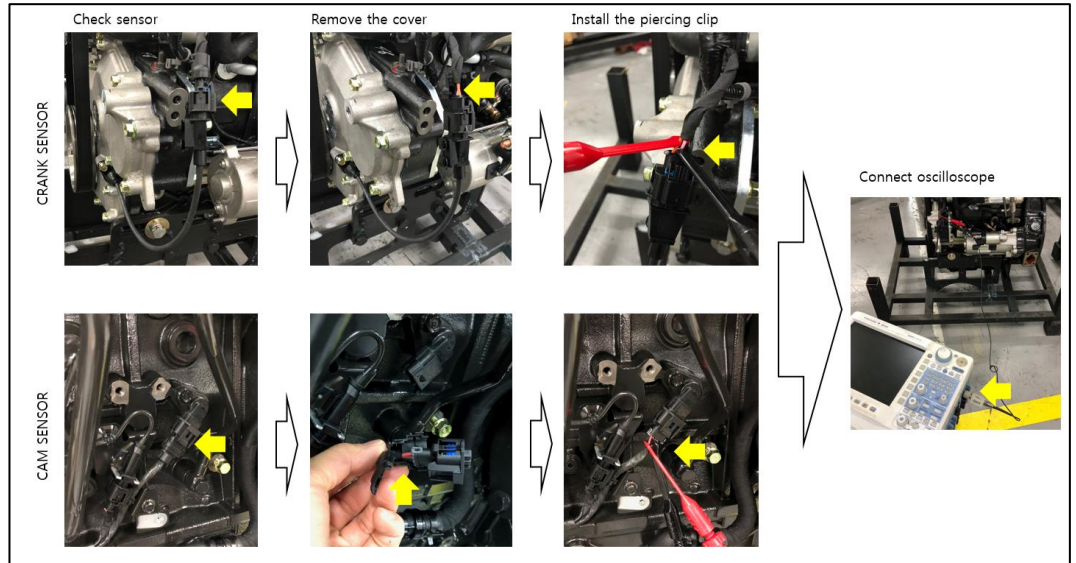


B. Check the CAM and CRANK sensor location and Pin information

| Sensor location | | CRANK sensor connector | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|---------|---|--------------------|-------------|--------------------|--------------------|---|-----|-----------------------|---------------|---|-----|-----------------------|------------------|---|-----|--------|---|--|----|---------|-------------|--------------------|---|-----|---------------------------------------|---|---|-----|----------------------------------|---------------|---|-----|----------------------------------|------------------|
| | | <table border="1"> <thead> <tr> <th>No</th> <th>ECU Pin</th> <th>Description</th> <th>Oscilloscope Probe</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>A20</td> <td>Crank Sensor Positive</td> <td>Probe Tip (+)</td> </tr> <tr> <td>2</td> <td>A21</td> <td>Crank Sensor Negative</td> <td>Probe Ground (-)</td> </tr> <tr> <td>3</td> <td>A57</td> <td>Shield</td> <td>-</td> </tr> </tbody> </table> | No | ECU Pin | Description | Oscilloscope Probe | 1 | A20 | Crank Sensor Positive | Probe Tip (+) | 2 | A21 | Crank Sensor Negative | Probe Ground (-) | 3 | A57 | Shield | - | <table border="1"> <thead> <tr> <th>No</th> <th>ECU Pin</th> <th>Description</th> <th>Oscilloscope Probe</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>A37</td> <td>CAM Shaft Position Sensor Supply (5V)</td> <td>-</td> </tr> <tr> <td>2</td> <td>A52</td> <td>CAM Shaft Position Sensor signal</td> <td>Probe Tip (+)</td> </tr> <tr> <td>3</td> <td>A51</td> <td>CAM Shaft Position Sensor Ground</td> <td>Probe Ground (-)</td> </tr> </tbody> </table> | No | ECU Pin | Description | Oscilloscope Probe | 1 | A37 | CAM Shaft Position Sensor Supply (5V) | - | 2 | A52 | CAM Shaft Position Sensor signal | Probe Tip (+) | 3 | A51 | CAM Shaft Position Sensor Ground | Probe Ground (-) |
| | | No | ECU Pin | Description | Oscilloscope Probe | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | A20 | Crank Sensor Positive | Probe Tip (+) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | A21 | Crank Sensor Negative | Probe Ground (-) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | A57 | Shield | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No | ECU Pin | Description | Oscilloscope Probe | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | A37 | CAM Shaft Position Sensor Supply (5V) | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | A52 | CAM Shaft Position Sensor signal | Probe Tip (+) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | A51 | CAM Shaft Position Sensor Ground | Probe Ground (-) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

C. Installation step

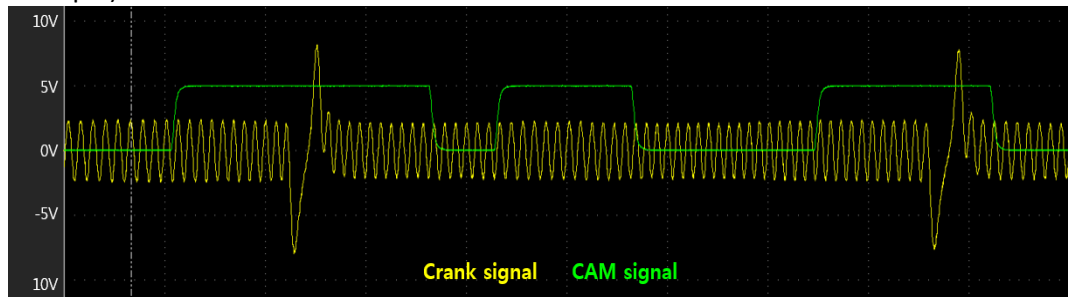
- i. Remove the connection cover
- ii. Install the piercing clip (CAM and CRANK)
- iii. Connect probe each clip



D. Measuring step

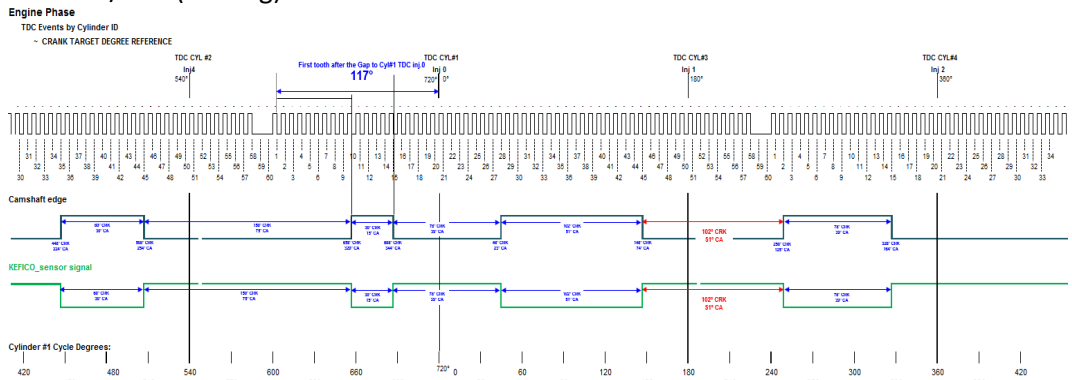
- i. Measuring CAM and CRANK signal at same time

Example)



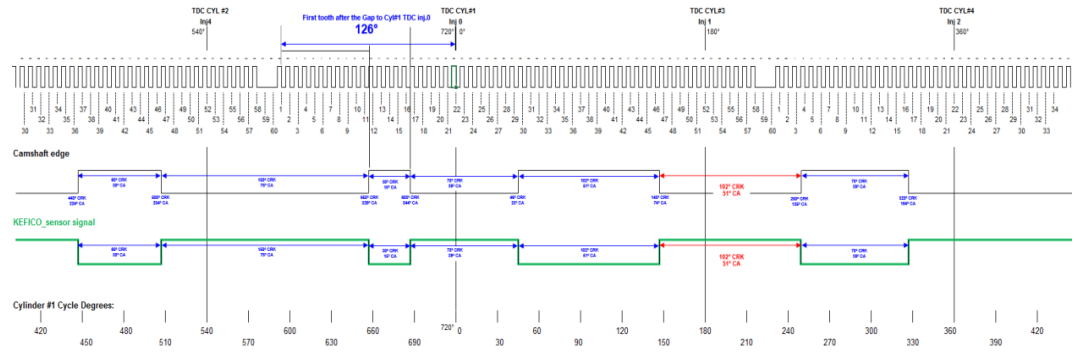
- ii. Inspection the signal (focus at CRANK signal tooth depend on CAM rising edge and falling edge)

1. D18/D24 (117deg)



Engine Phase

TDC Events by Cylinder ID



5. Rail pressure fault trouble shooting guide tip

The rail pressure fault can be occurred by failure of LPC(Low pressure circuit : Fuel tank to HP pump) and HPC(High pressure circuit : HP pump to injector). So it is usually necessary to check the following items.

| No. | Fault | Fault code | Detection description | Detection | Remark |
|-----|--|---|---|-------------------------|---------|
| 1 | Maximum positive deviation of rail pressure exceeded (DFC_RailMeUn0) | P0002 SPN : 157 FMI : 11 | If the rail pressure governor deviation exceeds the limiting value(Normally 70~150bar) based on the engine speed and the set value of the Fuel Metering unit volume is greater than the upper limit, an error will be detected. | Cranking Engine running | 2.5 sec |
| | Estimated Root cause | - This fault could be detected when there is a lot of air in the fuel or the fuel is not supplied well. 1) When engine is continuously operated with very low fuel level.(or empty) 2) Fuel LPC(Low pressure circuit - Fuel tank, Fuel filter, Electric fuel feed pump) leakage 3) Fuel filter plugged 4) Electric fuel feed pump failure | | | |
| 2 | Fuel Leakage is detected based on fuel quantity balance (DFC_RailMeUn10) | P0087 SPN : 157 FMI : 10 | If the high pressure pump delivery quantity exceeds the plausibility limit of the volume flow balance (evaluated over the product life and supplemented to include tolerances), an error will be detected. | Cranking Engine running | 2.5 sec |
| | Estimated Root cause | - This fault could be detected when there is a lot of air in the fuel or the fuel is not supplied well. 1) When engine is continuously operated with very low fuel level.(or empty) 2) Fuel LPC(Low pressure circuit - Fuel tank, Fuel filter, Electric fuel feed pump) leakage 3) Fuel HPC(High pressure circuit - HP pump, common rail, injector) leakage (almost 10~25L/h high leakage) 3) Fuel filter plugged 4) Electric fuel feed pump failure | | | |
| 3 | Maximum negative rail pressure deviation with metering unit on lower limit is exceeded (DFC_RailMeUn2) | P0254 SPN : 1076 FMI : 16 | If the rail pressure governor deviation falls below the limiting value(Normally -200~-117bar) and the high pressure pump delivery quantity falls to the threshold, an error will be detected. | Cranking Engine running | 5.0 sec |
| | Estimated Root cause | - This fault could be detected when the fuel LPC issue. 1) HP pump return line plugged 2) HP pump inlet pressure is too high (Electric fuel feed pump failure) | | | |
| 4 | Rail pressure too low fault (DFC_RailMeUn3) | P190C SPN : 157 FMI : 26 | If the rail pressure falls below the limiting value(Normally 120bar) based on the engine speed, an error will be detected. | Cranking Engine running | 2.5 sec |

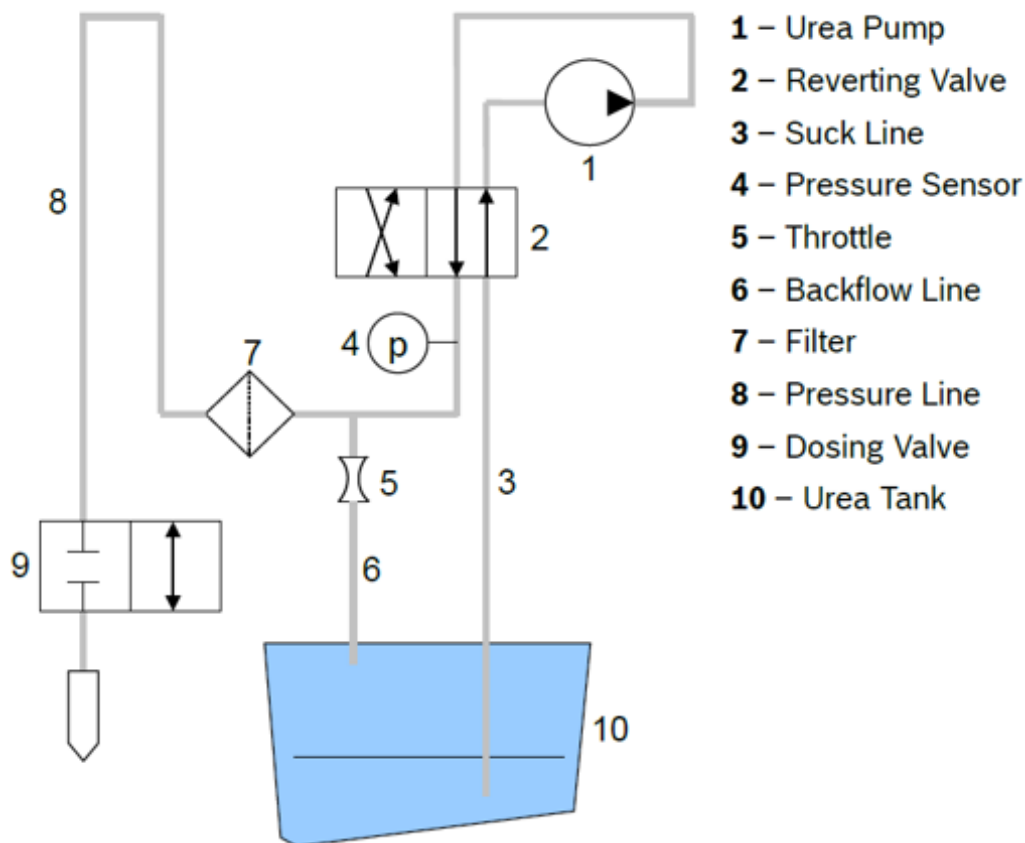
| | | | | | | |
|---|---|--|---|---|---------|--|
| | Estimated Root cause | <p>- This fault could be detected when there is a lot of air in the fuel or the fuel is not supplied well.</p> <p>1) When engine is continuously operated with very low fuel level. (or empty)</p> <p>2) Fuel LPC(Low pressure circuit - Fuel tank, Fuel filter, Electric fuel feed pump) leakage</p> <p>3) Fuel filter plugged</p> <p>4) Electric fuel feed pump failure</p> | | | | |
| 5 | Maximum rail pressure exceeded (DFC_RailMeUn4) | P190B SPN : 157 FMI : 27 | If the rail pressure exceeds the limiting value (Normally 1950bar), an error will be detected. | Cranking Engine running | 1.0 sec | |
| | Estimated Root cause | <p>- This fault could be detected when the rail pressure control is not performed properly due to a lot of air in the fuel.</p> <p>1) When engine is continuously operated with very low fuel level.(or empty)</p> <p>2) Fuel LPC(Low pressure circuit - Fuel tank, Fuel filter, Electric fuel feed pump) leakage</p> <p>3) Fuel filter plugged</p> <p>4) Electric fuel feed pump failure</p> <p>5) HP pump metering unit failure</p> <p>6) Rail pressure sensor failure</p> | | | | |
| 6 | Fuel Metering unit plausibility error in overrun mode (DFC_RailMeUn7) | P0004 SPN : 1076 FMI : 03 | If the high pressure pump delivery quantity exceeds the threshold based on the pressure at overrun mode, an error will be detected. | Engine running at Overrun condition only | 2.5 sec | - Very unlikely to occur because there is little overrun in machine operation condition. |
| | Estimated Root cause | <p>- This fault could be detected when there is a lot of air in the fuel or the fuel is not supplied well.</p> <p>1) When engine is continuously operated with very low fuel level.(or empty)</p> <p>2) Fuel LPC(Low pressure circuit - Fuel tank, Fuel filter, Electric fuel feed pump) leakage</p> <p>3) Fuel filter plugged</p> <p>4) Electric fuel feed pump failure</p> | | | | |
| 7 | Fuel Metering unit plausibility error in idle mode (DFC_RailMeUn8) | P0003 SPN : 1076 FMI : 04 | If the high pressure pump delivery quantity exceeds the threshold based on the pressure at idle mode, an error will be detected. | Engine running at Low idle condition only | 2.5 sec | - Low idle only |
| | Estimated Root cause | <p>- This fault could be detected when there is a lot of air in the fuel or the fuel is not supplied well.</p> <p>1) When engine is continuously operated with very low fuel level.(or empty)</p> <p>2) Fuel LPC(Low pressure circuit - Fuel tank, Fuel filter, Electric fuel feed pump) leakage</p> <p>3) Fuel filter plugged</p> <p>4) Electric fuel feed pump failure</p> | | | | |
| 8 | Rail pressure too low for injection (DFC_RailMonInjRIs) | P0252 SPN : 1076 FMI : 20 | The rail pressure falls below the minimum threshold for injection. (100bar) | Cranking Engine running | 0.5 sec | |

| | | | | | | |
|---|---|--|---|-------------------------|---------|--------------------------|
| | Estimated Root cause | <p>- This fault could be detected when there is a lot of air in the fuel or the fuel is not supplied well.</p> <p>1) When engine is continuously operated with very low fuel level.(or empty)</p> <p>2) Fuel LPC(Low pressure circuit - Fuel tank, Fuel filter, Electric fuel feed pump) leakage</p> <p>3) Fuel HPC(High pressure circuit - HP pump, common rail, injector) leakage (almost 10~25L/h high leakage)</p> <p>4) Fuel filter plugged</p> <p>5) Electric fuel feed pump failure</p> | | | | |
| 9 | Pressure relief valve(PRV) failure (DFC_RailPRV4) | P1934 SPN : 157 FMI : 28 | The fault is occurred when If PRV(Pressure relief valve) open fault (P000F) occurs but rail pressure does not decrease. There can be a problem with PRV itself. | Cranking Engine running | 1.2 sec | - Very unlikely to occur |
| | Estimated Root cause | - PRV(Common rail pressure regulating valve) failure | | | | |

6. SCR state machine technical tip

This is a technical description of the SCR state. Refer to it when SCR related parts inspection and trouble shooting. This material is based on Bosch DNOX 2.2EVO hardware.

※ Bosch DNOX2.2evo System schematics



* Start state (Key on)

Standby [1]

→ No Pressure Control [2]

→ Pressure Control (Refil [3.1] → Pressure Build Up (Ventilation) [3.2] → Detection Mode [3.3]

→ Metering Control [3.4])

* End state (Key off)

Pressure Control (Metering Control [3.4])

→ Pressure Reduction [4]

→ No Pressure Control [2]

→ Standby [1]

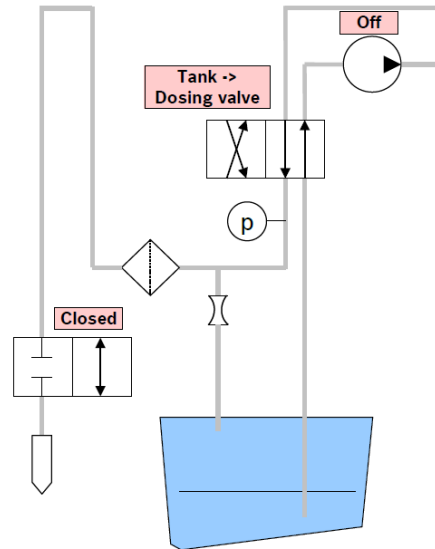
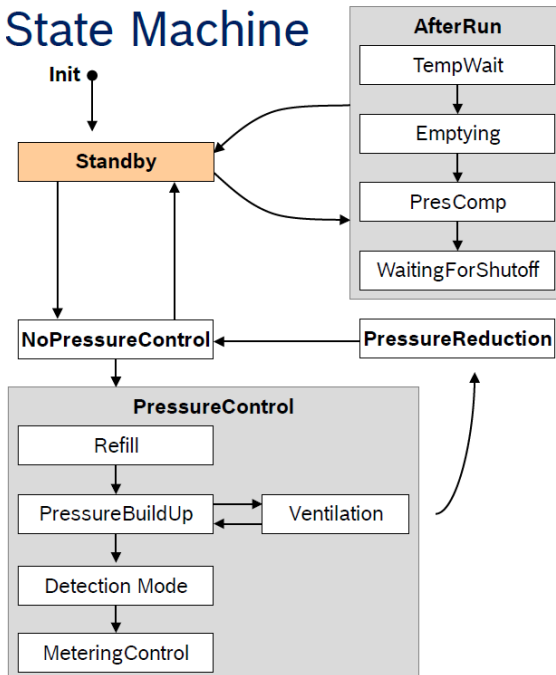
→ After Run (Temp Wait [5.1] → Emptying [5.2] → Pres Comp [5.3]

→ Waiting For Shut off [5.4])

[1] Standby

The STANDBY state is assumed either after initialization or in the case of errors.

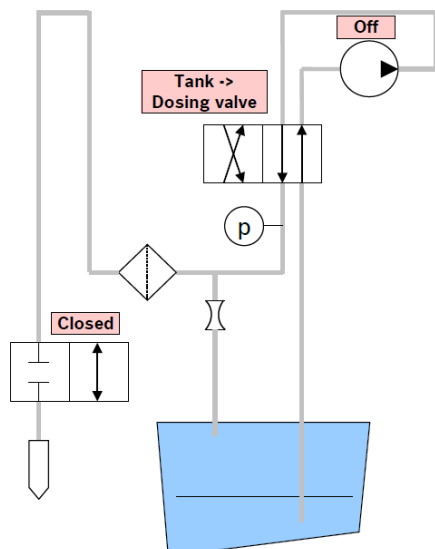
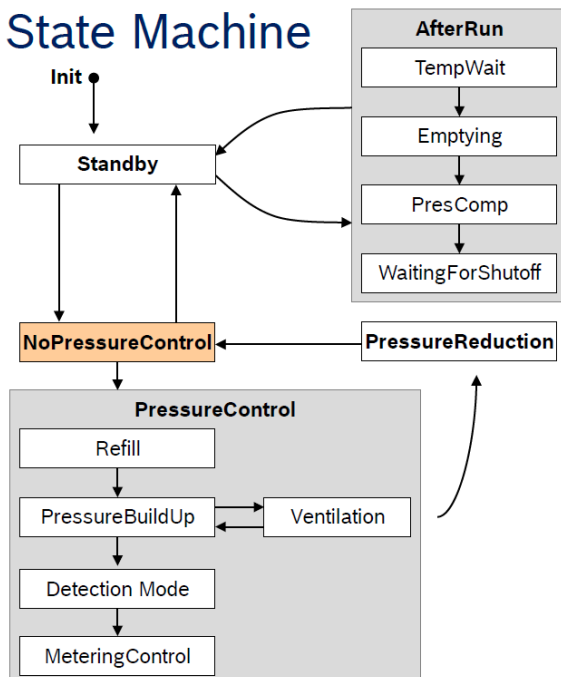
State Machine



2) NOPPRESSURECONTROL

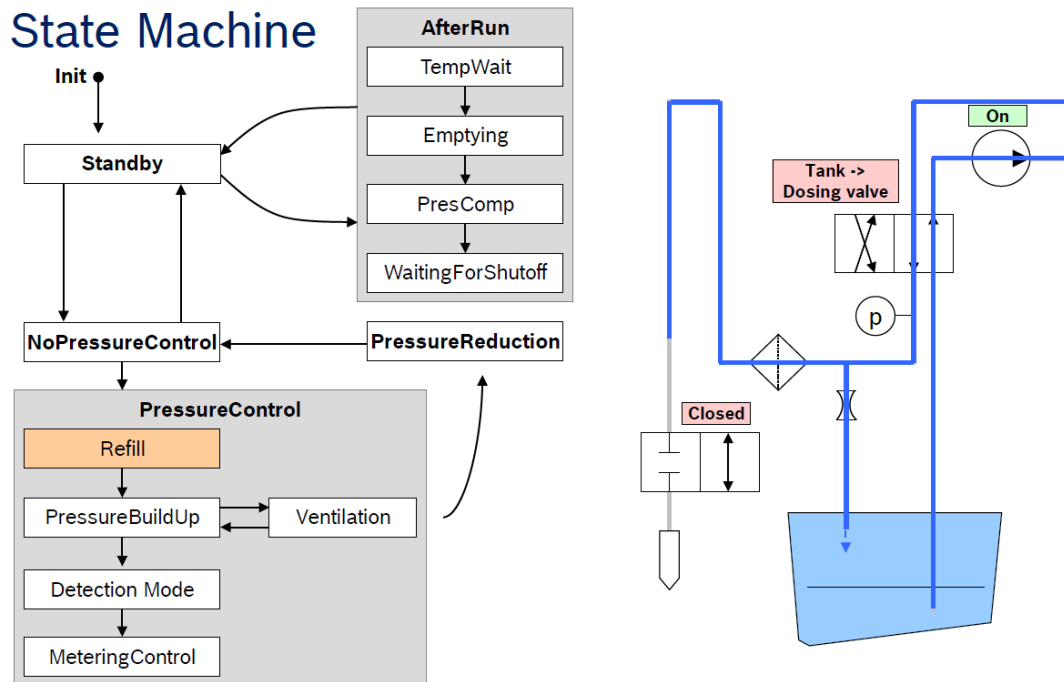
The NOPPRESSURECONTROL state will be reached if no errors are found in the system. In this state the system waits for the release of pressure control by temperatures and engine status.

State Machine



[3.1] PRESSURECONTROL (Refill)

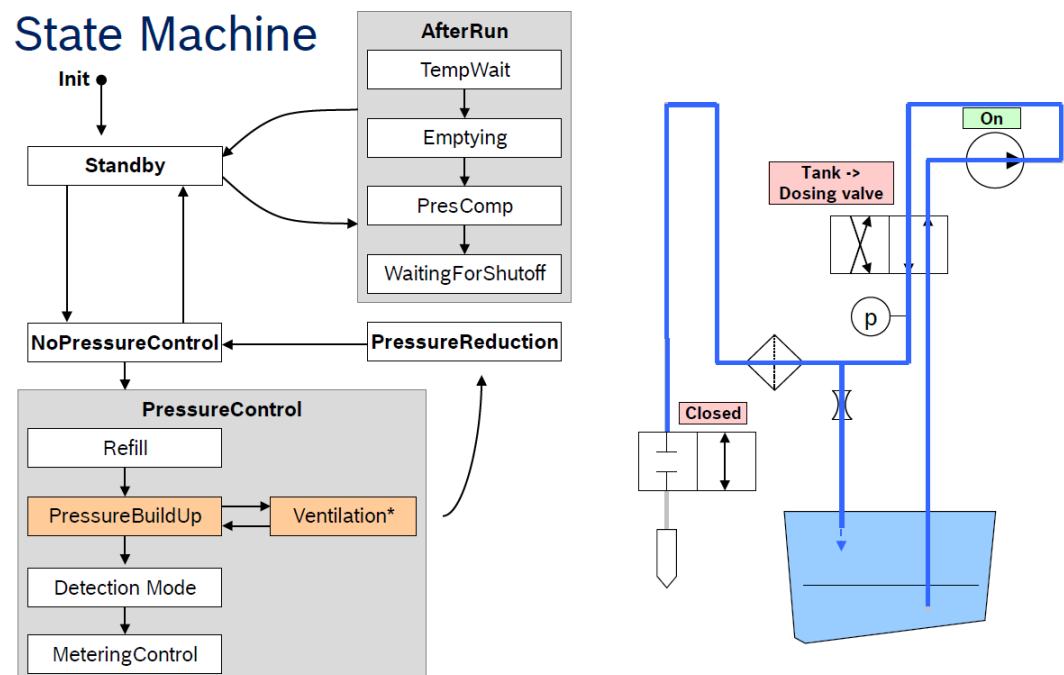
When Refill state, the supply module, the suction and the pressure line are filled with AdBlue(DEF- Diesel Exhaust Fluid).



[3.2] PRESSURECONTROL (PressureBuildUp & Ventilation)

The pressure is build up to the desired pressure(9bar(relative pressure)) within an applicable time, the state machine will change to the DetectionMode.

If the desired pressure buildup is not reached after the applicable time has expired, the state machine will switch back to the VENTILATION.



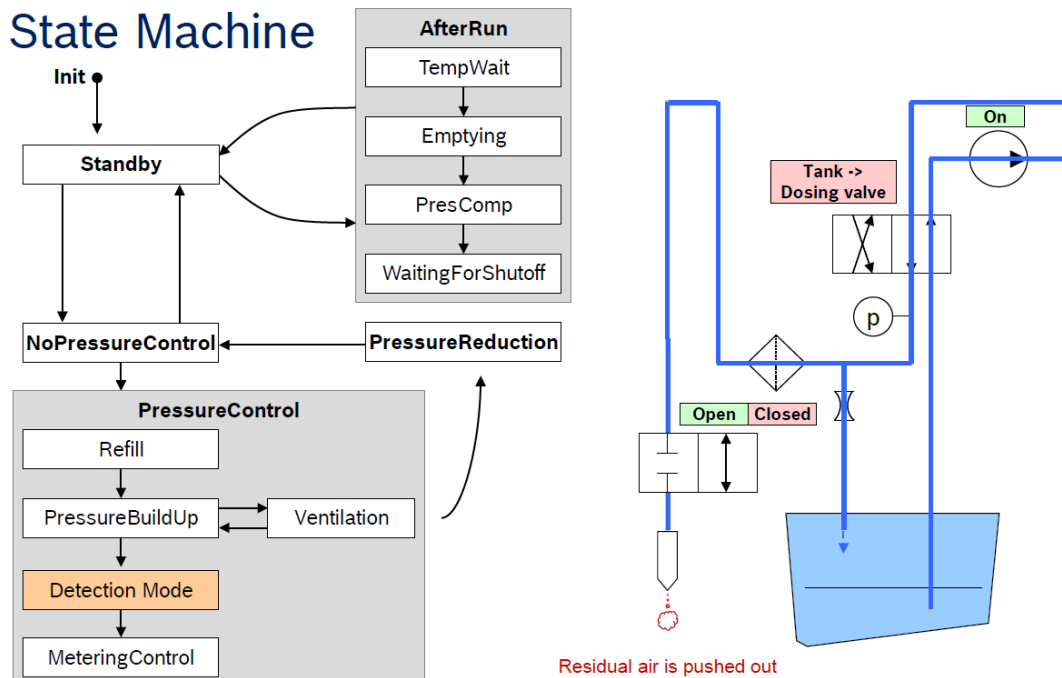
[3.3] PRESSURECONTROL (Detection Mode)

For the suction line, the defrosted detection is already done at PRESSUREBUILDUP state.

But because of pressure sensor's location (It is mounted after the supply pump and before the pressure line), it could show the desired pressure, but it is not ensured that the pressure line itself is ready for dosing. Therefore, in DETECTIONMODE, whether defrosted of pressure line is checked.

For reference, P204A (DEF pressure check error at DETECTIONMODE

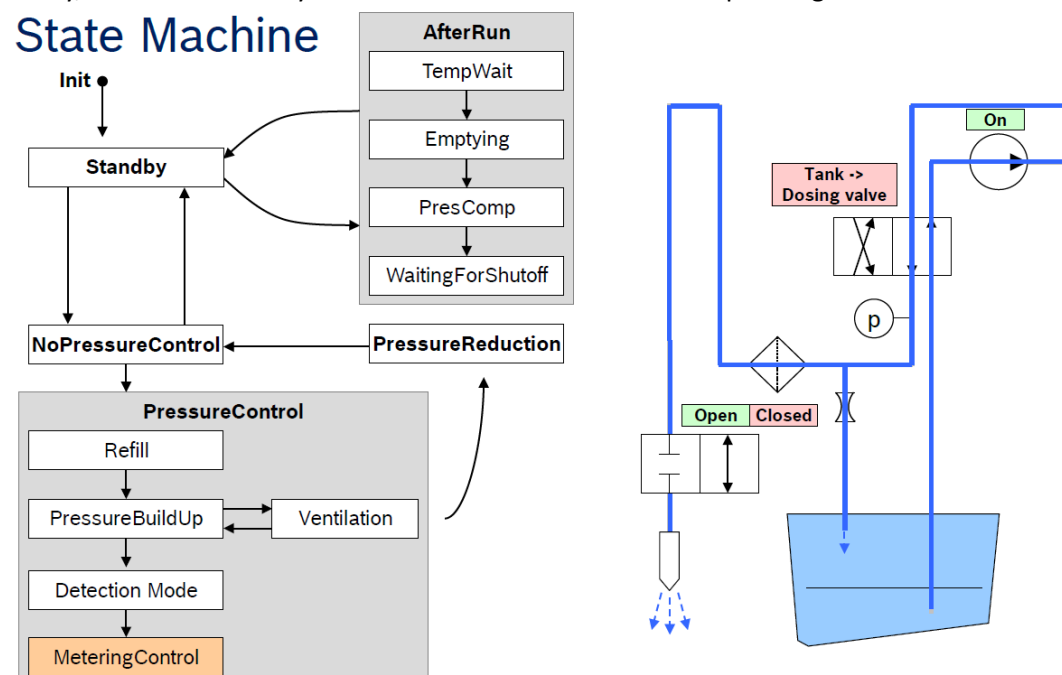
(Detected an insufficient pressure drop)) Diagnoses if the pressure line is not defrosted or the dosing module is blocked(does not function normally).



[3.4] PRESSURECONTROL (Metering Control)

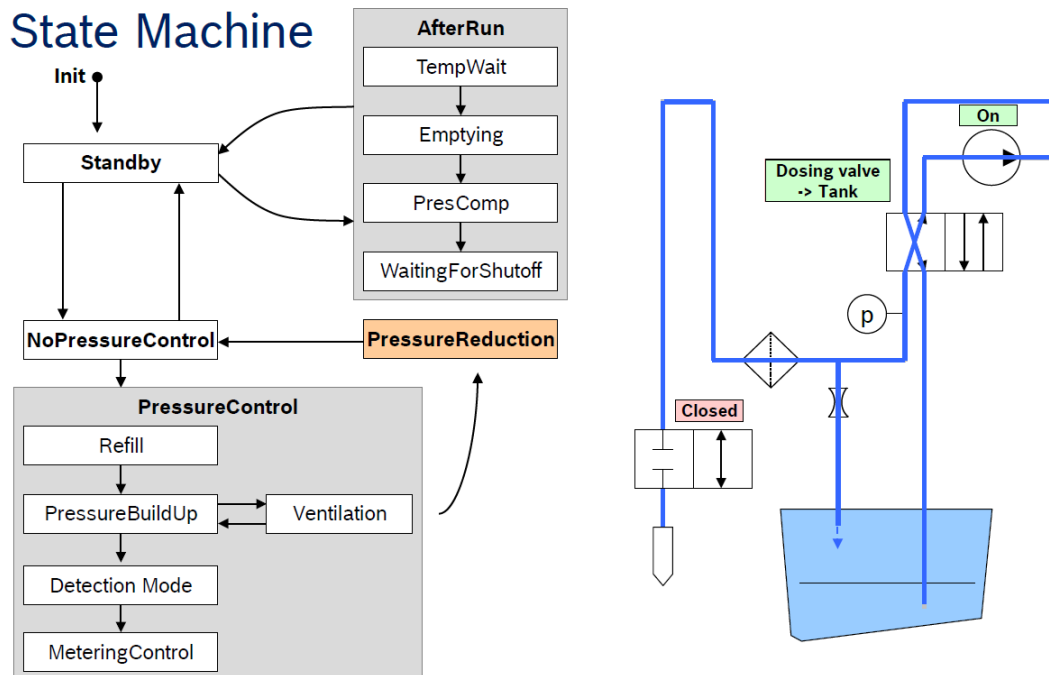
For Metering control state, the DEF(Diesel Exhaust Fluid) dosing can be released.

Normally, this state is mostly maintained when the machine is operating.



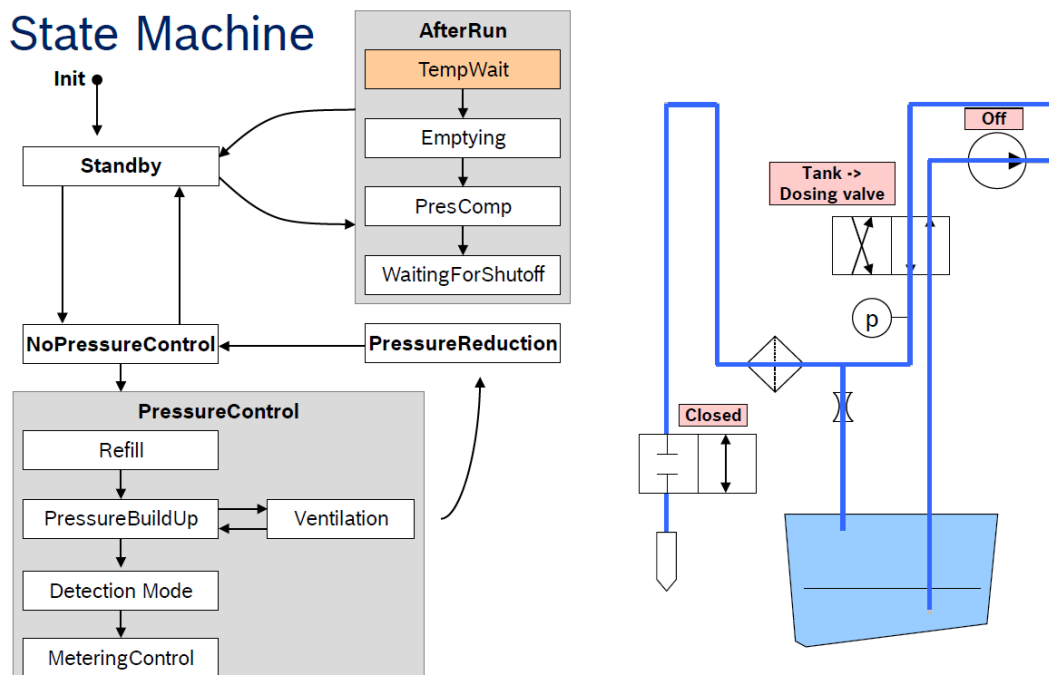
[4] PressureReduction

The pressure reduction in the SCR system. If a pressure threshold is reached within an applicable time, the state machine will switch to the NOPRESSURECONTROL state.



[5.1] AfterRun (TempWait)

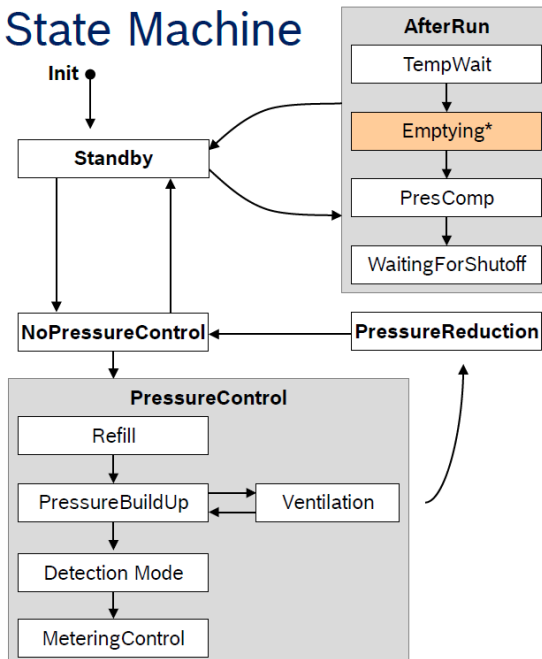
The SCR system will be shut down in the AFTERRUN state. If key is switched back ON before AFTERRUN is finished, AFTERRUN will be considered to have been aborted and the state machine will switch to the STANDBY state. If this is not the case, the substates of the AFTERRUN state will run through. The SCR system wait for cooling-off at TempWait state.



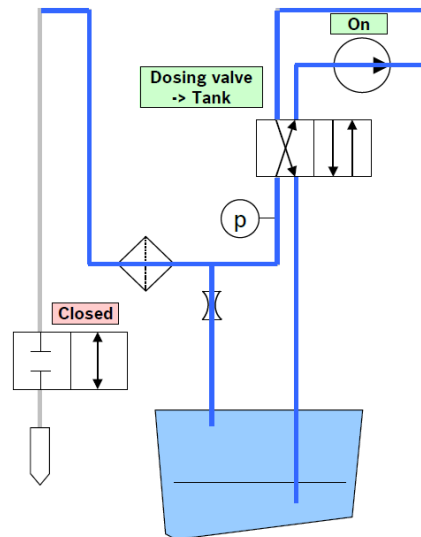
[5.2] AfterRun (Emptying)

For AFTERRUN_EMPTYING state, the pressure line and the supply module are emptied after cooling-off.

State Machine



*in case of partial emptying
siphon needed in pressure line

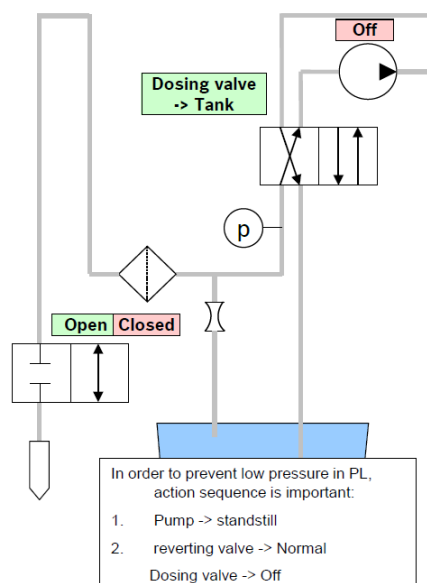
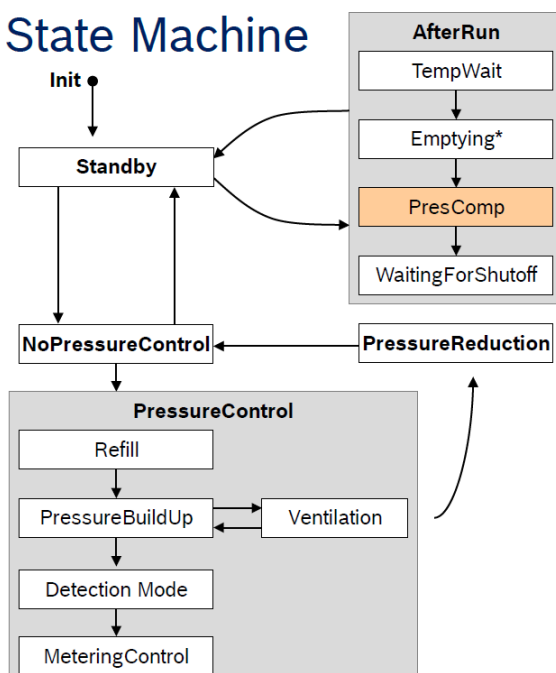


[5.3] AfterRun (PresComp)

After the system has been emptied completely, the state machine will switch to the PresComp (Pressure Compensation) state. In this state the pump is switched OFF, then the dosing valve and the reverting valve are closed in succession with a delay.

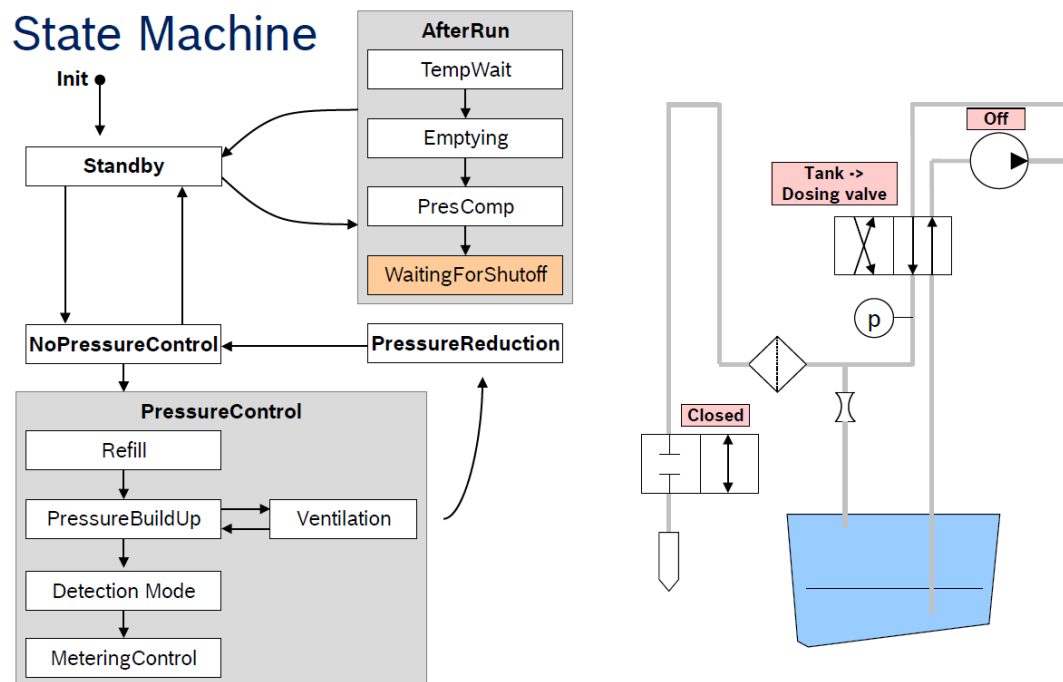
During this period, we perform a feasibility check using a pressure sensor. For example, P1460 (DEF underpressure error at AFTERRUN_PRESSURECOMPENSATION), the DEF pressure is below the minimum pressure threshold, it is considered that DEF backflow line is clogged or the DEF is existed in back flow line due to excessive DEF level.

State Machine



[5.4] AfterRun (WaitingForShutoff)

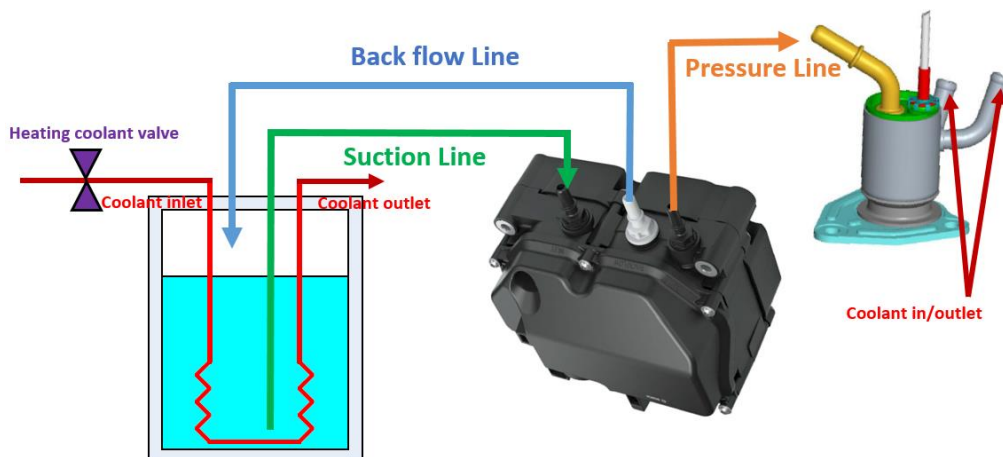
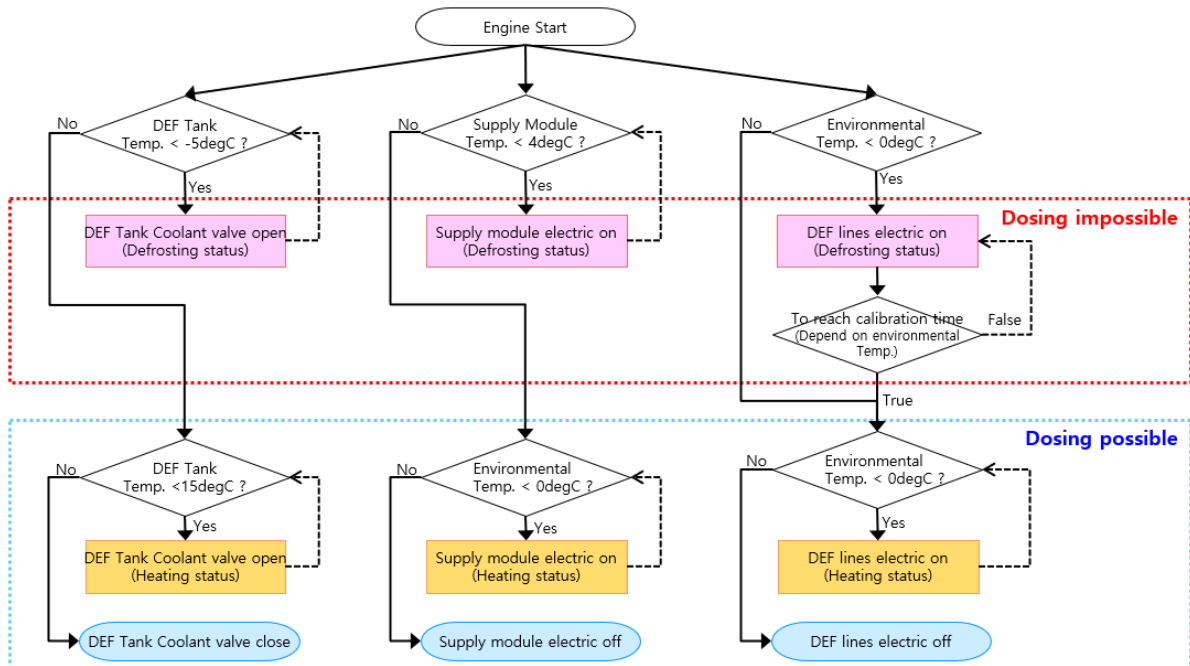
ECU will be shut down and switched off.



7. SCR system Heating condition technical tip

Because the DEF does freeze at -11 degC, SCR system should be provided heating control to the DEF tank, Supply module and lines.

It allows the DEF to thaw rapidly and keeps it flowing to the SCR aftertreatment system regardless of the outside environment temperature.



8. NCD (NOx Control Diagnostic system) inducement fault group summary & Repeat offense

The NCD(NOx Control Diagnostic system) inducement fault group is below one. Fault codes can be added or deleted depending on the fault strategy during development.

"EGR Block" group 24 faults were added (with EGR system only), Not used for No EGR system

| Emission | Engine system | EGR block (Group1) | Dosing interrupt (Group2) | DEF consumption (Group3 - Not Used) | DEF quality (Group4) | Tampering (Group5) |
|----------|---------------|--------------------|---------------------------|-------------------------------------|----------------------|--------------------|
| Stage5 | NoEGR +SCR | Not used | Used | Not used | Used | Used |
| | EGR only | Used | Not used | Not used | Not used | Not used |
| US T4F | NoEGR +SCR | Not used | Used | Not used | Used | Used |
| | EGR only | Not used | Not used | Not used | Not used | Not used |
| China4 | EGR only | Used | Not used | Not used | Not used | Used |

| No. | 1 | | | 2 | | | 4 | | | 5 | | |
|-----|-----------|-----|--------|------------------|-----|--------|-------------|-----|--------|-----------|-----|----------------|
| | EGR block | | | Dosing interrupt | | | DEF quality | | | Tampering | | |
| | SPN | FMI | P-code | SPN | FMI | P-code | SPN | FMI | P-code | SPN | FMI | P-code |
| 1 | 27 | 0 | P042E | 3031 | 14 | P205E | 3516 | 0 | P106D | 1761 | 19 | P1230 |
| 2 | 27 | 1 | P042F | 3216 | 4 | P2397 | 3516 | 1 | P106C | 3216 | 18 | P225D |
| 3 | 27 | 3 | P0406 | 3226 | 4 | P2398 | | | | 3219 | 7 | U030D |
| 4 | 27 | 4 | P0407 | 3360 | 14 | P263D | | | | 3224 | 5 | P2203 |
| 5 | 27 | 20 | P0C17 | 3361 | 3 | P2047 | | | | 3224 | 6 | P2202 |
| 6 | 27 | 22 | P0C18 | 3361 | 4 | P2048 | | | | 3229 | 7 | U030E |
| 7 | 27 | 23 | P0C19 | 3361 | 13 | P202E | | | | 3234 | 5 | P2216 |
| 8 | 102 | 3 | P0108 | 3361 | 22 | P2050 | | | | 3234 | 6 | P2215 |
| 9 | 102 | 4 | P0107 | 3361 | 23 | P2051 | | | | 3242 | 3 | P2033 |
| 10 | 105 | 3 | P00AD | 3363 | 3 | P20B4 | | | | 3242 | 4 | P2032 |
| 11 | 105 | 4 | P00AC | 3363 | 4 | P20B3 | | | | 3242 | 11 | P2034 |
| 12 | 110 | 3 | P0118 | 3363 | 7 | P30B1 | | | | 3251 | 3 | P2455 |
| 13 | 110 | 4 | P0117 | 4335 | 7 | P202D | | | | 3251 | 4 | P2454 |
| 14 | 132 | 3 | P0103 | 4374 | 3 | P208D | | | | 3251 | 18 | P1454 or P244A |
| 15 | 132 | 4 | P0102 | 4374 | 4 | P208C | | | | 3361 | 5 | P2049 |
| 16 | 132 | 19 | P0100 | 4374 | 7 | P208B | | | | 3361 | 14 | P2C11 |
| 17 | 132 | 21 | P00BE | 4374 | 8 | P108A | | | | 3361 | 27 | P208E |
| 18 | 2789 | 3 | P0546 | 4374 | 9 | P108B | | | | 3363 | 5 | P20B1 |
| 19 | 2789 | 4 | P0545 | 4374 | 12 | P108C | | | | 3520 | 3 | U1028 |

| | | | | | | | | | | | | |
|----|------|----|-------|------|----|-------|--|--|--|--------|----|-------|
| 20 | 2791 | 3 | P2145 | 5491 | 3 | P20C0 | | | | 3520 | 4 | U1030 |
| 21 | 2791 | 4 | P2144 | 5491 | 4 | P20BF | | | | 3532 | 3 | P203A |
| 22 | 2791 | 5 | P2143 | 5491 | 7 | P30BD | | | | 3532 | 4 | P2041 |
| 23 | 3236 | 0 | P049B | 5491 | 12 | P20BE | | | | 4335 | 0 | P1450 |
| 24 | 3236 | 16 | P0408 | 5746 | 3 | P21C4 | | | | 4335 | 1 | P1451 |
| 25 | | | | 5746 | 4 | P21C3 | | | | 4335 | 2 | P1457 |
| 26 | | | | 5746 | 7 | P31C5 | | | | 4335 | 12 | P1452 |
| 27 | | | | 6875 | 3 | P204D | | | | 4335 | 15 | P1459 |
| 28 | | | | 6875 | 4 | P204C | | | | 4344 | 2 | P1893 |
| 29 | | | | 6875 | 16 | P304D | | | | 4365 | 3 | P2043 |
| 30 | | | | 6875 | 18 | P304C | | | | 4365 | 4 | P2046 |
| 31 | | | | 7069 | 3 | P20C4 | | | | 4365 | 14 | P1227 |
| 32 | | | | 7069 | 4 | P20C3 | | | | 4374 | 5 | P208A |
| 33 | | | | 7069 | 7 | P30C1 | | | | 5435 | 10 | P1453 |
| 34 | | | | 7069 | 12 | P20C2 | | | | 5435 | 12 | P204A |
| 35 | | | | 7416 | 3 | P20BC | | | | 5436 | 3 | P20A3 |
| 36 | | | | 7416 | 4 | P20BB | | | | 5436 | 4 | P20A2 |
| 37 | | | | 7416 | 7 | P30B9 | | | | 5436 | 5 | P20A0 |
| 38 | | | | 7416 | 12 | P20BA | | | | 5436 | 7 | P20A1 |
| 39 | | | | 7538 | 12 | P06F0 | | | | 5436 | 11 | P20A5 |
| 40 | | | | 7538 | 13 | P06F1 | | | | 5436 | 14 | P1461 |
| 41 | | | | 7538 | 22 | P20AC | | | | 5491 | 5 | P20BD |
| 42 | | | | 7538 | 23 | P20AD | | | | 5706 | 12 | P23B3 |
| 43 | | | | 7538 | 24 | P20B0 | | | | 5706 | 14 | P23B4 |
| 44 | | | | 7538 | 25 | P20FF | | | | 5706 | 22 | P23B2 |
| 45 | | | | 7538 | 26 | P056D | | | | 5746 | 5 | P21C2 |
| 46 | | | | 7540 | 3 | P20C8 | | | | 5965 | 3 | P21C9 |
| 47 | | | | 7540 | 4 | P20C7 | | | | 5965 | 4 | P21C8 |
| 48 | | | | 7540 | 7 | P30C5 | | | | 5965 | 5 | P21C7 |
| 49 | | | | 7540 | 12 | P20C6 | | | | 7069 | 5 | P20C1 |
| 50 | | | | | | | | | | 7107 | 12 | P23B5 |
| 51 | | | | | | | | | | 7107 | 14 | P23B6 |
| 52 | | | | | | | | | | 7416 | 5 | P20B9 |
| 53 | | | | | | | | | | 7540 | 5 | P20C5 |
| 54 | | | | | | | | | | 61454 | 19 | U029D |
| 55 | | | | | | | | | | 61455 | 19 | U029E |
| 56 | | | | | | | | | | 64923 | 19 | U02A2 |
| 57 | | | | | | | | | | 65110 | 19 | U0619 |
| 58 | | | | | | | | | | 104332 | 9 | P2383 |
| 59 | | | | | | | | | | 104385 | 9 | P2384 |

| | | | | | | | | | | | | |
|----|--|--|--|--|--|--|--|--|--|------|----|-------|
| 60 | | | | | | | | | | 5629 | 14 | P246C |
|----|--|--|--|--|--|--|--|--|--|------|----|-------|

The repeat offense of NCD(NOx Control Diagnostic system) inducement is different dependent on Emission regulation. Refer to the below example case for better understanding.

1. EU (Stage5)

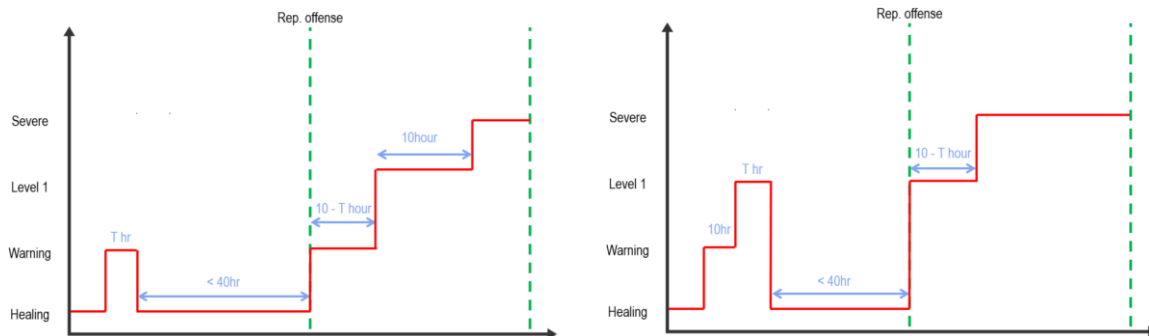
| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|---|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | $\geq 90\%$ of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | $\geq 95\%$ of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

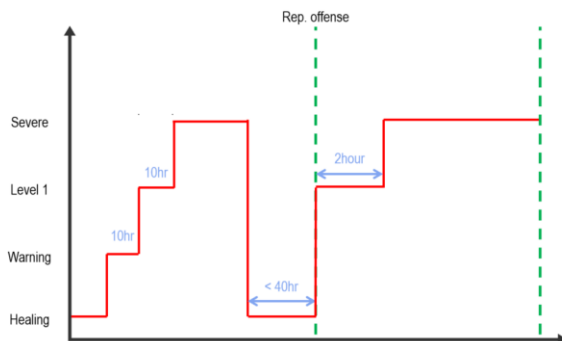
* EU Stage5

If DEF quality or Dosing Interrupt faults are confirmed up to warning/Level1, and faults are occurred again within 40 hours, the fault counter is setting to last value when repeat offense is enabled.



Graph 8-1. EU Stage5 DEF quality or Dosing interrupt Repeat offense at Warning/Level

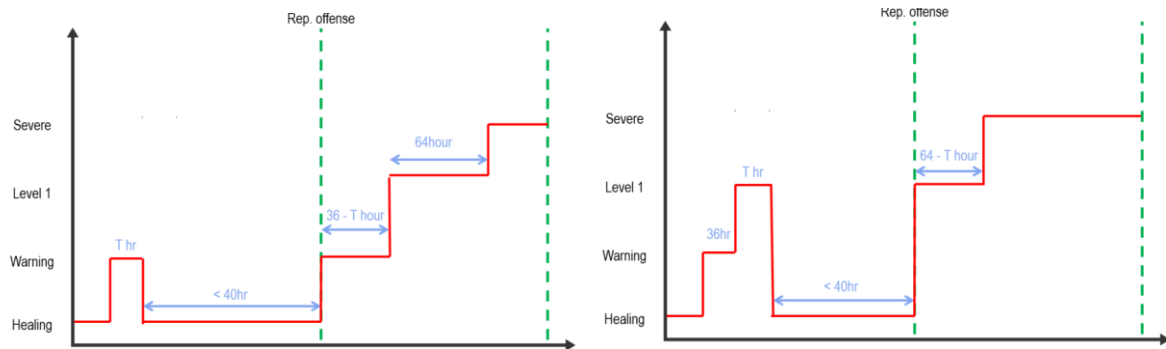
If DEF quality or Dosing Interrupt faults are confirmed up to Severe level, and faults are occurred again within 40 hours, the fault counter is changed before 90%(18hrs) of counter value of Severe level. It means that the fault level is changed to Level1 and Severe level will be reached within 2hrs.



Graph 8-2. EU Stage5 DEF quality or Dosing interrupt Repeat offense at Severe Level

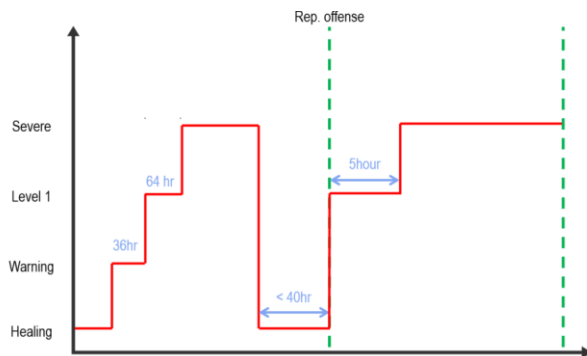
The repeat offense of Impeded EGR or Tampering faults are only differed the NCD inducement counter(time), and the operation is same to DEF quality or Dosing interrupt fault

If Impeded EGR or Tampering faults are confirmed up to warning/Level1, and faults are occurred again within 40 hours, the fault counter is setting to last value when repeat offense is enabled.



Graph 8-3. EU Stage5 Impeded EGR or Tampering Repeat offense at Warning/Level

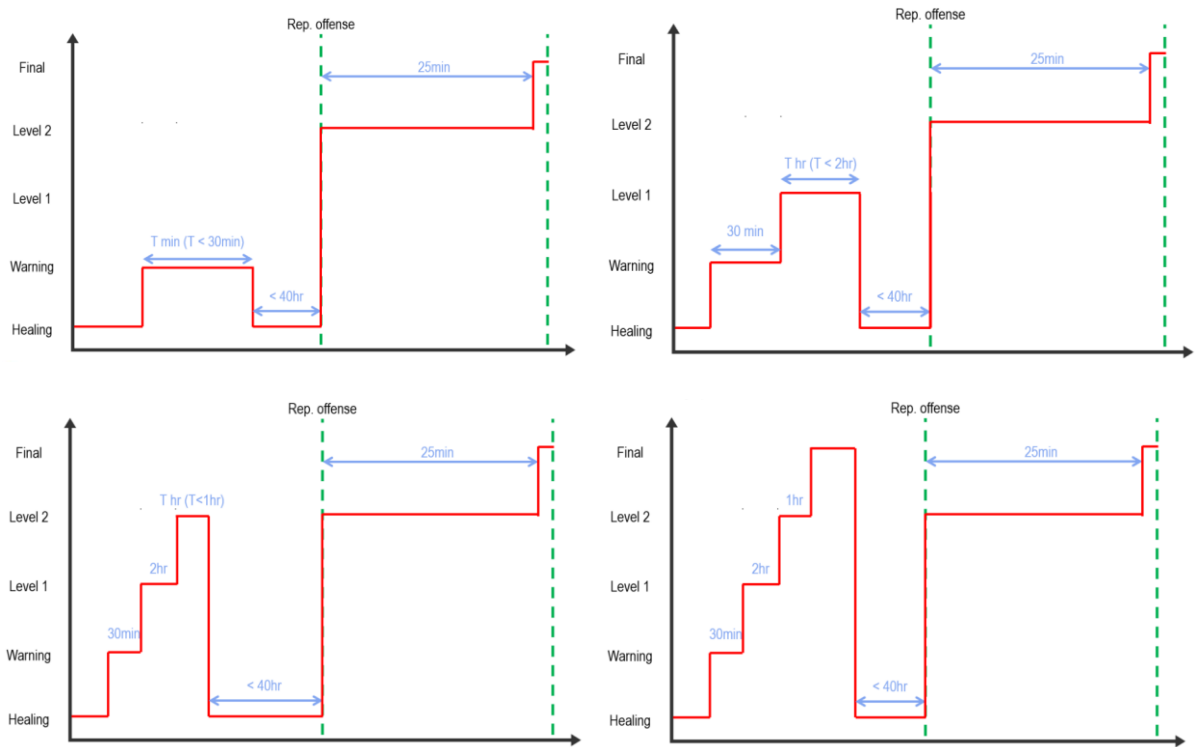
If Impeded EGR or Tampering faults are confirmed up to Severe level, and faults are occurred again within 40 hours, the fault counter is changed before 95%(95hrs) of counter value of Severe level. It means that the fault level is changed to Level1 and Severe level will be reached within 5hrs.



Graph 8-4. EU Stage5 Impeded EGR or Tampering Repeat offense at Severe level

*** US Tier4Final**

If any NCD inducement faults are confirmed and occurred again within 40 hours, fault level is changed to Level2 and Final inducement level will be reached within 25min.




Graph 8-5. US Tier4Final Repeat offense


9. Diagnostic connector

Diagnostic connector used to connect with service tool or data-logger.

1) 6Pin

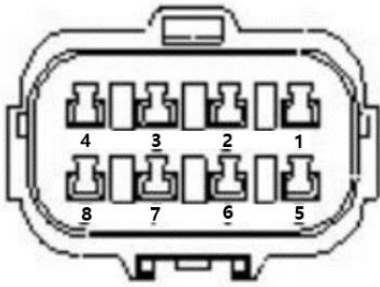

| Manufacture | | Deutsch | | Pin No. | 6 Pin | |
|-----------------|-----------|------------|------------|----------|-------|---------|
| Pin information | | | | | | |
| Line | component | Protocol | Resolution | Position | ECU | DT04-6P |
| | | | | | | 6pin |
| CAN1 | ECU | UDS, J1939 | 250Kbyte | Low | K31 | 4 |
| | | | | High | K30 | 3 |
| CAN2 | ECU | UDS, CCP | 1Mbyte | Low | K80 | 6 |
| | | | | High | K81 | 5 |
| Machine | Power | - | - | Vbatt+ | - | - |
| | | | | Ignition | - | 1 |
| | | | | Ground | - | 2 |

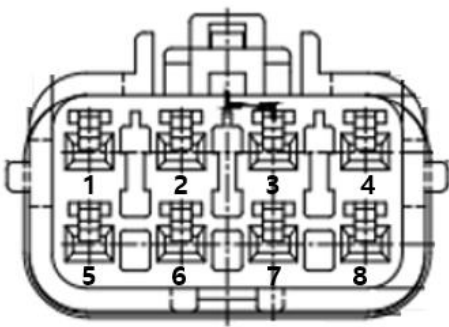

| Diagnostic tool side | | | |
|--|---------|----------|------|
| Part number | DT04-6P | Pin Type | Male |
|  | | | |

| Machine side | | | |
|--|---------|----------|--------|
| Part number | DT06-6S | Pin Type | Female |
|  | | | |

2) 8Pin

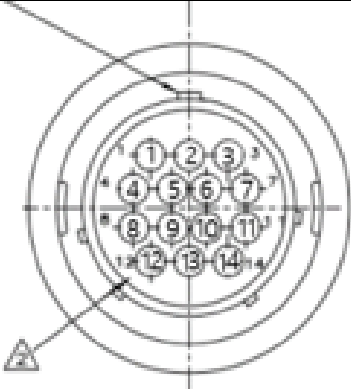
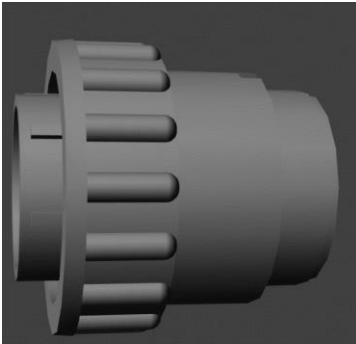

| | | | | | | |
|-----------------|-----------|---------------|------------|----------|-------|------------------|
| Manufacture | | YAZAKI or KET | | Pin No. | 8 Pin | |
| Pin information | | | | | | |
| Line | component | Protocol | Resolution | Position | ECU | KET MG 640341 |
| | | | | | | 8pin |
| CAN1 | ECU | UDS, J1939 | 250Kbyte | Low | K31 | 4 |
| | | | | High | K30 | 3 |
| CAN2 | ECU | UDS, CCP | 1Mbyte | Low | K80 | 6 |
| | | | | High | K81 | 5 |
| Machine | Power | - | - | Vbatt+ | - | TBD |
| | | | | Ignition | - | 1 |
| | | | | Ground | - | 2 |


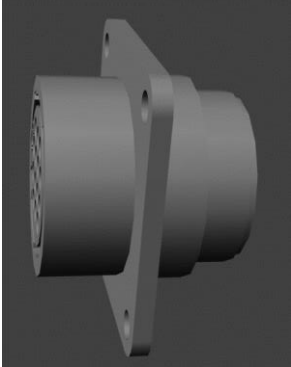

| | | | |
|---|---|---|------|
| Diagnostic tool side | | | |
| Part number | YAZAKI 7222-7484-40 or KET MG 640341 | Pin Type | Male |
|  | |  | |

| | | | |
|---|--|---|--------|
| Machine side | | | |
| Part number | YAZAKI 7123-7484-40 or KET MG 61033 | Pin Type | Female |
|  | |  | |

3) 14Pin

| Manufacture | | | TE | | Pin No. | 14 Pin | |
|-----------------|-----------|------------|------------|----------|---------|---------------|--|
| Pin information | | | | | | | |
| Line | component | Protocol | Resolution | Position | ECU | AMP 182649 | |
| | | | | | | 14pin | |
| CAN1 | ECU | UDS, J1939 | 250Kbyte | Low | K31 | 5 | |
| | | | | High | K30 | 4 | |
| CAN2 | ECU | UDS, CCP | 1Mbyte | Low | K80 | 8 | |
| | | | | High | K81 | 7 | |
| Machine | Power | - | - | Vbatt+ | - | TBD | |
| | | | | Ignition | - | 12 | |
| | | | | Ground | - | 13 | |



| Diagnostic tool side | | | |
|--|---|--|------|
| Part number | AMP 18264 | Pin Type | Male |
|  |  |  | |

| Machine side | | | |
|---|---|---|--------|
| Part number | AMP 18264 | Pin Type | Female |
|  |  |  | |

4) 16Pin

| Manufacture | | OBD2 | | Pin No. | 16 Pin | |
|-----------------|-----------|------------|------------|----------|--------|-------|
| Pin information | | | | | | |
| Line | component | Protocol | Resolution | Position | ECU | OBD2 |
| | | | | | | 16pin |
| CAN1 | ECU | UDS, J1939 | 250Kbyte | Low | K31 | 14 |
| | | | | High | K30 | 6 |
| CAN2 | ECU | UDS, CCP | 1Mbyte | Low | K80 | 13 |
| | | | | High | K81 | 12 |
| Machine | Power | - | - | Vbatt+ | - | 16 |
| | | | | Ignition | - | 1 |
| | | | | Ground | - | 5 |

| Diagnostic tool side | | | |
|--|-----------|----------|------|
| Part number | AMP 18264 | Pin Type | Male |
|   | | | |

| Machine side | | | |
|---|-----------|----------|--------|
| Part number | AMP 18264 | Pin Type | Female |
|   | | | |

10. Fault list summary

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|-----|-----|--|-------------|-----------------|-------------|-----------|----------------------|-------------------|
| 1 | U0607 | 0 | 19 | Timeout Error of CAN-Receive-Frame TSC1VE (Engine speed & Torque demand) | ON | Level1 (Mild) | | | | |
| 2 | P042E | 27 | 0 | EGR Position Open jammed fault | Blink or ON | Level2 (severe) | | | EGR Block (EGR only) | Active Forced |
| 3 | P042F | 27 | 1 | EGR Position Closed jammed fault | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 4 | P0406 | 27 | 3 | EGR Position Sensor High Fault | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 5 | P0407 | 27 | 4 | EGR Position Sensor Low Fault | ON | No | | | EGR Block (EGR only) | Active Forced |
| 6 | P0C17 | 27 | 20 | EGR Close Position Learning Range Over Fault | ON | No | | | EGR Block (EGR only) | Active Forced |
| 7 | P0C18 | 27 | 22 | EGR Close Position Learning Drift Fault for long time | ON | No | | | EGR Block (EGR only) | Active Forced |
| 8 | P0C19 | 27 | 23 | EGR Close Position Learning Drift Fault for short time | ON | No | | | EGR Block (EGR only) | Active Forced |
| 9 | P0223 | 29 | 3 | Accel pedal position track2 sensor High fault | ON | Level1 (Mild) | | | | |
| 10 | P0222 | 29 | 4 | Accel pedal position track2 sensor Low fault | ON | Level1 (Mild) | | | | |
| 11 | P0221 | 29 | 15 | Hand pedal position track2 sensor High fault | ON | Level1 (Mild) | | | | |
| 12 | P0224 | 29 | 17 | Hand pedal position track2 sensor Low fault | ON | Level1 (Mild) | | | | |
| 13 | P02E4 | 51 | 0 | Throttle valve Position Open jammed fault | ON | No | | | | Active Forced |
| 14 | P02E5 | 51 | 1 | Throttle valve Position Closed jammed fault | ON | No | | | | Active Forced |
| 15 | P02E9 | 51 | 3 | Throttle valve Position Sensor High Fault | ON | No | | | | Active Forced |
| 16 | P02E8 | 51 | 4 | Throttle valve Position Sensor Low Fault | ON | No | | | | Active Forced |
| 17 | P02EA | 51 | 22 | Throttle valve Close Position Learning Drift Fault for long time | ON | No | | | | Active Forced |
| 18 | P02EB | 51 | 23 | Throttle valve Close Position Learning Drift Fault for short time | ON | No | | | | Active Forced |
| 19 | P02E7 | 51 | 30 | Throttle valve Close Position Learning Drift Fault | ON | No | | | | |
| 20 | P0123 | 91 | 3 | Accel pedal position track1 sensor High fault | ON | Level1 (Mild) | | | | |
| 21 | P0122 | 91 | 4 | Accel pedal position track1 sensor Low fault | ON | Level1 (Mild) | | | | |
| 22 | P2135 | 91 | 11 | Accel pedal position sensor plausibility fault (Not synchronism between track1 and track2) | ON | Level1 (Mild) | | | | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|-----|-----|---|---------|-----------------|-------------|-----------|----------------------|-------------------|
| 23 | P2136 | 91 | 12 | Hand pedal position sensor plausibility fault (Not synchronism between track1 and track2) | ON | Level1 (Mild) | | | | |
| 24 | P0121 | 91 | 15 | Hand pedal position track1 sensor High fault | ON | Level1 (Mild) | | | | |
| 25 | P0124 | 91 | 17 | Hand pedal position track1 sensor Low fault | ON | Level1 (Mild) | | | | |
| 26 | U0606 | 91 | 19 | Timeout Error of CAN-Receive-Frame EEC2 (Pedal) | ON | Level1 (Mild) | | | | |
| 27 | P2267 | 97 | 3 | Water In Fuel Sensor signal range high fault | Blink | Level2 (severe) | | | | |
| 28 | P2266 | 97 | 4 | Water In Fuel Sensor signal range low fault | Blink | Level2 (severe) | | | | |
| 29 | P2269 | 97 | 14 | Water in fuel detected – Warning step | ON | No | | | | |
| 30 | P2265 | 97 | 23 | Water in fuel detected – Torque de-rate step (After 20min) | Blink | Level2 (severe) | | | | |
| 31 | P250D | 98 | 3 | Oil combination (Level and temperature) signal short circuit to battery error | ON | No | | | | |
| 32 | P250C | 98 | 4 | Oil combination (Level and temperature) signal short circuit to ground error | ON | No | | | | |
| 33 | P250A | 98 | 5 | Oil combination (Level and temperature) sensor itself open or short circuit error | ON | No | | | | |
| 34 | P250F | 98 | 18 | Engine oil level is too low (Low step3) | ON | No | | | | |
| 35 | P350D | 98 | 22 | Oil combination (Level and temperature) sensor timeout fault | ON | No | | | | |
| 36 | P0196 | 175 | 11 | Oil combination (Level and temperature) sensor itself Oil temperature out of range error | ON | No | | | | |
| 37 | P350E | 98 | 23 | Oil combination (Level and temperature) sensor itself Voltage out of range error | ON | No | | | | |
| 38 | P350F | 98 | 24 | Engine oil level is low (Low step2) | ON | No | | | | |
| 39 | P1522 | 100 | 1 | Engine Oil Pressure Too Low Fault | Blink | Level2 (severe) | Used | | | Active Forced |
| 40 | P0523 | 100 | 3 | Engine Oil Pressure Sensor High Fault | Blink | Level2 (severe) | Used | | | |
| 41 | P0522 | 100 | 4 | Engine Oil Pressure Sensor Low Fault | Blink | Level2 (severe) | Used | | | |
| 42 | P0108 | 102 | 3 | Intake Manifold Pressure Sensor High Fault | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 43 | P0107 | 102 | 4 | Intake Manifold Pressure Sensor Low Fault | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 44 | P00AD | 105 | 3 | Intake manifold temperature sensor High fault | ON | No | | | EGR Block (EGR only) | Active Forced |
| 45 | P00AC | 105 | 4 | Intake manifold temperature sensor Low fault | ON | No | | | EGR Block (EGR only) | Active Forced |
| 46 | P10AD | 105 | 16 | Intake manifold temperature High fault | ON | No | | | | Active Forced |
| 47 | P2229 | 108 | 3 | Atmospheric Pressure Sensor High Fault | ON | No | | | | |
| 48 | P2228 | 108 | 4 | Atmospheric Pressure Sensor Low Fault | ON | No | | | | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|-----|-----|---|-------------|-----------------|-------------|-----------|----------------------|-------------------|
| 49 | P1118 | 110 | 0 | Coolant high temperature Fault | ON | depend on temp. | | | | Active Forced |
| 50 | P0118 | 110 | 3 | Coolant Temperature Sensor High Fault | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 51 | P0117 | 110 | 4 | Coolant Temperature Sensor Low Fault | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 52 | P011E | 110 | 10 | Coolant Temperature Plausibility Fault | ON | Level1 (Mild) | | | | |
| 53 | P00BC | 132 | 1 | Intake manifold pressure low plausibility fault (Compressor out pressure too low) | Blink | Level2 (severe) | | | | Active Forced |
| 54 | P0103 | 132 | 3 | Signal range check high error for Air mass flow sensor | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 55 | P0102 | 132 | 4 | Signal range check low error for Air mass flow sensor | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 56 | P0101 | 132 | 5 | Battery voltage error of Air mass flow sensor | ON | No | | | | Active Forced |
| 57 | P0100 | 132 | 19 | Signal error of Air mass flow sensor | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 58 | P00BE | 132 | 21 | Sensitivity drift error low for Air mass flow sensor | Blink or ON | Level2 (severe) | | | EGR Block (EGR only) | Active Forced |
| 59 | P0087 | 157 | 10 | Fuel Leakage is detected based on fuel quantity balance | ON | Level1 (Mild) | Used | | | Active Forced |
| 60 | P0002 | 157 | 11 | Maximum positive deviation of rail pressure exceeded | ON | Level1 (Mild) | Used | | | Active Forced |
| 61 | P190C | 157 | 26 | Rail pressure too low fault | ON | Level1 (Mild) | Used | | | Active Forced |
| 62 | P190B | 157 | 27 | Maximum rail pressure exceeded | ON | Level1 (Mild) | | | | Active Forced |
| 63 | P1934 | 157 | 28 | Pressure relief valve(PRV) failure | Blink | Level2 (severe) | Used | Used | | Active Forced |
| 64 | P1073 | 171 | 0 | Environment Temperature Too High | ON | No | | | | |
| 65 | P0073 | 171 | 3 | Environment Temperature Sensor Signal High | ON | No | | | | |
| 66 | P0072 | 171 | 4 | Environment Temperature Sensor Signal Low | ON | No | | | | |
| 67 | P107D | 172 | 0 | Inlet air temperature High fault | ON | No | | | | |
| 68 | P007D | 172 | 3 | Inlet air temperature sensor High fault | ON | No | | | | Active Forced |
| 69 | P007C | 172 | 4 | Inlet air temperature sensor Low fault | ON | No | | | | Active Forced |
| 70 | P0421 | 173 | 1 | DOC Exothermal Efficiency Fault | ON | No | | | | Active |
| 71 | P1183 | 174 | 0 | Fuel temperature high fault | ON | depend on temp. | | | | Active Forced |
| 72 | P0183 | 174 | 3 | Fuel Temperature Sensor High Fault | ON | No | | | | Active Forced |
| 73 | P0182 | 174 | 4 | Fuel Temperature Sensor Low Fault | ON | No | | | | Active Forced |
| 74 | P273F | 177 | 15 | Transmission oil temperature high fault (CAN) | ON | Level1 (Mild) | | | | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|-----|-----|---|---------|-----------------|-------------|-----------|----------------|-------------------|
| 75 | P274F | 177 | 16 | Transmission oil temperature high fault (H/W Switch) | ON | Level1 (Mild) | | | | |
| 76 | P0219 | 190 | 0 | Engine over speed detection fault | ON | No | | | | |
| 77 | P1563 | 444 | 0 | Battery Voltage High fault (Warning) | ON | No | | | | |
| 78 | P1562 | 444 | 1 | Battery Voltage Low fault (Warning) | ON | No | | | | |
| 79 | P1565 | 444 | 2 | Powerstage diagnosis could be disabled due to low Battery voltage | ON | No | | | | |
| 80 | P0563 | 444 | 3 | Battery Voltage Signal Range Max fault | ON | Level1 (Mild) | | | | Active Forced |
| 81 | P0562 | 444 | 4 | Battery Voltage Signal Range Min fault | ON | Level1 (Mild) | | | | Active Forced |
| 82 | P1564 | 444 | 12 | Powerstage diagnosis disabled due to high Battery voltage | ON | No | | | | |
| 83 | P0512 | 626 | 12 | Starter switch stuck fault (Cranking request is too long.) | ON | No | | | | |
| 84 | P0372 | 636 | 2 | Crank Signal disturbed fault | Blink | Level2 (severe) | Used | | | Active Forced |
| 85 | P0374 | 636 | 8 | Cranks No signal error | Blink | Level2 (severe) | Used | | | Active Forced |
| 86 | P0344 | 637 | 2 | Cam Signal disturbed fault | ON | No | | | | |
| 87 | P0342 | 637 | 8 | Cam Signal Lost fault | ON | No | | | | |
| 88 | P0340 | 637 | 30 | Cam Signal Drift Fault | ON | No | | | | |
| 89 | U0029 | 639 | 2 | CAN communication error | ON | Level1 (Mild) | | | | |
| 90 | U0028 | 639 | 19 | CAN bus off error | ON | Level1 (Mild) | | | | |
| 91 | P268C | 651 | 2 | Injector Code(IQA) Program Missing Fault (Cylinder#1) | ON | No | | | | |
| 92 | P02EE | 651 | 4 | Injector Short circuit Fault (Cylinder #1) | ON | No | | | | Active Forced |
| 93 | P0201 | 651 | 5 | Injector Open circuit Fault (Cylinder #1) | ON | No | | | | Active Forced |
| 94 | P32EE | 651 | 22 | Injector High Low side Short circuit Fault (Cylinder #1) | ON | No | | | | Active Forced |
| 95 | P268D | 652 | 2 | Injector Code(IQA) Program Missing Fault (Cylinder#2) | ON | No | | | | |
| 96 | P02EF | 652 | 4 | Injector Short circuit Fault (Cylinder #2) | ON | No | | | | Active Forced |
| 97 | P0202 | 652 | 5 | Open load on the power stage for cylinder #2 | ON | No | | | | Active Forced |
| 98 | P32EF | 652 | 22 | Injector High Low side Short circuit Fault (Cylinder #2) | ON | No | | | | Active Forced |
| 99 | P268E | 653 | 2 | Injector Code(IQA) Program Missing Fault (Cylinder#3) | ON | No | | | | |
| 100 | P02F0 | 653 | 4 | Injector Short circuit Fault (Cylinder #3) | ON | No | | | | Active Forced |
| 101 | P0203 | 653 | 5 | Injector Open circuit Fault (Cylinder #3) | ON | No | | | | Active Forced |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|------|-----|--|---------|-----------------|-------------|-----------|----------------|-------------------|
| 102 | P32F0 | 653 | 22 | Injector High Low side Short circuit Fault (Cylinder #3) | ON | No | | | | Active Forced |
| 103 | P268F | 654 | 2 | Injector Code(IQA) Program Missing Fault (Cylinder#4) | ON | No | | | | |
| 104 | P02F1 | 654 | 4 | Injector Short circuit Fault (Cylinder #4) | ON | No | | | | Active Forced |
| 105 | P0204 | 654 | 5 | Injector Open circuit Fault (Cylinder #4) | ON | No | | | | Active Forced |
| 106 | P32F1 | 654 | 22 | Injector High Low side Short circuit Fault (Cylinder #4) | ON | No | | | | Active Forced |
| 107 | P0384 | 676 | 3 | Glow plug Relay driver Short circuit to Battery Fault | ON | No | | | | |
| 108 | P0383 | 676 | 4 | Glow plug Relay driver Short circuit to Ground Fault | ON | No | | | | |
| 109 | P0380 | 676 | 5 | Glow plug Relay driver Open circuit Fault | ON | No | | | | |
| 110 | U1003 | 970 | 12 | Engine shut off request through CAN (EBC1) | OFF | No | | Used | | |
| 111 | P0215 | 970 | 22 | Engine shut off request through hardwire | OFF | No | | Used | | |
| 112 | P028E | 975 | 3 | PWM FAN Output short to battery circuit fault | ON | No | | | | |
| 113 | P028D | 975 | 4 | PWM FAN Output short to ground circuit fault | ON | No | | | | |
| 114 | P028A | 975 | 5 | PWM FAN Output open circuit fault | ON | No | | | | |
| 115 | P1931 | 987 | 3 | CE(Check engine) Lamp Short to Battery | ON | No | | | | |
| 116 | P192F | 987 | 4 | CE(Check engine) Lamp Short to Ground | ON | No | | | | |
| 117 | P192E | 987 | 5 | CE(Check engine) Lamp Open circuit | ON | No | | | | |
| 118 | P0004 | 1076 | 3 | Fuel Metering unit plausibility error in overrun mode | ON | Level1 (Mild) | Used | | | Active Forced |
| 119 | P0003 | 1076 | 4 | Fuel Metering unit plausibility error in idle mode | ON | Level1 (Mild) | Used | | | Active Forced |
| 120 | P0254 | 1076 | 16 | Maximum negative rail pressure deviation with metering unit on lower limit is exceeded | ON | Level1 (Mild) | Used | | | Active Forced |
| 121 | P0252 | 1076 | 20 | Rail pressure too low for injection | ON | No | | | | |
| 122 | P2381 | 1081 | 3 | Glow plug Lamp Short to Battery | ON | No | | | | |
| 123 | P1904 | 1081 | 4 | Glow plug Lamp Short to Ground | ON | No | | | | |
| 124 | P0381 | 1081 | 5 | Glow plug Lamp Open circuit | ON | No | | | | |
| 125 | P0669 | 1207 | 0 | ECU temperature High fault | ON | No | | | | |
| 126 | P06AE | 1207 | 3 | ECU temperature sensor High fault (Short circuit to battery) | ON | No | | | | |
| 127 | P06AD | 1207 | 4 | ECU temperature sensor Low fault (Short circuit to ground) | ON | No | | | | |
| 128 | P018D | 1382 | 0 | Fuel filter pressure high fault | ON | Level1 (Mild) | | | | |
| 129 | P018C | 1382 | 1 | Fuel filter pressure low fault | Blink | Level2 (Severe) | | | | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|------|-----|---|---------|----------------|-------------|-----------|----------------------|-------------------|
| 130 | P01C6 | 1382 | 3 | Fuel filter pressure sensor signal high fault | ON | No | | | | |
| 131 | P01C2 | 1382 | 4 | Fuel filter pressure sensor signal low fault | ON | No | | | | |
| 132 | P01C4 | 1382 | 7 | Fuel Filter Pressure low detection 1 - Warning | ON | No | | | | |
| 133 | P01C5 | 1382 | 13 | Fuel Filter Pressure low detection 2 - Torque reduction | ON | Level1 (Mild) | | | | |
| 134 | P0685 | 1485 | 7 | ECU Main relay Stuck fault | ON | No | | | | |
| 135 | P068A | 1485 | 11 | ECU Main relay Early opening fault | ON | No | | | | |
| 136 | P2547 | 1568 | 3 | Multi-torque switch signal too high fault | ON | No | | | | |
| 137 | P2546 | 1568 | 4 | Multi-torque switch signal too low fault | ON | No | | | | |
| 138 | P062D | 1612 | 3 | Injector bank 1st Short circuit fault | ON | No | | | | Active Forced |
| 139 | P062E | 1612 | 12 | Injector bank 2nd Short circuit fault | ON | No | | | | Active Forced |
| 140 | P0528 | 1639 | 3 | Fan speed too high fault | ON | No | | | | |
| 141 | P0529 | 1639 | 4 | Fan speed too low fault | ON | No | | | | |
| 142 | P0527 | 1639 | 11 | Fan speed signal long period fault path | ON | No | | | | |
| 143 | P1230 | 1761 | 19 | DEF Tank Level Signal error | ON | SCR induce | | | Tampering | |
| 144 | P2505 | 1867 | 1 | ECU over temperature for SCR Monitoring | ON | No | | | | |
| 145 | P2508 | 1867 | 3 | "ABE active" report due to overvoltage detection | ON | No | | | | |
| 146 | P2507 | 1867 | 4 | "ABE active" report due to undervoltage detection | ON | No | | | | |
| 147 | P2511 | 1867 | 11 | "WDA/ABE active" report due to unknown reason | ON | No | | | | |
| 148 | P2509 | 1867 | 19 | "WDA active" report due to errors in query-response communication | ON | No | | | | |
| 149 | P2506 | 1867 | 22 | ECU Software Reset 0 fault | ON | No | | | | |
| 150 | P1546 | 2789 | 0 | Turbine inlet temperature High fault | ON | Level1 (Mild) | | | | Active Forced |
| 151 | P0546 | 2789 | 3 | Turbine inlet temperature sensor High fault | ON | No | | | EGR Block (EGR only) | |
| 152 | P0545 | 2789 | 4 | Turbine inlet temperature sensor Low fault | ON | No | | | EGR Block (EGR only) | |
| 153 | P0544 | 2789 | 11 | Turbine inlet temperature Plausibility Fault | ON | No | | | | Active Forced |
| 154 | P2145 | 2791 | 3 | EGR H-Bridge Driver Short circuit to battery | ON | No | | | EGR Block (EGR only) | Active Forced |
| 155 | P2144 | 2791 | 4 | EGR H-Bridge Driver Short circuit to ground | ON | No | | | EGR Block (EGR only) | Active Forced |
| 156 | P2143 | 2791 | 5 | EGR H-Bridge Driver Open Circuit Fault | ON | No | | | EGR Block (EGR only) | Active Forced |
| 157 | P205E | 3031 | 14 | DEF Tank temperature overheated | ON | No | | | | |
| 158 | P1045 | 3031 | 16 | DEF Tank Temperature sensor High plausibility fault | ON | No | | | | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|------|-----|--|---------|----------------|-------------|-----------|----------------------|-------------------|
| 159 | P1044 | 3031 | 18 | DEF Tank Temperature sensor Low plausibility fault | ON | No | | | | |
| 160 | P2397 | 3216 | 4 | NOx sensor signal low fault (Upstream NOx sensor) | ON | SCR induce | | | Dosing interrupt | |
| 161 | P225D | 3216 | 18 | NOx sensor 1 (Upstream) concentration Low plausibility fault | ON | SCR induce | | | Tampering | |
| 162 | U030D | 3219 | 7 | NOx sensor heating error (Upstream NOx sensor) | ON | SCR induce | | | Tampering | |
| 163 | P2203 | 3224 | 5 | NOx sensor Open circuit fault (Upstream NOx sensor) | ON | SCR induce | | | Tampering | |
| 164 | P2202 | 3224 | 6 | NOx sensor Short circuit fault (Upstream NOx sensor) | ON | SCR induce | | | Tampering | |
| 165 | P2398 | 3226 | 4 | NOx sensor signal low fault (Downstream NOx sensor) | ON | SCR induce | | | Dosing interrupt | |
| 166 | U030E | 3229 | 7 | NOx sensor heating error (Downstream NOx sensor) | ON | SCR induce | | | Tampering | |
| 167 | P2216 | 3234 | 5 | NOx sensor Open circuit fault (Downstream NOx sensor) | ON | SCR induce | | | Tampering | |
| 168 | P2215 | 3234 | 6 | NOx sensor Short circuit fault (Downstream NOx sensor) | ON | SCR induce | | | Tampering | |
| 169 | P0408 | 3236 | 16 | Maximum EGR rate governor deviation | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 170 | P049B | 3236 | 0 | EGR rate slow response positive error | ON | Level1 (Mild) | | | EGR Block (EGR only) | Active Forced |
| 171 | P1033 | 3242 | 0 | DPF(SDPF) inlet temperature High fault | ON | No | | | | Active Forced |
| 172 | P2033 | 3242 | 3 | DPF(SDPF) inlet temperature sensor High fault | ON | SCR induce | | | Tampering | Active Forced |
| 173 | P2032 | 3242 | 4 | DPF(SDPF) inlet temperature sensor Low fault | ON | SCR induce | | | Tampering | Active Forced |
| 174 | P2034 | 3242 | 11 | DPF(SDPF) inlet temperature Plausibility Fault | ON | SCR induce | | | Tampering | Active Forced |
| 175 | P2035 | 3242 | 20 | DPF(SDPF) inlet temperature Drift fault | ON | Level1 (Mild) | | | | Active Forced |
| 176 | P2455 | 3251 | 3 | DPF differential pressure sensor High fault | ON | Level1 (Mild) | | | Tampering | Active Forced |
| 177 | P2454 | 3251 | 4 | DPF differential pressure sensor Low fault | ON | Level1 (Mild) | | | Tampering | Active Forced |
| 178 | P3052 | 3251 | 13 | DPF differential pressure drift fault | ON | No | | | | Active Forced |
| 179 | P1454 | 3251 | 18 | DPF differential pressure too low fault | ON | Level1 (Mild) | | | Tampering | Active Forced |
| 180 | P244A | 3251 | 18 | DPF differential pressure too low fault | ON | Level1 (Mild) | | | Tampering | Active Forced |
| 181 | P263D | 3360 | 14 | DEF pressure line heater error (Perform afterrun) | ON | SCR induce | | | Dosing interrupt | |
| 182 | P2047 | 3361 | 3 | DEF dosing valve actuator Short circuit to battery Fault | ON | SCR induce | | | Dosing interrupt | |
| 183 | P2048 | 3361 | 4 | DEF dosing valve actuator Short circuit to ground Fault | ON | SCR induce | | | Dosing interrupt | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|------|-----|--|---------|----------------|-------------|-----------|------------------|-------------------|
| 184 | P2049 | 3361 | 5 | DEF dosing valve actuator Open Circuit Fault | ON | SCR induce | | | Tampering | |
| 185 | P202E | 3361 | 13 | DEF dosing valve actuator Over temperature Fault | ON | SCR induce | | | Dosing interrupt | |
| 186 | P2C11 | 3361 | 14 | DEF dosing valve plausibility fault | ON | SCR induce | | | Tampering | |
| 187 | P2050 | 3361 | 22 | DEF dosing valve actuator HS(High side) Short circuit to battery Fault | ON | SCR induce | | | Dosing interrupt | |
| 188 | P2051 | 3361 | 23 | DEF dosing valve actuator HS(High side) Short circuit to ground Fault | ON | SCR induce | | | Dosing interrupt | |
| 189 | P208E | 3361 | 27 | DEF Dosing valve is blocked | ON | SCR induce | | | Tampering | |
| 190 | P20B4 | 3363 | 3 | DEF Tank heating coolant valve output Short circuit to battery Fault | ON | SCR induce | | | Dosing interrupt | |
| 191 | P20B3 | 3363 | 4 | DEF Tank heating coolant valve output Short circuit to ground Fault | ON | SCR induce | | | Dosing interrupt | |
| 192 | P20B1 | 3363 | 5 | DEF Tank heating coolant valve output Open circuit Fault | ON | SCR induce | | | Tampering | |
| 193 | P30B1 | 3363 | 7 | DEF Tank heating coolant valve output Over temperature Fault | ON | SCR induce | | | Dosing interrupt | |
| 194 | P0659 | 3509 | 3 | ECU Sensor Supply (5V)1 Over voltage fault | ON | Level1 (Mild) | | | | Active Forced |
| 195 | P0658 | 3509 | 4 | ECU Sensor Supply (5V)1 Under voltage fault | ON | Level1 (Mild) | | | | Active Forced |
| 196 | P1657 | 3509 | 5 | ECU Sensor Supply (5V)1 voltage fault | ON | Level1 (Mild) | | | | Active Forced |
| 197 | P0657 | 3509 | 6 | ECU Sensor Supply (5V)1 Short circuit to ground | ON | Level1 (Mild) | | | | |
| 198 | P0641 | 3509 | 11 | ECU Sensor Supply (5V) Overvoltage monitoring error | ON | No | | | | |
| 199 | P2671 | 3510 | 3 | ECU Sensor Supply (5V)2 Over voltage fault | ON | Level1 (Mild) | | | | Active Forced |
| 200 | P2670 | 3510 | 4 | ECU Sensor Supply (5V)2 Under voltage fault | ON | Level1 (Mild) | | | | Active Forced |
| 201 | P1669 | 3510 | 5 | ECU Sensor Supply (5V)2 voltage fault | ON | Level1 (Mild) | | | | Active Forced |
| 202 | P2669 | 3510 | 6 | ECU Sensor Supply (5V)2 Short circuit to ground | ON | Level1 (Mild) | | | | |
| 203 | P0642 | 3510 | 11 | ECU Sensor Supply (5V) Undervoltage monitoring error | ON | No | | | | |
| 204 | P2686 | 3511 | 3 | ECU Sensor Supply (5V)3 Over voltage fault | ON | Level1 (Mild) | | | | Active Forced |
| 205 | P2685 | 3511 | 4 | ECU Sensor Supply (5V)3 Under voltage fault | ON | Level1 (Mild) | | | | Active Forced |
| 206 | P1684 | 3511 | 5 | ECU Sensor Supply (5V)3 voltage fault | ON | Level1 (Mild) | | | | Active Forced |
| 207 | P2684 | 3511 | 6 | ECU Sensor Supply (5V)3 Short circuit to ground | ON | Level1 (Mild) | | | | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|------|-----|---|---------|----------------|-------------|-----------|----------------|-------------------|
| 208 | P106D | 3516 | 0 | DEF Quality Too High fault | ON | SCR induce | | | DEF Quality | |
| 209 | P106C | 3516 | 1 | DEF Quality Too Low fault | ON | SCR induce | | | DEF Quality | |
| 210 | P203F | 3517 | 18 | DEF Tank level is empty | ON | SCR induce | | | DEF level | |
| 211 | U1028 | 3520 | 3 | DEF Quality Sensor Open circuit | ON | SCR induce | | | Tampering | |
| 212 | U1030 | 3520 | 4 | DEF Quality Sensor Short circuit | ON | SCR induce | | | Tampering | |
| 213 | P203A | 3532 | 3 | DEF Level Sensor Open circuit | ON | SCR induce | | | Tampering | |
| 214 | P2041 | 3532 | 4 | DEF Level Sensor Short circuit | ON | SCR induce | | | Tampering | |
| 215 | P25BC | 3695 | 3 | DPF regeneration inhibit switch Stuck (Short to Battery) fault (Hardwire) | ON | No | | | | |
| 216 | P25BB | 3696 | 3 | DPF regeneration enable switch Stuck (Short to Battery) fault (Hardwire) | ON | No | | | | |
| 217 | P25BA | 3696 | 11 | DPF regeneration inhibit & enable switch plausibility fault (Hardwire) | ON | No | | | | |
| 218 | P2611 | 3697 | 3 | DPF lamp 1 (DPF regeneration switch enable lamp) Short to Battery | ON | No | | | | |
| 219 | P260F | 3697 | 4 | DPF lamp 1 (DPF regeneration switch enable lamp) Short to Ground | ON | No | | | | |
| 220 | P260E | 3697 | 5 | DPF lamp 1 (DPF regeneration switch enable lamp) Open circuit | ON | No | | | | |
| 221 | P246B | 3715 | 14 | DPF regeneration failure (DPF regeneration is not performed well during machine operation mode) | OFF | No | | | | Active |
| 222 | P242F | 3720 | 16 | DPF Ash loading High fault (Ash cleaning is needed) | ON | No | | | | |
| 223 | P025D | 4082 | 3 | Fuel metering unit Short circuit to Battery fault | ON | Level1 (Mild) | | | | Active Forced |
| 224 | P025C | 4082 | 4 | Fuel metering unit Short circuit to Ground fault | ON | Level1 (Mild) | | | | Active Forced |
| 225 | P025A | 4082 | 5 | Fuel metering unit Open circuit fault | ON | Level1 (Mild) | | | | Active Forced |
| 226 | P025B | 4082 | 7 | Fuel metering unit Over temperature fault | ON | Level1 (Mild) | | | | Active Forced |
| 227 | P1450 | 4335 | 0 | DEF Overpressure error at METERINGCONTROL (DEF pump pressure is too high) | ON | SCR induce | | | Tampering | |
| 228 | P1451 | 4335 | 1 | DEF Underpressure error at METERINGCONTROL (DEF pump pressure is too low) | ON | SCR induce | | | Tampering | |
| 229 | P1457 | 4335 | 2 | DEF pressure build up error at PRESSUREBUILDUP (DEF pump pressure is too low) | ON | SCR induce | | | Tampering | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|------|-----|--|---------|----------------|-------------|-----------|------------------|-------------------|
| 230 | P202D | 4335 | 7 | DEF Leakage detection at METERINGCONTROL | ON | No | | | | |
| 231 | P1452 | 4335 | 12 | DEF Overpressure error regardless of the state (DEF pump pressure is too high) | ON | SCR induce | | | Tampering | |
| 232 | P1459 | 4335 | 15 | DEF Pressure reduction error at PRESSUREREDUCTION (Detected an insufficient pressure drop) | ON | SCR induce | | | Tampering | |
| 233 | P1460 | 4335 | 16 | DEF underpressure error at AFTERRUN_PRESSURECOMPENSATION | ON | No | | | | |
| 234 | P1893 | 4344 | 2 | DEF backflow Line plausibility error at DETECTIONMODE (Does not detect a pressure drop) | ON | SCR induce | | | Tampering | |
| 235 | P221D | 4354 | 5 | DEF Pressure line heater circuit Open circuit Fault | ON | No | | | | |
| 236 | P221C | 4354 | 6 | DEF Pressure line heater circuit Open circuit or Short circuit to ground Fault | ON | No | | | | |
| 237 | P221F | 4355 | 5 | DEF Backflow line heater circuit Open circuit Fault | ON | No | | | | |
| 238 | P221E | 4355 | 6 | DEF Backflow line heater circuit Open circuit or Short circuit to ground Fault | ON | No | | | | |
| 239 | P215F | 4356 | 5 | DEF Suction line heater circuit Open circuit Fault | ON | No | | | | |
| 240 | P215E | 4356 | 6 | DEF Suction line heater circuit Open circuit or Short circuit to ground Fault | ON | No | | | | |
| 241 | P20EE | 4364 | 14 | SCR Efficiency Too low fault | ON | Level1 (Mild) | | | | |
| 242 | P2043 | 4365 | 3 | DEF Temperature Sensor Open circuit | ON | SCR induce | | | Tampering | |
| 243 | P2046 | 4365 | 4 | DEF Temperature Sensor Short circuit | ON | SCR induce | | | Tampering | |
| 244 | P1227 | 4365 | 14 | DEF Tank temperature plausibility fault (Insufficient temperature increment) | ON | SCR induce | | | Tampering | |
| 245 | P208D | 4374 | 3 | DEF Supply Pump Motor Signal Short circuit to battery Fault | ON | SCR induce | | | Dosing interrupt | |
| 246 | P208C | 4374 | 4 | DEF Supply Pump Motor Signal Short circuit to ground Fault | ON | SCR induce | | | Dosing interrupt | |
| 247 | P208A | 4374 | 5 | DEF Supply Pump Motor Signal Open circuit Fault | ON | SCR induce | | | Tampering | |
| 248 | P208B | 4374 | 7 | DEF Supply Pump Motor Signal Over temperature Fault | ON | SCR induce | | | Dosing interrupt | |
| 249 | P108A | 4374 | 8 | DEF Supply Pump Motor Speed Deviation Fault | ON | SCR induce | | | Dosing interrupt | |
| 250 | P108B | 4374 | 9 | DEF Supply Pump Motor Speed Deviation Permanent Fault | ON | SCR induce | | | Dosing interrupt | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|------|-----|---|---------|-----------------|-------------|-----------|------------------|-------------------|
| 251 | P108C | 4374 | 12 | DEF Supply Pump Motor No activation Fault | ON | SCR induce | | | Dosing interrupt | |
| 252 | P24A3 | 4781 | 15 | DPF Soot mass too high status (> 120%) | Blink | Level2 (severe) | | | | Active Switch |
| 253 | P2463 | 4781 | 16 | DPF Soot mass high status (> 110%) | ON | Level1 (Mild) | | | | |
| 254 | P0593 | 5067 | 3 | PTO (Idle up) Lamp Short to Battery | ON | No | | | | |
| 255 | P0592 | 5067 | 4 | PTO (Idle up) Lamp Short to Ground | ON | No | | | | |
| 256 | P0591 | 5067 | 5 | PTO (Idle up) Lamp Open circuit | ON | No | | | | |
| 257 | P055D | 5099 | 3 | Oil Pressure Warning Lamp Short to Battery | ON | No | | | | |
| 258 | P055C | 5099 | 4 | Short circuit to ground error of oil pressure lamp | ON | No | | | | |
| 259 | P055B | 5099 | 5 | Oil Pressure Warning Lamp Open circuit | ON | No | | | | |
| 260 | P0193 | 5313 | 3 | Rail pressure sensor High fault | ON | Level1 (Mild) | | | | Active Forced |
| 261 | P0192 | 5313 | 4 | Rail pressure sensor Low fault | ON | Level1 (Mild) | | | | Active Forced |
| 262 | P02E3 | 5419 | 3 | Throttle valve H-Bridge Driver Short circuit to battery | ON | No | | | | Active Forced |
| 263 | P02E2 | 5419 | 4 | Throttle valve H-Bridge Driver Short circuit to ground | ON | No | | | | Active Forced |
| 264 | P02E0 | 5419 | 5 | Throttle valve H-Bridge Driver Open Circuit Fault | ON | No | | | | Active Forced |
| 265 | P1453 | 5435 | 10 | DEF pressure stabilization error at DETECTIONMODE (DEF pump pressure is not stable) | ON | SCR induce | | | Tampering | |
| 266 | P204A | 5435 | 12 | DEF pressure check error at DETECTIONMODE (Detected an insufficient pressure drop) | ON | SCR induce | | | Tampering | |
| 267 | P20A3 | 5436 | 3 | DEF Reverting valve output Short circuit to battery Fault | ON | SCR induce | | | Tampering | |
| 268 | P20A2 | 5436 | 4 | DEF Reverting valve output Short circuit to ground Fault | ON | SCR induce | | | Tampering | |
| 269 | P20A0 | 5436 | 5 | DEF Reverting valve output Open circuit Fault | ON | SCR induce | | | Tampering | |
| 270 | P20A1 | 5436 | 7 | DEF Reverting valve output Over temperature Fault | ON | SCR induce | | | Tampering | |
| 271 | P20A5 | 5436 | 11 | DEF Reverting valve Pressure drop plausibility fault | ON | SCR induce | | | Tampering | |
| 272 | P1461 | 5436 | 14 | DEF Reverting valve is blocked (Detected an insufficient pressure drop) | ON | SCR induce | | | Tampering | |
| 273 | P20C0 | 5491 | 3 | DEF Pressure line heater relay output Short circuit to battery Fault | ON | SCR induce | | | Dosing interrupt | |
| 274 | P20BF | 5491 | 4 | DEF Pressure line heater relay output Short circuit to ground Fault | ON | SCR induce | | | Dosing interrupt | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|------|-----|--|---------|----------------|-------------|-----------|------------------|-------------------|
| 275 | P20BD | 5491 | 5 | DEF Pressure line heater relay output Open circuit Fault | ON | SCR induce | | | Tampering | |
| 276 | P30BD | 5491 | 7 | DEF Pressure line heater relay output Over temperature Fault | ON | SCR induce | | | Dosing interrupt | |
| 277 | P20BE | 5491 | 12 | DEF Pressure line heater feedback plausibility Fault | ON | SCR induce | | | Dosing interrupt | |
| 278 | P009B | 5571 | 22 | Common rail pressure relief valve reached maximum allowed opening count | ON | No | | | | |
| 279 | P009C | 5571 | 23 | Common rail pressure relief valve Forced to open status (Pressure increase) | ON | Level1 (Mild) | Used | | | Active Forced |
| 280 | P009D | 5571 | 24 | Common rail pressure relief valve Forced to open status (Pressure shock) | ON | Level1 (Mild) | Used | | | Active Forced |
| 281 | P000F | 5571 | 25 | Common rail pressure relief valve is open | ON | Level1 (Mild) | Used | | | Active Forced |
| 282 | P009F | 5571 | 27 | Averaged rail pressure is outside the expected tolerance range | ON | No | | | | Active Forced |
| 283 | P018F | 5571 | 28 | Common rail pressure relief valve reached maximum allowed open time | ON | No | | | | Active Forced |
| 284 | P246C | 5629 | 14 | DPF differential pressure too high fault | ON | Level1 (Mild) | | | Tampering | Active Forced |
| 285 | P2465 | 5629 | 15 | DPF differential pressure high fault (Warning) | ON | No | | | | |
| 286 | P214F | 5706 | 5 | DEF Supply module heater circuit Open circuit Fault | ON | No | | | | |
| 287 | P21DD | 5706 | 6 | DEF Supply module heater circuit Open circuit or Short circuit to ground Fault | ON | No | | | | |
| 288 | P23B3 | 5706 | 12 | DEF Supply module heater temperature plausibility fault (Insufficient temperature increment) | ON | SCR induce | | | Tampering | |
| 289 | P23B4 | 5706 | 14 | DEF Supply module heater temperature plausibility fault at cold start (Insufficient temperature increment) | ON | SCR induce | | | Tampering | |
| 290 | P23B2 | 5706 | 22 | DEF Supply module heater plausibility fault (Insufficient temperature increment) | ON | SCR induce | | | Tampering | |
| 291 | P21C4 | 5746 | 3 | DEF Main heater relay output Short circuit to battery Fault | ON | SCR induce | | | Dosing interrupt | |
| 292 | P21C3 | 5746 | 4 | DEF Main heater relay output Short circuit to ground Fault | ON | SCR induce | | | Dosing interrupt | |
| 293 | P21C2 | 5746 | 5 | DEF Main heater relay output Open circuit Fault | ON | SCR induce | | | Tampering | |
| 294 | P05ED | 5746 | 6 | DEF heater line circuit Short circuit to battery Fault | ON | No | | | | |
| 295 | P31C5 | 5746 | 7 | DEF Main heater relay output Over temperature Fault | ON | SCR induce | | | Dosing interrupt | |
| 296 | P21C9 | 5965 | 3 | SCR system Main relay short circuit to battery | ON | SCR induce | | | Tampering | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|------|-----|---|---------|----------------|-------------|-----------|------------------|-------------------|
| 297 | P21C8 | 5965 | 4 | SCR system Main relay short circuit to ground | ON | SCR induce | | | Tampering | |
| 298 | P21C7 | 5965 | 5 | SCR system Main relay open circuit | ON | SCR induce | | | Tampering | |
| 299 | P2634 | 6323 | 3 | Electric fuel feed pump Output short to battery circuit fault | ON | No | | | | |
| 300 | P2633 | 6323 | 4 | Electric fuel feed pump Output short to ground circuit fault | ON | No | | | | |
| 301 | P2632 | 6323 | 5 | Electric fuel feed pump Output open circuit fault | ON | No | | | | |
| 302 | P2635 | 6323 | 13 | Electric fuel feed pump performance fault | ON | No | | | | |
| 303 | U1033 | 6385 | 19 | Timeout Error of CAN-Receive-Frame EOI (Engine Starter Motor Relay Control) | ON | No | | | | |
| 304 | P204D | 6875 | 3 | DEF Supply Pump pressure sensor High fault | ON | SCR induce | | | Dosing interrupt | |
| 305 | P204C | 6875 | 4 | DEF Supply Pump pressure sensor Low fault | ON | SCR induce | | | Dosing interrupt | |
| 306 | P304D | 6875 | 16 | DEF Supply Pump pressure sensor High plausibility fault | ON | SCR induce | | | Dosing interrupt | |
| 307 | P304C | 6875 | 18 | DEF Supply Pump pressure sensor Low plausibility fault | ON | SCR induce | | | Dosing interrupt | |
| 308 | P3611 | 6915 | 3 | DPF lamp 2 (DPF Regeneration Active Lamp) Short to Battery | ON | No | | | | |
| 309 | P360F | 6915 | 4 | DPF lamp 2 (DPF Regeneration Active Lamp) Short to Ground | ON | No | | | | |
| 310 | P360E | 6915 | 5 | DPF lamp 2 (DPF Regeneration Active Lamp) Open circuit | ON | No | | | | |
| 311 | P1908 | 6916 | 3 | DPF lamp 3 (DPF regeneration switch inhibit lamp) Short to Battery | ON | No | | | | |
| 312 | P1907 | 6916 | 4 | DPF lamp 3 (DPF regeneration switch inhibit lamp) Short to Ground | ON | No | | | | |
| 313 | P1906 | 6916 | 5 | DPF lamp 3 (DPF regeneration switch inhibit lamp) Open circuit | ON | No | | | | |
| 314 | P20C4 | 7069 | 3 | DEF Backflow line heater relay output Short circuit to battery Fault | ON | SCR induce | | | Dosing interrupt | |
| 315 | P20C3 | 7069 | 4 | DEF Backflow line heater relay output Short circuit to ground Fault | ON | SCR induce | | | Dosing interrupt | |
| 316 | P20C1 | 7069 | 5 | DEF Backflow line heater relay output Open circuit Fault | ON | SCR induce | | | Tampering | |
| 317 | P30C1 | 7069 | 7 | DEF Backflow line heater relay output Over temperature Fault | ON | SCR induce | | | Dosing interrupt | |
| 318 | P20C2 | 7069 | 12 | DEF Backflow line heater feedback plausibility Fault | ON | SCR induce | | | Dosing interrupt | |
| 319 | P23B5 | 7107 | 12 | DEF Supply module temperature plausibility fault (Insufficient temperature increment) | ON | SCR induce | | | Tampering | |
| 320 | P23B6 | 7107 | 14 | DEF Supply module temperature plausibility fault at cold start (Insufficient temperature increment) | ON | SCR induce | | | Tampering | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|-------|-----|--|---------|-----------------|-------------|-----------|------------------|-------------------|
| 321 | P20BC | 7416 | 3 | DEF Supply module heater relay output Short circuit to battery Fault | ON | SCR induce | | | Dosing interrupt | |
| 322 | P20BB | 7416 | 4 | DEF Supply module heater relay output Short circuit to ground Fault | ON | SCR induce | | | Dosing interrupt | |
| 323 | P20B9 | 7416 | 5 | DEF Supply module heater relay output Open circuit Fault | ON | SCR induce | | | Tampering | |
| 324 | P30B9 | 7416 | 7 | DEF Supply module heater relay output Over temperature Fault | ON | SCR induce | | | Dosing interrupt | |
| 325 | P20BA | 7416 | 12 | DEF Supply module heater feedback plausibility Fault | ON | SCR induce | | | Dosing interrupt | |
| 326 | P06F0 | 7538 | 12 | DEF Supply module temperature duty cycle in failure range | ON | SCR induce | | | Dosing interrupt | |
| 327 | P06F1 | 7538 | 13 | Diagnostic Fault Check for DEF supply module duty cycle in the invalid range | ON | SCR induce | | | Dosing interrupt | |
| 328 | P20AC | 7538 | 22 | DEF Supply module heater temperature duty cycle in failure range | ON | SCR induce | | | Dosing interrupt | |
| 329 | P20AD | 7538 | 23 | DEF Supply module heater temperature duty cycle in invalid range | ON | SCR induce | | | Dosing interrupt | |
| 330 | P20B0 | 7538 | 24 | DEF Supply module temperature measurement non-availability fault | ON | SCR induce | | | Dosing interrupt | |
| 331 | P20FF | 7538 | 25 | DEF Supply module time period outside specified range | ON | SCR induce | | | Dosing interrupt | |
| 332 | P056D | 7538 | 26 | DEF Supply module PWM signal fault | ON | SCR induce | | | Dosing interrupt | |
| 333 | P20C8 | 7540 | 3 | DEF Suction line heater relay output Short circuit to battery Fault | ON | SCR induce | | | Dosing interrupt | |
| 334 | P20C7 | 7540 | 4 | DEF Suction line heater relay output Short circuit to ground Fault | ON | SCR induce | | | Dosing interrupt | |
| 335 | P20C5 | 7540 | 5 | DEF Suction line heater relay output Open circuit Fault | ON | SCR induce | | | Tampering | |
| 336 | P30C5 | 7540 | 7 | DEF Suction line heater relay output Over temperature Fault | ON | SCR induce | | | Dosing interrupt | |
| 337 | P20C6 | 7540 | 12 | DEF Suction line heater feedback plausibility Fault | ON | SCR induce | | | Dosing interrupt | |
| 338 | P0617 | 7748 | 3 | Starter relay power stage output short circuit to battery | ON | No | | | | |
| 339 | P0616 | 7748 | 4 | Starter relay power stage output short circuit to ground | ON | No | | | | |
| 340 | P0615 | 7748 | 5 | Starter relay power stage output open circuit | ON | No | | | | |
| 341 | P213E | 8614 | 12 | Injection cut off demand (ICO) for shut off coordinator | Blink | Level2 (severe) | | Used | | |
| 342 | P062F | 55296 | 12 | ECU EEPROM Read Error | ON | No | | | | |
| 343 | P0630 | 55552 | 12 | ECU EEPROM Write Error | ON | No | | | | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|--------|-----|---|---------|----------------|-------------|-----------|----------------|-------------------|
| 344 | U01B7 | 57344 | 19 | Timeout Error of CAN-Receive-Frame CM1 (Status of regeneration initiate and inhibit switches) | ON | No | | | | |
| 345 | U01B9 | 61441 | 19 | Timeout Error of CAN-Receive-Frame EBC1 (Engine shut off request) | ON | No | | | | |
| 346 | U029D | 61454 | 19 | Timeout Error of CAN-Receive-Frame AT1IG1 (NOx Upstream Concentration) | ON | SCR induce | | | Tampering | |
| 347 | U029E | 61455 | 19 | Timeout Error of CAN-Receive-Frame AT1O1 (NOx Downstream Concentration) | ON | SCR induce | | | Tampering | |
| 348 | U02A2 | 64923 | 19 | Timeout Error of CAN-Receive-Frame A1DEF1 (DEF Tank) | ON | SCR induce | | | Tampering | |
| 349 | U0619 | 65110 | 19 | Timeout Error of CAN-Receive-Frame AT1T11 (DEF Level, Temperature over CAN) | ON | SCR induce | | | Tampering | |
| 350 | U1001 | 65164 | 19 | Timeout Error of CAN-Receive-Frame AAI (Hydraulic Oil Temperature) | ON | No | | | | |
| 351 | U1031 | 65241 | 19 | Timeout Error of CAN-Receive-Frame AUXIO1 (status of vehicle cut off [Safety bar]) | ON | No | | | | |
| 352 | U1032 | 65265 | 19 | Timeout Error of CAN-Receive-Frame RxCCVS (PTO / Idle up) | ON | No | | | | |
| 353 | P0218 | 65272 | 19 | Timeout Error of CAN-Receive-Frame TRF1 (Transmission oil temperature) | ON | No | | | | |
| 354 | U0632 | 65320 | 19 | Timeout Error of CAN-Receive-Frame FanCtl (FAN Control) | ON | No | | | | |
| 355 | U0608 | 65400 | 19 | Timeout Error of CAN-Receive-Frame RxSMVCU (Pedal & Engine speed demand from VCU) | ON | Level1 (Mild) | | | | |
| 356 | U013C | 65400 | 22 | Message Check Sum Error of CAN Receive Frame SMVCU (Pedal & Engine speed demand from VCU) | ON | Level1 (Mild) | | | | |
| 357 | U043D | 65400 | 23 | Message Counter Error of CAN Receive Frame SMVCU (Pedal & Engine speed demand from VCU) | ON | Level1 (Mild) | | | | |
| 358 | U010F | 65401 | 19 | Timeout Error of CAN-Receive-Frame DPM1 (Air Conditioning Switch Status / Oil life reset) | ON | No | | | | |
| 359 | U01B8 | 65402 | 19 | Timeout Error of CAN-Receive-Frame DPM9 (Multiple torque Map select switch) | ON | No | | | | |
| 360 | P2383 | 104332 | 9 | NOx sensor Mounting Error (Upstream NOx sensor) | ON | SCR induce | | | Tampering | |
| 361 | P2384 | 104385 | 9 | NOx sensor Mounting Error (Downstream NOx sensor) | ON | SCR induce | | | Tampering | |
| 362 | P160B | 520601 | 12 | CY327(Power control chipset) SPI (Serial Peripheral Interface Bus) Communication Error | ON | No | | | | |
| 363 | P060B | 520618 | 12 | ECU ADC(Analog to Digital Convertor) NTP(Null Load Test Pulse) Monitoring fault | ON | No | | | | |

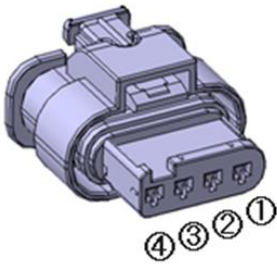
| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|--------|-----|---|---------|-----------------|-------------|-----------|----------------|-------------------|
| 364 | P160F | 520641 | 12 | ECU ROM Memory multiple error | ON | No | | | | |
| 365 | P1610 | 520642 | 12 | ECU MM(Monitoring Module) Synchronization Loss fault during Shut-off path test | ON | No | | | | |
| 366 | P101A | 520643 | 12 | MoF(Monitoring of Function) Over Run error | ON | No | | | | |
| 367 | P160C | 520696 | 12 | ECU ADC(Analog to Digital Convertor) Test error | ON | No | | | | |
| 368 | P160D | 520697 | 12 | ECU ADC(Analog to Digital Convertor) Voltage ratio error | ON | No | | | | |
| 369 | P060C | 520698 | 12 | ECU query response-communication error | Blink | Level2 (severe) | | Used | | |
| 370 | P160E | 520699 | 12 | ECU SPI (Serial Peripheral Interface Bus) communication error | ON | No | | | | |
| 371 | P1611 | 520700 | 12 | ECU Shut—off path test error | Blink | Level2 (severe) | | | | |
| 372 | P1612 | 520701 | 12 | ECU Wrong set response time error during shut off path test | ON | No | | | | |
| 373 | P1613 | 520702 | 12 | ECU Too many SPI (Serial Peripheral Interface Bus) errors during shut off path test | ON | No | | | | |
| 374 | P1615 | 520703 | 12 | ECU WDA working error during Shut-off path test | ON | No | | | | |
| 375 | P1616 | 520704 | 12 | ECU OS Timeout error during Shut-off path test | ON | No | | | | |
| 376 | P1617 | 520705 | 12 | ECU Positive test failure error during Shut-off path test | ON | No | | | | |
| 377 | P1618 | 520706 | 12 | ECU Shut-off path test timeout fault | ON | No | | | | |
| 378 | P1619 | 520707 | 3 | ECU Overvoltage error during Shut-off path test | ON | No | | | | |
| 379 | P1614 | 520707 | 4 | ECU Undervoltage error during Shut-off path test | ON | No | | | | |
| 380 | P12E5 | 520723 | 12 | NCD inducement Fault Level1 (Group1 - EGR Block) | OFF | No | | | | |
| 381 | P12E6 | 520724 | 12 | NCD inducement Fault Level2 (Group1 - EGR Block) | OFF | No | | | | |
| 382 | P12E7 | 520725 | 12 | NCD inducement Fault Level3 Final inducement (Group1 - EGR Block) | OFF | No | | | | |
| 383 | P12E8 | 520726 | 12 | NCD inducement Fault Warning (Group1 - EGR Block) | OFF | No | | | | |
| 384 | P12E9 | 520727 | 12 | NCD inducement Fault Level1 (Group2 – Dosing Interrupt) | OFF | No | | | | |
| 385 | P12EA | 520728 | 12 | NCD inducement Fault Level2 (Group2 – Dosing Interrupt) | OFF | No | | | | |
| 386 | P12EB | 520729 | 12 | NCD inducement Fault Level3 Final inducement (Group2 – Dosing Interrupt) | OFF | No | | | | |
| 387 | P12EC | 520730 | 12 | NCD inducement Fault Warning (Group2 – Dosing Interrupt) | OFF | No | | | | |

| No. | Code | SPN | FMI | Description | CE lamp | Torque de-rate | Speed limit | Eng. stop | NCD/PCD induce | DPF regen inhibit |
|-----|-----------------------|--------|-----|---|---------|----------------|-------------|-----------|----------------|-------------------|
| 388 | P12F2 | 520736 | 12 | NCD inducement Fault Level1 (Group4 – DEF Quality) | OFF | No | | | | |
| 389 | P12F3 | 520737 | 12 | NCD inducement Fault Level2 (Group4 – DEF Quality) | OFF | No | | | | |
| 390 | P12F4 | 520738 | 12 | NCD inducement Fault Level3 Final inducement (Group4 – DEF Quality) | OFF | No | | | | |
| 391 | P12F5 | 520739 | 12 | NCD inducement Fault Warning (Group4 – DEF Quality) | OFF | No | | | | |
| 392 | P12F6 | 520740 | 12 | NCD inducement Fault Level1 (Group5 – Tampering) | OFF | No | | | | |
| 393 | P12F7 | 520741 | 12 | NCD inducement Fault Level2 (Group5 – Tampering) | OFF | No | | | | |
| 394 | P12F8 | 520742 | 12 | NCD inducement Fault Level3 Final inducement (Group5 – Tampering) | OFF | No | | | | |
| 395 | P12F9 | 520743 | 12 | NCD inducement Fault Warning (Group5 – Tampering) | OFF | No | | | | |
| 396 | P1303 | 520790 | 12 | NCD inducement Repeat offense Level1 | OFF | No | | | | |
| 397 | P1304 | 520791 | 12 | NCD inducement Repeat offense Level2 | OFF | No | | | | |
| 398 | P1305 | 520792 | 12 | NCD inducement Repeat offense Level3 Final inducement | OFF | No | | | | |
| 399 | P1013 | 520797 | 12 | MoF(Monitoring of Function) Engine speed error | ON | No | | | | |

| Fault Code | Fault Name |
|-----------------------|---|
| P0101 | Battery voltage error of Air mass flow sensor |

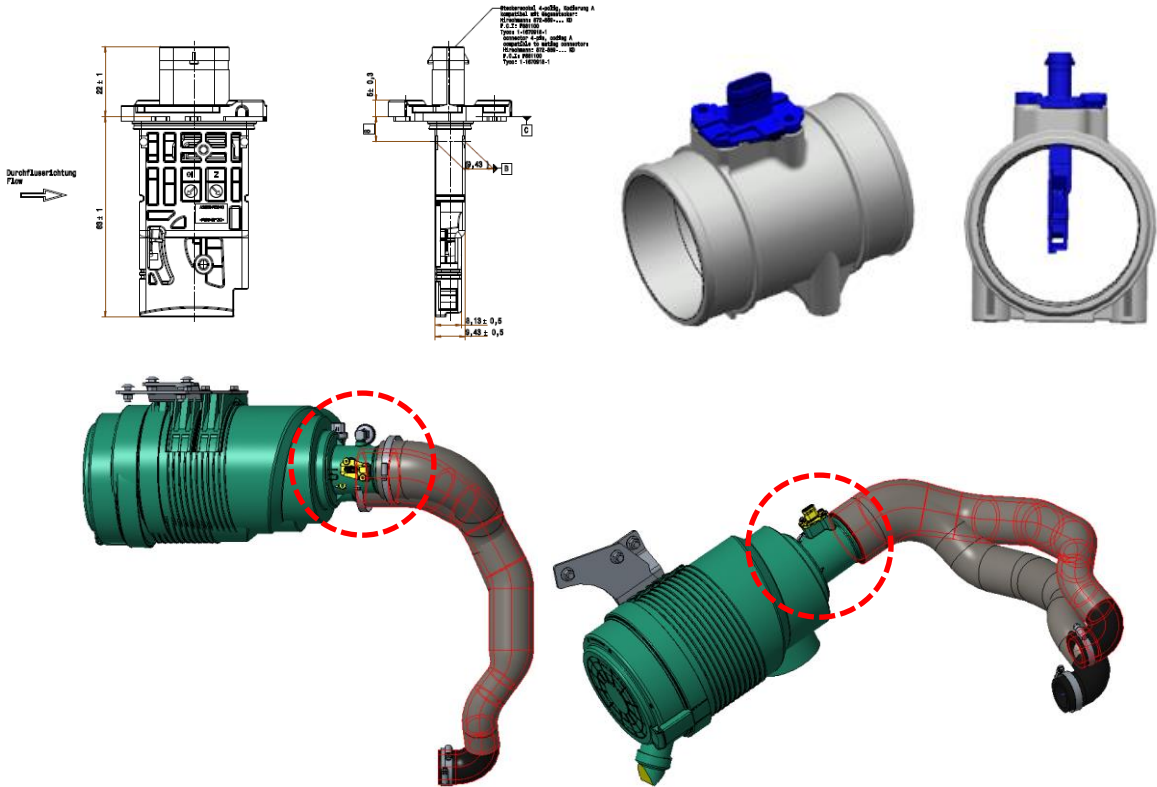
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000132-05 | 1. Electrical problem (Battery voltage too high / low) 2. Electrical problem (Faulty Alternator, Alternator wiring harness) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|----|---------|---|
|  | No | ECU Pin | Description |
| | 1 | K86 | Air Mass Flow Sensor, frequency signal |
| | 2 | K79 | Air Mass Flow Sensor Supply (5V) |
| | 3 | K87 | Air mass flow & temperature Sensor Ground |
| | 4 | K76 | Inlet air temperature sensor signal |

2) Component Location

Air mass flow sensor location is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The supply voltage exceeds the thresholds. (17V)

5) Condition for Clearing the Fault Code

The supply voltage is within operation range (6~17V)

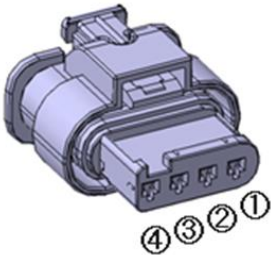
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|---------------------|------------------|
| 1 | P0101 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | Do necessary repair | Step 4 |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check battery charge circuit Charge circuit problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P00BE | Sensitivity drift error low for Air mass flow sensor |

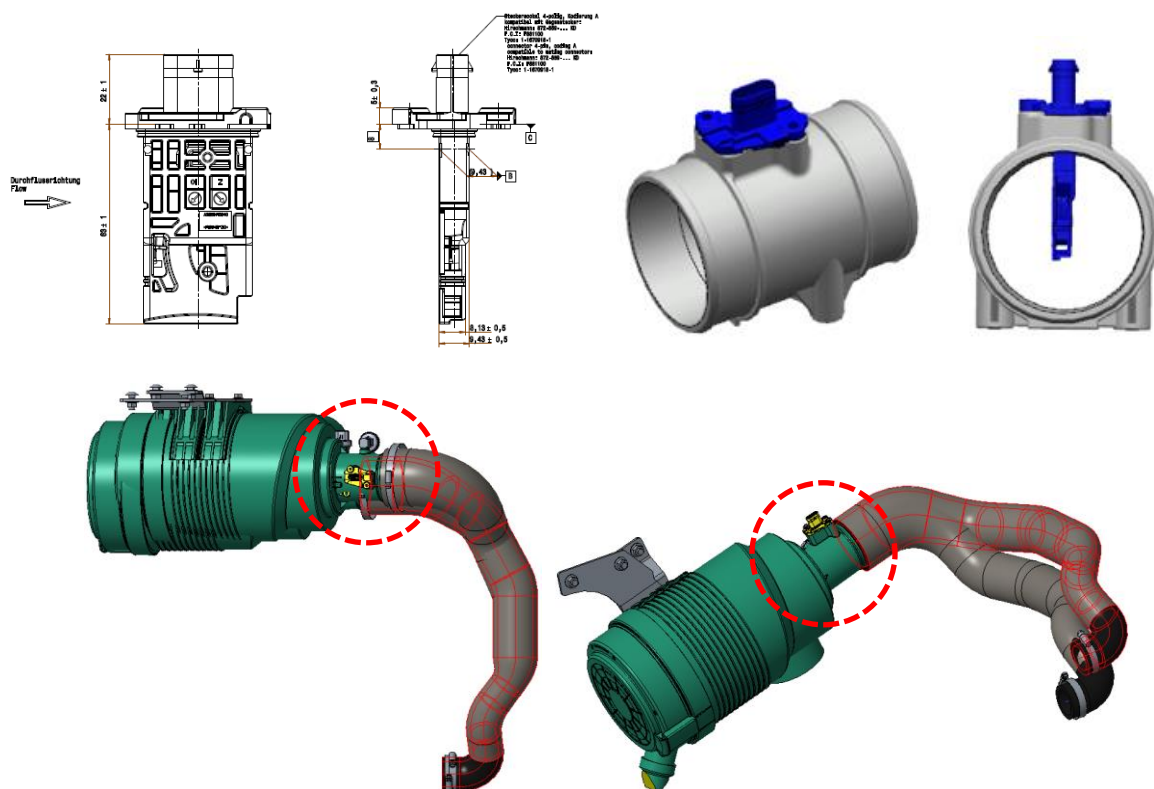
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000132-21 | 1. Air Path problem (Leakage of air cleaner to compressor inlet) 2. Installation problem (reverse installation of the Air mass flow sensor) 3. Electrical problem (Faulty Intake manifold pressure sensor, Faulty Intake manifold temperature sensor, Faulty Air mass flow sensor) | CE lamp Blink or ON Torque Reduction 2(Severe) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

| | | | |
|--|----|---------|---|
|  | No | ECU Pin | Description |
| | 1 | K86 | Air Mass Flow Sensor, frequency signal |
| | 2 | K79 | Air Mass Flow Sensor Supply (5V) |
| | 3 | K87 | Air mass flow & temperature Sensor Ground |
| | 4 | K76 | Inlet air temperature sensor signal |

2) Component Location

Air mass flow sensor location is dependent on machine application.



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The difference between measured value by air mass flow sensor and calculated air mass flow into the cylinder becomes out of the threshold, the fault code is raised.

5) Condition for Clearing the Fault Code

The difference between measured value by air mass flow sensor and calculated air mass flow into the cylinder is within the threshold, the fault code is cleared.

6) Check List

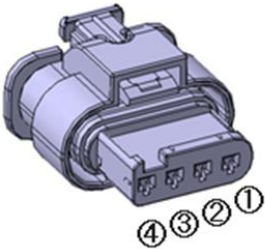
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P00BE is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch | | Step3 | |
| 3 | Check the intake hose between air filter and turbocharger compressor? Is there any leakage? If no leakage is found visually, Check leakage during engine running in machine stationary condition. | | Step7 | Step4 |
| 4 | Check the intake hose between turbocharger compressor outlet and intercooler. Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Step7 | Step5 |
| 5 | Check the intake hose between intercooler and intake manifold. Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Step7 | Step6 |
| 6 | Is there abnormal value of intake manifold pressure sensor or air mass flow sensor? (ex. Value is not increase even engine speed increase) *Variables 1) Engine speed(Epm_nEng) 2) Intake manifold pressure (Air_plntkVUs) 3) Air mass flow (AFS_dmSens) 4) Model air mass flow (AirMod_mfGasIntkVlv_f) | | Step 8 | Contact Helpdesk |
| 7 | Fix the leakage or change the hose. After fix the leakage, start the engine and change the RPM from low idle to high idle. | | Problem solved | Step7 |

| | | | | |
|---|---|--|-----------------------|-------------------------|
| | Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | | |
| 8 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------------|
| P0100 | Signal error of Air mass flow sensor |

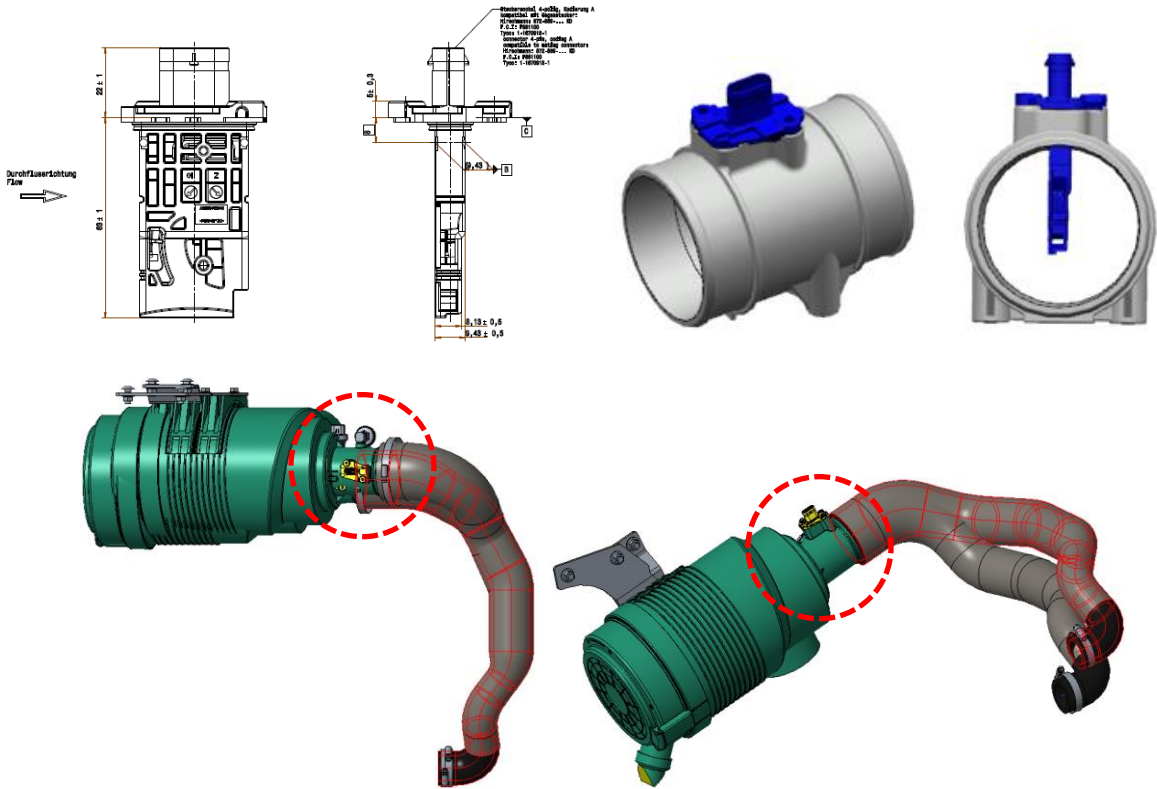
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000132-19 | 1. Electrical problem (Air mass flow sensor connector) 2. Electrical problem (Wiring harness Air mass flow sensor to ECU, Faulty Air mass flow sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

| | | | |
|--|----|---------|---|
|  | No | ECU Pin | Description |
| | 1 | K86 | Air Mass Flow Sensor, frequency signal |
| | 2 | K79 | Air Mass Flow Sensor Supply (5V) |
| | 3 | K87 | Air mass flow & temperature Sensor Ground |
| | 4 | K76 | Inlet air temperature sensor signal |

2) Component Location

Air mass flow sensor location is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If there is short circuit to battery OR open load on the Air mass flow signal line.

5) Condition for Clearing the Fault Code

Air mass flow signal value is in operation range

6) Check List

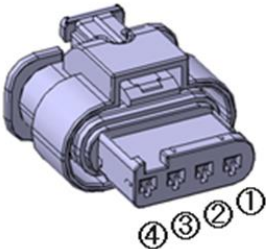
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0100 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal sensor Sensor problem? | | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P0103 | Signal range check high error for Air mass flow sensor |

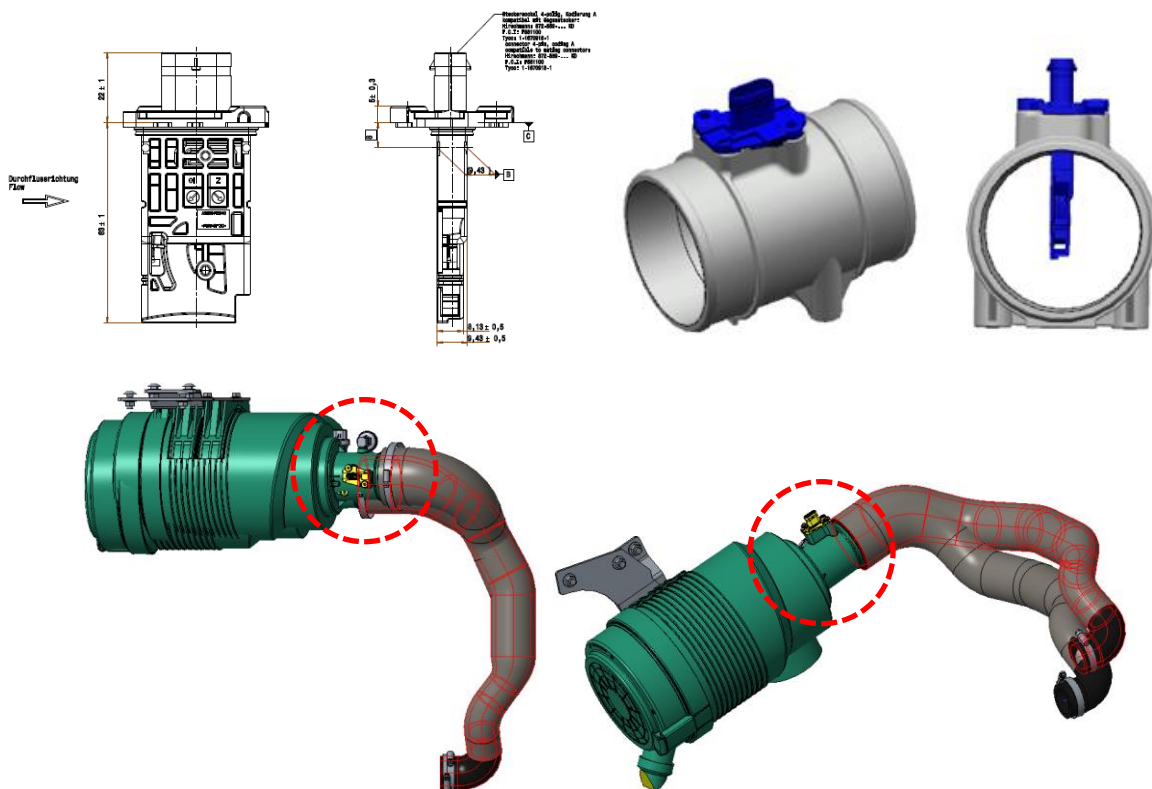
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000132-03 | <ol style="list-style-type: none"> 1. Electrical problem (Air mass flow sensor connector) 2. Electrical problem (Wiring harness Air mass flow sensor to ECU, Faulty Air mass flow sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

| | | | |
|--|----|---------|---|
|  | No | ECU Pin | Description |
| | 1 | K86 | Air Mass Flow Sensor, frequency signal |
| | 2 | K79 | Air Mass Flow Sensor Supply (5V) |
| | 3 | K87 | Air mass flow & temperature Sensor Ground |
| | 4 | K76 | Inlet air temperature sensor signal |

2) Component Location

Air mass flow sensor location is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Air mass flow signal is higher than maximum operation frequency (1000us)

5) Condition for Clearing the Fault Code

Air mass flow signal value is in operation range

6) Check List

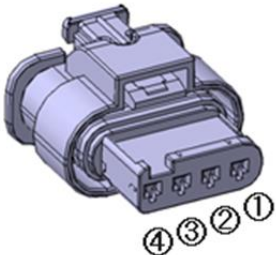
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0103 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal sensor Sensor problem? | | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P0102 | Signal range check low error for Air mass flow sensor |

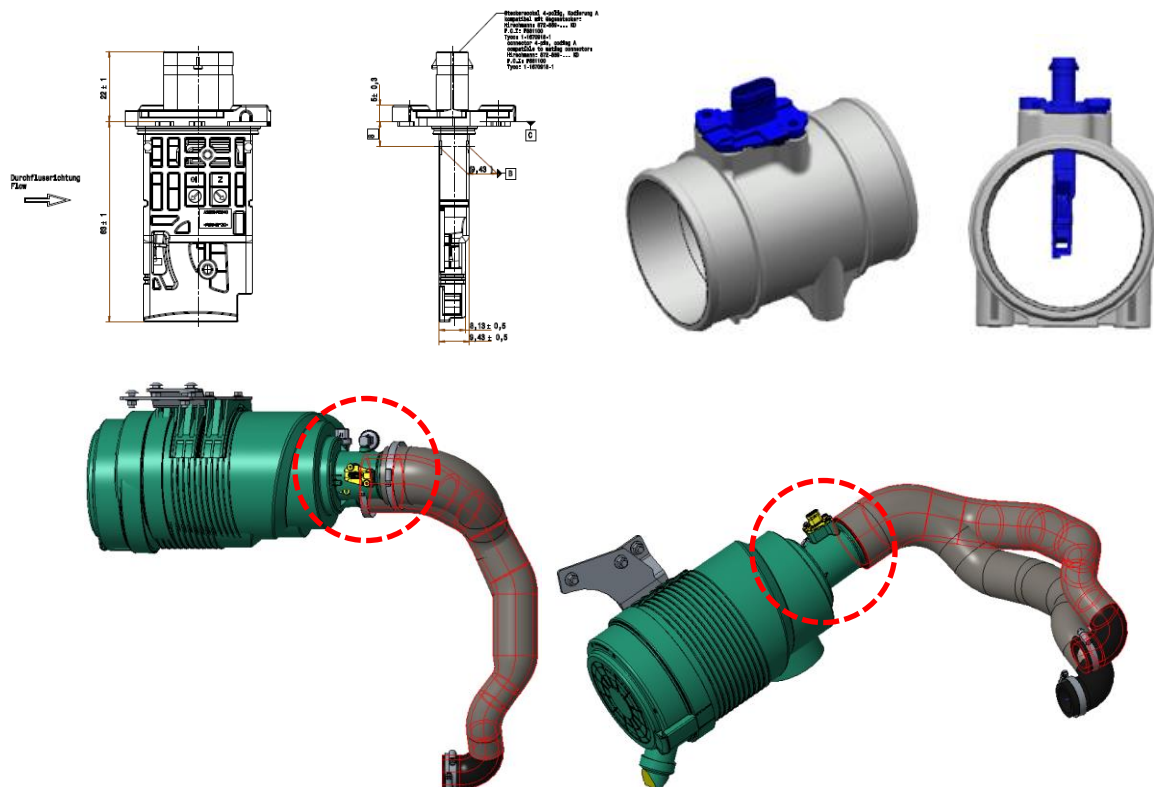
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000132-04 | <ol style="list-style-type: none"> 1. Electrical problem (Air mass flow sensor connector) 2. Electrical problem (Wiring harness Air mass flow sensor to ECU, Faulty Air mass flow sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

| | | | |
|--|----|---------|---|
|  | No | ECU Pin | Description |
| | 1 | K86 | Air Mass Flow Sensor, frequency signal |
| | 2 | K79 | Air Mass Flow Sensor Supply (5V) |
| | 3 | K87 | Air mass flow & temperature Sensor Ground |
| | 4 | K76 | Inlet air temperature sensor signal |

2) Component Location

Air mass flow sensor location is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Air mass flow signal is less than minimum operation frequency (70us)

5) Condition for Clearing the Fault Code

Air mass flow signal value is in operation range

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0102 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal sensor Sensor problem? | | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

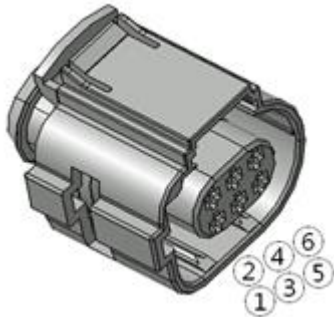
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|-------------------------------------|
| P0408 | Maximum EGR rate governor deviation |

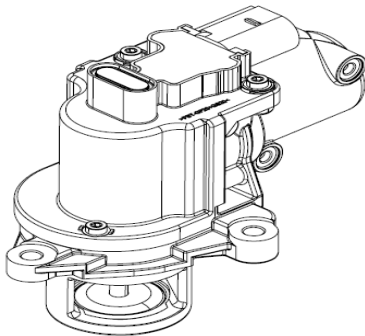
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003236-16 | 1. Air path problem (EGR cooler plugged, Tampering by user) 2. Air path problem (EGR path leakage, Intake air path leakage) 3. Electrical problem (Faulty Air mass flow sensor, Faulty Intake manifold pressure sensor) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

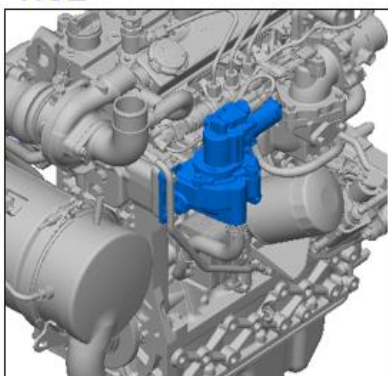
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



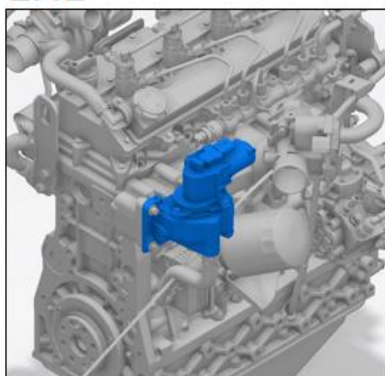
2) Component Location



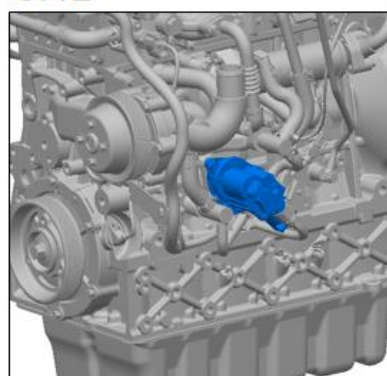
1.8L



2.4L



3.4L



3) Condition for Running Diagnostic

During engine running, Coolant temperature > 60 degC

4) Condition for Setting the Fault Code

The limit for the maximum permissible positive closed-loop EGR rate control deviation of the exhaust gas recirculation control has been exceeded. over than 60sec.

5) Condition for Clearing the Fault Code

The limit for the maximum permissible positive closed-loop EGR rate control deviation of the exhaust gas recirculation control has been within operation range.

The fault is healed only after key off & on condition.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|-------|-------|
| 1 | P0408 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF. | | Step3 | |
| 3 | Check the EGR pipe between exhaust manifold and EGR valve? Is there any leakage? Or blocked line ? If no leakage is found visually, Start up the engine and check the leakage/blocked again in machine stationary condition. | | Step7 | Step4 |
| 4 | Check EGR pipe between EGR cooler and intake manifold. Is there any leakage? Or Blocked line ? If no leakage is found visually, Start up the engine and check the leakage/blocked again in machine stationary condition. | | Step7 | Step5 |
| 5 | Check intake air path between Air filter and intake manifold. Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Step7 | Step6 |

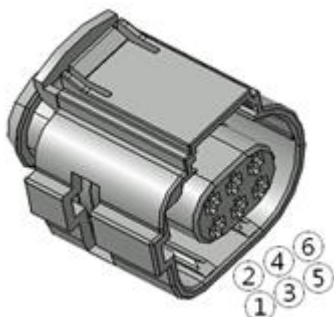
| | | | | |
|---|---|--|---|-------------------------|
| 6 | Is there any fault code related intake manifold pressure sensor, intake manifold temperature sensor? If yes, fix the fault based on its troubleshooting guide. | | Fix the fault based on its troubleshooting guide | Step8 |
| 7 | Fix the leakage/blocked line or change the pipe. After fix, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 60 seconds. Fault code is cleared? | | Problem solved | Step8 |
| 8 | Is there abnormal value of intake manifold pressure sensor or air mass flow sensor? (ex. Service tool value is not increase even engine speed increase) *Variables 1) Engine speed(Epm_nEng) 2) Intake manifold pressure (Air_pIntkVUs) 3) Air mass flow (AFS_dmSens) 4) Model air mass flow (AirMod_mfGasIntkVlv_f) | | Step 9 | Contact Helpdesk |
| 9 | Change the suspected parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P049B | EGR rate slow response positive error |

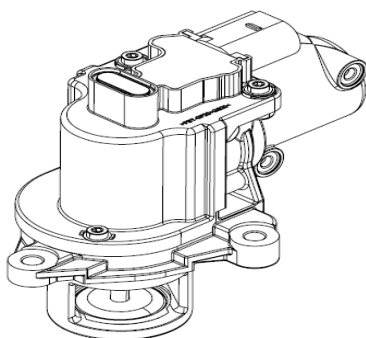
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003236-00 | 1. Air path problem (EGR cooler plugged, Tampering by user) 2. Air path problem (EGR path leakage, Intake air path leakage) 3. Electrical problem (Faulty Air mass flow sensor, Faulty Intake manifold pressure sensor) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

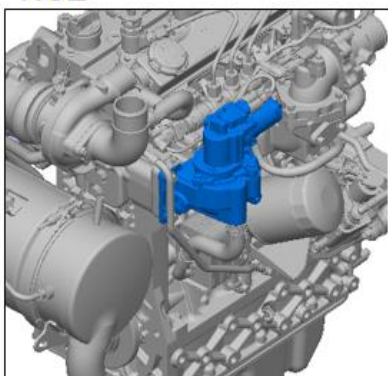
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



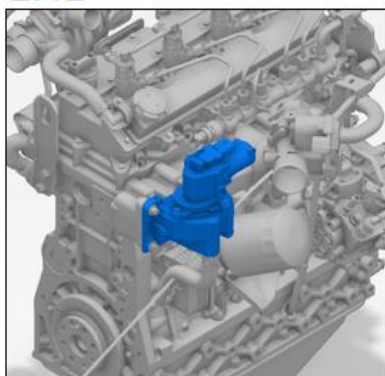
2) Component Location



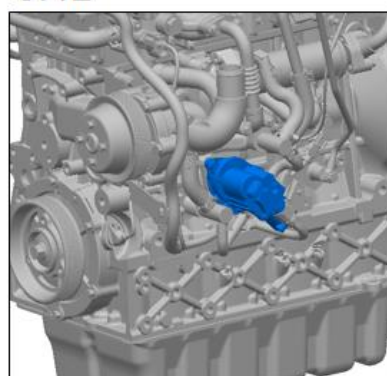
1.8L



2.4L



3.4L



3) Condition for Running Diagnostic

During engine running, Coolant temperature > 60 degC

4) Condition for Setting the Fault Code

The EGR rate positive response is too slow than threshold time.

5) Condition for Clearing the Fault Code

The EGR rate response is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|-------|
| 1 | P049B is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF. | | Step3 | |
| 3 | Check the EGR pipe between exhaust manifold and EGR valve? Is there any leakage? Or blocked line ? If no leakage is found visually, Start up the engine and check the leakage/blocked again in machine stationary condition. | | Step7 | Step4 |
| 4 | Check EGR pipe between EGR cooler and intake manifold. Is there any leakage? Or Blocked line ? If no leakage is found visually, Start up the engine and check the leakage/blocked again in machine stationary condition. | | Step7 | Step5 |
| 5 | Check intake air path between Air filter and intake manifold. Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Step7 | Step6 |
| 6 | Is there any fault code related intake manifold pressure sensor, intake manifold temperature sensor? If yes, fix the fault based on its troubleshooting guide. | | Fix the fault based on its troubleshooting guide | Step8 |

| | | | | |
|----------|---|--|-----------------------|-------------------------|
| 7 | Fix the leakage/blocked line or change the pipe. After fix, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 60 seconds. Fault code is cleared? | | Problem solved | Step8 |
| 8 | Is there abnormal value of intake manifold pressure sensor or air mass flow sensor? (ex. Service tool value is not increase even engine speed increase) *Variables 1) Engine speed(Epm_nEng) 2) Intake manifold pressure (Air_pIntkVUs) 3) Air mass flow (AFS_dmSens) 4) Model air mass flow (AirMod_mfGasIntkVlv_f) | | Step 9 | Contact Helpdesk |
| 9 | Change the suspected parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------------|
| P1563 | Battery Voltage High fault (Warning) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000444-00 | 1. Electrical problem (Alternator, Alternator wiring harness) 2. Electrical problem (Battery, Wiring harness, Battery terminal, Connector) 3. Electrical problem (External battery charger) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|----------------------|
| 1 | K01 | Battery supply (12V) |
| 2 | K03 | Battery supply (12V) |
| 3 | K05 | Battery supply (12V) |
| 4 | K02 | Power Ground |
| 5 | K04 | Power Ground |
| 6 | K06 | Power Ground |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

Battery voltage is more than maximum warning operation voltage (15V)

4) Condition for Clearing the Fault Code

Battery voltage is in warning operation range (10V~15V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|---------------------|
| 1 | P1563 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | Do necessary repair | Step 4 |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check battery charge circuit Charge circuit problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-------------------------------------|
| P1562 | Battery Voltage Low fault (Warning) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000444-01 | 1. Electrical problem (Alternator, Alternator wiring harness) 2. Electrical problem (Battery, Wiring harness, Battery terminal, Connector) 3. Electrical problem (External battery charger) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|----------------------|
| 1 | K01 | Battery supply (12V) |
| 2 | K03 | Battery supply (12V) |
| 3 | K05 | Battery supply (12V) |
| 4 | K02 | Power Ground |
| 5 | K04 | Power Ground |
| 6 | K06 | Power Ground |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

Battery voltage is less than minimum warning operation voltage (10V)

4) Condition for Clearing the Fault Code

Battery voltage is in warning operation range (10V~15V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|---------------------|
| 1 | P1562 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | Do necessary repair | Step 4 |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check battery charge circuit Charge circuit problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0563 | Battery Voltage Signal Range Max fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000444-03 | 1. Electrical problem (Alternator, Alternator wiring harness) 2. Electrical problem (Battery, Wiring harness, Battery terminal, Connector) 3. Electrical problem (External battery charger) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| No | ECU Pin | Description |
|----|---------|----------------------|
| 1 | K01 | Battery supply (12V) |
| 2 | K03 | Battery supply (12V) |
| 3 | K05 | Battery supply (12V) |
| 4 | K02 | Power Ground |
| 5 | K04 | Power Ground |
| 6 | K06 | Power Ground |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

Battery voltage is more than maximum operation voltage (16V)

4) Condition for Clearing the Fault Code

Battery voltage is in operation range (6V~16V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|---------------------|
| 1 | P0563 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | Do necessary repair | Step 4 |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check battery charge circuit Charge circuit problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0562 | Battery Voltage Signal Range Min fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000444-04 | 1. Electrical problem (Alternator, Alternator wiring harness) 2. Electrical problem (Battery, Wiring harness, Battery terminal, Connector) 3. Electrical problem (External battery charger) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| No | ECU Pin | Description |
|----|---------|----------------------|
| 1 | K01 | Battery supply (12V) |
| 2 | K03 | Battery supply (12V) |
| 3 | K05 | Battery supply (12V) |
| 4 | K02 | Power Ground |
| 5 | K04 | Power Ground |
| 6 | K06 | Power Ground |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

Battery voltage is less than minimum operation voltage (6V)

4) Condition for Clearing the Fault Code

Battery voltage is in operation range (6V~16V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|---------------------|
| 1 | P1562 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | Do necessary repair | Step 4 |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check battery charge circuit Charge circuit problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-------------------------|
| U0029 | CAN communication error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000639-02 | 1. Abnormal engine shut down (The battery is removed at engine running or key on condition, Battery out (<6V)) 2. After ECU reflash 3. Electrical problem (CAN wiring harness-insulation, resistance) 4. Electrical problem (ECU connector, Faulty VCU, Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

| No | ECU Pin | Description |
|----|---------|-------------|
| 1 | K30 | CAN Hi |
| 2 | K31 | CAN Lo |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

CAN communication error

Normally, it is diagnosed when the communication problem is occurred with the vehicle control unit (VCU).

The root cause could be when the VCU itself is powered off or the CAN line is disconnected.

4) Condition for Clearing the Fault Code

CAN Bus Repair

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | U0029 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check Network Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-------------------|
| U0028 | CAN bus off error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000639-19 | 1. Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out (<6V)) 2. After ECU reflash 3. Electrical problem (CAN wiring harness-insulation, resistance) 2. Electrical problem (ECU connector, Faulty VCU, Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

| No | ECU Pin | Description |
|----|---------|-------------|
| 1 | K30 | CAN Hi |
| 2 | K31 | CAN Lo |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

CAN Bus OFF

This fault usually occurs when the CAN line is shorted.

For example,

- 1) CAN Hi and CAN Low are shorted.
- 2) CAN Low is shorted to battery.
- 3) CAN Hi is shorted to ground.

4) Condition for Clearing the Fault Code

CAN Bus Repair

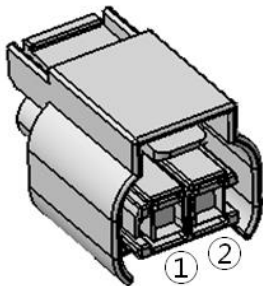
5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | U0028 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check Network Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P011E | Coolant Temperature Plausibility Fault |

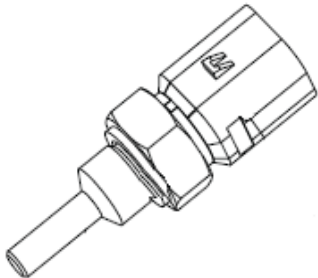
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000110-10 | 1. Thermostat problem (broken or normally open) 2. Electrical problem (Coolant temperature sensor connector, Wiring harness coolant temperature sensor to ECU, Faulty Coolant temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) |



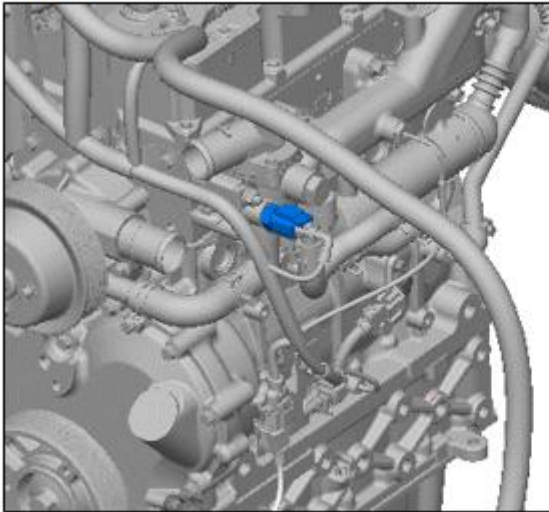
| No | ECU Pin | Description |
|----|---------|----------------------------|
| 1 | A99 | Coolant Temperature Ground |
| 2 | A100 | Coolant Temperature Signal |

2) Component Location

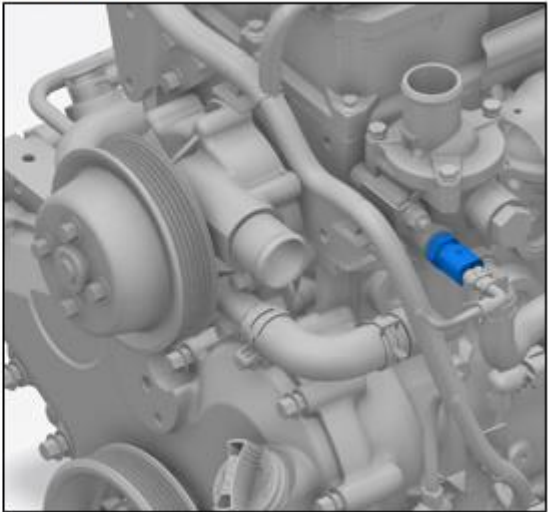


| Coolant Temperature sensor | | | |
|----------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -35 | -31 | 36010 | 4819 |
| 0 | 32 | 6050 | 4112 |
| 10 | 50 | 3891 | 3744 |
| 20 | 68 | 2569 | 3315 |
| 30 | 86 | 1737 | 2855 |
| 80 | 176 | 331 | 1011 |
| 125 | 257 | 103 | 369 |

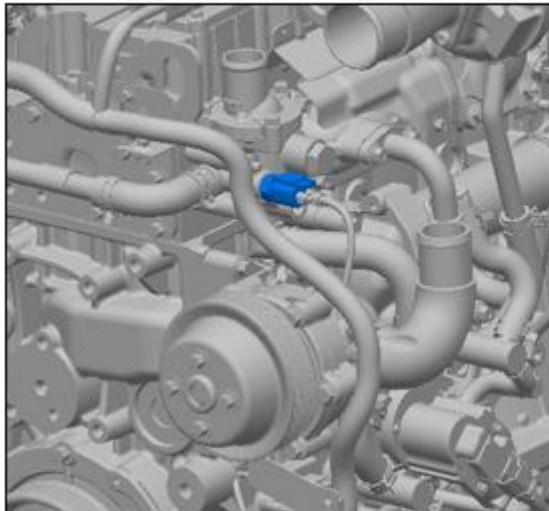
1.8L



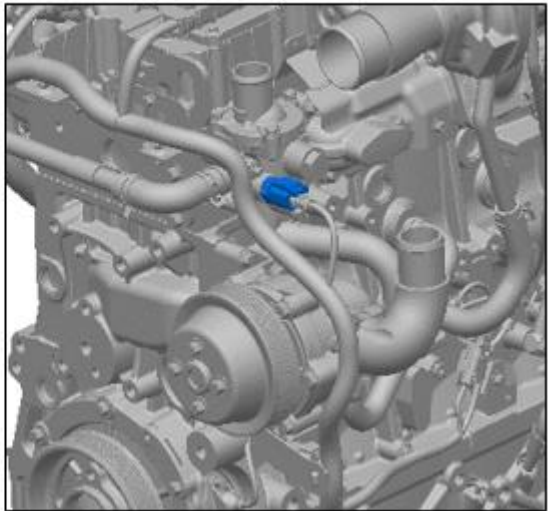
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

- 1) Engine running (The diagnostic is started after engine running 120sec.)
- 2) Coolant temperature < 30degC at starting
- 3) Engine speed > 1300rpm

4) Condition for Setting the Fault Code

If the coolant temperature is not higher than the threshold during restricted condition, fault code is raised. (Example : Coolant is not increased 5degC at soaking temperature 0degC during 1000sec)

5) Condition for Clearing the Fault Code

If the coolant temperature is higher than the threshold during restricted condition, fault code is cleared.

6) Check List

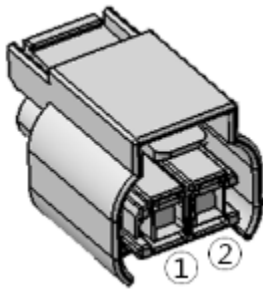
| Step | Inspection | Standard Value | YES | NO |
|------|------------|----------------|-----|----|
|------|------------|----------------|-----|----|

| | | | | |
|----------|---|--|-----------------------|-------------------------|
| 1 | P011E is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch | | Step3 | |
| 3 | Check service tool value of coolant temperature with engine running. Coolant temperature is not increased even engine running? *Variables 1) Engine speed(Epm_nEng) 2) Coolant temperature(CEngDsT_t) | | Step 4 | Problem solved |
| 4 | Check the thermostat. Is the thermostat broken? For example thermostat is always wide open. | | Step 6 | Step 5 |
| 5 | Change the coolant temperature sensor. Start the engine and set the RPM in high idle, 10 minutes. After that set the RPM in low idle, fault code is cleared and torque limit is deactivated? | | Problem solved | Contact Helpdesk |
| 6 | Change the thermostat as a normal one. Start the engine and set the RPM in high idle, 10 minutes. After that set the RPM in low idle, fault code is cleared and torque limit is deactivated? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------|
| P1118 | Coolant high temperature Fault |

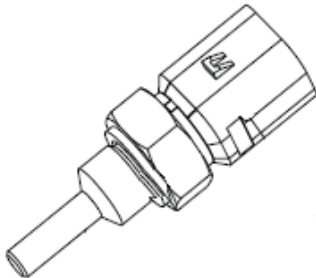
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000110-00 | 1. Cooling problem (Low coolant, Thermostat broken - fully closed) 2. Electrical problem (Faulty Coolant temperature sensor) 3. Cooling problem (Faulty of water pump) | CE lamp ON Torque reduction (Dependent on temp.) DPF regeneration inhibit by Active and Forced |



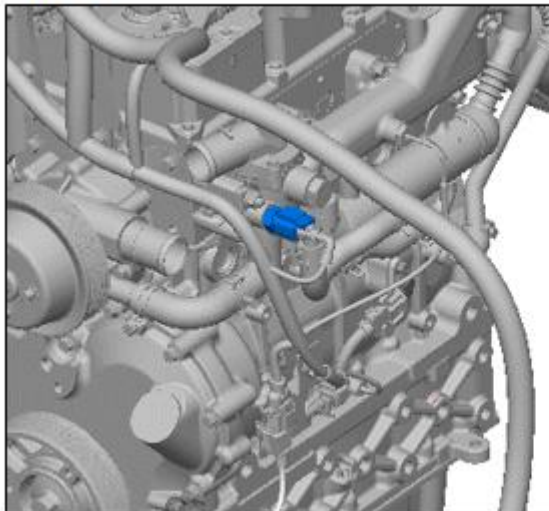
| No | ECU Pin | Description |
|----|---------|----------------------------|
| 1 | A99 | Coolant Temperature Ground |
| 2 | A100 | Coolant Temperature Signal |

2) Component Location

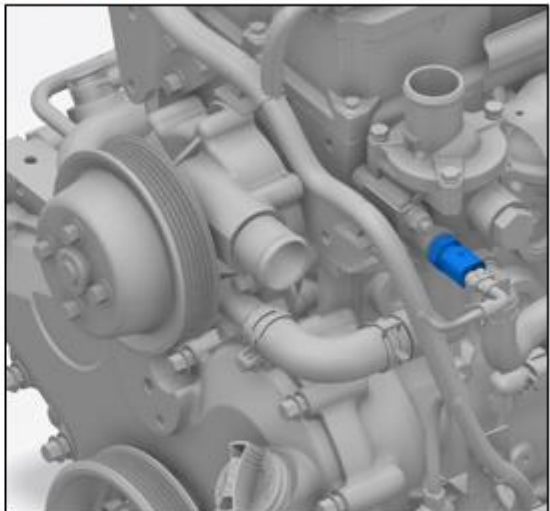


| Coolant Temperature sensor | | | |
|----------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -35 | -31 | 36010 | 4819 |
| 0 | 32 | 6050 | 4112 |
| 10 | 50 | 3891 | 3744 |
| 20 | 68 | 2569 | 3315 |
| 30 | 86 | 1737 | 2855 |
| 80 | 176 | 331 | 1011 |
| 125 | 257 | 103 | 369 |

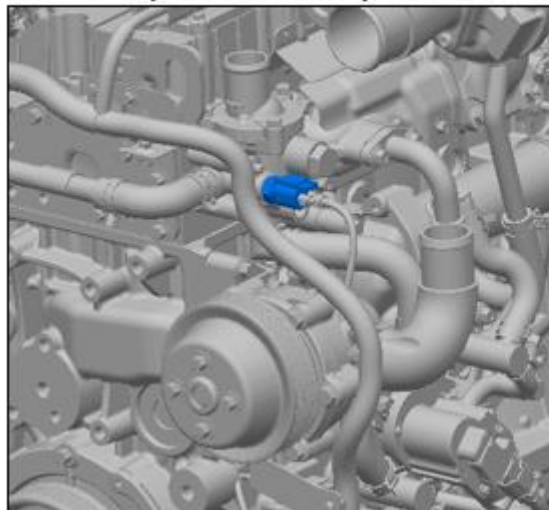
1.8L



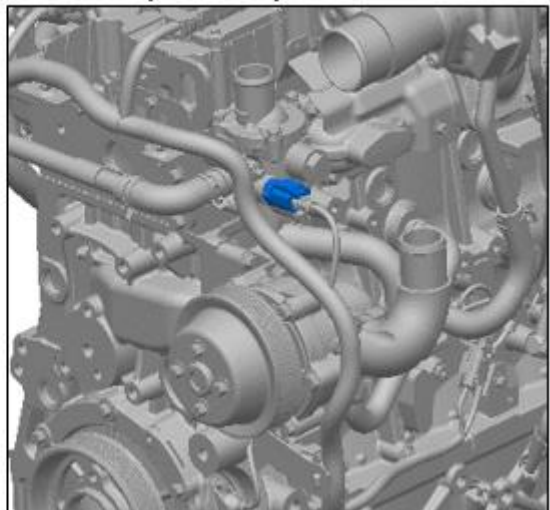
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

During engine running

4) Condition for Setting the Fault Code

If the coolant temperature is higher than the threshold, fault code is raised. (110degC)

5) Condition for Clearing the Fault Code

If the coolant temperature is below the threshold, fault code is cleared.

6) Check List

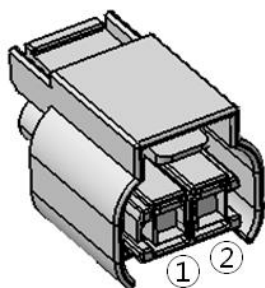
| Step | Inspection | Standard Value | YES | NO |
|------|------------------------------------|----------------|-------|----|
| 1 | P1118 is detected on service tool? | | Step2 | |

| | | | | |
|----------|---|--|-----------------------|-------------------------|
| 2 | After let the machine be in safety area and turn-off the key switch | | Step3 | |
| 3 | Check coolant system. - The level of coolant in the reservoir tank. If the level is too low, refill the coolant. If you open the radiator cap, make sure that the engine and radiator are cooled. - State of connection between cooler and coolant hose, cooling fan belt. (Information : With very hot condition, this fault can be occurred without any engine trouble.) | | Problem solved | Step4 |
| 4 | Check the thermostat and water pump. Is broken? For example thermostat is always closed. | | Step6 | Step5 |
| 5 | Change the coolant temperature sensor. Start the engine and set the RPM in high idle, 10 minutes. After that set the RPM in low idle, fault code is cleared and torque limit is deactivated? | | Problem solved | Contact Helpdesk |
| 6 | Change the thermostat or water pump as a normal one. Start the engine and set the RPM in high idle, 10 minutes. After that set the RPM in low idle, fault code is cleared and torque limit is deactivated? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P0118 | Coolant Temperature Sensor High Fault |

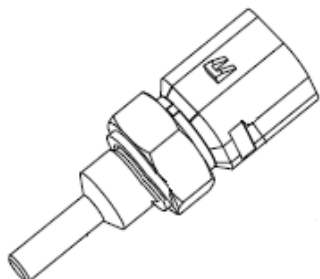
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000110-03 | 1. Electrical problem (Coolant temperature sensor connector) 2. Electrical problem (Wiring harness coolant temperature sensor to ECU, Faulty Coolant temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |



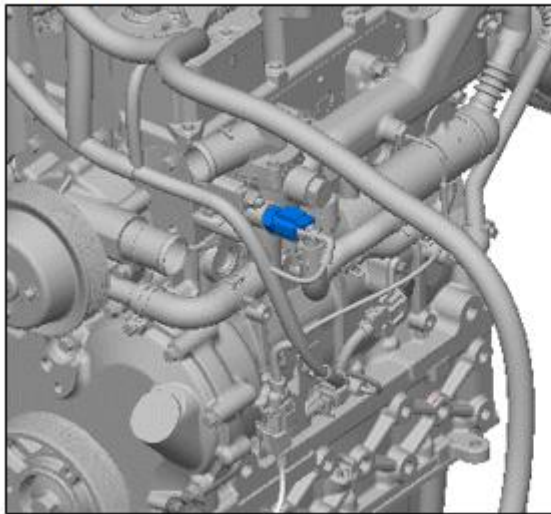
| No | ECU Pin | Description |
|----|---------|----------------------------|
| 1 | A99 | Coolant Temperature Ground |
| 2 | A100 | Coolant Temperature Signal |

2) Component Location

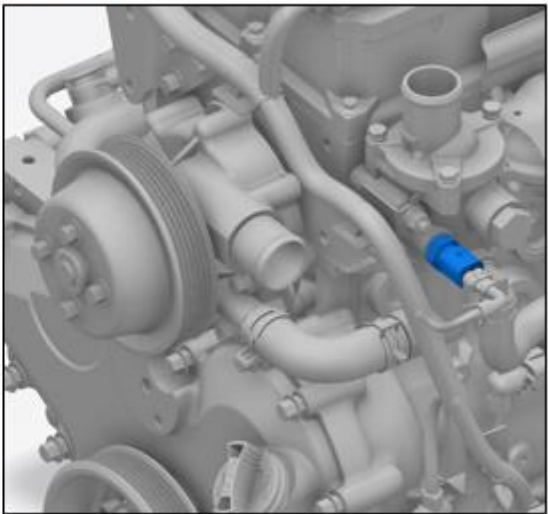


| Coolant Temperature sensor | | | |
|----------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -35 | -31 | 36010 | 4819 |
| 0 | 32 | 6050 | 4112 |
| 10 | 50 | 3891 | 3744 |
| 20 | 68 | 2569 | 3315 |
| 30 | 86 | 1737 | 2855 |
| 80 | 176 | 331 | 1011 |
| 125 | 257 | 103 | 369 |

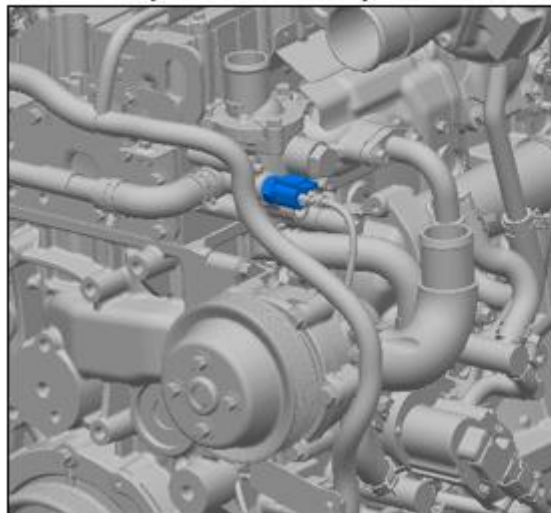
1.8L



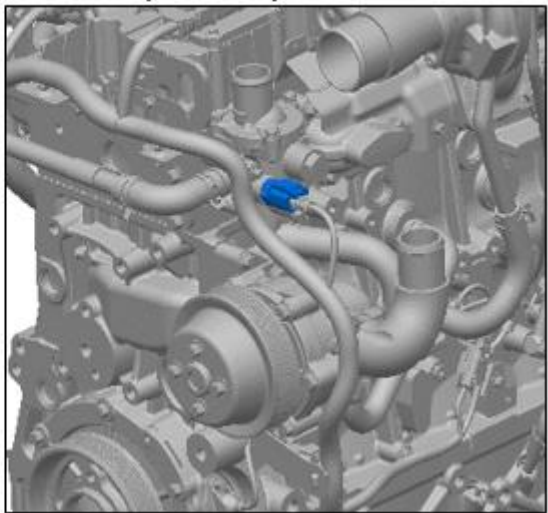
2.4L



3.4L (No-SCR)



3.4L (SCR)



- 3) Condition for Running Diagnostic
Key on or engine running or Key off(ECU on)
- 4) Condition for Setting the Fault Code
Coolant temperature signal voltage is more than 4.926V
- 5) Condition for Clearing the Fault Code
Coolant temperature signal value is in operation range

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|------------------------------------|----------------|--------|----|
| 1 | P0118 is detected on service tool? | | Step 2 | |

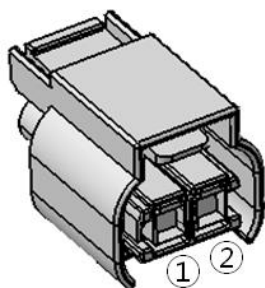
| | | | | |
|----------|--|--------------------|---|-------------------------|
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check sensor resistance (remove sensor connector and measure the resistance across pins 1 and 2 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--------------------------------------|
| P0117 | Coolant Temperature Sensor Low Fault |

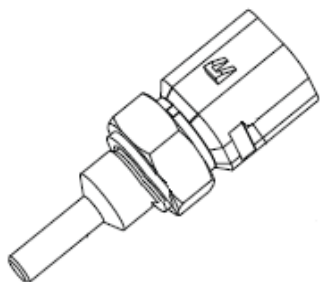
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000110-04 | 1. Electrical problem (Coolant temperature sensor connector) 2. Electrical problem (Wiring harness coolant temperature sensor to ECU, Faulty Coolant temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |



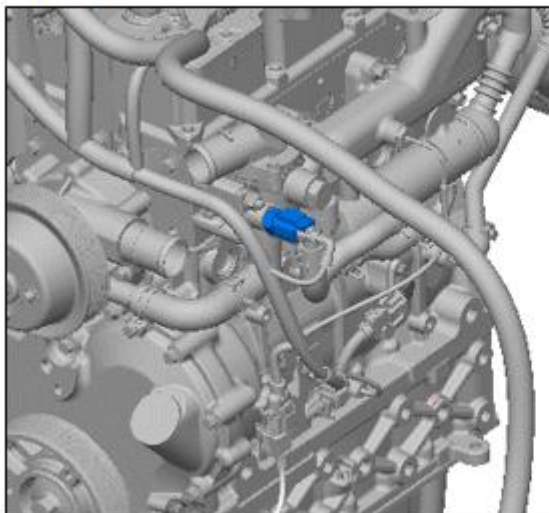
| No | ECU Pin | Description |
|----|---------|----------------------------|
| 1 | A99 | Coolant Temperature Ground |
| 2 | A100 | Coolant Temperature Signal |

2) Component Location

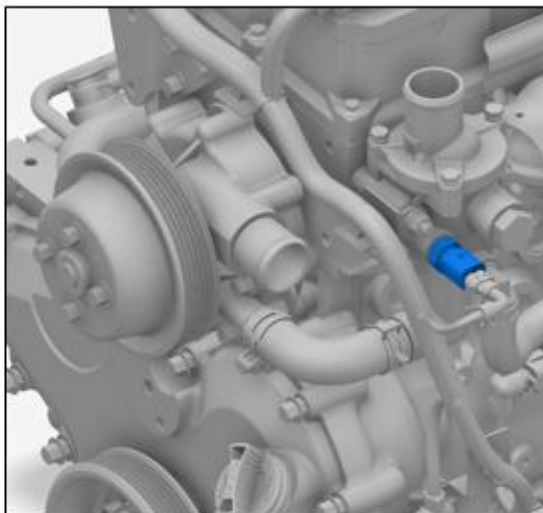


| Coolant Temperature sensor | | | |
|----------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -35 | -31 | 36010 | 4819 |
| 0 | 32 | 6050 | 4112 |
| 10 | 50 | 3891 | 3744 |
| 20 | 68 | 2569 | 3315 |
| 30 | 86 | 1737 | 2855 |
| 80 | 176 | 331 | 1011 |
| 125 | 257 | 103 | 369 |

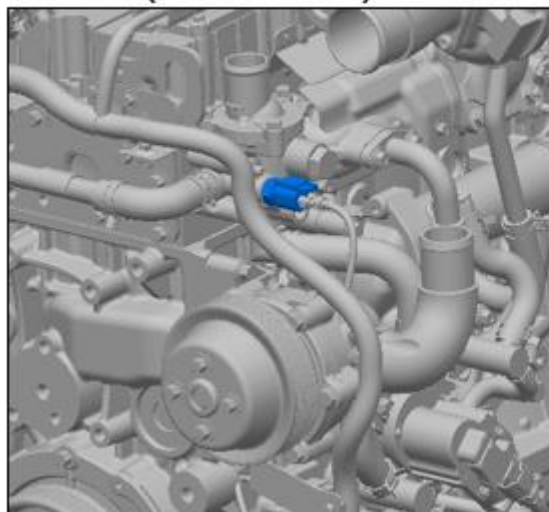
1.8L



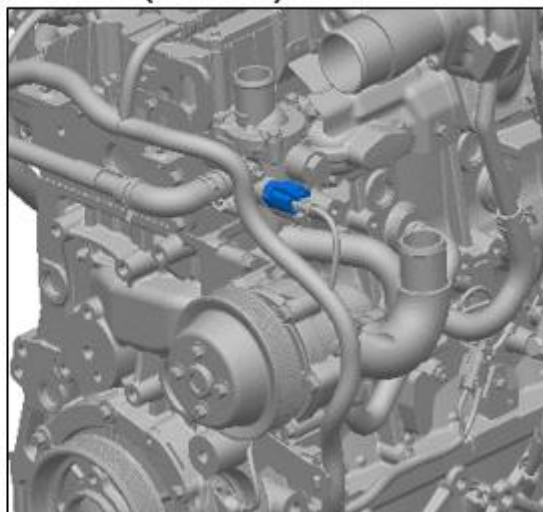
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Coolant temperature signal voltage is almost 0V(123mV)

5) Condition for Clearing the Fault Code

Coolant temperature signal value is in operation range

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|------------------------------------|----------------|--------|----|
| 1 | P0117 is detected on service tool? | | Step 2 | |

| | | | | |
|----------|--|--------------------|---|-------------------------|
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check sensor resistance (remove sensor connector and measure the resistance across pins 1 and 2 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| U02A2 | Timeout Error of CAN-Receive-Frame A1DEFI (DEF Tank) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E064923-19 | 1. Electrical problem (DEF tank module connector, DEF tank module, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | Inducement Group5 (Tampering) |

2) Component Location

DEF tank location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | U02A2 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Replace DEF tank module DEF tank module problem? | | Change DEF Tank Module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| U1001 | Timeout Error of CAN-Receive-Frame AAI (Hydraulic Oil Temperature) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E065164-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

Hydraulic oil temperature sensor (or switch) location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

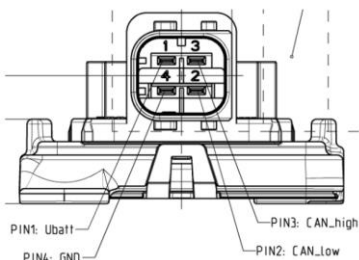
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U1001 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| U029D | Timeout Error of CAN-Receive-Frame AT1IG1 (NOx Upstream Concentration) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|----------------------------------|
| E061454-19 | 1. Electrical problem (Upstream NOx sensor connector, Upstream NOx sensor power, Upstream NOx sensor, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | Inducement Group5 (Tampering) |

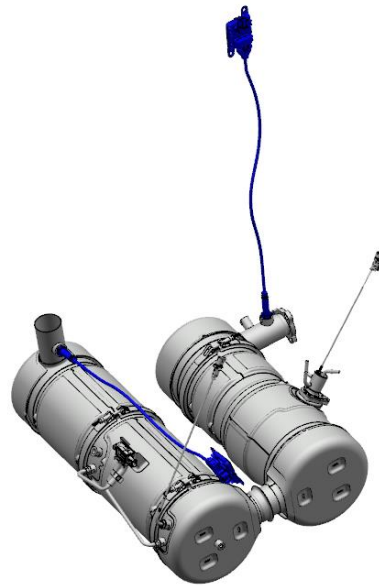


| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector





3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

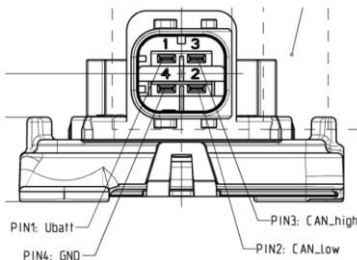
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U029D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Replace NOx sensor NOx sensor problem? | | Change sensor | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U029E | Timeout Error of CAN-Receive-Frame AT101 (NOx Downstream Concentration) |

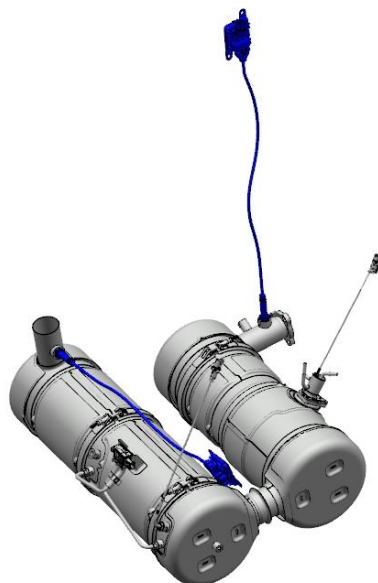
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------------|
| E061455-19 | 1. Electrical problem (Downstream NOx sensor connector, Downstream NOx sensor power, Faulty Downstream NOx sensor, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | Inducement Group5 (Tampering) |

|  <p>PIN1: Ubat1 PIN2: CAN_low PIN3: CAN_high PIN4: GND</p> | <table> <tr> <th>No</th><th>Description</th></tr> <tr> <td>1</td><td>Battery supply (+12V)</td></tr> <tr> <td>2</td><td>CAN low</td></tr> <tr> <td>3</td><td>CAN high</td></tr> <tr> <td>4</td><td>Ground</td></tr> </table> | No | Description | 1 | Battery supply (+12V) | 2 | CAN low | 3 | CAN high | 4 | Ground |
|--|--|----|-------------|---|-----------------------|---|---------|---|----------|---|--------|
| No | Description | | | | | | | | | | |
| 1 | Battery supply (+12V) | | | | | | | | | | |
| 2 | CAN low | | | | | | | | | | |
| 3 | CAN high | | | | | | | | | | |
| 4 | Ground | | | | | | | | | | |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U029E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Replace NOx sensor NOx sensor problem? | | Change sensor | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U0619 | Timeout Error of CAN-Receive-Frame AT1T1I (DEF Level, Temperature over CAN) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------------|
| E065110-19 | 1. Electrical problem (DEF tank module connector, DEF tank module, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | Inducement Group5 (Tampering) |

2) Component Location

DEF tank location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | U0619 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Replace DEF tank module DEF tank module problem? | | Change DEF Tank module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U01B7 | Timeout Error of CAN-Receive-Frame CM1 (Status of regeneration initiate and inhibit switches) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E057344-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

DPF(DeSOx) regeneration active(inhibit) switch location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (10)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (10) means that no data has been received for 10 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U01B7 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| U013C | Message Check Sum Error of CAN Receive Frame SMVCU (Pedal & Engine speed demand from VCU) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E065400-22 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

Pedal module location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

The error is reported when the Check Sum of the CAN frame received is not equal to the Defined Algorithm

5) Condition for Clearing the Fault Code

When the CAN frame is received right Check Sum dataset.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U013C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection & software version Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U010F | Timeout Error of CAN-Receive-Frame DPM1 (Air Conditioning Switch Status / Oil life reset) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E065401-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

Aircon switch and oil life reset switch location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U010F is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U01B8 | Timeout Error of CAN-Receive-Frame DPM9 (Multiple torque Map select switch) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E065402-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

Multi torque Map select switch location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U01B8 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U01B9 | Timeout Error of CAN-Receive-Frame EBC1 (Engine shut off request) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E061441-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

Engine shut off request (Emergency stop) switch location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U01B9 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U1003 | Engine shut off request through CAN (EBC1) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---------------------------------------|
| E000970-12 | 1. External shut off request by Electronic Brake Controller 1 message. | Alarm only Engine stop immediately |

2) Component Location

Engine shut off request (Emergency stop) switch location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

External shut off request by Electronic Brake Controller 1 message.

5) Condition for Clearing the Fault Code

This item is not a fault and indicates that the VCU has issued an emergency stop request.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|-------------------------|
| 1 | U1003 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | If the engine stop occurs unintentionally, check the Emergency stop switch of the machine. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| U0632 | Timeout Error of CAN-Receive-Frame FanCtl (FAN Control) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E065320-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

FAN control module location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (5)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (5) means that no data has been received for 5 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|--------|
| 1 | U0632 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |

| | | | | |
|----------|---|--|--------------------------------|-----------------------------|
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------|
| U1028 | DEF Quality Sensor Open circuit |

1) Overview

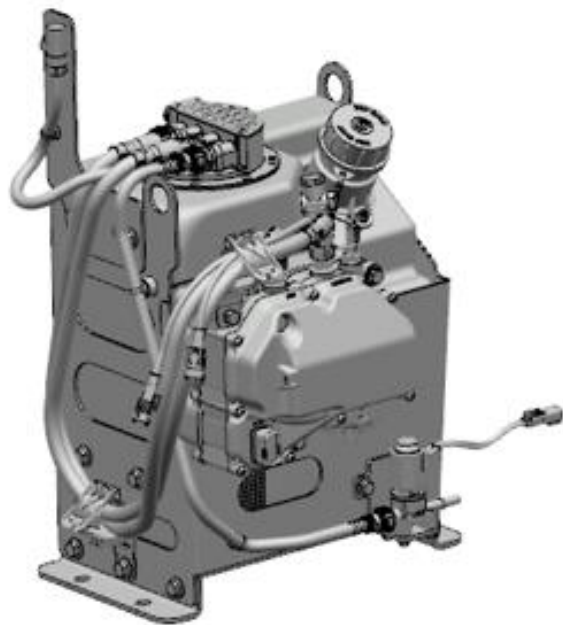
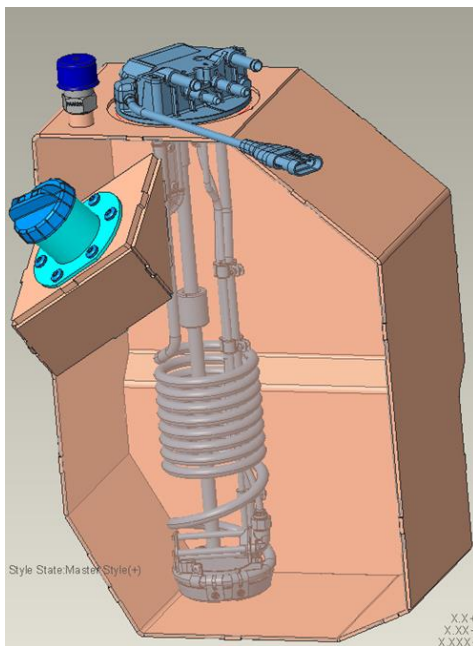
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E003520-03 | 1. Electrical problem (Faulty DEF quality sensor, Wiring harness in the DEF module) 2. Electrical problem (CAN wiring harness-insulation, Resistance) | Inducement Group5 (Tampering) |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The error is reported if its FMI is equal to 3 (Open circuit)

5) Condition for Clearing the Fault Code

The error is healed when its FMI is not equal to 3

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | U1028 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Tank module DEF Tank module problem? | | Change DEF Tank module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|----------------------------------|
| U1030 | DEF Quality Sensor Short circuit |

1) Overview

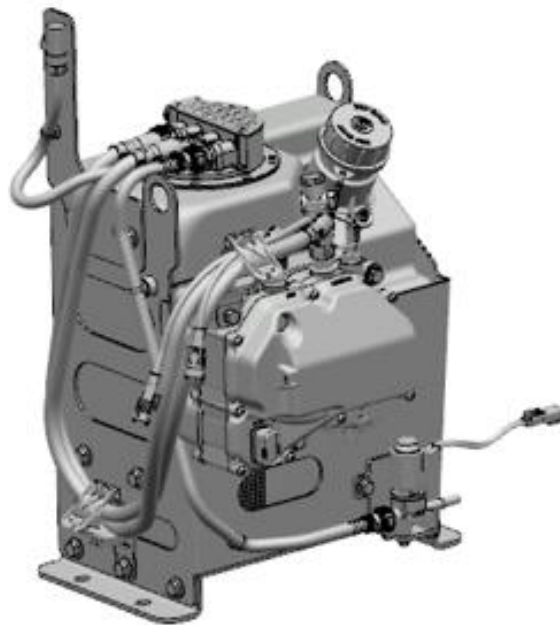
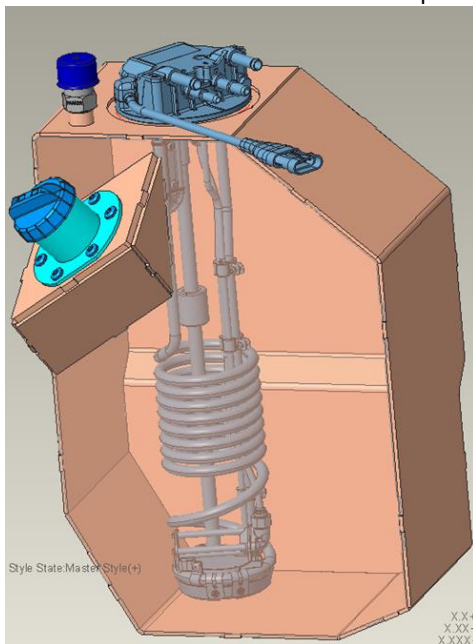
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E003520-04 | 1. Electrical problem (Faulty DEF quality sensor, Wiring harness in the DEF module) 2. Electrical problem (CAN wiring harness-insulation, Resistance) | Inducement Group5 (Tampering) |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The error is reported if its FMI is equal to 4 (Short circuit)

5) Condition for Clearing the Fault Code

The error is healed when its FMI is not equal to 4

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | U1030 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Tank module DEF Tank module problem? | | Change DEF Tank module | Contact Helpdesk |

| Fault Code | Fault Name |
|------------|--|
| U043D | Message Counter Error of CAN Receive Frame SMVCU (Pedal & Engine speed demand from VCU) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E065400-23 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

Pedal module location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

The error is reported when the Rolling Counter of the CAN frame received is not equal.

5) Condition for Clearing the Fault Code

When the CAN frame is received right Rolling Counter dataset.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U043D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection & software version Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U1032 | Timeout Error of CAN-Receive-Frame RxCCVS (PTO / Idle up) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E065265-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

PTO and Idle up switch location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U1032 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| U1031 | Timeout Error of CAN-Receive-Frame AUXIO1 (status of vehicle cut off [Safety bar]) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E065241-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

Safety bar module location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U1031 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| U0606 | Timeout Error of CAN-Receive-Frame EEC2 (Pedal) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000091-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

Pedal module location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|-------------------------|
| 1 | U0606 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U1033 | Timeout Error of CAN-Receive-Frame EOI (Engine Starter Motor Relay Control) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E006385-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

Engine starter motor relay location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U1033 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U0608 | Timeout Error of CAN-Receive-Frame RxSMVCU (Pedal & Engine speed demand from VCU) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E065400-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

Pedal module location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|-------------------------|
| 1 | U0608 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-------------------------------|
| P203A | DEF Level Sensor Open circuit |

1) Overview

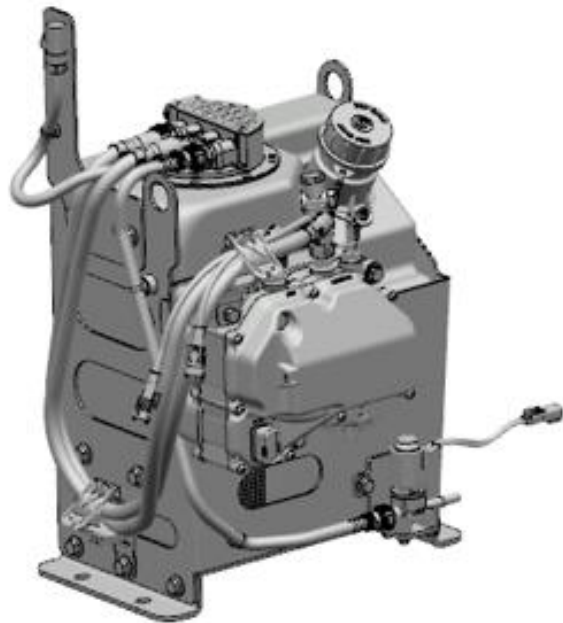
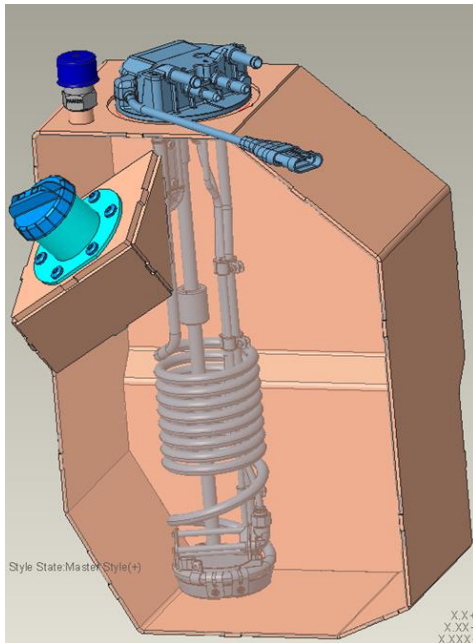
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E003532-03 | 1. Electrical problem (DEF level sensor, Wiring harness in the DEF module) 2. Electrical problem (CAN wiring harness-insulation, Resistance) | Inducement Group5 (Tampering) |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The error is reported if its FMI is equal to 3 (Open circuit)

5) Condition for Clearing the Fault Code

The error is healed when its FMI is not equal to 3

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | P203A is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace DEF Tank module DEF Tank module problem? | | Change DEF Tank Module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------|
| P2041 | DEF Level Sensor Short circuit |

1) Overview

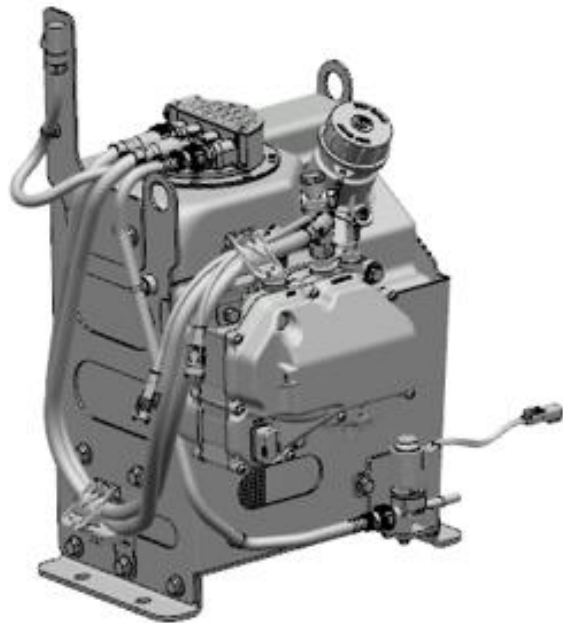
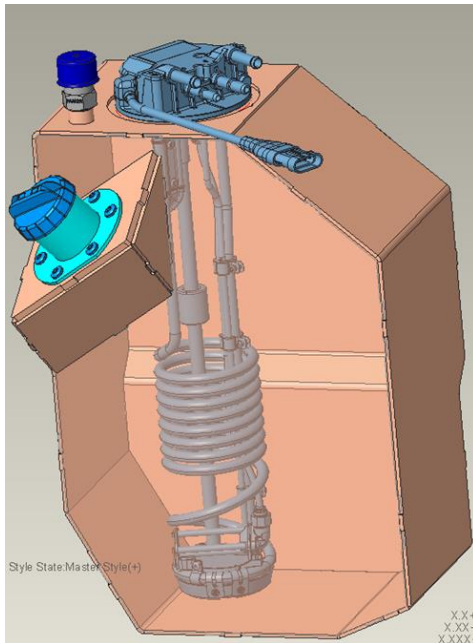
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E003532-04 | 1. Electrical problem (Faulty DEF level sensor, Wiring harness in the DEF module) 2. Electrical problem (CAN wiring harness-insulation, Resistance) | Inducement Group5 (Tampering) |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The error is reported if its FMI is equal to 4 (Short circuit)

5) Condition for Clearing the Fault Code

The error is healed when its FMI is not equal to 4

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | P2041 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace DEF Tank module DEF Tank module problem? | | Change DEF Tank Module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-------------------------------------|
| P2043 | DEF Temperature Sensor Open circuit |

1) Overview

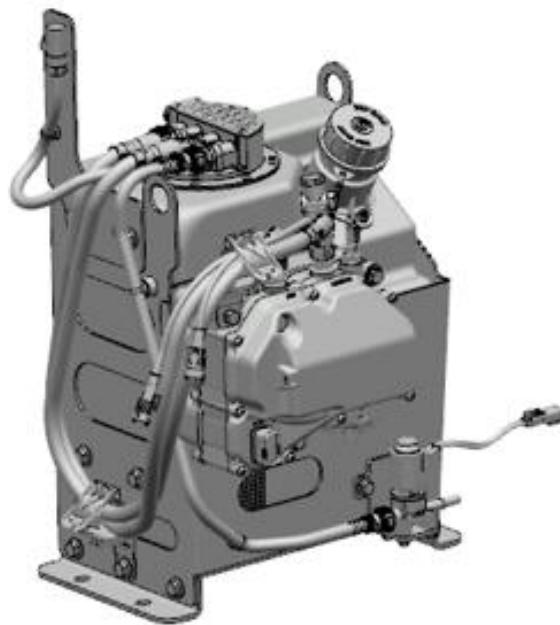
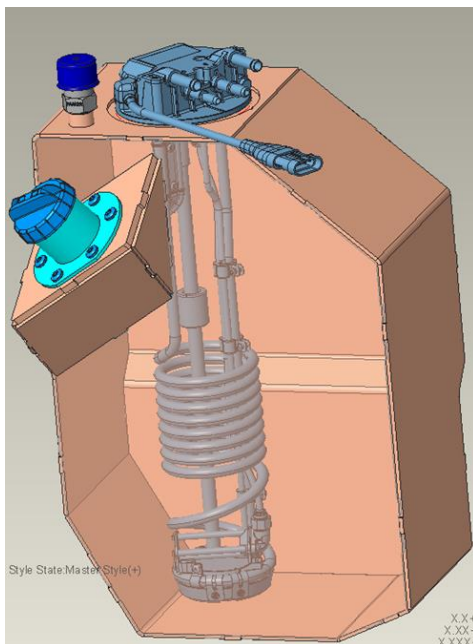
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E004365-03 | 1. Electrical problem (Faulty DEF temperature sensor, Wiring harness in the DEF module) 2. Electrical problem (CAN wiring harness-insulation, Resistance) | Inducement Group5 (Tampering) |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The error is reported if its FMI is equal to 3 (Open circuit)

5) Condition for Clearing the Fault Code

The error is healed when its FMI is not equal to 3

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | P2043 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace DEF Tank module DEF Tank module problem? | | Change DEF Tank Module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------------|
| P2046 | DEF Temperature Sensor Short circuit |

1) Overview

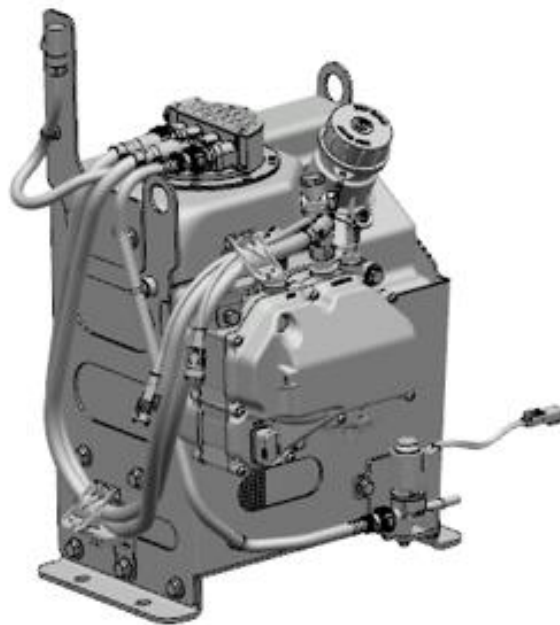
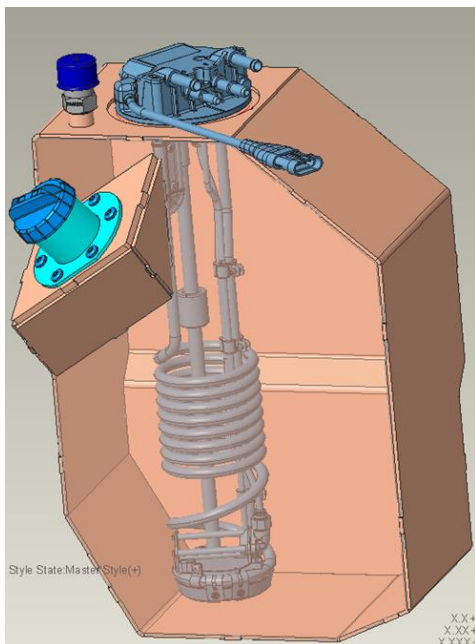
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E004365-04 | 1. Electrical problem (Faulty DEF temperature sensor, Wiring harness in the DEF module) 2. Electrical problem (CAN wiring harness-insulation, Resistance) | Inducement Group5 (Tampering) |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The error is reported if its FMI is equal to 4 (Short circuit)

5) Condition for Clearing the Fault Code

The error is healed when its FMI is not equal to 4

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | P2046 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace DEF Tank module DEF Tank module problem? | | Change DEF Tank Module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0218 | Timeout Error of CAN-Receive-Frame TRF1 (Transmission oil temperature) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E065272-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

Transmission oil temperature sensor(or switch) location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P0218 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| U0607 | Timeout Error of CAN-Receive-Frame TSC1VE (Engine speed & Torque demand) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000000-19 | 1. Electrical problem (VCU, Abnormal network) 2. Electrical problem (CAN wiring harness insulation, Resistance) | CE lamp ON |

2) Component Location

Pedal module location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Continuously checked in every sample time

4) Condition for Setting the Fault Code

CAN frame has a time out for the number of cycles (4)

CAN data is transmitted and received every fixed period (time). If the CAN data that the ECU needs to receive for a certain period of time does not come in, it is diagnosed "time-out". Cycles (4) means that no data has been received for 4 consecutive times."

5) Condition for Clearing the Fault Code

When the CAN frame is received again.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | U0607 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check VCU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------|
| P0591 | PTO (Idle up) Lamp Open circuit |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E005067-05 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|--------------------|
| 1 | K20 | PTO (Idle up) Lamp |

2) Component Location

PTO (Idle up) lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is opened.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|---------------------|------------------|
| 1 | P0591 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-------------------------------------|
| P0593 | PTO (Idle up) Lamp Short to Battery |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E005067-03 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|--------------------|
| 1 | K20 | PTO (Idle up) Lamp |

2) Component Location

PTO (Idle up) lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to battery.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|------------------------|---------------------|
| 1 | P0593 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|------------------------------------|
| P0592 | PTO (Idle up) Lamp Short to Ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E005067-04 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|--------------------|
| 1 | K20 | PTO (Idle up) Lamp |

2) Component Location

PTO (Idle up) lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to ground.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|---------------------|------------------|
| 1 | P0592 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

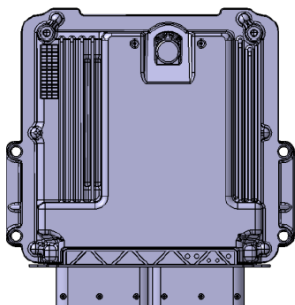
| Fault Code | Fault Name |
|-----------------------|---|
| P160B | CY327(Power control chipset) SPI(Serial Peripheral Interface Bus) Communication Error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520601-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The SPI(Serial Peripheral Interface Bus)-communication is monitored by the CY327 driver. A fault is detected if the received data has incorrect check-bytes or a data transfer is not possible.

5) Condition for Clearing the Fault Code

The SPI(Serial Peripheral Interface Bus)-communication is well received data.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P160B is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P1564 | Powerstage diagnosis disabled due to high Battery voltage |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000444-12 | 1. Electrical problem (Faulty Alternator, Alternator wiring harness) 2. Electrical problem (Battery, Wiring harness, Battery terminal, Connector) 3. Electrical problem (External battery charger) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|----------------------|
| 1 | K01 | Battery supply (12V) |
| 2 | K03 | Battery supply (12V) |
| 3 | K05 | Battery supply (12V) |
| 4 | K02 | Power Ground |
| 5 | K04 | Power Ground |
| 6 | K06 | Power Ground |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

Power stage diagnosis disabled error due to battery voltage is more than maximum operation voltage (16V)

* Power stage operation range refers to the area where the ECU can control external actuators such as EGR and throttle valve.

4) Condition for Clearing the Fault Code

Battery voltage is in power stage operation range (6.5V~16V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P1564 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | Do necessary repair | Step 4 |

| | | | | |
|----------|---|--|--------------------------------|-----------------------------|
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check battery charge circuit Charge circuit problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P1565 | Powerstage diagnosis disabled due to low Battery voltage |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000444-02 | 1. Electrical problem (Faulty Alternator, Alternator wiring harness) 2. Electrical problem (Battery, Wiring harness, Battery terminal, Connector) 3. Electrical problem (External battery charger) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|----------------------|
| 1 | K01 | Battery supply (12V) |
| 2 | K03 | Battery supply (12V) |
| 3 | K05 | Battery supply (12V) |
| 4 | K02 | Power Ground |
| 5 | K04 | Power Ground |
| 6 | K06 | Power Ground |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

Power stage diagnosis disabled error due to battery voltage is less than minimum power stage operation voltage (6.5V)

* Power stage operation range refers to the area where the ECU can control external actuators such as EGR and throttle valve.

4) Condition for Clearing the Fault Code

Battery voltage is in power stage operation range (6.5V~16V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P1565 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | Do necessary repair | Step 4 |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |

| | | | | |
|---|---|--|--------------------------------|-----------------------------|
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check battery charge circuit Charge circuit problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0215 | Engine shut off request through hardwire |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---------------------------------------|
| E000970-22 | 1. Engine shut off request by hardwire switch | Alarm only Engine stop immediately |

| No | ECU Pin | Description |
|----|---------|----------------------------|
| | K51 | Engine stop request switch |

2) Component Location

Engine shut off request (Emergency stop) switch location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Engine shut off request by hardwire

5) Condition for Clearing the Fault Code

This item is not a fault and indicates that an emergency stop request is performed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P0215 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | If the engine stop occurs unintentionally, check the Emergency stop switch of the machine. | | Do necessary repair | Contact Helpdesk |

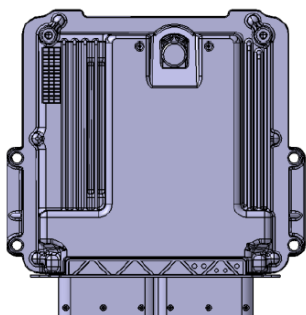
| Fault Code | Fault Name |
|-----------------------|-----------------------|
| P062F | ECU EEPROM Read Error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E055296-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

At every read access to memory media

4) Condition for Setting the Fault Code

Fault is set when data for when the number of blocks that could not be read from memory media is greater or equal to threshold.

5) Condition for Clearing the Fault Code

Fault is cleared when number of block read failure is less then threshold in next drive cycle.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P062F is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

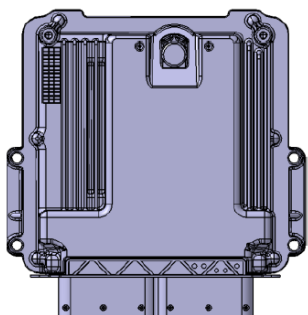
| Fault Code | Fault Name |
|-----------------------|------------------------|
| P0630 | ECU EEPROM Write Error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E055552-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

At every write access to memory media

4) Condition for Setting the Fault Code

If a block cannot be written more than 3 times, an error will be registered

5) Condition for Clearing the Fault Code

Fault is cleared if there was one successful write for any block in the next drive cycle.

6) Check List

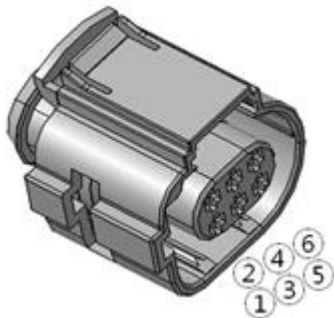
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P0630 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0C17 | EGR Close Position Learning Range Over Fault |

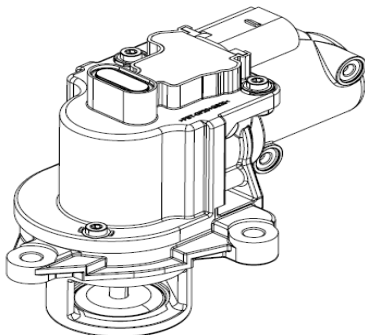
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000027-20 | 1. Actuator problem (Valve sticking, foreign material, deep carbon) 2. Electrical problem (Faulty EGR Valve) 3. Electrical problem (EGR valve connector, Wiring harness, Faulty ECU, ECU connector) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

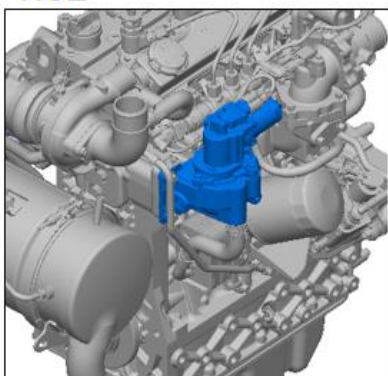
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



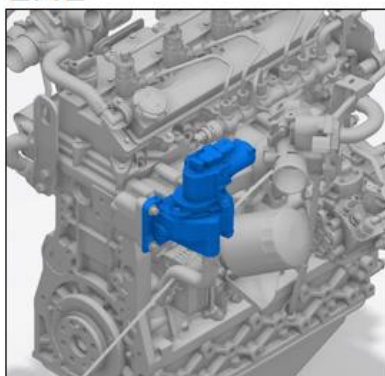
2) Component Location



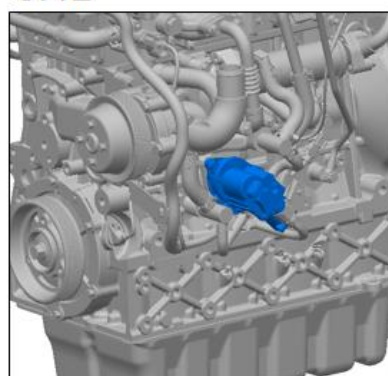
1.8L



2.4L



3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If EGR position feedback in the closed stop is not within the limits. (3.4~4.35V)

5) Condition for Clearing the Fault Code

If EGR position feedback in the closed stop is within the limits.

6) Check List

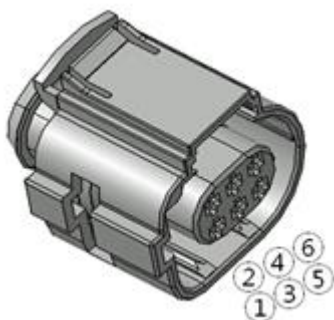
| Step | Inspection | Standard Value | YES | NO |
|------|---|---------------------|----------------|------------------|
| 1 | POC17 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check connection between ECU and EGR valve. Wire harness is damaged? Check the supply voltage. | Supply voltage = 5V | Step 5 | Step 4 |
| 4 | Check that the valve position can reach demand position by service tool. (1%/50%/99%) ("Input/Output Test – Actuator test of EGR" function of the service tool) * Variables 1) EGR valve position feedback (EGRVlv_rAct) EGR valve position cannot reach to demand? | | Step 5 | Problem solved |
| 5 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P2143 | EGR H-Bridge Driver Open Circuit Fault |

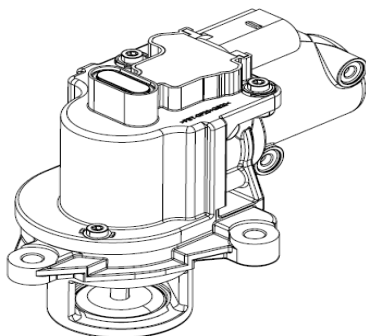
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E002791-05 | 1. Electrical problem (EGR valve connector, Faulty EGR valve motor) 2. Electrical problem (Wiring harness EGR to ECU) 3. Abnormal overheating condition 4. Electrical problem (Faulty ECU) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

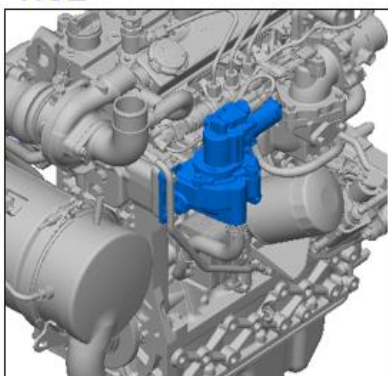
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



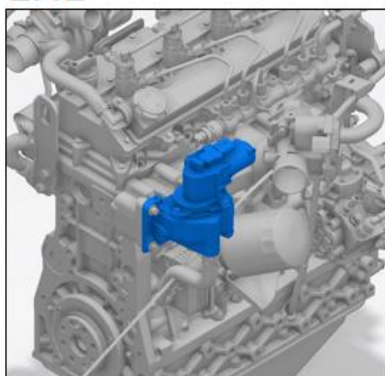
2) Component Location



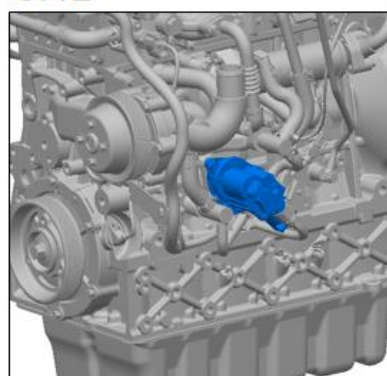
1.8L



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3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the pins of EGR H-bridge have been opened or H-Bridge circuit included EGR valve is damaged.

EGR motor H-bridge fault could be temporary diagnosed when exposed to abnormal overheating conditions (lack of coolant etc...). So it is necessary to check whether the fault is reproduced after improving the cause of overheating.

5) Condition for Clearing the Fault Code

If the pins of EGR H-bridge is connected or H-Bridge circuit included EGR valve is corrected.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--|------------------|
| 1 | P2143 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Has the engine been exposed to abnormal overheating conditions? EGR motor H-bridge fault could be temporary diagnosed when exposed to abnormal overheating conditions (lack of coolant etc...). | | Re-check whether the fault is reproduced after improving the cause of overheating. | Step 4 |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check the EGR valve harness connection between ECU and EGR valve. Fault code is not cleared? | | Step 6 | Problem solved. |
| 6 | Check visually outside of the EGR valve. Any damaged EGR valve? | | Change EGR valve | Step 7 |
| 7 | Change the EGR valve Fault code is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies.

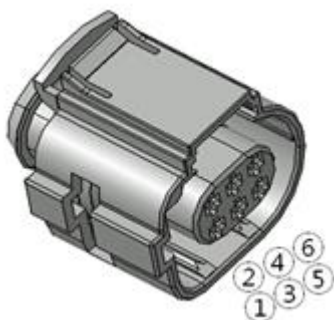
Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P2145 | EGR H-Bridge Driver Short circuit to battery |

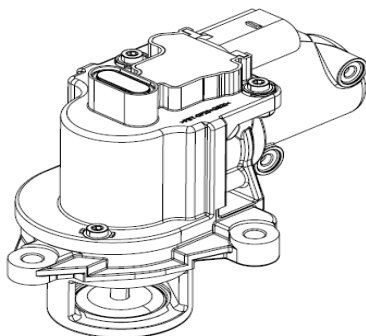
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E002791-03 | 1. Electrical problem (EGR valve connector, Faulty EGR valve motor) 2. Electrical problem (Wiring harness EGR to ECU) 3. Abnormal overheating condition 4. Electrical problem (Faulty ECU) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

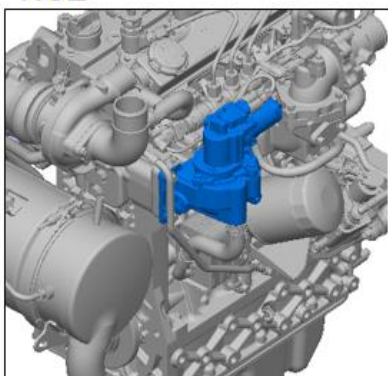
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



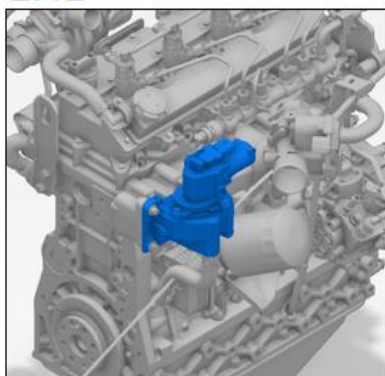
2) Component Location



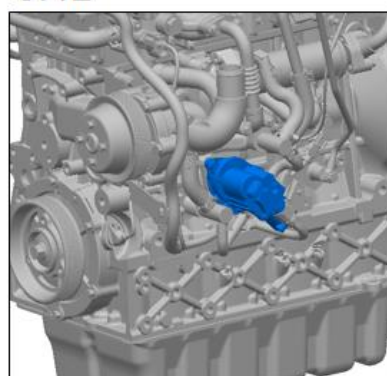
1.8L



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3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the pins of EGR H-bridge have been shorted to battery or H-Bridge circuit included EGR valve is damaged.

EGR motor H-bridge fault could be temporary diagnosed when exposed to abnormal overheating conditions (lack of coolant etc...). So it is necessary to check whether the fault is reproduced after improving the cause of overheating.

5) Condition for Clearing the Fault Code

If the pins of EGR H-bridge is connected or H-Bridge circuit included EGR valve is corrected.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--|------------------|
| 1 | P2145 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Has the engine been exposed to abnormal overheating conditions? EGR motor H-bridge fault could be temporary diagnosed when exposed to abnormal overheating conditions (lack of coolant etc...). | | Re-check whether the fault is reproduced after improving the cause of overheating. | Step 4 |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check the EGR valve harness connection between ECU and EGR valve. Fault code is not cleared? | | Step 6 | Problem solved. |
| 6 | Check visually outside of the EGR valve. Any damaged EGR valve? | | Change EGR valve | Step 7 |
| 7 | Change the EGR valve Fault code is cleared? | | Problem solved | Contact Helpdesk |

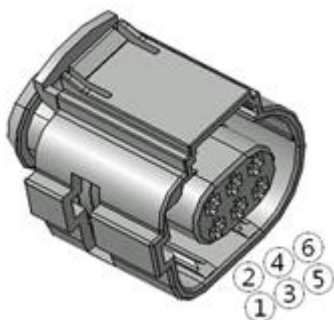
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P2144 | EGR H-Bridge Driver Short circuit to ground |

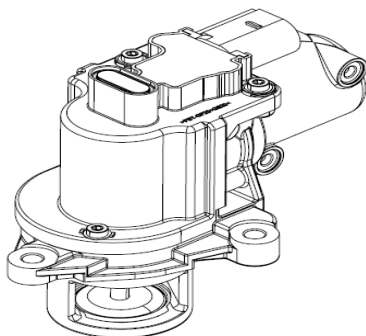
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E002791-04 | 1. Electrical problem (EGR valve connector, Faulty EGR valve motor) 2. Electrical problem (Wiring harness EGR to ECU) 3. Abnormal overheating condition 4. Electrical problem (Faulty ECU) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

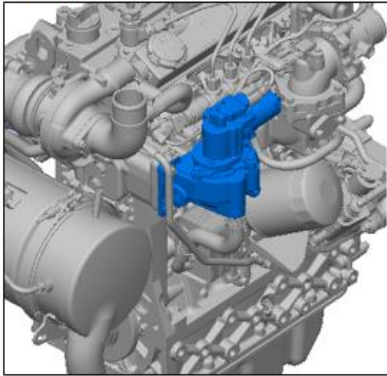
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



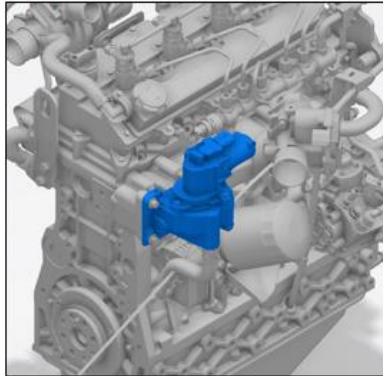
2) Component Location



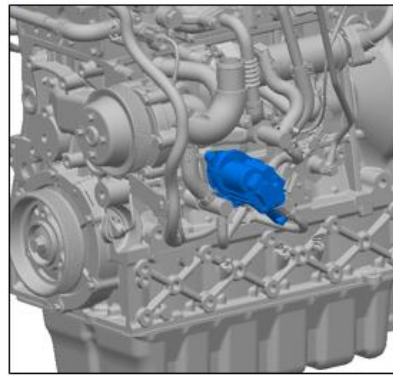
1.8L



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3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the pins of EGR H-bridge have been shorted to ground or H-Bridge circuit included EGR valve is damaged.

EGR motor H-bridge fault could be temporary diagnosed when exposed to abnormal overheating conditions (lack of coolant etc...). So it is necessary to check whether the fault is reproduced after improving the cause of overheating.

5) Condition for Clearing the Fault Code

If the pins of EGR H-bridge is connected or H-Bridge circuit included EGR valve is corrected.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--|------------------|
| 1 | P2144 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Has the engine been exposed to abnormal overheating conditions? EGR motor H-bridge fault could be temporary diagnosed when exposed to abnormal overheating conditions (lack of coolant etc...). | | Re-check whether the fault is reproduced after improving the cause of overheating. | Step 4 |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check the EGR valve harness connection between ECU and EGR valve. Fault code is not cleared? | | Step 6 | Problem solved. |
| 6 | Check visually outside of the EGR valve. Any damaged EGR valve? | | Change EGR valve | Step 7 |
| 7 | Change the EGR valve Fault code is cleared? | | Problem solved | Contact Helpdesk |

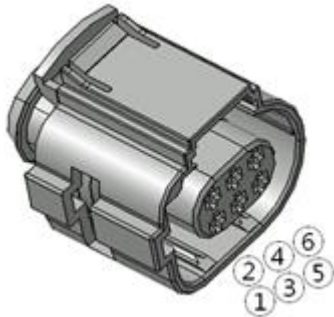
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|----------------------------------|
| P042F | EGR Position Closed jammed fault |

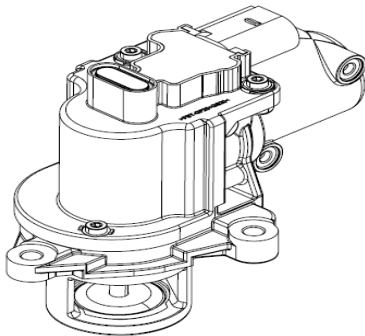
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000027-01 | 1. Actuator problem (Faulty EGR valve motor, EGR valve sticking, Carbon or foreign material, Faulty EGR position sensor) 2. Electrical problem (Wiring harness EGR to ECU) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

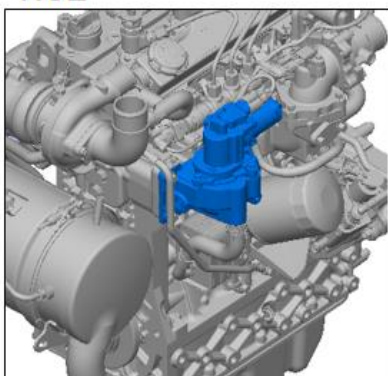
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



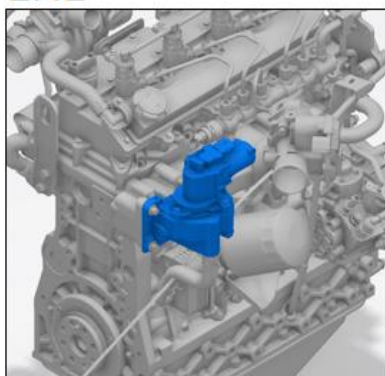
2) Component Location



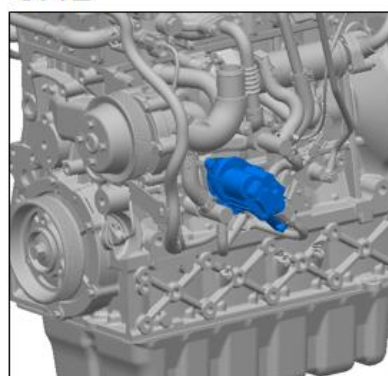
1.8L



2.4L



3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on), coolant temperature > 60 degC.

4) Condition for Setting the Fault Code

If the difference between EGR position demand and EGR position feedback is over the threshold.

5) Condition for Clearing the Fault Code

If the difference between EGR position demand and EGR position feedback is within the threshold.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|---------------------|---------------------|--|
| 1 | P042F is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the EGR position learning status Did reset the learning value using the "Part replacement" function of the service tool when changing new EGR valve? Or did input the previous learned value using the "Part replacement" function of the service tool when replacing new ECU? | | Step 4 | Perform the Part replacement guideline |
| 4 | Check connection between ECU and EGR valve. Wire harness is damaged? | | Do necessary repair | Step 5 |
| 5 | Check that the supply voltage is correct Voltage problem? | Supply voltage = 5V | Do necessary repair | Step 6 |
| 6 | Check that the valve position can reach demand position by service tool. (1%/50%/99%) ("Input/Output Test – Actuator test of EGR" function of the service tool) * Variables 1) EGR valve position feedback (EGRVlv_rAct) EGR valve position cannot reach to demand? | | Step 7 | Problem solved |

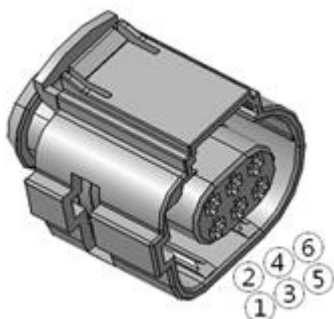
| | | | | |
|---|--|--|-------------------|-----------------------------|
| 7 | Replace EGR valve. Run the engine with high RPM and load. Fault code is cleared? | | Problem Solved | Contact Helpdesk Line |
|---|--|--|-------------------|-----------------------------|

| Fault Code | Fault Name |
|-----------------------|--------------------------------|
| P042E | EGR Position Open jammed fault |

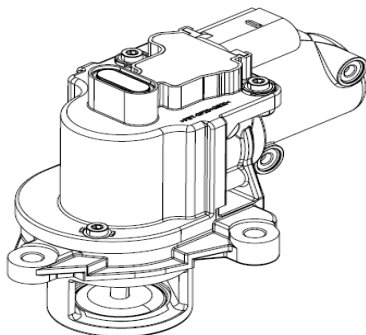
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000027-00 | 1. Actuator problem (Faulty EGR valve motor, EGR valve sticking, Carbon or foreign material, Faulty EGR position sensor) 2. Electrical problem (Wiring harness EGR to ECU) | CE lamp Blink or ON Torque Reduction 2(Severe) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

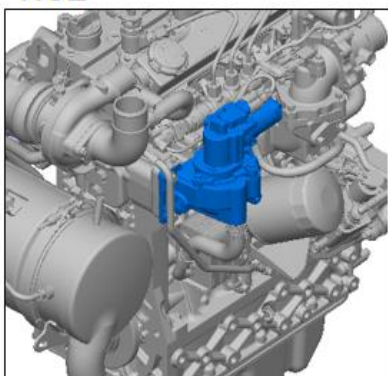
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



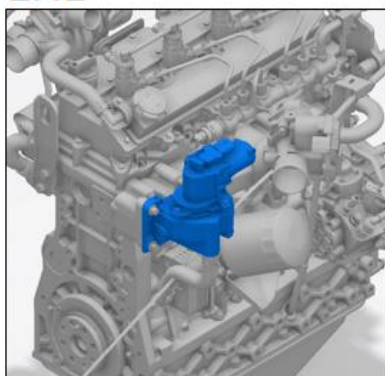
2) Component Location



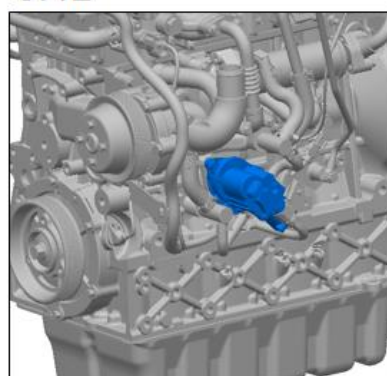
1.8L



2.4L



3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on), coolant temperature > 60 degC.

4) Condition for Setting the Fault Code

If the difference between EGR position demand and EGR position feedback is over the threshold.

5) Condition for Clearing the Fault Code

If the difference between EGR position demand and EGR position feedback is within the threshold.

6) Check List

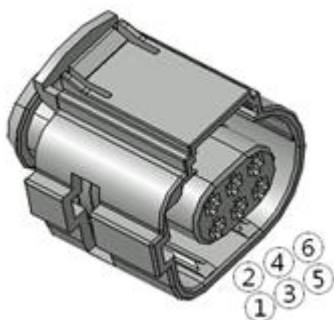
| Step | Inspection | Standard Value | YES | NO |
|------|---|---------------------|---------------------|--|
| 1 | P042E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the EGR position learning status Did reset the learning value using the "Part replacement" function of the service tool when changing new EGR valve? Or did input the previous learned value using the "Part replacement" function when replacing new ECU? | | Step 4 | Perform the Part replacement guideline |
| 4 | Check connection between ECU and EGR valve. Wire harness is damaged? | | Do necessary repair | Step 5 |
| 5 | Check that the supply voltage is correct Voltage problem? | Supply voltage = 5V | Do necessary repair | Step 6 |
| 6 | Check that the valve position can reach demand position by service tool. (1%/50%/99%) ("Input/Output Test – Actuator test of EGR" function of the service tool) * Variables 1) EGR valve position feedback (EGRVlv_rAct) EGR valve position cannot reach to demand? | | Step 7 | Problem solved |
| 7 | Replace EGR valve. Run the engine with high RPM and load. Fault code is cleared? | | Problem Solved | Contact Helpdesk Line |

| Fault Code | Fault Name |
|-----------------------|---|
| P0C18 | EGR Close Position Learning Drift Fault for long time |

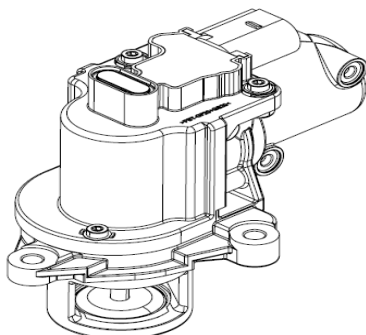
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000027-22 | 1. Actuator problem (Valve sticking, foreign material, deep carbon) 2. Electrical problem (Faulty EGR Valve) 3. Electrical problem (EGR valve connector, Wiring harness, Faulty ECU, ECU connector) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

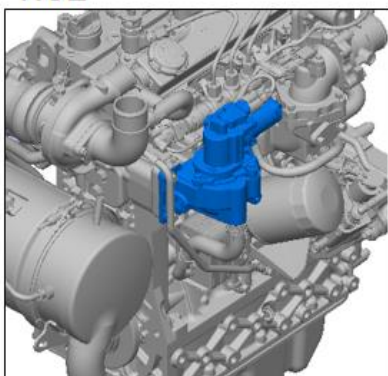
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



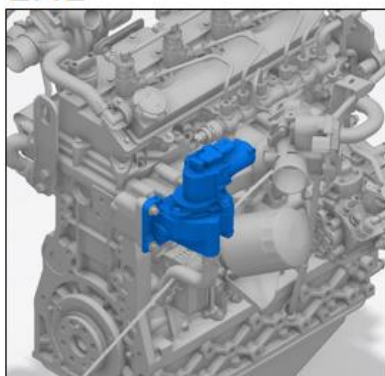
2) Component Location



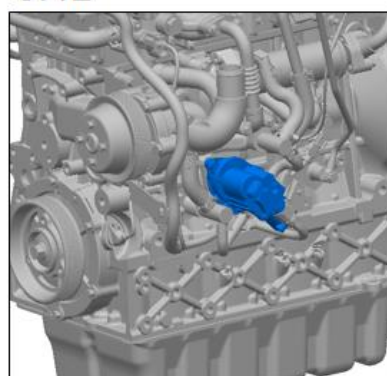
1.8L



2.4L



3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The difference of the learned voltage values in the mechanical end stops and the first learned voltage values is greater than 0.7V for long time.

5) Condition for Clearing the Fault Code

The difference of the learned voltage values in the mechanical end stops and the first learned voltage value is within threshold.

6) Check List

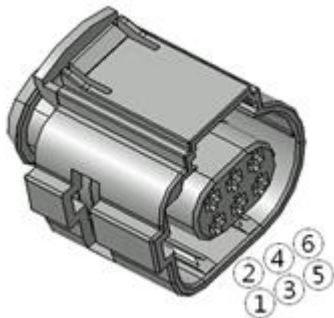
| Step | Inspection | Standard Value | YES | NO |
|------|---|---------------------|----------------|------------------|
| 1 | POC18 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check connection between ECU and EGR valve. Wire harness is damaged? Check that the supply voltage is incorrect? | Supply voltage = 5V | Step 5 | Step 4 |
| 4 | Check that the valve position can reach demand position by service tool. (1%/50%/99%) ("Input/Output Test – Actuator test of EGR" function of the service tool) * Variables 1) EGR valve position feedback (EGRVlv_rAct) EGR valve position cannot reach to demand? | | Step 5 | Problem solved |
| 5 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0C19 | EGR Close Position Learning Drift Fault for short time |

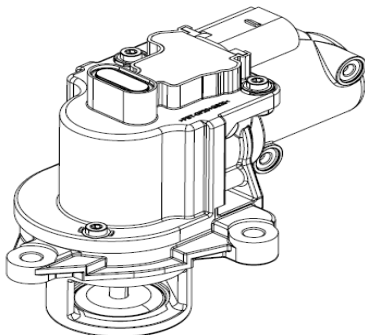
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000027-23 | 1. Actuator problem (Valve sticking, foreign material, deep carbon) 2. Electrical problem (Faulty EGR Valve) 3. Electrical problem (EGR valve connector, Wiring harness, Faulty ECU, ECU connector) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

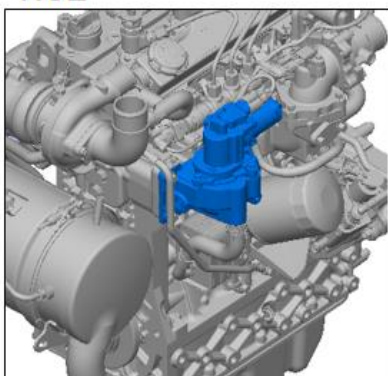
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



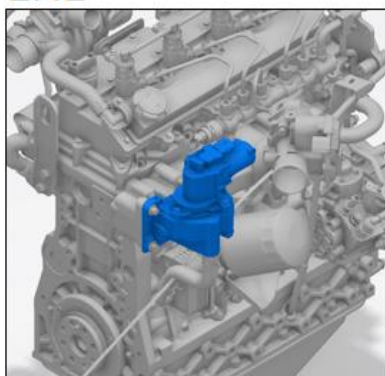
2) Component Location



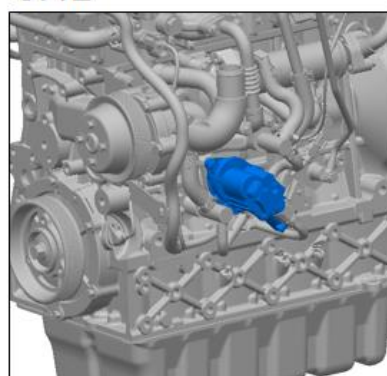
1.8L



2.4L



3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The difference of the learned voltage values in the mechanical end stops and the last learned voltage value is greater than 0.7V for short time.

5) Condition for Clearing the Fault Code

The difference of the learned voltage values in the mechanical end stops and the last learned voltage value is within threshold.

6) Check List

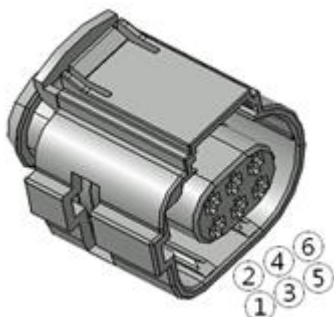
| Step | Inspection | Standard Value | YES | NO |
|------|---|---------------------|----------------|------------------|
| 1 | P0C19 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check connection between ECU and EGR valve. Wire harness is damaged? Check that the supply voltage is incorrect? | Supply voltage = 5V | Step 5 | Step 4 |
| 4 | Check that the valve position can reach demand position by service tool. (1%/50%/99%) ("Input/Output Test – Actuator test of EGR" function of the service tool) * Variables 1) EGR valve position feedback (EGRVlv_rAct) EGR valve position cannot reach to demand? | | Step 5 | Problem solved |
| 5 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------|
| P0406 | EGR Position Sensor High Fault |

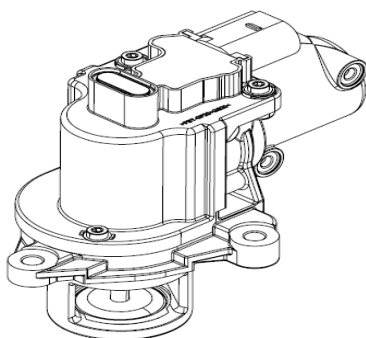
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000027-03 | 1. Electrical problem (Faulty EGR valve, EGR valve connector, Wiring harness EGR to ECU) 2. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

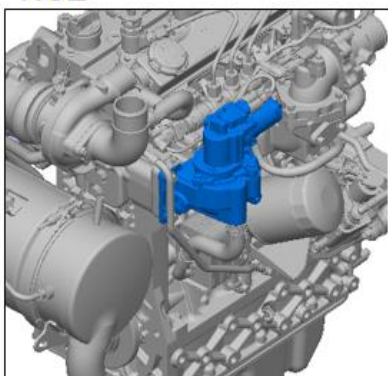
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



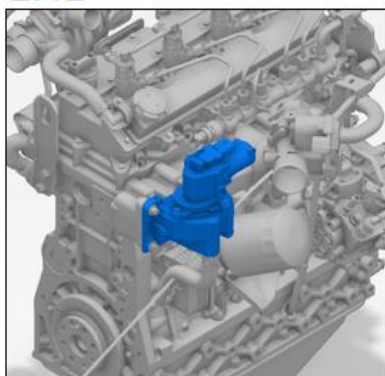
2) Component Location



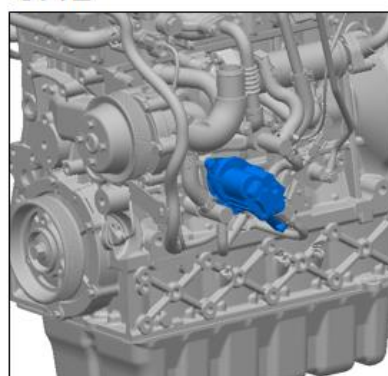
1.8L



2.4L



3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

EGR Feedback Position value is more than maximum operation range(4.55V).

5) Condition for Clearing the Fault Code

EGR Feedback Position value is in operation range.

6) Check List

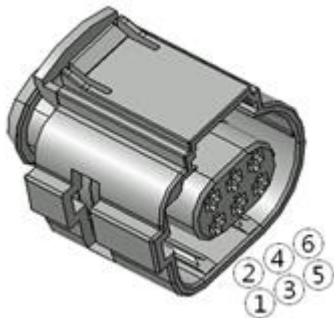
| Step | Inspection | Standard Value | YES | NO |
|------|---|---------------------|----------------|------------------|
| 1 | P0406 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check connection between ECU and EGR valve. Wire harness is damaged? Check that the supply voltage is incorrect? | Supply voltage = 5V | Step 5 | Step 4 |
| 4 | Check that the valve position can reach demand position by service tool. (1%/50%/99%) ("Input/Output Test – Actuator test of EGR" function of the service tool) * Variables 1) EGR valve position feedback (EGRVlv_rAct) EGR valve position cannot reach to demand? | | Step 5 | Problem solved |
| 5 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-------------------------------|
| P0407 | EGR Position Sensor Low Fault |

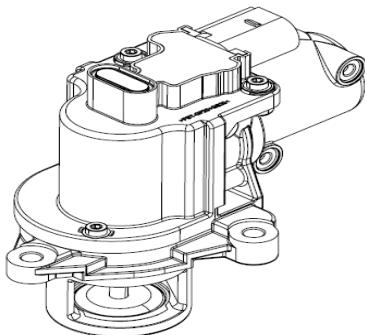
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000027-04 | 1. Electrical problem (Faulty EGR valve, EGR valve connector, Wiring harness EGR to ECU) 2. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

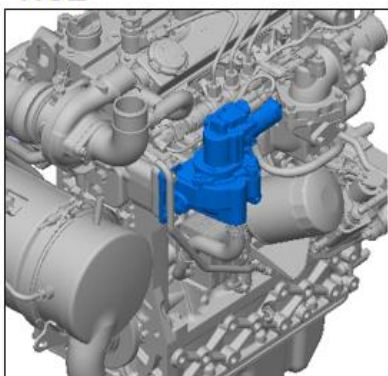
| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | A40 | EGR Position Sensor Supply (5V) |
| 2 | A88 | EGR (H-Bridge Neg) |
| 3 | A78 | EGR Position Sensor Ground |
| 4 | - | Not used |
| 5 | A79 | EGR Position Sensor Signal |
| 6 | A67 | EGR (H-Bridge Pos) |



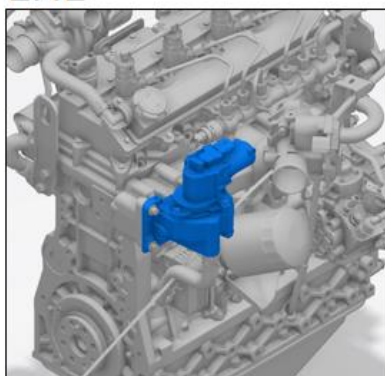
2) Component Location



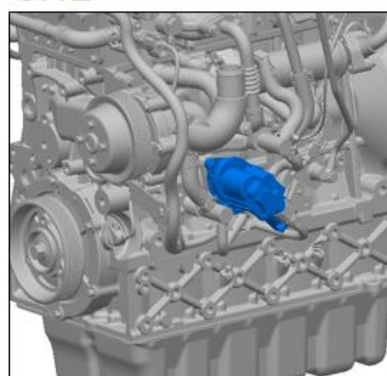
1.8L



2.4L



3.4L



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

EGR Feedback Position value is less than minimum operation range(0.4V).

5) Condition for Clearing the Fault Code

EGR Feedback Position value is in operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|---------------------|----------------|------------------|
| 1 | P0407 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check connection between ECU and EGR valve. Wire harness is damaged? Check that the supply voltage is incorrect? | Supply voltage = 5V | Step 5 | Step 4 |
| 4 | Check that the valve position can reach demand position by service tool. (1%/50%/99%) ("Input/Output Test – Actuator test of EGR" function of the service tool) * Variables 1) EGR valve position feedback (EGRVlv_rAct) EGR valve position cannot reach to demand? | | Step 5 | Problem solved |
| 5 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

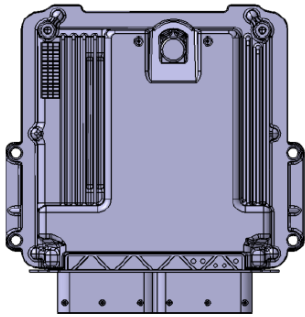
| Fault Code | Fault Name |
|-----------------------|---|
| P213E | Injection cut off demand (ICO) for shut off coordinator |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E008614-12 | 1. Injection cut-off request by ECU internal calculation for safety based on malfunction of accel pedal, injection control, etc.. 2. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 3. Electrical problem (ECU) | CE lamp Blink Torque Reduction 2(Severe) Engine stop immediately |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

Injection cut-off request by ECU internal calculation for safety based on malfunction of accel pedal, injection control, etc.

5) Condition for Clearing the Fault Code

Injection cut-off request reason is cleared.

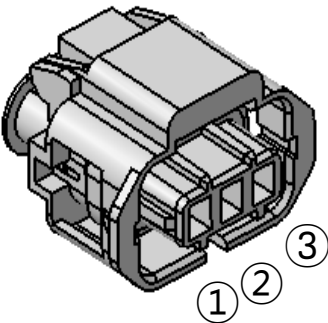
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P213E is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On and run, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-----------------------------------|
| P0219 | Engine over speed detection fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000190-00 | 1. The machine operation mode is that the engine speed is too higher mode. 2. Electrical problem (Faulty Crank or CAM sensor) | CE lamp ON |

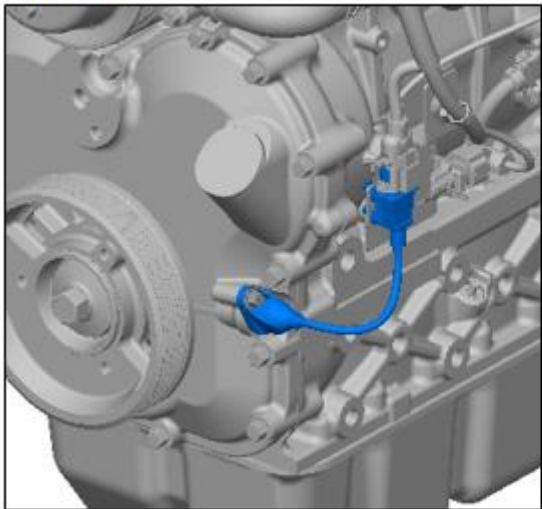


| No | ECU Pin | Description |
|----|---------|------------------|
| 1 | A21 | Crank Sensor Neg |
| 2 | A20 | Crank Sensor Pos |
| 3 | A57 | Shield |

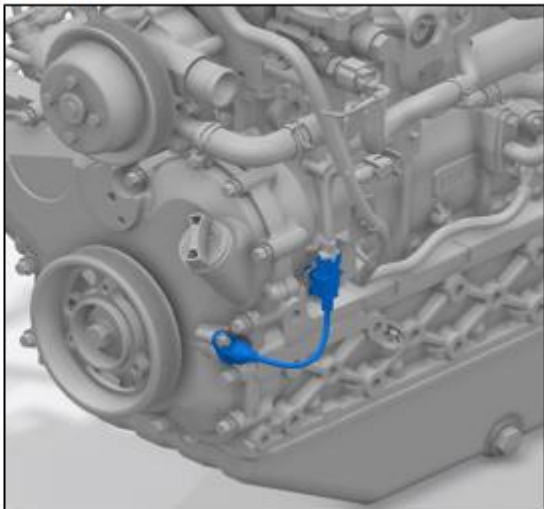
2) Component Location



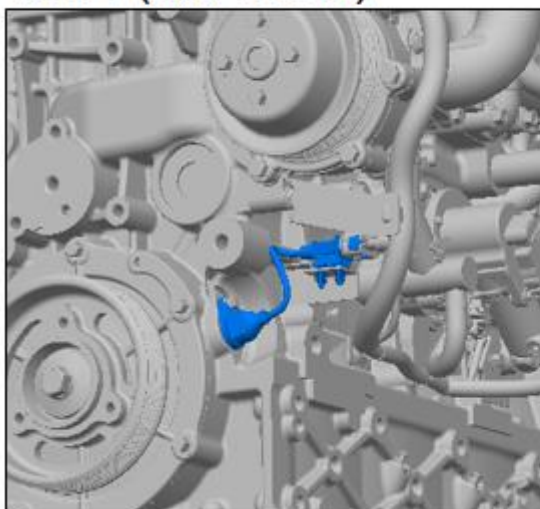
1.8L



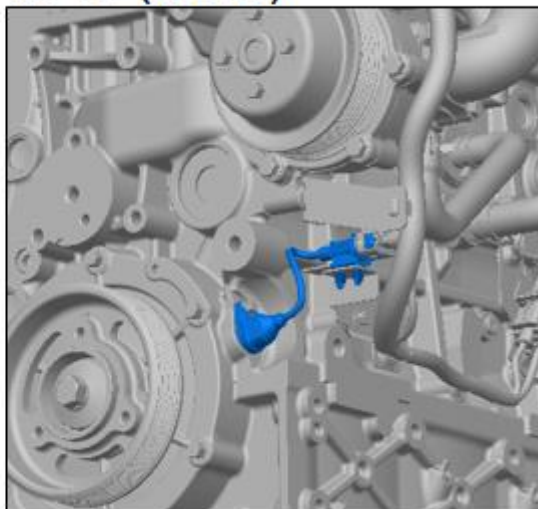
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

During engine running (included cranking mode)

4) Condition for Setting the Fault Code

Engine speed is much higher than threshold. (3300rpm)

- This can occur when running downhill from a gear equipped with transmission to low gear. If the engine is continuously operated in this mode, the engine can be damaged. So guide the driver to avoid operating in these modes.
- If the fault is occurred even though it is not operated with over speed as in the above mode, check the sensor because there may be a problem with the CAM / Crank sensor.

5) Condition for Clearing the Fault Code

Engine speed is in a normal range

6) Check List

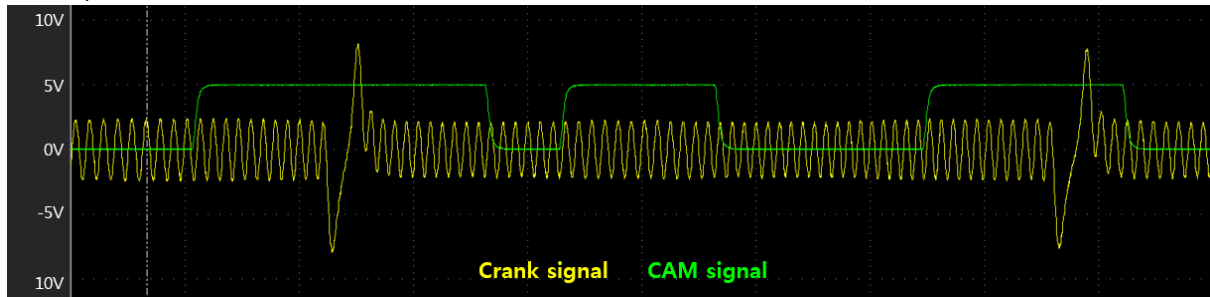
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---|----------------|
| 1 | P0219 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the engine operation mode. This can occur when running downhill from a gear equipped with transmission to low gear. If the engine is continuously operated in this mode, the engine can be damaged. | | Guide the driver to avoid operating in these modes. | Step 4 |
| 4 | If scope available, display CAM and Crank signals on the scope Signals not conform to template? | | Change CAM or Crank sensor | Step 5 |
| 5 | New sensor connected Problem still present? | | Change Timing wheel | Step 6 |
| 6 | New Timing wheel fitted Problem still present? | | Contact Helpdesk | Problem solved |

* Scope profile

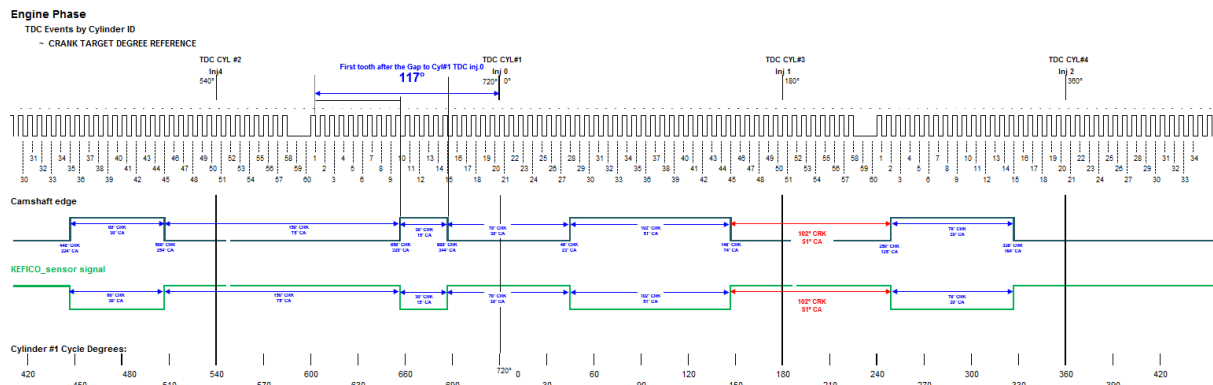
Probe connection : Crank (positive : A20, negative : A21), CAM (Signal : A52, Ground : A51)

Use Insulation piercing clip

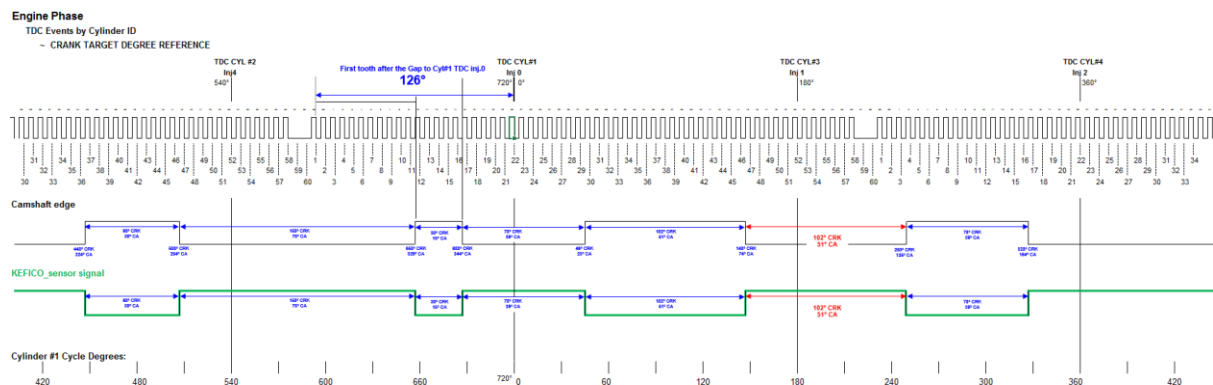
* Example



1) D18/D24 (117deg)



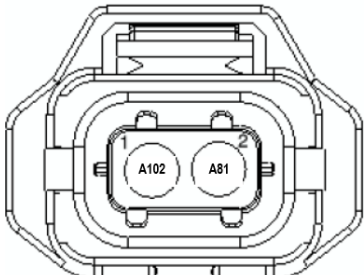
2) D34 (126deg)



| Fault Code | Fault Name |
|-----------------------|----------------------------------|
| P1073 | Environment Temperature Too High |

1) Overview

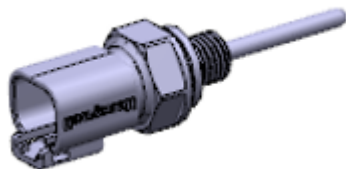
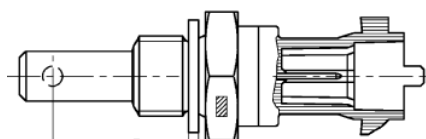
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000171-00 | 1. Electrical problem (Environment temperature sensor connector) 2. Electrical problem (Wiring harness from ECU to environment temperature sensor, Environment temperature sensor, ECU connector, Faulty ECU) | CE lamp ON |



| No. | ECU Pin | PIN description |
|-----|---------|--------------------------------|
| 1 | A102 | Environment temperature Signal |
| 2 | A81 | Environment temperature Ground |

2) Component Location

Not a special location (Normally near the supply module and DEF supply line)



| Environment Temperature sensor | | | |
|--------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 45313 | 4777 |
| 0 | 32 | 5896 | 3667 |
| 25 | 77 | 2057 | 2448 |
| 100 | 212 | 186 | 401 |
| 140 | 284 | 71 | 162 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The environment temperature is greater than a threshold(129.96℃)

5) Condition for Clearing the Fault Code

The environment temperature is less than or equal to a threshold.

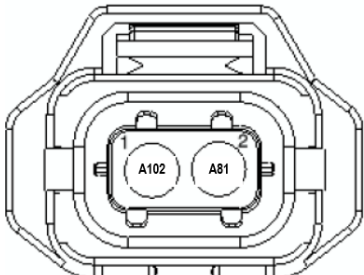
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|---------------------|------------------|
| 1 | P1073 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check value of Environment temperature sensors by service tool. Is temperature value abnormal? * Variable 1)Environment temperature (EnvT_tSens) | | Change sensor | Step 5 |
| 5 | Check sensor resistance (remove sensor connector and measure the resistance across pins 1 and 2 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0073 | Environment Temperature Sensor Signal High |

1) Overview

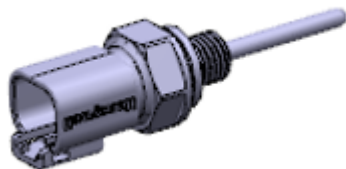
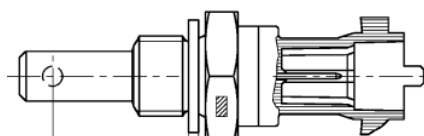
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000171-03 | 1. Electrical problem (Environment temperature sensor connector) 2. Electrical problem (Wiring harness from ECU to environment temperature sensor, Environment temperature sensor, ECU connector, Faulty ECU) | CE lamp ON |



| No. | ECU Pin | PIN description |
|-----|---------|--------------------------------|
| 1 | A102 | Environment temperature Signal |
| 2 | A81 | Environment temperature Ground |

2) Component Location

Not a special location (Normally near the supply module and DEF supply line)



| Environment Temperature sensor | | | |
|--------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 45313 | 4777 |
| 0 | 32 | 5896 | 3667 |
| 25 | 77 | 2057 | 2448 |
| 100 | 212 | 186 | 401 |
| 140 | 284 | 71 | 162 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The signal value of environment temperature sensor is above a threshold. (4.844V)

5) Condition for Clearing the Fault Code

The signal value of environment temperature sensor becomes equal to or lesser than a threshold

6) Check List

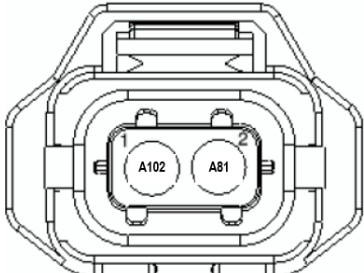
| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|---------------------|------------------|
| 1 | P0073 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check value of Environment temperature sensors by service tool. Is temperature value abnormal? * Variable 1)Environment temperature (EnvT_tSens) | | Change sensor | Step 5 |
| 5 | Check sensor resistance (remove sensor connector and measure the resistance across pins 1 and 2 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0072 | Environment Temperature Sensor Signal Low |

1) Overview

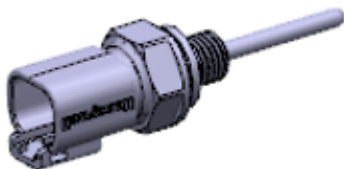
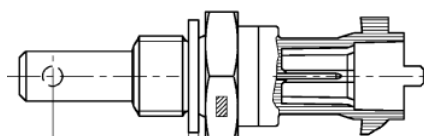
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000171-04 | 1. Electrical problem (Environment temperature sensor connector) 2. Electrical problem (Wiring harness from ECU to environment temperature sensor, Environment temperature sensor, ECU connector, Faulty ECU) | CE lamp ON |

| No. | ECU Pin | PIN description |
|-----|---------|--------------------------------|
| 1 | A102 | Environment temperature Signal |
| 2 | A81 | Environment temperature Ground |



2) Component Location

Not a special location (Normally near the supply module and DEF supply line)



| Environment Temperature sensor | | | |
|--------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 45313 | 4777 |
| 0 | 32 | 5896 | 3667 |
| 25 | 77 | 2057 | 2448 |
| 100 | 212 | 186 | 401 |
| 140 | 284 | 71 | 162 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The signal value of environment temperature sensor is below a threshold. (0.56V)

5) Condition for Clearing the Fault Code

The signal value of environment temperature sensor becomes equal to or greater than a threshold

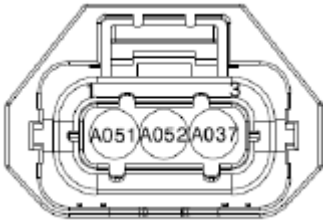
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|---------------------|------------------|
| 1 | P0072 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check value of Environment temperature sensors by service tool. Is temperature value abnormal? * Variable 1)Environment temperature (EnvT_tSens) | | Change sensor | Step 5 |
| 5 | Check sensor resistance (remove sensor connector and measure the resistance across pins 1 and 2 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

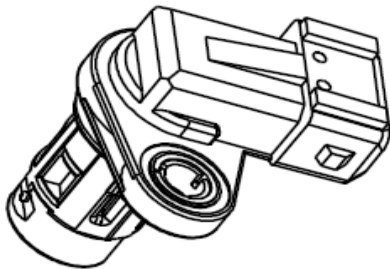
| Fault Code | Fault Name |
|-----------------------|----------------------------|
| P0344 | Cam Signal disturbed fault |

1) Overview

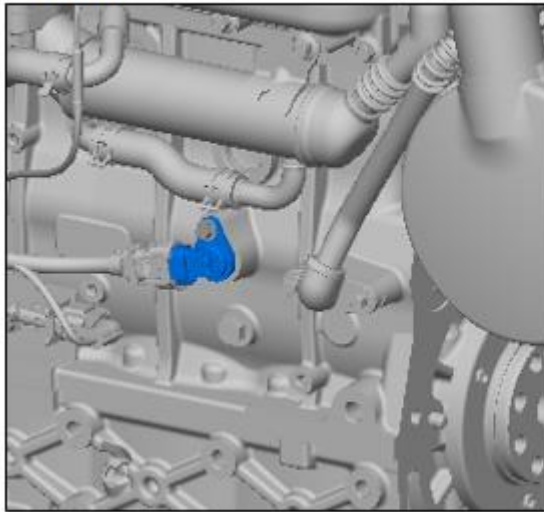
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000637-02 | 1. Electrical problem (CAM sensor connector) 2. Electrical problem (Wiring harness from CAM sensor to ECU, Faulty CAM sensor) 3. Electrical problem (Faulty ECU, ECU connector) 4. Hardware problem (Faulty CAM shaft) | CE lamp ON |

|  | No | ECU Pin | Description |
|---|----|---------|---------------------------------------|
| | 1 | A37 | CAM Shaft Position Sensor Supply (5V) |
| | 2 | A52 | CAM Shaft Position Sensor signal |
| | 3 | A51 | CAM Shaft Position Sensor Ground |

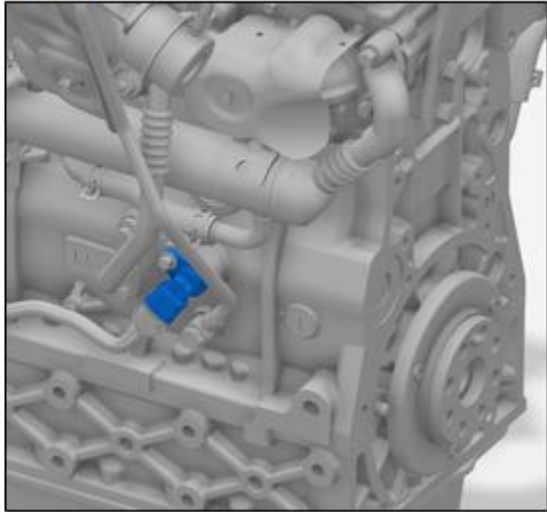
2) Component Location



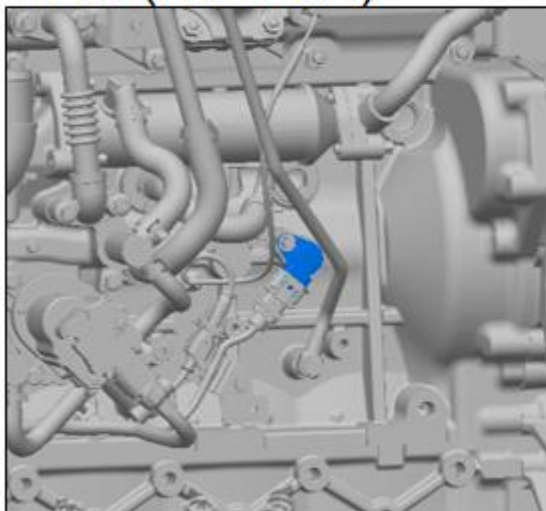
1.8L



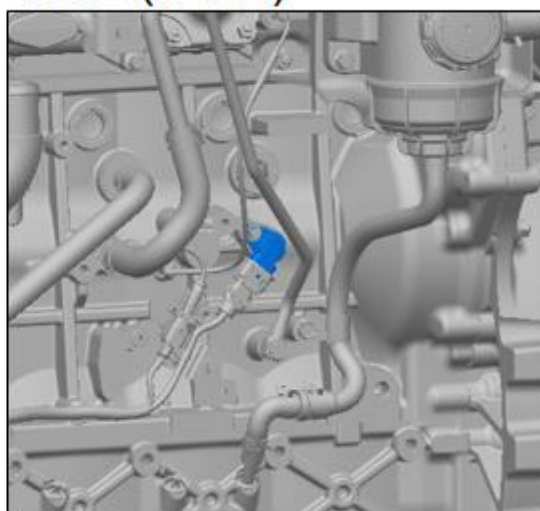
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine Cranking or Running

4) Condition for Setting the Fault Code

In between of several camshaft revolutions there are too many or too less camshaft edges present or the distance or the series of the camshaft edges is implausible.

5) Condition for Clearing the Fault Code

Cam sensor signal is coming normally.

6) Check List

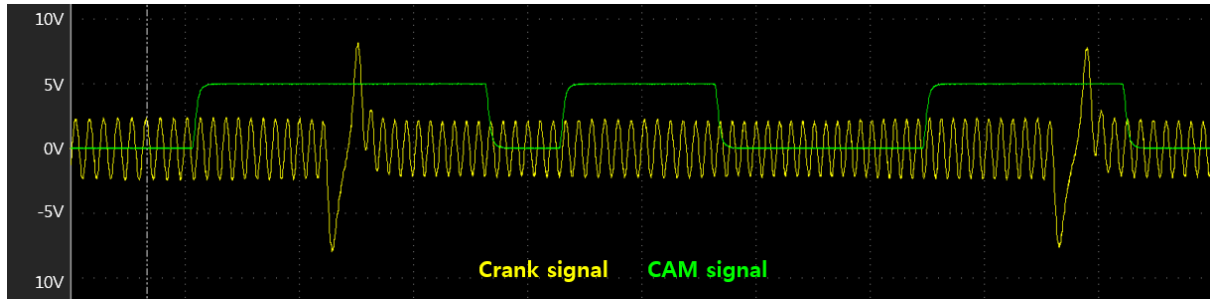
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------------------|----------------|
| 1 | P0344 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | If scope available, display CAM and Crank signals on the scope Signals not conform to template? | | Change CAM or Crank sensor | Step 6 |
| 6 | New sensor connected Problem still present? | | Contact Helpdesk | Problem solved |

* Scope profile

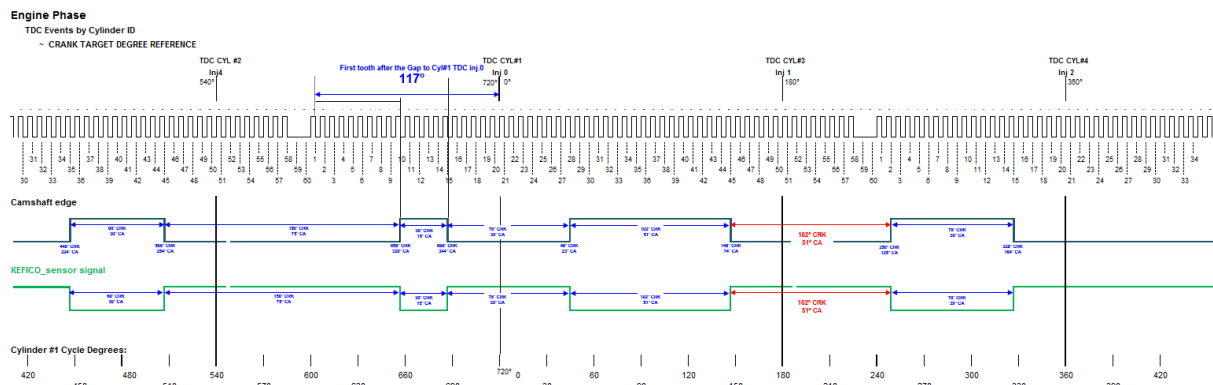
Probe connection : Crank (positive : A20, negative : A21), CAM (Signal : A52, Ground : A51)

Use Insulation piercing clip

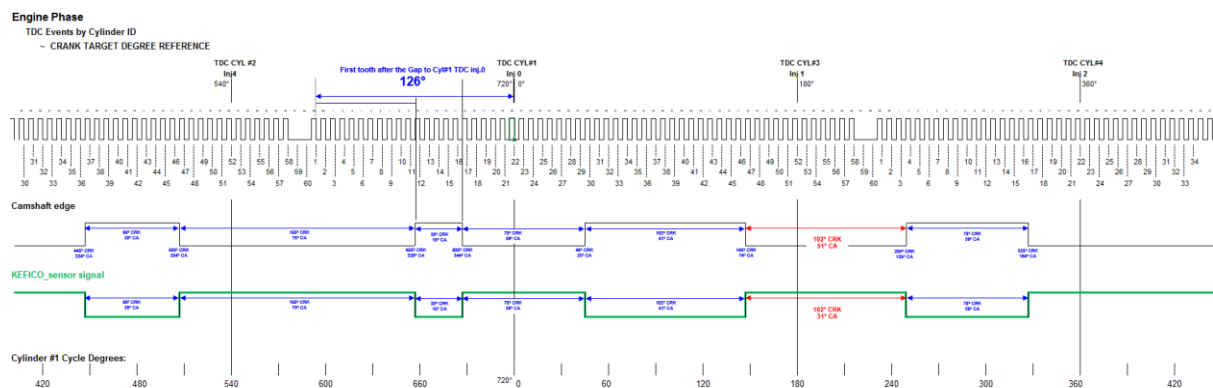
* Example



1) D18/D24 (117deg)



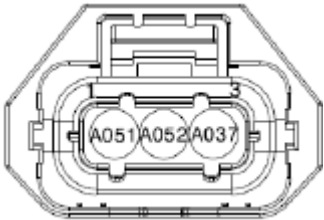
2) D34 (126deg)



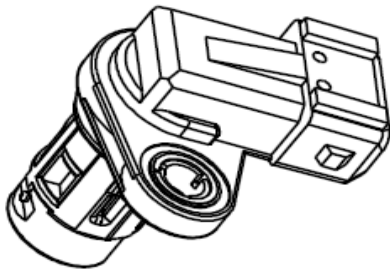
| Fault Code | Fault Name |
|-----------------------|-----------------------|
| P0342 | Cam Signal Lost fault |

1) Overview

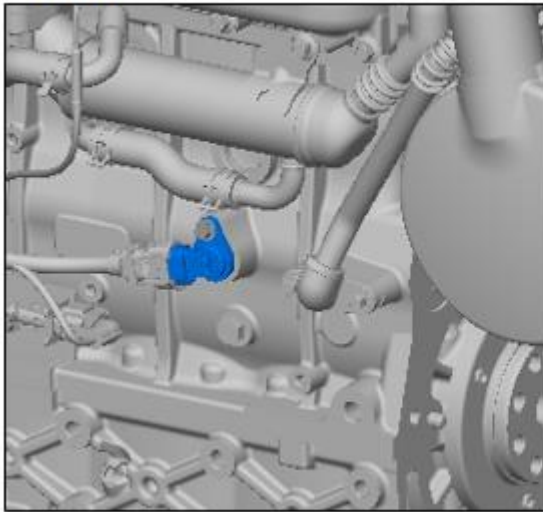
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000637-08 | 1. Electrical problem (CAM sensor connector) 2. Electrical problem (Wiring harness from CAM sensor to ECU, Faulty CAM sensor) 3. Electrical problem (Faulty ECU, ECU connector) 4. Hardware problem (Faulty CAM shaft) | CE lamp ON |

|  | No | ECU Pin | Description |
|---|----|---------|---------------------------------------|
| | 1 | A37 | CAM Shaft Position Sensor Supply (5V) |
| | 2 | A52 | CAM Shaft Position Sensor signal |
| | 3 | A51 | CAM Shaft Position Sensor Ground |

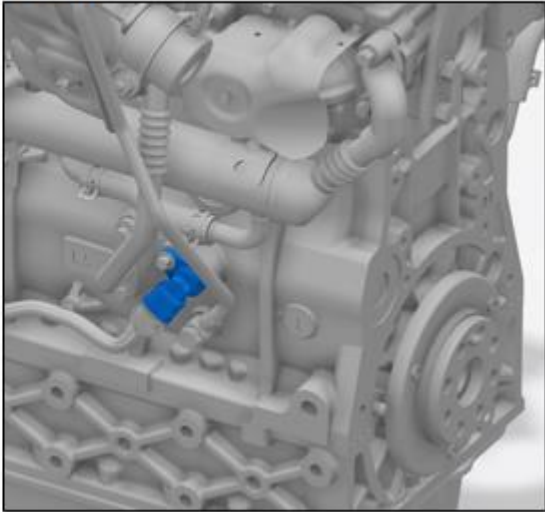
2) Component Location



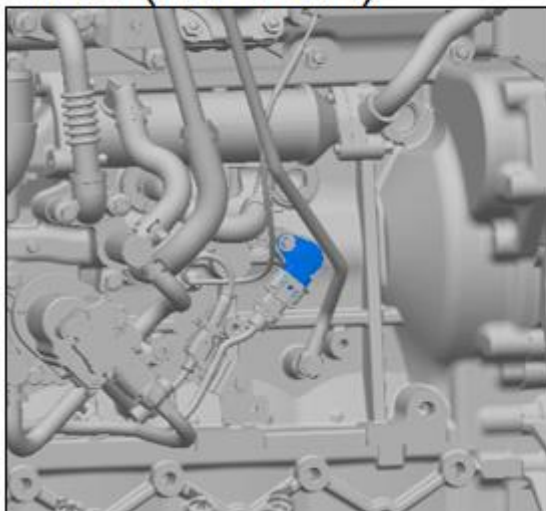
1.8L



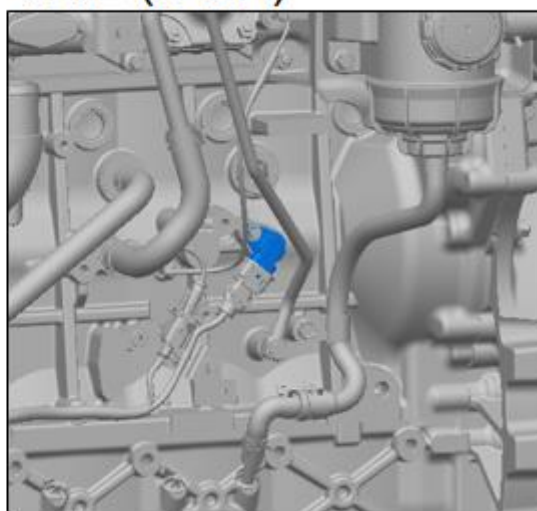
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine Cranking or Running

4) Condition for Setting the Fault Code

In between of several crankshaft revolutions there is not any camshaft edge present

5) Condition for Clearing the Fault Code

Cam sensor signal is coming normally.

6) Check List

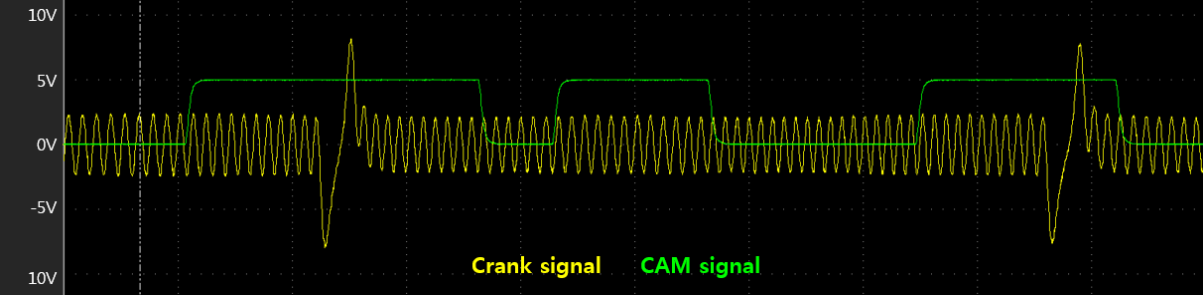
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------------------|----------------|
| 1 | P0342 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | If scope available, display CAM and Crank signals on the scope Signals not conform to template? | | Change CAM or Crank sensor | Step 6 |
| 6 | New sensor connected Problem still present? | | Contact Helpdesk | Problem solved |

* Scope profile

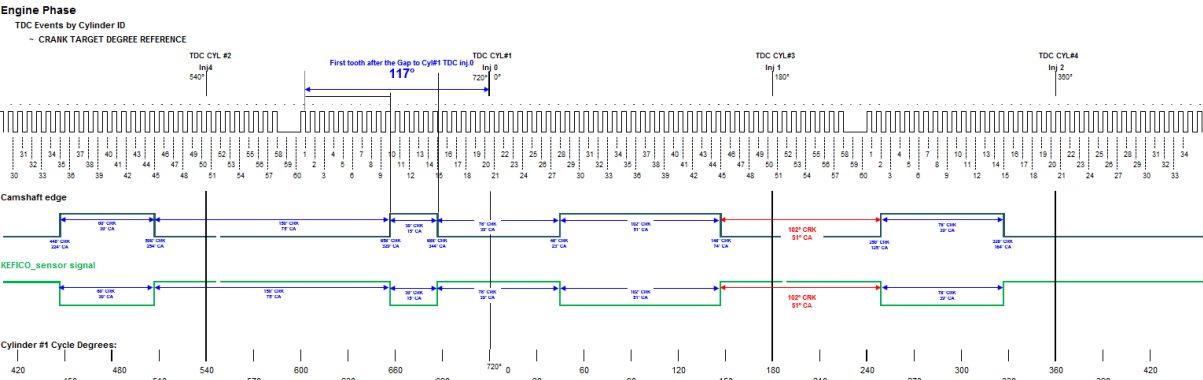
Probe connection : Crank (positive : A20, negative : A21), CAM (Signal : A52, Ground : A51)

Use Insulation piercing clip

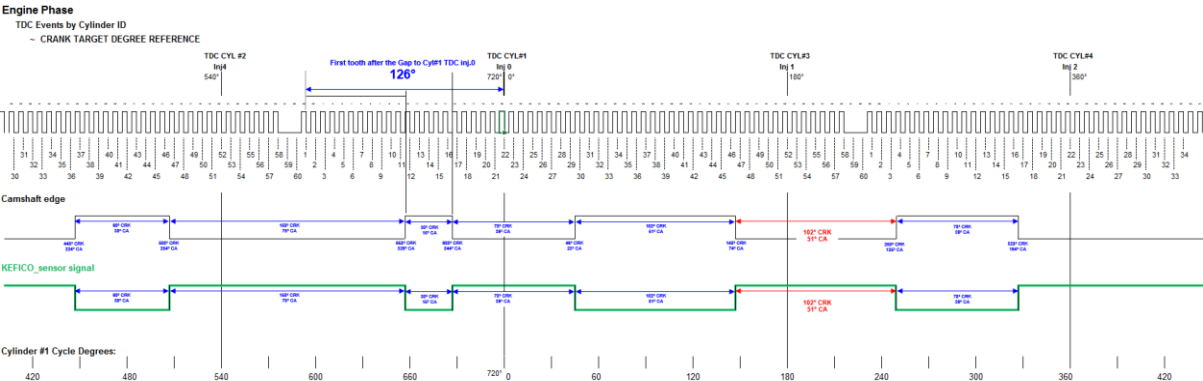
* Example



1) D18/D24 (117deg)



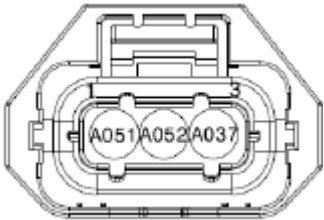
2) D34 (126deg)



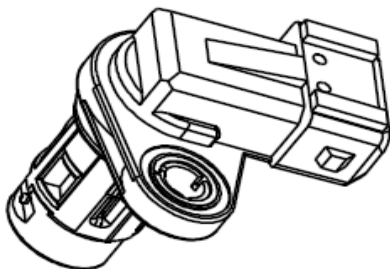
| Fault Code | Fault Name |
|-----------------------|------------------------|
| P0340 | Cam Signal Drift Fault |

1) Overview

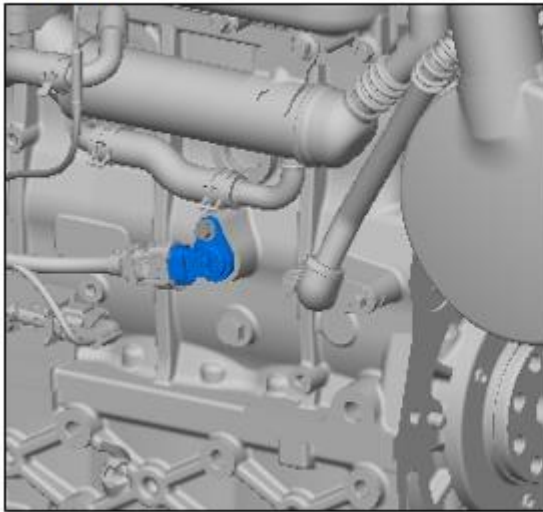
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000637-30 | 1. Electrical problem (CAM sensor connector) 2. Electrical problem (Wiring harness from CAM sensor to ECU, Faulty CAM sensor) 3. Electrical problem (Faulty ECU, ECU connector) 4. Hardware problem (Faulty CAM shaft) | CE lamp ON |

|  | No | ECU Pin | Description |
|---|----|---------|---------------------------------------|
| | 1 | A37 | CAM Shaft Position Sensor Supply (5V) |
| | 2 | A52 | CAM Shaft Position Sensor signal |
| | 3 | A51 | CAM Shaft Position Sensor Ground |

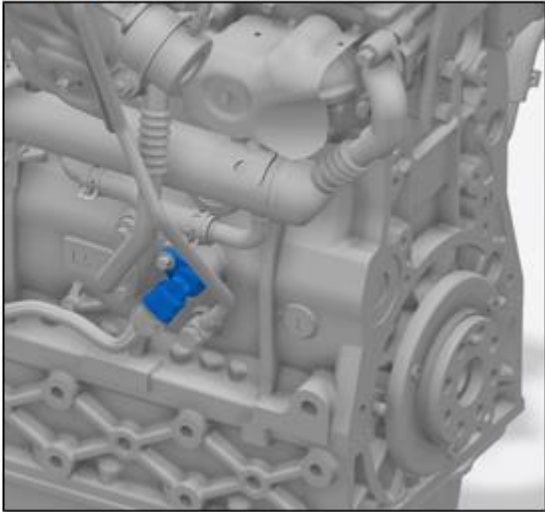
2) Component Location



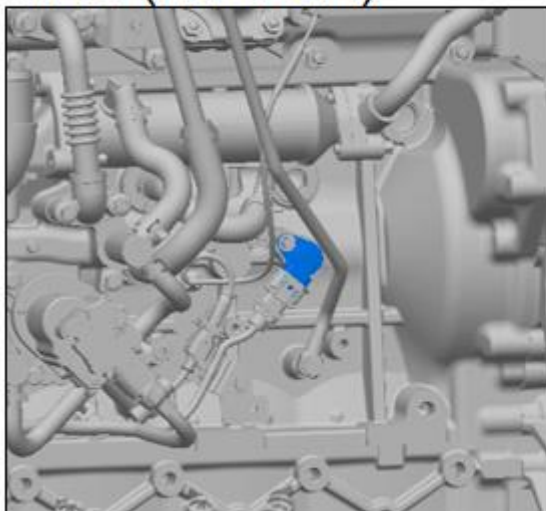
1.8L



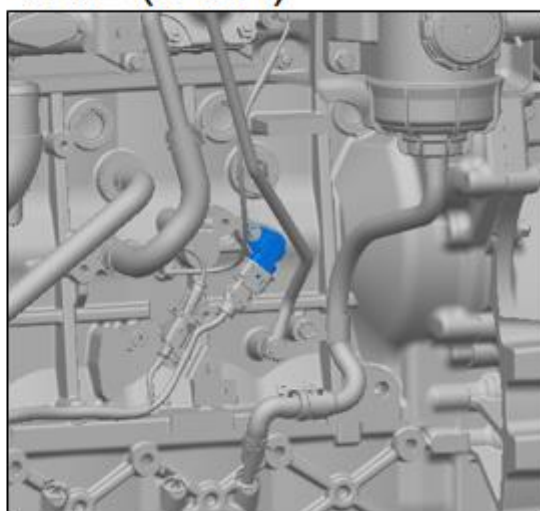
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine Cranking or Running

4) Condition for Setting the Fault Code

Cam signal drift higher than threshold.

5) Condition for Clearing the Fault Code

Cam sensor signal is coming normally.

6) Check List

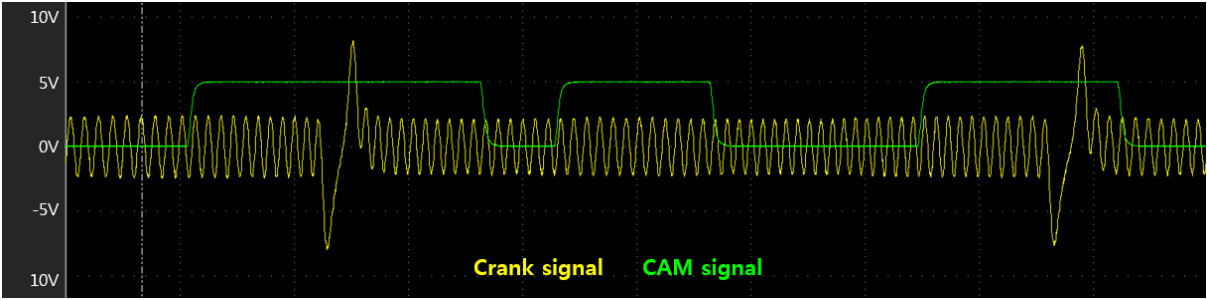
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------------------|----------------|
| 1 | P0340 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | If scope available, display CAM and Crank signals on the scope Signals not conform to template? | | Change CAM or Crank sensor | Step 6 |
| 6 | New sensor connected Problem still present? | | Contact Helpdesk | Problem solved |

* Scope profile

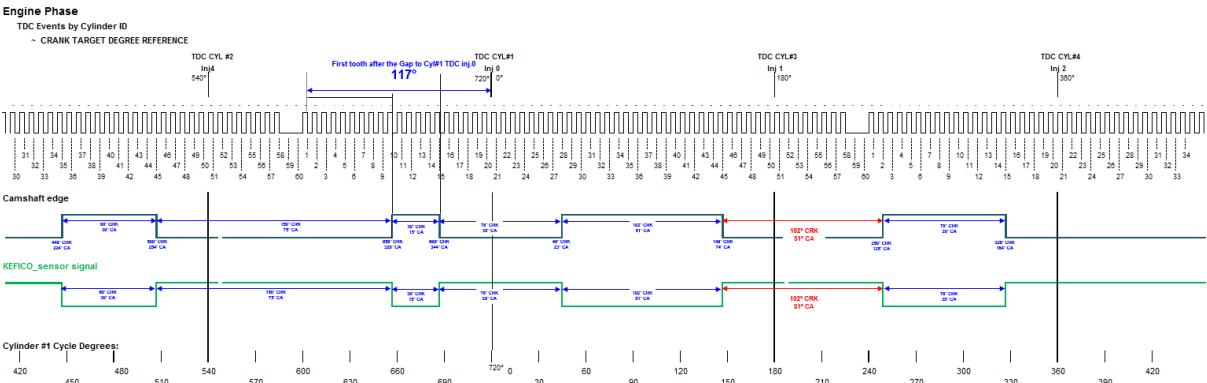
Probe connection : Crank (positive : A20, negative : A21), CAM (Signal : A52, Ground : A51)

Use Insulation piercing clip

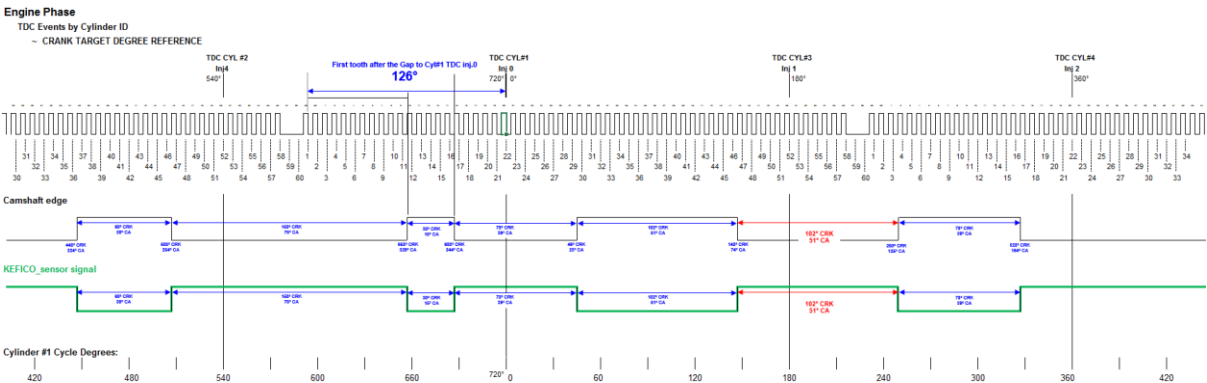
* Example



1) D18/D24 (117deg)



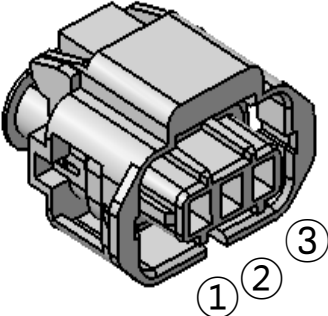
2) D34 (126deg)



| Fault Code | Fault Name |
|-----------------------|------------------------------|
| P0372 | Crank Signal disturbed fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000636-02 | 1. Electrical problem (Crank sensor connector) 2. Electrical problem (Wiring harness from crank sensor to ECU, Faulty crank sensor) 3. Electrical problem (Faulty ECU, ECU connector) 4. Hardware problem (Faulty Timing wheel) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

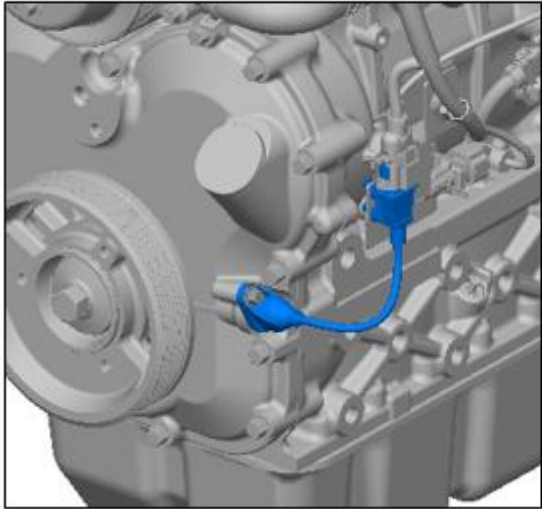


| No | ECU Pin | Description |
|----|---------|------------------|
| 1 | A20 | Crank Sensor Pos |
| 2 | A21 | Crank Sensor Neg |
| 3 | A57 | Shield |

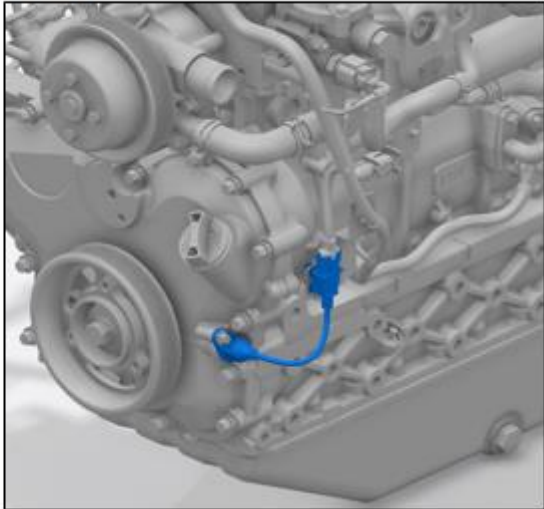
2) Component Location



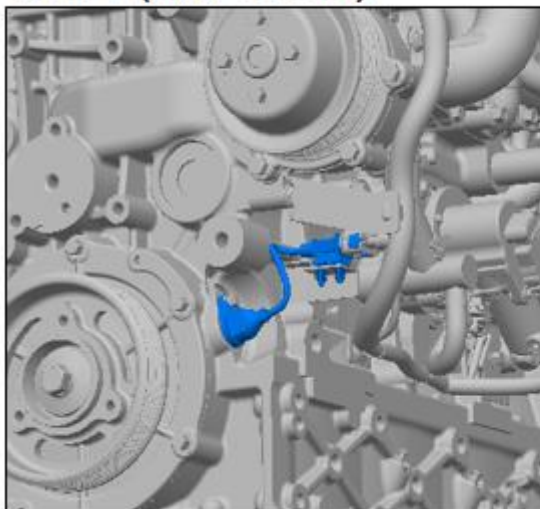
1.8L



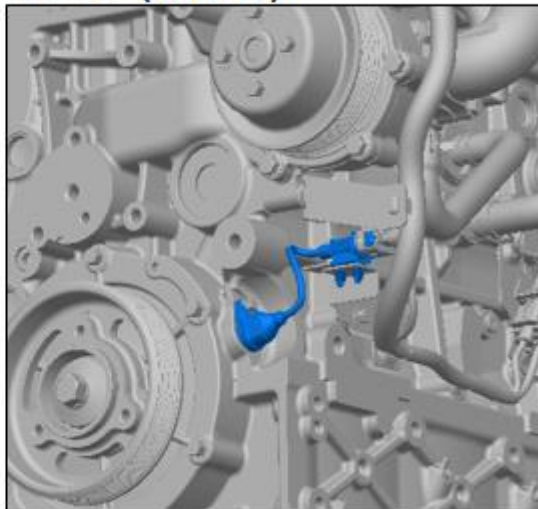
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

During engine running (included cranking mode)

4) Condition for Setting the Fault Code

If the crank shaft signal is disturbed one or more of the reasons.

5) Condition for Clearing the Fault Code

Crank sensor signal is coming as normally.

6) Check List

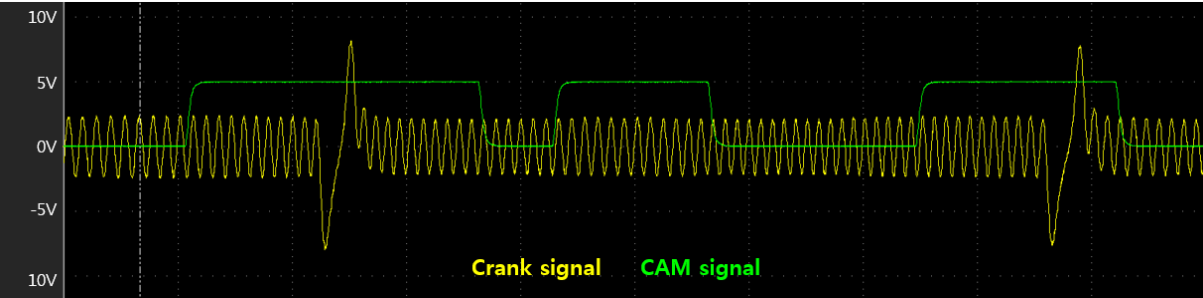
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------------------|----------------|
| 1 | P0372 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | If scope available, display CAM and Crank signals on the scope Signals not conform to template? | | Change CAM or Crank sensor | Step 6 |
| 6 | New sensor connected Problem still present? | | Change Timing wheel | Step 7 |
| 7 | New Timing wheel fitted Problem still present? | | Contact Helpdesk | Problem solved |

* Scope profile

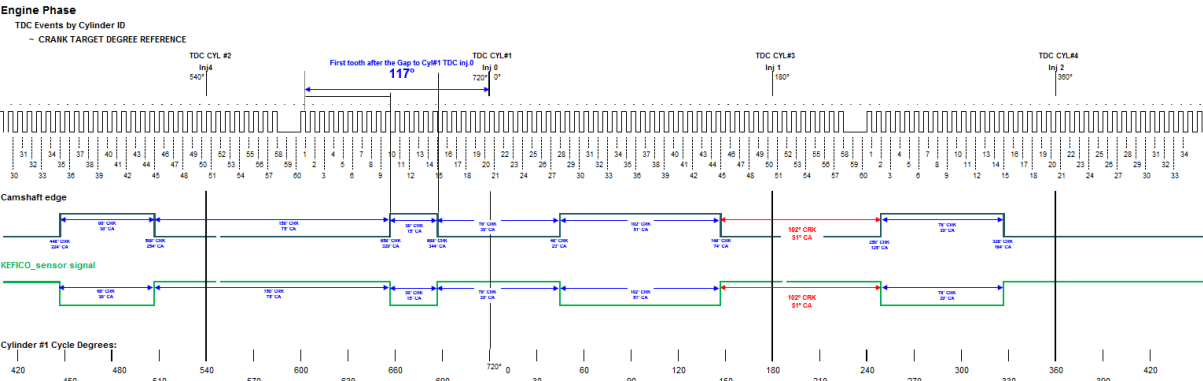
Probe connection : Crank (positive : A20, negative : A21), CAM (Signal : A52, Ground : A51)

Use Insulation piercing clip

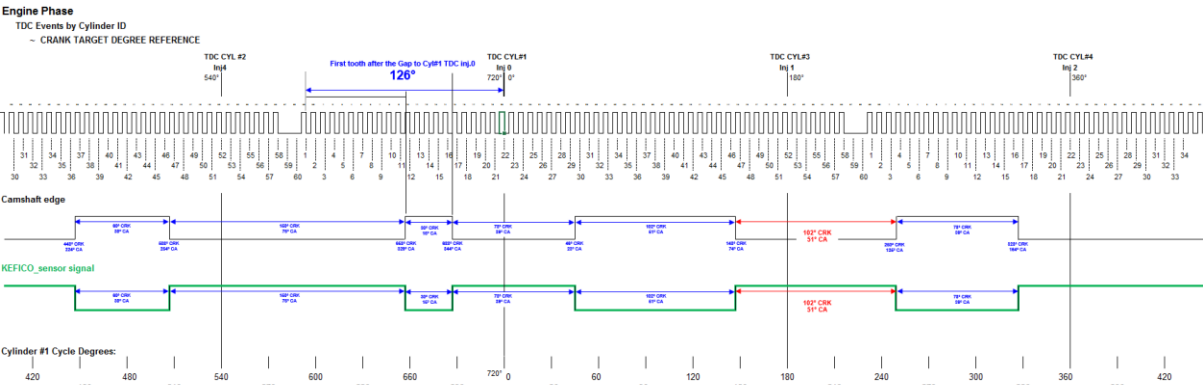
* Example



1) D18/D24 (117deg)



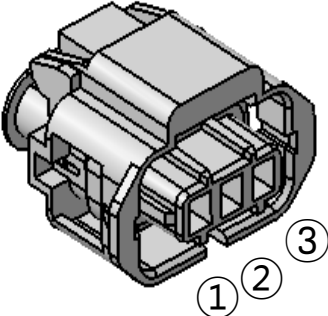
2) D34 (126deg)



| Fault Code | Fault Name |
|-----------------------|------------------------|
| P0374 | Cranks No signal error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000636-08 | 1. Electrical problem (Crank sensor connector) 2. Electrical problem (Wiring harness from crank sensor to ECU, Faulty crank sensor) 3. Electrical problem (Faulty ECU, ECU connector) 4. Hardware problem (Faulty Timing wheel) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

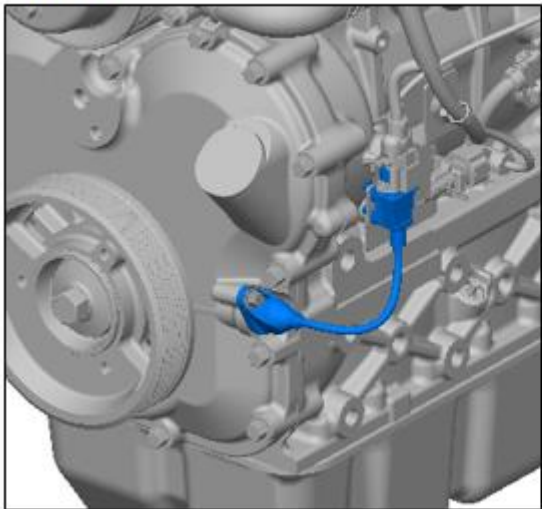


| No | ECU Pin | Description |
|----|---------|------------------|
| 1 | A20 | Crank Sensor Pos |
| 2 | A21 | Crank Sensor Neg |
| 3 | A57 | Shield |

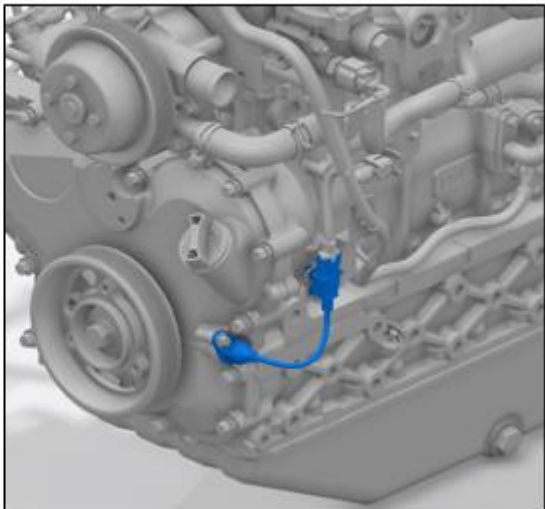
2) Component Location



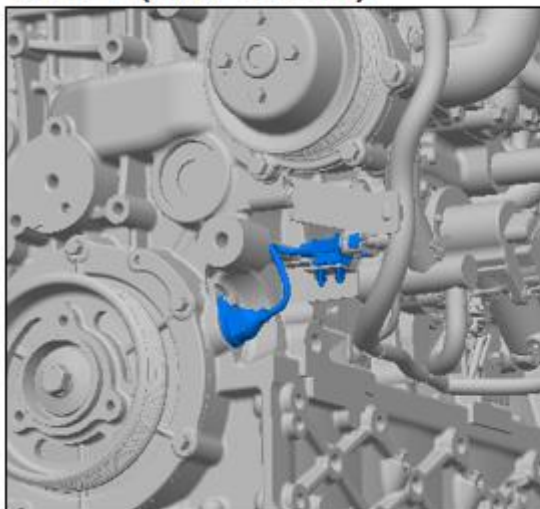
1.8L



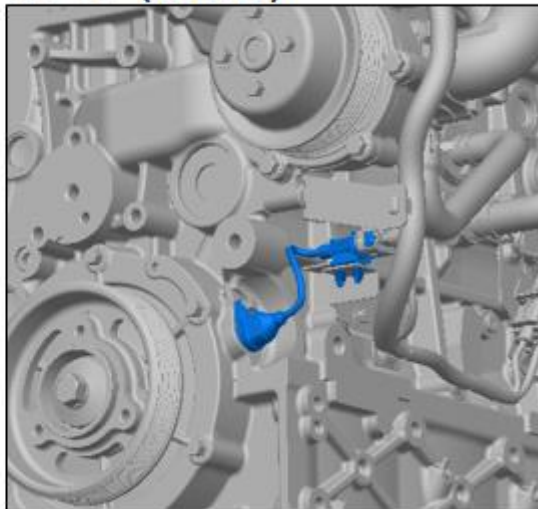
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

During engine running (included cranking mode)

4) Condition for Setting the Fault Code

The engine is rotating but there is no crankshaft signal detectable.

5) Condition for Clearing the Fault Code

Crank sensor signal is coming as normally.

6) Check List

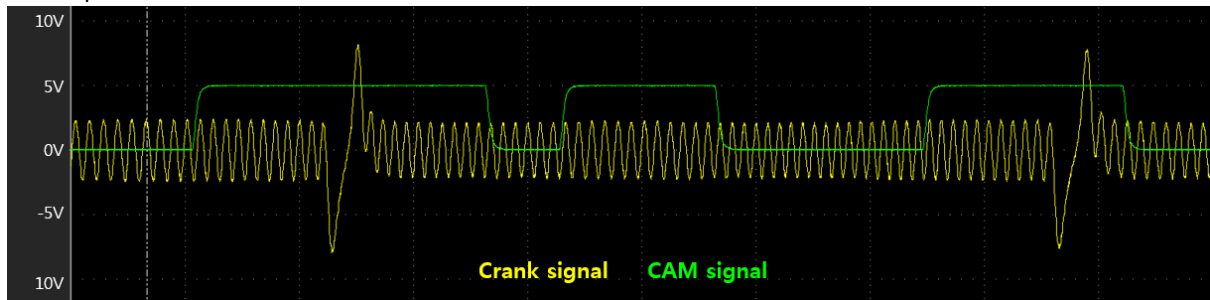
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------------------|----------------|
| 1 | P0374 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | If scope available, display CAM and Crank signals on the scope Signals not conform to template? | | Change CAM or Crank sensor | Step 6 |
| 6 | New sensor connected Problem still present? | | Change Timing wheel | Step 7 |
| 7 | New Timing wheel fitted Problem still present? | | Contact Helpdesk | Problem solved |

* Scope profile

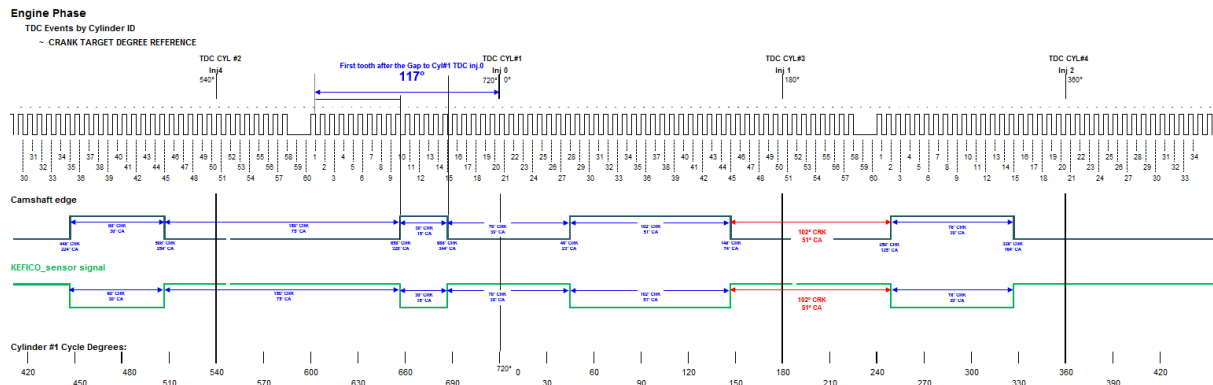
Probe connection : Crank (positive : A20, negative : A21), CAM (Signal : A52, Ground : A51)

Use Insulation piercing clip

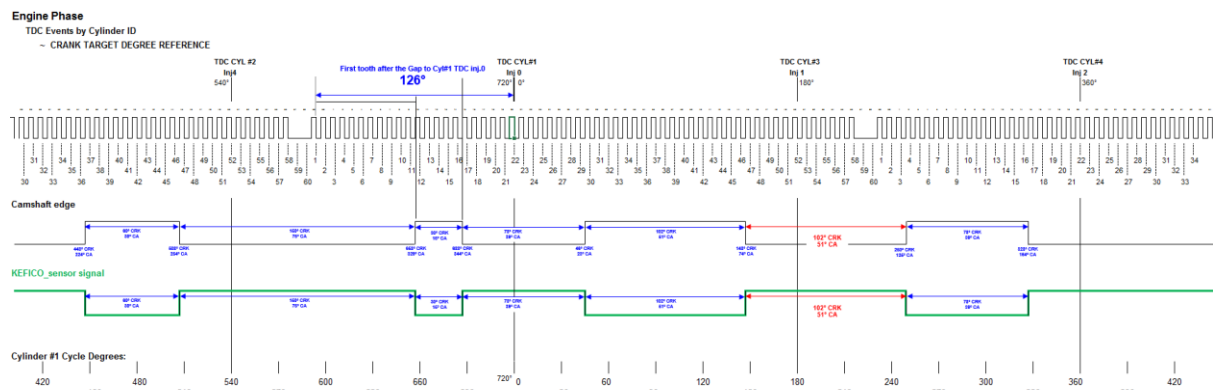
* Example



1) D18/D24 (117deg)



2) D34 (126deg)

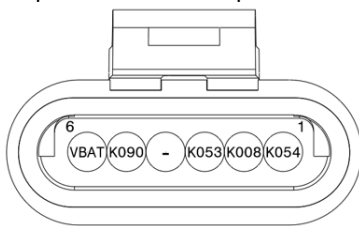


| Fault Code | Fault Name |
|-----------------------|-----------------------------------|
| P028A | PWM FAN Output open circuit fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000975-05 | 1. Electrical problem (FAN controller connector) 2. Electrical problem (Wiring harness from ECU to FAN controller, FAN controller) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

The pin definition is dependent on the FAN type.



| No | ECU Pin | Description |
|----|---------|-----------------------------------|
| 1 | K54 | Auto fan speed sensor ground |
| 2 | K08 | Auto fan speed Sensor Supply (5V) |
| 3 | K53 | Auto fan speed sensor signal |
| 4 | - | Not used |
| 5 | K90 | Auto fan control output PWM (-) |
| 6 | - | 12V supply |

2) Component Location

Fan module location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

The hardware detects an open load error on the PWM output power stage for the Fan actuator.

5) Condition for Clearing the Fault Code

The hardware detects no open load error on the PWM output power stage for the Fan actuator.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P028A is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the FAN module harness connection between ECU and FAN module. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the FAN module. Any damaged FAN module? Change the FAN module Fault code is cleared? | | Problem solved | Contact Helpdesk |

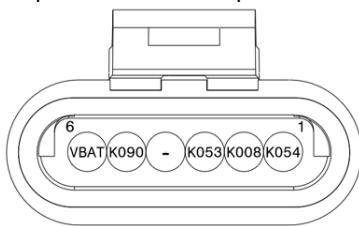
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P028E | PWM FAN Output short to battery circuit fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000975-03 | 1. Electrical problem (FAN controller connector) 2. Electrical problem (Wiring harness from ECU to FAN controller, FAN controller) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

The pin definition is dependent on the FAN type.



| No | ECU Pin | Description |
|----|---------|-----------------------------------|
| 1 | K54 | Auto fan speed sensor ground |
| 2 | K08 | Auto fan speed Sensor Supply (5V) |
| 3 | K53 | Auto fan speed sensor signal |
| 4 | - | Not used |
| 5 | K90 | Auto fan control output PWM (-) |
| 6 | - | 12V supply |

2) Component Location

Fan module location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The hardware detects a short circuit to battery error on the PWM output power stage for the Fan actuator.

5) Condition for Clearing the Fault Code

The hardware detects no short circuit to battery error on the PWM output power stage for the Fan

actuator.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P028E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the FAN module harness connection between ECU and FAN module. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the FAN module. Any damaged FAN module? Change the FAN module Fault code is cleared? | | Problem solved | Contact Helpdesk |

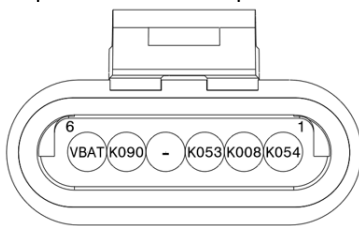
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P028D | PWM FAN Output short to ground circuit fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000975-04 | 1. Electrical problem (FAN controller connector) 2. Electrical problem (Wiring harness from ECU to FAN controller, FAN controller) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

The pin definition is dependent on the FAN type.



| No | ECU Pin | Description |
|----|---------|-----------------------------------|
| 1 | K54 | Auto fan speed sensor ground |
| 2 | K08 | Auto fan speed Sensor Supply (5V) |
| 3 | K53 | Auto fan speed sensor signal |
| 4 | - | Not used |
| 5 | K90 | Auto fan control output PWM (-) |
| 6 | - | 12V supply |

2) Component Location

Fan module location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The hardware detects a short circuit to ground error on the PWM output power stage for the Fan actuator.

5) Condition for Clearing the Fault Code

The hardware detects no short circuit to ground error on the PWM output power stage for the Fan

actuator.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P028D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the FAN module harness connection between ECU and FAN module. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the FAN module. Any damaged FAN module? Change the FAN module Fault code is cleared? | | Problem solved | Contact Helpdesk |

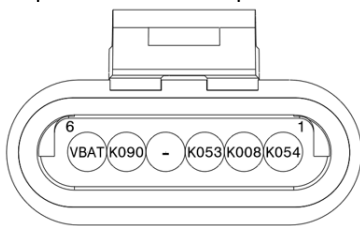
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P0527 | Fan speed signal long period fault path |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001639-11 | 1. Electrical problem (FAN controller connector) 2. Electrical problem (Wiring harness from ECU to FAN controller, FAN controller) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

The pin definition is dependent on the FAN type.



| No | ECU Pin | Description |
|----|---------|-----------------------------------|
| 1 | K54 | Auto fan speed sensor ground |
| 2 | K08 | Auto fan speed Sensor Supply (5V) |
| 3 | K53 | Auto fan speed sensor signal |
| 4 | - | Not used |
| 5 | K90 | Auto fan control output PWM (-) |
| 6 | - | 12V supply |

2) Component Location

Fan module location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

A long period error is detected when the signal period is greater than the maximum measurement limit of the timer

5) Condition for Clearing the Fault Code

The signal period is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0527 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the FAN module harness connection between ECU and FAN module. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the FAN module. Any damaged FAN module? Change the FAN module Fault code is cleared? | | Problem solved | Contact Helpdesk |

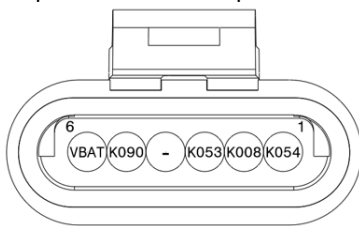
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--------------------------|
| P0528 | Fan speed too high fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001639-03 | 1. Electrical problem (FAN controller connector) 2. Electrical problem (Wiring harness from ECU to FAN controller, FAN controller) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

The pin definition is dependent on the FAN type.



| No | ECU Pin | Description |
|----|---------|-----------------------------------|
| 1 | K54 | Auto fan speed sensor ground |
| 2 | K08 | Auto fan speed Sensor Supply (5V) |
| 3 | K53 | Auto fan speed sensor signal |
| 4 | - | Not used |
| 5 | K90 | Auto fan control output PWM (-) |
| 6 | - | 12V supply |

2) Component Location

Fan module location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The FAN speed is higher than the maximum threshold.

5) Condition for Clearing the Fault Code

The FAN speed is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0528 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the FAN module harness connection between ECU and FAN module. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the FAN module. Any damaged FAN module? Change the FAN module Fault code is cleared? | | Problem solved | Contact Helpdesk |

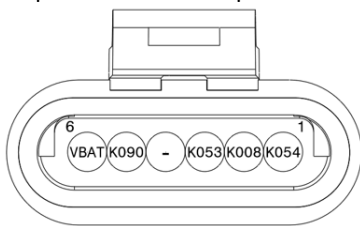
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|-------------------------|
| P0529 | Fan speed too low fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001639-04 | 1. Electrical problem (FAN controller connector) 2. Electrical problem (Wiring harness from ECU to FAN controller, FAN controller) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

The pin definition is dependent on the FAN type.



| No | ECU Pin | Description |
|----|---------|-----------------------------------|
| 1 | K54 | Auto fan speed sensor ground |
| 2 | K08 | Auto fan speed Sensor Supply (5V) |
| 3 | K53 | Auto fan speed sensor signal |
| 4 | - | Not used |
| 5 | K90 | Auto fan control output PWM (-) |
| 6 | - | 12V supply |

2) Component Location

Fan module location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The FAN speed is lower than the minimum threshold.

5) Condition for Clearing the Fault Code

The FAN speed is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0529 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the FAN module harness connection between ECU and FAN module. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the FAN module. Any damaged FAN module? Change the FAN module Fault code is cleared? | | Problem solved | Contact Helpdesk |

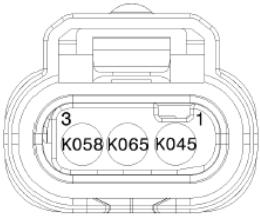
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P01C4 | Fuel Filter Pressure low detection 1 - Warning |

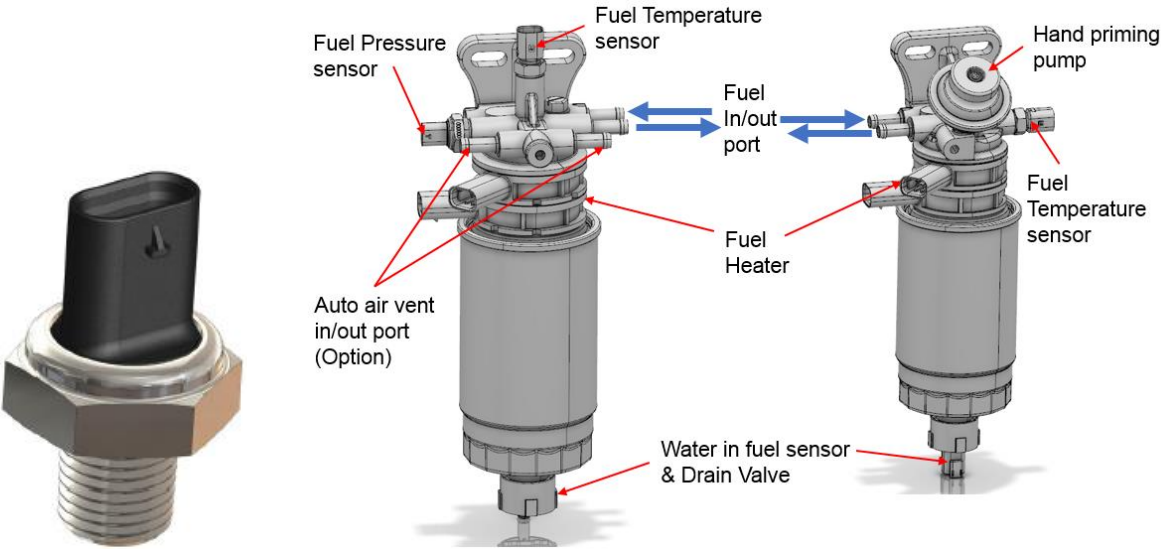
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001382-07 | 1. LPC problem (Fuel filter plugged, Faulty fuel tank cap, Fuel line clogging, Fuel waxing at cold condition, No fuel, Fuel electric feed pump failure) 2. Electrical problem (Electric fuel feed pump connector, Wiring harness from Electric fuel feed pump to ECU, Faulty Electric fuel feed pump) 3. Electrical problem (Fuel filter pressure sensor connector, Wiring harness from Fuel filter pressure sensor to ECU, Faulty fuel filter pressure sensor) 4. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K45 | Fuel filter pressure Sensor Signal |
| 2 | K65 | Fuel filter pressure sensor Ground |
| 3 | K58 | Fuel filter pressure sensor Supply (5V) |



2) Component Location



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

“Fuel filter pressure – Atmospheric pressure” is below than warning threshold. (without E-feed pump <-30kPa)

5) Condition for Clearing the Fault Code

“Fuel filter pressure – Atmospheric pressure” is within normal operation range.

6) Check List

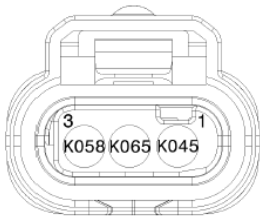
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------------------|----------------|
| 1 | P01C4 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | If the pump is installed, check Electric fuel feed pump connection. Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check wiring connection between pump and ECU (refer to Pin No.) | | Do necessary repair | Step 5 |
| 5 | Replace with another Electric fuel feed pump Pump problem? | | Replace Electric fuel feed pump | Step 6 |
| 6 | Check wiring connection between sensor and ECU (refer to Pin No.) | | Do necessary repair | Step 7 |
| 7 | Replace with another normal sensor Sensor problem? | | Replace sensor | Step 8 |
| 8 | Check fuel line (included fuel filter, E-feed pump, overflow valve, bypass valve, fuel tank). Something block the fuel line from tank, this fault can be happened. Check fuel tank inside also. | | Do necessary repair | Step 9 |
| 9 | Replace fuel filter sensor and erase the faults. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault occurred? | | Contact Helpdesk | Problem solved |

| Fault Code | Fault Name |
|-----------------------|---|
| P01C5 | Fuel Filter Pressure low detection 2 - Torque reduction |

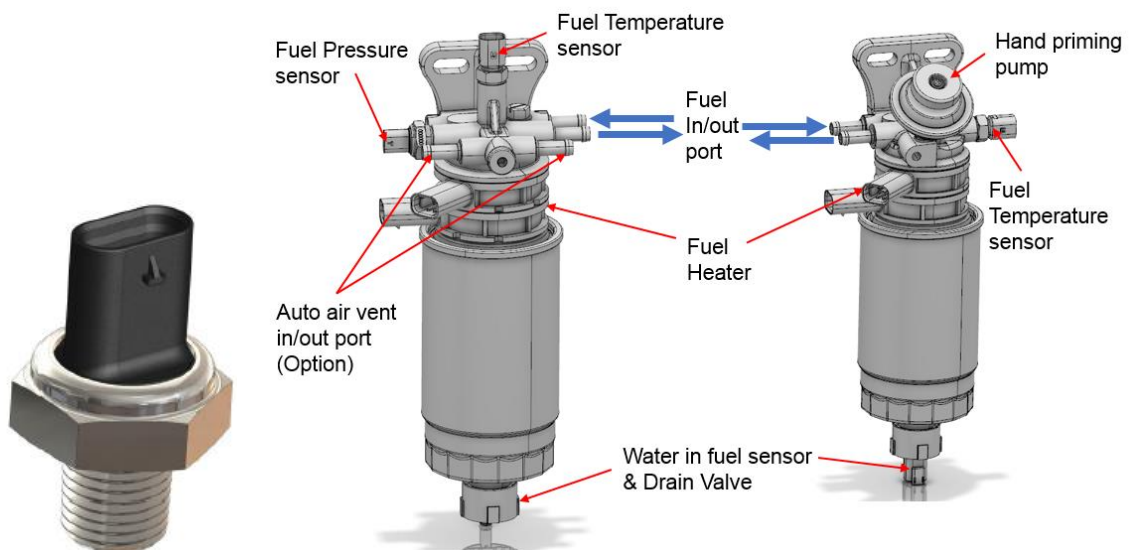
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E001382-13 | 1. LPC problem (Fuel filter plugged, Faulty fuel tank cap, Fuel line clogging, Fuel waxing at cold condition, No fuel, Fuel electric feed pump failure) 2. Electrical problem (Electric fuel feed pump connector, Wiring harness from Electric fuel feed pump to ECU, Faulty Electric fuel feed pump) 3. Electrical problem (Fuel filter pressure sensor connector, Wiring harness from Fuel filter pressure sensor to ECU, Faulty fuel filter pressure sensor) 4. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K45 | Fuel filter pressure Sensor Signal |
| 2 | K65 | Fuel filter pressure sensor Ground |
| 3 | K58 | Fuel filter pressure sensor Supply (5V) |



2) Component Location



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

“Fuel filter pressure – Atmospheric pressure” is below than torque reduction threshold. (without E-feed pump <-35kPa)

5) Condition for Clearing the Fault Code

“Fuel filter pressure – Atmospheric pressure” is within normal operation range.

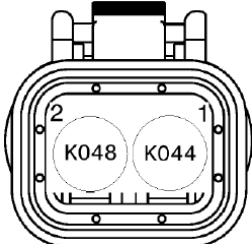
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------------------|----------------|
| 1 | P01C5 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | If the pump is installed, check Electric fuel feed pump connection. Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check wiring connection between pump and ECU (refer to Pin No.) | | Do necessary repair | Step 5 |
| 5 | Replace with another Electric fuel feed pump Pump problem? | | Replace Electric fuel feed pump | Step 6 |
| 6 | Check wiring connection between sensor and ECU (refer to Pin No.) | | Do necessary repair | Step 7 |
| 7 | Replace with another normal sensor Sensor problem? | | Replace sensor | Step 8 |
| 8 | Check fuel line (included fuel filter, E-feed pump, overflow valve, bypass valve, fuel tank). Something block the fuel line from tank, this fault can be happened. Check fuel tank inside also. | | Do necessary repair | Step 9 |
| 9 | Replace fuel filter sensor and erase the faults. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault occurred? | | Contact Helpdesk | Problem solved |

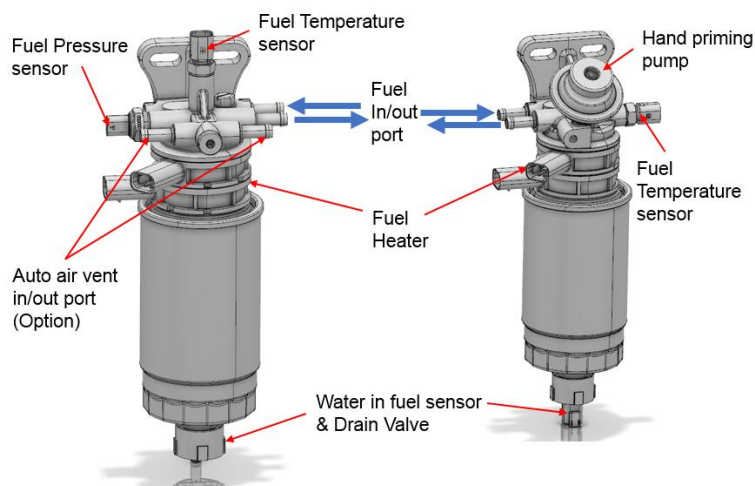
| Fault Code | Fault Name |
|-----------------------|--|
| P2267 | Water In Fuel Sensor signal range high fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000097-03 | 1. Electrical problem (WIF sensor connector) 2. Electrical problem (Wiring harness from WIF to ECU, Faulty WIF sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp Blink Torque Reduction 2(Severe) |

|  | No | ECU Pin | Description |
|---|----|---------|-----------------------------|
| | 1 | K44 | Water In Fuel Sensor Signal |
| | 2 | K48 | Water in Fuel Sensor Ground |

2) Component Location



| Water in fuel sensor | Internal WIF sensor resistance | | |
|------------------------|--------------------------------|----------|----------|
| | Base | Option A | Option B |
| | 82 kohm | 200 kohm | 220 kohm |
| Water detect threshold | < 2.90V | < 3.85V | < 3.78V |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Water in Fuel signal is more than maximum threshold. (4.886V)

5) Condition for Clearing the Fault Code

Water in Fuel signal is within operation range

6) Check List

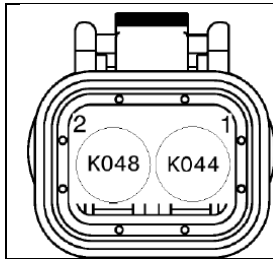
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P2267 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check WIF sensor connection. Problem still present? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Change Sensor Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P2266 | Water In Fuel Sensor signal range low fault |

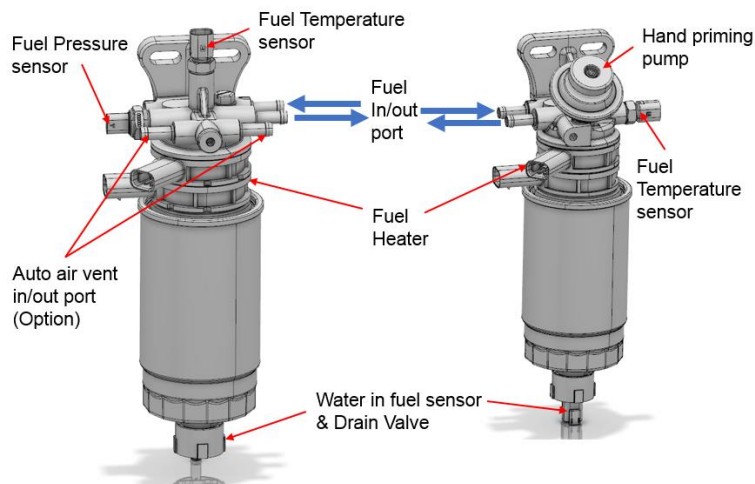
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000097-04 | 1. Electrical problem (WIF sensor connector) 2. Electrical problem (Wiring harness from WIF to ECU, Faulty WIF sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp Blink Torque Reduction 2(Severe) |



| No | ECU Pin | Description |
|----|---------|-----------------------------|
| 1 | K44 | Water In Fuel Sensor Signal |
| 2 | K48 | Water in Fuel Sensor Ground |

2) Component Location



| Water in fuel sensor | Internal WIF sensor resistance | | |
|------------------------|--------------------------------|----------|----------|
| | Base | Option A | Option B |
| | 82 kohm | 200 kohm | 220 kohm |
| Water detect threshold | < 2.90V | < 3.85V | < 3.78V |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Water in Fuel signal is less than minimum threshold. (0.116V)

5) Condition for Clearing the Fault Code

Water in Fuel signal is within operation range

6) Check List

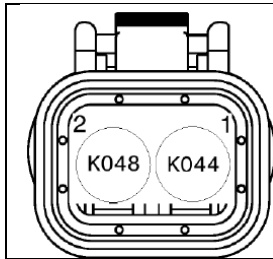
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P2266 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check WIF sensor connection. Problem still present? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Change Sensor Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P2269 | Water in fuel detected – Warning step |

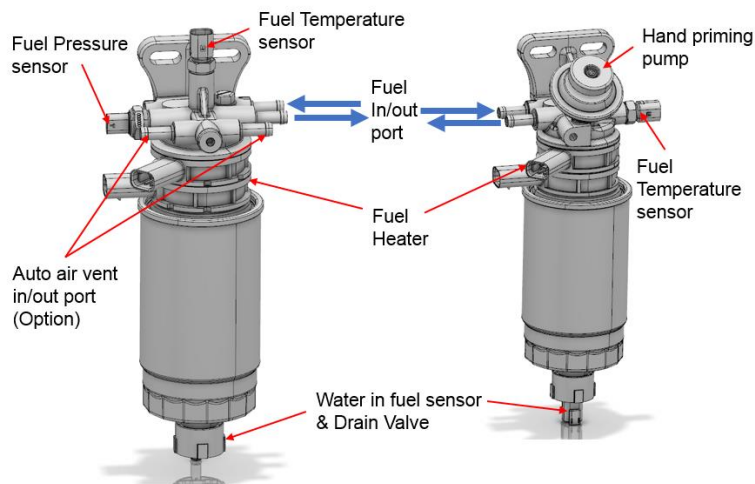
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000097-14 | 1. Water in fuel problem (Water is detected in the fuel filter) 2. Electrical problem (WIF sensor connector, Wiring harness from WIF to ECU, Faulty WIF sensor, Faulty ECU, ECU connector) | CE lamp ON After 20min torque de-rate Torque Reduction 2(Severe) |



| No | ECU Pin | Description |
|----|---------|-----------------------------|
| 1 | K44 | Water In Fuel Sensor Signal |
| 2 | K48 | Water in Fuel Sensor Ground |

2) Component Location



| Water in fuel sensor | Internal WIF sensor resistance | | |
|------------------------|--------------------------------|----------|----------|
| | Base | Option A | Option B |
| | 82 kohm | 200 kohm | 220 kohm |
| Water detect threshold | < 2.90V | < 3.85V | < 3.78V |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Water in Fuel signal is within the threshold to detect water ([Base : <2.90V](#)).

5) Condition for Clearing the Fault Code

Water in Fuel signal is within fuel range

6) Check List

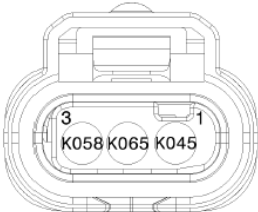
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------------|------------------|
| 1 | P2269 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Open the drain valve to drain the water. Fault is cleared? | | Problem solved | Step4 |
| 4 | Check presence of electrical fault on water in fuel sensor. Electrical problem? | | Do necessary repair | Step 5 |
| 5 | Check water in fuel sensor connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check water in fuel sensor variables Resistance problem? * Variables 1) Water in fuel signal (FI_uWLvlSensRawVal) | | Replace Water-in-Fuel sensor | Step 7 |
| 7 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------|
| P018D | Fuel filter pressure high fault |

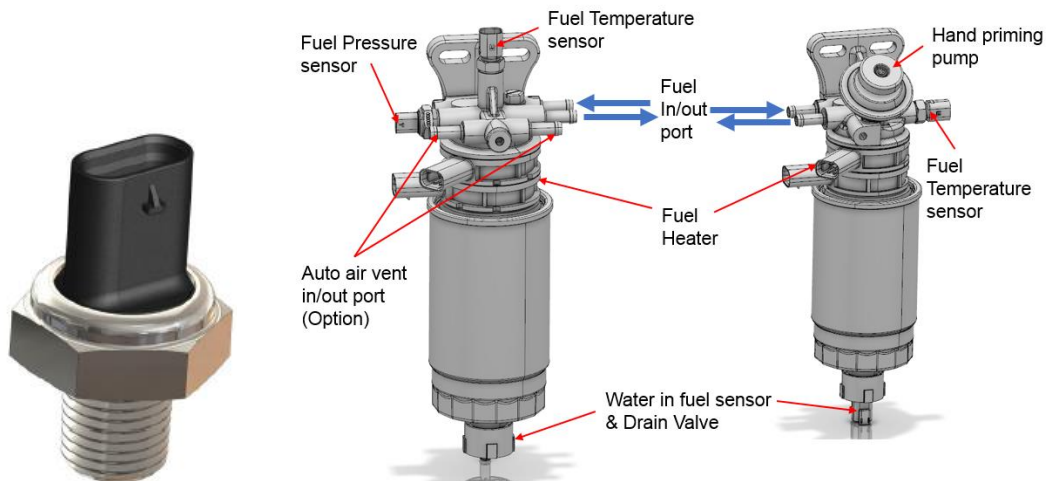
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E001382-00 | 1. LPC problem (Overflow valve failure) 2. Electrical problem (Fuel filter pressure sensor connector, Wiring harness from Fuel filter pressure sensor to ECU, Faulty fuel filter pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K45 | Fuel filter pressure Sensor Signal |
| 2 | K65 | Fuel filter pressure sensor Ground |
| 3 | K58 | Fuel filter pressure sensor Supply (5V) |



2) Component Location



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Fuel filter pressure is higher than the maximum threshold. (>200kPa)

This fault can be occurred when the overflow valve is clogged failure.

The overflow valve is installed with an electric fuel feed pump and it is located on the front of the main fuel filter as a T-connector.

5) Condition for Clearing the Fault Code

Fuel filter pressure is within operation range.

6) Check List

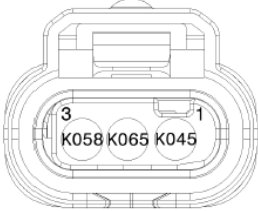
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|------------------------------|-------------------|
| 1 | P018D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the overflow valve Overflow valve clogging problem? | | Replace Overflow valve | Step4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step5 |
| 5 | Check wiring connection between sensor and ECU (refer to Pin No.) | | Do necessary repair | Step 6 |
| 6 | Replace fuel filter sensor and erase the faults. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault occurred? | | Contact Helpdesk | Problem solved |

| Fault Code | Fault Name |
|-----------------------|--------------------------------|
| P018C | Fuel filter pressure low fault |

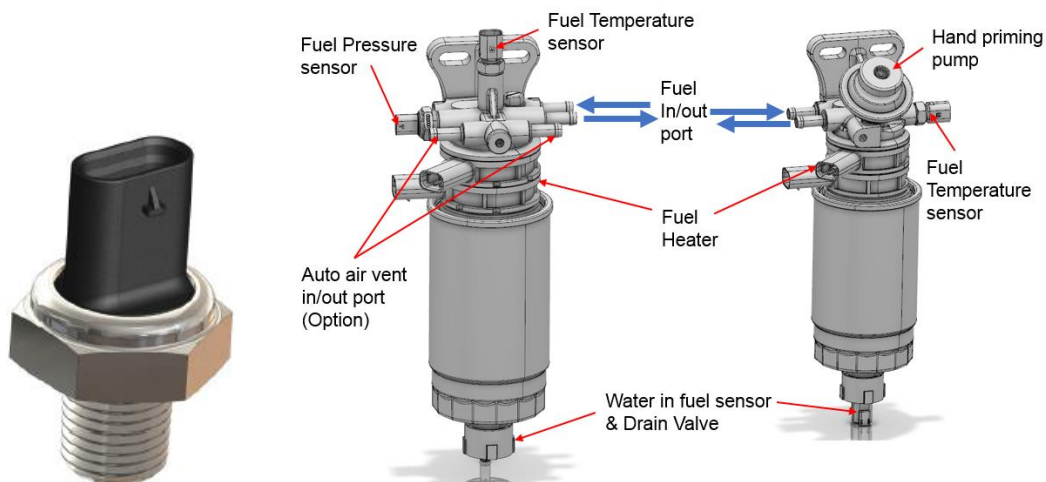
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E001382-01 | 1. LPC problem (Fuel filter plugged, Faulty fuel tank cap, Fuel line clogging, Fuel waxing at cold condition, No fuel, Fuel electric feed pump failure) 2. Electrical problem (Electric fuel feed pump connector, Wiring harness from Electric fuel feed pump to ECU, Faulty Electric fuel feed pump) 3. Electrical problem (Fuel filter pressure sensor connector, Wiring harness from Fuel filter pressure sensor to ECU, Faulty fuel filter pressure sensor) 4. Electrical problem (Faulty ECU, ECU connector) | CE lamp Blink Torque Reduction 2(Severe) |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K45 | Fuel filter pressure Sensor Signal |
| 2 | K65 | Fuel filter pressure sensor Ground |
| 3 | K58 | Fuel filter pressure sensor Supply (5V) |



2) Component Location



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Fuel filter pressure is lower than the minimum threshold. (<50kPa)

5) Condition for Clearing the Fault Code

Fuel filter pressure is within operation range.

6) Check List

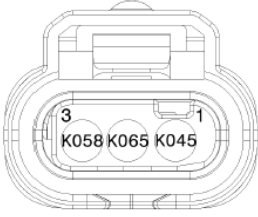
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------------------|----------------|
| 1 | P018C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | If the pump is installed, check Electric fuel feed pump connection. Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check wiring connection between pump and ECU (refer to Pin No.) | | Do necessary repair | Step 5 |
| 5 | Replace with another Electric fuel feed pump Pump problem? | | Replace Electric fuel feed pump | Step 6 |
| 6 | Check wiring connection between sensor and ECU (refer to Pin No.) | | Do necessary repair | Step 7 |
| 7 | Replace with another normal sensor Sensor problem? | | Replace sensor | Step 8 |
| 8 | Check fuel line (included fuel filter, E-feed pump, overflow valve, bypass valve, fuel tank). Something block the fuel line from tank, this fault can be happened. Check fuel tank inside also. | | Do necessary repair | Step 9 |
| 9 | Replace fuel filter sensor and erase the faults. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault occurred? | | Contact Helpdesk | Problem solved |

| Fault Code | Fault Name |
|-----------------------|---|
| P01C6 | Fuel filter pressure sensor signal high fault |

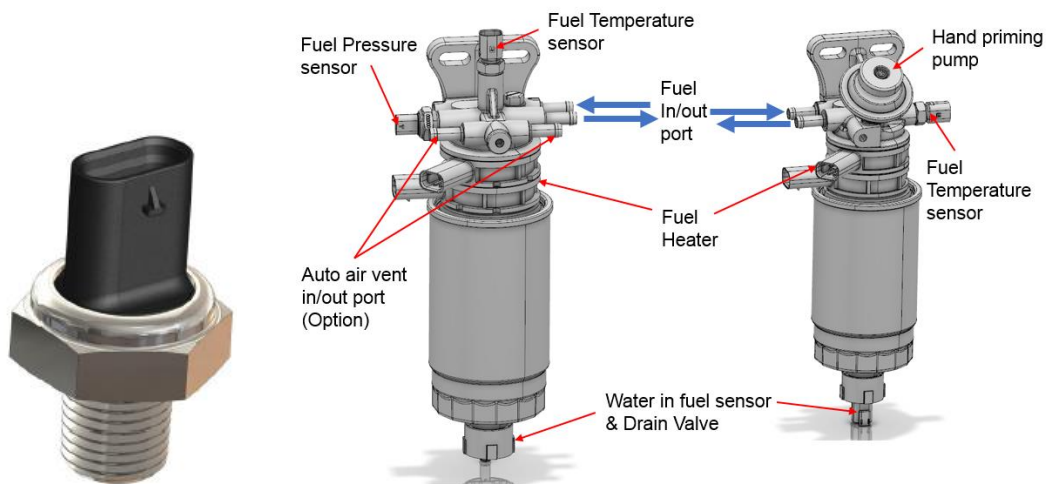
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001382-03 | 1. Electrical problem (Fuel filter pressure sensor connector) 2. Electrical problem (Wiring harness from Fuel filter pressure sensor to ECU, Faulty fuel filter pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K45 | Fuel filter pressure Sensor Signal |
| 2 | K65 | Fuel filter pressure sensor Ground |
| 3 | K58 | Fuel filter pressure sensor Supply (5V) |



2) Component Location



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Fuel filter pressure signal is above than maximum threshold. (4.754V)

5) Condition for Clearing the Fault Code

Fuel filter pressure signal is within operation range.

6) Check List

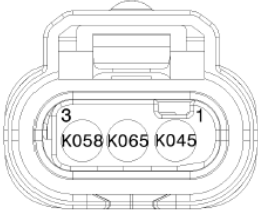
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P01C6 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step4 |
| 4 | Check wiring connection between sensor and ECU (refer to Pin No.) | | Do necessary repair | Step 5 |
| 5 | Replace fuel filter sensor and erase the faults. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault occurred? | | Contact Helpdesk | Problem solved |

| Fault Code | Fault Name |
|-----------------------|--|
| P01C2 | Fuel filter pressure sensor signal low fault |

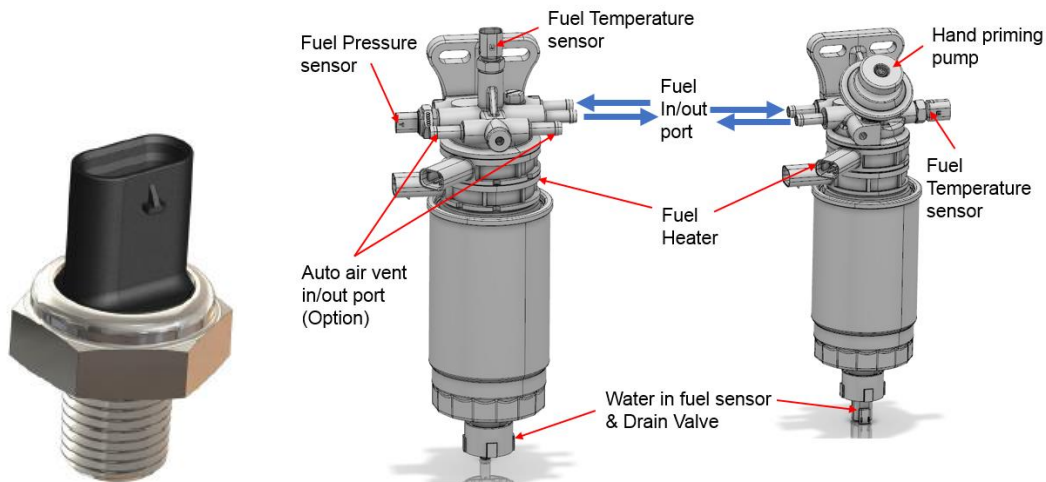
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001382-04 | 1. Electrical problem (Fuel filter pressure sensor connector) 2. Electrical problem (Wiring harness from Fuel filter pressure sensor to ECU, Faulty fuel filter pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K45 | Fuel filter pressure Sensor Signal |
| 2 | K65 | Fuel filter pressure sensor Ground |
| 3 | K58 | Fuel filter pressure sensor Supply (5V) |



2) Component Location



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Fuel filter pressure signal is less than minimum threshold. (0.25V)

5) Condition for Clearing the Fault Code

Fuel filter pressure signal is within operation range.

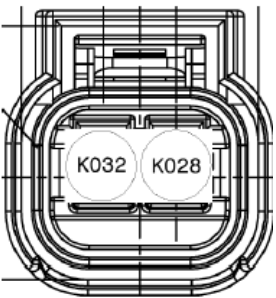
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P01C2 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step4 |
| 4 | Check wiring connection between sensor and ECU (refer to Pin No.) | | Do necessary repair | Step 5 |
| 5 | Replace fuel filter sensor and erase the faults. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault occurred? | | Contact Helpdesk | Problem solved |

| Fault Code | Fault Name |
|-----------------------|-----------------------------|
| P1183 | Fuel Temperature High Fault |

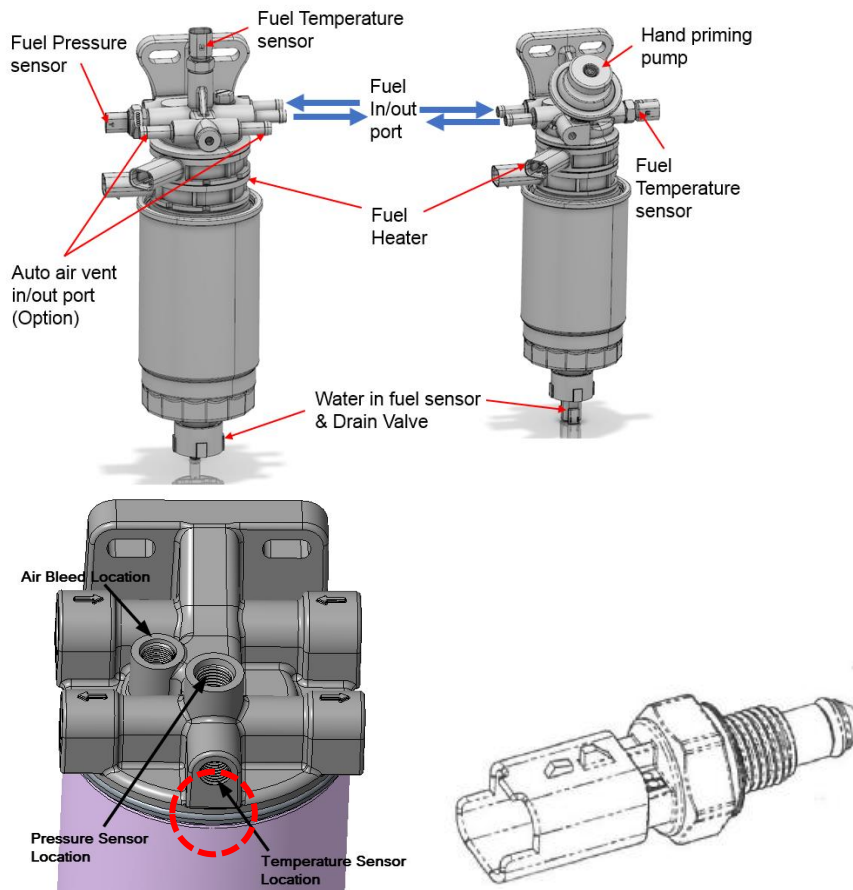
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000174-00 | 1. Fuel temperature is exceeded than engine limit 2. Electrical problem (Fuel temperature sensor connector, Wiring harness from ECU to fuel temperature sensor, Fuel temperature sensor, ECU connector, Faulty ECU) | CE lamp ON Torque reduction (Dependent on temp.) DPF regeneration inhibit by Active and Forced |

| | | | |
|---|----|---------|--------------------------------|
|  | No | ECU Pin | Description |
| | 1 | K28 | Fuel Temperature Sensor Signal |
| | 2 | K32 | Fuel Temperature Sensor Ground |

2) Component Location

The location of sensor is dependent on Fuel filter type.



| Fuel Temperature sensor | | | | | |
|-------------------------|--------|-----------|-----------|-----------|-----------|
| Temperature | | Bosch | | Parker | |
| | | R nominal | V nominal | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] | [ohm] | [mV] |
| -40 | -40 | 40490 | 4868 | 48110 | 4876 |
| 0 | 32 | 5466 | 4102 | 6050 | 4121 |
| 20 | 68 | 2351 | 3293 | 2569 | 3324 |
| 40 | 104 | 1118 | 2377 | 1201 | 2404 |
| 80 | 176 | 313 | 1000 | 331 | 1019 |
| 140 | 284 | 68 | 265 | 73 | 275 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Fuel temperature is higher than normal operation threshold. (80degC)

5) Condition for Clearing the Fault Code

Fuel temperature is below the threshold.

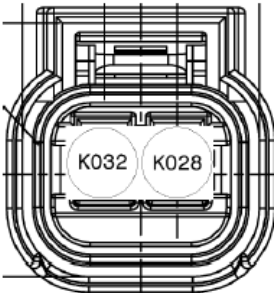
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P1183 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check cooling system included Fuel cooler - Engine cooling system (Cooling FAN & Radiator, Fuel cooler, etc...) (Information : With very hot condition, this fault can be occurred without any engine trouble.) | | Do necessary repair | Step 4 |
| 4 | Change the fuel temperature sensor. Start the engine and set the RPM in high idle, 10minutes. After that set the RPM in low idle, fault code is cleared and torque limited is deactivated? | | Change sensor | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|------------------------------------|
| P0183 | Fuel Temperature Sensor High Fault |

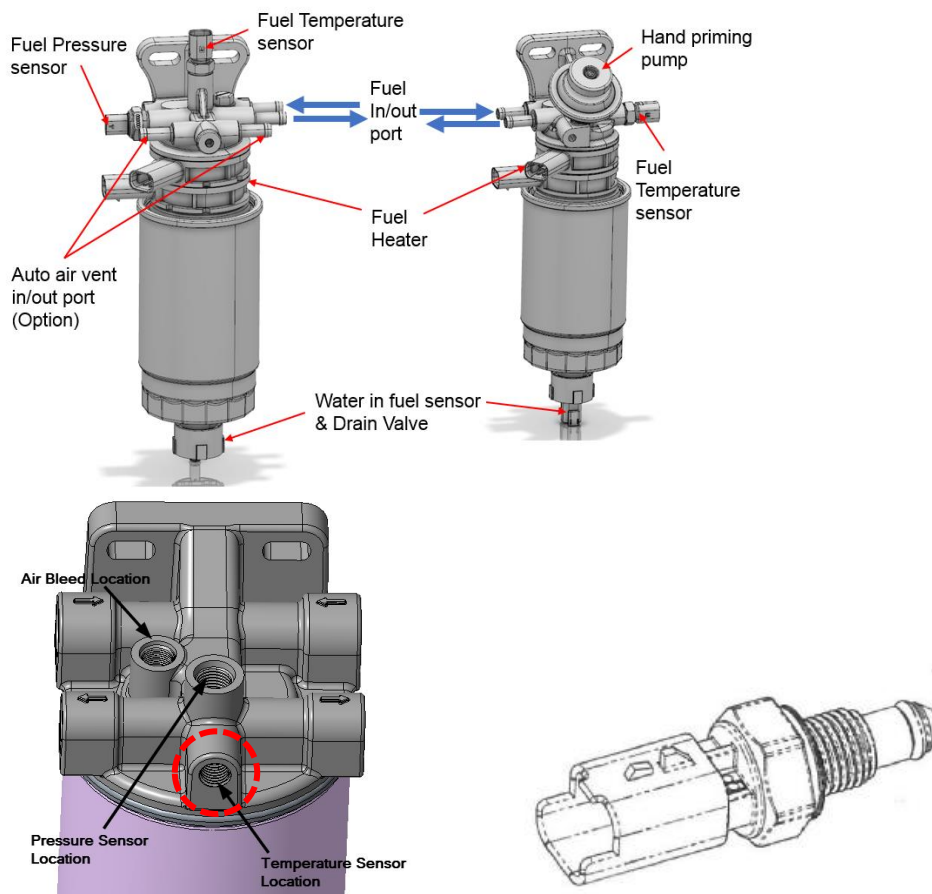
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000174-03 | 1. Electrical problem (Fuel temperature sensor connector) 2. Electrical problem (Wiring harness from fuel temperature sensor to ECU, Faulty fuel temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

|  | No | ECU Pin | Description |
|---|----|---------|--------------------------------|
| | 1 | K28 | Fuel Temperature Sensor Signal |
| | 2 | K32 | Fuel Temperature Sensor Ground |

2) Component Location

The location of sensor is dependent on Fuel filter type.



| Fuel Temperature sensor | | | | | |
|-------------------------|--------|-----------|-----------|-----------|-----------|
| Temperature | | Bosch | | Parker | |
| | | R nominal | V nominal | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] | [ohm] | [mV] |
| -40 | -40 | 40490 | 4868 | 48110 | 4876 |
| 0 | 32 | 5466 | 4102 | 6050 | 4121 |
| 20 | 68 | 2351 | 3293 | 2569 | 3324 |
| 40 | 104 | 1118 | 2377 | 1201 | 2404 |
| 80 | 176 | 313 | 1000 | 331 | 1019 |
| 140 | 284 | 68 | 265 | 73 | 275 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Fuel temperature signal is more than maximum operation threshold. (4.958V)

5) Condition for Clearing the Fault Code

Fuel temperature signal is within normal operation range

6) Check List

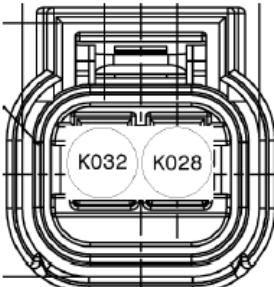
| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|--|------------------|
| 1 | P0183 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check sensor resistance (remove sensor connector and measure the resistance across pins 1 and 2 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|-----------------------------------|
| P0182 | Fuel Temperature Sensor Low Fault |

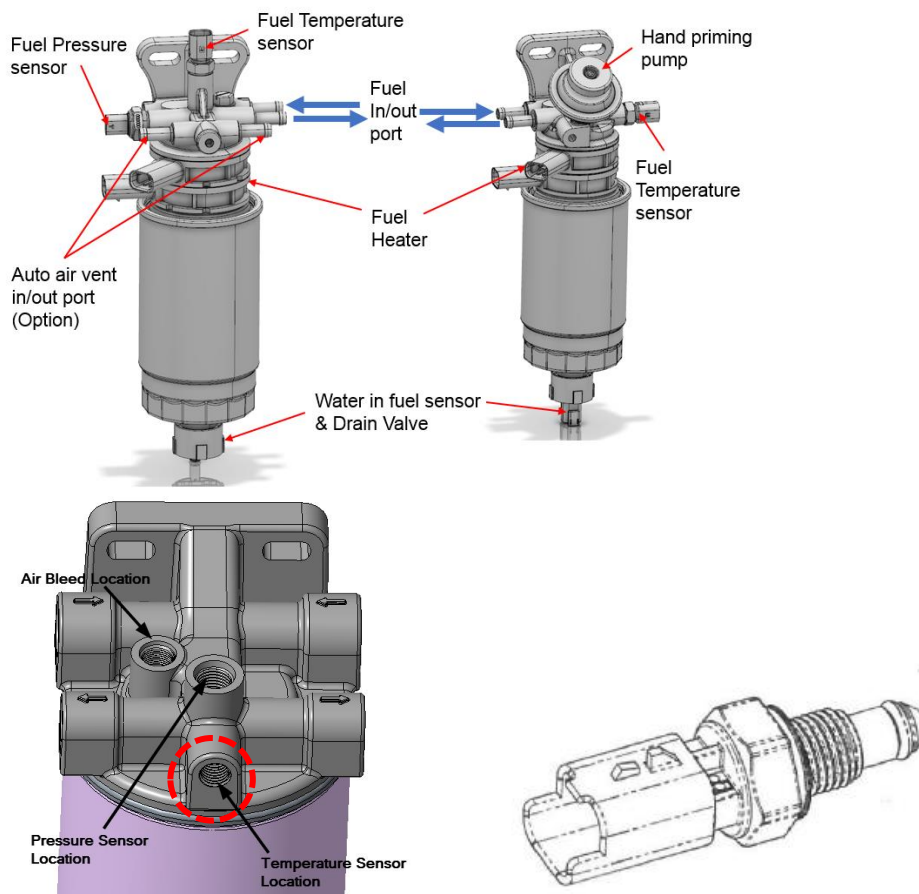
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000174-04 | 1. Electrical problem (Fuel temperature sensor connector) 2. Electrical problem (Wiring harness from fuel temperature sensor to ECU, Faulty fuel temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|----|---------|--------------------------------|
|  | No | ECU Pin | Description |
| | 1 | K28 | Fuel Temperature Sensor Signal |
| | 2 | K32 | Fuel Temperature Sensor Ground |

2) Component Location

The location of sensor is dependent on Fuel filter type.



| Fuel Temperature sensor | | | | | |
|-------------------------|--------|-----------|-----------|-----------|-----------|
| Temperature | | Bosch | | Parker | |
| | | R nominal | V nominal | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] | [ohm] | [mV] |
| -40 | -40 | 40490 | 4868 | 48110 | 4876 |
| 0 | 32 | 5466 | 4102 | 6050 | 4121 |
| 20 | 68 | 2351 | 3293 | 2569 | 3324 |
| 40 | 104 | 1118 | 2377 | 1201 | 2404 |
| 80 | 176 | 313 | 1000 | 331 | 1019 |
| 140 | 284 | 68 | 265 | 73 | 275 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Fuel temperature signal is less than minimum operation threshold. (0.116V)

5) Condition for Clearing the Fault Code

Fuel temperature signal is within normal operation range

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|--|------------------|
| 1 | P0183 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check sensor resistance (remove sensor connector and measure the resistance across pins 1 and 2 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P273F | Transmission oil temperature high fault (CAN) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000177-15 | 1. Cooling problem (Transmission oil over heating) 2. Electrical problem (Connector, Wiring harness, switch) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

Transmission oil temperature sensor location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Transmission oil temperature is above the operation range.

5) Condition for Clearing the Fault Code

Transmission oil temperature is in operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|---------------------|
| 1 | P273F is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check transmission oil temperature Temp is too high? | | Do necessary rest | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P274F | Transmission oil temperature high fault (H/W Switch) |

1) Overview

| CODE | REASON | EFFECT |
|------------|---|--|
| E000177-16 | 1. Cooling problem (Transmission oil over heating) 2. Electrical problem (Connector, Wiring harness, switch) | CE lamp ON Torque Reduction 1(Mild) |

| No | ECU Pin | Description |
|----|---------|-------------------------------------|
| 1 | K85 | Transmission oil temperature switch |

2) Component Location

Transmission oil temperature sensor location and connector is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Transmission oil temperature is above the operation range.

5) Condition for Clearing the Fault Code

Transmission oil temperature is in operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P274F is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check transmission oil temperature Temp is too high? | | Do necessary rest | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-----------------------------|
| P0381 | Glow plug Lamp Open circuit |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E001081-05 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|----------------|
| 1 | K37 | Glow plug Lamp |

2) Component Location

Glowplug lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is opened.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P0381 is detected on service tool? | | Step 2 | |
| 2 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 3 |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------|
| P2381 | Glow plug Lamp Short to Battery |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E001081-03 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|----------------|
| 1 | K37 | Glow plug Lamp |

2) Component Location

Glowplug lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to battery.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P2381 is detected on service tool? | | Step 2 | |
| 2 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 3 |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------|
| P1904 | Glow plug Lamp Short to Ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E001081-04 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|----------------|
| 1 | K37 | Glow plug Lamp |

2) Component Location

Glowplug lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to ground.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

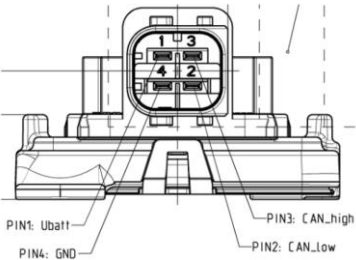
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P1904 is detected on service tool? | | Step 2 | |
| 2 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 3 |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U030D | NOx sensor heating error (Upstream NOx sensor) |

1) Overview

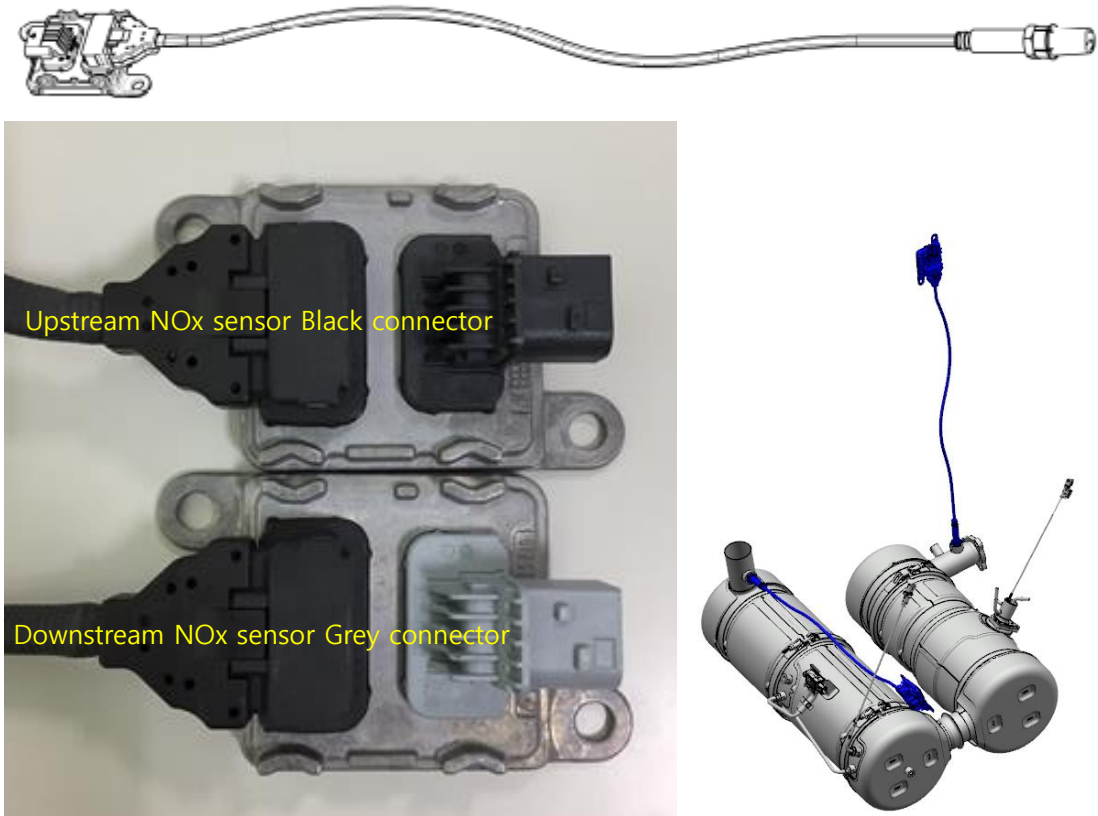
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E003219-07 | 1. Electrical problem (NOx sensor) 2. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to Sensing part, CAN wiring harness-insulation, resistance) | Inducement Group5 (Tampering) |



| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

A fault is detected if the heater won't stay heated up after dew point release. (650sec)

5) Condition for Clearing the Fault Code

The NOx sensor heater stays heated up condition.

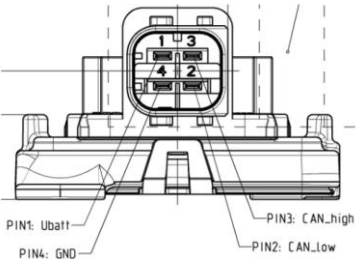
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | U030D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Replace with another normal sensor Start and run the engine at high idle more than 15 minutes and key off & on. Is fault occurred? Sensor problem? | | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| U030E | NOx sensor heating error (Downstream NOx sensor) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E003229-07 | 1. Electrical problem (NOx sensor) 2. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to Sensing part, CAN wiring harness-insulation, resistance) | Inducement Group5 (Tampering) |

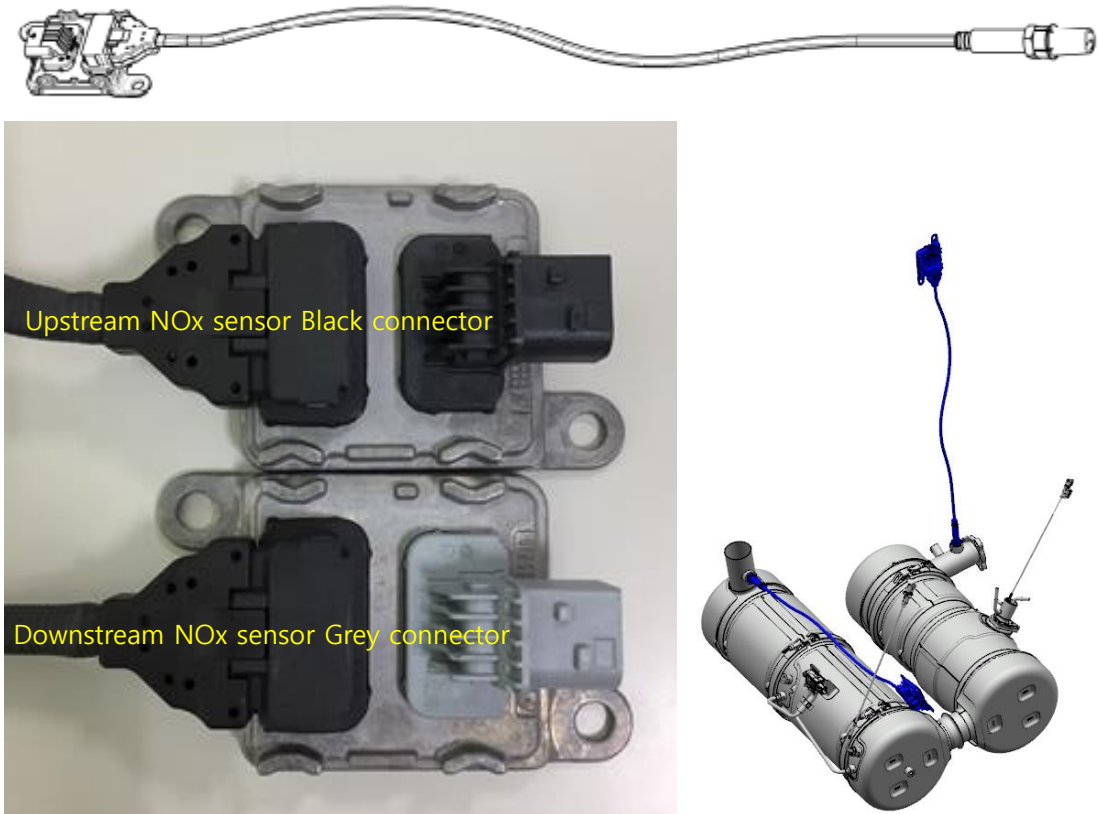


PIN1: Ubat+
PIN2: CAN_low
PIN3: CAN_high
PIN4: GND

| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

A fault is detected if the heater won't stay heated up after dew point release. (650sec)

5) Condition for Clearing the Fault Code

The NOx sensor heater stays heated up condition.

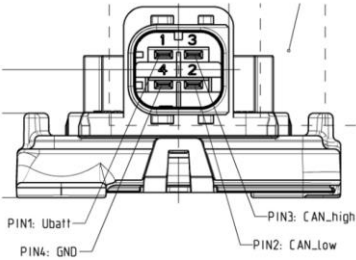
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | U030E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Replace with another normal sensor Start and run the engine at high idle more than 15 minutes and key off & on. Is fault occurred? Sensor problem? | | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P2383 | NOx sensor Mounting Error (Upstream NOx sensor) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E104332-09 | <ol style="list-style-type: none"> 1. Tampering (NOx sensor tampering such as being mounted outside to save DEF consumption) 2. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to sensing part, Faulty NOx sensor) 3. Electrical problem (CAN wiring harness-insulation, Resistance) | Inducement Group5 (Tampering) |

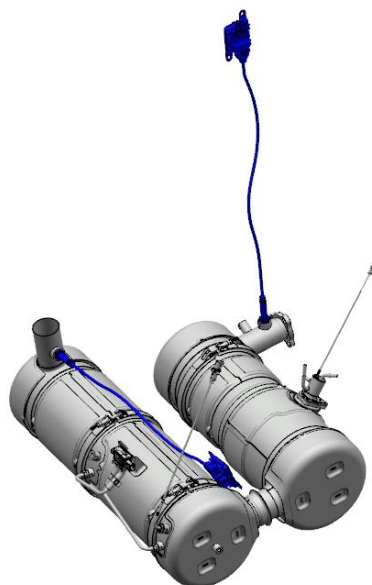


| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector





3) Condition for Running Diagnostic

Always if the defined operation point is active and stable

- Engine torque change rate < 100Nm
- Engine torque > 250Nm
- Engine speed > 750rpm

4) Condition for Setting the Fault Code

If the O2 concentration is above the defined threshold (Sensor is probably not mounted correctly)

5) Condition for Clearing the Fault Code

The O2 concentration has to be below the defined threshold

(Sensor has to be mounted correctly and be placed in the exhaust gas pipe)

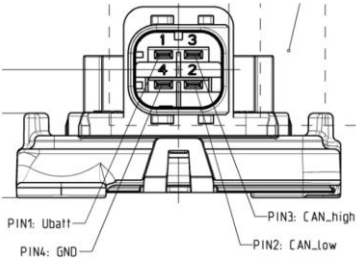
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P2383 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Re-assembly sensor & Check the fault state Is this fault detected continuously? | | Change sensor | Problem solved |

| Fault Code | Fault Name |
|-----------------------|---|
| P2384 | NOx sensor Mounting Error (Downstream NOx sensor) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E104385-09 | 1. Tampering (NOx sensor tampering such as being mounted outside to save DEF consumption) 2. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to sensing part, Faulty NOx sensor) 3. Electrical problem (CAN wiring harness-insulation, Resistance) | Inducement Group5 (Tampering) |

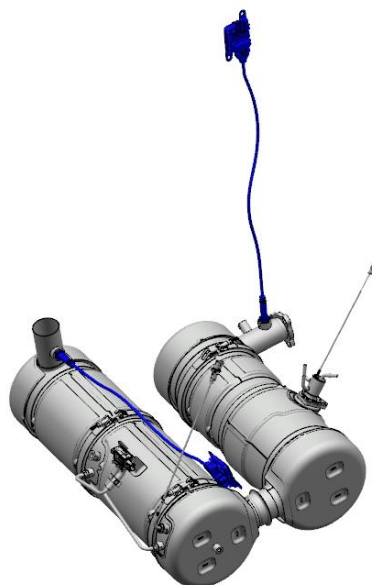


| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector





3) Condition for Running Diagnostic

Always if the defined operation point is active and stable

- Engine torque change rate < 100Nm
- Engine torque > 250Nm
- Engine speed > 750rpm

4) Condition for Setting the Fault Code

If the O2 concentration is above the defined threshold (Sensor is probably not mounted correctly)

5) Condition for Clearing the Fault Code

The O2 concentration has to be below the defined threshold

(Sensor has to be mounted correctly and be placed in the exhaust gas pipe)

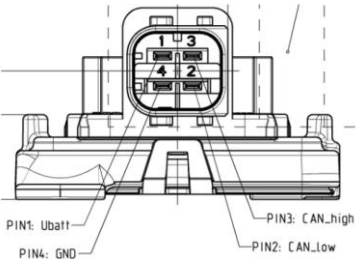
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P2384 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Re-assembly sensor & Check the fault state Is this fault detected continuously? | | Change sensor | Problem solved |

| Fault Code | Fault Name |
|-----------------------|---|
| P2397 | NOx sensor signal low fault (Upstream NOx sensor) |

1) Overview

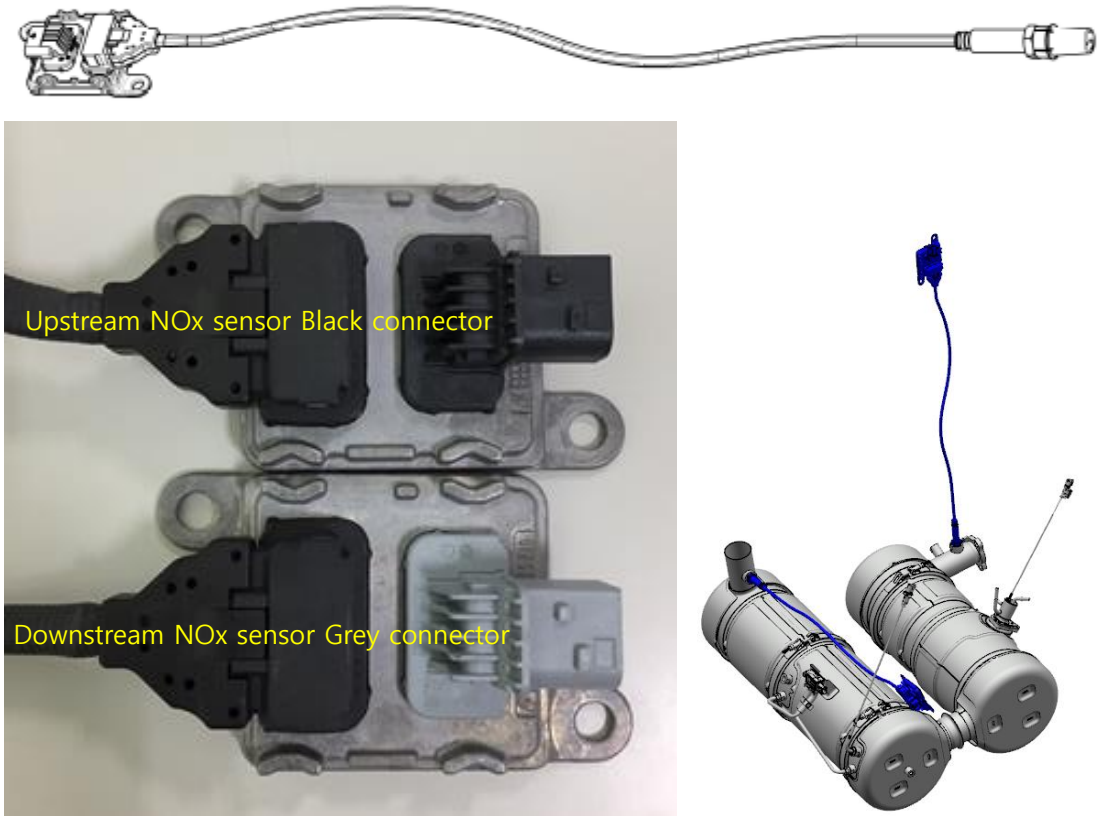
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E003216-04 | 1. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to sensing part, Faulty NOx sensor) 2. Electrical problem (CAN wiring harness-insulation, resistance) | Inducement Group2 (Dosing interrupt) |



| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

- All of the following conditions should be met.
- There are no error in NOx sensor connection.
 - Exhaust gas temperature is higher than 100degC
 - Battery voltage is inside the range 10.3V and 16V.

4) Condition for Setting the Fault Code

NOx signal is less than minimum threshold.(-75ppm)

5) Condition for Clearing the Fault Code

NOx signal is within normal operation range.

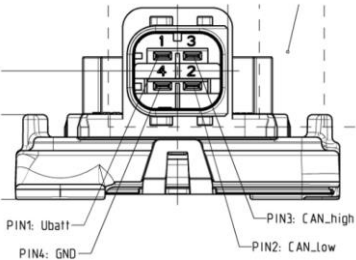
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P2397 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Re-assembly sensor & Check the fault state Is this fault detected continuously? | | Change sensor | Problem solved |

| Fault Code | Fault Name |
|-----------------------|---|
| P2398 | NOx sensor signal low fault (Downstream NOx sensor) |

1) Overview

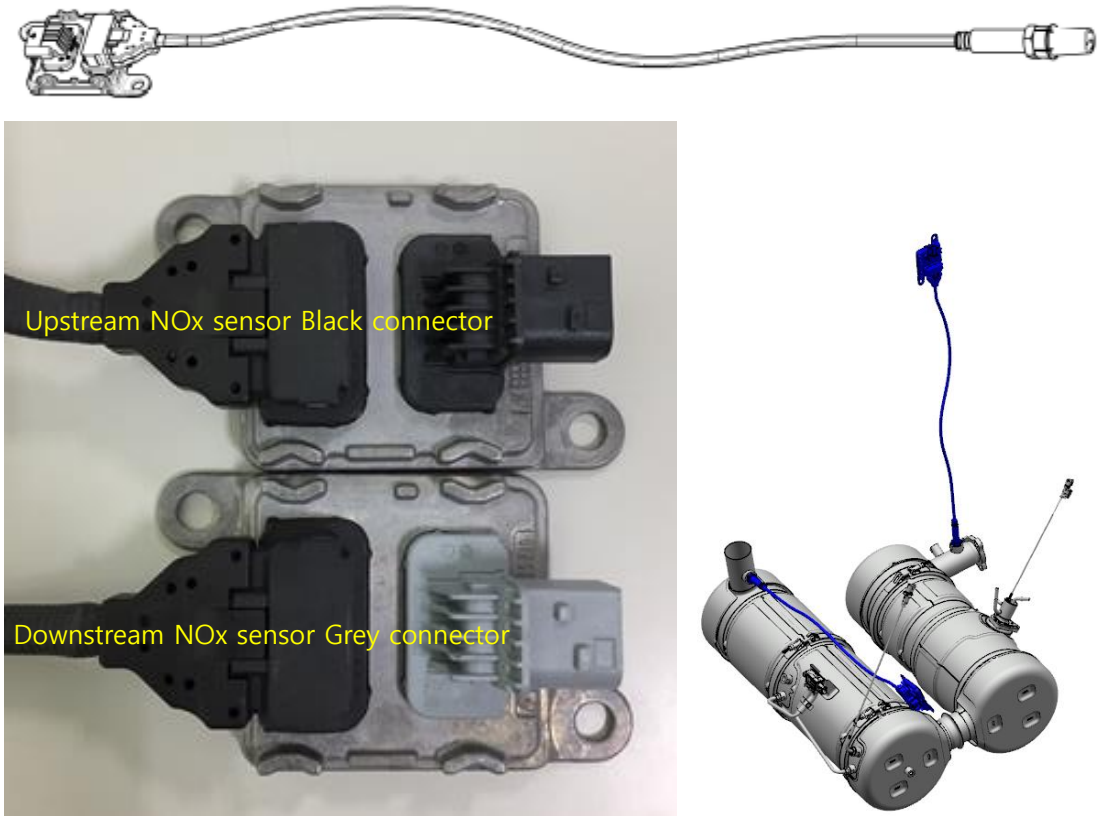
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E003226-04 | 1. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to sensing part, Faulty NOx sensor) 2. Electrical problem (CAN wiring harness-insulation, resistance) | Inducement Group2 (Dosing interrupt) |



| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

- All of the following conditions should be met.
- There are no error in NOx sensor connection.
 - Exhaust gas temperature is higher than 100degC
 - Battery voltage is inside the range 10.3V and 16V.

4) Condition for Setting the Fault Code

NOx signal is less than minimum threshold.(-75ppm)

5) Condition for Clearing the Fault Code

NOx signal is within normal operation range.

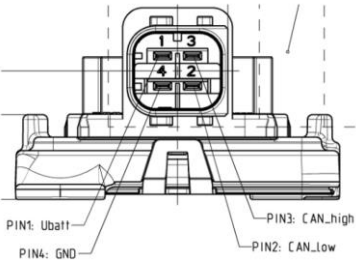
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P2398 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Re-assembly sensor & Check the fault state Is this fault detected continuously? | | Change sensor | Problem solved |

| Fault Code | Fault Name |
|-----------------------|---|
| P2203 | NOx sensor Open circuit fault (Upstream NOx sensor) |

1) Overview

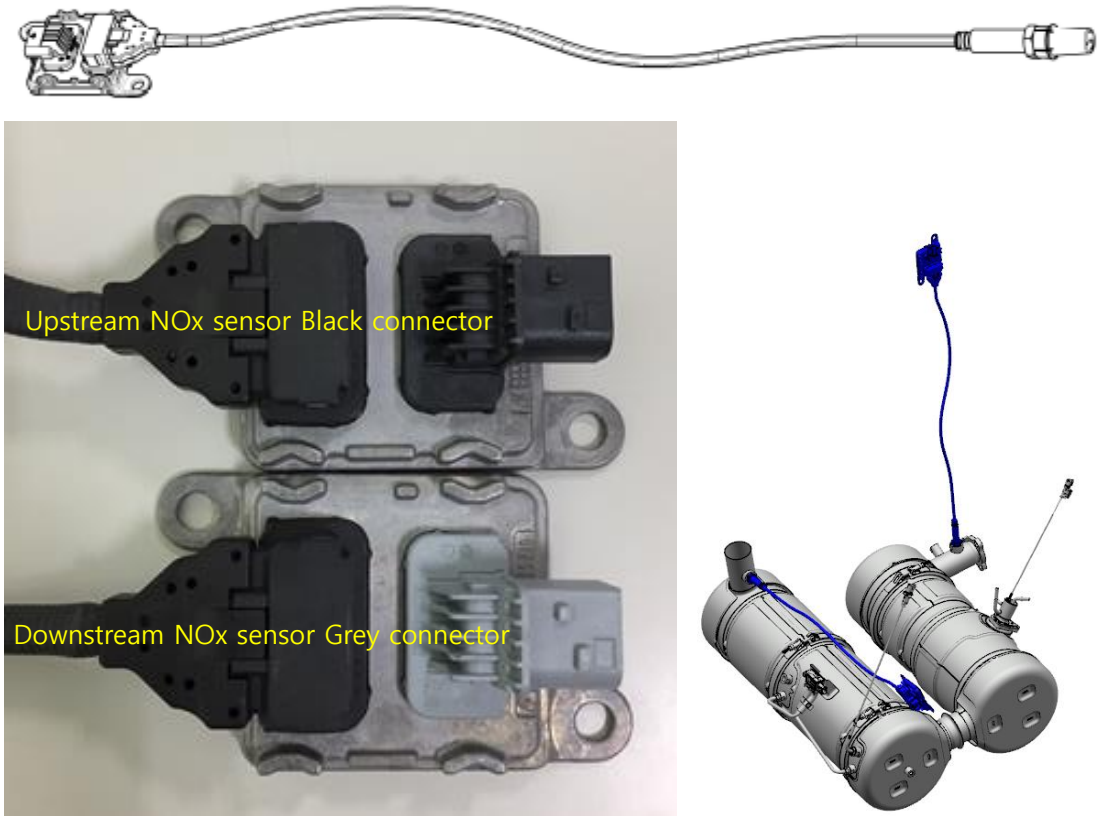
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E003224-05 | 1. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to sensing part, Faulty NOx sensor) 2. Electrical problem (CAN wiring harness-insulation, resistance) | Inducement Group5 (Tampering) |



| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

- All of the following conditions should be met.
- There are no error in NOx sensor connection.
 - Exhaust gas temperature is higher than 100degC
 - Battery voltage is inside the range 10.3V and 16V.

4) Condition for Setting the Fault Code

NOx sensor control unit detects an open circuit

5) Condition for Clearing the Fault Code

NOx sensor wiring problem is restored..

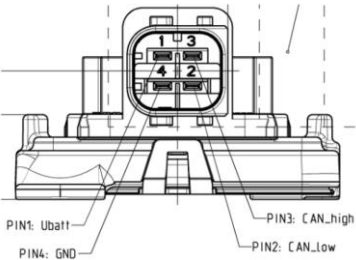
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P2203 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Re-assembly sensor & Check the fault state Is this fault detected continuously? | | Change sensor | Problem solved |

| Fault Code | Fault Name |
|-----------------------|---|
| P2216 | NOx sensor Open circuit fault (Downstream NOx sensor) |

1) Overview

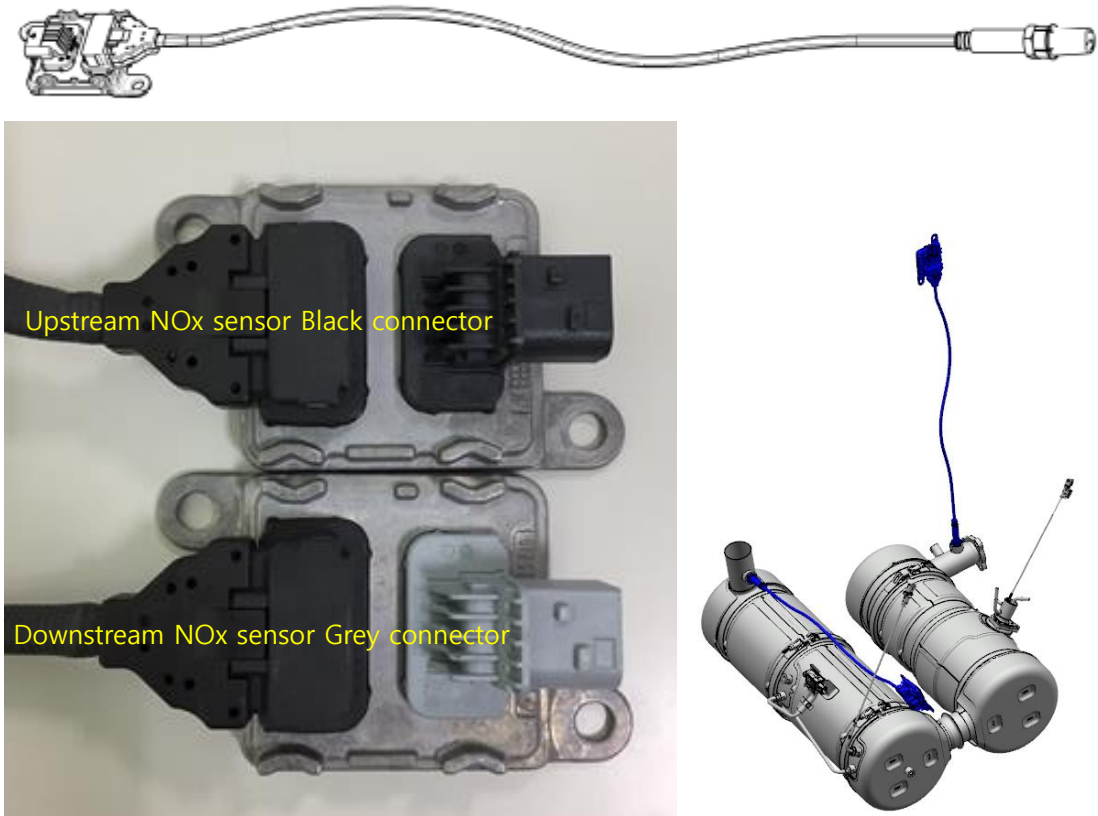
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E003234-05 | 1. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to sensing part, Faulty NOx sensor) 2. Electrical problem (CAN wiring harness-insulation, resistance) | Inducement Group5 (Tampering) |



| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

- All of the following conditions should be met.
- There are no error in NOx sensor connection.
 - Exhaust gas temperature is higher than 100degC
 - Battery voltage is inside the range 10.3V and 16V.

4) Condition for Setting the Fault Code

NOx sensor control unit detects an open circuit

5) Condition for Clearing the Fault Code

NOx sensor wiring problem is restored.

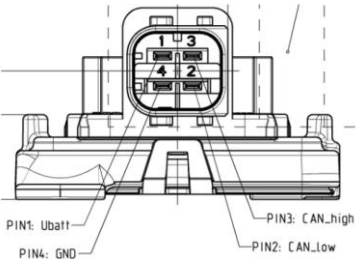
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P2216 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Re-assembly sensor & Check the fault state Is this fault detected continuously? | | Change sensor | Problem solved |

| Fault Code | Fault Name |
|-----------------------|--|
| P2202 | NOx sensor Short circuit fault (Upstream NOx sensor) |

1) Overview

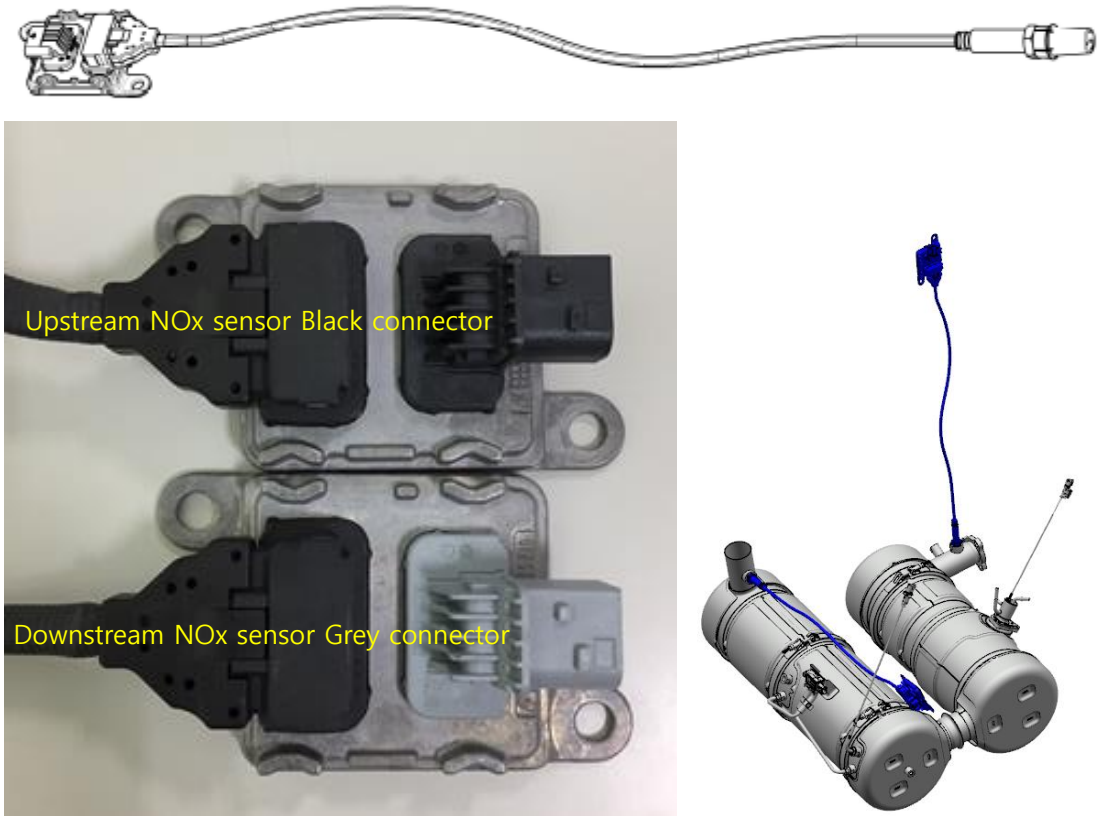
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E003224-06 | 1. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to sensing part, Faulty NOx sensor) 2. Electrical problem (CAN wiring harness-insulation, resistance) | Inducement Group5 (Tampering) |



| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

- All of the following conditions should be met.
- There are no error in NOx sensor connection.
 - Exhaust gas temperature is higher than 100degC
 - Battery voltage is inside the range 10.3V and 16V.

4) Condition for Setting the Fault Code

NOx sensor control unit detects a short circuit

5) Condition for Clearing the Fault Code

NOx sensor wiring problem is restored.

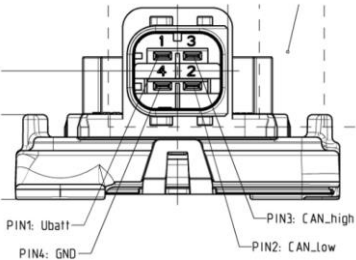
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P2202 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Re-assembly sensor & Check the fault state Is this fault detected continuously? | | Change sensor | Problem solved |

| Fault Code | Fault Name |
|-----------------------|--|
| P2215 | NOx sensor Short circuit fault (Downstream NOx sensor) |

1) Overview

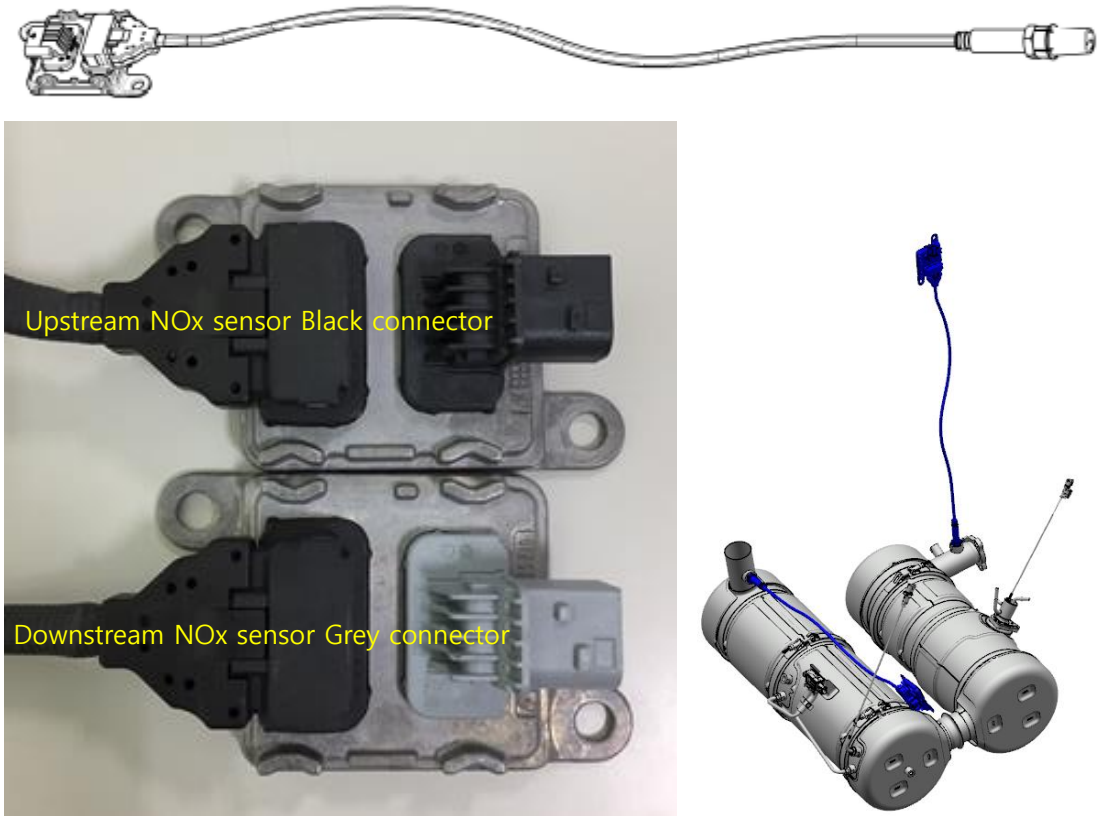
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E003234-06 | 1. Electrical problem (NOx sensor connector, Wiring harness from NOx sensor controller to sensing part, Faulty NOx sensor) 2. Electrical problem (CAN wiring harness-insulation, resistance) | Inducement Group5 (Tampering) |



| No | Description |
|----|-----------------------|
| 1 | Battery supply (+12V) |
| 2 | CAN low |
| 3 | CAN high |
| 4 | Ground |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

- All of the following conditions should be met.
- There are no error in NOx sensor connection.
 - Exhaust gas temperature is higher than 100degC
 - Battery voltage is inside the range 10.3V and 16V.

4) Condition for Setting the Fault Code

NOx sensor control unit detects a short circuit

5) Condition for Clearing the Fault Code

NOx sensor wiring problem is restored..

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|----------------|
| 1 | P2215 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check Network (CAN line, resistance of H/L) Network problem? | | Do necessary repair | Step 6 |
| 6 | Re-assembly sensor & Check the fault state Is this fault detected continuously? | | Change sensor | Problem solved |

| Fault Code | Fault Name |
|-----------------------|---|
| P0380 | Glow plug Relay driver Open circuit Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000676-05 | 1. Electrical problem (Relay, Wiring harness, connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|-------------------------|
| 1 | A93 | Air Heater Relay driver |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

Glow plug relay is not connected (open)

4) Condition for Clearing the Fault Code

Glow plug relay problem is restored.

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P0380 is detected on service tool? | | Step 2 | |
| 2 | Perform Glow Plug Test. Test OK? | | Contact Helpdesk | Step 3 |
| 3 | Check relay connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Change relay, perform Glow Plug Test Test OK? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0384 | Glow plug Relay driver Short circuit to Battery Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000676-03 | 1. Electrical problem (Relay, Wiring harness, connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|-------------------------|
| 1 | A93 | Air Heater Relay driver |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

Glow plug relay is connected to battery (Short to Battery).

4) Condition for Clearing the Fault Code

Glow plug relay problem is restored.

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P0384 is detected on service tool? | | Step 2 | |
| 2 | Perform Glow Plug Test. Test OK? | | Contact Helpdesk | Step 3 |
| 3 | Check relay connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Change relay, perform Glow Plug Test Test OK? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0383 | Glow plug Relay driver Short circuit to Ground Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000676-04 | 1. Electrical problem (Relay, Wiring harness, connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|-------------------------|
| 1 | A93 | Air Heater Relay driver |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

Glow plug relay is connected to ground (Short to Ground).

4) Condition for Clearing the Fault Code

Glow plug relay problem is restored.

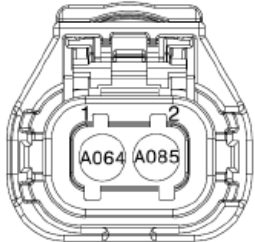
5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P0383 is detected on service tool? | | Step 2 | |
| 2 | Perform Glow Plug Test. Test OK? | | Contact Helpdesk | Step 3 |
| 3 | Check relay connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Change relay, perform Glow Plug Test Test OK? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0201 | Injector Open circuit Fault (Cylinder #1) |

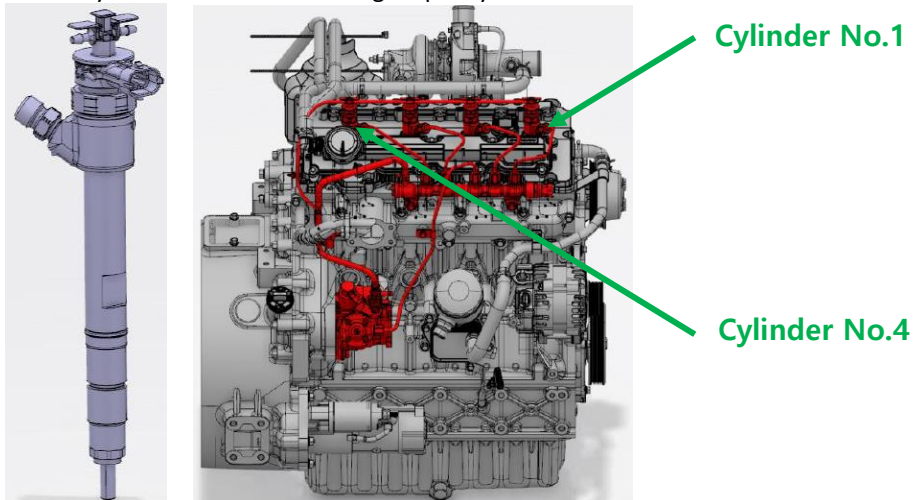
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000651-05 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|-----------------------------------|---------|---------------------|
|  | Cylinder #1 injector (All engine) | | |
| | No | ECU Pin | Description |
| | 1 | A64 | Fuel Injector HSD11 |
| | 2 | A85 | Fuel Injector LSD11 |

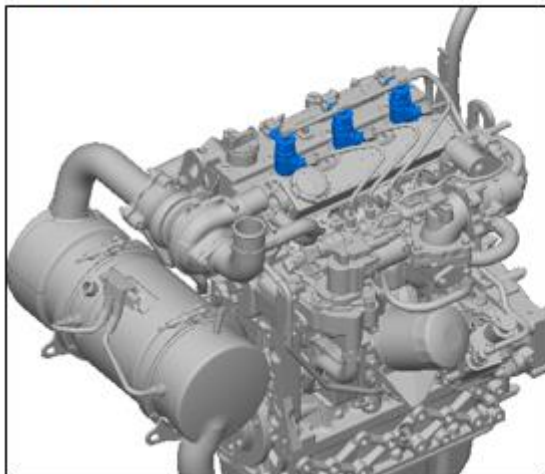
2) Component Location

Cylinder #1 is located to engine pulley side.

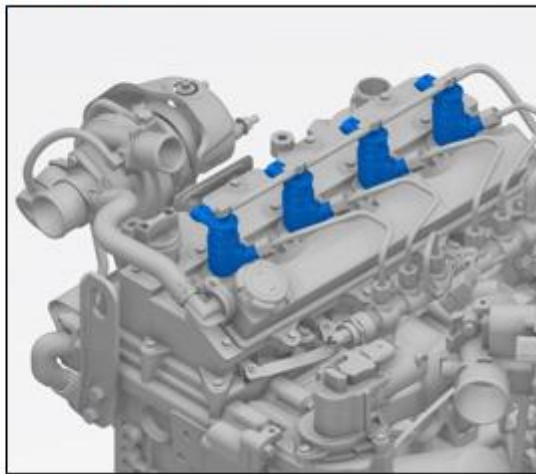


| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64 | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85 | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66 | O_P_INJVH12 | | | | |
| A87 | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22 | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43 | O_P_INJVL21 | | | | |
| A24 | O_P_INJVH22 | Cyl2 | Cyl2 | - | |
| A45 | O_P_INJVL22 | | | | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

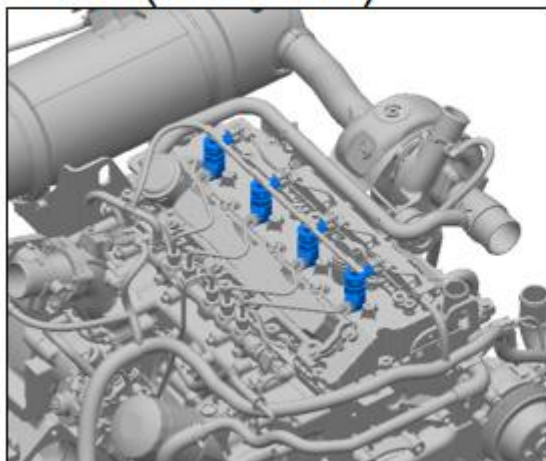
1.8L



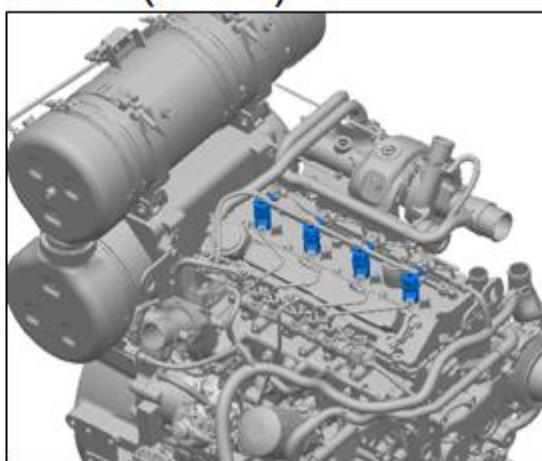
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The injector of cylinder #1 is opened.

5) Condition for Clearing the Fault Code

The injector of cylinder #1 is restored

6) Check List

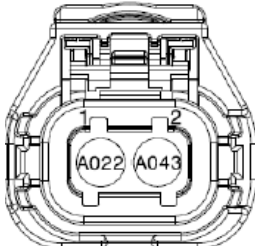
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|-----------------|
| 1 | P0201 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check injector resistance (remove injector connector and check injector itself resistance : pin No.1&2) | | Step 5 | Change injector |


| | | | | |
|---|---|--|----------------------------|-------------------------|
| | If the resistance value is infinite, it can be judged as an internal circuit issue of the injector. | | | |
| 5 | Swap connection between 2 injectors if harness enables it. | | Change injector | Step 6 |
| 6 | Check ECU Connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0203 | Injector Open circuit Fault (Cylinder #3) |

1) Overview

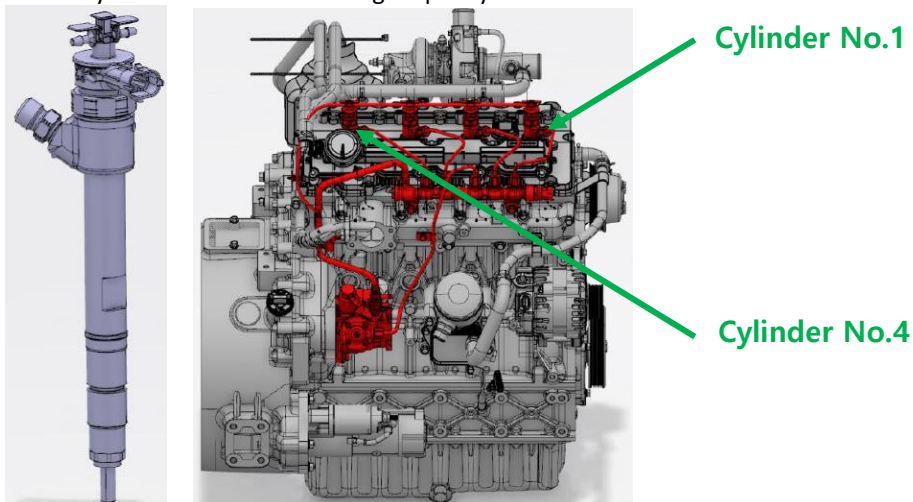
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000653-05 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|------------------------------|---------|---------------------|
|  | D24/D34 Cylinder #3 injector | | |
| | No | ECU Pin | Description |
| | 1 | A22 | Fuel Injector HSD21 |
| | 2 | A43 | Fuel Injector LSD21 |

| | | | |
|--|--------------------------|---------|---------------------|
|  | D18 Cylinder #3 injector | | |
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

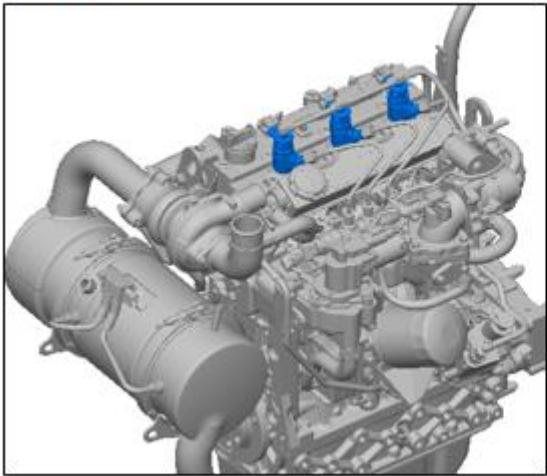
2) Component Location

Cylinder #1 is located to engine pulley side.

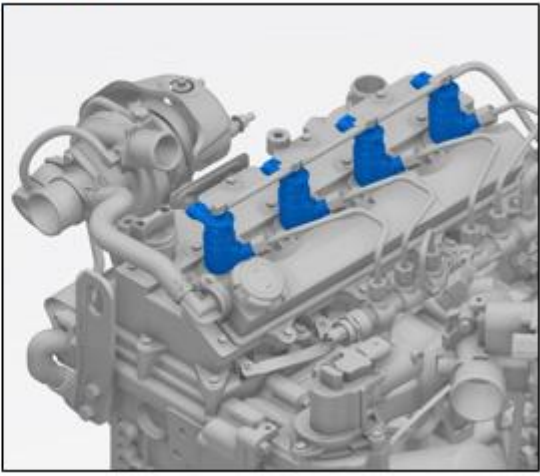


| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64C | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85C | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66C | O_P_INJVH12 | | | | |
| A87C | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| | BANK 1 | | | | |
| A22C | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43C | O_P_INJVL21 | | | | |
| A24C | O_P_INJVH22 | | | | |
| A45C | O_P_INJVL22 | Cyl2 | Cyl2 | - | |
| | BANK 2 | | | | |
| Cylinder Interfacing | | | | | |

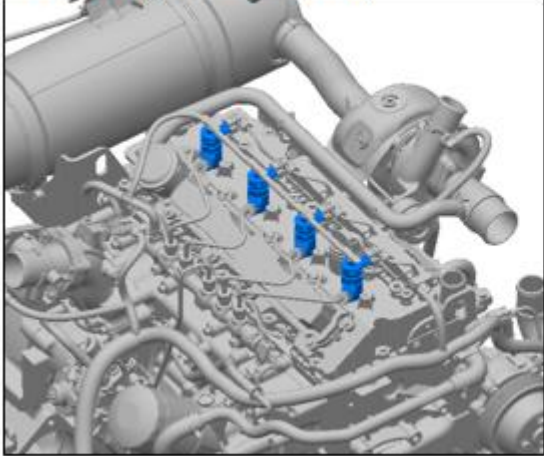
1.8L



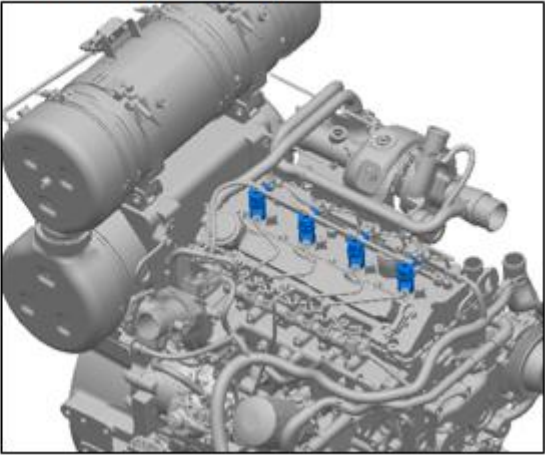
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic
Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code
The injector of cylinder #3 is opened.

5) Condition for Clearing the Fault Code

The injector of cylinder #3 is restored

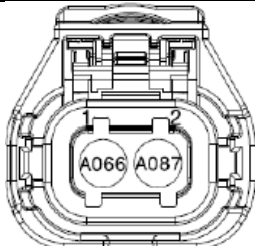
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P0203 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check injector resistance (remove injector connector and check injector itself resistance : pin No.1&2) If the resistance value is infinite, it can be judged as an internal circuit issue of the injector. | | Step 5 | Change injector |
| 5 | Swap connection between 2 injectors if harness enables it. | | Change injector | Step 6 |
| 6 | Check ECU Connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0204 | Injector Open circuit Fault (Cylinder #4) |

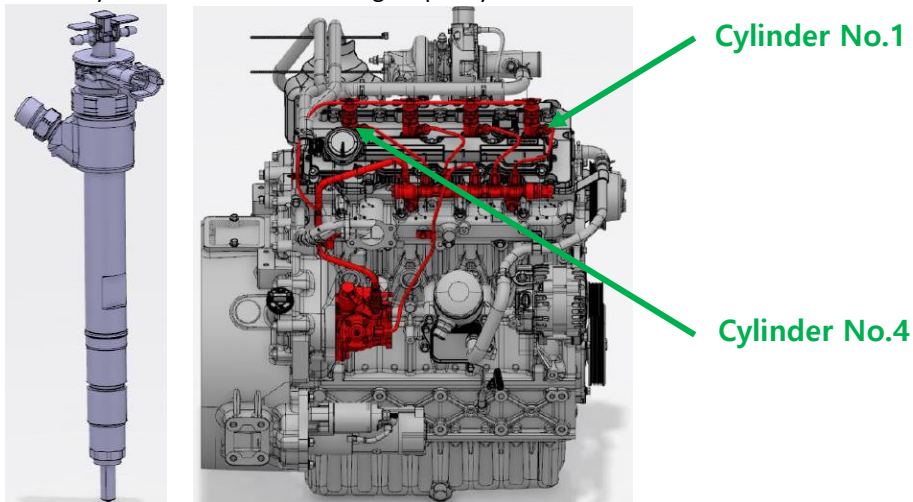
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000654-05 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

|  | Cylinder #4 injector | | |
|---|----------------------|---------|---------------------|
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

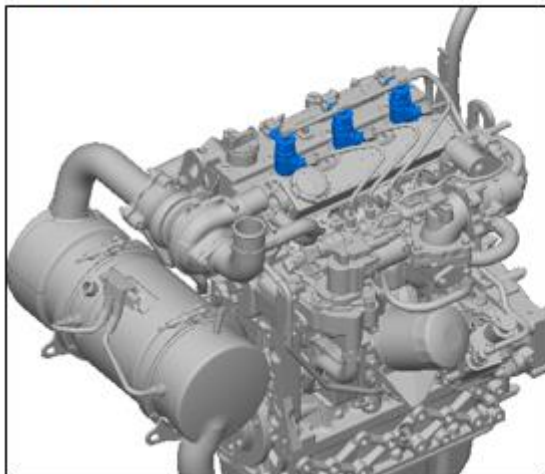
2) Component Location

Cylinder #1 is located to engine pulley side.

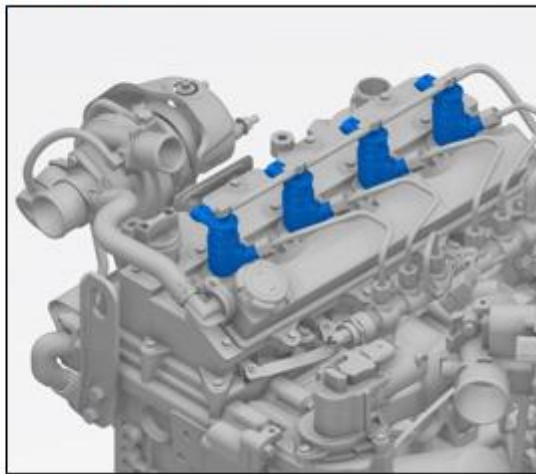


| | | D24 | D34 | D18 | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
|----------------------|-------------|------|------|------|---|
| A64 | O_P_INJVH11 | | | | |
| A85 | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66 | O_P_INJVH12 | | | | |
| A87 | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22 | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43 | O_P_INJVL21 | | | | |
| A24 | O_P_INJVH22 | Cyl2 | Cyl2 | - | |
| A45 | O_P_INJVL22 | | | | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

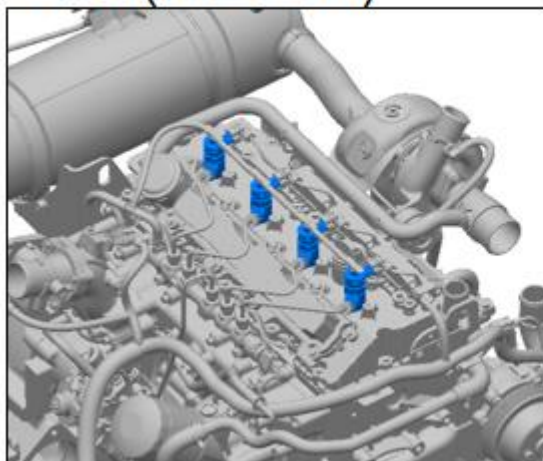
1.8L



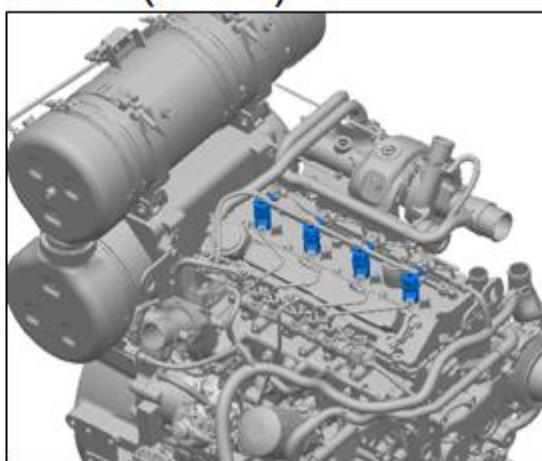
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The injector of cylinder #4 is opened.

5) Condition for Clearing the Fault Code

The injector of cylinder #4 is restored

6) Check List

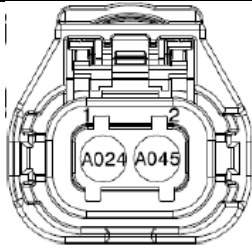
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|-----------------|
| 1 | P0204 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check injector resistance (remove injector connector and check injector itself resistance : pin No.1&2) | | Step 5 | Change injector |

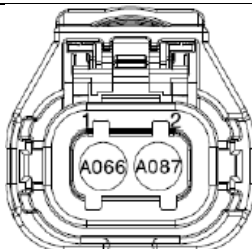
| | | | | |
|---|---|--|----------------------------|-------------------------|
| | If the resistance value is infinite, it can be judged as an internal circuit issue of the injector. | | | |
| 5 | Swap connection between 2 injectors if harness enables it. | | Change injector | Step 6 |
| 6 | Check ECU Connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0202 | Injector Open circuit Fault (Cylinder #2) |

1) Overview

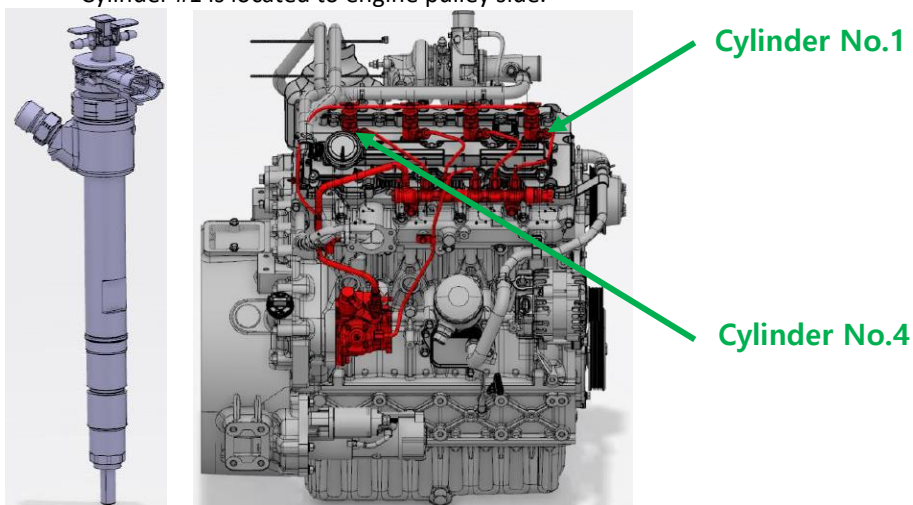
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000652-05 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|------------------------------|---------|---------------------|
|  | D24/D34 Cylinder #2 injector | | |
| | No | ECU Pin | Description |
| | 1 | A24 | Fuel Injector HSD22 |
| | 2 | A45 | Fuel Injector LSD22 |

| | | | |
|--|--------------------------|---------|---------------------|
|  | D18 Cylinder #2 injector | | |
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

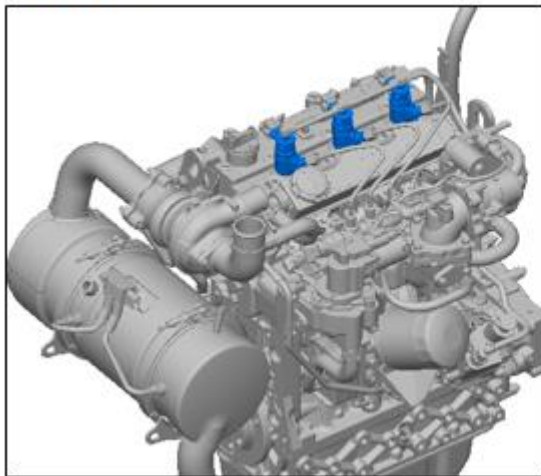
2) Component Location

Cylinder #1 is located to engine pulley side.

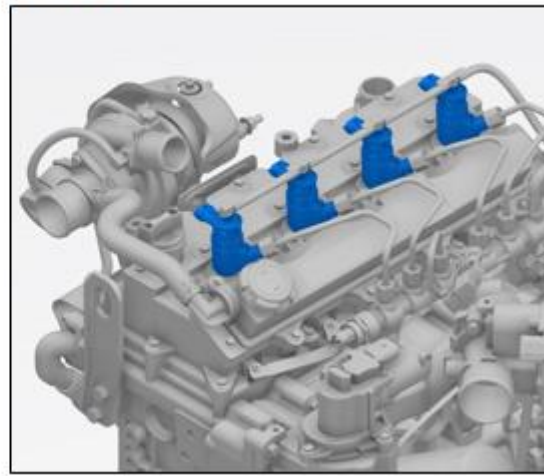


| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64C | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85C | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66C | O_P_INJVH12 | | | | |
| A87C | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| | BANK 1 | | | | |
| A22C | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43C | O_P_INJVL21 | | | | |
| A24C | O_P_INJVH22 | | | | |
| A45C | O_P_INJVL22 | Cyl2 | Cyl2 | - | |
| | BANK 2 | | | | |
| Cylinder Interfacing | | | | | |

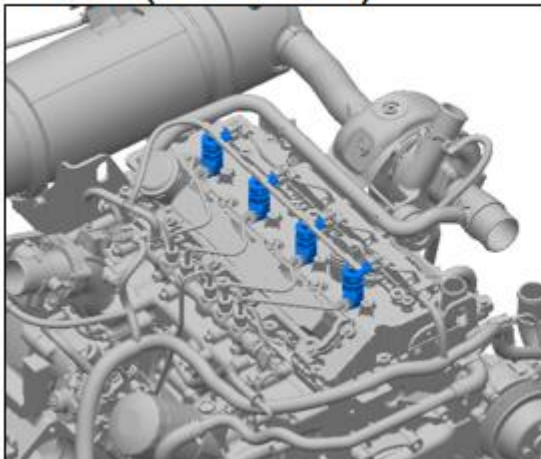
1.8L



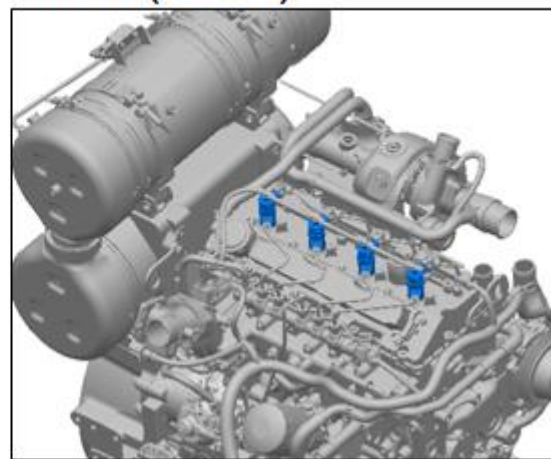
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The injector of cylinder #2 is opened.

5) Condition for Clearing the Fault Code

The injector of cylinder #2 is restored

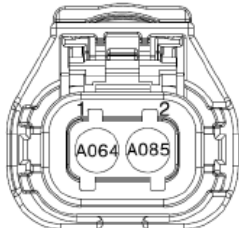
6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P0202 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check injector resistance (remove injector connector and check injector itself resistance : pin No.1&2) If the resistance value is infinite, it can be judged as an internal circuit issue of the injector. | | Step 5 | Change injector |
| 5 | Swap connection between 2 injectors if harness enables it. | | Change injector | Step 6 |
| 6 | Check ECU Connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P062D | Injector bank 1st Short circuit fault |

1) Overview

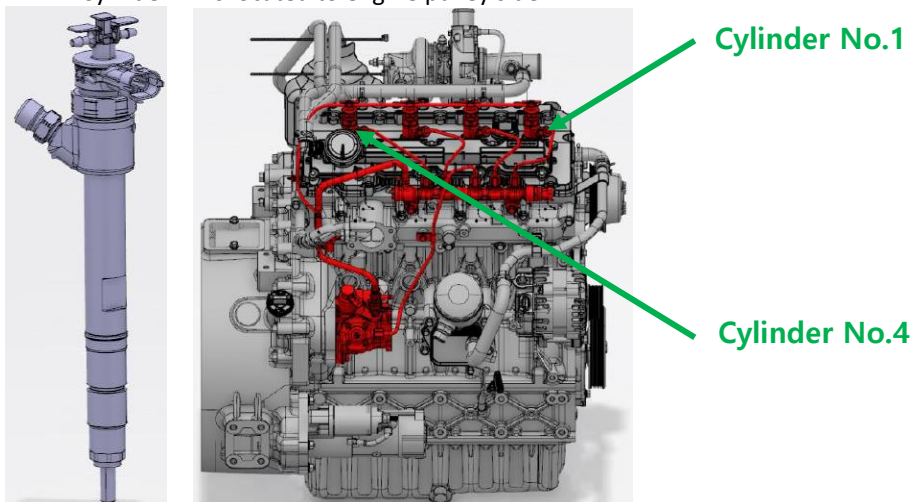
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E001612-03 | 1. Electrical problem (Faulty injector insulation, water ingress, Injector bank short to battery or ground) 2. Electrical problem (Wiring harness from injector to ECU) 3. Electrical problem (Faulty ECU) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|-----------------------------------|---------|---------------------|
|  | Cylinder #1 injector (All engine) | | |
| | No | ECU Pin | Description |
| | 1 | A64 | Fuel Injector HSD11 |
| | 2 | A85 | Fuel Injector LSD11 |

| | | | |
|--|---|---------|---------------------|
|  | Cylinder #4 injector (D18 : Cylinder #3 injector) | | |
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

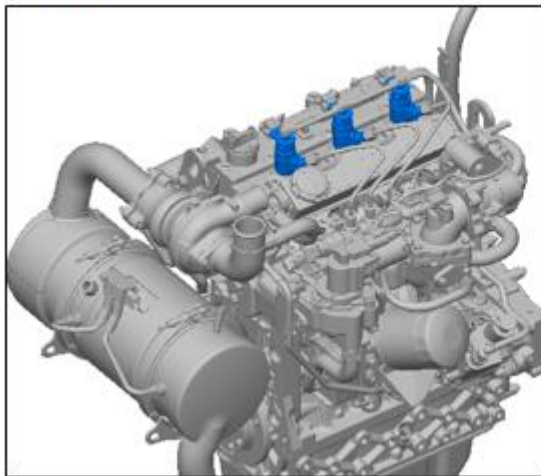
2) Component Location

Cylinder #1 is located to engine pulley side.

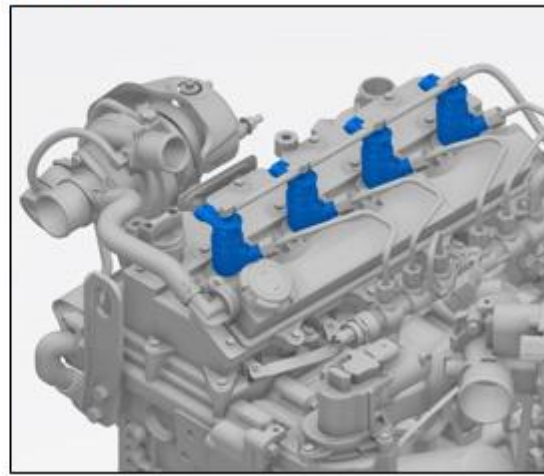


| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64C | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85C | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66C | O_P_INJVH12 | | | | |
| A87C | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22C | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43C | O_P_INJVL21 | | | | |
| A24C | O_P_INJVH22 | | | | |
| A45C | O_P_INJVL22 | Cyl2 | Cyl2 | - | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

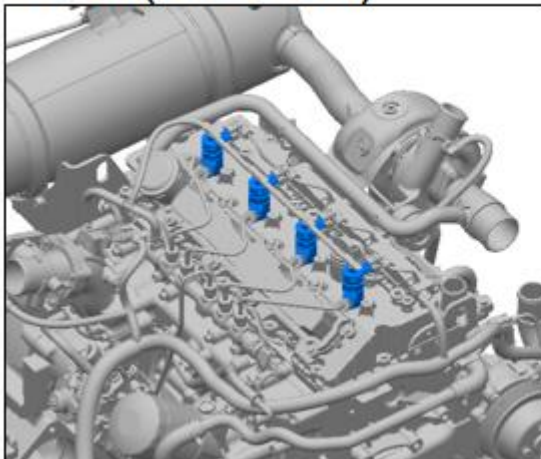
1.8L



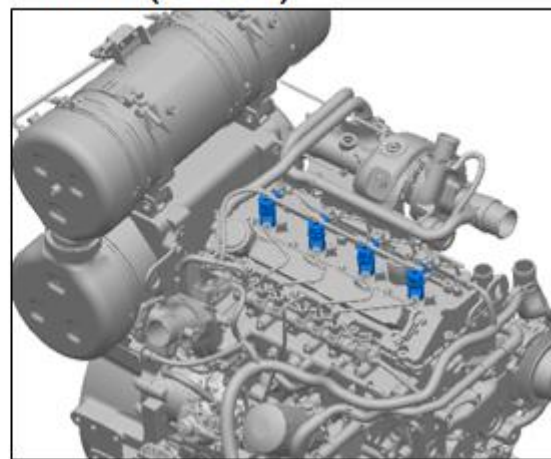
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The 1st injector bank is short circuit.

- D18 : #1 & #3 injector
- D24/D34 : #1 & #4 injector

5) Condition for Clearing the Fault Code

The 1st injector bank is restored

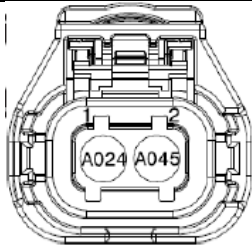
6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P0602D is detected on service tool? | | Step2 | |
| 2 | After let the machine is in safety area and turn-off the key switch. | | Step3 | |
| 3 | Check injector connections corresponding to fault bank Connection problem? | | Do necessary repair | Step4 |
| 4 | Disconnect injectors and key on Problem still present? | | Step5 | Step7 |
| 5 | Check ECU Connection Connection problem? | | Do necessary repair | Step6 |
| 6 | Clear fault then key off then reconnect ONE injector then key on Problem back? | | Step 7 | Step 8 |
| 7 | Change corresponding injector Do not forget to write new Individual Injector Correction to ECU | | Step 8 | |
| 8 | Iterate previous step on all injectors Try another injector (STEP 5) Problem back? | | Step 7 | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P062E | Injector bank 2nd Short circuit fault |

1) Overview

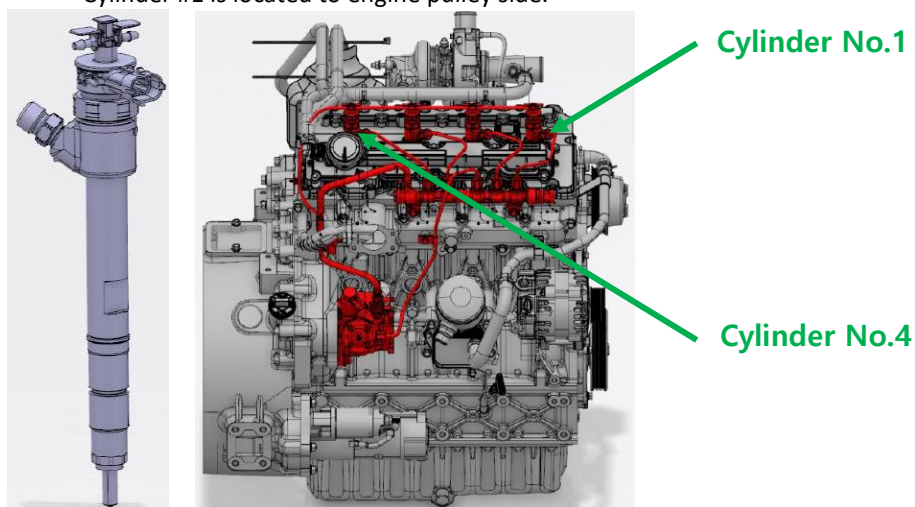
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E001612-12 | 1. Electrical problem (Faulty injector insulation, water ingress, Injector bank short to battery or ground) 2. Electrical problem (Wiring harness from injector to ECU) 3. Electrical problem (Faulty ECU) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|----------------------|---------|---------------------|
|  | Cylinder #2 injector | | |
| | No | ECU Pin | Description |
| | 1 | A24 | Fuel Injector HSD22 |
| | 2 | A45 | Fuel Injector LSD22 |

| | | | |
|--|---|---------|---------------------|
|  | Cylinder #3 injector (D18 : Cylinder #2 injector) | | |
| | No | ECU Pin | Description |
| | 1 | A22 | Fuel Injector HSD21 |
| | 2 | A43 | Fuel Injector LSD21 |

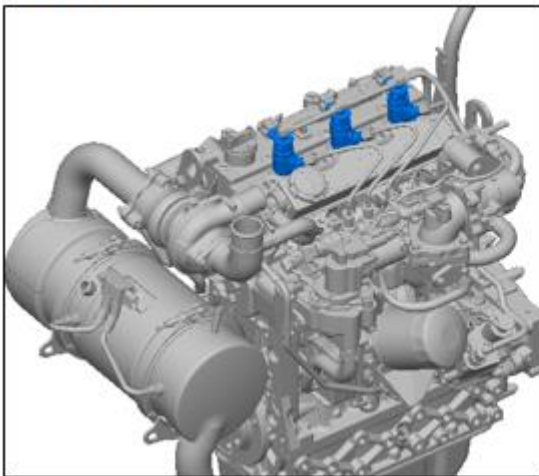
2) Component Location

Cylinder #1 is located to engine pulley side.

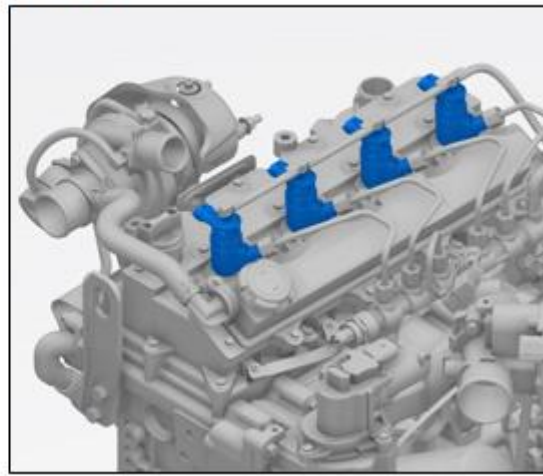


| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64C | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85C | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66C | O_P_INJVH12 | | | | |
| A87C | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| | BANK 1 | | | | |
| A22C | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43C | O_P_INJVL21 | | | | |
| A24C | O_P_INJVH22 | | | | |
| A45C | O_P_INJVL22 | Cyl2 | Cyl2 | - | |
| | BANK 2 | | | | |
| Cylinder Interfacing | | | | | |

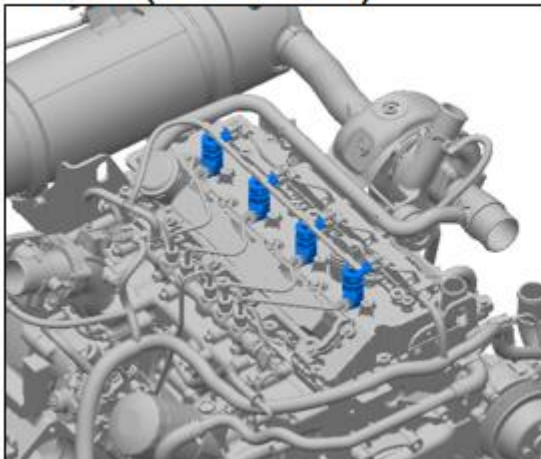
1.8L



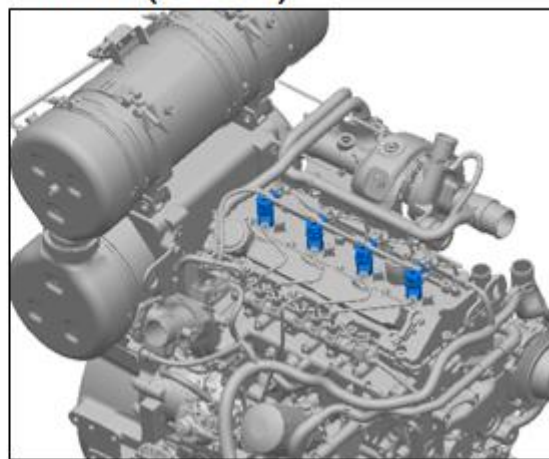
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The 2nd injector bank is short circuit.

- D18 : #2 injector
- D24/D34 : #2 & #3 injector

5) Condition for Clearing the Fault Code

The 2nd injector bank is restored

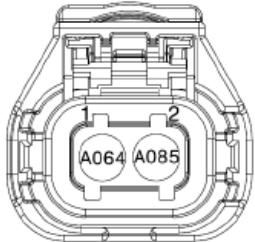
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P0602E is detected on service tool? | | Step2 | |
| 2 | After let the machine is in safety area and turn-off the key switch. | | Step3 | |
| 3 | Check injector connections corresponding to fault bank Connection problem? | | Do necessary repair | Step4 |
| 4 | Disconnect injectors and key on Problem still present? | | Step5 | Step7 |
| 5 | Check ECU Connection Connection problem? | | Do necessary repair | Step6 |
| 6 | Clear fault then key off then reconnect ONE injector then key on Problem back? | | Step 7 | Step 8 |
| 7 | Change corresponding injector Do not forget to write new Individual Injector Correction to ECU | | Step 8 | |
| 8 | Iterate previous step on all injectors Try another injector (STEP 5) Problem back? | | Step 7 | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P02EE | Injector Short circuit Fault (Cylinder #1) |

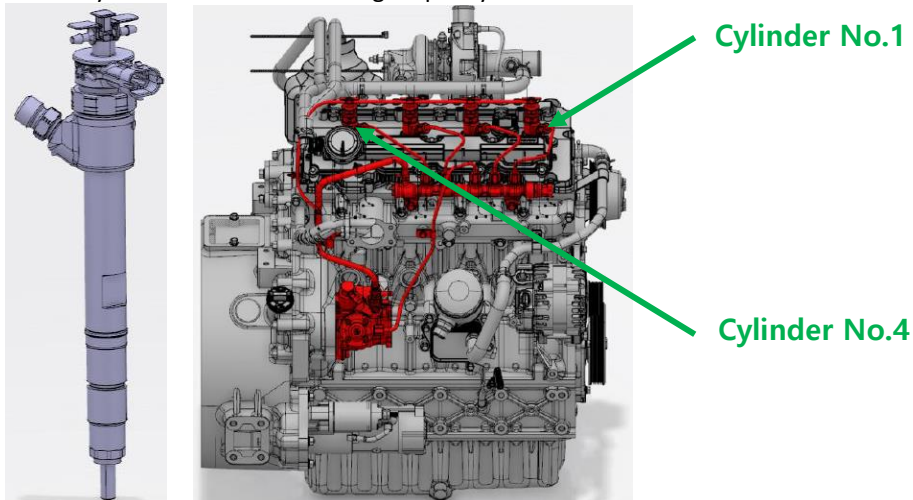
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000651-04 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|-----------------------------------|---------|---------------------|
|  | Cylinder #1 injector (All engine) | | |
| | No | ECU Pin | Description |
| | 1 | A64 | Fuel Injector HSD11 |
| | 2 | A85 | Fuel Injector LSD11 |

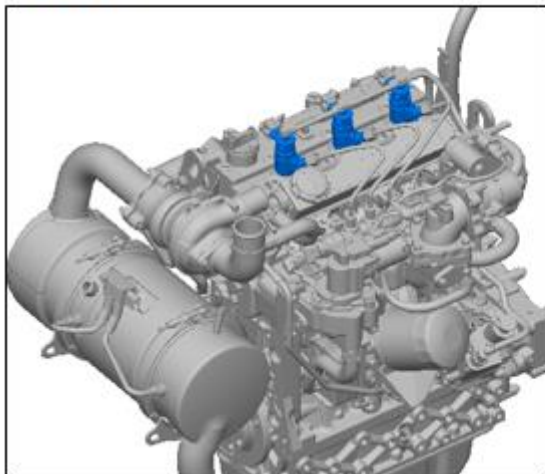
2) Component Location

Cylinder #1 is located to engine pulley side.

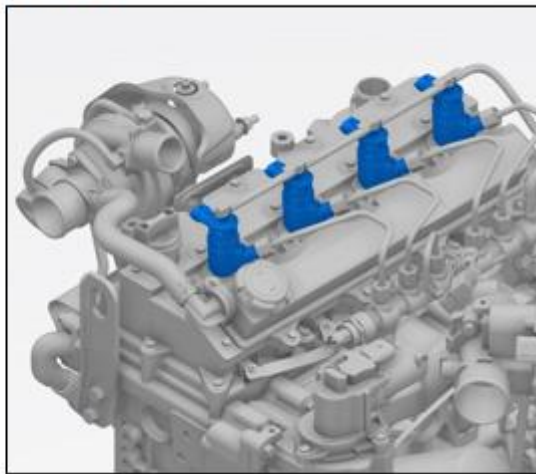


| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|--|
| A64 | O_P_INJVH11 | | | | Firing order (°): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85 | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66 | O_P_INJVH12 | | | | |
| A87 | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22 | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43 | O_P_INJVL21 | | | | |
| A24 | O_P_INJVH22 | Cyl2 | Cyl2 | - | |
| A45 | O_P_INJVL22 | | | | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

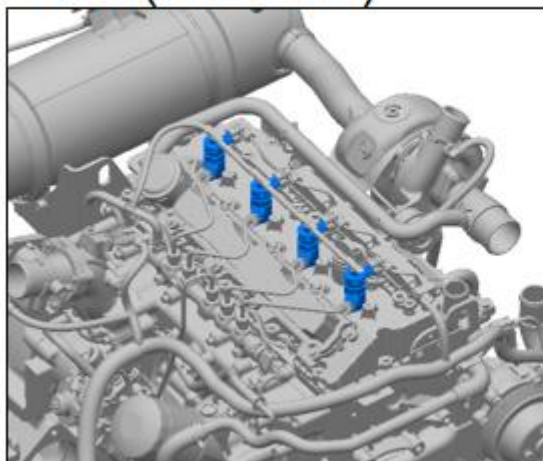
1.8L



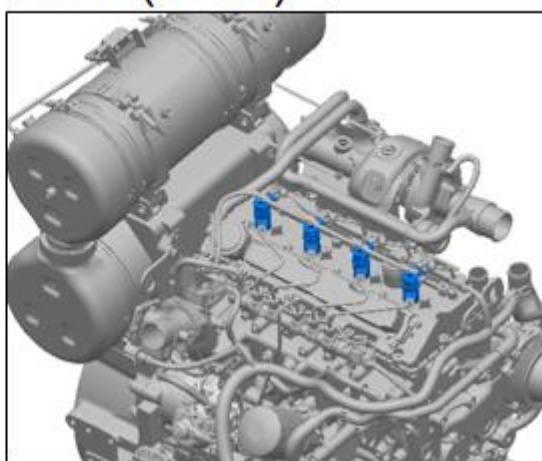
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The injector of cylinder #1 is shorted.

5) Condition for Clearing the Fault Code

The injector of cylinder #1 is restored

6) Check List

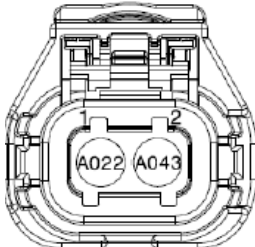
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|--------|
| 1 | P02EE is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | | | | Step5 |


| | | | | |
|----------|---|--|--|-----------------------------|
| | Disconnect injector. Fault disappeared? | | Change injector | |
| 5 | If an intermediate engine connector is present, disconnect it. Fault disappeared? | | Fix intermediate engine harness | Stet 6 |
| 6 | Short circuit before injector. Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P02F0 | Injector Short circuit Fault (Cylinder #3) |

1) Overview

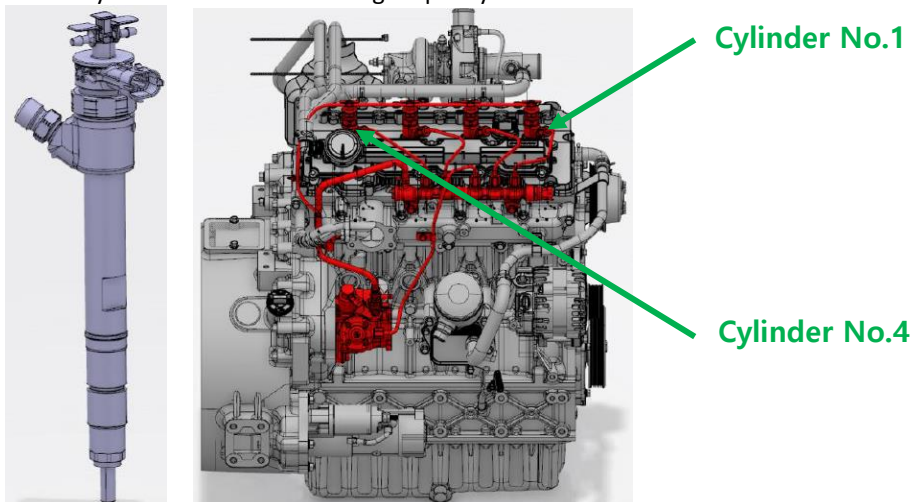
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000653-04 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|------------------------------|---------|---------------------|
|  | D24/D34 Cylinder #3 injector | | |
| | No | ECU Pin | Description |
| | 1 | A22 | Fuel Injector HSD21 |
| | 2 | A43 | Fuel Injector LSD21 |

| | | | |
|--|--------------------------|---------|---------------------|
|  | D18 Cylinder #3 injector | | |
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

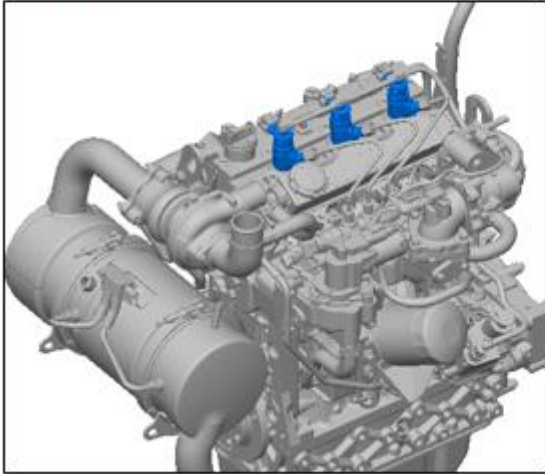
2) Component Location

Cylinder #1 is located to engine pulley side.

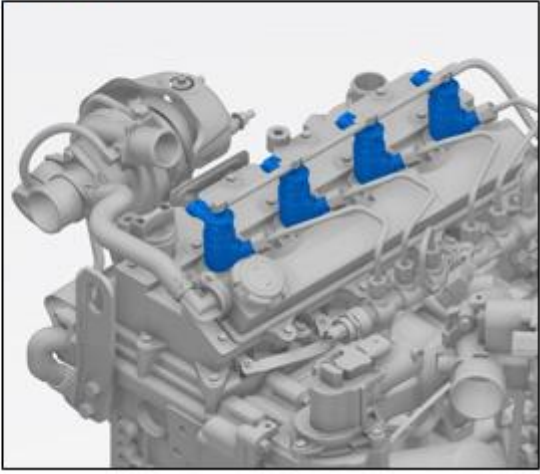


| | | D24 | D34 | D18 | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
|----------------------|-------------|------|------|------|---|
| A64 | O_P_INJVH11 | | | | |
| A85 | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66 | O_P_INJVH12 | | | | |
| A87 | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22 | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43 | O_P_INJVL21 | | | | |
| A24 | O_P_INJVH22 | | | | |
| A45 | O_P_INJVL22 | Cyl2 | Cyl2 | - | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

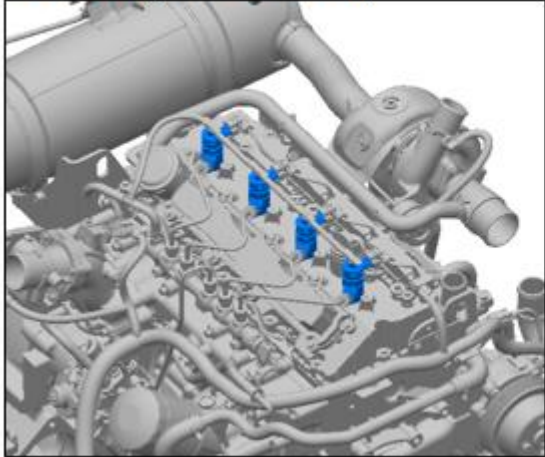
1.8L



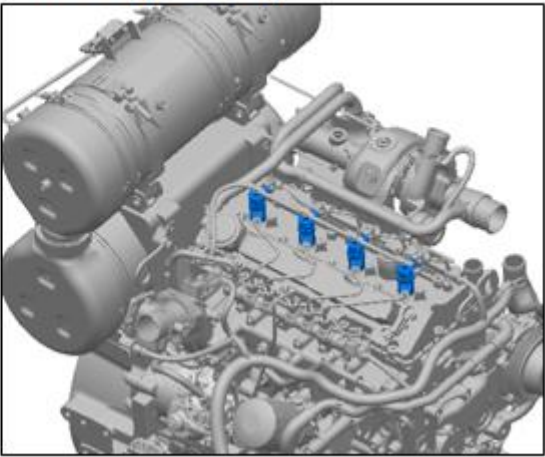
2.4L



3.4L (No-SCR)



3.4L (SCR)



- 3) **Condition for Running Diagnostic**
Key on or engine running or Key off(ECU on)
- 4) **Condition for Setting the Fault Code**
The injector of cylinder #3 is shorted.

5) Condition for Clearing the Fault Code

The injector of cylinder #3 is restored

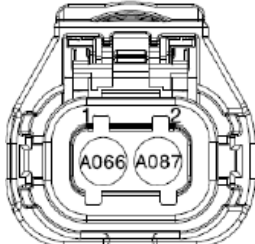
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------------------|------------------|
| 1 | P02F0 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Disconnect injector. Fault disappeared? | | Change injector | Step5 |
| 5 | If an intermediate engine connector is present, disconnect it. Fault disappeared? | | Fix intermediate engine harness | Stet 6 |
| 6 | Short circuit before injector. Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P02F1 | Injector Short circuit Fault (Cylinder #4) |

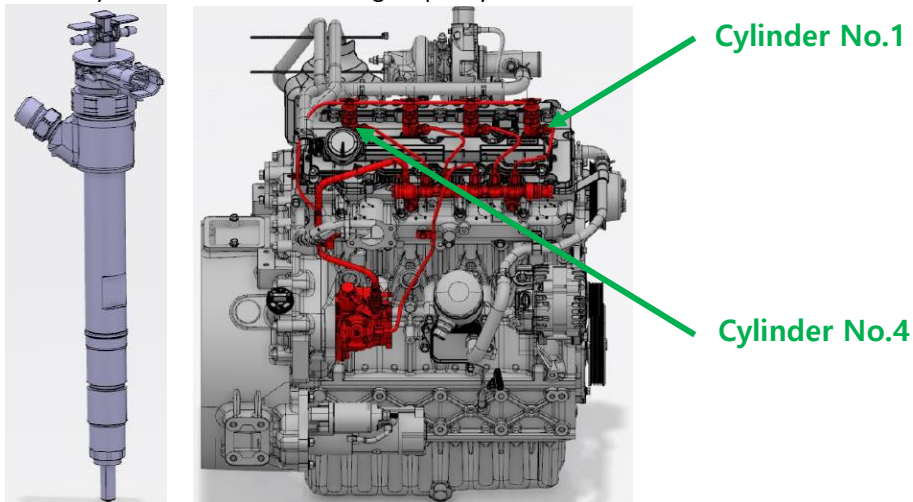
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000654-04 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

|  | Cylinder #4 injector | | |
|---|----------------------|---------|---------------------|
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

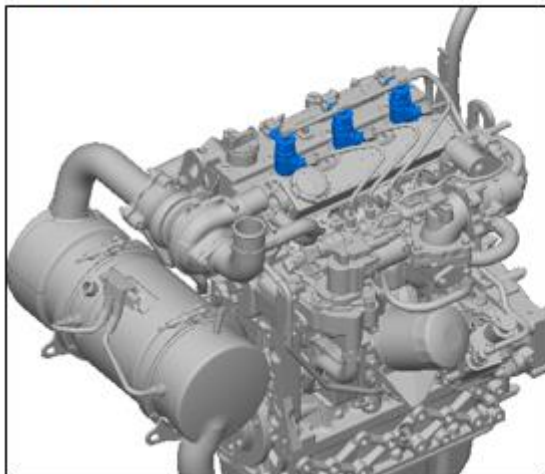
2) Component Location

Cylinder #1 is located to engine pulley side.

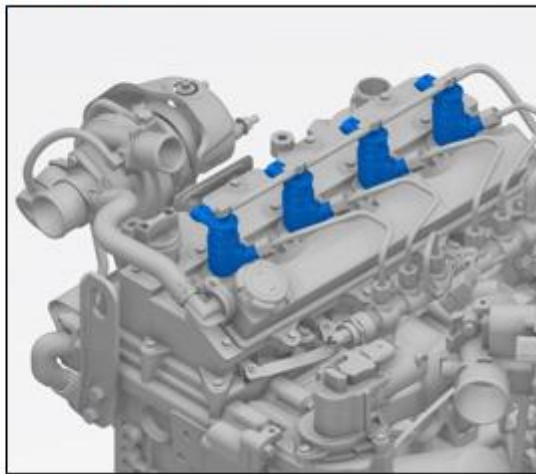


| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64c | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85c | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66c | O_P_INJVH12 | | | | |
| A87c | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22c | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43c | O_P_INJVL21 | | | | |
| A24c | O_P_INJVH22 | | | | |
| A45c | O_P_INJVL22 | Cyl2 | Cyl2 | - | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

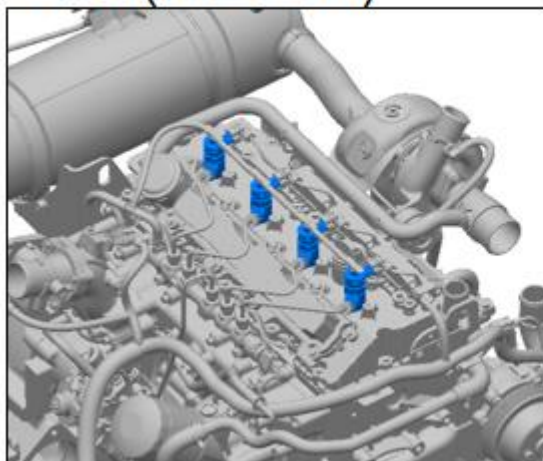
1.8L



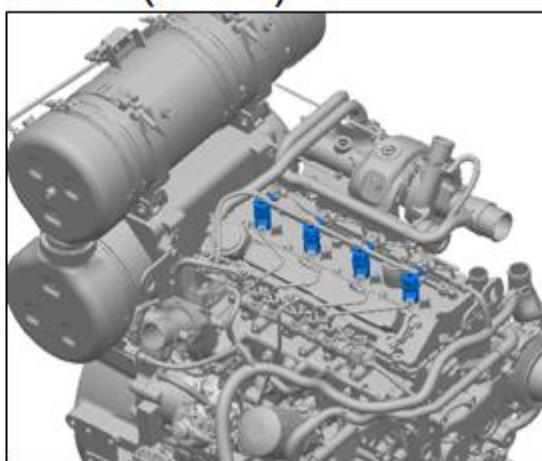
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The injector of cylinder #4 is shorted..

5) Condition for Clearing the Fault Code

The injector of cylinder #4 is restored

6) Check List

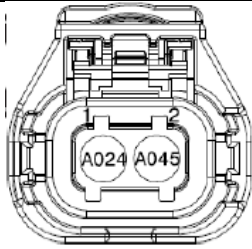
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|------------------------|--------|
| 1 | P02F1 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | | | | Step5 |

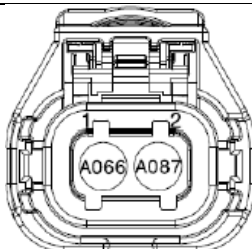
| | | | | |
|----------|---|--|--|-----------------------------|
| | Disconnect injector. Fault disappeared? | | Change injector | |
| 5 | If an intermediate engine connector is present, disconnect it. Fault disappeared? | | Fix intermediate engine harness | Stet 6 |
| 6 | Short circuit before injector. Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P02EF | Injector Short circuit Fault (Cylinder #2) |

1) Overview

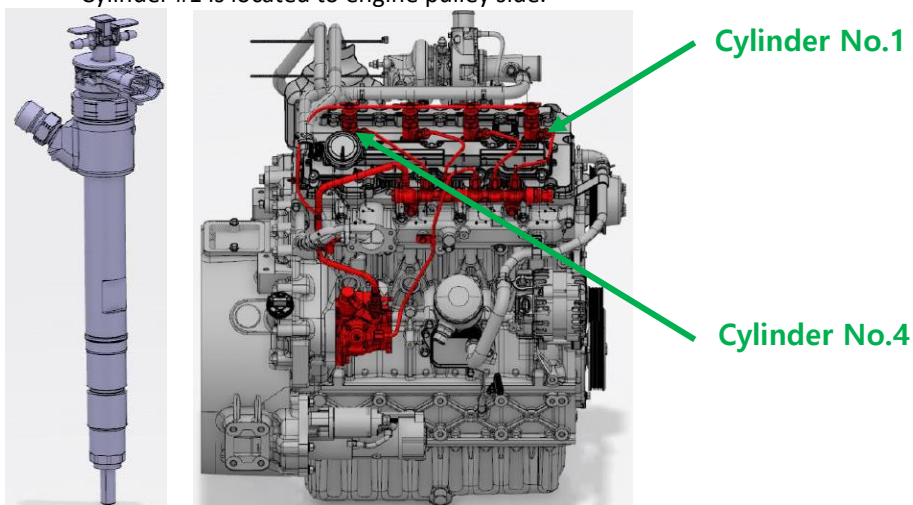
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000652-04 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|------------------------------|---------|---------------------|
|  | D24/D34 Cylinder #2 injector | | |
| | No | ECU Pin | Description |
| | 1 | A24 | Fuel Injector HSD22 |
| | 2 | A45 | Fuel Injector LSD22 |

| | | | |
|--|--------------------------|---------|---------------------|
|  | D18 Cylinder #2 injector | | |
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

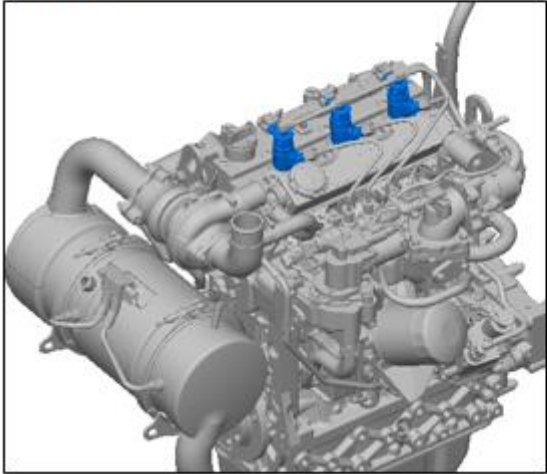
2) Component Location

Cylinder #1 is located to engine pulley side.

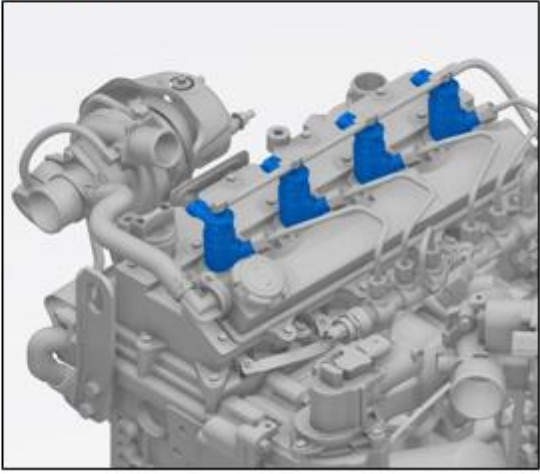


| | | D24 | D34 | D18 | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
|----------------------|-------------|------|------|------|---|
| A64C | O_P_INJVH11 | | | | |
| A85C | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66C | O_P_INJVH12 | | | | |
| A87C | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22C | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43C | O_P_INJVL21 | | | | |
| A24C | O_P_INJVH22 | | | | |
| A45C | O_P_INJVL22 | Cyl2 | Cyl2 | - | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

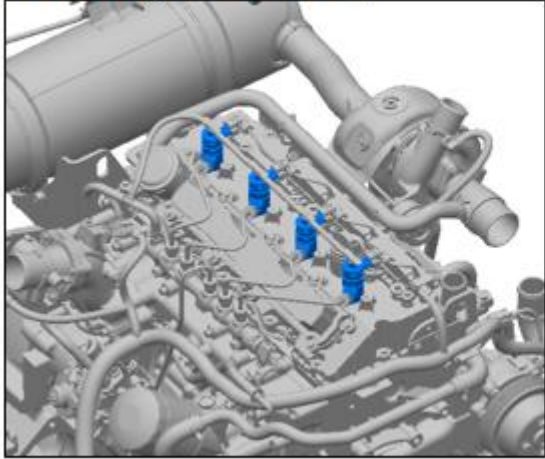
1.8L



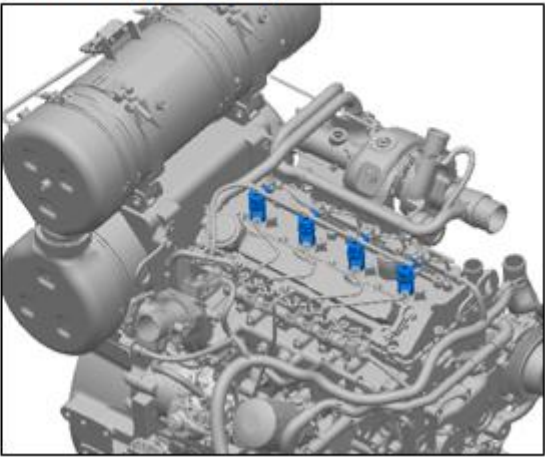
2.4L



3.4L (No-SCR)



3.4L (SCR)



- 3) **Condition for Running Diagnostic**
Key on or engine running or Key off(ECU on)
- 4) **Condition for Setting the Fault Code**
The injector of cylinder #2 is shorted.

5) Condition for Clearing the Fault Code

The injector of cylinder #2 is restored

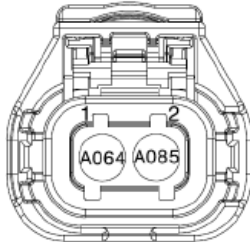
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------------------|------------------|
| 1 | P02EF is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Disconnect injector. Fault disappeared? | | Change injector | Step5 |
| 5 | If an intermediate engine connector is present, disconnect it. Fault disappeared? | | Fix intermediate engine harness | Stet 6 |
| 6 | Short circuit before injector. Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P32EE | Injector High Low side Short circuit Fault (Cylinder #1) |

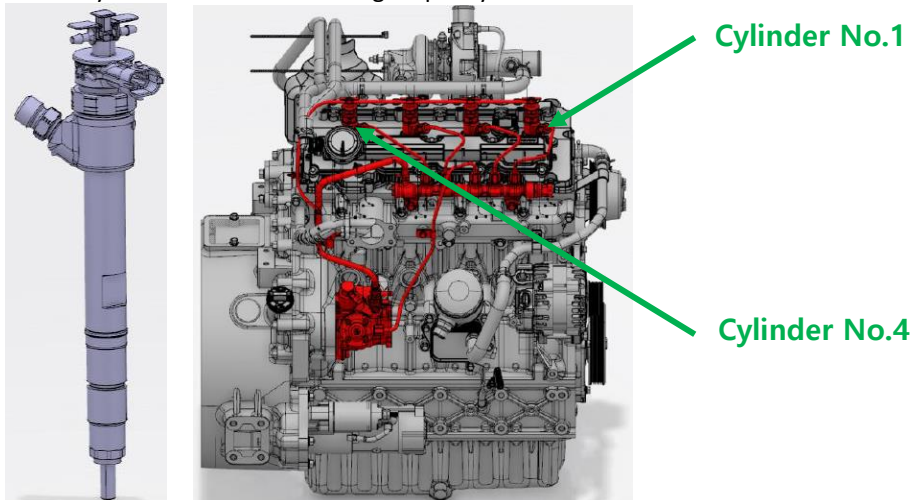
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000651-22 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|-----------------------------------|---------|---------------------|
|  | Cylinder #1 injector (All engine) | | |
| | No | ECU Pin | Description |
| | 1 | A64 | Fuel Injector HSD11 |
| | 2 | A85 | Fuel Injector LSD11 |

2) Component Location

Cylinder #1 is located to engine pulley side.



| | | | | | | |
|-----|-------------|--|---------------|------|------|------|
| A64 | O_P_INJVH11 | | BANK 1 | D24 | D34 | D18 |
| A85 | O_P_INJVL11 | | | Cyl1 | Cyl1 | Cyl1 |
| A66 | O_P_INJVH12 | | | | | |
| A87 | O_P_INJVL12 | | | Cyl4 | Cyl4 | Cyl3 |
| | | | | | | |
| | | | | | | |
| A22 | O_P_INJVH21 | | BANK 2 | Cyl3 | Cyl3 | Cyl2 |
| A43 | O_P_INJVL21 | | | | | |
| A24 | O_P_INJVH22 | | | | | |
| A45 | O_P_INJVL22 | | | Cyl2 | Cyl2 | - |
| | | | | | | |

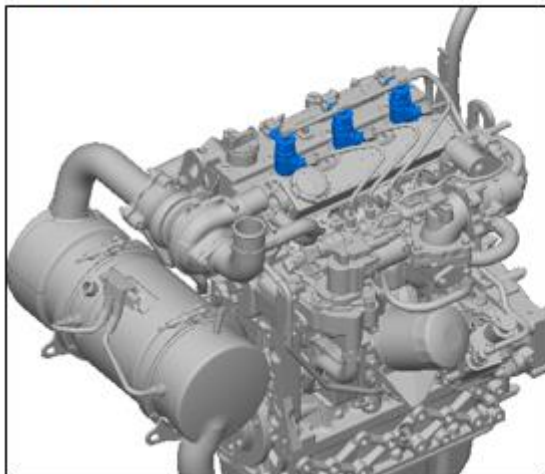
Firing order (\$):

D24 & D34
4 Cyl.: 1 3 4 2

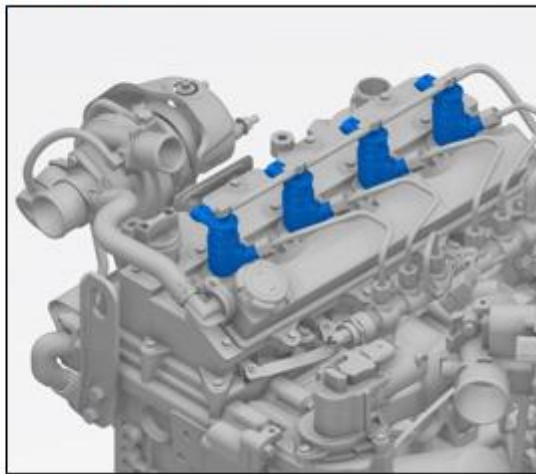
D18
3 Cyl.: 1 2 3

Cylinder Interfacing

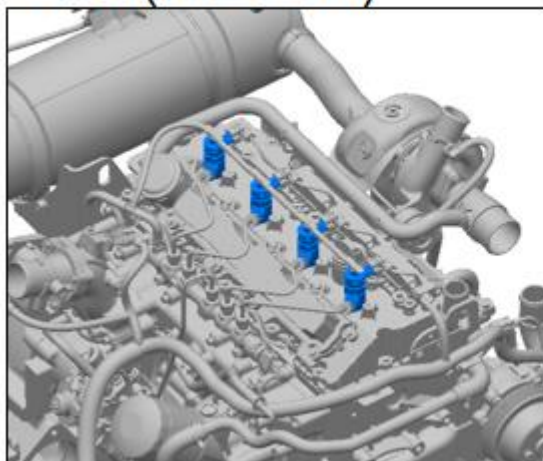
1.8L



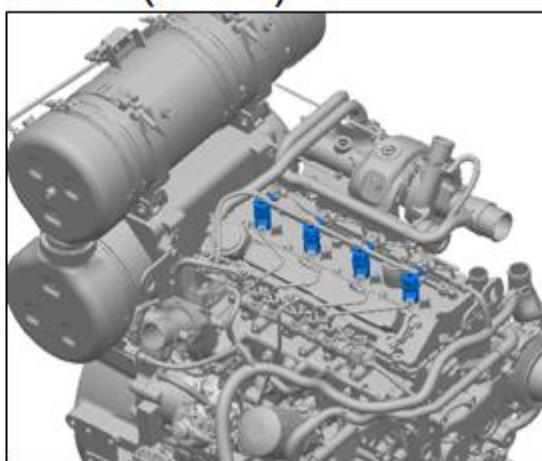
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The injector of cylinder #1 is shorted between high-side to low-side in the injector.

5) Condition for Clearing the Fault Code

The injector of cylinder #1 is restored

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|--------|
| 1 | P32EE is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Disconnect injector. Fault disappeared? | | Change injector | Step5 |


| | | | | |
|---|--|--|--|-------------------------|
| 5 | If an intermediate engine connector is present, disconnect it. Fault disappeared? | | Fix intermediate engine harness | Stet 6 |
| 6 | Short circuit before injector. Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P32F0 | Injector High Low side Short circuit Fault (Cylinder #3) |

1) Overview

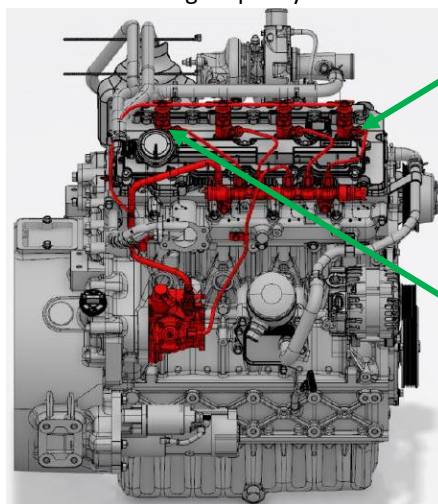
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000653-22 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|------------------------------|---------|---------------------|
|  | D24/D34 Cylinder #3 injector | | |
| | No | ECU Pin | Description |
| | 1 | A22 | Fuel Injector HSD21 |
| | 2 | A43 | Fuel Injector LSD21 |

| | | | |
|--|--------------------------|---------|---------------------|
|  | D18 Cylinder #3 injector | | |
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

2) Component Location

Cylinder #1 is located to engine pulley side.

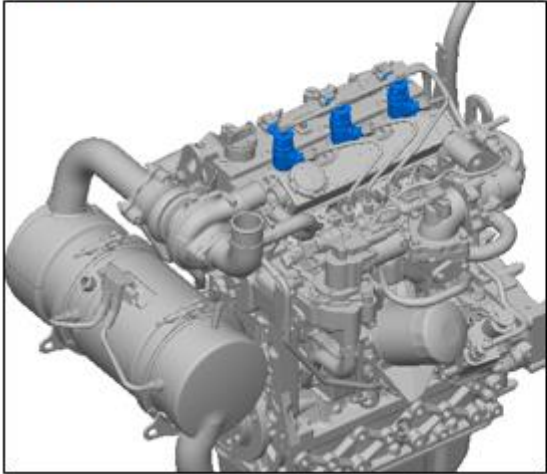


Cylinder No.1

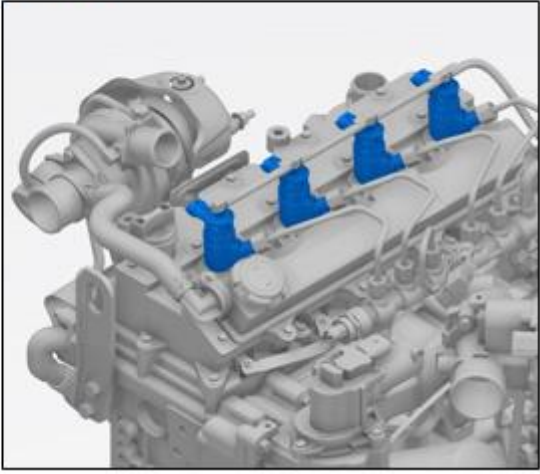
Cylinder No.4

| | | D24 | D34 | D18 | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
|----------------------|-------------|------|------|------|---|
| A64C | O_P_INJVH11 | | | | |
| A85C | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66C | O_P_INJVH12 | | | | |
| A87C | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22C | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43C | O_P_INJVL21 | | | | |
| A24C | O_P_INJVH22 | | | | |
| A45C | O_P_INJVL22 | Cyl2 | Cyl2 | - | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

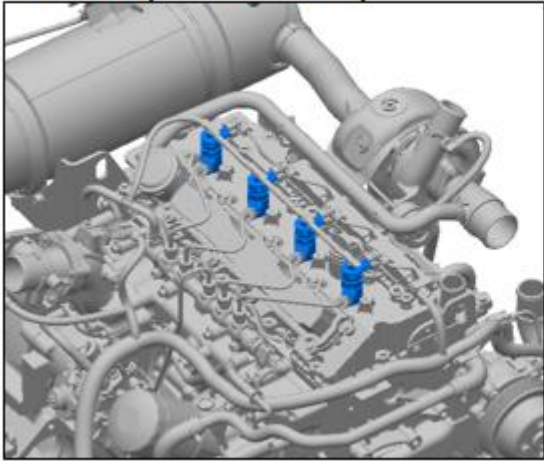
1.8L



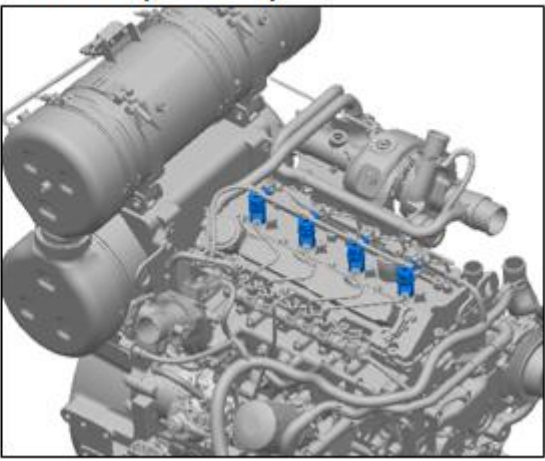
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The injector of cylinder #3 is shorted between high-side to low-side in the injector.

5) Condition for Clearing the Fault Code

The injector of cylinder #3 is restored

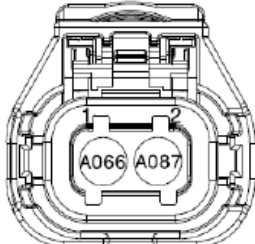
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------------------|------------------|
| 1 | P32F0 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Disconnect injector. Fault disappeared? | | Change injector | Step5 |
| 5 | If an intermediate engine connector is present, disconnect it. Fault disappeared? | | Fix intermediate engine harness | Stet 6 |
| 6 | Short circuit before injector. Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P32F1 | Injector High Low side Short circuit Fault (Cylinder #4) |

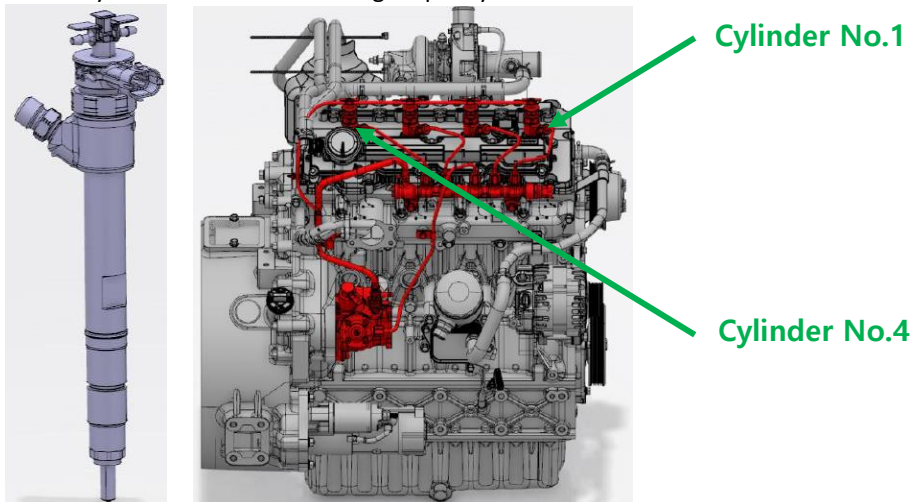
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000654-22 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

|  | Cylinder #4 injector | | |
|---|----------------------|---------|---------------------|
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

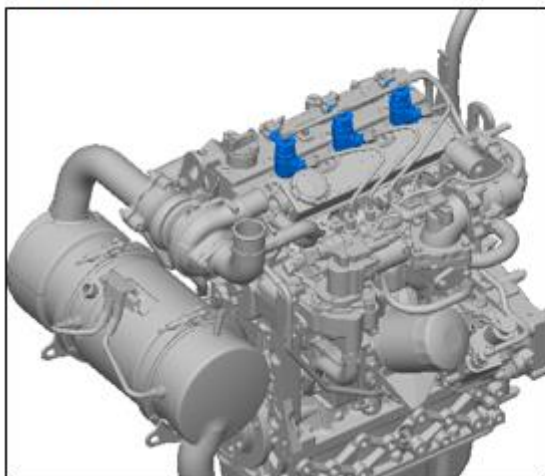
2) Component Location

Cylinder #1 is located to engine pulley side.

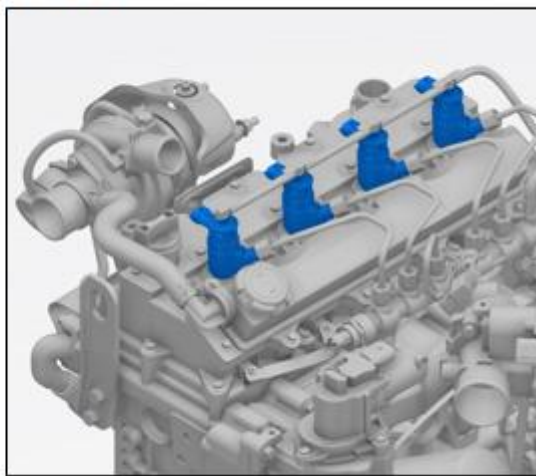


| | | D24 | D34 | D18 | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
|----------------------|-------------|------|------|------|---|
| A64 | O_P_INJVH11 | | | | |
| A85 | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66 | O_P_INJVH12 | | | | |
| A87 | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22 | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43 | O_P_INJVL21 | | | | |
| A24 | O_P_INJVH22 | Cyl2 | Cyl2 | - | |
| A45 | O_P_INJVL22 | | | | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

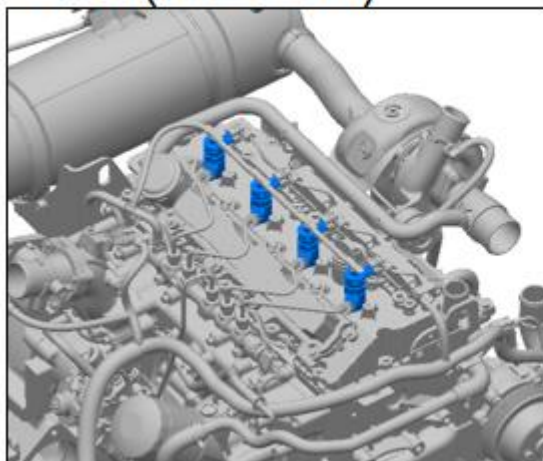
1.8L



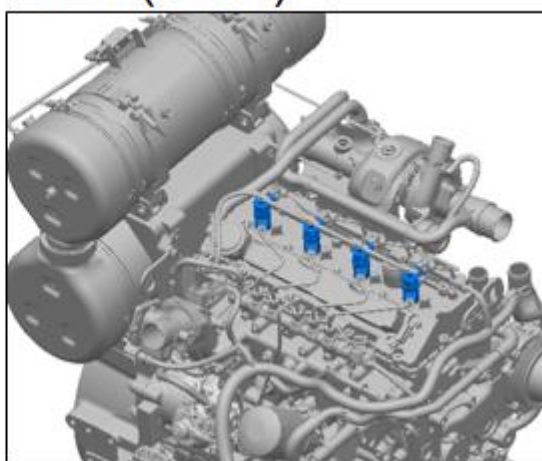
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The injector of cylinder #4 is shorted between high-side to low-side in the injector.

5) Condition for Clearing the Fault Code

The injector of cylinder #4 is restored

6) Check List

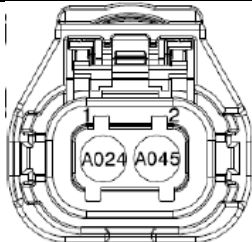
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|--------|
| 1 | P32F1 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | | | | Step5 |

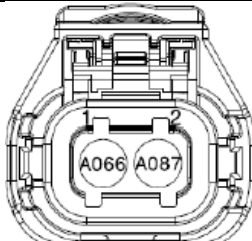
| | | | | |
|----------|---|--|--|-----------------------------|
| | Disconnect injector. Fault disappeared? | | Change injector | |
| 5 | If an intermediate engine connector is present, disconnect it. Fault disappeared? | | Fix intermediate engine harness | Stet 6 |
| 6 | Short circuit before injector. Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P32EF | Injector High Low side Short circuit Fault (Cylinder #2) |

1) Overview

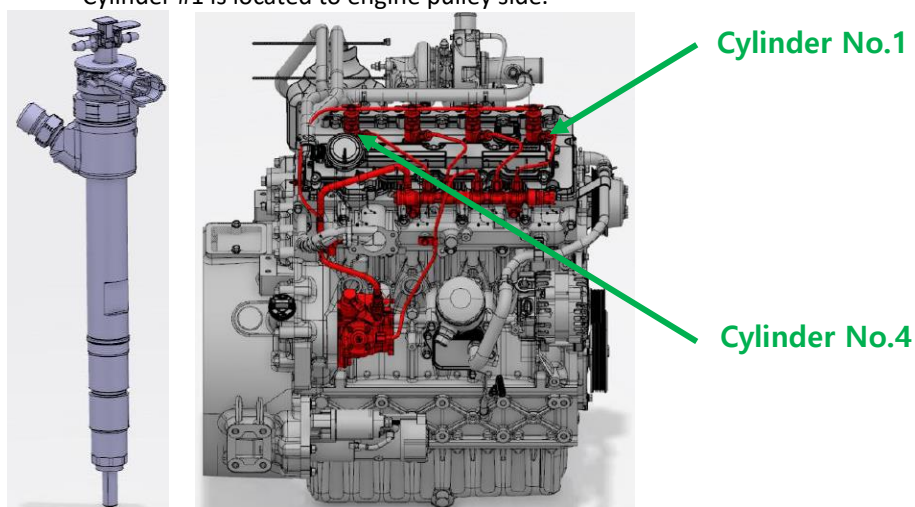
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000652-22 | 1. Electrical problem (Injector connector) 2. Electrical problem (Wiring harness from injector to ECU, Faulty injector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

| | | | |
|---|------------------------------|---------|---------------------|
|  | D24/D34 Cylinder #2 injector | | |
| | No | ECU Pin | Description |
| | 1 | A24 | Fuel Injector HSD22 |
| | 2 | A45 | Fuel Injector LSD22 |

| | | | |
|--|--------------------------|---------|---------------------|
|  | D18 Cylinder #2 injector | | |
| | No | ECU Pin | Description |
| | 1 | A66 | Fuel Injector HSD12 |
| | 2 | A87 | Fuel Injector LSD12 |

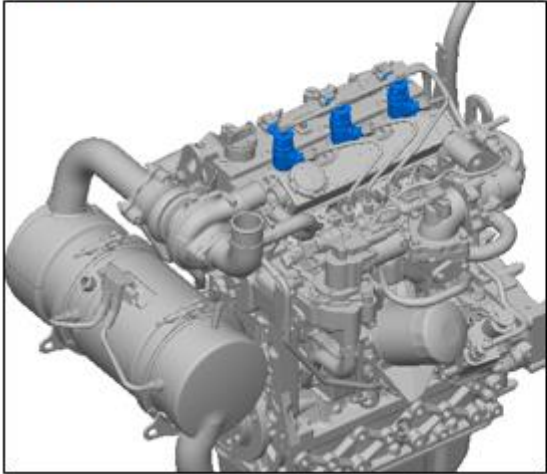
2) Component Location

Cylinder #1 is located to engine pulley side.

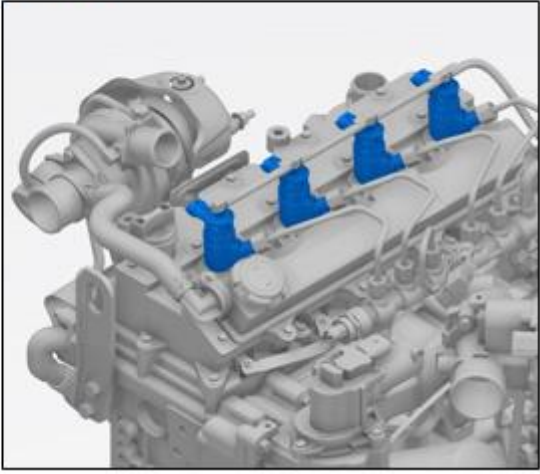


| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64C | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85C | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66C | O_P_INJVH12 | | | | |
| A87C | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22C | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43C | O_P_INJVL21 | | | | |
| A24C | O_P_INJVH22 | | | | |
| A45C | O_P_INJVL22 | Cyl2 | Cyl2 | - | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |

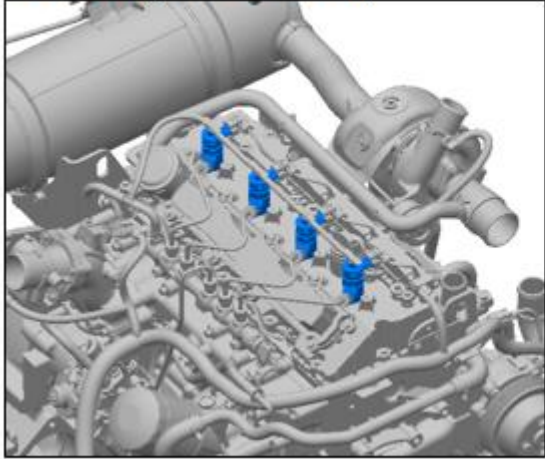
1.8L



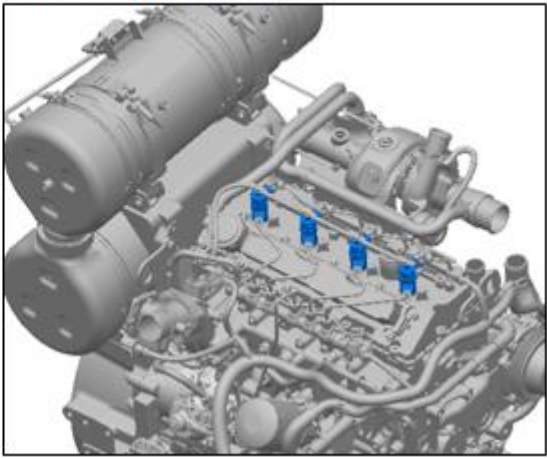
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The injector of cylinder #2 is shorted between high-side to low-side in the injector.

5) Condition for Clearing the Fault Code

The injector of cylinder #2 is restored

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------------------|------------------|
| 1 | P32EF is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check injector Connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Disconnect injector. Fault disappeared? | | Change injector | Step5 |
| 5 | If an intermediate engine connector is present, disconnect it. Fault disappeared? | | Fix intermediate engine harness | Stet 6 |
| 6 | Short circuit before injector. Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

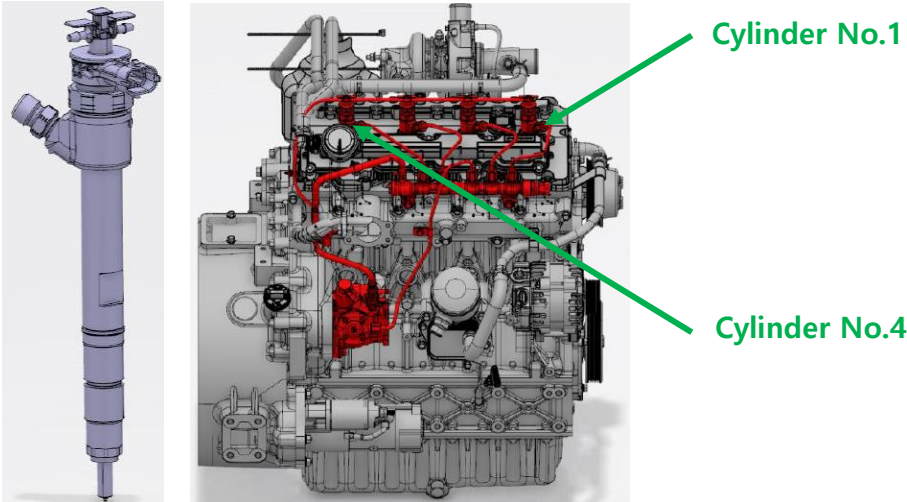
| Fault Code | Fault Name |
|-----------------------|---|
| P268C | Injector Code(IQA) Program Missing Fault (Cylinder#1) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000651-02 | 1. Coding problem (The injector code(IQA) is not updated at fresh ECU or after ECU reset.) 2. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

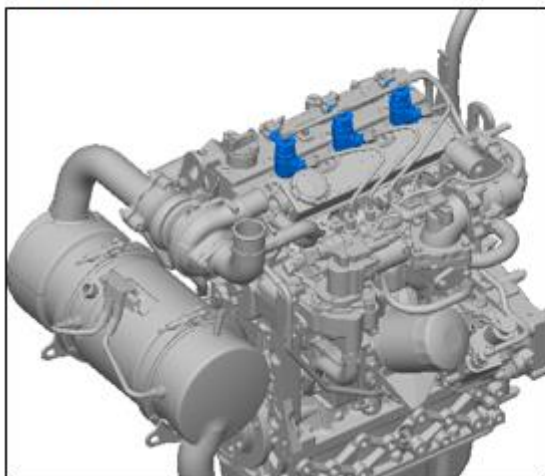
Cylinder #1 is located to engine pulley side.



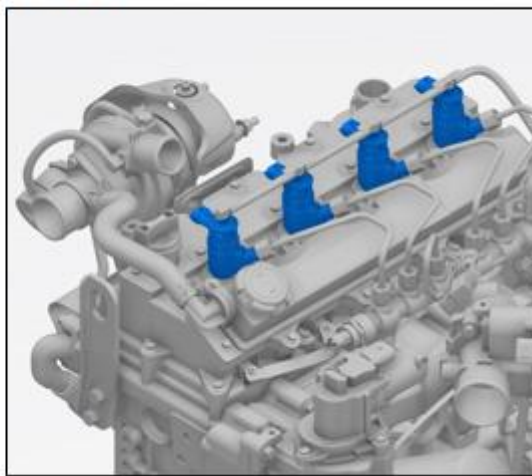
| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A640 | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A850 | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A660 | O_P_INJVH12 | | | | |
| A870 | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A220 | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A430 | O_P_INJVL21 | | | | |
| A240 | O_P_INJVH22 | Cyl2 | Cyl2 | - | |
| A450 | O_P_INJVL22 | | | | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |



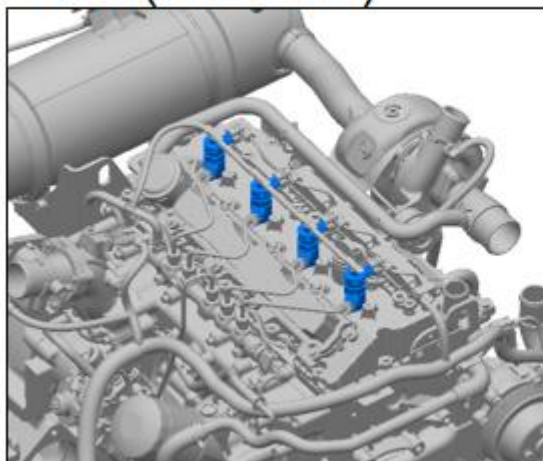
1.8L



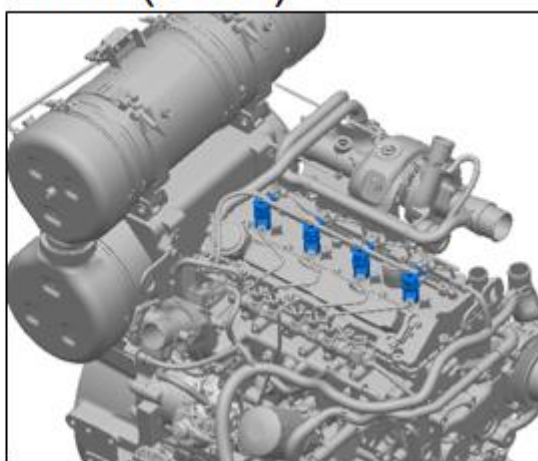
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the monitoring for missing or faulty programming of the injector adjustment values, the fault is active.

5) Condition for Clearing the Fault Code

If the IQA data of ECU is matched with each injector

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P268C is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step3 | |

| | | | | |
|----------|--|--|----------------------------|-------------------------|
| 3 | Re-Write injector codes (IQA) by service tool and key off. Wait over 30sec until main ECU power relay turn off. Key on and erase faults. Fault disappeared? | | Problem solved | Step4 |
| 4 | Check power relay operation. Relay not operation? | | Fix relay or wiring | step5 |
| 5 | Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

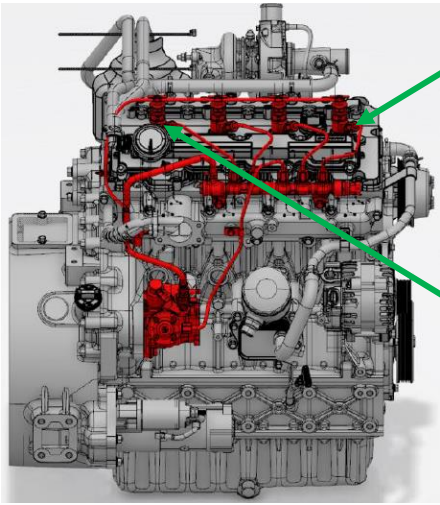
| Fault Code | Fault Name |
|-----------------------|---|
| P268E | Injector Code(IQA) Program Missing Fault (Cylinder#3) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000653-02 | 1. Coding problem (The injector code(IQA) is not updated at fresh ECU or after ECU reset.) 2. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

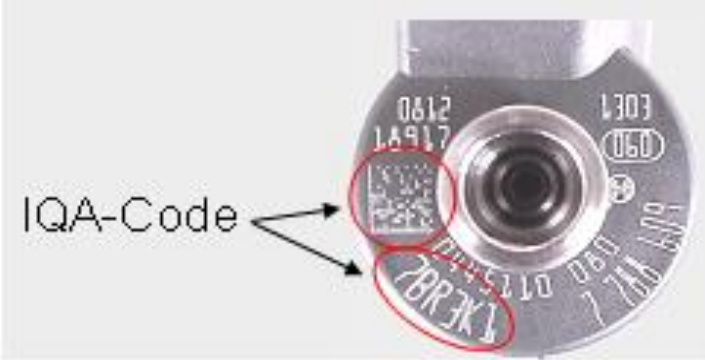
Cylinder #1 is located to engine pulley side.



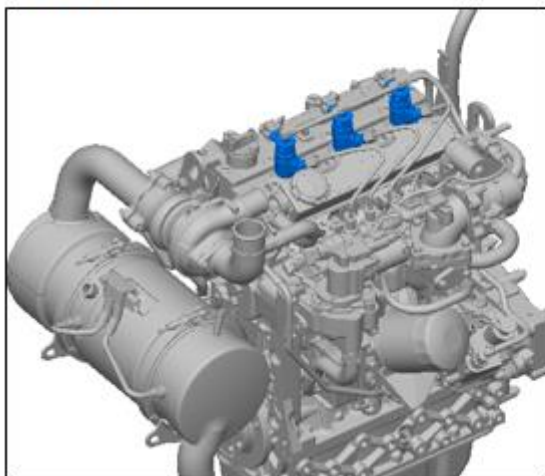
Cylinder No.1

Cylinder No.4

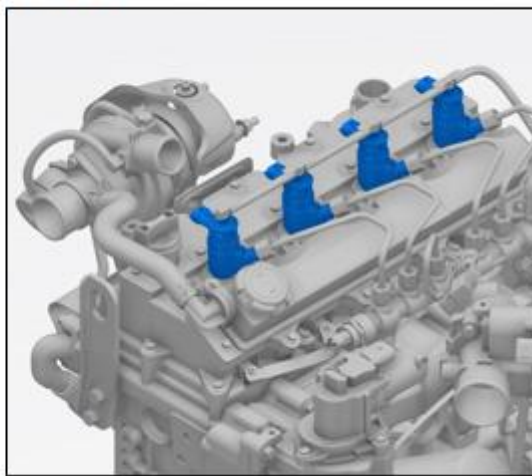
| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64c | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85c | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66c | O_P_INJVH12 | | | | |
| A87c | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22c | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43c | O_P_INJVL21 | | | | |
| A24c | O_P_INJVH22 | Cyl2 | Cyl2 | - | |
| A45c | O_P_INJVL22 | | | | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |



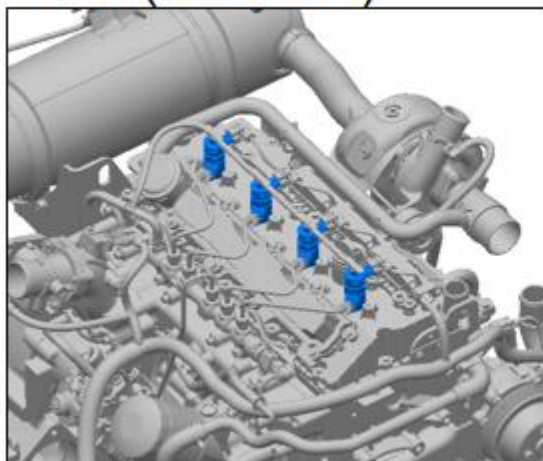
1.8L



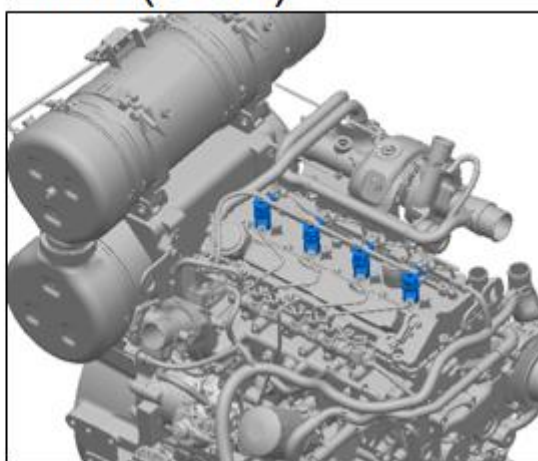
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the monitoring for missing or faulty programming of the injector adjustment values, the fault is active.

5) Condition for Clearing the Fault Code

If the IQA data of ECU is matched with each injector

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P268E is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step3 | |

| | | | | |
|----------|--|--|----------------------------|-------------------------|
| 3 | Re-Write injector codes (IQA) by service tool and key off. Wait over 30sec until main ECU power relay turn off. Key on and erase faults. Fault disappeared? | | Problem solved | Step4 |
| 4 | Check power relay operation. Relay not operation? | | Fix relay or wiring | step5 |
| 5 | Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

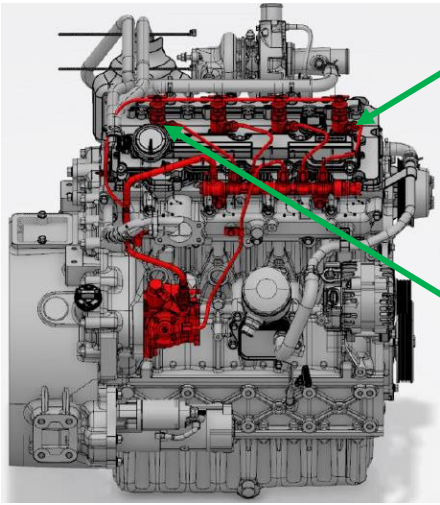
| Fault Code | Fault Name |
|-----------------------|---|
| P268F | Injector Code(IQA) Program Missing Fault (Cylinder#4) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000654-02 | 1. Coding problem (The injector code(IQA) is not updated at fresh ECU or after ECU reset.) 2. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

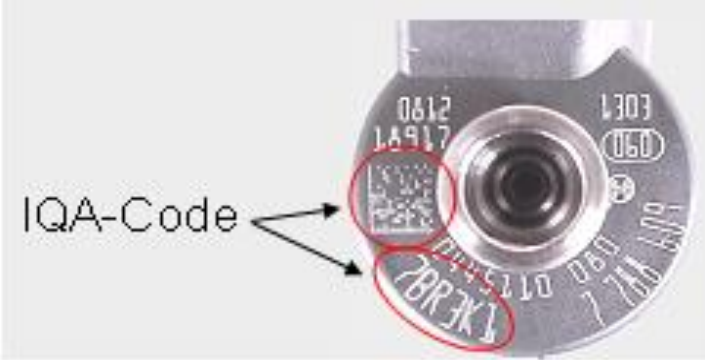
Cylinder #1 is located to engine pulley side.



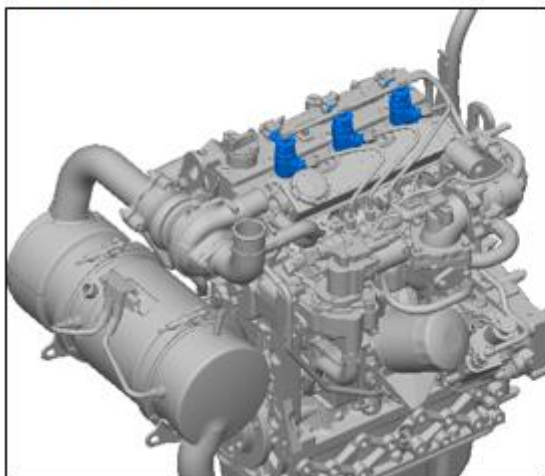
Cylinder No.1

Cylinder No.4

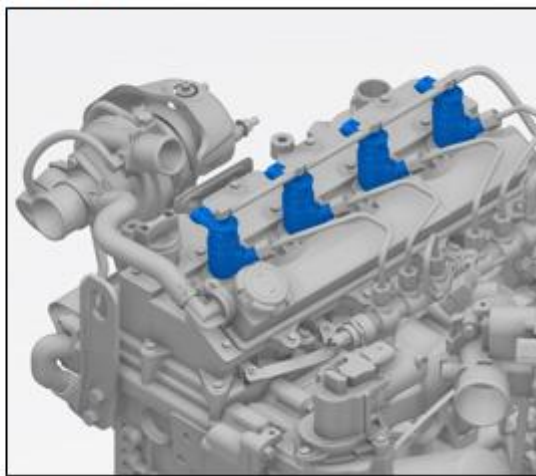
| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64c | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85c | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66c | O_P_INJVH12 | | | | |
| A87c | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22c | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43c | O_P_INJVL21 | | | | |
| A24c | O_P_INJVH22 | Cyl2 | Cyl2 | - | |
| A45c | O_P_INJVL22 | | | | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |



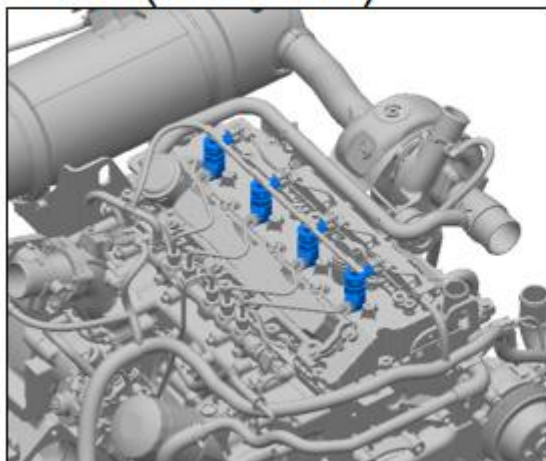
1.8L



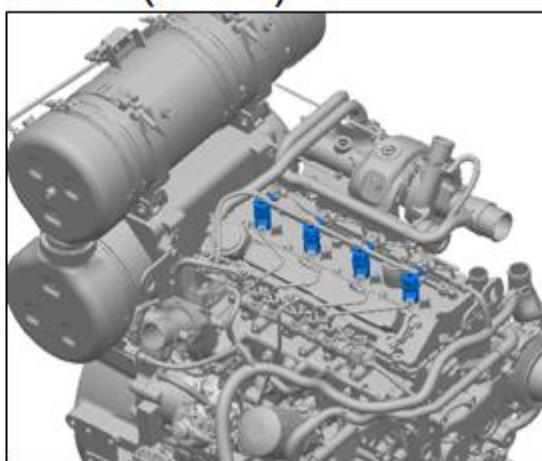
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the monitoring for missing or faulty programming of the injector adjustment values, the fault is active.

5) Condition for Clearing the Fault Code

If the IQA data of ECU is matched with each injector

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P268F is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step3 | |

| | | | | |
|----------|--|--|----------------------------|-------------------------|
| 3 | Re-Write injector codes (IQA) by service tool and key off. Wait over 30sec until main ECU power relay turn off. Key on and erase faults. Fault disappeared? | | Problem solved | Step4 |
| 4 | Check power relay operation. Relay not operation? | | Fix relay or wiring | step5 |
| 5 | Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

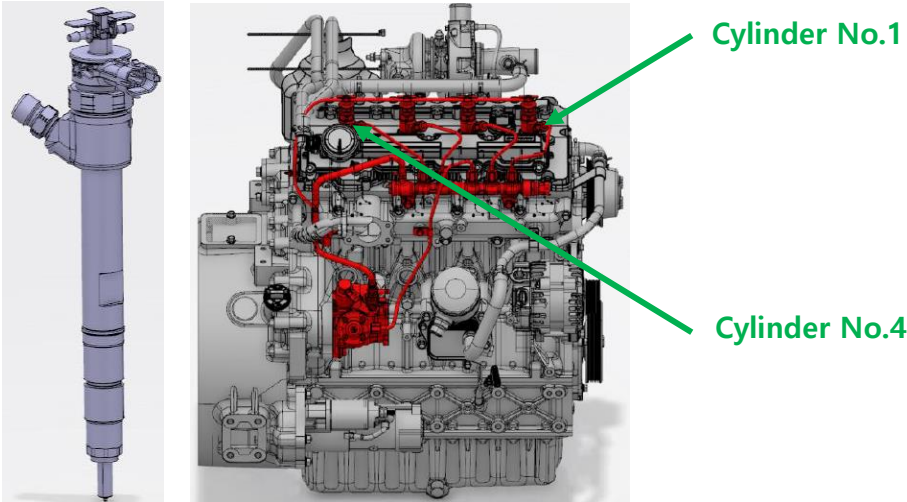
| Fault Code | Fault Name |
|-----------------------|---|
| P268D | Injector Code(IQA) Program Missing Fault (Cylinder#2) |

1) Overview

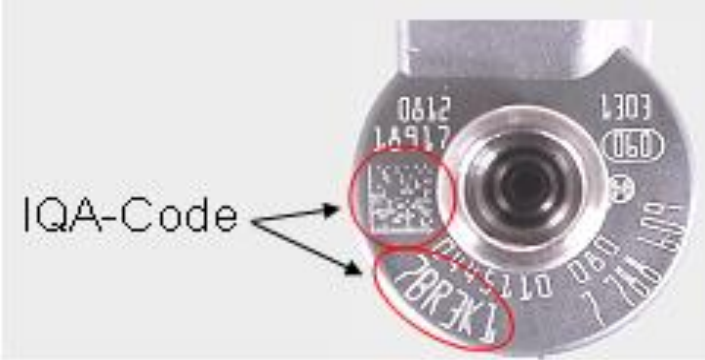
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000652-02 | 1. Coding problem (The injector code(IQA) is not updated at fresh ECU or after ECU reset.) 2. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

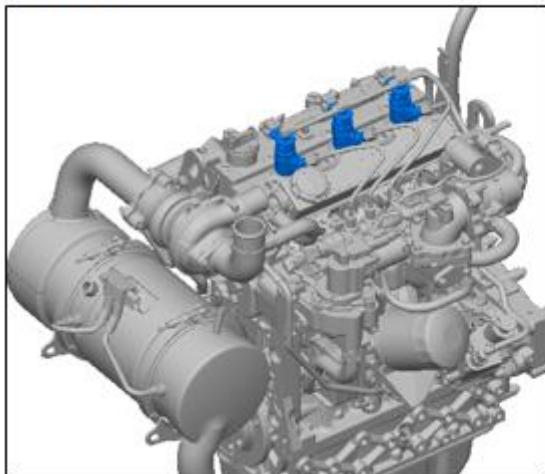
Cylinder #1 is located to engine pulley side.



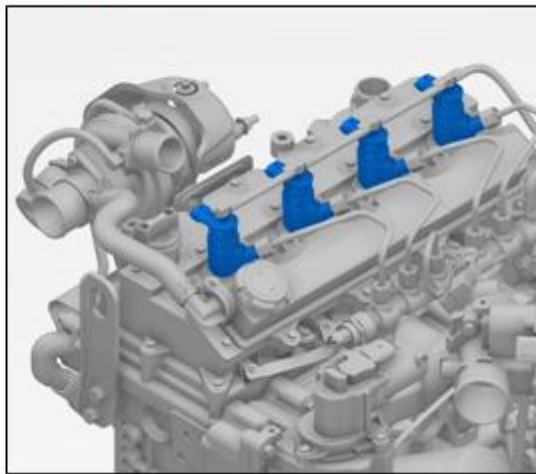
| | | D24 | D34 | D18 | |
|----------------------|-------------|------|------|------|---|
| A64c | O_P_INJVH11 | | | | Firing order (\$): D24 & D34 4 Cyl.: 1 3 4 2 D18 3 Cyl.: 1 2 3 |
| A85c | O_P_INJVL11 | Cyl1 | Cyl1 | Cyl1 | |
| A66c | O_P_INJVH12 | | | | |
| A87c | O_P_INJVL12 | Cyl4 | Cyl4 | Cyl3 | |
| BANK 1 | | | | | |
| A22c | O_P_INJVH21 | Cyl3 | Cyl3 | Cyl2 | |
| A43c | O_P_INJVL21 | | | | |
| A24c | O_P_INJVH22 | Cyl2 | Cyl2 | - | |
| A45c | O_P_INJVL22 | | | | |
| BANK 2 | | | | | |
| Cylinder Interfacing | | | | | |



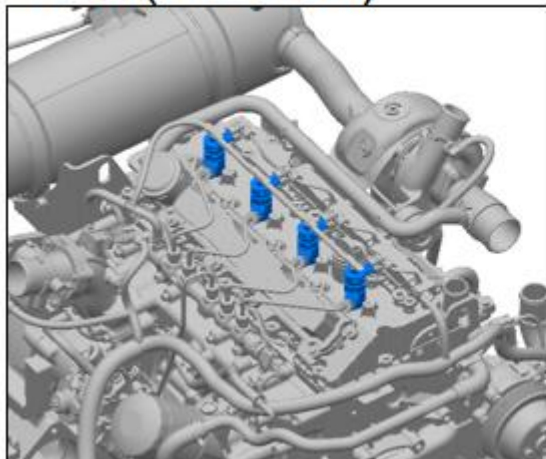
1.8L



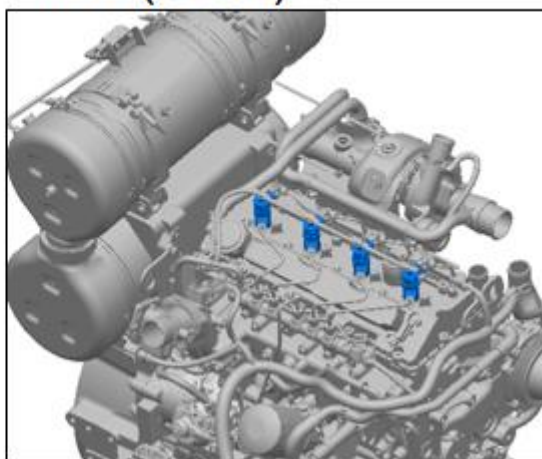
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the monitoring for missing or faulty programming of the injector adjustment values, the fault is active.

5) Condition for Clearing the Fault Code

If the IQA data of ECU is matched with each injector

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P268D is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step3 | |

| | | | | |
|----------|--|--|----------------------------|-------------------------|
| 3 | Re-Write injector codes (IQA) by service tool and key off. Wait over 30sec until main ECU power relay turn off. Key on and erase faults. Fault disappeared? | | Problem solved | Step4 |
| 4 | Check power relay operation. Relay not operation? | | Fix relay or wiring | step5 |
| 5 | Check ECU connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P2547 | Multi-torque switch signal too high fault |

1) Overview

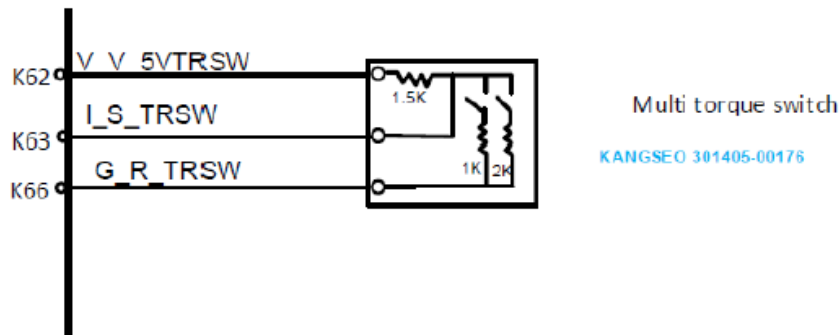
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001568-03 | 1. Electrical problem (Multi-torque switch) 2. Electrical problem (Wiring harness Multi-torque switch t to ECU, Faulty Multi-torque switch) 3. Electrical problem (Faulty ECU, ECU connection) | CE lamp ON |

This pin description is only for hardwire to ECU connection type.

| No | ECU Pin | Description |
|----|---------|----------------------------|
| 1 | K62 | Multi-torque switch supply |
| 2 | K63 | Multi-torque switch signal |
| 3 | K66 | Multi-torque switch ground |

2) Component Location

The multi-torque switch is dependent on machine strategy.
The below one is typical base shape. (4 Stage switch)



| | SRC RANGE | |
|----------------------|-----------|--------|
| | min(V) | max(V) |
| Both 1K and 2K open | 2.34 | 2.56 |
| 1K open & 2K close | 1.7 | 1.8 |
| 1K close & 2K open | 1.33 | 1.49 |
| Both 1K and 2K close | 1.09 | 1.24 |

3) Condition for Running Diagnostic

Key ON or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The multi-torque switch raw value is higher than threshold. (>2.56V)

5) Condition for Clearing the Fault Code

The multi-torque switch is normal.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P2547 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check switch connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal switch Switch problem? | | Change switch | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P2546 | Multi-torque switch signal too low fault |

1) Overview

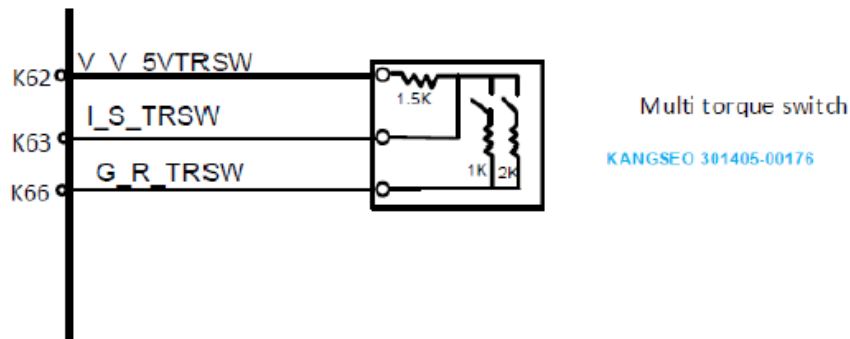
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001568-04 | 1. Electrical problem (Multi-torque switch) 2. Electrical problem (Wiring harness Multi-torque switch t to ECU, Faulty Multi-torque switch) 3. Electrical problem (Faulty ECU, ECU connection) | CE lamp ON |

This pin description is only for hardwire to ECU connection type.

| No | ECU Pin | Description |
|----|---------|----------------------------|
| 1 | K62 | Multi-torque switch supply |
| 2 | K63 | Multi-torque switch signal |
| 3 | K66 | Multi-torque switch ground |

2) Component Location

The multi-torque switch is dependent on machine strategy.
The below one is typical base shape. (4 Stage switch)



| | SRC RANGE | |
|----------------------|-----------|--------|
| | min(V) | max(V) |
| Both 1K and 2K open | 2.34 | 2.56 |
| 1K open & 2K close | 1.7 | 1.8 |
| 1K close & 2K open | 1.33 | 1.49 |
| Both 1K and 2K close | 1.09 | 1.24 |

3) Condition for Running Diagnostic

Key ON or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The multi-torque switch raw value is lower than threshold. (< 1.09V)

5) Condition for Clearing the Fault Code

The multi-torque switch is normal.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P2546 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check switch connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal switch Switch problem? | | Change switch | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P025A | Fuel metering unit Open circuit fault |

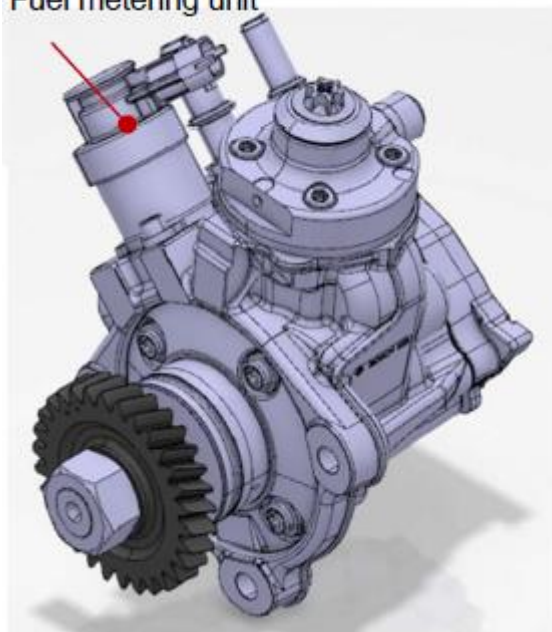
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E004082-05 | 1. Electrical problem (Metering unit connector) 2. Electrical problem (Wiring harness from Metering unit to ECU, Faulty Metering unit) 3. Electrical problem (Faulty ECU, ECU connection) 4. Electrical problem (ECU power supply) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

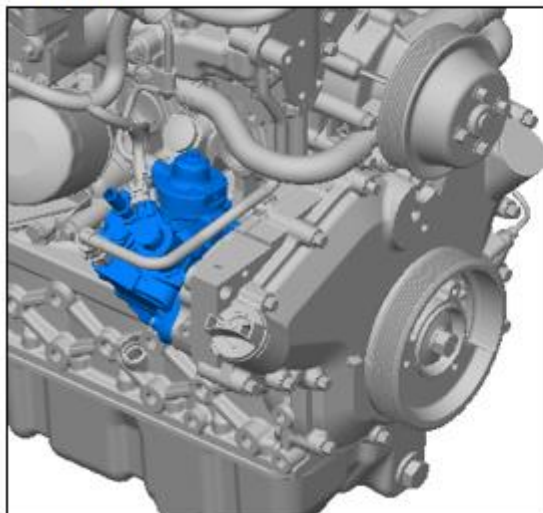
|  | | |
|---|---------|---------------------------|
| No | ECU Pin | Description |
| 1 | A7 (K1) | Fuel metering unit supply |
| 2 | A6 | Fuel metering unit signal |

2) Component Location

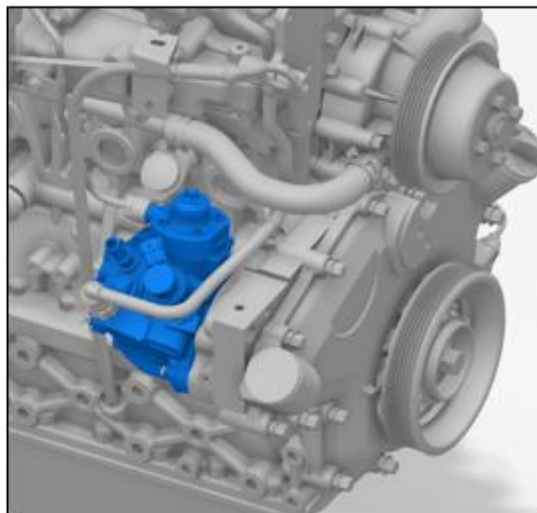
Fuel metering unit



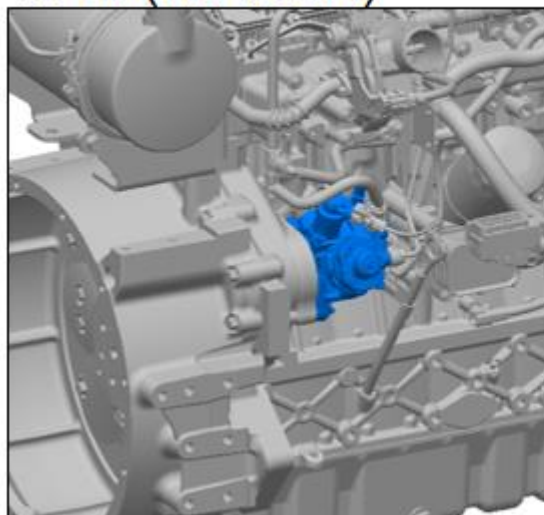
1.8L



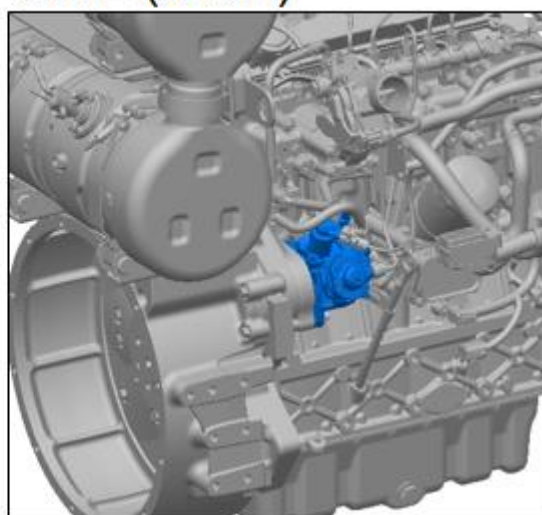
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the fuel metering unit signal is opened, fault code is raised.

5) Condition for Clearing the Fault Code

If the fault condition is restored, fault code is cleared.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|--------|
| 1 | P025A is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the Fuel Metering unit connection | | | Step 4 |

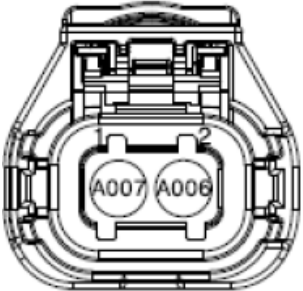
| | | | | |
|----------|--|--------------------------------|----------------------------------|-------------------------|
| | Connection problem? (pin to pin) | | Do necessary repair | |
| 4 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step5 |
| 5 | Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Resistance problem? | 2.6~3.15 Ω @ 20 degC | Change Fuel metering unit | Step6 |
| 6 | Check the ECU power supply (K1 pin – Battery+) Connection or fuse problem? | ~12V | Do necessary repair | Contact Helpdesk |

* The service tool supports the “Metering unit test” function for related checking.

| Fault Code | Fault Name |
|-----------------------|---|
| P025B | Fuel metering unit Over temperature fault |

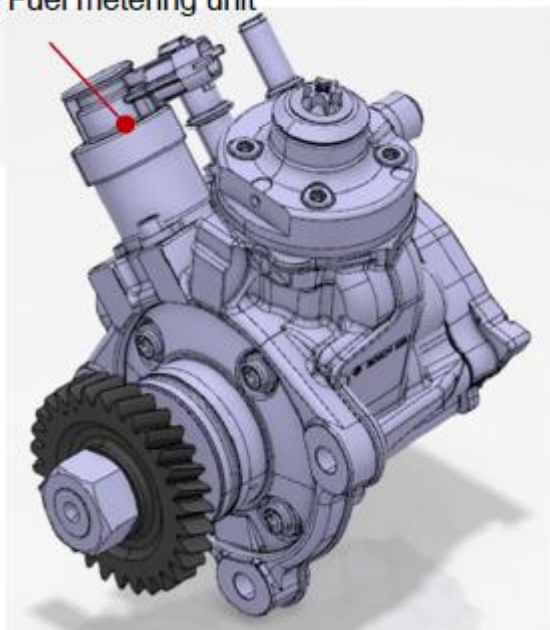
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E004082-07 | 1. Electrical problem (Metering unit connector) 2. Electrical problem (Wiring harness from Metering unit to ECU, Faulty Metering unit) 3. Electrical problem (Faulty ECU, ECU connection) 4. Electrical problem (ECU power supply) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

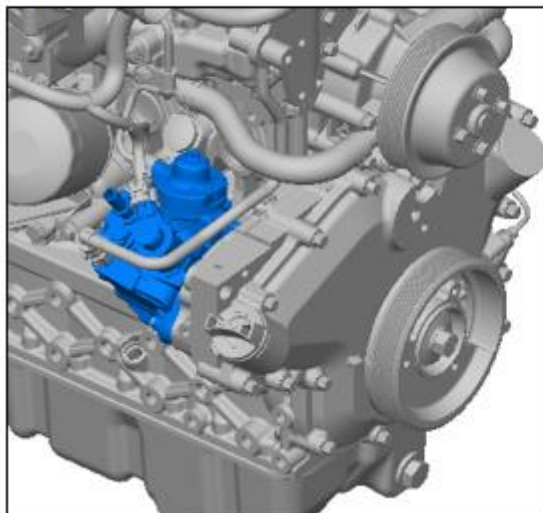
|  | | |
|---|---------|---------------------------|
| No | ECU Pin | Description |
| 1 | A7 (K1) | Fuel metering unit supply |
| 2 | A6 | Fuel metering unit signal |

2) Component Location

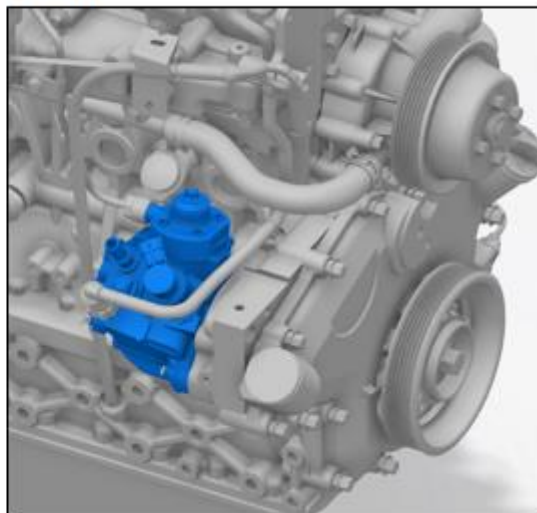
Fuel metering unit



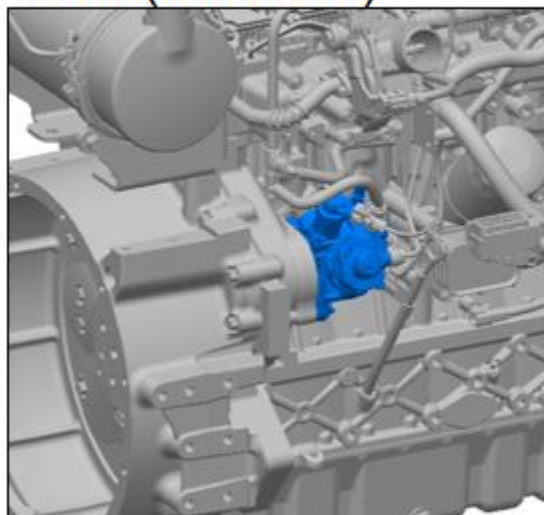
1.8L



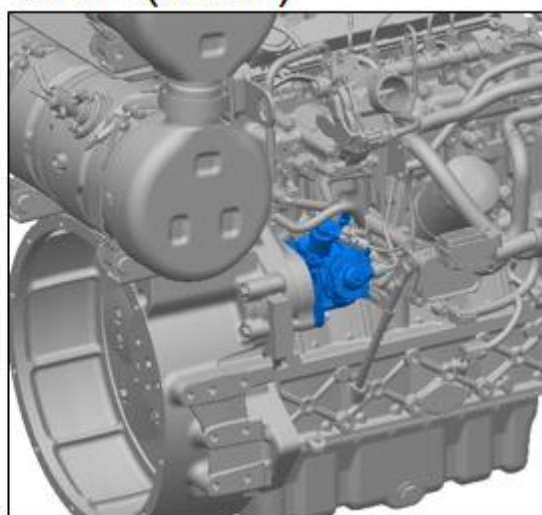
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the fuel metering unit signal is over temperature, fault code is raised.

5) Condition for Clearing the Fault Code

If the fault condition is restored, fault code is cleared.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|--------|
| 1 | P025B is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the Fuel Metering unit connection | | | Step 4 |

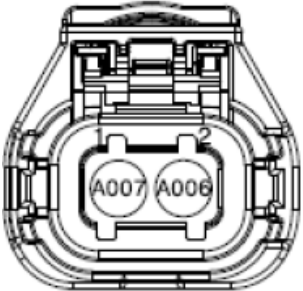
| | | | | |
|----------|--|--------------------------------|----------------------------------|-------------------------|
| | Connection problem? (pin to pin) | | Do necessary repair | |
| 4 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step5 |
| 5 | Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Resistance problem? | 2.6~3.15 Ω @ 20 degC | Change Fuel metering unit | Step6 |
| 6 | Check the ECU power supply (K1 pin – Battery+) Connection or fuse problem? | ~12V | Do necessary repair | Contact Helpdesk |

* The service tool supports the “Metering unit test” function for related checking.

| Fault Code | Fault Name |
|-----------------------|---|
| P025D | Fuel metering unit Short circuit to Battery fault |

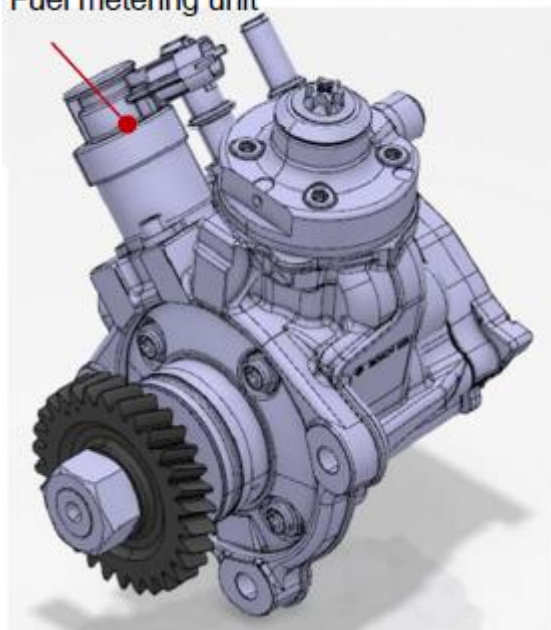
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E004082-03 | 1. Electrical problem (Metering unit connector) 2. Electrical problem (Wiring harness from Metering unit to ECU, Faulty Metering unit) 3. Electrical problem (Faulty ECU, ECU connection) 4. Electrical problem (ECU power supply) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

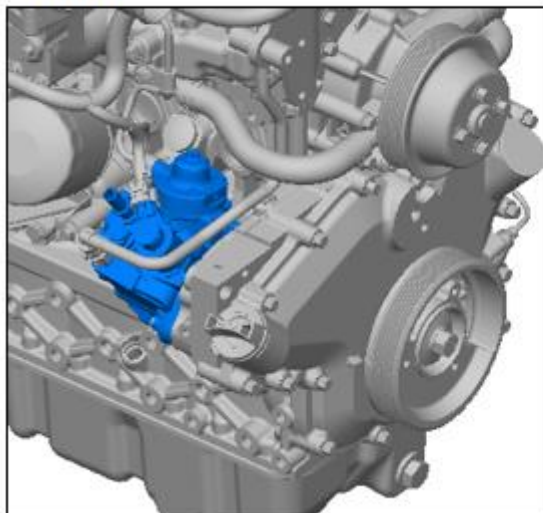
|  | | |
|---|---------|---------------------------|
| No | ECU Pin | Description |
| 1 | A7 (K1) | Fuel metering unit supply |
| 2 | A6 | Fuel metering unit signal |

2) Component Location

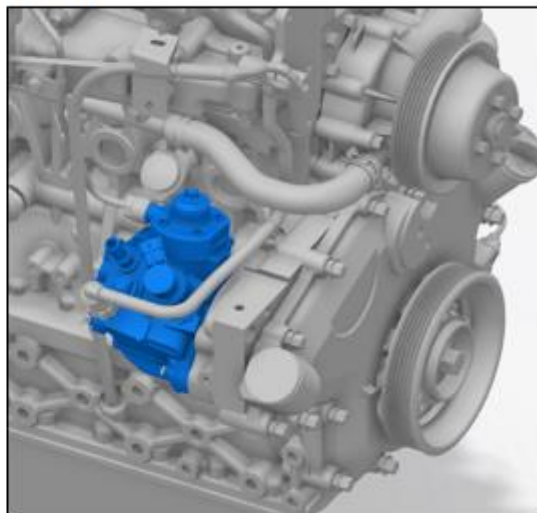
Fuel metering unit



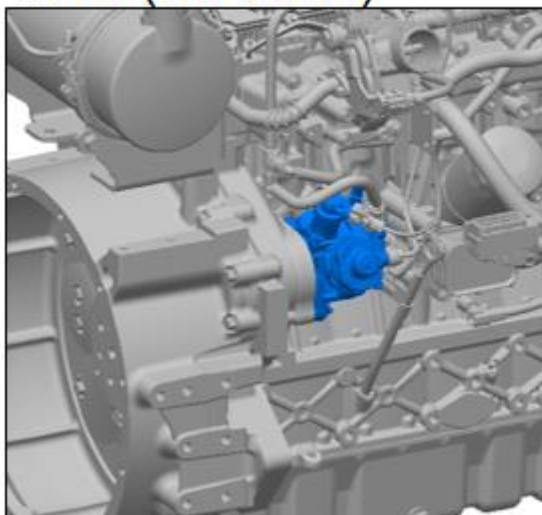
1.8L



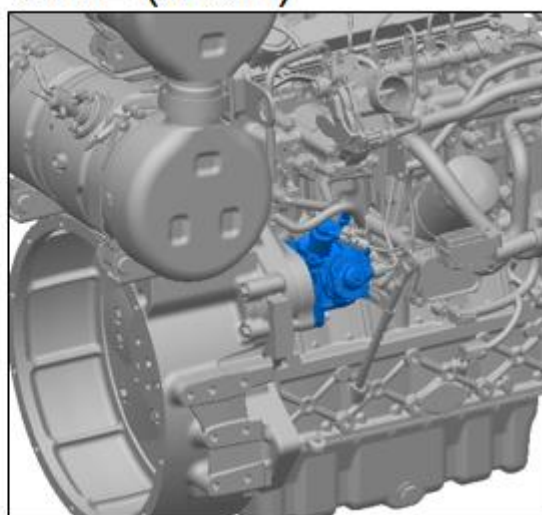
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the fuel metering unit signal is short circuit to battery, fault code is raised.

5) Condition for Clearing the Fault Code

If the fault condition is restored, fault code is cleared.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|--------|
| 1 | P025D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the Fuel Metering unit connection | | | Step 4 |

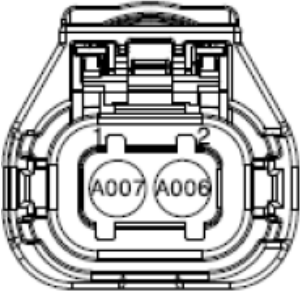
| | | | | |
|----------|--|--------------------------------|----------------------------------|-------------------------|
| | Connection problem? (pin to pin) | | Do necessary repair | |
| 4 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step5 |
| 5 | Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Resistance problem? | 2.6~3.15 Ω @ 20 degC | Change Fuel metering unit | Step6 |
| 6 | Check the ECU power supply (K1 pin – Battery+) Connection or fuse problem? | ~12V | Do necessary repair | Contact Helpdesk |

* The service tool supports the “Metering unit test” function for related checking.

| Fault Code | Fault Name |
|-----------------------|--|
| P025C | Fuel metering unit Short circuit to Ground fault |

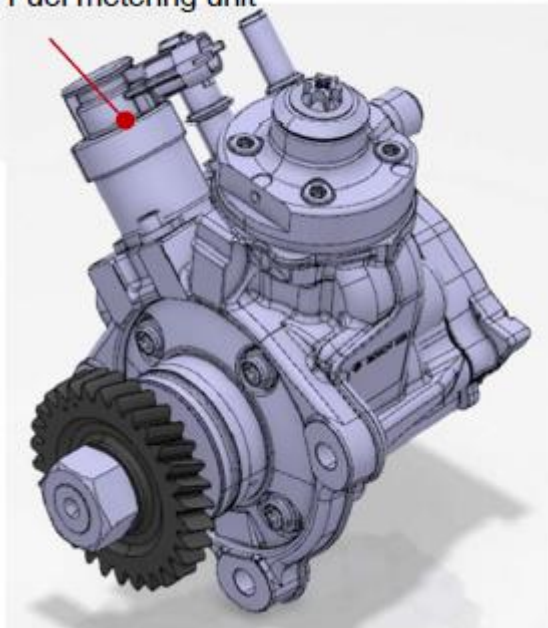
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E004082-04 | 1. Electrical problem (Metering unit connector) 2. Electrical problem (Wiring harness from Metering unit to ECU, Faulty Metering unit) 3. Electrical problem (Faulty ECU, ECU connection) 4. Electrical problem (ECU power supply) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

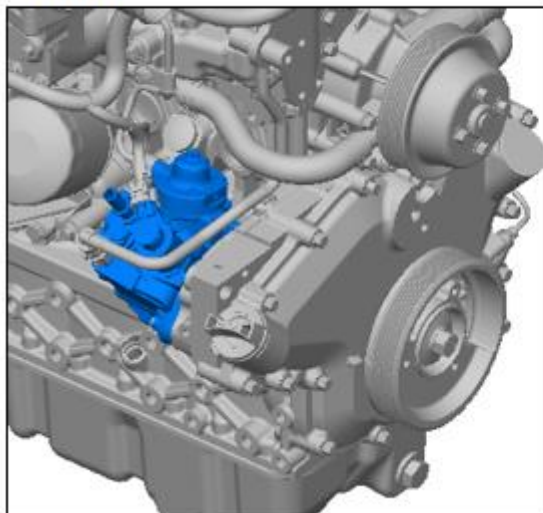
|  | | |
|---|---------|---------------------------|
| No | ECU Pin | Description |
| 1 | A7 (K1) | Fuel metering unit supply |
| 2 | A6 | Fuel metering unit signal |

2) Component Location

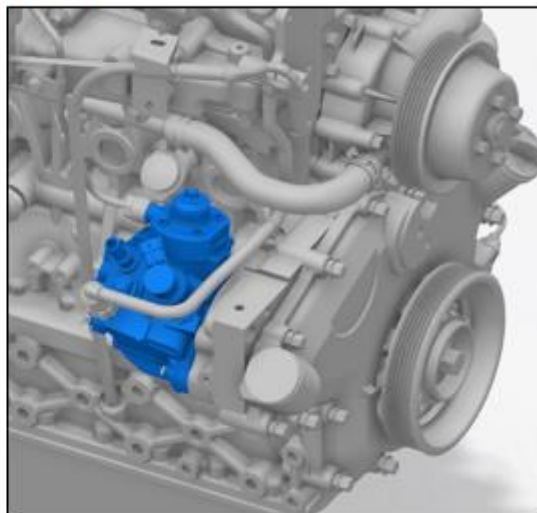
Fuel metering unit



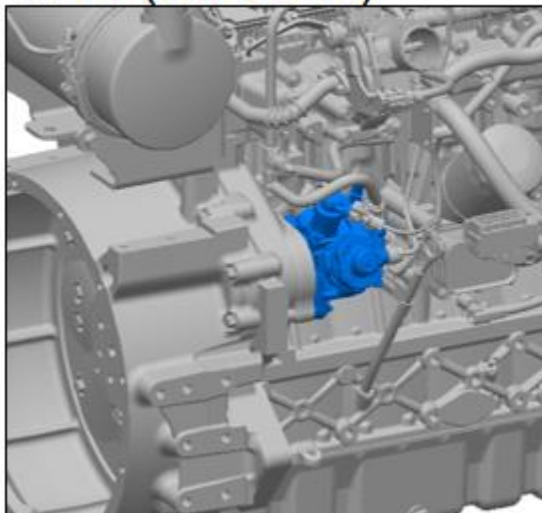
1.8L



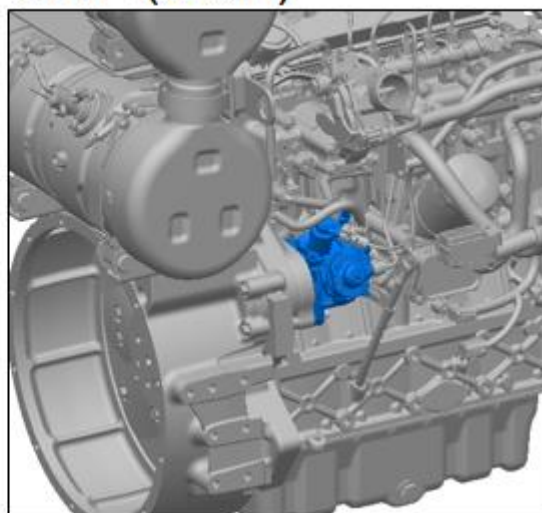
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the fuel metering unit signal is short circuit to ground, fault code is raised.

5) Condition for Clearing the Fault Code

If the fault condition is restored, fault code is cleared.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|--------|
| 1 | P025C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the Fuel Metering unit connection | | | Step 4 |

| | | | | |
|----------|--|-------------------------|----------------------------------|-------------------------|
| | Connection problem? (pin to pin) | | Do necessary repair | |
| 4 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step5 |
| 5 | Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Resistance problem? | 2.6~3.15 Ω @ 20 degC | Change Fuel metering unit | Step6 |
| 6 | Check the ECU power supply (K1 pin – Battery+) Connection or fuse problem? | ~12V | Do necessary repair | Contact Helpdesk |

* The service tool supports the “Metering unit test” function for related checking.

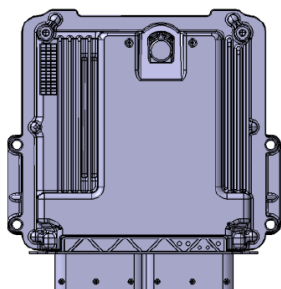
| Fault Code | Fault Name |
|-----------------------|---|
| P060B | ECU ADC(Analog to Digital Convertor) NTP(Null Load Test Pulse) Monitoring fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520618-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the value converted by the ADC channel is greater than the threshold (4.5V), after the debounce counter has reached the final value (15).

5) Condition for Clearing the Fault Code

If the value converted by the ADC channel is lower than the threshold.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P060B is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

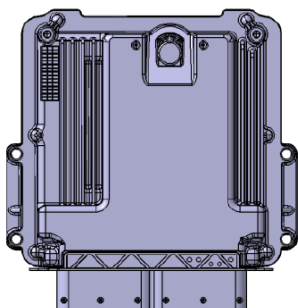
| Fault Code | Fault Name |
|-----------------------|---|
| P160C | ECU ADC(Analog to Digital Convertor) Test error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520696-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the value converted by the ADC, does not lie between minimum(4.726V) and maximum (4.829V) after the debounce counter has reached the final value. (15)

5) Condition for Clearing the Fault Code

If the value converted by the ADC is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P160C is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

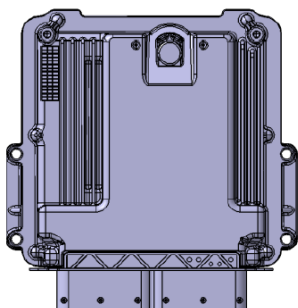
| Fault Code | Fault Name |
|-----------------------|--|
| P160D | ECU ADC(Analog to Digital Convertor) Voltage ratio error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520697-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the ratio correction value converted by the ADC, does not lie between minimum (0.95) and maximum (1.05) after the debounce counter has reached the final value. (15)

5) Condition for Clearing the Fault Code

If the ratio correction value converted by the ADC is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P160D is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

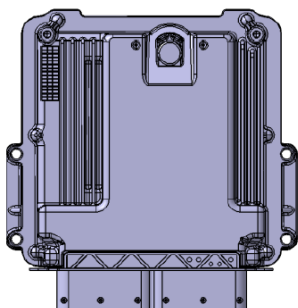
| Fault Code | Fault Name |
|-----------------------|--|
| P060C | ECU query response-communication error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E520698-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp Blink Torque Reduction 2(Severe) Engine stop immediately |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the ECU query response is late.

5) Condition for Clearing the Fault Code

If the ECU query response is on time.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P060C is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

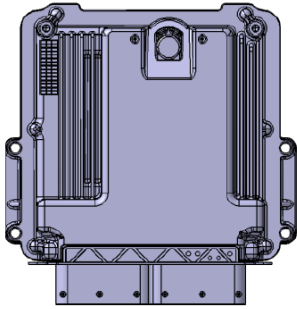
| Fault Code | Fault Name |
|-----------------------|--|
| P160E | ECU SPI(Serial Peripheral Interface Bus)-communication error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520699-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the ECU SPI(Serial Peripheral Interface Bus) response is late.

5) Condition for Clearing the Fault Code

If the ECU SPI(Serial Peripheral Interface Bus) response is on time.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P160E is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

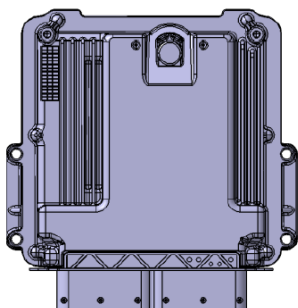
| Fault Code | Fault Name |
|-----------------------|-------------------------------|
| P160F | ECU ROM Memory multiple error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520641-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Multiple errors are detected while testing the complete ROM memory.

5) Condition for Clearing the Fault Code

Multiple errors are cleared while testing the complete ROM memory.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P160F is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

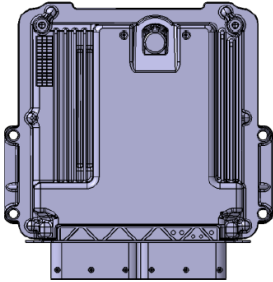
| Fault Code | Fault Name |
|-----------------------|--|
| P1610 | ECU MM(Monitoring Module) Synchronization Loss fault during Shut-off path test |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520642-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key off(ECU on)

4) Condition for Setting the Fault Code

This fault is detected when the MM(Monitoring Module) does not receive the whole response from CPU during shut-off path test.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1610 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

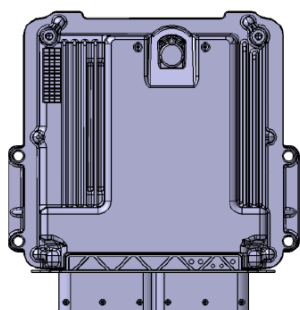
| Fault Code | Fault Name |
|-----------------------|------------------------------|
| P1611 | ECU Shut-off path test error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E520700-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp Blink Torque Reduction 2(Severe) |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key off(ECU on)

4) Condition for Setting the Fault Code

This fault is detected when the any error found during the execution of the shut-off path test.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1611 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

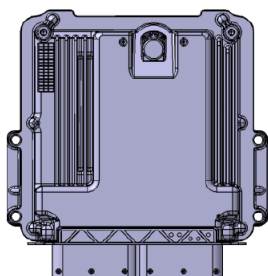
| Fault Code | Fault Name |
|-----------------------|---|
| P1612 | ECU Wrong set response time error during shut-off path test |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520701-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key off(ECU on)

4) Condition for Setting the Fault Code

This fault is detected when the wrong set MM Response time during shut-off path test.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1612 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

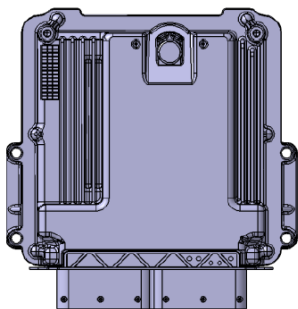
| Fault Code | Fault Name |
|-----------------------|--|
| P1613 | ECU Too many SPI(Serial Peripheral Interface Bus) errors during shut-off path test |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520702-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key off(ECU on)

4) Condition for Setting the Fault Code

This fault is detected when the errors detected in the SPI(Serial Peripheral Interface Bus) communication during shut-off path test.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1613 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

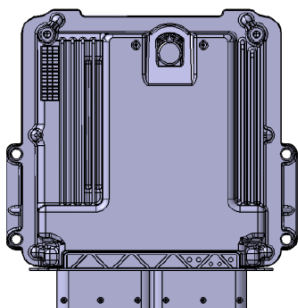
| Fault Code | Fault Name |
|-----------------------|--|
| P1614 | ECU Undervoltage error during Shut-off path test |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520707-04 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

When the under voltage is detected during shut-off path test.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1614 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

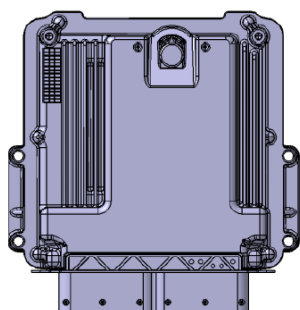
| Fault Code | Fault Name |
|-----------------------|---|
| P1615 | ECU WDA working error during Shut-off path test |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520703-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The WDA is not working correct during shut-off path test.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1615 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

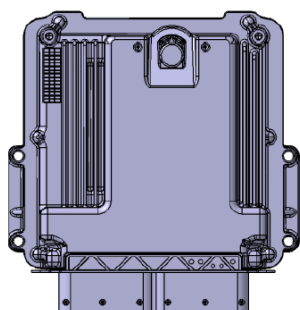
| Fault Code | Fault Name |
|-----------------------|--|
| P1616 | ECU OS Timeout error during Shut-off path test |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520704-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The OS timeout error during shut-off path test.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1616 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

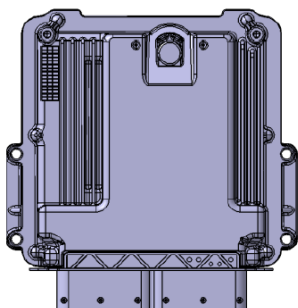
| Fault Code | Fault Name |
|-----------------------|---|
| P1617 | ECU Positive test failure error during Shut-off path test |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520705-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The positive test failure error during shut-off path test.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1617 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

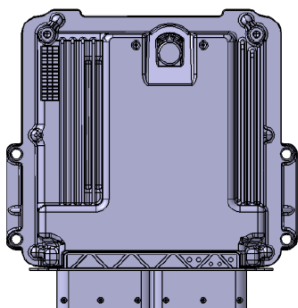
| Fault Code | Fault Name |
|-----------------------|--------------------------------------|
| P1618 | ECU Shut-off path test timeout fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520706-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The shut-off path test time is longer than threshold.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1618 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

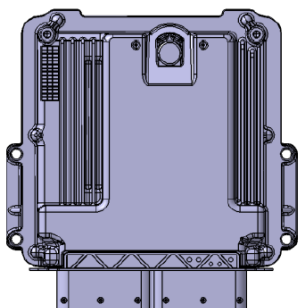
| Fault Code | Fault Name |
|-----------------------|---|
| P1619 | ECU Overvoltage error during Shut-off path test |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520707-03 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The overvoltage is detected during shut-off path test.

5) Condition for Clearing the Fault Code

No fault detection during shut-off path test.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1619 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

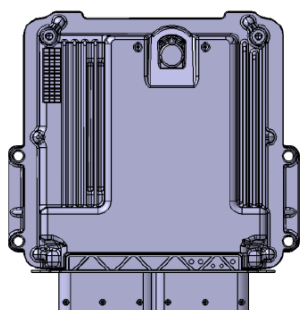
| Fault Code | Fault Name |
|-----------------------|--|
| P1013 | MoF(Monitoring of Function) Engine speed error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520797-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Implausible engine speed.

5) Condition for Clearing the Fault Code

No fault detection by MoF(ECU Safety Monitoring function)

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P1013 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

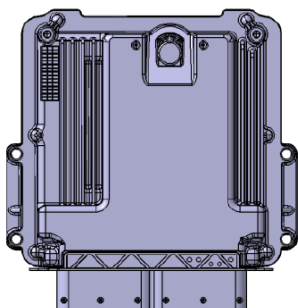
| Fault Code | Fault Name |
|-----------------------|--|
| P101A | MoF(Monitoring of Function) Over Run error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E520643-12 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The current energizing time is greater than the maximum permitted energizing time after overrun demand by the driver.

5) Condition for Clearing the Fault Code

No fault detection by MoF(ECU Safety Monitoring function)

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P101A is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

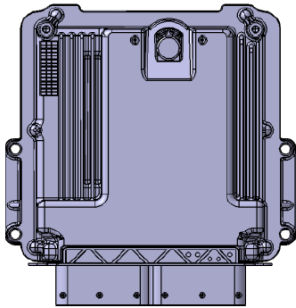
| Fault Code | Fault Name |
|-----------------------|---|
| P0641 | ECU Monitoring Sensor Supply (5V) Overvoltage error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E003509-11 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem Fault sensor or actuator used by ECU 5V supply) 3. Electrical problem (Faulty wiring harness) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The Sensor Supply (5V) voltage is higher than monitoring threshold.

5) Condition for Clearing the Fault Code

If the Sensor Supply (5V) voltage is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P0641 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

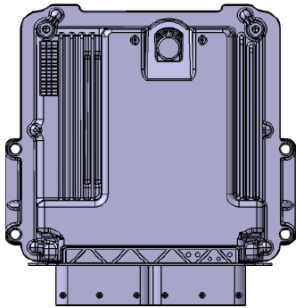
| Fault Code | Fault Name |
|-----------------------|--|
| P0642 | ECU Monitoring Sensor Supply (5V) Undervoltage error |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E003510-11 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem Fault sensor or actuator used by ECU 5V supply) 3. Electrical problem (Faulty wiring harness) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The Sensor Supply (5V) voltage is lower than monitoring threshold.

5) Condition for Clearing the Fault Code

If the Sensor Supply (5V) voltage is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P0642 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|------------------------------------|
| P068A | ECU Main relay Early opening fault |

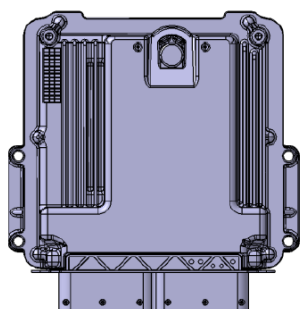
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001485-11 | 1. Electrical problem (Abnormal engine power shut down) 2. Electrical problem (Faulty main relay, Wiring harness ECU power supply and ground) 3. Electrical problem (Faulty ECU) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|----------------------|
| 1 | K01 | Battery supply (12V) |
| 2 | K03 | Battery supply (12V) |
| 3 | K05 | Battery supply (12V) |
| 4 | K02 | Power Ground |
| 5 | K04 | Power Ground |
| 6 | K06 | Power Ground |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key ON or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The fault is detected when the main relay has been opened without any request.

5) Condition for Clearing the Fault Code

The main relay is operating normally.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P068A is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|--|--------------------------------|-----------------------------|
| 3 | Check relay connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Change relay, engine running and key off for after run (over 1minute) Test OK? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|----------------------------|
| P0685 | ECU Main relay Stuck fault |

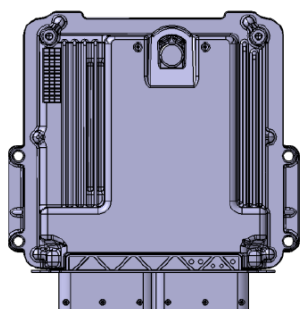
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E001485-07 | 1. Electrical problem (Faulty main relay, Wiring harness ECU power supply and ground) 2. Electrical problem (Faulty ECU) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|----------------------|
| 1 | K01 | Battery supply (12V) |
| 2 | K03 | Battery supply (12V) |
| 3 | K05 | Battery supply (12V) |
| 4 | K02 | Power Ground |
| 5 | K04 | Power Ground |
| 6 | K06 | Power Ground |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or Key off(ECU on)

4) Condition for Setting the Fault Code

The fault is detected, if main relay was not opened by time (150ms) after commanding to open main relay during shutdown.

5) Condition for Clearing the Fault Code

The main relay is operating normally.

6) Check List

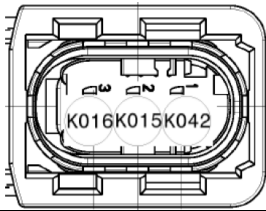
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0685 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|--|--------------------------------|-----------------------------|
| 3 | Check relay connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Change relay, engine running and key off for after run (over 1minute) Test OK? | | Problem solved | Contact Helpdesk |

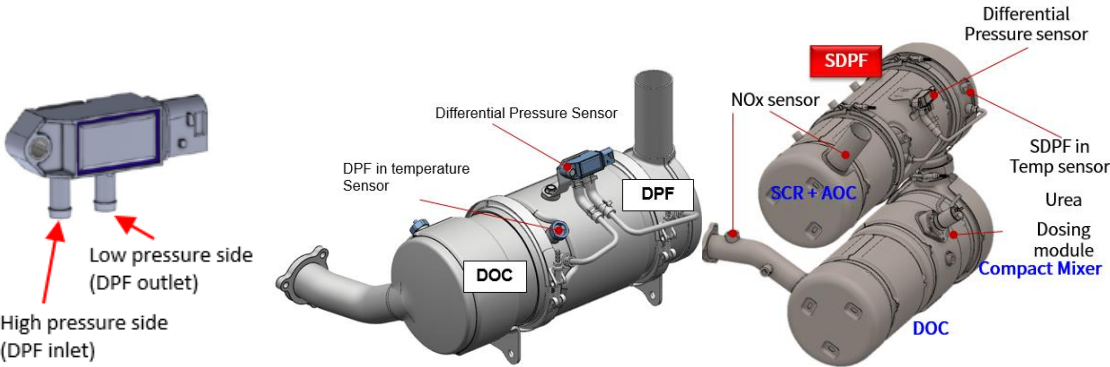
| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P3052 | DPF differential pressure drift fault |

1) Overview

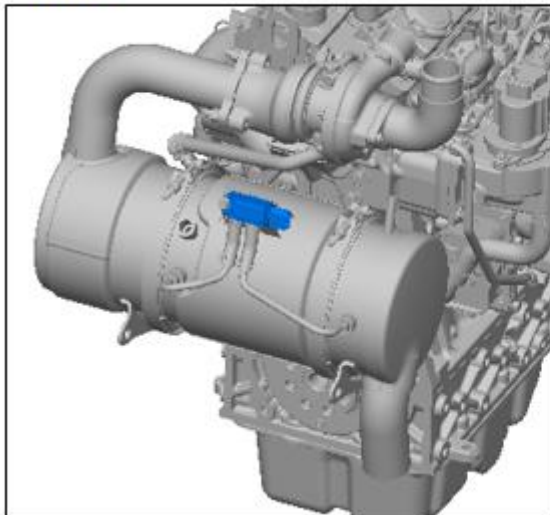
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E003251-13 | 1. DPF Differential pressure sensor drift 2. Electrical problem (Differential pressure sensor connector, Wiring harness from ECU to Differential pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

|  | No | ECU Pin | Description |
|--|----|---------|--|
| | 1 | K42 | DPF differential pressure Sensor Supply (5V) |
| | 2 | K15 | DPF differential pressure sensor Ground |
| | 3 | K16 | DPF differential pressure sensor Signal |

2) Component Location



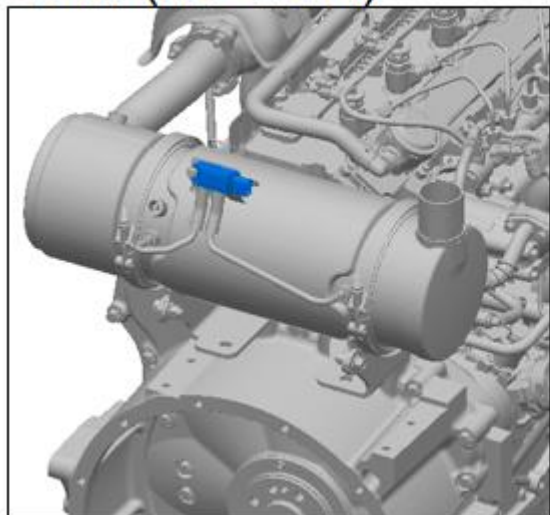
1.8L



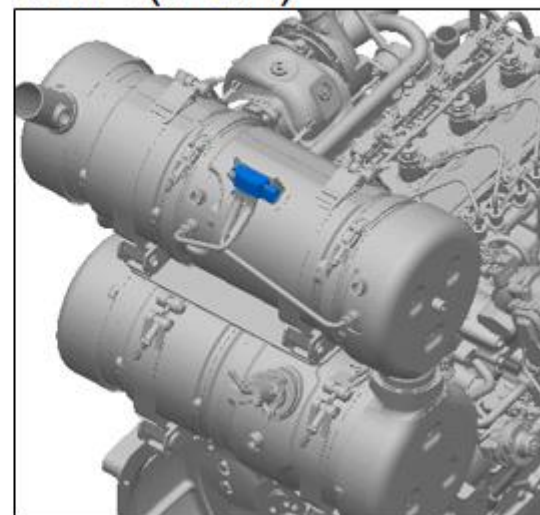
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or Key off(ECU on)

4) Condition for Setting the Fault Code

The DPF differential pressure sensor was drift than threshold at drift check condition.

5) Condition for Clearing the Fault Code

The DPF differential pressure sensor is within normal threshold at drift check condition.

6) Check List

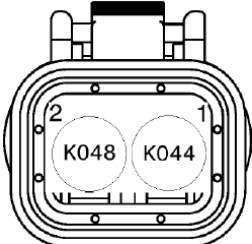
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P3052 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|--------------------------------|---------------------------|
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step4 |
| 4 | Check wiring connection between sensor and ECU (refer to Pin No.) Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace DPF differential pressure sensor and clear fault code. Start and run the engine at high idle more than 5 minutes and key off & on.. Is fault occurred? | | Contact Helpdesk | Problem solved |

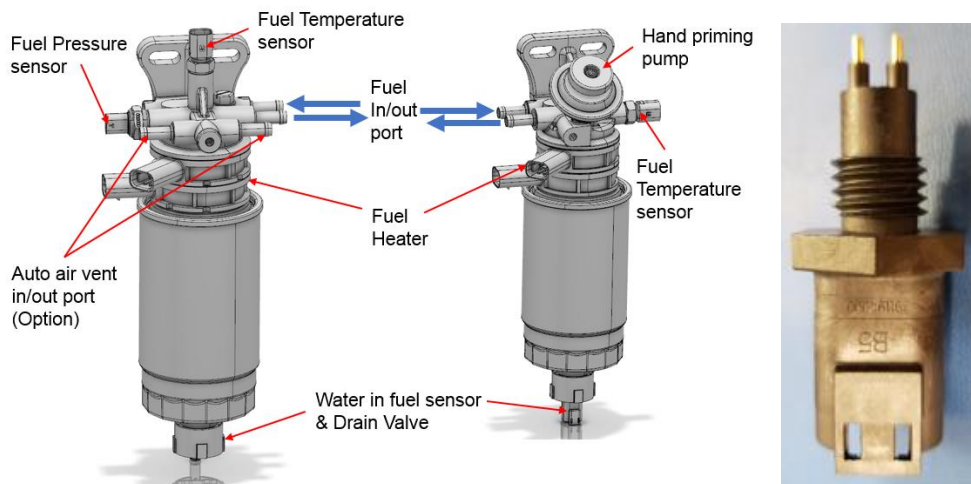
| Fault Code | Fault Name |
|-----------------------|--|
| P2265 | Water in fuel detected – Torque de-rate step (After 20min) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000097-23 | 1. Water in fuel problem (Water is detected in the fuel filter after 20 minutes) 2. Electrical problem (WIF sensor connector, Wiring harness from WIF to ECU, Faulty WIF sensor, Faulty ECU, ECU connector) | CE lamp Blink Torque Reduction 2(Severe) |

|  | No | ECU Pin | Description |
|---|----|---------|-----------------------------|
| | 1 | K44 | Water In Fuel Sensor Signal |
| | 2 | K48 | Water in Fuel Sensor Ground |

2) Component Location



| Water in fuel sensor | Internal WIF sensor resistance | | |
|------------------------|--------------------------------|----------|----------|
| | Base | Option A | Option B |
| | 82 kohm | 200 kohm | 220 kohm |
| Water detect threshold | < 2.90V | < 3.85V | < 3.78V |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Water in Fuel signal is within the threshold to detect water ([Base <2.90V](#)).
And 20 minutes have elapsed since the error was detected.

5) Condition for Clearing the Fault Code

Water in Fuel signal is within fuel range

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------------|------------------|
| 1 | P2265 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Open the drain valve to drain the water. Fault is cleared? | | Problem solved | Step4 |
| 4 | Check presence of electrical default on water in fuel sensor. Electrical problem? | | Do necessary repair | Step 5 |
| 5 | Check water in fuel sensor connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check water in fuel sensor variables Resistance problem? * Variables 1) Water in fuel signal (FI_uWLvISensRawVal) | | Replace Water-in-Fuel sensor | Step 7 |
| 7 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

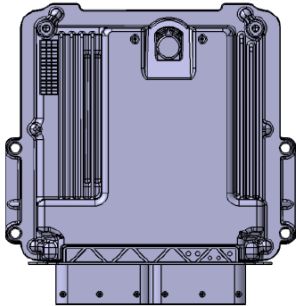
| Fault Code | Fault Name |
|-----------------------|---|
| P2509 | "WDA active" report due to errors in query-response communication |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001867-19 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The fault is detected when WDA is active due to in query-response communication.

5) Condition for Clearing the Fault Code

No fault in query-response communication.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2509 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

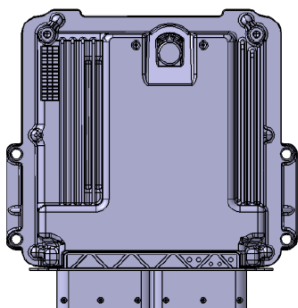
| Fault Code | Fault Name |
|-----------------------|---|
| P2507 | "ABE active" report due to undervoltage detection |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001867-04 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The fault is detected when ABE is active due to undervoltage detection.

5) Condition for Clearing the Fault Code

No fault related to undervoltage detection

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2507 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

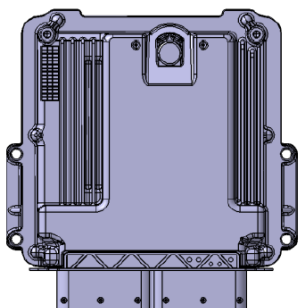
| Fault Code | Fault Name |
|-----------------------|--|
| P2508 | "ABE active" report due to overvoltage detection |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001867-03 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The fault is detected when ABE is active due to overvoltage detection.

5) Condition for Clearing the Fault Code

No fault related to overvoltage detection

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2508 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

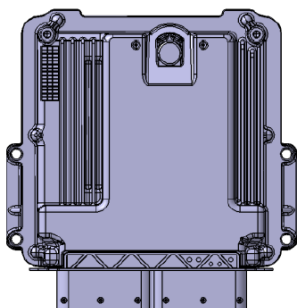
| Fault Code | Fault Name |
|-----------------------|---|
| P2511 | "WDA/ABE active" report due to unknown reason |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001867-11 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 3. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The fault is detected when WDA/ABE is active due to unknown reason.

5) Condition for Clearing the Fault Code

No fault related to WDA/ABE active

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2511 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | After Key On, check the fault state. Is this fault detected continuously? | | Step4 | Problem solved |
| 4 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P250A | Oil combination (Level and temperature) sensor itself open or short circuit error |

1) Overview

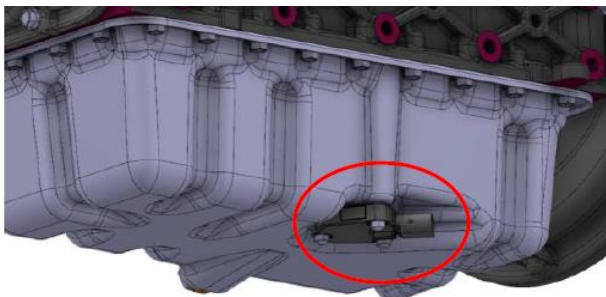
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000098-05 | 1. Electrical problem (Oil combination sensor) 2. Electrical problem (Wiring harness from ECU to Oil combination sensor, Oil combination sensor connector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------------|
| 1 | - | Battery voltage (+12V) |
| 2 | K70 | Oil combination sensor ground |
| 3 | K69 | Oil combination sensor signal(PWM) |



2) Component Location

Oil level characteristic is dependent on Oil Pan type.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The oil combination sensor hardware detects an open or short circuit error at sensor itself.

5) Condition for Clearing the Fault Code

There is no fault of oil combination sensor.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|------------------|
| 1 | P250A is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the oil combination sensor harness connection between ECU and oil combination sensor. Fault code is cleared? | | Problem solved | Step 4 |
| 4 | Check visually outside of the oil combination sensor. Any damaged oil combination sensor? Change the oil combination sensor. Fault is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P250D | Oil combination (Level and temperature) signal short circuit to battery error |

1) Overview

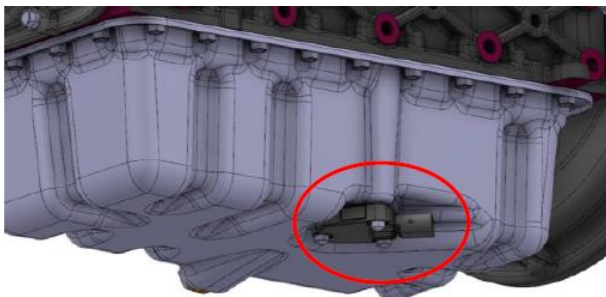
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000098-03 | 1. Electrical problem (Oil combination sensor connector) 2. Electrical problem (Wiring harness from ECU to Oil combination sensor, Oil combination sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------------|
| 1 | - | Battery voltage (+12V) |
| 2 | K70 | Oil combination sensor ground |
| 3 | K69 | Oil combination sensor signal(PWM) |



2) Component Location

Oil level characteristic is dependent on Oil Pan type.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The oil combination sensor signal is shorted circuit to battery error.

5) Condition for Clearing the Fault Code

There is no fault of oil combination sensor.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|------------------|
| 1 | P250D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the oil combination sensor harness connection between ECU and oil combination sensor. Fault code is cleared? | | Problem solved | Step 4 |
| 4 | Check visually outside of the oil combination sensor. Any damaged oil combination sensor? Change the oil combination sensor. Fault is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P250C | Oil combination (Level and temperature) signal short circuit to ground error |

1) Overview

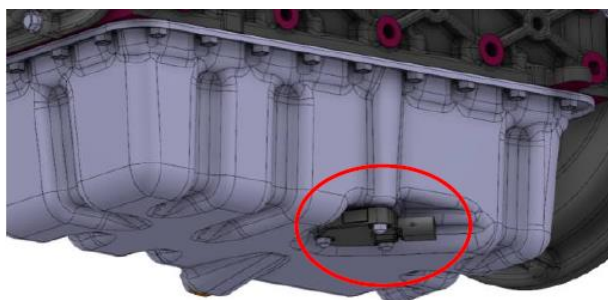
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000098-04 | 1. Electrical problem (Oil combination sensor connector) 2. Electrical problem (Wiring harness from ECU to Oil combination sensor, Oil combination sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------------|
| 1 | - | Battery voltage (+12V) |
| 2 | K70 | Oil combination sensor ground |
| 3 | K69 | Oil combination sensor signal(PWM) |



2) Component Location

Oil level characteristic is dependent on Oil Pan type.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The oil combination sensor signal is shorted circuit to ground error.

5) Condition for Clearing the Fault Code

There is no fault of oil combination sensor.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|------------------|
| 1 | P250C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the oil combination sensor harness connection between ECU and oil combination sensor. Fault code is cleared? | | Problem solved | Step 4 |
| 4 | Check visually outside of the oil combination sensor. Any damaged oil combination sensor? Change the oil combination sensor. Fault is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P350D | Oil combination (Level and temperature) sensor timeout fault |

1) Overview

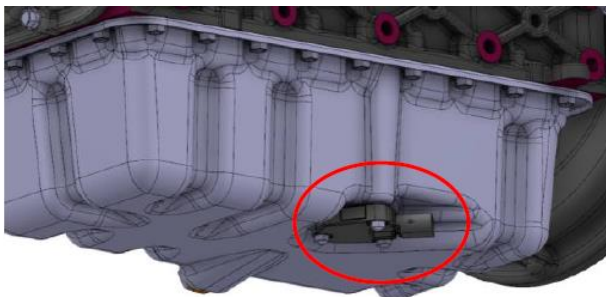
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000098-22 | 1. Electrical problem (Oil combination sensor) 2. Electrical problem (Wiring harness from ECU to Oil combination sensor, Oil combination sensor connector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------------|
| 1 | - | Battery voltage (+12V) |
| 2 | K70 | Oil combination sensor ground |
| 3 | K69 | Oil combination sensor signal(PWM) |



2) Component Location

Oil level characteristic is dependent on Oil Pan type.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The oil combination sensor signal response time is exceeded the threshold.

5) Condition for Clearing the Fault Code

The oil combination sensor signal is normally responded.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|------------------|
| 1 | P350D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the oil combination sensor harness connection between ECU and oil combination sensor. Fault code is cleared? | | Problem solved | Step 4 |
| 4 | Check visually outside of the oil combination sensor. Any damaged oil combination sensor? Change the oil combination sensor. Fault is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0196 | Oil combination (Level and temperature) sensor itself Oil temperature out of range error |

1) Overview

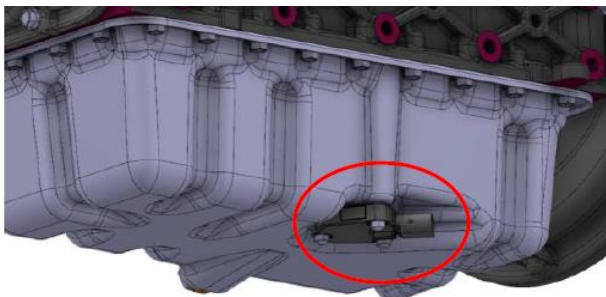
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000175-11 | 1. Electrical problem (Oil combination sensor) 2. Electrical problem (Wiring harness from ECU to Oil combination sensor, Oil combination sensor connector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------------|
| 1 | - | Battery voltage (+12V) |
| 2 | K70 | Oil combination sensor ground |
| 3 | K69 | Oil combination sensor signal(PWM) |



2) Component Location

Oil level characteristic is dependent on Oil Pan type.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The oil combination sensor hardware detects a temperature out of range error at sensor itself.

5) Condition for Clearing the Fault Code

There is no fault of oil combination sensor.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|------------------|
| 1 | P0196 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the oil combination sensor harness connection between ECU and oil combination sensor. Fault code is cleared? | | Problem solved | Step 4 |
| 4 | Check visually outside of the oil combination sensor. Any damaged oil combination sensor? Change the oil combination sensor. Fault is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P350E | Oil combination (Level and temperature) sensor itself Voltage out of range error |

1) Overview

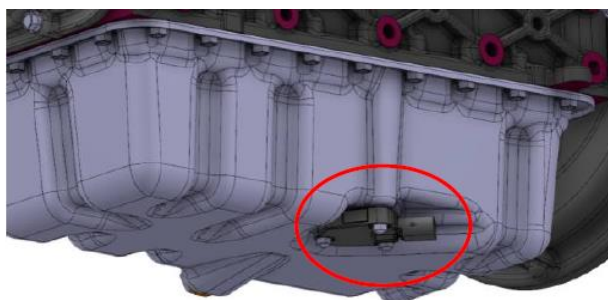
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000098-23 | 1. Electrical problem (Oil combination sensor) 2. Electrical problem (Wiring harness from ECU to Oil combination sensor, Oil combination sensor connector) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------------|
| 1 | - | Battery voltage (+12V) |
| 2 | K70 | Oil combination sensor ground |
| 3 | K69 | Oil combination sensor signal(PWM) |



2) Component Location

Oil level characteristic is dependent on Oil Pan type.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The oil combination sensor hardware detects a voltage out of range error at sensor itself.

5) Condition for Clearing the Fault Code

There is no fault of oil combination sensor.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|------------------|
| 1 | P350E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the oil combination sensor harness connection between ECU and oil combination sensor. Fault code is cleared? | | Problem solved | Step 4 |
| 4 | Check visually outside of the oil combination sensor. Any damaged oil combination sensor? Change the oil combination sensor. Fault is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-------------------------------------|
| P350F | Engine oil level is low (Low step2) |

1) Overview

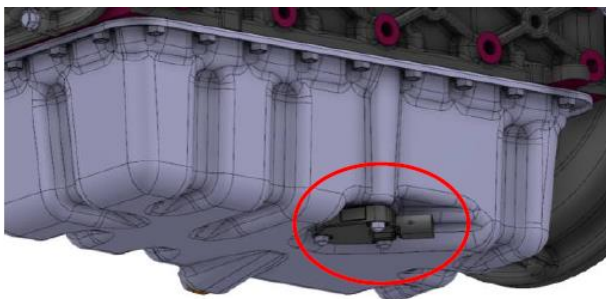
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000098-24 | 1. The oil level height be lower than minimum level step2. 2. In the incline condition, the engine oil level can be recognized at a lower or higher depending on the tilt angle. 3. Electrical problem (Oil combination sensor) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------------|
| 1 | - | Battery voltage (+12V) |
| 2 | K70 | Oil combination sensor ground |
| 3 | K69 | Oil combination sensor signal(PWM) |



2) Component Location

Oil level characteristic is dependent on Oil Pan type.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The oil level height be lower than minimum level step2. (Ref : <30~40%, Normal 50~90%)

In the incline condition, the engine oil level can be recognized at a lower or higher depending on the tilt angle. If the equipment was on incline condition, check the oil level on the flat ground condition.

5) Condition for Clearing the Fault Code

The oil level is within normal range.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------------------|------------------|
| 1 | P350F is detected on service tool? | | Step 2 | |
| 2 | In the incline condition, the engine oil level can be recognized at a lower or higher depending on the tilt angle. If the equipment was on incline condition, check the oil level on the flat ground condition. Oil level is lower or higher than normal range? If not, refill the oil and recheck Fault is cleared? | | Refill Engine oil | Step 3 |
| 3 | Check visually outside of the oil combination sensor. Any damaged oil combination sensor? Change the oil combination sensor. Fault is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P250F | Engine oil level is too low (Low step3) |

1) Overview

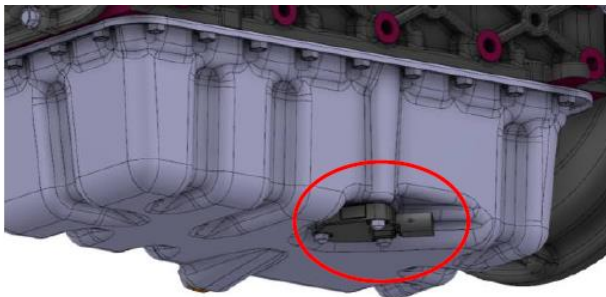
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000098-18 | 1. The oil level height be lower than minimum level step3. 2. In the incline condition, the engine oil level can be recognized at a lower or higher depending on the tilt angle. 3. Electrical problem (Oil combination sensor) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------------|
| 1 | - | Battery voltage (+12V) |
| 2 | K70 | Oil combination sensor ground |
| 3 | K69 | Oil combination sensor signal(PWM) |



2) Component Location

Oil level characteristic is dependent on Oil Pan type.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The oil level height be lower than minimum level step3. (Ref : <20~30%, Normal 50~90%)

In the incline condition, the engine oil level can be recognized at a lower or higher depending on the tilt angle. If the equipment was on incline condition, check the oil level on the flat ground condition.

5) Condition for Clearing the Fault Code

The oil level is within normal range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|----------|--|----------------|--------------------------|-------------------------|
| 1 | P250F is detected on service tool? | | Step 2 | |
| 2 | In the incline condition, the engine oil level can be recognized at a lower or higher depending on the tilt angle. If the equipment was on incline condition, check the oil level on the flat ground condition. Oil level is lower or higher than normal range? If not, refill the oil and recheck Fault is cleared? | | Refill Engine oil | Step 3 |
| 3 | Check visually outside of the oil combination sensor. Any damaged oil combination sensor? Change the oil combination sensor. Fault is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P055B | Oil Pressure Warning Lamp Open circuit |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E005099-05 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---------------------------|
| 1 | K19 | Oil pressure warning lamp |

2) Component Location

Oil Pressure warning lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is opened.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P055B is detected on service tool? | | Step 2 | |
| 2 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 3 |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P055D | Oil Pressure Warning Lamp Short to Battery |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E005099-03 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---------------------------|
| 1 | K19 | Oil pressure warning lamp |

2) Component Location

Oil Pressure warning lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to battery.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P055D is detected on service tool? | | Step 2 | |
| 2 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 3 |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P055C | Oil Pressure Warning Lamp Short to Ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E005099-04 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---------------------------|
| 1 | K19 | Oil pressure warning lamp |

2) Component Location

Oil Pressure warning lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to ground.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P055C is detected on service tool? | | Step 2 | |
| 2 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 3 |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-----------------------------------|
| P1522 | Engine Oil Pressure Too Low Fault |

1) Overview

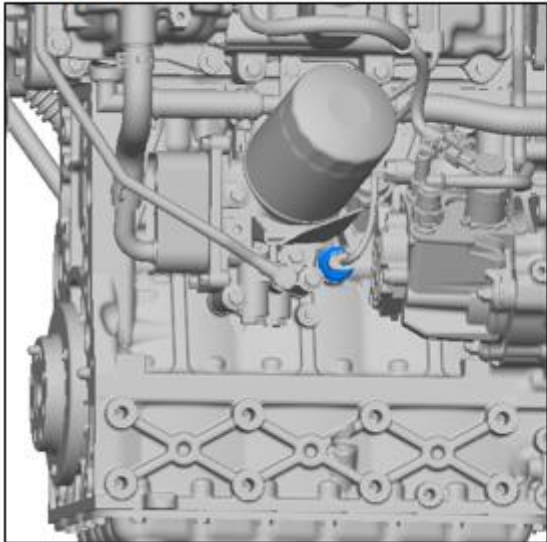
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000100-01 | <ol style="list-style-type: none"> 1. Oil level low problem (Oil change period, Oil leakage) 2. Oil path problem (Oil filter or Oil suction pipe clogging) 3. Oil path problem (Oil filter or Oil pump broken) 4. Electrical problem (Oil pressure sensor connector, Oil pressure sensor, Wiring harness from Sensor to ECU, Faulty ECU, ECU connector) | CE lamp Blink Torque Reduction 2(Severe) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

| | | | |
|--|----|---------|--|
|  | No | ECU Pin | Description |
| | 1 | A36 | Engine oil pressure sensor signal |
| | 2 | A35 | Engine oil pressure sensor ground |
| | 3 | A14 | Engine oil pressure Sensor Supply (5V) |

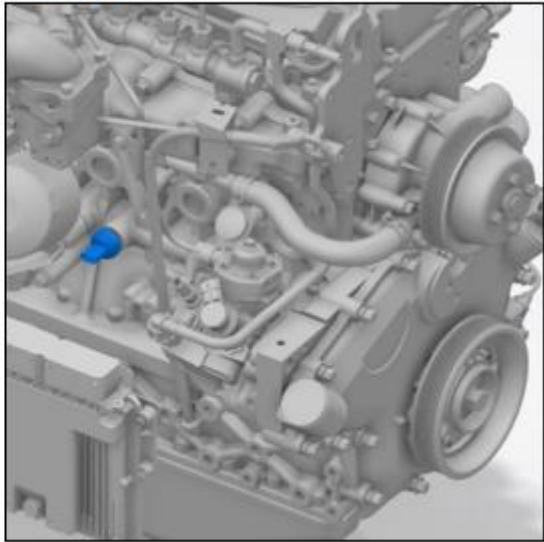
2) Component Location



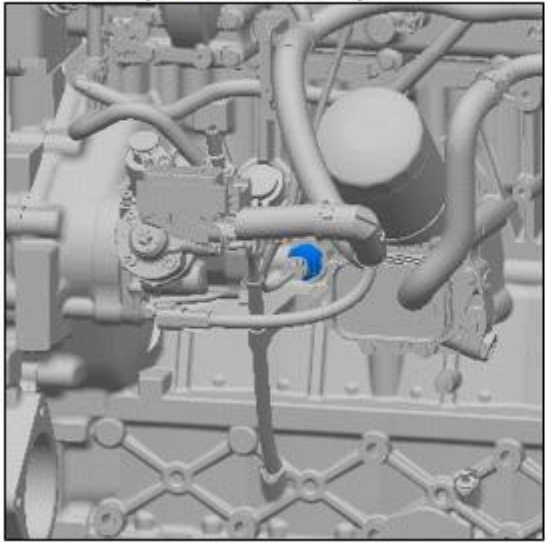
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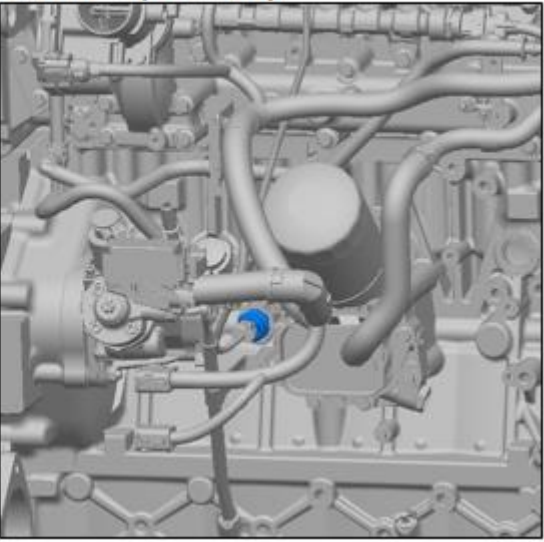
2.4L



3.4L (No-SCR)



3.4L (SCR)



- 3) Condition for Running Diagnostic**
Engine running
- 4) Condition for Setting the Fault Code**
Engine oil pressure is below the threshold (180kPa~250kPa, depend on engine speed) value at engine running condition.
- 5) Condition for Clearing the Fault Code**
Engine oil pressure sensor is within the normal range, fault is cleared.
- 6) Check List**

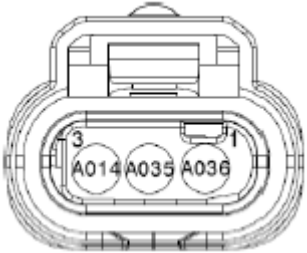
| Step | Inspection | Standard Value | YES | NO |
|------|------------------------------------|----------------|--------|----|
| 1 | P1522 is detected on service tool? | | Step 2 | |

| | | | | |
|----------|--|--|----------------------------|-----------------------|
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the engine oil level in the oil pan. Does the amount of engine oil meet the standard? | | Step 4 | Step 6 |
| 4 | Check service tool value of oil pressure with engine running. Oil pressure is not increased to the threshold when engine starting or running? * Variables 1) Engine speed (Epm_nEng) 2) Oil pressure (Oil_pSwmp) | | Step 5 | Problem solved |
| 5 | Check the engine oil leakage in oil path. Is there any leakage? | | Do necessary repair | Step 6 |
| 6 | Oil pump damage or oil filter blocked or oil path blocked or oil sensor drift can be suspected. | | Contact Helpdesk | |
| 7 | Refill the engine oil and start the engine. Keep low idle during 3minutes. The same fault code is happened from low idle to high idle? | | Step 4 | Problem solved |

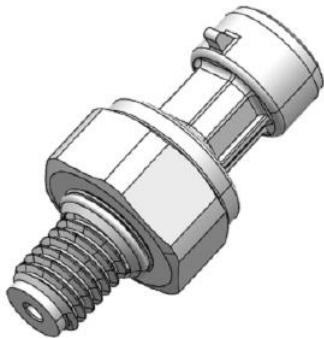
| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P0523 | Engine Oil Pressure Sensor High Fault |

1) Overview

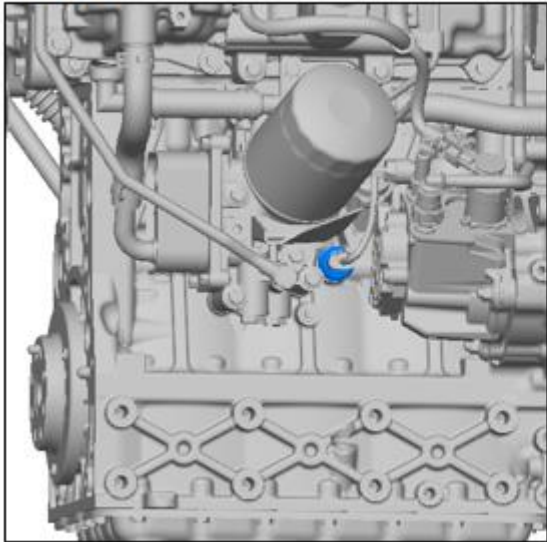
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000100-03 | 1. Electrical problem (Oil pressure sensor connector) 2. Electrical problem (Wiring harness from Oil pressure sensor to ECU, Faulty Oil pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp Blink Torque Reduction 2(Severe) Max engine speed limit (<1500rpm) |

|  | No | ECU Pin | Description |
|---|----|---------|---|
| | 1 | A36 | Engine oil pressure sensor signal |
| | 2 | A35 | Engine oil pressure sensor ground |
| | 3 | A14 | Engine oil pressure Sensor Supply (5V) (5V) |

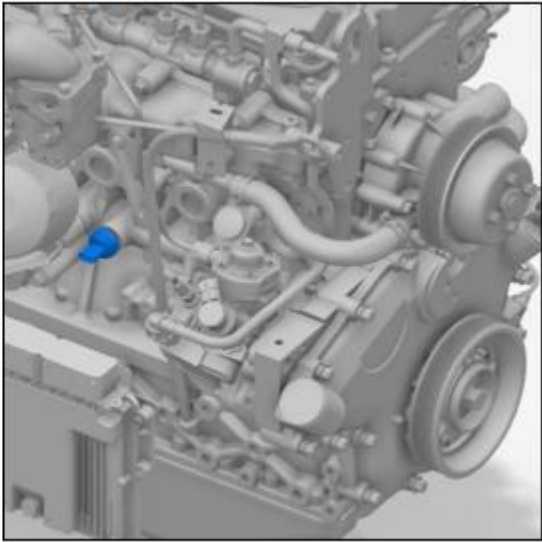
2) Component Location



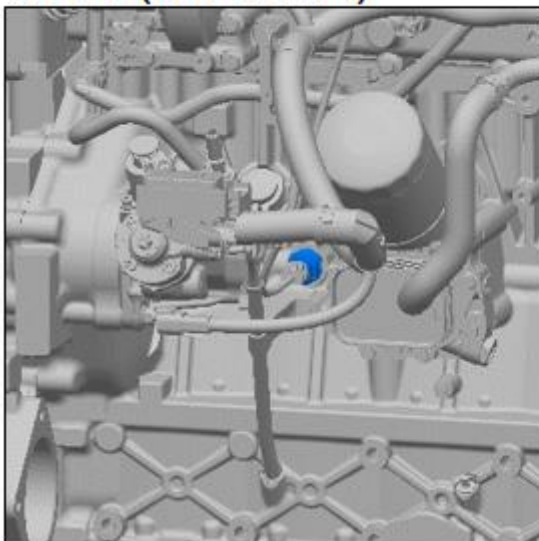
1.8L



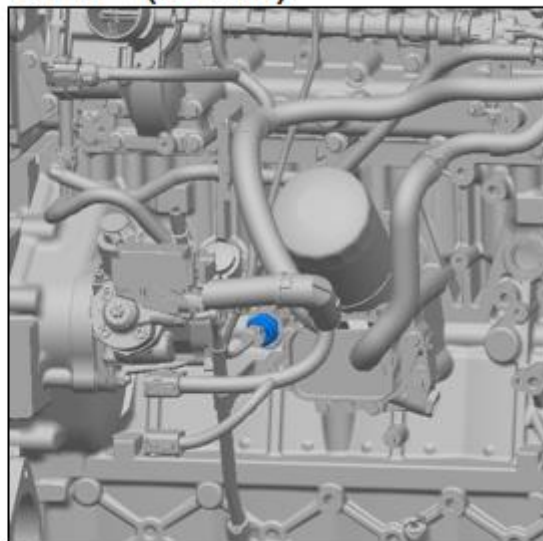
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Engine oil pressure signal is more than maximum threshold (4.696V)

5) Condition for Clearing the Fault Code

Engine oil pressure signal is in the operation range

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0523 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal sensor Sensor problem? | | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

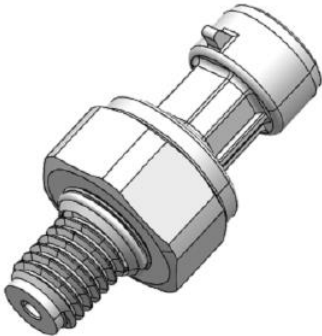
| Fault Code | Fault Name |
|-----------------------|--------------------------------------|
| P0522 | Engine Oil Pressure Sensor Low Fault |

1) Overview

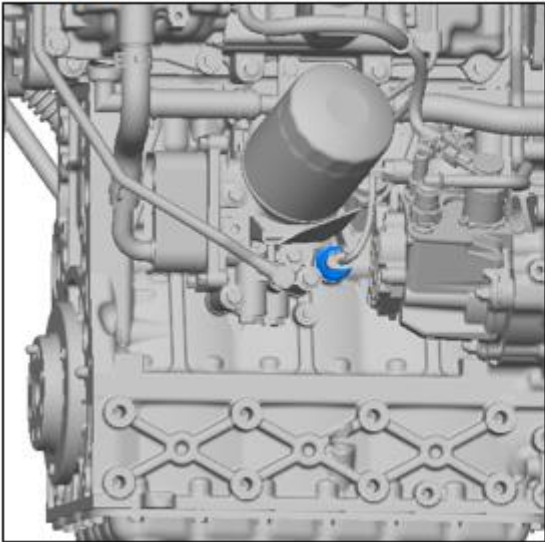
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000100-04 | 1. Electrical problem (Oil pressure sensor connector) 2. Electrical problem (Wiring harness from Oil pressure sensor to ECU, Faulty Oil pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp Blink Torque Reduction 2(Severe) Max engine speed limit (<1500rpm) |

|  | No | ECU Pin | Description |
|---|----|---------|--|
| | 1 | A36 | Engine oil pressure sensor signal |
| | 2 | A35 | Engine oil pressure sensor ground |
| | 3 | A14 | Engine oil pressure Sensor Supply (5V) |

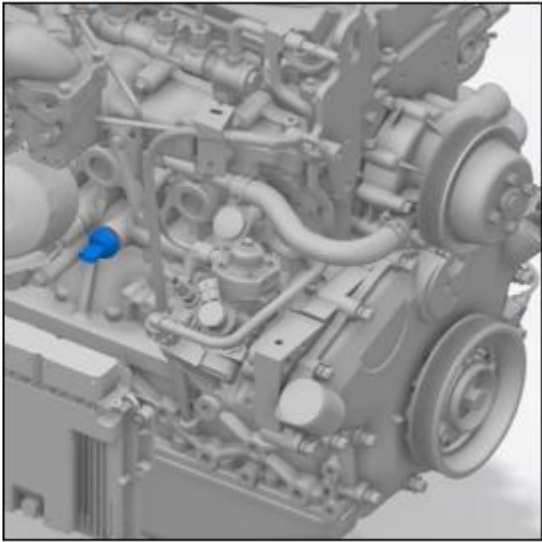
2) Component Location



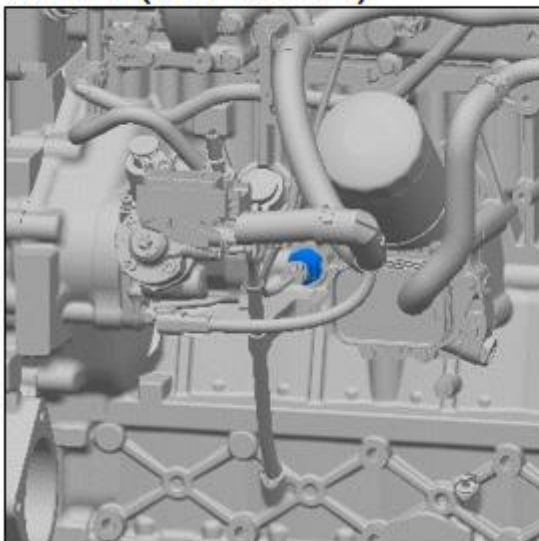
1.8L



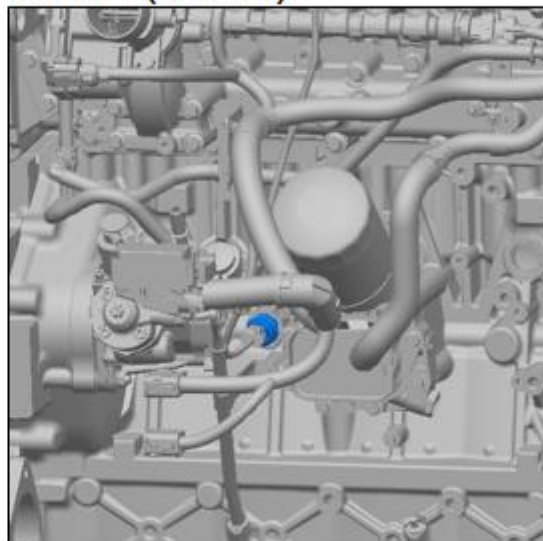
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Engine oil pressure signal is less than minimum threshold (0.275V)

5) Condition for Clearing the Fault Code

Engine oil pressure signal is in the operation range

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0522 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal sensor Sensor problem? | | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

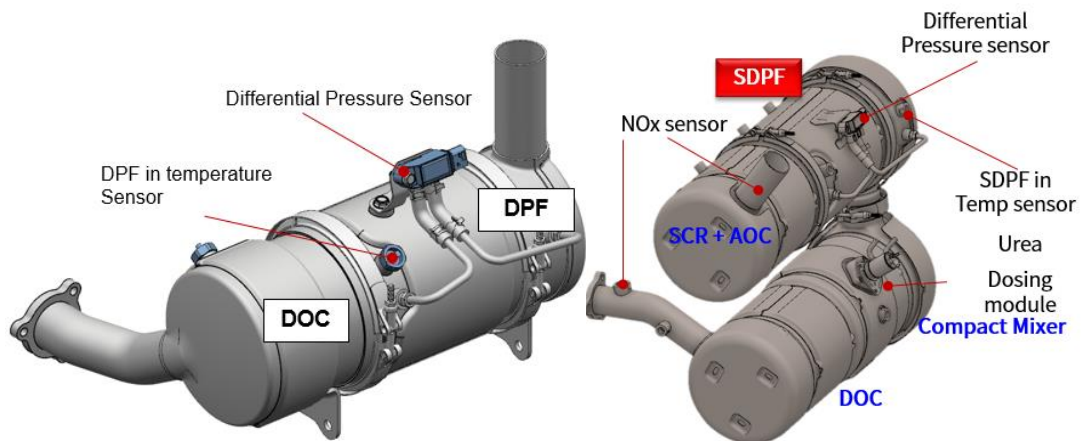
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---------------------------------|
| P0421 | DOC Exothermal Efficiency Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000173-01 | 1. Electrical problem (Faulty DPF(SDPF) in temperature sensor) 2. Air path problem (Leakage of turbine out to DOC in) 3. Hardware problem (DOC was poisoned by sulfur) 4. Injector problem (Injector close stuck, not controlled well) 5. Hardware problem (Faulty DOC) | CE lamp ON DPF regeneration inhibit by Active |

2) Component Location



3) Condition for Running Diagnostic

- Engine running
- DPF regeneration active
- 260degC < DPF(SDPF) upstream temperature

4) Condition for Setting the Fault Code

If calculated DOC efficiency is lower than threshold at DPF regeneration.

If this fault occurs, there is a problem with the DOC and normal DPF regeneration (DeSOx) is not possible. Therefore, Active DPF regeneration (DeSOx) during engine operation is inhibited until fault healing.

Forced DPF regeneration is allowable for trouble shooting and the white smoke (due to HC slip) could be occurred until problem fix during Forced DPF regeneration.

5) Condition for Clearing the Fault Code

If calculated DOC efficiency is within the threshold.

Fault clear is only when the calculated DOC efficiency is within the threshold during DPF regeneration active mode. Since after problem is fixed, perform the DPF regeneration and check if it works properly.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|------------|----------------|-----|----|
|------|------------|----------------|-----|----|

| | | | | |
|----------|---|--|--|----------------------|
| 1 | P0421 is detected on service tool? | | Step 2 | |
| 2 | After let the machine be in safety area and turn-off the key switch | | Step 3 | |
| 3 | Check service tool value of DPF(SDPF) in temperature with engine running. DPF(SDPF) in temperature is not increased even engine running? * Variables 1) Engine speed (Epm_nEng) 2) DPF(SDPF) in temperature (Exh_tSensTPFIUs) | | Change sensor | Step 4 |
| 4 | Process Forced DPF regeneration by switch in machine or service tool at stationary condition. Is the fault cleared? | | Problem solved (DOC was poisoned by sulfur) | Step 5 |
| 5 | Is there any leakage in the exhaust pipe? If yes, fix the leakage. Process Forced DPF regeneration by switch in machine or service tool at stationary condition. Is the fault cleared? | | Do necessary repair | Step 6 |
| 6 | Change the DOC. Process Forced DPF regeneration by switch in machine or service tool at stationary condition. Is the fault cleared? | | Problem solved | Call Hot line |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ **Forced DPF regeneration procedure**

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position < 5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|----------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal Max | ~ 2300 3000 |

• Service regeneration stop and not start condition

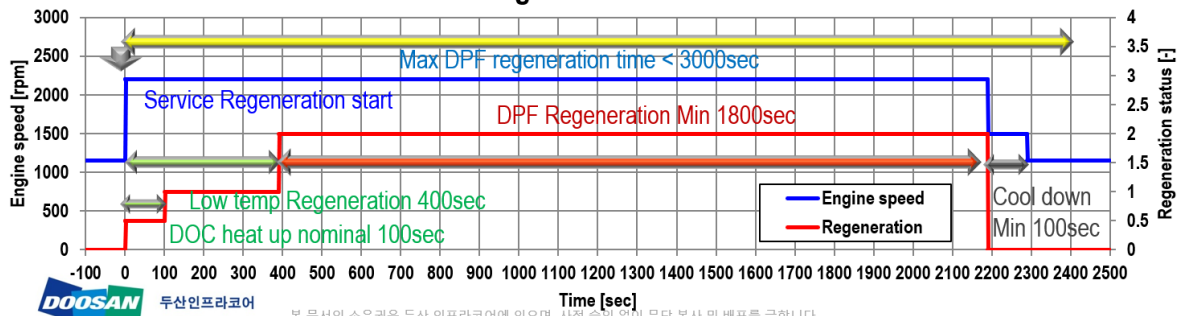
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

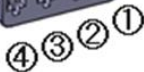
Service regeneration Procedure



P00BC

1) Overview

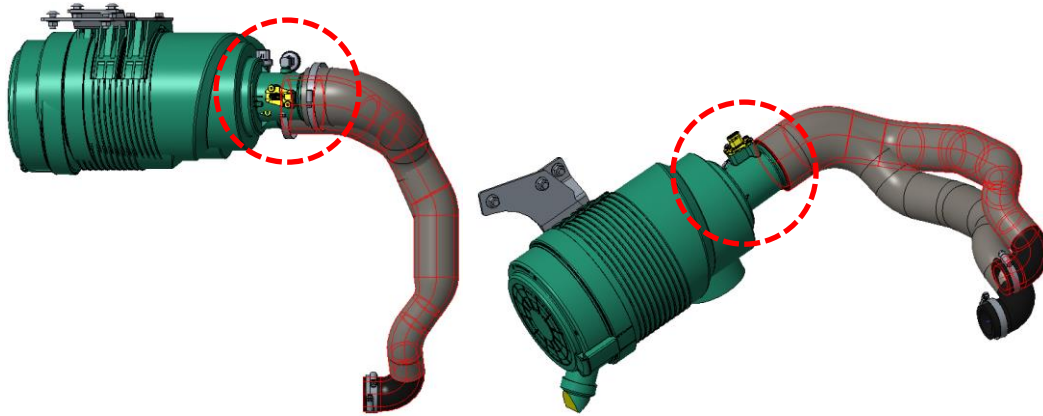
E000132-01

No

2) Component Location

Air mass flow sensor location is dependent on machine application.





3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The intake manifold pressure is lower than estimated target minimum threshold.

5) Condition for Clearing the Fault Code

The intake manifold pressure is higher than estimated target minimum threshold.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|-------|
| 1 | P00BC is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch | | Step3 | |
| 3 | Check the intake hose between air filter and turbocharger compressor? Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Step7 | Step4 |
| 4 | Check the intake hose between turbocharger compressor outlet and intercooler. Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Step7 | Step5 |
| 5 | Check the intake hose between intercooler and intake manifold. Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Step7 | Step6 |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| 6 | Is there abnormal value of intake manifold pressure sensor or air mass flow sensor? (ex. Value is not increase even engine speed increase) *Variables 1) Engine speed(Epm_nEng) 2) Intake manifold pressure (Air_pIntkVUs) 3) Air mass flow (AFS_dmSens) 4) Model air mass flow (AirMod_mfGasIntkVlv_f) | | Step 8 | Contact Helpdesk |
| 7 | Fix the leakage or change the hose. After fix the leakage, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Step7 |
| 8 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

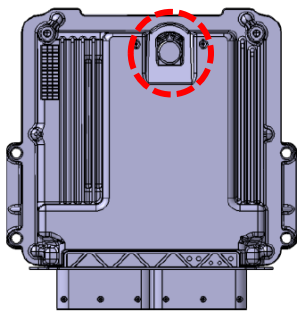
| Fault Code | Fault Name |
|-----------------------|--|
| P2229 | Atmospheric Pressure Sensor High Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000108-03 | 1. Electrical problem (Faulty Atmospheric pressure sensor in ECU) 2. Atmospheric problem (Too high atmospheric pressure > 115kPa, underground mine condition < -1500m) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

Atmospheric Pressure value is more than Maximum operation pressure (>115kPa)

5) Condition for Clearing the Fault Code

Atmospheric Pressure value is in operation pressure

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2229 is detected on service tool? | | Step2 | |
| 2 | Change the ECU as a normal one. Fault code is cleared with new ECU? | | Problem solved | Contact Helpdesk |

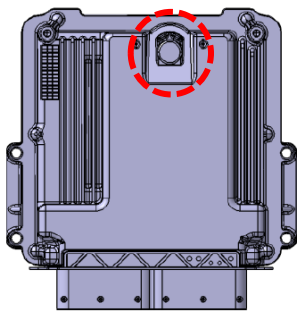
| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P2228 | Atmospheric Pressure Sensor Low Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000108-04 | 1. Electrical problem (Faulty Atmospheric pressure sensor in ECU) 2. Atmospheric problem (Too low atmospheric pressure < 50kPa, High altitude condition > 5000m) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Atmospheric Pressure value is less than minimum operation pressure (< 50kPa)

5) Condition for Clearing the Fault Code

Atmospheric Pressure value is in operation pressure

6) Check List

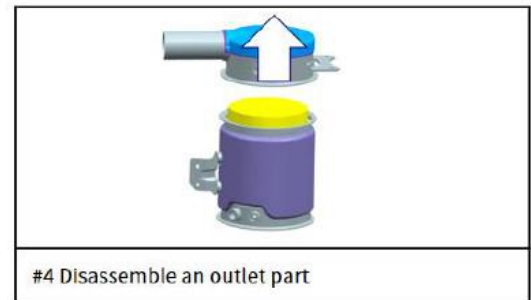
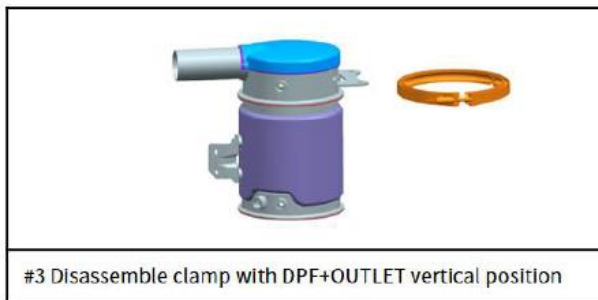
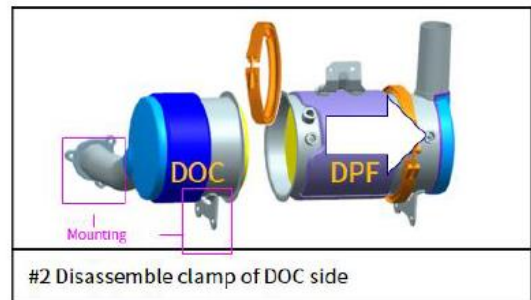
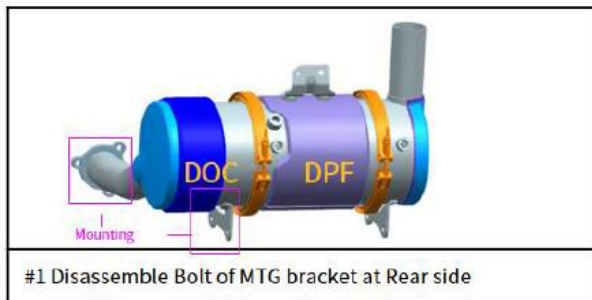
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2228 is detected on service tool? | | Step2 | |
| 2 | Change the ECU as a normal one. Fault code is cleared with new ECU? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P242F | DPF Ash loading High fault (Ash cleaning is needed) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--------------------------------|------------|
| E003720-16 | 1. DPF ash cleaning is needed. | CE lamp ON |

2) Component Location



* Disassemble the DPF in vehicle after the DPF is cooled down to handle it



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

DPF ash loading is more than maximum threshold.

Ash cleaning is needed, and ash cleaning interval is dependent on After-treatment system size.

5) Condition for Clearing the Fault Code

Ash loading value is reset by service tool after Ash cleaning.

6) Check List

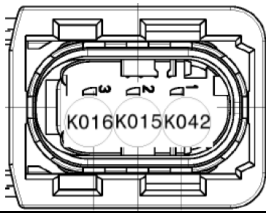
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|------------------|
| 1 | P242F is detected on service tool? | | Step2 | |
| 2 | Has the DPF ash cleaning cycle arrived? The Ash cleaning interval is typically 5000hrs(Dependent on machine variant.) * Ash loading can be checked with "PFItLd_volAsh", where 1 means 100%. The DPF size and the Ash cleaning cycle are different for each machine application. | | Step3 | Contact Helpdesk |
| 3 | Proceed with Ash cleaning and reset the accumulated Ash loading memory value by service tool. * The DPF regeneration cycle may be gradually shortened if the reset by service tool is repeated without Ash cleaning. | | Problem solved | |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

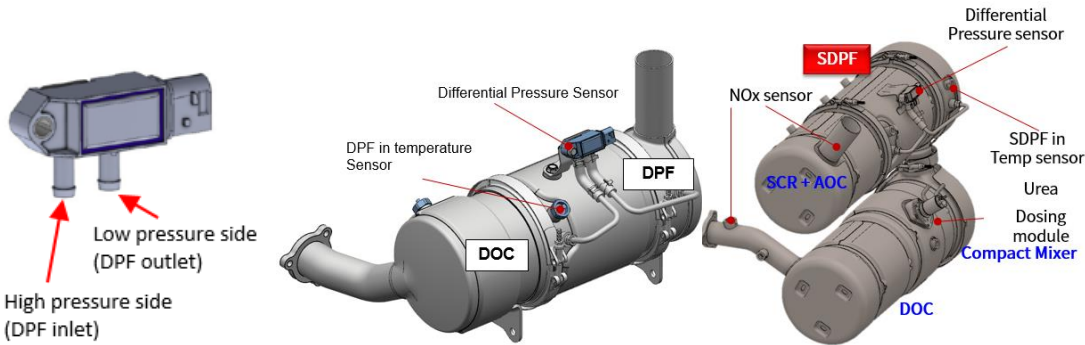
| Fault Code | Fault Name |
|-----------------------|---|
| P1454 | DPF differential pressure too low fault |

1) Overview

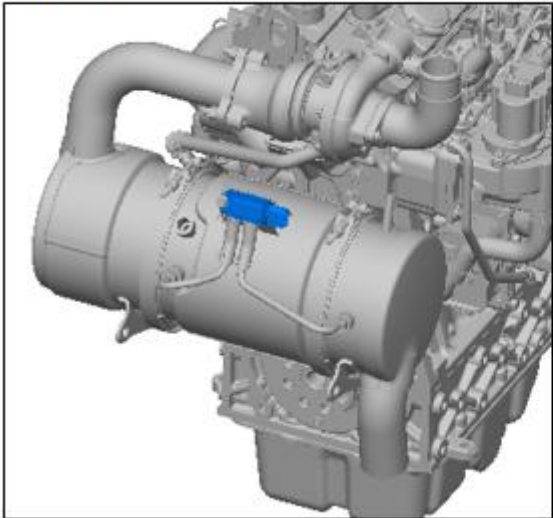
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E003251-18 | 1. DPF Differential pressure sensor hose open or leakage 2. DPF failure (Crack) 3. Electrical problem (Differential pressure sensor connector, Wiring harness from ECU to Differential pressure sensor) 4. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group5 (Tampering) DPF regeneration inhibit by Active and Forced |

|  | No | ECU Pin | Description |
|--|----|---------|--|
| | 1 | K42 | DPF differential pressure Sensor Supply (5V) |
| | 2 | K15 | DPF differential pressure sensor Ground |
| | 3 | K16 | DPF differential pressure sensor Signal |

2) Component Location



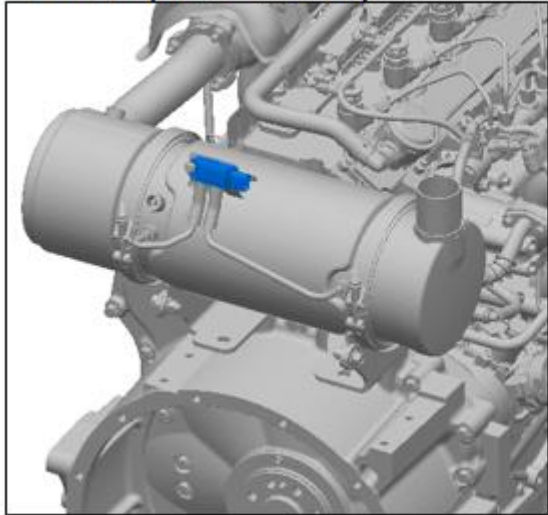
1.8L



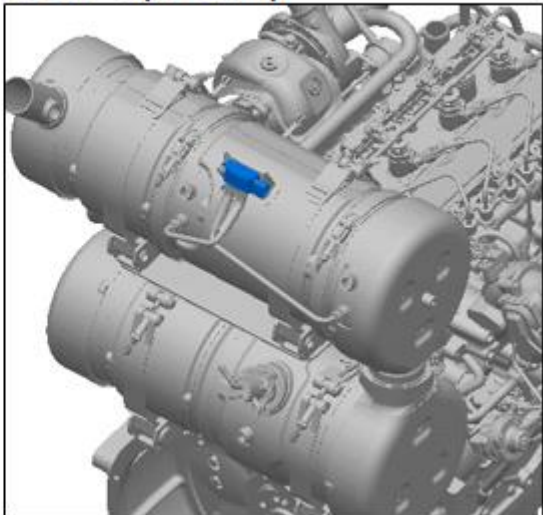
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The DPF differential pressure is less than minimum pressure dependent on exhaust gas flow.
(Ref <1kPa)

5) Condition for Clearing the Fault Code

The DPF differential pressure is within normal operation range.

6) Check List

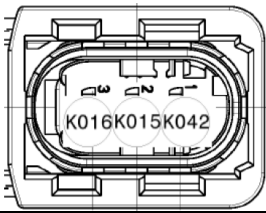
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P1454 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|---|-------------------------|
| 3 | Check the hose of DPF differential pressure sensor. Is there any leakage or open? in/out hose in/out is swapped? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Fix the leakage or change the hose | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check wiring connection between sensor and ECU (refer to Pin No.) Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace DPF differential pressure sensor and clear fault code. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault occurred? | | Do necessary repair | Step 7 |
| 7 | Change the DPF (New or ash cleaned DPF) and clear fault code. When replace DPF, it is necessary to reset the DPF related memory stored value using by the service tool. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault cleared? | | Problem solved | Contact Helpdesk |

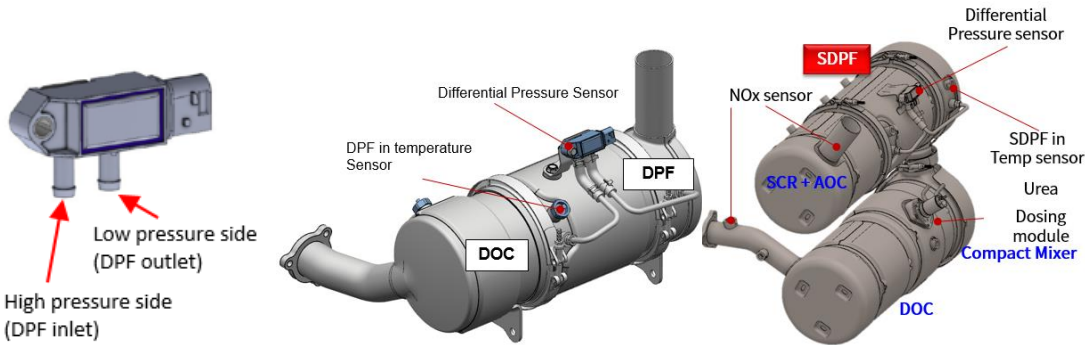
| Fault Code | Fault Name |
|-----------------------|---|
| P244A | DPF differential pressure too low fault |

1) Overview

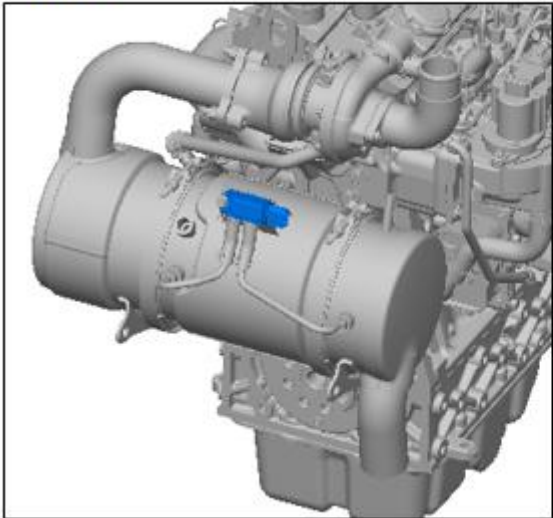
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E003251-18 | 1. DPF Differential pressure sensor hose open or leakage 2. DPF failure (Crack) 3. Electrical problem (Differential pressure sensor connector, Wiring harness from ECU to Differential pressure sensor) 4. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group5 (Tampering) DPF regeneration inhibit by Active and Forced |

|  | No | ECU Pin | Description |
|--|----|---------|--|
| | 1 | K42 | DPF differential pressure Sensor Supply (5V) |
| | 2 | K15 | DPF differential pressure sensor Ground |
| | 3 | K16 | DPF differential pressure sensor Signal |

2) Component Location



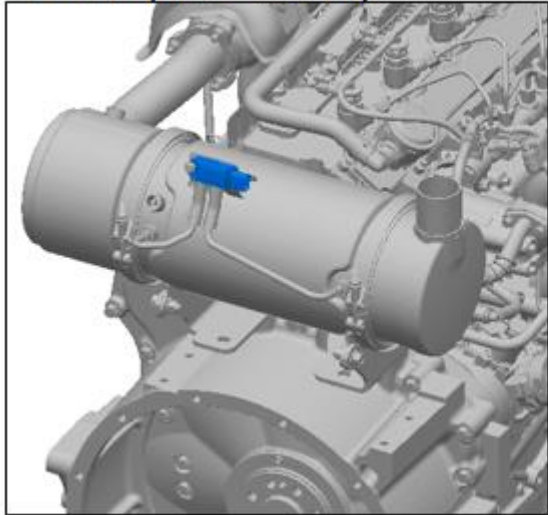
1.8L



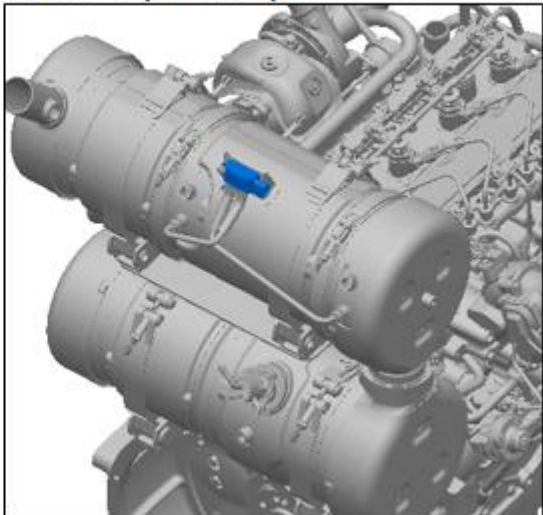
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The DPF differential pressure is less than minimum pressure dependent on exhaust gas flow.
(Ref <1kPa)

5) Condition for Clearing the Fault Code

The DPF differential pressure is within normal operation range.

6) Check List

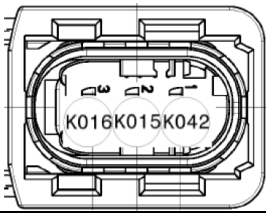
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P244A is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|---|-------------------------|
| 3 | Check the hose of DPF differential pressure sensor. Is there any leakage or open? in/out hose in/out is swapped? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Fix the leakage or change the hose | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check wiring connection between sensor and ECU (refer to Pin No.) Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace DPF differential pressure sensor and clear fault code. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault occurred? | | Do necessary repair | Step 7 |
| 7 | Change the DPF (New or ash cleaned DPF) and clear fault code. When replace DPF, it is necessary to reset the DPF related memory stored value using by the service tool. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault cleared? | | Problem solved | Contact Helpdesk |

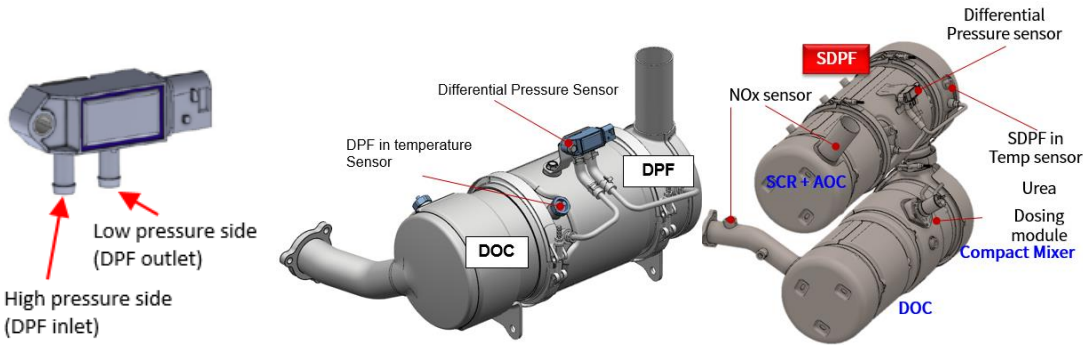
| Fault Code | Fault Name |
|-----------------------|--|
| P246C | DPF differential pressure too high fault |

1) Overview

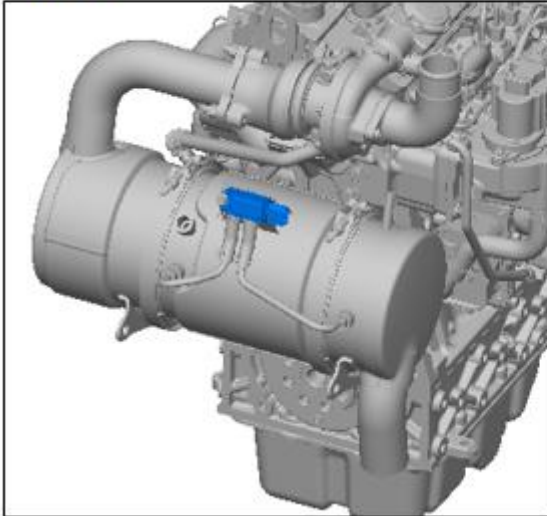
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E005629-14 | 1. DPF fully clogging 2. Electrical problem (Differential pressure sensor connector, Wiring harness from ECU to Differential pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group5 (Tampering) DPF regeneration inhibit by Active and Forced |

|  | No | ECU Pin | Description |
|--|----|---------|--|
| | 1 | K42 | DPF differential pressure Sensor Supply (5V) |
| | 2 | K15 | DPF differential pressure sensor Ground |
| | 3 | K16 | DPF differential pressure sensor Signal |

2) Component Location



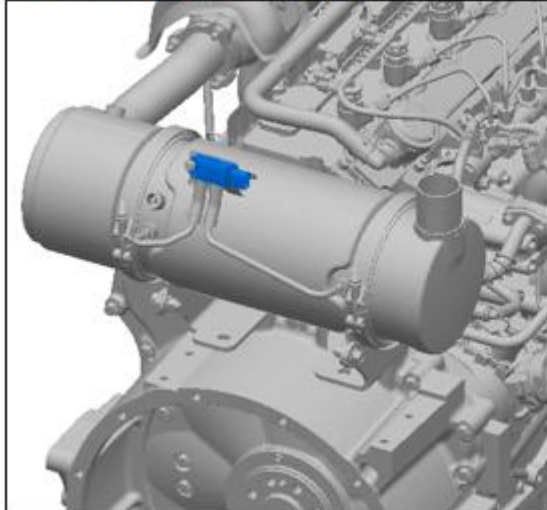
1.8L



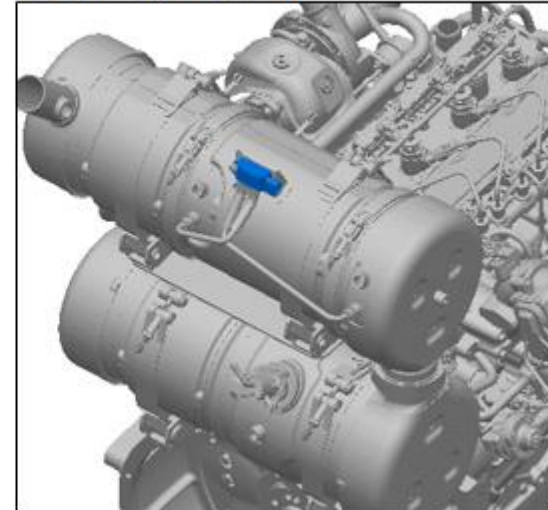
2.4L



3.4L (No-SCR)



3.4L (SCR)

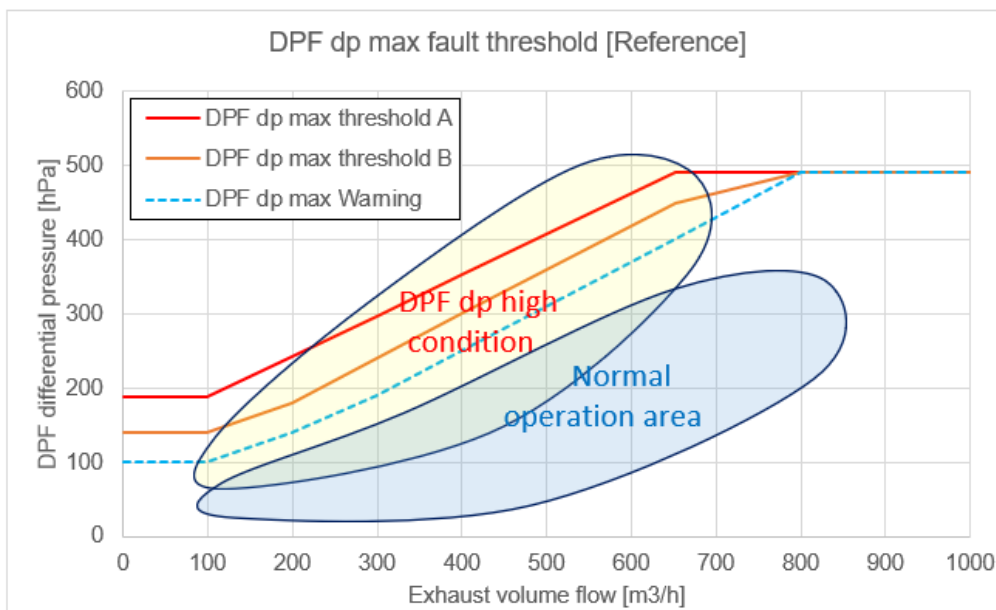


3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The DPF differential pressure is more than maximum pressure dependent on exhaust gas flow. This fault occurs when the soot in the DPF is overloaded. Therefore, if this fault continues to recur in a short time, it is necessary to improve the phenomenon that soot accumulates excessively. For example, air leak of Intake system, Injector failure etc.



5) Condition for Clearing the Fault Code

The DPF differential pressure is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---|--------|
| 1 | P246C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the hose of DPF differential pressure sensor. Is there any leakage or open or blocked? in/out hose in/out is swapped? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. Check whether the DPF differential pressure was increased using by the service tool. *Variables 1) Exhaust volume flow (ASMod_dvolPFItEG) 2) DPF differential pressure (Exh_pSensPPFItDiff) | | Fix the leakage or change the hose | Step4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step5 |
| 5 | Check wiring connection between sensor and ECU (refer to Pin No.) Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace DPF differential pressure sensor and clear fault code. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault cleared? | | Do necessary repair | Step 7 |

| | | | | |
|---|--|--|------------------------------|--------------------------------|
| 7 | <p>Change the DPF (New or ash cleaned DPF) and clear fault code.</p> <p>When replace DPF, it is necessary to reset the DPF related memory stored value using by the service tool.</p> <p>Start and run the engine at high idle more than 5 minutes and key off & on. Is fault cleared?</p> | | <p>Problem solved</p> | <p>Contact Helpdesk</p> |
|---|--|--|------------------------------|--------------------------------|

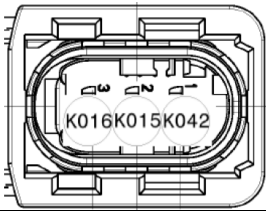
* DPF cleaning pre-conditioning for soot plugged(P246C) case

- 1) When soot is plugged(P246C) in DPF, before DPF cleaning, wet soot must be dried in thermal oven.
- 2) Dry temperature condition : 250~300 °C, over than 1 hour. (Do not burn DPF over 500°C.)

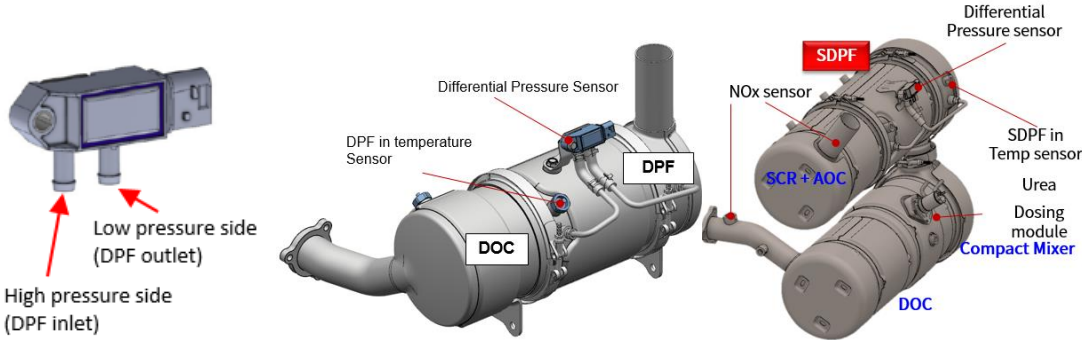
| Fault Code | Fault Name |
|-----------------------|--|
| P2465 | DPF differential pressure high fault (Warning) |

1) Overview

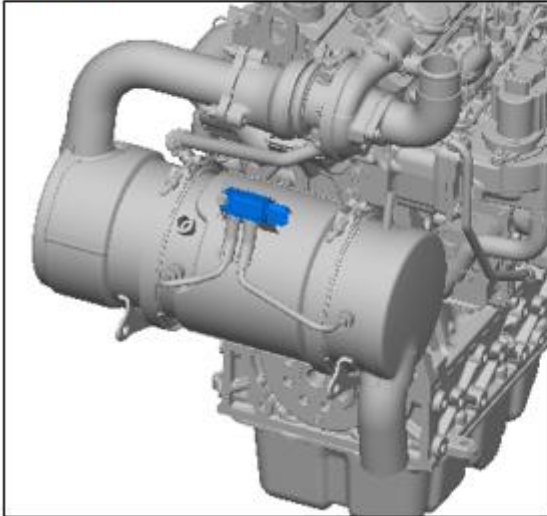
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E005629-15 | 1. DPF highly clogging 2. Electrical problem (Differential pressure sensor connector, Wiring harness from ECU to Differential pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

|  | No | ECU Pin | Description |
|--|----|---------|--|
| | 1 | K42 | DPF differential pressure Sensor Supply (5V) |
| | 2 | K15 | DPF differential pressure sensor Ground |
| | 3 | K16 | DPF differential pressure sensor Signal |

2) Component Location



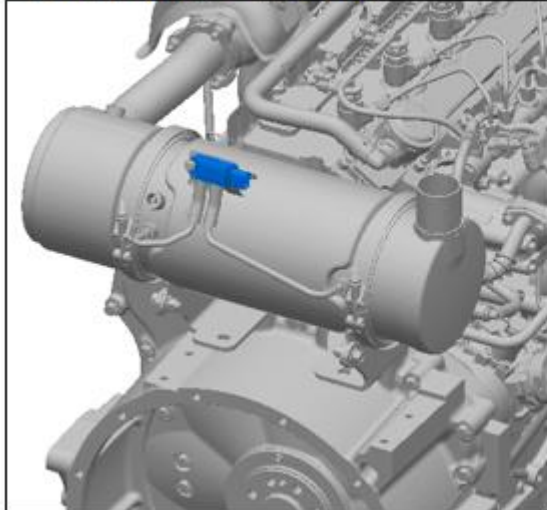
1.8L



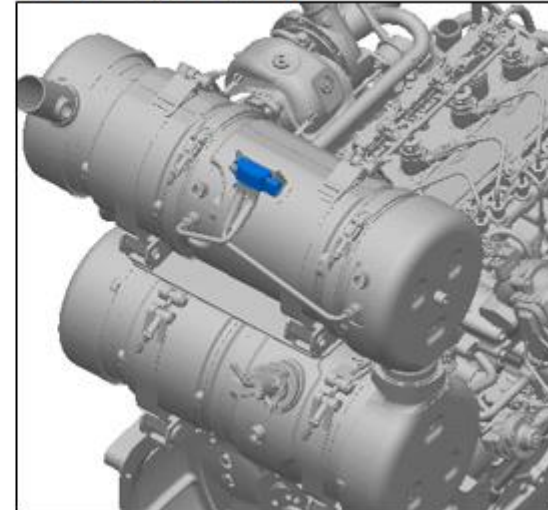
2.4L



3.4L (No-SCR)



3.4L (SCR)



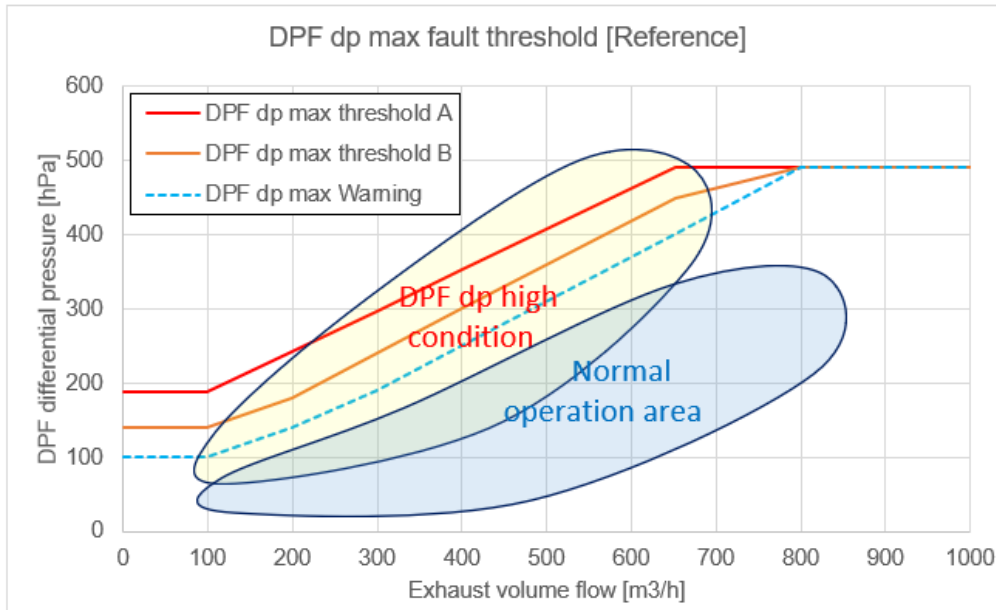
3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The DPF differential pressure is higher than Warning pressure dependent on exhaust gas flow.
This fault is for warning alarm before diagnosis of P246C (DPF differential pressure too high fault).
[Do Forced DPF regeneration by Service tool.](#)

This fault occurs when the soot in the DPF is overloaded. Therefore, if this fault continues to recur in a short time, it is necessary to improve the phenomenon that soot accumulates excessively. For example, air leak of Intake system, Injector failure etc.



5) Condition for Clearing the Fault Code

The DPF differential pressure is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|-------|
| 1 | P2465 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | <p>This fault is for warning alarm before diagnosis of P246C (DPF differential pressure too high fault). Do Forced DPF regeneration by service tool. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault cleared?</p> <p>This fault occurs when the soot in the DPF is overloaded. Therefore, if this fault continues to recur in a short time, it is necessary to improve the phenomenon that soot accumulates excessively. For example, air leak of Intake system, Injector failure etc.</p> | | Monitoring for recurrence in a short time & excessive smoke root cause improvement | Step4 |
| 4 | <p>Check the hose of DPF differential pressure sensor.</p> <p>Is there any leakage or open or blocked?</p> <p>in/out hose in/out is swapped?</p> <p>If no leakage is found visually,</p> <p>Start up the engine and check the leakage again in machine stationary condition.</p> <p>Check whether the DPF differential pressure was increased using by the service tool.</p> <p>*Variables</p> <p>1) Exhaust volume flow (ASMod_dvolPFItEG)</p> <p>2) DPF differential pressure (Exh_pSensPPFItDiff)</p> | | Fix the leakage or change the hose | Step5 |

| | | | | |
|----------|---|--|--------------------------------|-----------------------------|
| 5 | Check sensor connection Connection problem? | | Do necessary repair | Step6 |
| 6 | Check wiring connection between sensor and ECU (refer to Pin No.) Connection problem? | | Do necessary repair | Step 7 |
| 7 | Replace DPF differential pressure sensor and clear fault code. Start and run the engine at high idle more than 5 minutes and key off & on. Is fault cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P360E | DPF lamp 2 (DPF Regeneration Active Lamp) Open circuit |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E006915-05 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K22 | DPF lamp 2 (DPF Regeneration Active Lamp) |

2) Component Location

The lamp shape is dependent on display type. The below is typical shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is opened.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|---------------------|------------------|
| 1 | P360E is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|--|
| P3611 | DPF lamp 2 (DPF Regeneration Active Lamp) Short to Battery |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E006915-03 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K22 | DPF lamp 2 (DPF Regeneration Active Lamp) |

2) Component Location

The lamp shape is dependent on display type. The below is typical shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to battery.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|---------------------|------------------|
| 1 | P3611 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|---|
| P360F | DPF lamp 2 (DPF Regeneration Active Lamp) Short to Ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E006915-04 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K22 | DPF lamp 2 (DPF Regeneration Active Lamp) |

2) Component Location

The lamp shape is dependent on display type. The below is typical shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to ground.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|---------------------|------------------|
| 1 | P360F is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|--|
| P1906 | DPF lamp 3 (DPF regeneration switch inhibit lamp) Open circuit |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E006916-05 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K57 | DPF lamp 3 (DPF regeneration switch inhibit lamp) |

2) Component Location

The lamp shape is dependent on display type. The below is typical shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is opened.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|------------------------|---------------------|
| 1 | P1906 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|--|
| P1908 | DPF lamp 3 (DPF regeneration switch inhibit lamp) Short to Battery |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E006916-03 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K57 | DPF lamp 3 (DPF regeneration switch inhibit lamp) |

2) Component Location

The lamp shape is dependent on display type. The below is typical shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to battery.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|---------------------|------------------|
| 1 | P1908 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|---|
| P1907 | DPF lamp 3 (DPF regeneration switch inhibit lamp) Short to Ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E006916-04 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---|
| 1 | K57 | DPF lamp 3 (DPF regeneration switch inhibit lamp) |

2) Component Location

The lamp shape is dependent on display type. The below is typical shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to ground.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|------------------------|---------------------|
| 1 | P1907 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|---|
| P260E | DPF lamp 1 (DPF regeneration switch enable lamp) Open circuit |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E003697-05 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|--|
| 1 | K23 | DPF lamp 1 (DPF regeneration switch enable lamp) |

2) Component Location

The lamp shape is dependent on display type. The below is typical shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is opened.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|---------------------|------------------|
| 1 | P260E is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|---|
| P2611 | DPF lamp 1 (DPF regeneration switch enable lamp) Short to Battery |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E003697-03 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|--|
| 1 | K23 | DPF lamp 1 (DPF regeneration switch enable lamp) |

2) Component Location

The lamp shape is dependent on display type. The below is typical shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to battery.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|------------------------|---------------------|
| 1 | P2611 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|--|
| P260F | DPF lamp 1 (DPF regeneration switch enable lamp) Short to Ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E003697-04 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness from Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|--|
| 1 | K23 | DPF lamp 1 (DPF regeneration switch enable lamp) |

2) Component Location

The lamp shape is dependent on display type. The below is typical shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to ground.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-------------------------|---------------------|------------------|
| 1 | P260F is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key-on Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check battery connection Battery connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|---|
| P246B | DPF regeneration failure (DPF regeneration is not performed well during machine operation mode) |

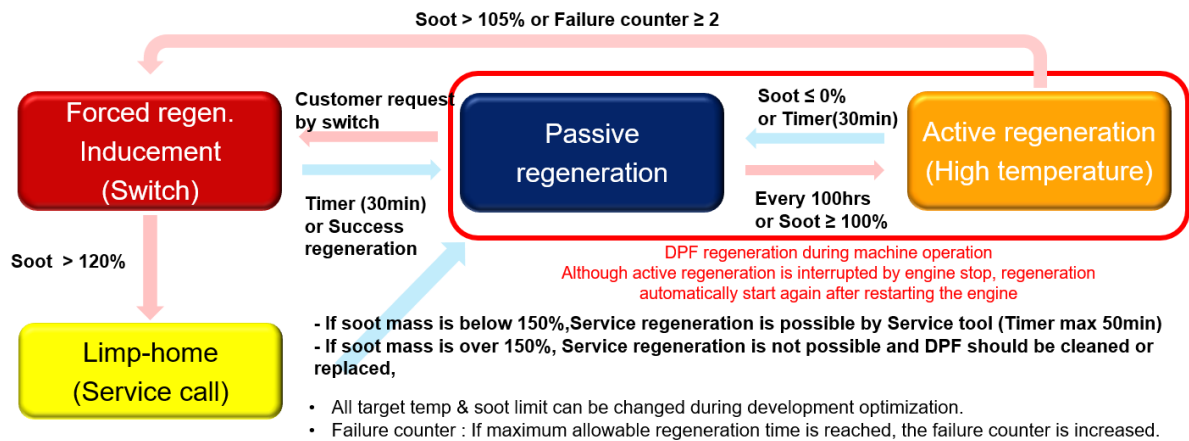
1) Overview

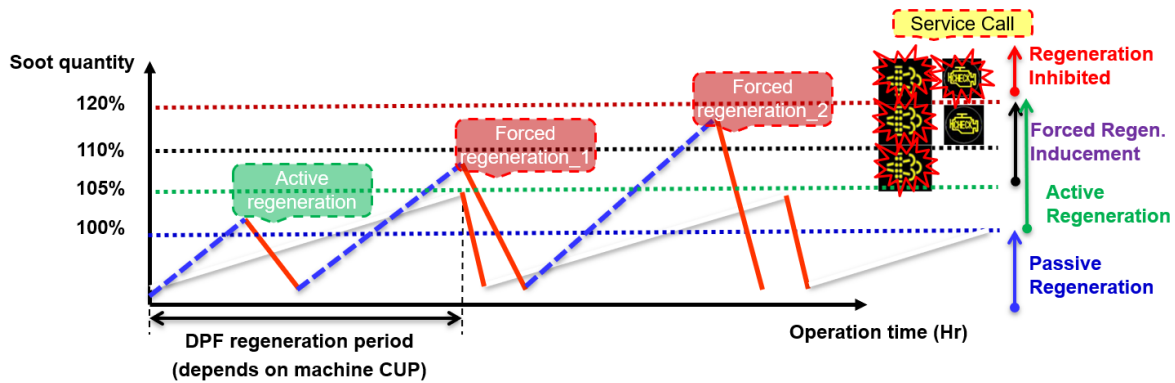
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003715-14 | 1. This fault is an indicator that DPF regeneration is not performed well during machine operation mode. (Reference only) 2. DPF system failure (Electric problem (Faulty DPF(SCRF) in temperature sensor, Leakage of turbine out to DOC in, DOC was poisoned by sulfur, Injector problem, Faulty DOC) | Alarm only DPF regeneration inhibit by Active |

2) Component Location

The DPF regeneration strategy dependent on machine strategy.

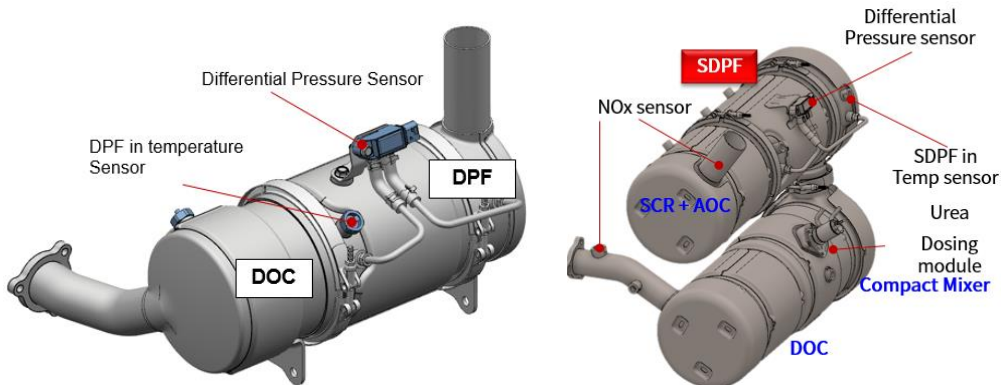
The below one is typical base strategy for reference only.





| Step | Soot quantity | DPF lamp * | Check engine lamp | Torque de-rate | Remark |
|------|---------------|------------|-------------------|-----------------------|--|
| 1 | Below 99% | Off | Off | No | - No Action (Passive regeneration dependent on machine CUP) |
| 2 | 100% ~ 105% | Off | Off | No | - Start active regen. With high temp.(580~640°C) during running |
| 3 | 106% ~ 110% | Slow Blink | Off | No | - Forced regeneration inducement (Alarm only) - Start active regen. With high temp.(580~640°C) during running |
| 4 | 111% ~ 120% | Slow Blink | ON | Mild Torque de-rate | - Forced regeneration inducement (Torque de-rate) - Start active regen. With high temp.(580~640°C) during running |
| 5 | Above 121% | Fast Blink | Blink | Severe Torque de-rate | - Forced regeneration is disabled. - Service call is needed to service regeneration for machine operating properly. |

* DPF lamp is off when soot quantity is higher than 150% and DPF should be cleaned or replaced.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DPF regeneration failure counter is exceed than threshold. (Normally 2)

This fault is an indicator that DPF regeneration is not performed well during machine operation mode. (Reference only)

DPF failure counter is calculated as follows.

- If the DPF regeneration is triggered but the DPF regeneration is not succeed within allowable time, the failure counter rises by one.
- If the failure counter rises, the DPF regeneration is stopped for 2 hours(Lock up mode) and then the DPF regeneration will be retried after lock up mode.
- If the DPF regeneration is also not succeed during the 2nd attempt, the DPF regeneration of "High temperature automatically" is disactivated, because the current operation mode is not suitable for DPF regeneration.

* The allowable time and failure counter could be different for machine application characteristic and operation mode.

5) Condition for Clearing the Fault Code

DPF regeneration process is successfully completed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|------------------|
| 1 | P246B is detected on service tool? | | Step 2 | |
| 2 | This item is not a fault and indicates that DPF regeneration is not performed well during machine operation mode. (Reference only) There is no chance to heat up or burn soot within very short time driving, physically. So it should be needed the Forced regeneration by DPF switch. Process Forced DPF regeneration by switch or service tool. The fault code is cleared? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ Forced DPF regeneration procedure

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position <5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|----------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal Max | ~ 2300 3000 |

• Service regeneration stop and not start condition

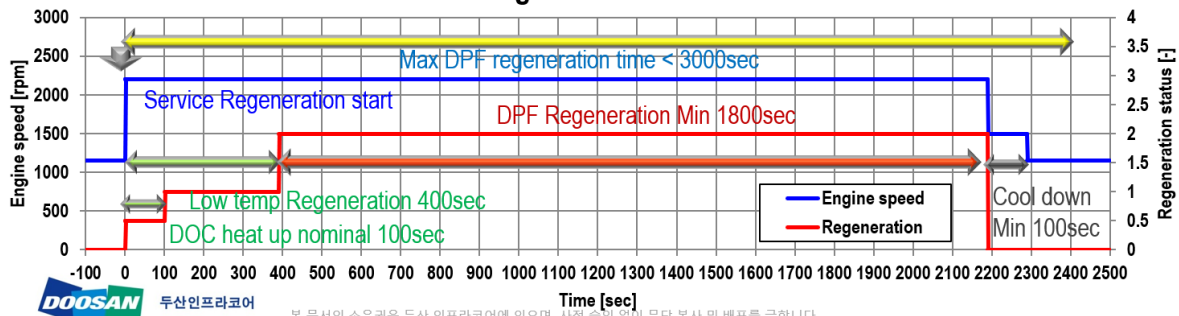
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure



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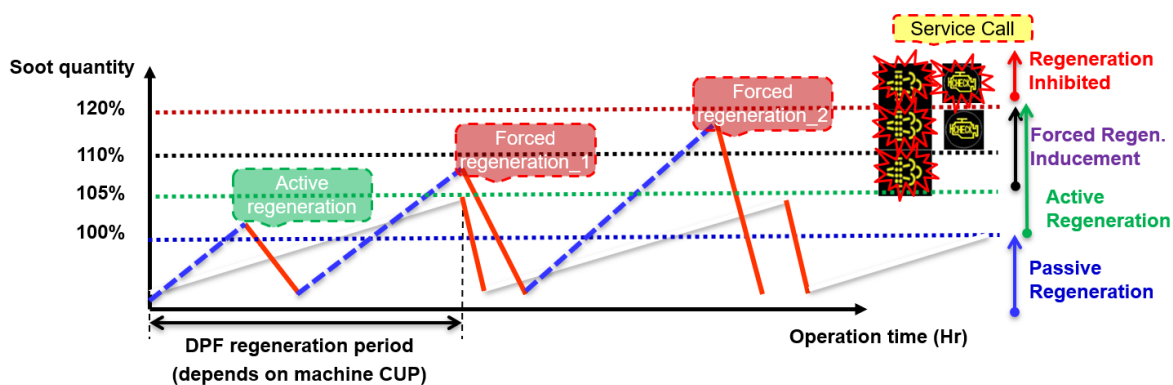
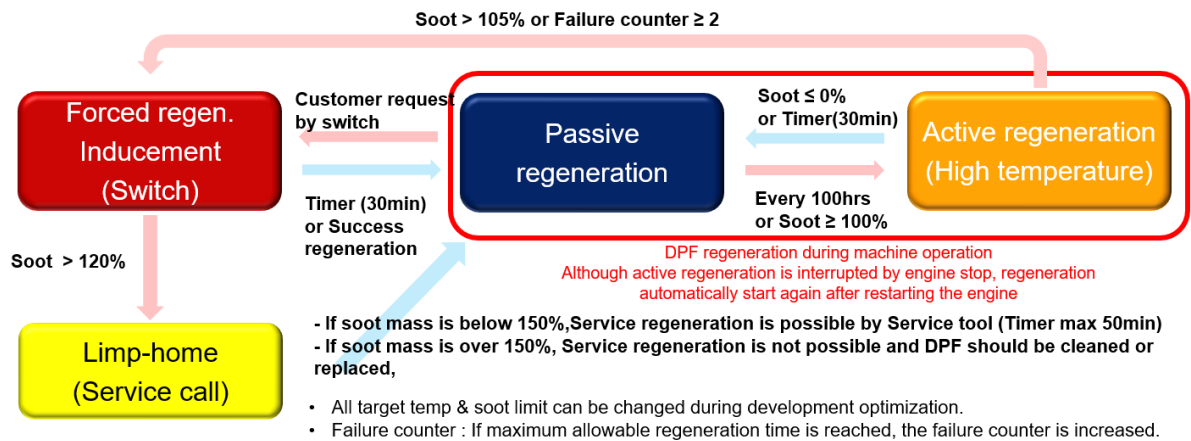
| Fault Code | Fault Name |
|-----------------------|------------------------------------|
| P2463 | DPF Soot mass high status (> 110%) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|------------------------------------|--|
| E004781-16 | 1. DPF soot loading is exceed 110% | CE lamp ON Torque Reduction 1(Mild) |

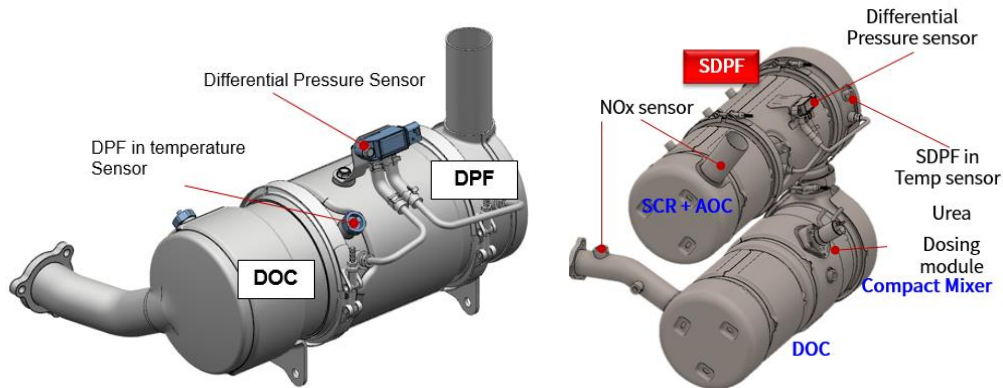
2) Component Location

The DPF regeneration strategy dependent on machine strategy.
The below one is typical base strategy for reference only.



| Step | Soot quantity | DPF lamp * | Check engine lamp | Torque de-rate | Remark |
|------|---------------|------------|-------------------|-----------------------|--|
| 1 | Below 99% | Off | Off | No | - No Action (Passive regeneration dependent on machine CUP) |
| 2 | 100% ~ 105% | Off | Off | No | - Start active regen. With high temp.(580~640°C) during running |
| 3 | 106% ~ 110% | Slow Blink | Off | No | - Forced regeneration inducement (Alarm only) - Start active regen. With high temp.(580~640°C) during running |
| 4 | 111% ~ 120% | Slow Blink | ON | Mild Torque de-rate | - Forced regeneration inducement (Torque de-rate) - Start active regen. With high temp.(580~640°C) during running |
| 5 | Above 121% | Fast Blink | Blink | Severe Torque de-rate | - Forced regeneration is disabled. - Service call is needed to service regeneration for machine operating properly. |

* DPF lamp is off when soot quantity is higher than 150% and DPF should be cleaned or replaced.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DPF soot loading is exceed 110%.

There is no chance to heat up or burn soot within very short time driving, physically. So it should be needed the Forced regeneration by DPF switch.

5) Condition for Clearing the Fault Code

The DPF soot loading is lower than 110%.

This item is not a fault and indicates that the DPF soot loading status for alarm.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2463 is detected on service tool? | | Step 2 | |
| 2 | This item is not a fault and indicates that the DPF soot loading status for alarm. There is no chance to heat up or burn soot within very short time driving, physically. So it should be needed the Forced regeneration by DPF switch. Process Forced DPF regeneration by switch or service tool. The fault code is cleared? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ Forced DPF regeneration procedure

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position < 5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)

7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|----------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal Max | ~ 2300 3000 |

• Service regeneration stop and not start condition

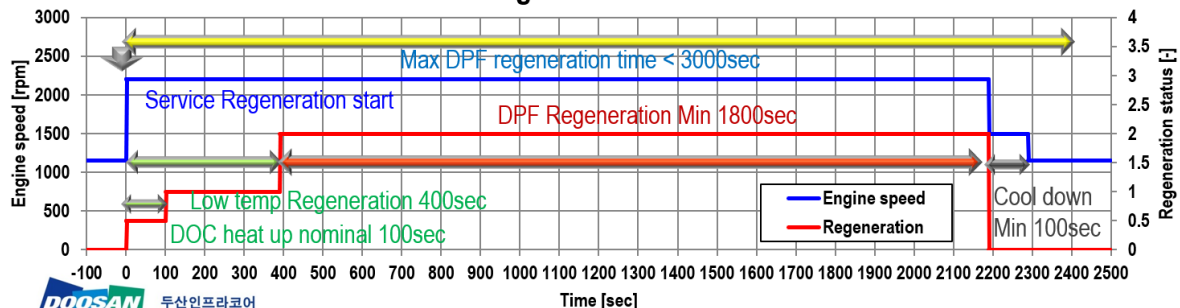
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure



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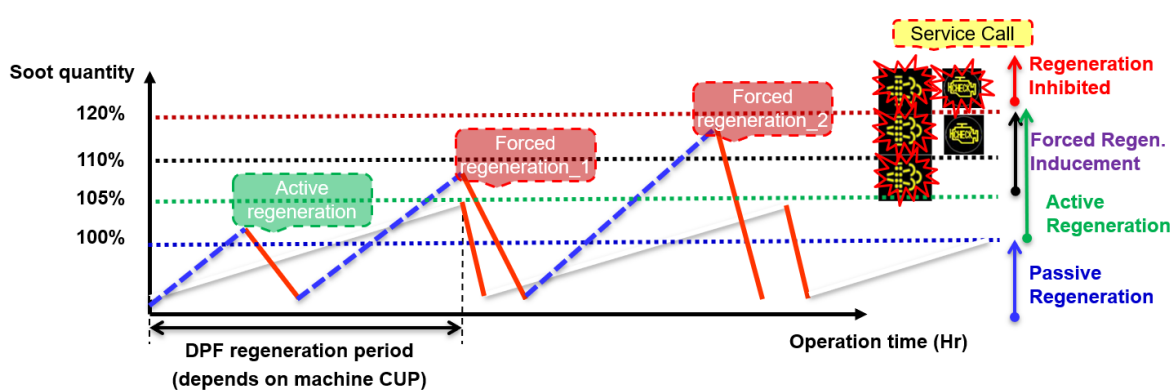
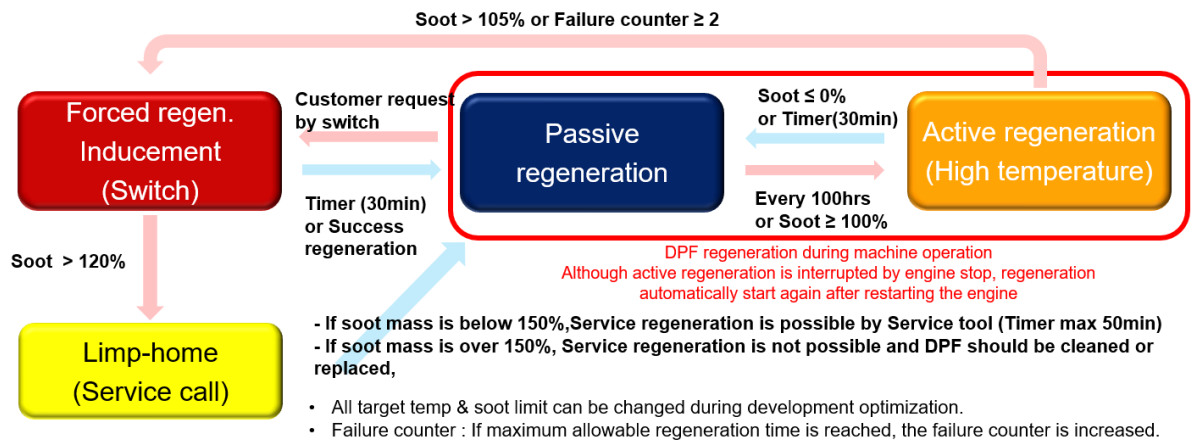
| Fault Code | Fault Name |
|-----------------------|--|
| P24A3 | DPF Soot mass too high status (> 120%) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|------------------------------------|--|
| E004781-15 | 1. DPF soot loading is exceed 120% | CE lamp Blink Torque Reduction 2(Severe) DPF regeneration inhibit by Active and Switch |

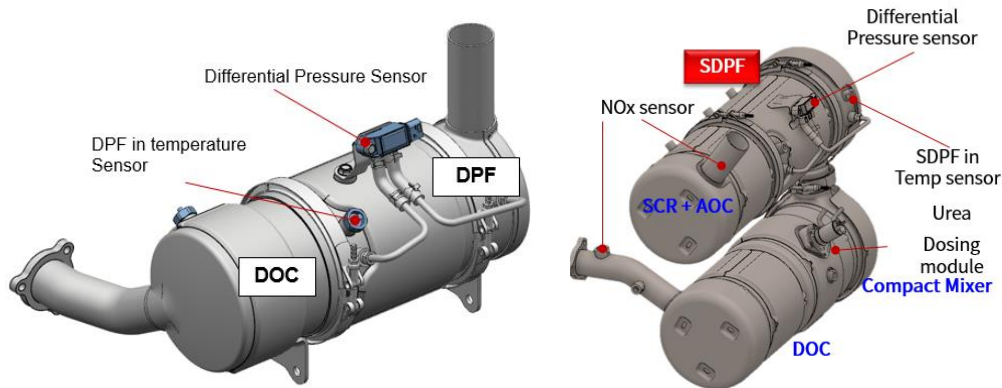
2) Component Location

The DPF regeneration strategy dependent on machine strategy.
The below one is typical base strategy for reference only.



| Step | Soot quantity | DPF lamp * | Check engine lamp | Torque de-rate | Remark |
|------|---------------|------------|-------------------|-----------------------|--|
| 1 | Below 99% | Off | Off | No | - No Action (Passive regeneration dependent on machine CUP) |
| 2 | 100% ~ 105% | Off | Off | No | - Start active regen. With high temp.(580~640°C) during running |
| 3 | 106% ~ 110% | Slow Blink | Off | No | - Forced regeneration inducement (Alarm only) - Start active regen. With high temp.(580~640°C) during running |
| 4 | 111% ~ 120% | Slow Blink | ON | Mild Torque de-rate | - Forced regeneration inducement (Torque de-rate) - Start active regen. With high temp.(580~640°C) during running |
| 5 | Above 121% | Fast Blink | Blink | Severe Torque de-rate | - Forced regeneration is disabled. - Service call is needed to service regeneration for machine operating properly. |

* DPF lamp is off when soot quantity is higher than 150% and DPF should be cleaned or replaced.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DPF soot loading is exceed 120%.

There is no chance to heat up or burn soot within very short time driving, physically. So it should be needed the Forced regeneration by DPF switch.

5) Condition for Clearing the Fault Code

The DPF soot loading is lower than 120%.

This item is not a fault and indicates that the DPF soot loading status for alarm.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P24A3 is detected on service tool? | | Step 2 | |
| 2 | This item is not a fault and indicates that the DPF soot loading status for alarm. There is no chance to heat up or burn soot within very short time driving, physically. So it should be needed the Forced regeneration by service tool. Process Forced DPF regeneration by service tool. The fault code is cleared? | | Problem solved | Contact Helpdesk |

* If soot loading exceeds 150%, DPF regeneration is inhibited, by even though service tool. In this case, DPF replacement or DPF cleaning is required.

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ Forced DPF regeneration procedure

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position < 5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)

7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|-------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal | ~ 2300 |
| | | Max | 3000 |

• Service regeneration stop and not start condition

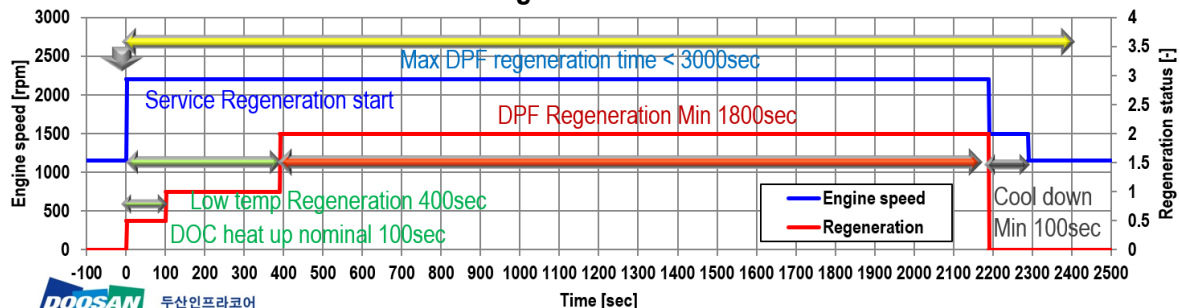
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure



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| Fault Code | Fault Name |
|-----------------------|--|
| P25BA | DPF regeneration inhibit & enable switch plausibility fault (Hardwire) |

1) Overview

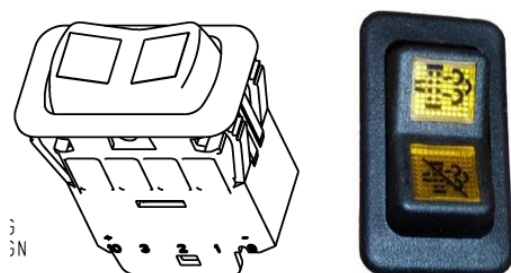
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E003696-11 | 1. Electrical problem (DPF regeneration switch connector) 2. Electrical problem (Wiring harness from DPF regeneration switch to ECU, Faulty DPF regeneration switch) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

This pin description is only for hardwire to ECU connection type.

| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | K11 | DPF Regeneration enable switch |
| 2 | K10 | DPF Regeneration inhibit switch |

2) Component Location

The DPF regeneration switch is dependent on machine strategy.
The below one is typical base shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If DPF regeneration inhibit switch is active and DPF regeneration enable switch is also activated.
The switch is connected directly to ECU.

5) Condition for Clearing the Fault Code

DPF regeneration switch is normal

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|------------------------------------|----------------|--------|----|
| 1 | P25BA is detected on service tool? | | Step 2 | |

| | | | | |
|----------|---|--|--------------------------------|-----------------------------|
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check switch connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal switch Switch problem? | | Change switch | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|---|
| P25BB | DPF regeneration enable switch Stuck (Short to Battery) fault (Hardwire) |

1) Overview

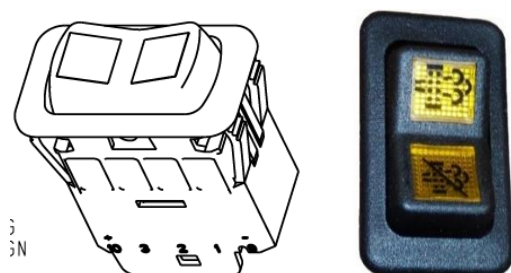
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E003696-03 | 1. Electrical problem (DPF regeneration switch connector) 2. Electrical problem (Wiring harness from DPF regeneration switch to ECU, Faulty DPF regeneration switch) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

This pin description is only for hardwire to ECU connection type.

| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | K11 | DPF Regeneration enable switch |
| 2 | K10 | DPF Regeneration inhibit switch |

2) Component Location

The DPF regeneration switch is dependent on machine strategy.
The below one is typical base shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If DPF regeneration enable switch is **pressured or locked (shorted to battery) for more than 12 seconds**.
The switch is connected directly to ECU.

5) Condition for Clearing the Fault Code

DPF regeneration switch is normal.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|------------------------------------|----------------|--------|----|
| 1 | P25BB is detected on service tool? | | Step 2 | |

| | | | | |
|----------|---|--|--------------------------------|-----------------------------|
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check switch connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal switch Switch problem? | | Change switch | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|--|
| P25BC | DPF regeneration inhibit switch Stuck (Short to Battery) fault (Hardwire) |

1) Overview

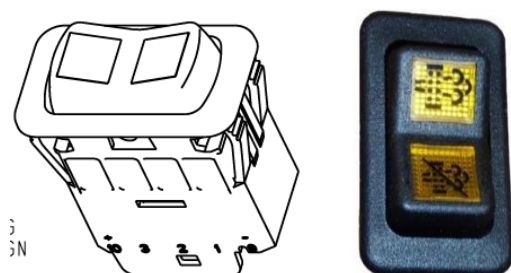
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E003695-03 | 1. Electrical problem (DPF regeneration switch connector) 2. Electrical problem (Wiring harness from DPF regeneration switch to ECU, Faulty DPF regeneration switch) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

This pin description is only for hardwire to ECU connection type.

| No | ECU Pin | Description |
|----|---------|---------------------------------|
| 1 | K11 | DPF Regeneration enable switch |
| 2 | K10 | DPF Regeneration inhibit switch |

2) Component Location

The DPF regeneration switch is dependent on machine strategy.
The below one is typical base shape.



3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

If DPF regeneration inhibit switch is **pressured or locked (shorted to battery) for more than 12 seconds**.
The switch is connected directly to ECU.

5) Condition for Clearing the Fault Code

DPF regeneration switch is normal.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|------------------------------------|----------------|--------|----|
| 1 | P25BC is detected on service tool? | | Step 2 | |

| | | | | |
|----------|---|--|--------------------------------|-----------------------------|
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check switch connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal switch Switch problem? | | Change switch | Contact Helpdesk |

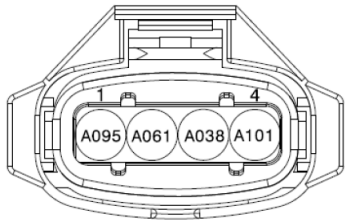
※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

| Fault Code | Fault Name |
|-----------------------|--|
| P0108 | Intake Manifold Pressure Sensor High Fault |

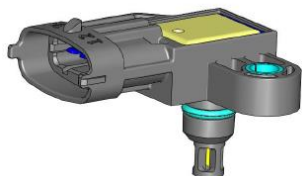
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000102-03 | 1. Electrical problem (Intake manifold pressure sensor connector) 2. Electrical problem (Wiring harness from Intake manifold pressure sensor to ECU, Faulty Intake manifold pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

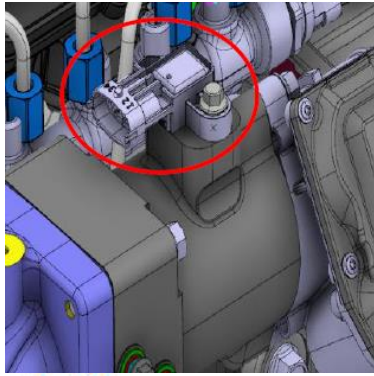
| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A95 | Intake manifold press/temp Ground |
| 2 | A61 | Intake manifold temperature Signal |
| 3 | A38 | Intake manifold pressure Supply (5V) |
| 4 | A101 | Intake Manifold Pressure Signal |



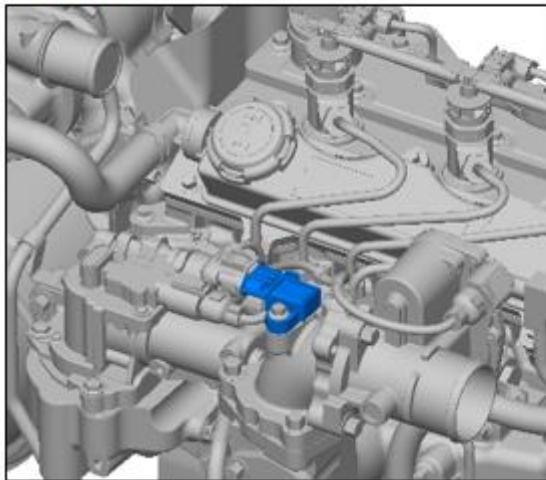
2) Component Location



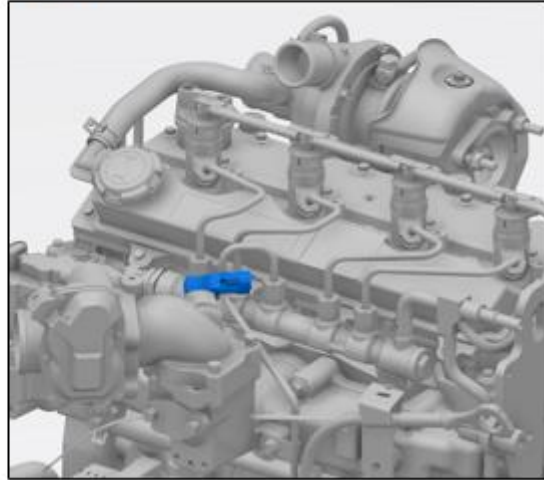
| Intake manifold Temperature sensor | | | |
|------------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 45303 | 4860 |
| 0 | 32 | 5895 | 4093 |
| 20 | 68 | 2499 | 3059 |
| 40 | 104 | 1174 | 2391 |
| 80 | 176 | 322 | 990 |
| 130 | 266 | 89 | 327 |



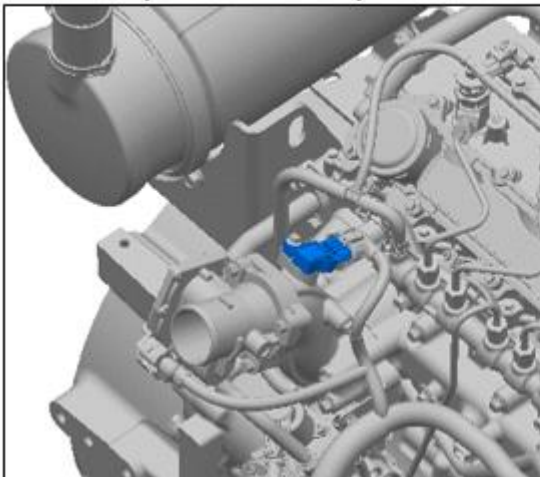
1.8L



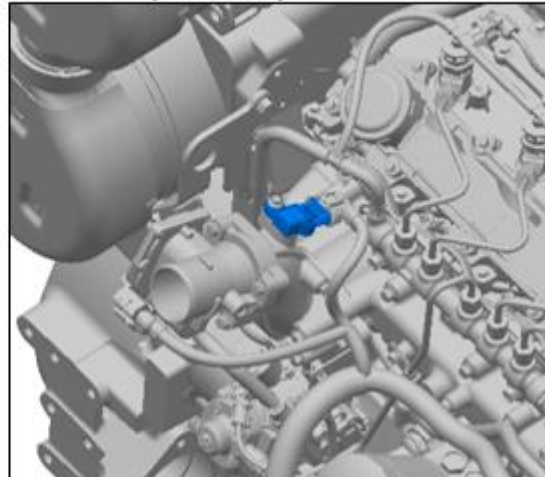
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Intake manifold pressure signal is more than maximum threshold (4.649V)

5) Condition for Clearing the Fault Code

Intake manifold pressure signal is in operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0108 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal sensor Sensor problem? | | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

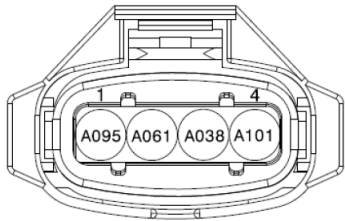
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P0107 | Intake Manifold Pressure Sensor Low Fault |

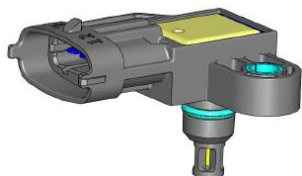
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000102-04 | 1. Electrical problem (Intake manifold pressure sensor connector) 2. Electrical problem (Wiring harness from Intake manifold pressure sensor to ECU, Faulty Intake manifold pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

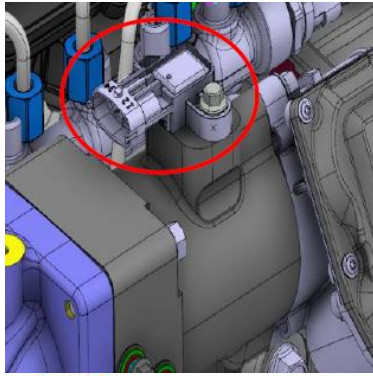
| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A95 | Intake manifold press/temp Ground |
| 2 | A61 | Intake manifold temperature Signal |
| 3 | A38 | Intake manifold pressure Supply (5V) |
| 4 | A101 | Intake Manifold Pressure Signal |



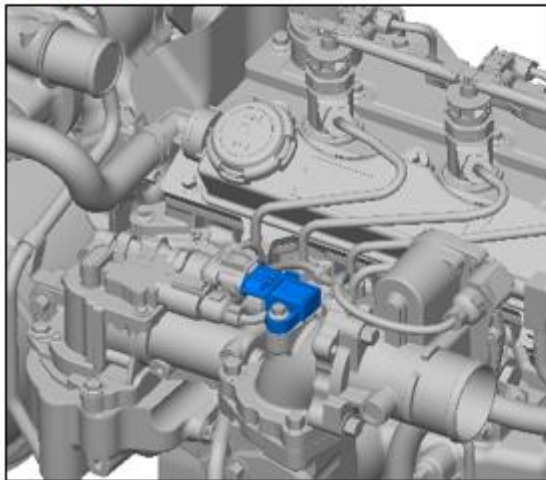
2) Component Location



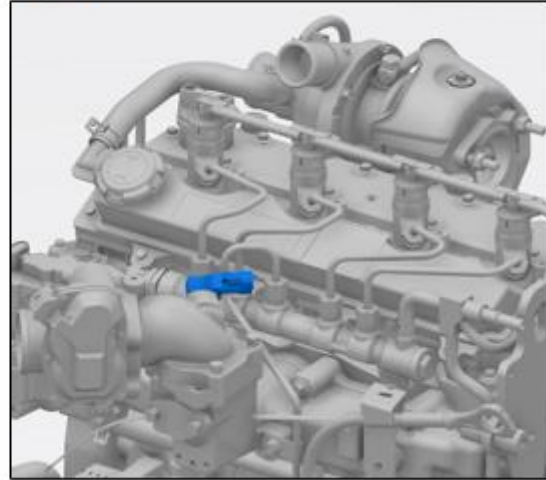
| Intake manifold Temperature sensor | | | |
|------------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 45303 | 4860 |
| 0 | 32 | 5895 | 4093 |
| 20 | 68 | 2499 | 3059 |
| 40 | 104 | 1174 | 2391 |
| 80 | 176 | 322 | 990 |
| 130 | 266 | 89 | 327 |



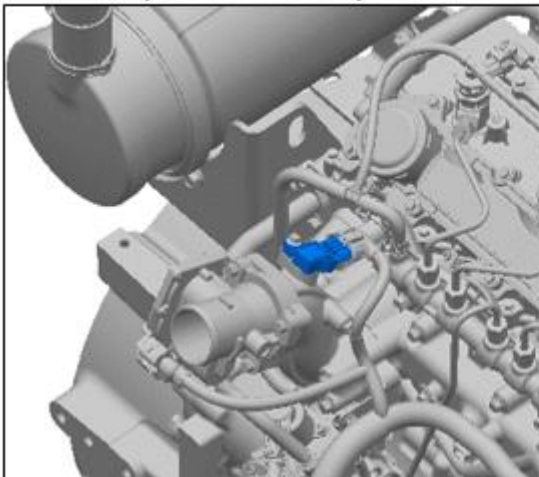
1.8L



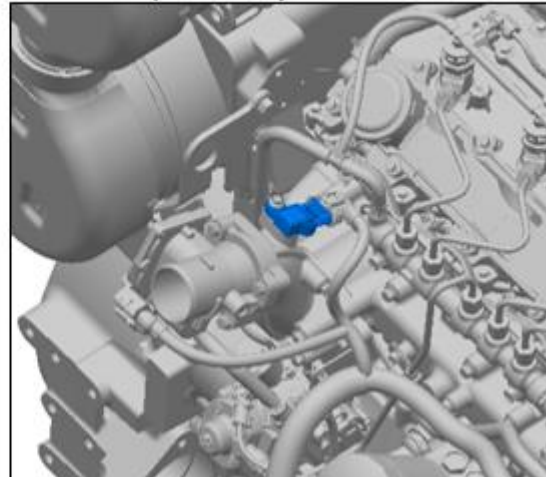
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Intake manifold pressure signal is less than minimum threshold (0.200V)

5) Condition for Clearing the Fault Code

Intake manifold pressure signal is in operation range.

6) Check List

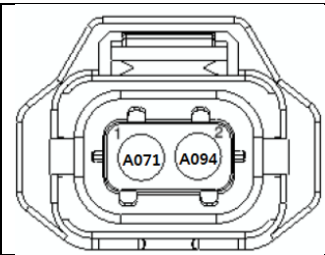
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0107 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal sensor Sensor problem? | | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|-------------------------------------|
| P2C11 | DEF dosing valve plausibility fault |

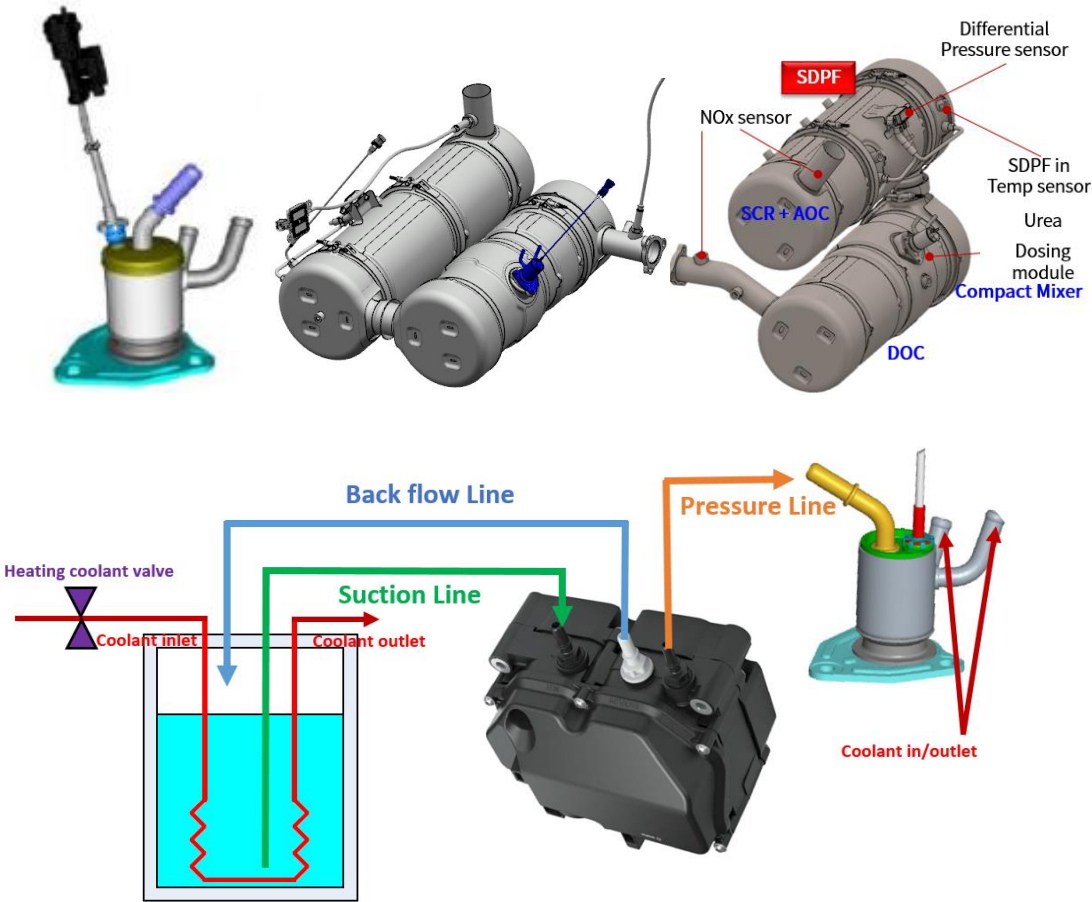
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E003361-14 | 1. The DEF dosing valve nozzle tip is clogged due to DEF crystallization (deposit). 2. The DEF hose line is clogged. 3. Electrical problem (DEF dosing valve connector, Wiring harness from ECU to DEF dosing valve, Dosing valve) 4. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

|  | No. | ECU Pin | PIN description |
|---|-----|---------|----------------------------|
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location

Muffler Layout can be different according to Machine but the position of DEF dosing valve is same.



3) Condition for Running Diagnostic

SCR control status is 'COSCR_METERINGCONTROL'.

4) Condition for Setting the Fault Code

The DEF dosing valve is detected as blocked if no opening signal is detected by the DEF dosing valve driver.

5) Condition for Clearing the Fault Code

DEF dosing valve is operated well.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-----------------------|-------------------------|------------------|
| 1 | P2C11 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF dosing valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check DEF hose line is clogged or not. Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 6 |
| 6 | Check DEF dosing valve resistance (key off & disconnect ECU) (Pin#1 & #2) Resistance problem? Check DEF dosing valve tip state. Dosing module tip is blocked? | 12 Ω @ 20 degC | Change DEF dosing valve | Contact Helpdesk |

※ SCR function test by service tool (Emptying, Leak, Complete test)

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)
 - * Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)
 - This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

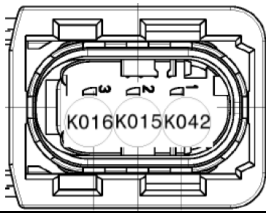
※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

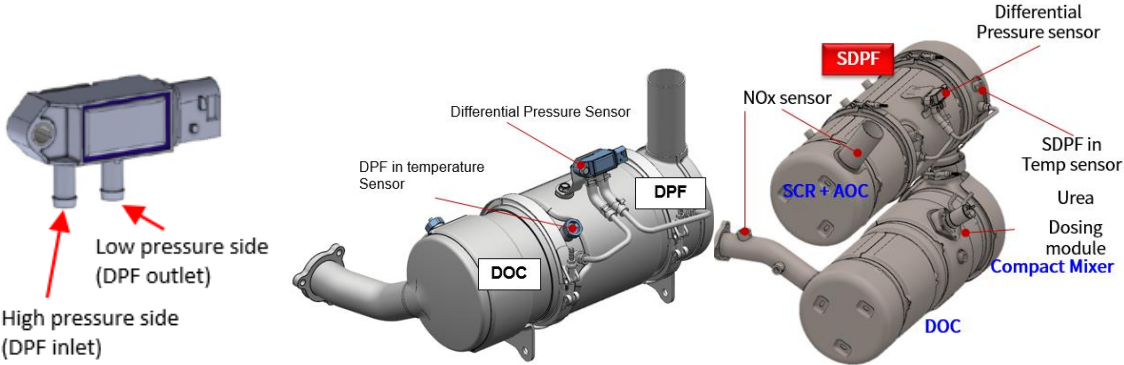
| Fault Code | Fault Name |
|-----------------------|---|
| P2455 | DPF differential pressure sensor High fault |

1) Overview

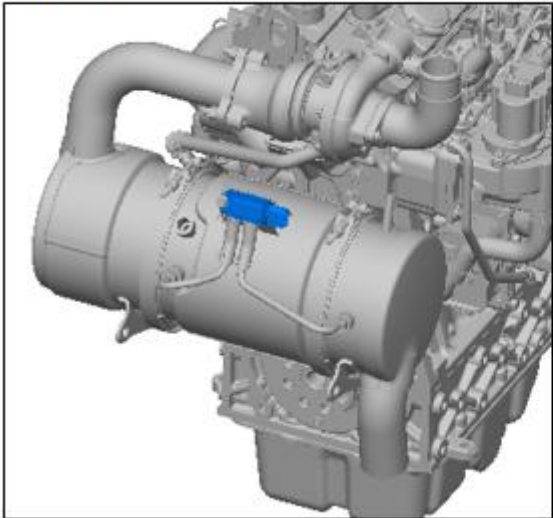
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003251-03 | 1. Electrical problem (Differential pressure sensor connector) 2. Electrical problem (Wiring harness from ECU to Differential pressure sensor, Faulty Differential pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group5 (Tampering) DPF regeneration inhibit by Active and Forced |

|  | No | ECU Pin | Description |
|--|----|---------|--|
| | 1 | K42 | DPF differential pressure Sensor Supply (5V) |
| | 2 | K15 | DPF differential pressure sensor Ground |
| | 3 | K16 | DPF differential pressure sensor Signal |

2) Component Location



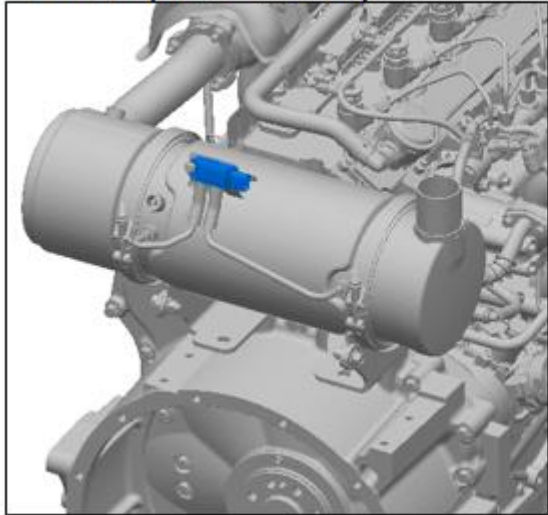
1.8L



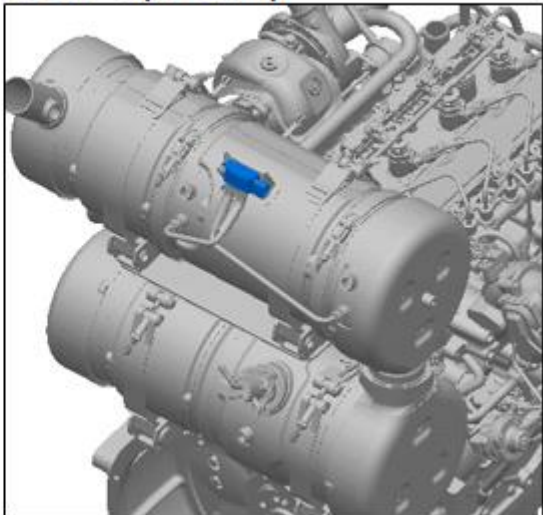
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DPF differential pressure sensor signal is more than maximum threshold. (4.649V)

* If there is no issue of the Differential sensor connection and the "DPF differential pressure too high fault(P246C)" has occurred together, check "DPF differential pressure too high fault(P246C)" fault first.

5) Condition for Clearing the Fault Code

The DPF differential pressure sensor signal is within normal operation range. .

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P2455 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

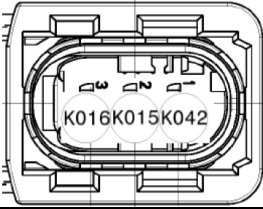
| | | | | |
|----------|---|--|---|-------------------------|
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | DPF differential pressure too high fault(P246C) present? | | Fix the fault based on its troubleshooting guide | Step 6 |
| 6 | Replace with another normal sensor Sensor problem? | | Change sensor | Step 7 |
| 7 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

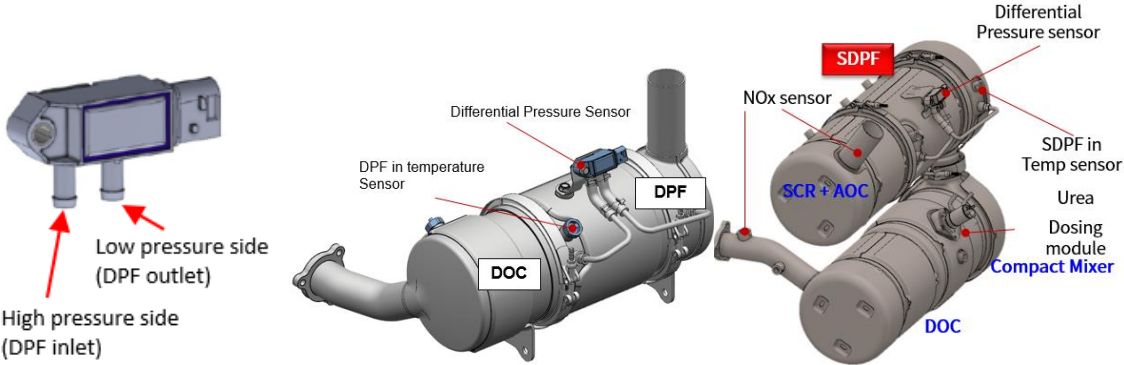
| Fault Code | Fault Name |
|-----------------------|--|
| P2454 | DPF differential pressure sensor Low fault |

1) Overview

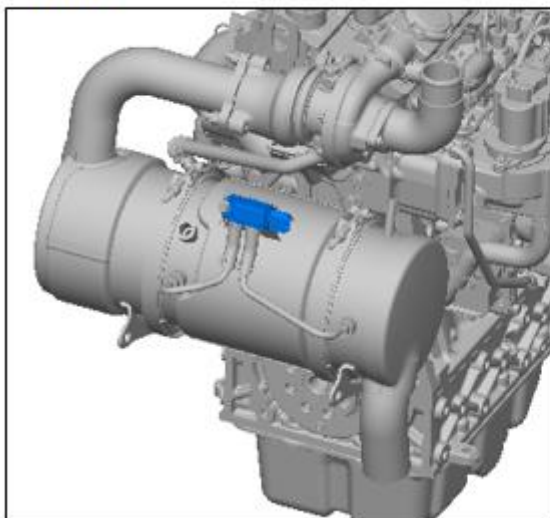
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003251-03 | 1. Electrical problem (Differential pressure sensor connector) 2. Electrical problem (Wiring harness from ECU to Differential pressure sensor, Faulty Differential pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) Inducement Group5 (Tampering) DPF regeneration inhibit by Active and Forced |

|  | No | ECU Pin | Description |
|--|----|---------|--|
| | 1 | K42 | DPF differential pressure Sensor Supply (5V) |
| | 2 | K15 | DPF differential pressure sensor Ground |
| | 3 | K16 | DPF differential pressure sensor Signal |

2) Component Location



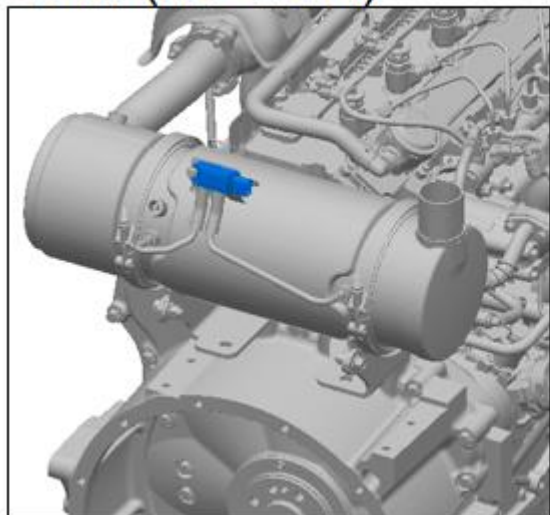
1.8L



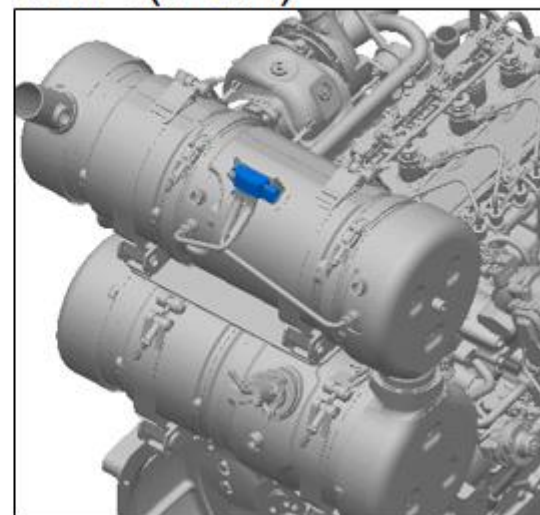
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DPF differential pressure sensor signal is less than minimum threshold. (0.374V)

5) Condition for Clearing the Fault Code

The DPF differential pressure sensor signal is within normal operation range. .

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------------------|--------|
| 1 | P2454 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? | | Fix the fault based on its | Step 4 |

| | | | | |
|----------|--|--|----------------------------------|-----------------------------|
| | 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | troubleshooting guide | |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal sensor Sensor problem? | | Change sensor | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

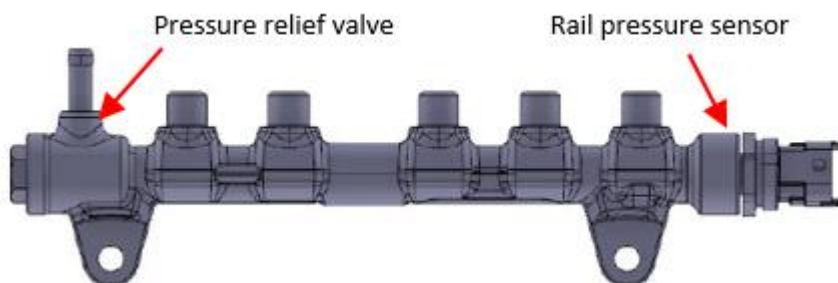
| Fault Code | Fault Name |
|-----------------------|---|
| P009B | Common rail pressure relief valve reached maximum allowed opening count |

1) Overview

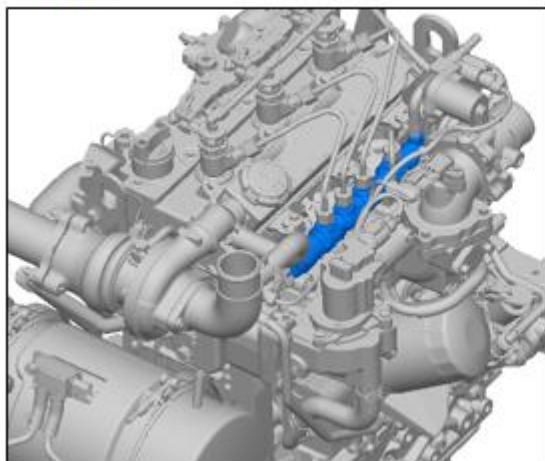
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E005571-22 | 1. Common rail pressure relief valve(PRV) open counter is exceeded than guideline. | CE lamp ON |

2) Component Location

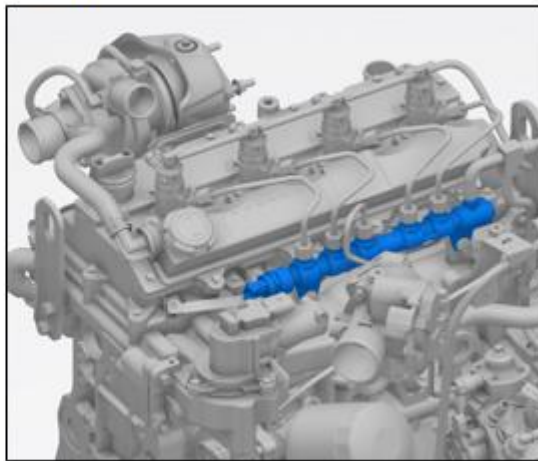
Common rail pressure relief valve is located on opposite to rail pressure sensor.



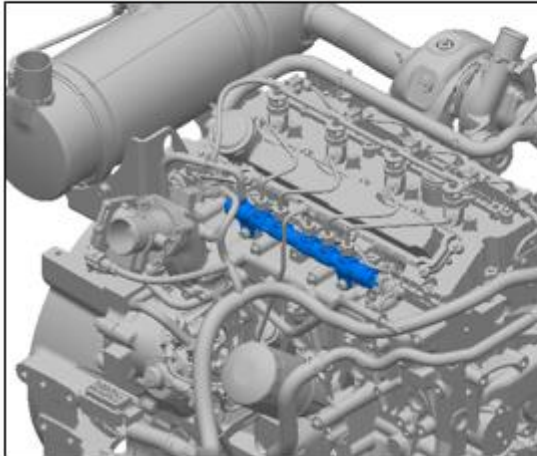
1.8L



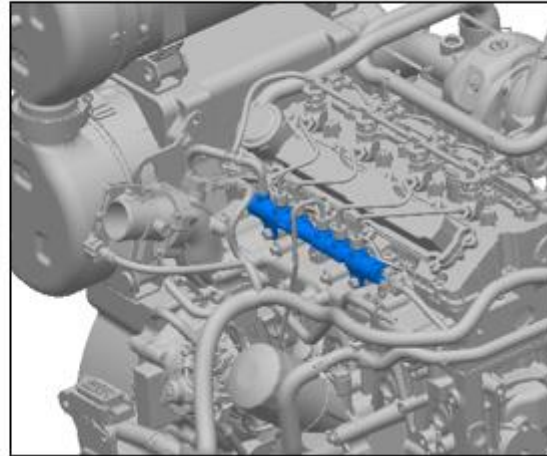
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

Common rail pressure relief valve (PRV) open counter is exceeded than guideline. (50)

The PRV open occurs when the rail pressure rises above 1950 bar, so if the fault recurs within a short time, a low pressure circuit (LPC) and high pressure circuit (HPC) check is required.

* LPC : Whole system from Fuel tank to Fuel high pressure pump

* HPC : Whole system from high pressure pump to Injector

If there is no problem with the LPC/HPC and other electric faults, and PRV open fault is only occurred, it could be an ECU power supply issue during very short time (<~30ms). Therefore, it should be checked the ECU power supply electric wire (including the connectivity of the ECU electric connector, battery electric connector) and determine the cause of the unstable ECU power supply.

5) Condition for Clearing the Fault Code

Common rail pressure relief valve (PRV) open counter is less than guideline.

The PRV open counter value can be reset by service tool after change the hardware.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|----|
| 1 | P009B is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |
| 3 | Change the PRV Reset the PRV open counter value by service tool. * If the fault recurs within a short time, the pressure circuit (LPC/HPC) and ECU power supply electric connection problem check should be required. | | Problem solved | |

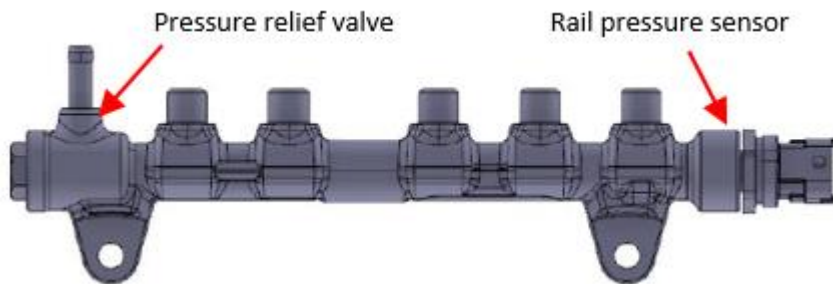
| Fault Code | Fault Name |
|-----------------------|---|
| P009C | Common rail pressure relief valve Forced to open status (Pressure increase) |

1) Overview

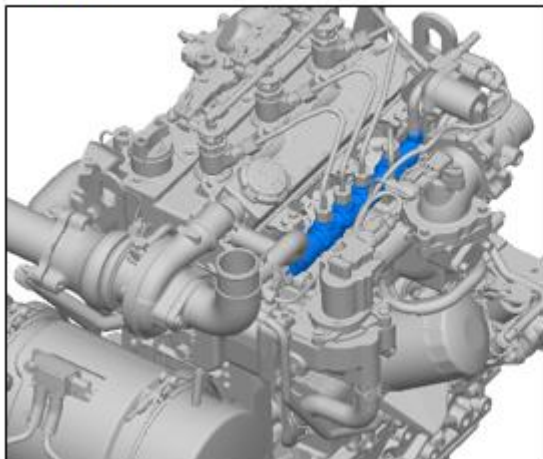
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E005571-23 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector close stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU, ECU power supply) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

2) Component Location

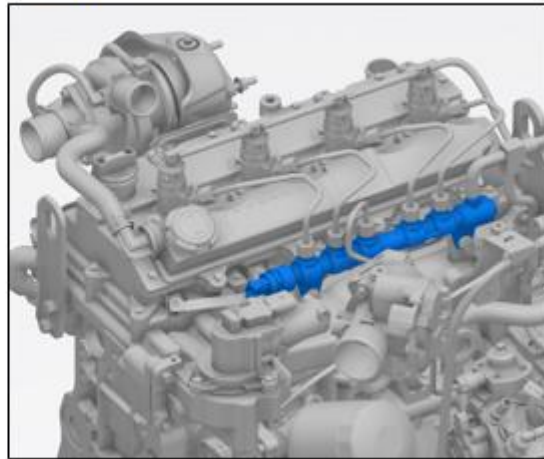
Common rail pressure relief valve is located on opposite to rail pressure sensor.



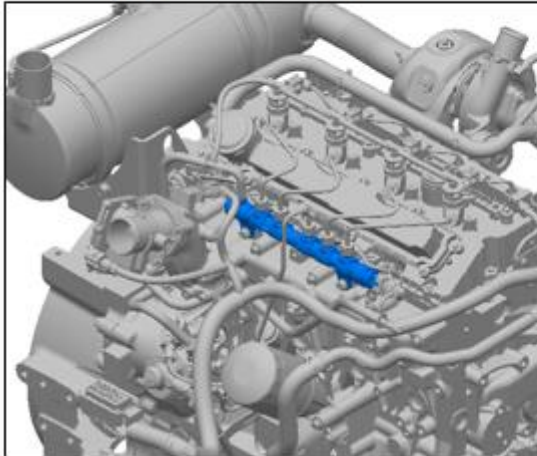
1.8L



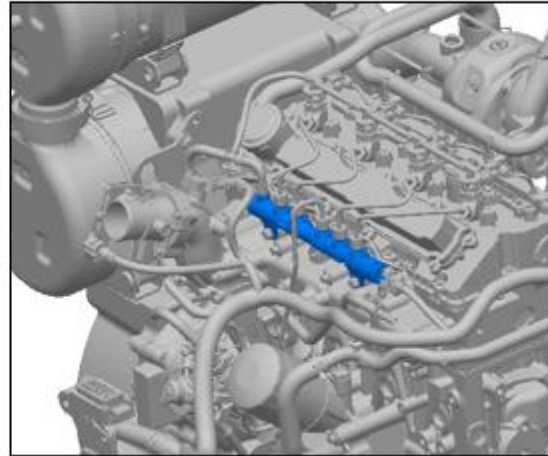
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If there is any malfunction related to FIE system, the PRV (pressure relief valve) is forced to open for protection FIE system and driver by performing of rail pressure increment.

In conclusion, this function is used to force the PRV to open and keep the rail pressure low.

If there is no problem with the LPC/HPC and other electric faults, and PRV open fault is only occurred, it could be an ECU power supply issue during very short time(<~30ms). Therefore, it should be checked the ECU power supply electric wire (including the connectivity of the ECU electric connector, battery electric connector) and determine the cause of the unstable ECU power supply.

5) Condition for Clearing the Fault Code

FIE system is operated normally.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P009C is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |
| 3 | Check FIE system hardware & the other fault Clear fault code after fixed the other FIE issue. Fault is cleared? | | Fix the fault based on its troubleshooting guide | Contact Helpdesk |

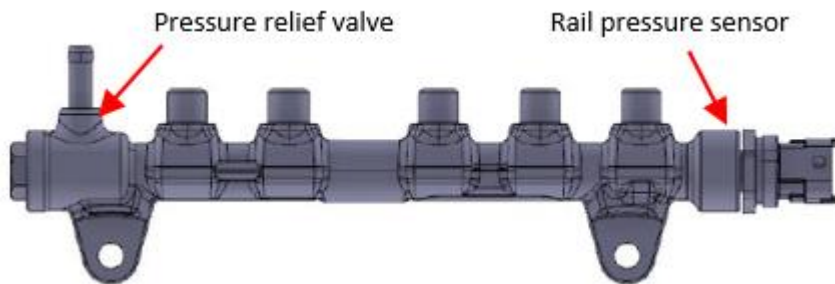
| Fault Code | Fault Name |
|-----------------------|--|
| P009D | Common rail pressure relief valve Forced to open status (Pressure shock) |

1) Overview

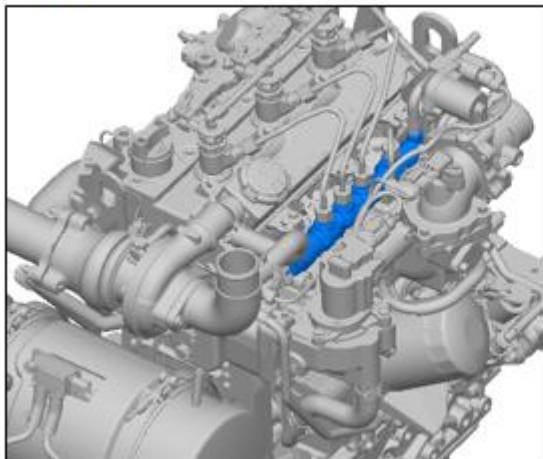
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E005571-23 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector close stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU, ECU power supply) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

2) Component Location

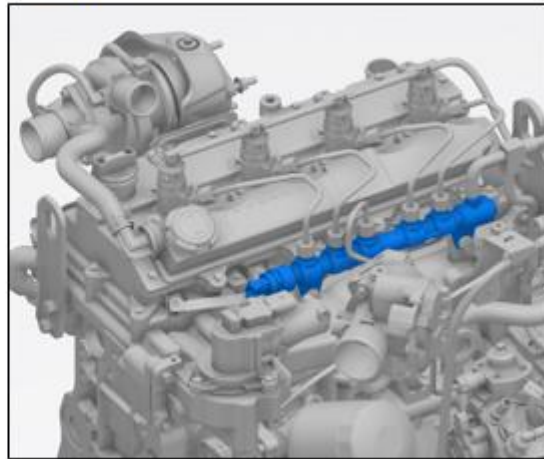
Common rail pressure relief valve is located on opposite to rail pressure sensor.



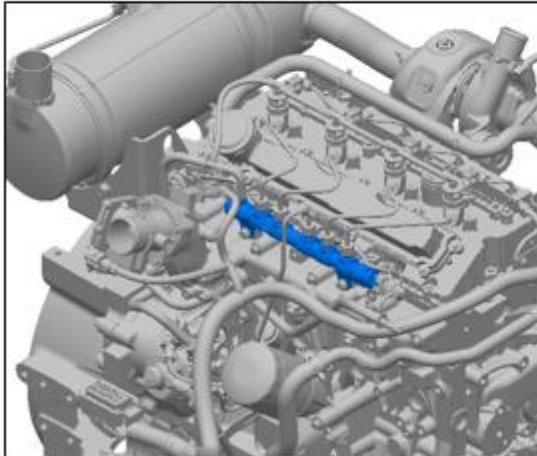
1.8L



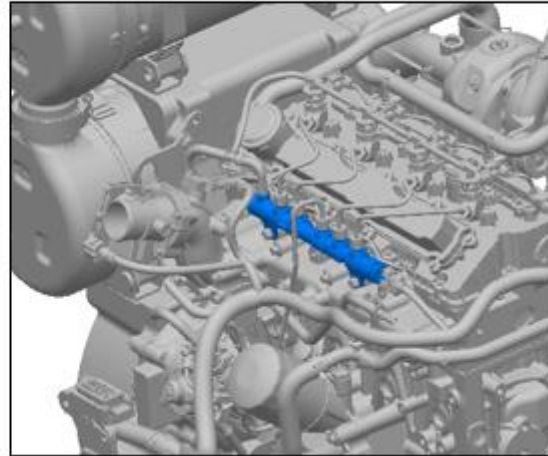
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If there is any malfunction related to FIE system, the PRV (pressure relief valve) is forced to open for protection FIE system and driver by performing of rail pressure and injection quantity increment.

If there is no problem with the LPC/HPC and other electric faults, and PRV open fault is only occurred, it could be an ECU power supply issue during very short time(<~30ms). Therefore, it should be checked the ECU power supply electric wire (including the connectivity of the ECU electric connector, battery electric connector) and determine the cause of the unstable ECU power supply.

5) Condition for Clearing the Fault Code

FIE system is operated normally.

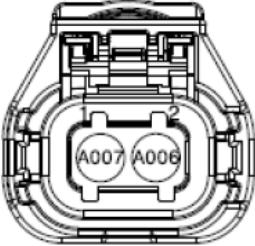
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P009D is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |
| 3 | Check FIE system hardware & the other fault Clear fault code after fixed the other FIE issue. Fault is cleared? | | Fix the fault based on its troubleshooting guide | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P000F | Common rail pressure relief valve is open |

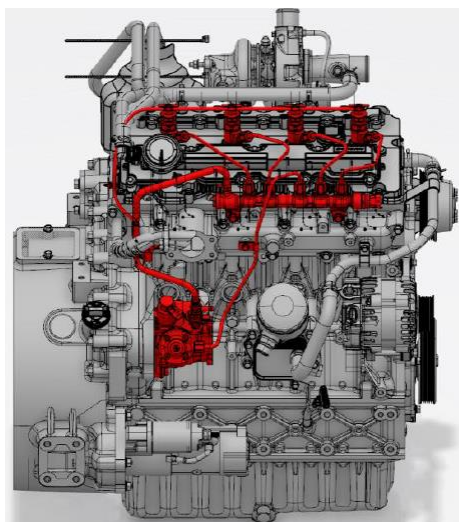
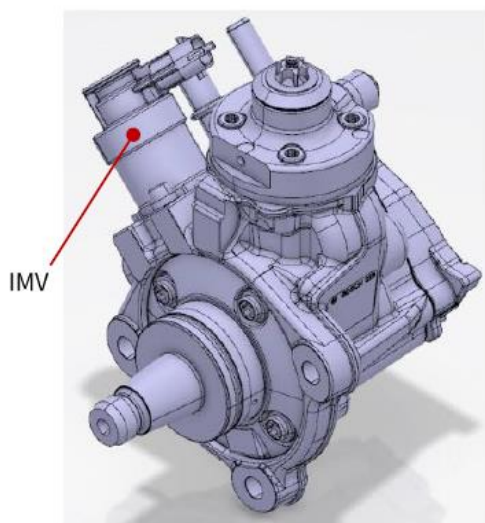
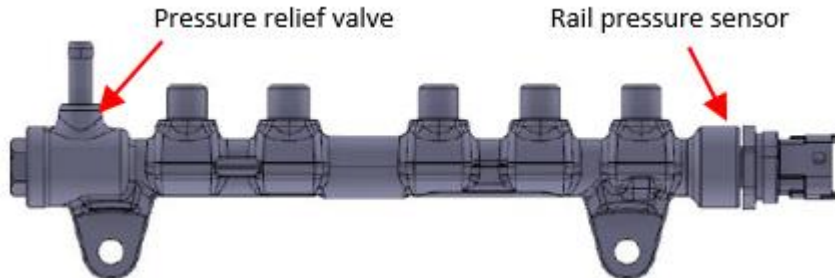
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E005571-25 | <ol style="list-style-type: none"> 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector close stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU, ECU power supply) <p>* LPC (Low pressure circuit) / HPC (High pressure circuit)</p> | <p>CE lamp ON</p> <p>Torque Reduction 1(Mild)</p> <p>Max engine speed limit (<1500rpm)</p> <p>DPF regeneration inhibit by Active and Forced</p> |

| | | | |
|--|----|---------|----------------------------------|
|  | No | ECU Pin | Description (Fuel metering unit) |
| | 1 | A7 | Fuel metering unit supply |
| | 2 | A6 | Fuel metering unit signal |

2) Component Location

Common rail pressure relief valve is located on opposite to rail pressure sensor.



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

Common rail pressure relief valve (PRV) is open.

The PRV open occurs when the rail pressure rises above 1950 bar, so if the fault recurs within a short time, a low pressure circuit (LPC) and high pressure circuit (HPC) check is required.

* LPC : Whole system from Fuel tank to Fuel high pressure pump

* HPC : Whole system from high pressure pump to Injector

If there is no problem with the LPC/HPC and other electric faults, and PRV open fault is only occurred, it could be an ECU power supply issue during very short time (<~30ms). Therefore, it should be checked the ECU power supply electric wire (including the connectivity of the ECU electric connector, battery electric connector) and determine the cause of the unstable ECU power supply.

5) Condition for Clearing the Fault Code

FIE system is operated normally.

6) Check List

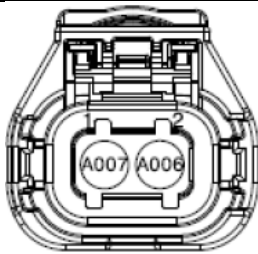
| Step | Inspection | Standard Value | YES | NO |
|------|---|--------------------------|---|--------|
| 1 | P000F is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection (incl. power supply). Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check service tool value of ECU power supply reset history. "8195" is measured? *Variables 1) Reset_xHistBuf_[0~7] | | Re-check ECU power supply electric wire (including the connectivity of the ECU electric connector, battery electric connector) and do necessary repair. | Step 7 |
| 7 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 8 |

| | | | | |
|-----------|---|--|-----------------------|-------------------------|
| 8 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 9 | Step 10 |
| 9 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 10 |
| 10 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

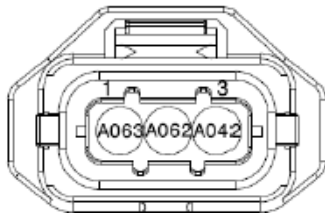
| Fault Code | Fault Name |
|-----------------------|---|
| P009F | The averaged rail pressure is outside the expected tolerance range for detection of the opened pressure relief valve. |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E005571-27 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector close stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU, ECU power supply) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON DPF regeneration inhibit by Active and Forced |



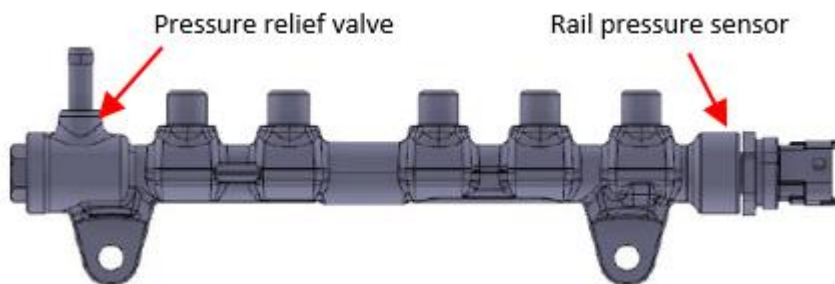
| No | ECU Pin | Description (Fuel metering unit) |
|----|---------|----------------------------------|
| 1 | A7 | Fuel metering unit supply |
| 2 | A6 | Fuel metering unit signal |

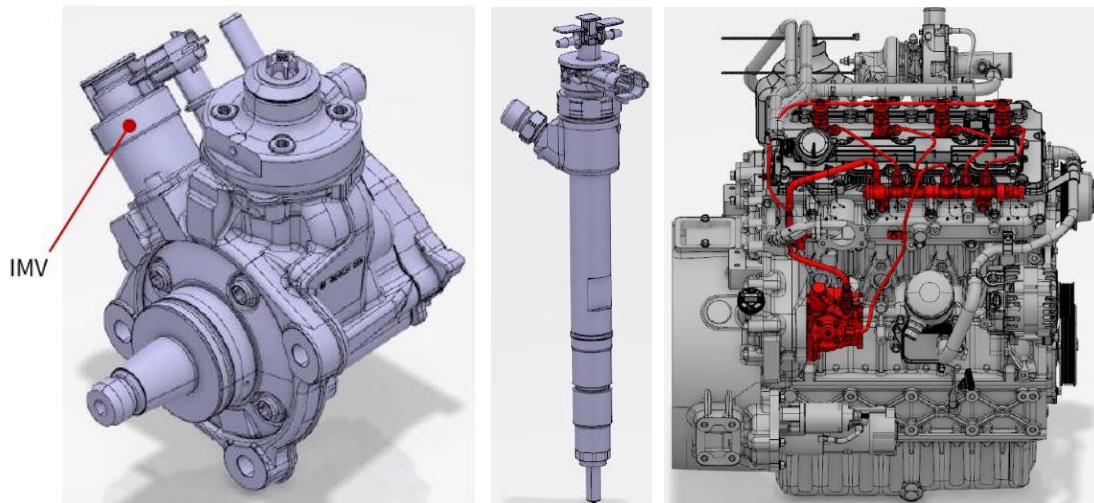


| No | ECU Pin | Description (Rail pressure sensor) |
|----|---------|---------------------------------------|
| 1 | A42 | Rail pressure Sensor Supply (5V) (5V) |
| 2 | A62 | Rail pressure sensor signal |
| 2 | A63 | Rail pressure sensor ground |

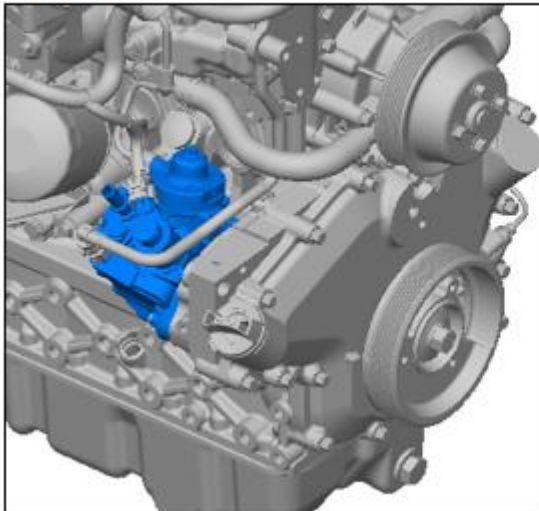
2) Component Location

Common rail pressure relief valve is located on opposite to rail pressure sensor.

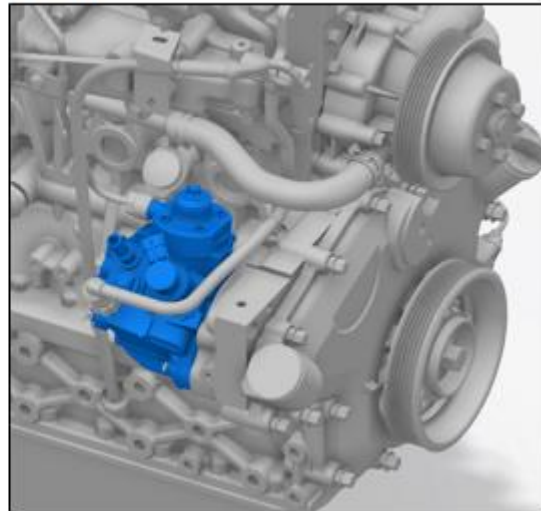




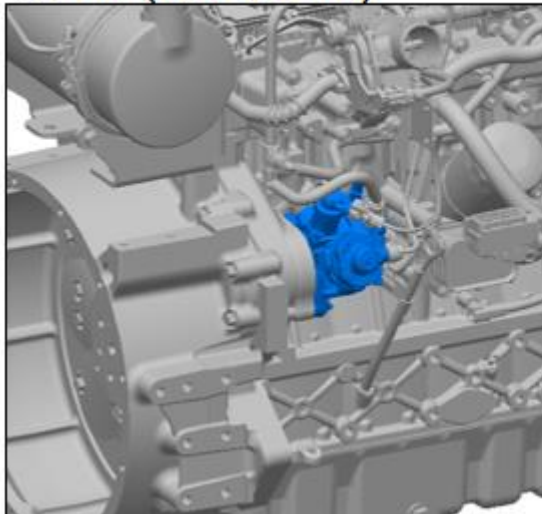
1.8L



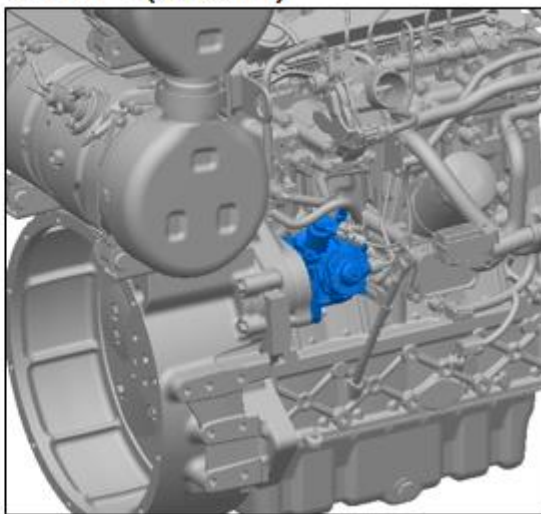
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The averaged rail pressure is outside the expected tolerance range for detection of the opened pressure relief valve.

If there is no problem with the LPC/HPC and other electric faults, and PRV open fault is only occurred, it could be an ECU power supply issue during very short time(<~30ms). Therefore, it should be checked the ECU power supply electric wire (including the connectivity of the ECU electric connector, battery electric connector) and determine the cause of the unstable ECU power supply.

5) Condition for Clearing the Fault Code

The average rail pressure signal is within detection range of the opened pressure relief valve.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|--------------------------|---------------------|------------------|
| 1 | P009F is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit & Rail pressure sensor connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection (incl. power supply). Connection problem? | | Do necessary repair | Step 6 |
| 6 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 7 |
| 7 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 8 | Step 9 |
| 8 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 9 |
| 9 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

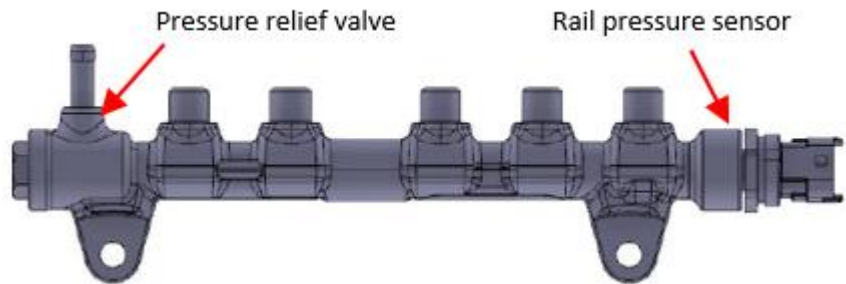
| Fault Code | Fault Name |
|-----------------------|---|
| P018F | Common rail pressure relief valve reached maximum allowed open time |

1) Overview

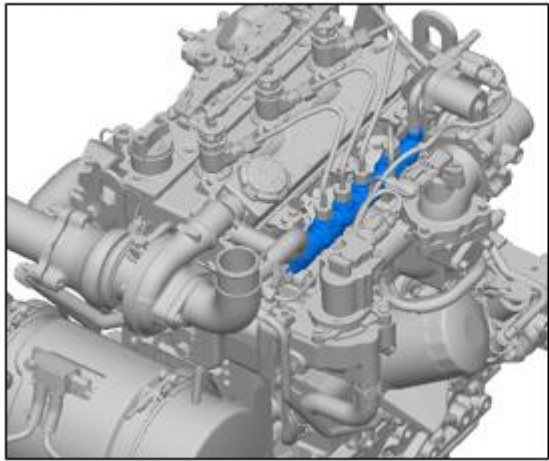
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E005571-28 | 1. Common rail pressure relief valve(PRV) open accumulated time is exceeded than guideline. | CE lamp ON DPF regeneration inhibit by Active and Forced |

2) Component Location

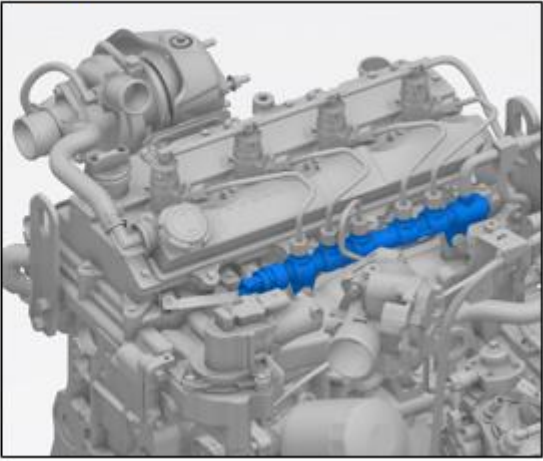
Common rail pressure relief valve is located on opposite to rail pressure sensor.



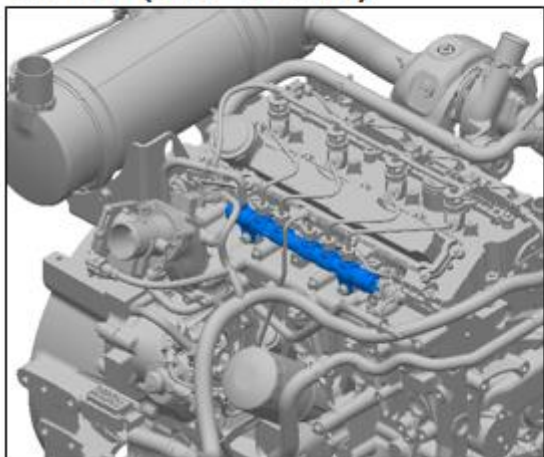
1.8L



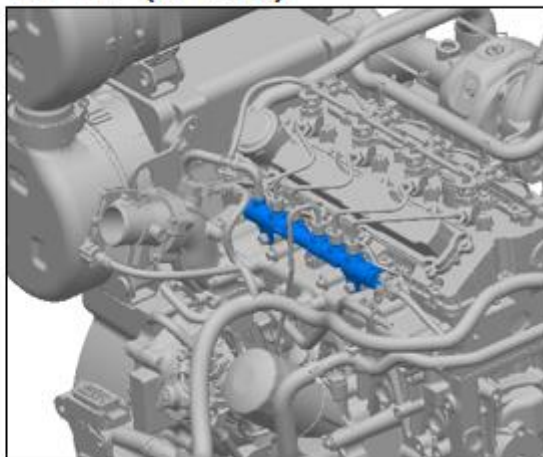
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Common rail pressure relief valve(PRV) open accumulated time is exceeded than guideline. (300 minutes)

The PRV open occurs when the rail pressure rises above 1950 bar, so if the fault recurs within a short time, a low pressure circuit (LPC) and high pressure circuit(HPC) check is required.

* LPC : Whole system from Fuel tank to Fuel high pressure pump

* HPC : Whole system from high pressure pump to Injector

If there is no problem with the LPC/HPC and other electric faults, and PRV open fault is only occurred, it could be an ECU power supply issue during very short time(<~30ms). Therefore, it should be checked the ECU power supply electric wire (including the connectivity of the ECU electric connector, battery electric connector) and determine the cause of the unstable ECU power supply.

5) Condition for Clearing the Fault Code

Common rail pressure relief valve(PRV) open accumulated time is less than guideline.

The PRV open accumulated time value can be reset by service tool after change the hardware.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|----|
| 1 | P018F is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |
| 3 | Change the PRV Reset the PRV open accumulated time value by service tool. * If the fault recurs within a short time, the pressure circuit (LPC/HPC) and ECU power supply electric connection problem check should be required. | | Problem solved | |

| Fault Code | Fault Name |
|-----------------------|---|
| P2632 | Electric fuel feed pump Output open circuit fault |

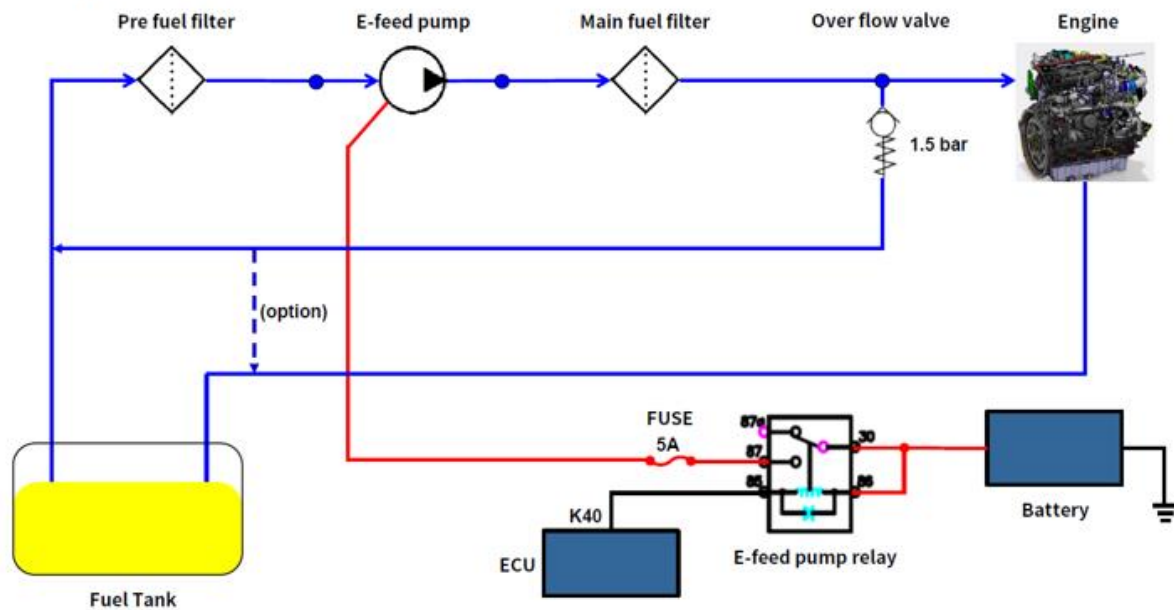
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E006323-05 | 1. Electrical problem (Electric fuel feed pump connector) 2. Electrical problem (Wiring harness from ECU to Electric fuel feed pump, Electric fuel feed pump) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

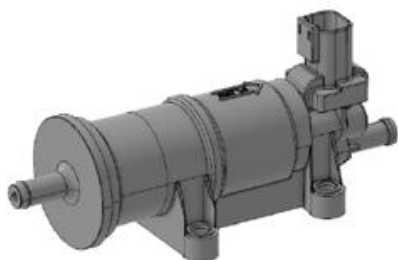
| No | ECU Pin | Description |
|----|---------|---------------------------------------|
| 1 | K40 | Electric fuel feed pump control relay |

2) Component Location

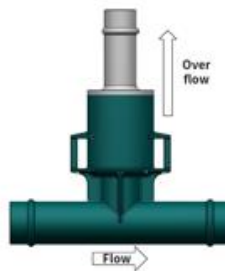
※ Low pressure circuit



※ Electric feed pump



※ Overflow valve



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on) (The control strategy is dependent on machine variant.)

4) Condition for Setting the Fault Code

The relay control output is opened.

5) Condition for Clearing the Fault Code

The relay control output wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2632 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the Electric fuel feed pump harness connection between ECU and Electric fuel feed pump. Fault code is not cleared? | | Step4 | Problem solved. |
| 4 | Check visually outside of the Electric fuel feed pump. Any damaged Electric fuel feed pump? Change the Electric fuel feed pump Fault code is cleared? | | Problem solved | Contact Helpdesk |

* The service tool supports the "Input/Output - Signal test of electric feed pump" function for related checking.
it can be used only when the ECU controls the pump

| Fault Code | Fault Name |
|-----------------------|---|
| P2635 | Electric fuel feed pump performance fault |

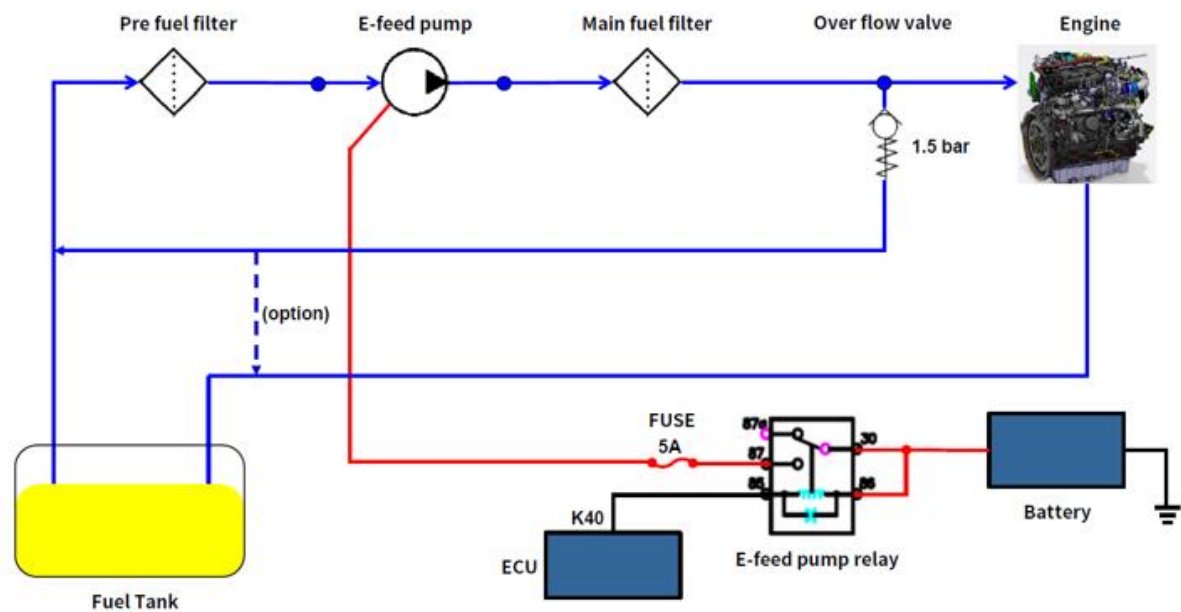
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E006323-13 | <ol style="list-style-type: none"> 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector close stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Electric fuel feed pump connector) 4. Electrical problem (Wiring harness from ECU to Electric fuel feed pump, Electric fuel feed pump) 5. Electrical problem (Faulty ECU, ECU connector) <p>* LPC (Low pressure circuit) / HPC (High pressure circuit)</p> | CE lamp ON |

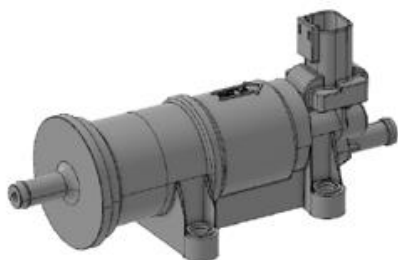
| No | ECU Pin | Description |
|----|---------|---------------------------------------|
| 1 | K40 | Electric fuel feed pump control relay |

2) Component Location

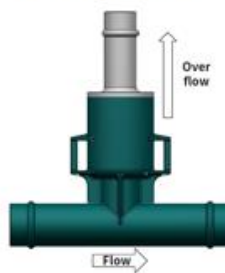
※ Low pressure circuit



※ Electric feed pump



※ Overflow valve



3) Condition for Running Diagnostic

Key off(ECU on) (The control strategy is dependent on machine variant.)

4) Condition for Setting the Fault Code

The fuel filter absolute pressure is below the diagnosis threshold at Key OFF condition.

If the electric fuel feed pump does not operate under the Key off condition, the fuel filter pressure value will not rise above the threshold.

5) Condition for Clearing the Fault Code

The electric fuel feed pump is working well.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P2635 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Electric fuel feed pump harness connection between ECU and Electric fuel feed pump. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the Electric fuel feed pump. Any damaged Electric fuel feed pump? Change the Electric fuel feed pump Fault code is cleared? | | Problem solved | Contact Helpdesk |

* The service tool supports the "Input/Output - Signal test of electric feed pump" function for related checking.
it can be used only when the ECU controls the pump

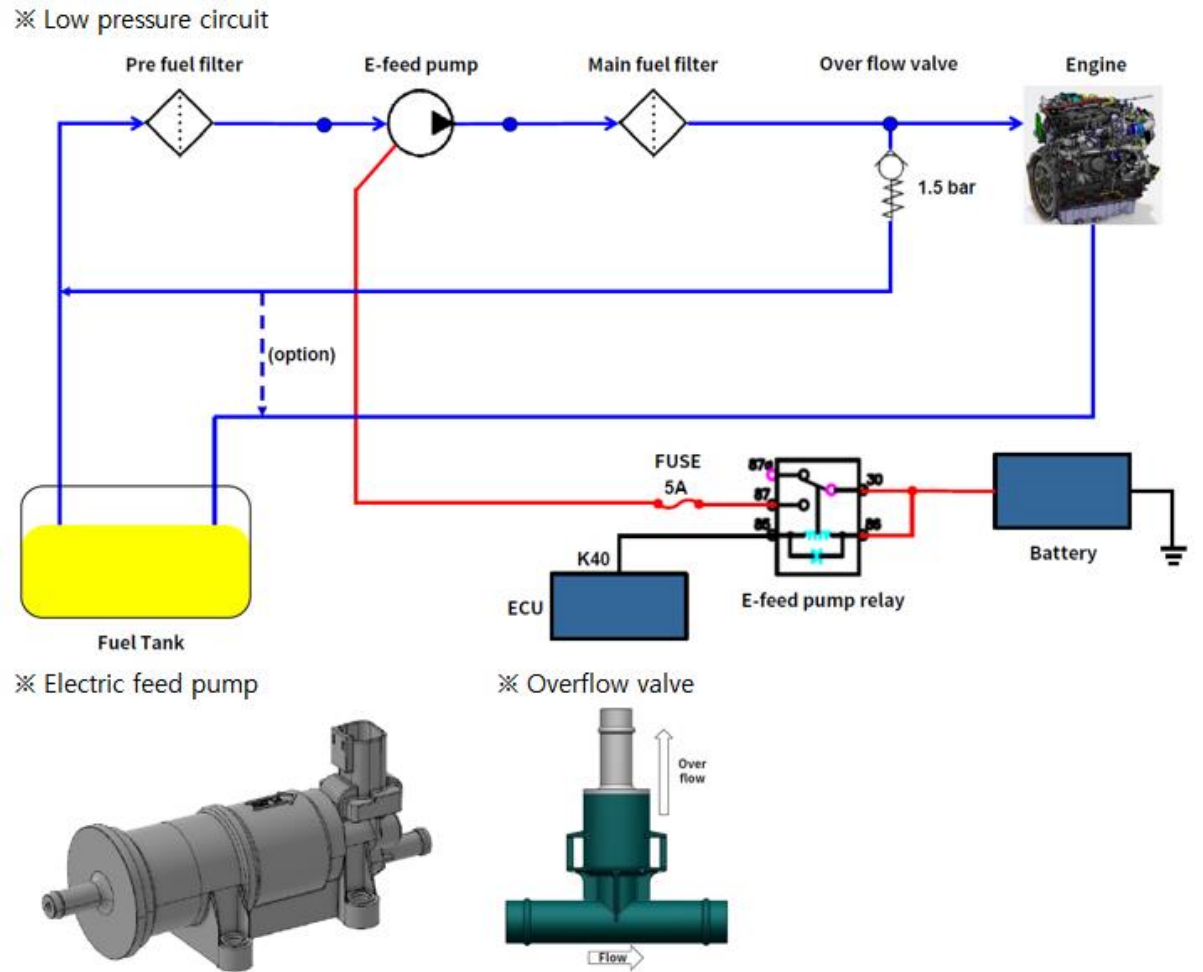
| Fault Code | Fault Name |
|-----------------------|---|
| P2634 | Electric fuel feed pump Output short to battery circuit fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E006323-03 | 1. Electrical problem (Electric fuel feed pump connector) 2. Electrical problem (Wiring harness from ECU to Electric fuel feed pump, Electric fuel feed pump) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|---------------------------------------|
| 1 | K40 | Electric fuel feed pump control relay |

2) Component Location



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on) (The control strategy is dependent on machine variant.)

4) Condition for Setting the Fault Code

The relay control output is shorted to battery.

5) Condition for Clearing the Fault Code

The relay control output wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2634 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the Electric fuel feed pump harness connection between ECU and Electric fuel feed pump. Fault code is not cleared? | | Step4 | Problem solved. |
| 4 | Check visually outside of the Electric fuel feed pump. Any damaged Electric fuel feed pump? Change the Electric fuel feed pump Fault code is cleared? | | Problem solved | Contact Helpdesk |

* The service tool supports the "Input/Output - Signal test of electric feed pump" function for related checking.
it can be used only when the ECU controls the pump

| Fault Code | Fault Name |
|-----------------------|--|
| P2633 | Electric fuel feed pump Output short to ground circuit fault |

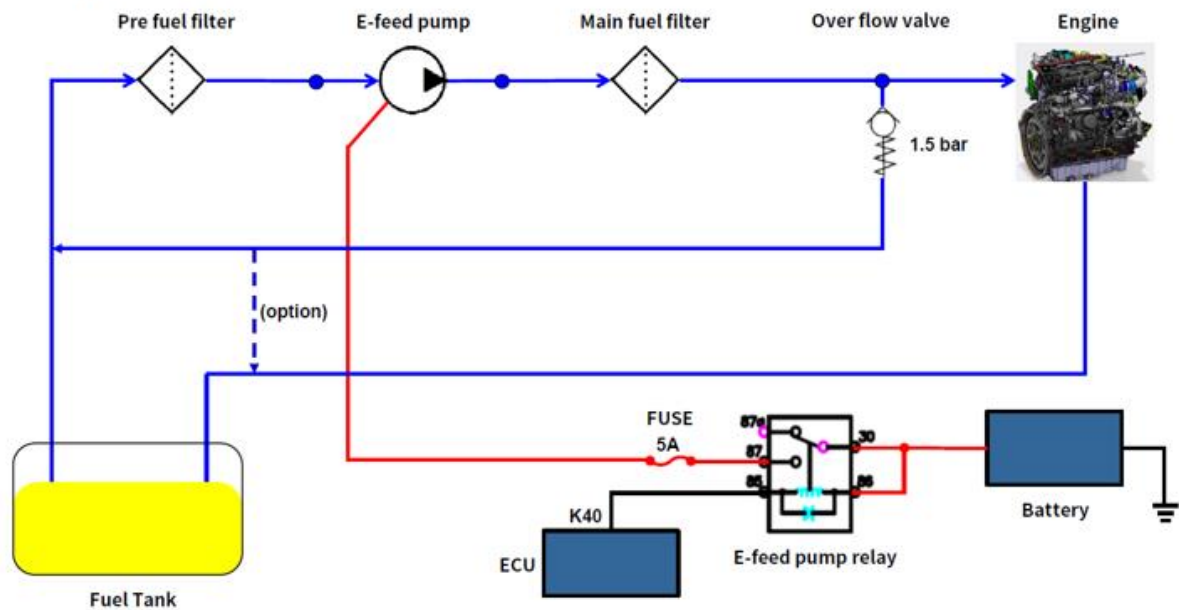
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E006323-04 | 1. Electrical problem (Electric fuel feed pump connector) 2. Electrical problem (Wiring harness from ECU to Electric fuel feed pump, Electric fuel feed pump) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

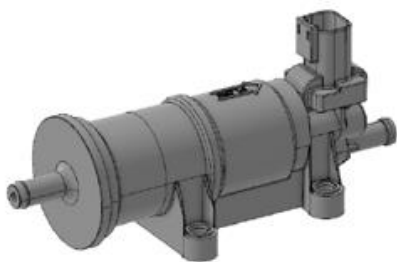
| No | ECU Pin | Description |
|----|---------|---------------------------------------|
| 1 | K40 | Electric fuel feed pump control relay |

2) Component Location

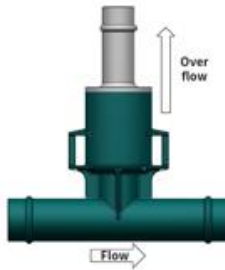
※ Low pressure circuit



※ Electric feed pump



※ Overflow valve



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on) (The control strategy is dependent on machine variant.)

4) Condition for Setting the Fault Code

The relay control output is shorted to ground.

5) Condition for Clearing the Fault Code

The relay control output wiring problem is restored.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P2633 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the Electric fuel feed pump harness connection between ECU and Electric fuel feed pump. Fault code is not cleared? | | Step4 | Problem solved. |
| 4 | Check visually outside of the Electric fuel feed pump. Any damaged Electric fuel feed pump? Change the Electric fuel feed pump Fault code is cleared? | | Problem solved | Contact Helpdesk |

* The service tool supports the "Input/Output - Signal test of electric feed pump" function for related checking.
it can be used only when the ECU controls the pump

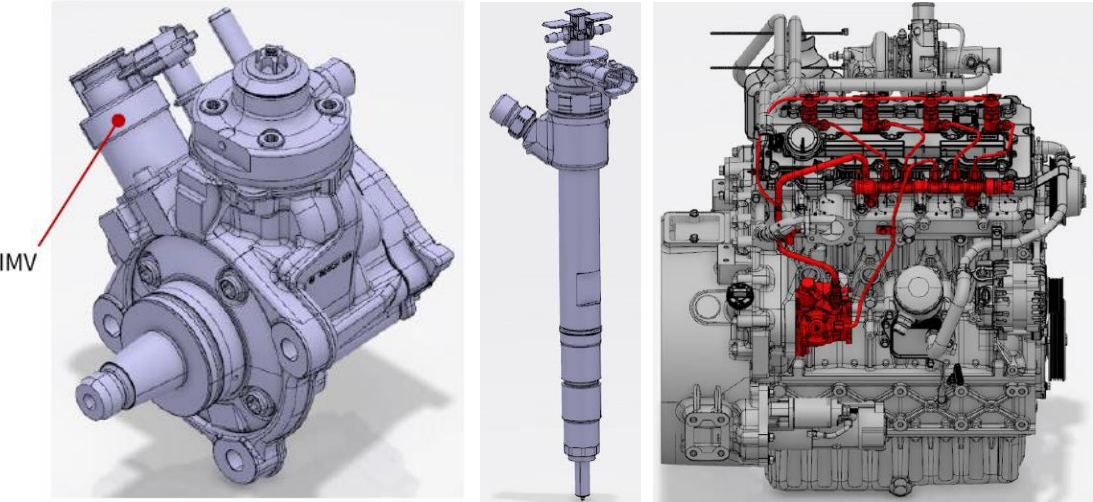
| Fault Code | Fault Name |
|-----------------------|--|
| P0002 | Maximum positive deviation of rail pressure exceeded |

1) Overview

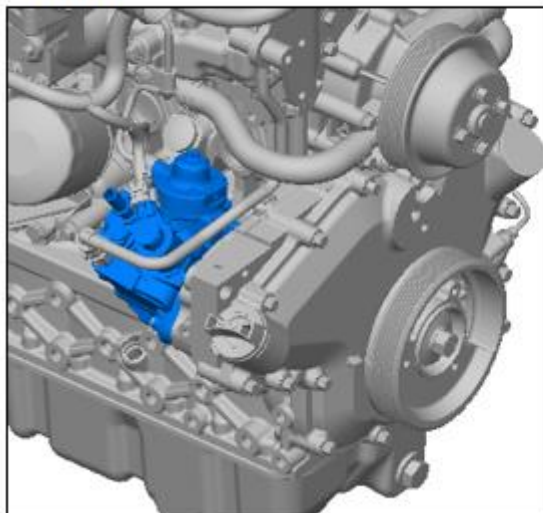
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000157-11 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector open stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

| | | | |
|---|----|---------|----------------------------------|
|  | No | ECU Pin | Description (Fuel metering unit) |
| | 1 | A7 | Fuel metering unit supply |
| | 2 | A6 | Fuel metering unit signal |

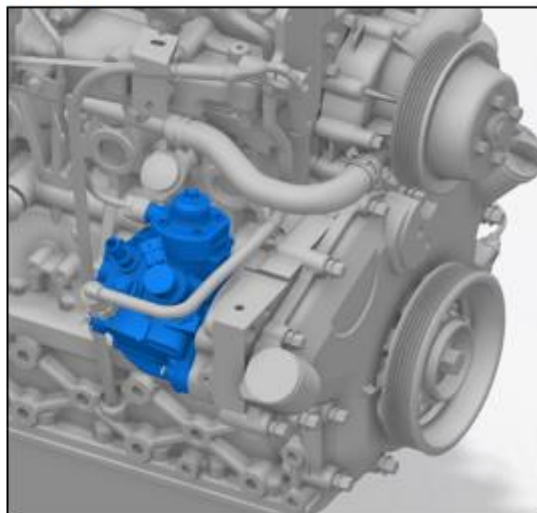
2) Component Location



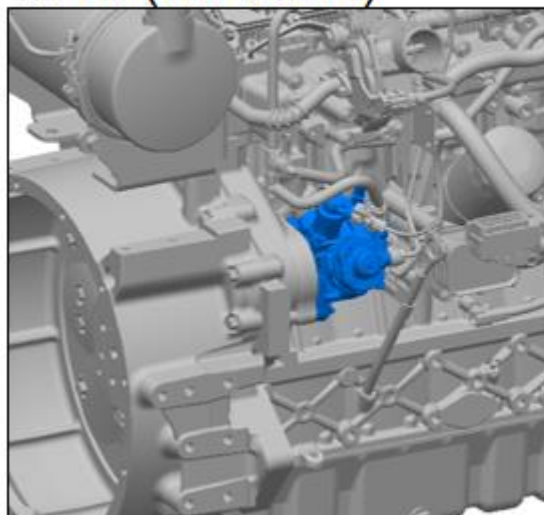
1.8L



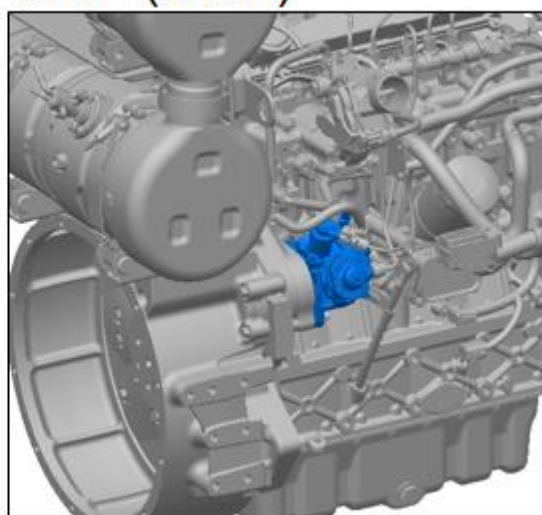
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If the rail pressure governor deviation exceeds the limiting value(Normally 70~150bar) based on the engine speed and the set value of the Fuel Metering unit volume is greater than the upper limit, an error will be detected.

5) Condition for Clearing the Fault Code

The rail pressure is controlled within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P0002 is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |


| | | | | |
|----------|---|---------------------------------|--------------------------------|-----------------------------|
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 7 |
| 7 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 8 | Step 9 |
| 8 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 9 |
| 9 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

* The service tool supports the "Rail pressure test" function for related checking.

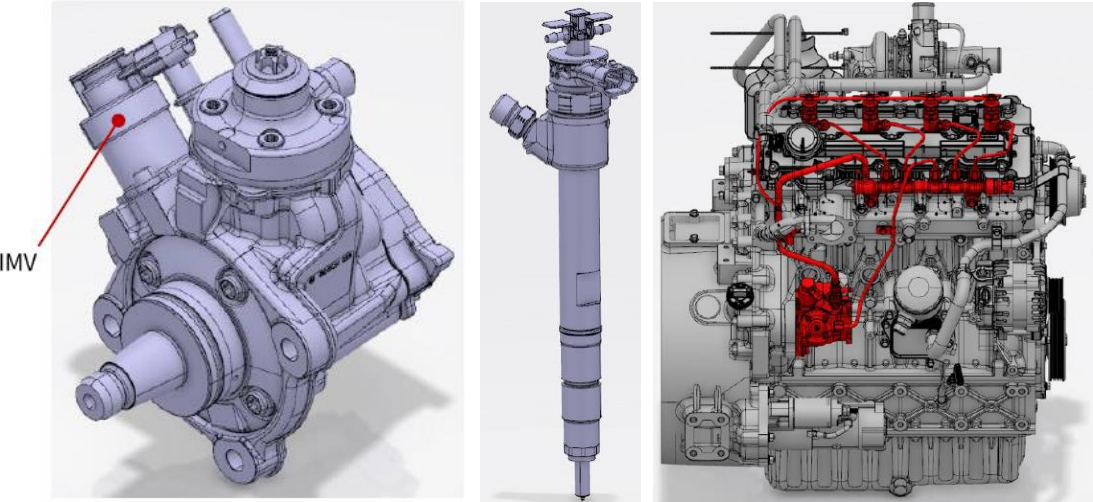
| Fault Code | Fault Name |
|-----------------------|---|
| P0087 | Fuel Leakage is detected based on fuel quantity balance |

1) Overview

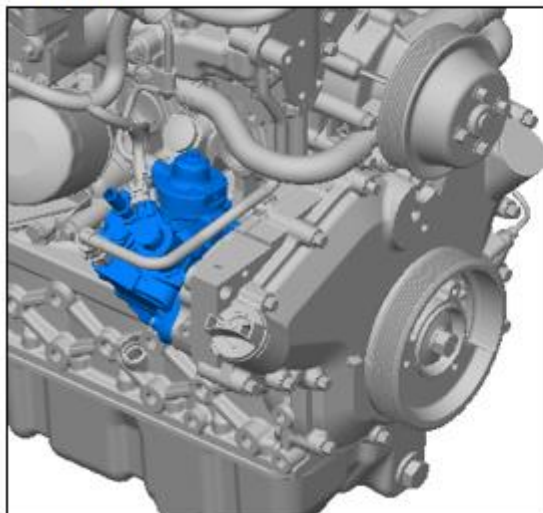
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000157-10 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector open stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

| | | | |
|---|----|---------|----------------------------------|
|  | No | ECU Pin | Description (Fuel metering unit) |
| | 1 | A7 | Fuel metering unit supply |
| | 2 | A6 | Fuel metering unit signal |

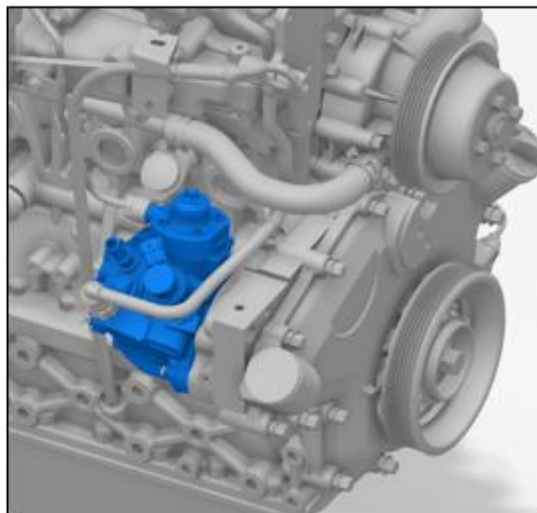
2) Component Location



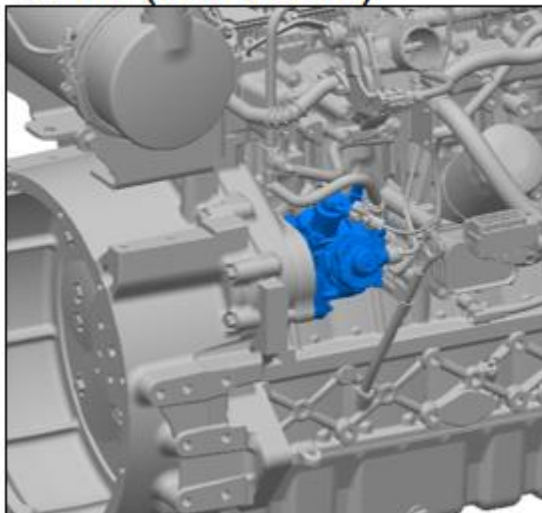
1.8L



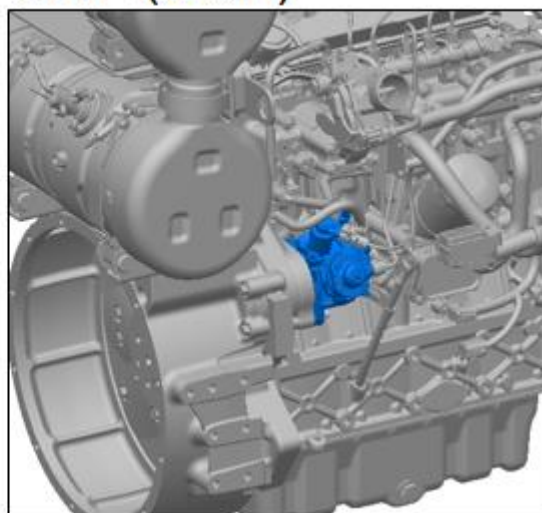
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If the high pressure pump delivery quantity exceeds the plausibility limit of the volume flow balance (evaluated over the product life and supplemented to include tolerances), an error will be detected.

5) Condition for Clearing the Fault Code

The rail pressure is controlled within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P0087 is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |

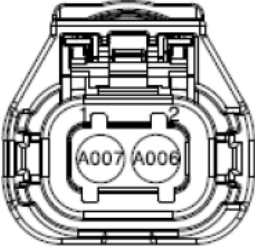
| | | | | |
|----------|---|--------------------------|--------------------------------|-----------------------------|
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 7 |
| 7 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 8 | Step 9 |
| 8 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 9 |
| 9 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

* The service tool supports the "Rail pressure test" function for related checking.

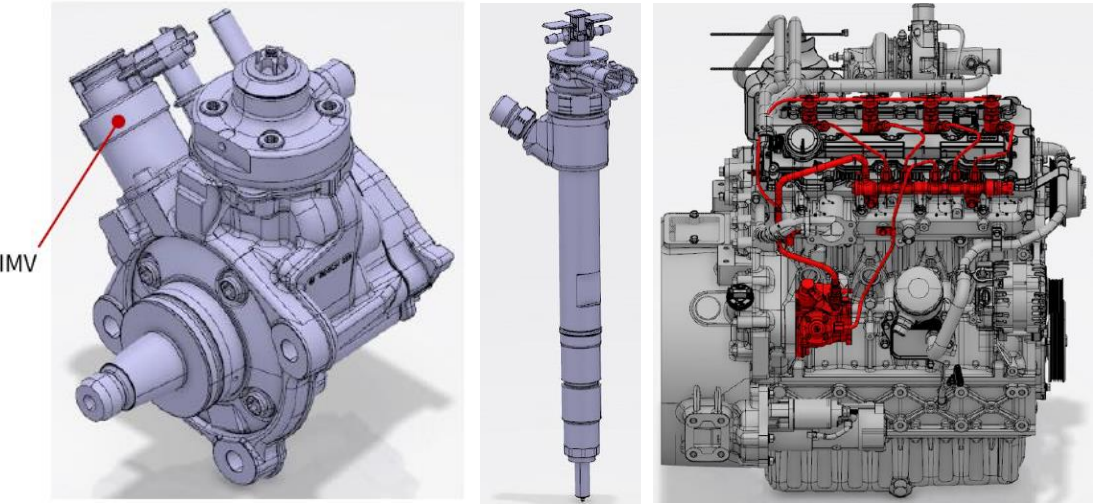
| Fault Code | Fault Name |
|-----------------------|--|
| P0254 | Maximum negative rail pressure deviation with metering unit on lower limit is exceeded |

1) Overview

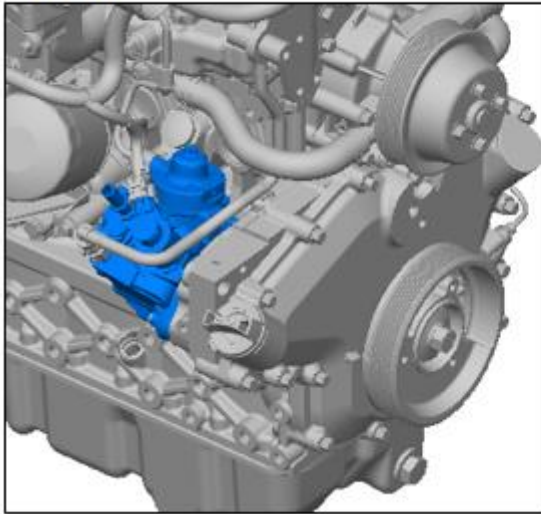
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E001076-16 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector close stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

| | | | |
|--|----|---------|----------------------------------|
|  | No | ECU Pin | Description (Fuel metering unit) |
| | 1 | A7 | Fuel metering unit supply |
| | 2 | A6 | Fuel metering unit signal |

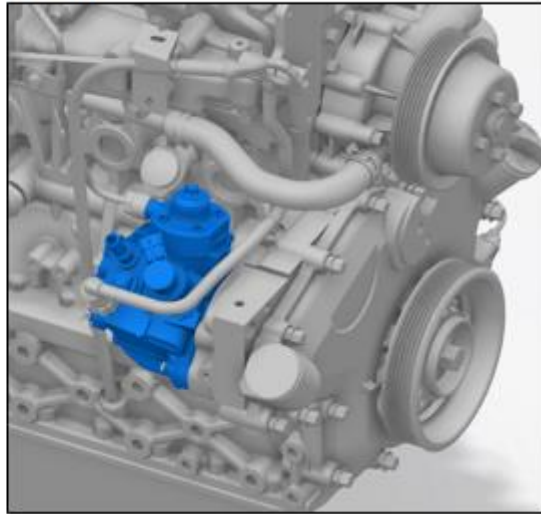
2) Component Location



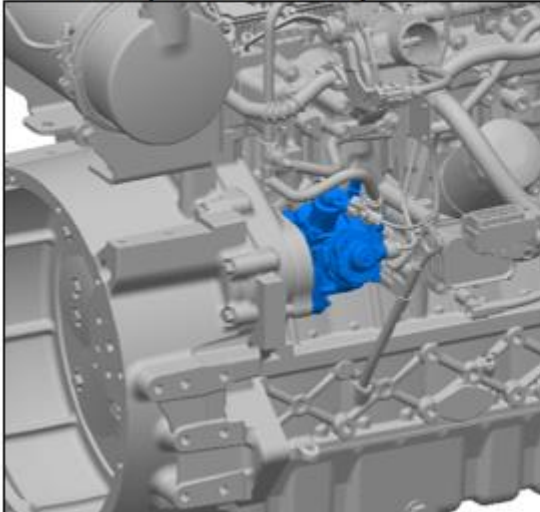
1.8L



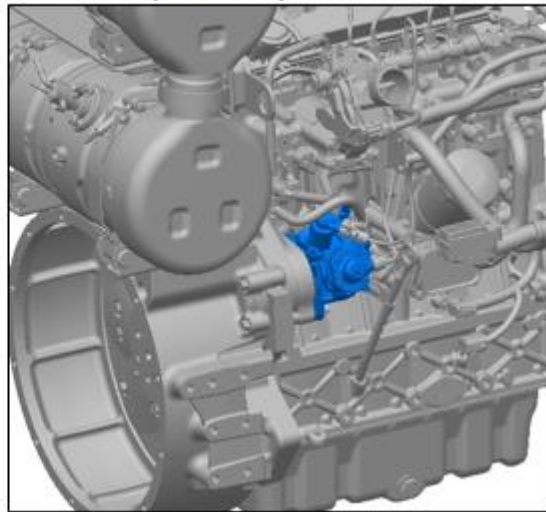
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If the rail pressure governor deviation falls below the limiting value(Normally -200~-117bar) and the high pressure pump delivery quantity falls to the threshold, an error will be detected.

5) Condition for Clearing the Fault Code

The rail pressure is controlled within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P0254 is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |


| | | | | |
|----------|---|--------------------------|--------------------------------|-----------------------------|
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 7 |
| 7 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 8 | Step 9 |
| 8 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 9 |
| 9 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

* The service tool supports the "Rail pressure test" function for related checking.

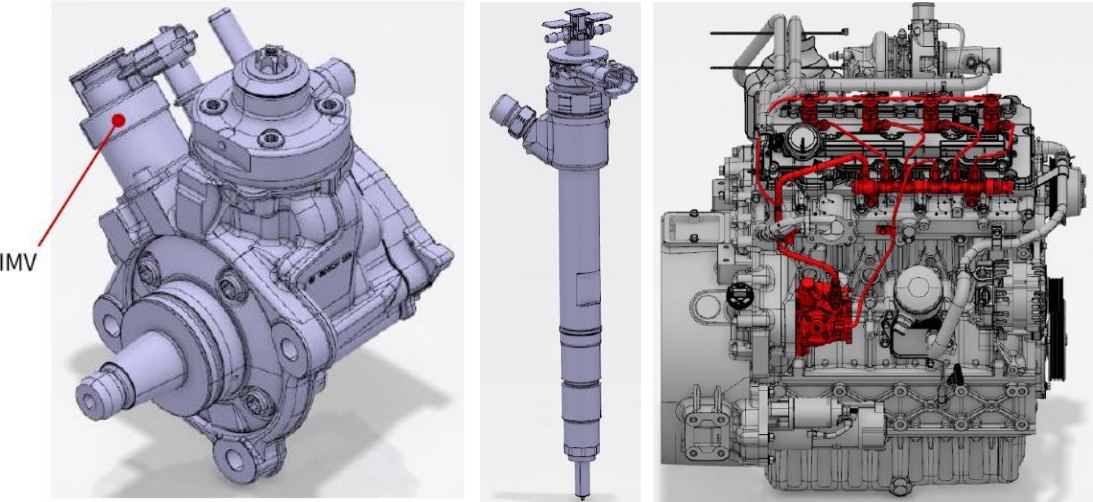
| Fault Code | Fault Name |
|-----------------------|-----------------------------|
| P190C | Rail pressure too low fault |

1) Overview

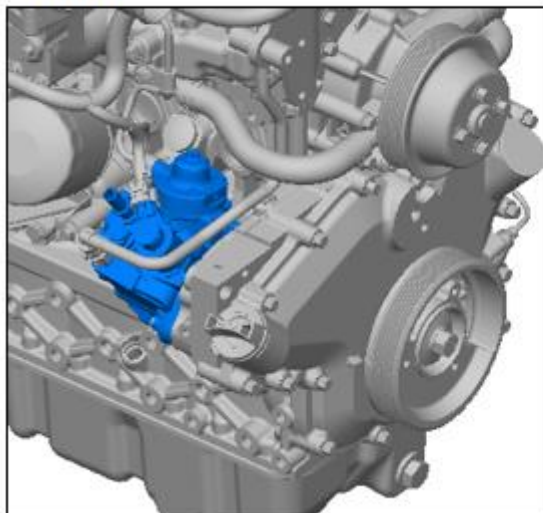
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000157-26 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector open stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

| | | | |
|---|----|---------|----------------------------------|
|  | No | ECU Pin | Description (Fuel metering unit) |
| | 1 | A7 | Fuel metering unit supply |
| | 2 | A6 | Fuel metering unit signal |

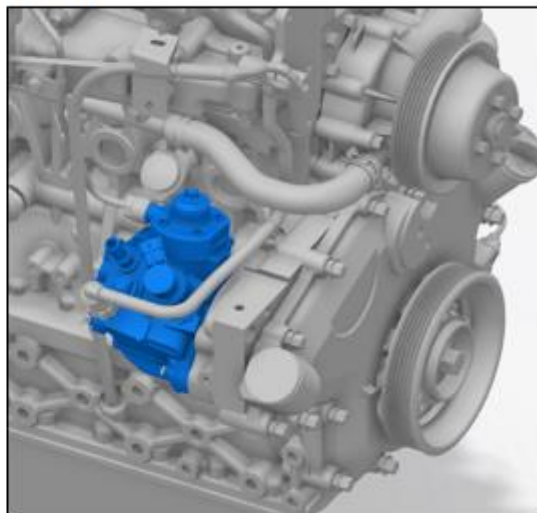
2) Component Location



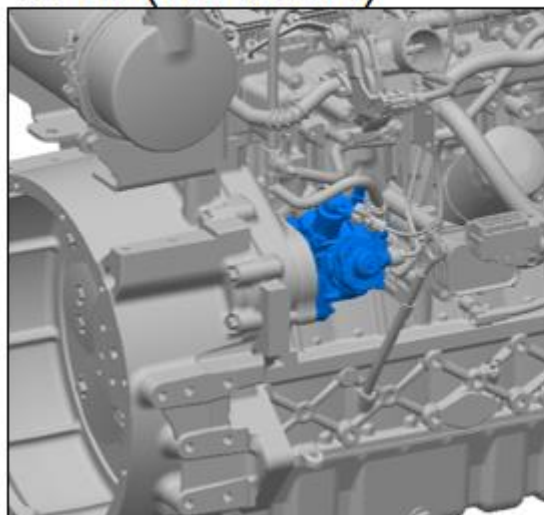
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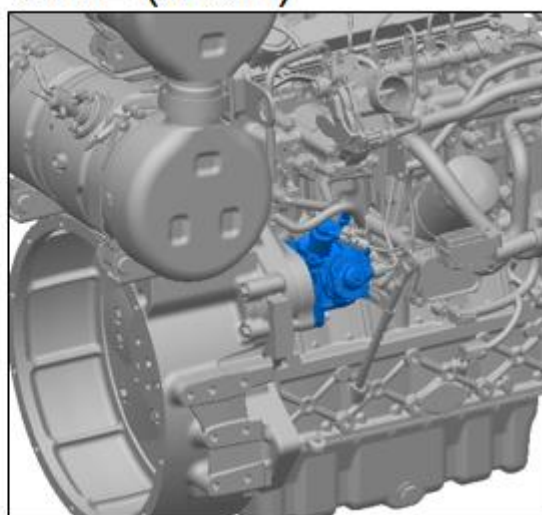
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If the rail pressure falls below the limiting value(Normally 120bar) based on the engine speed, an error will be detected.

5) Condition for Clearing the Fault Code

The rail pressure is controlled within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P190C is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |


| | | | | |
|----------|---|---------------------------------|--------------------------------|-----------------------------|
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 7 |
| 7 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 8 | Step 9 |
| 8 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 9 |
| 9 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

* The service tool supports the "Rail pressure test" function for related checking.

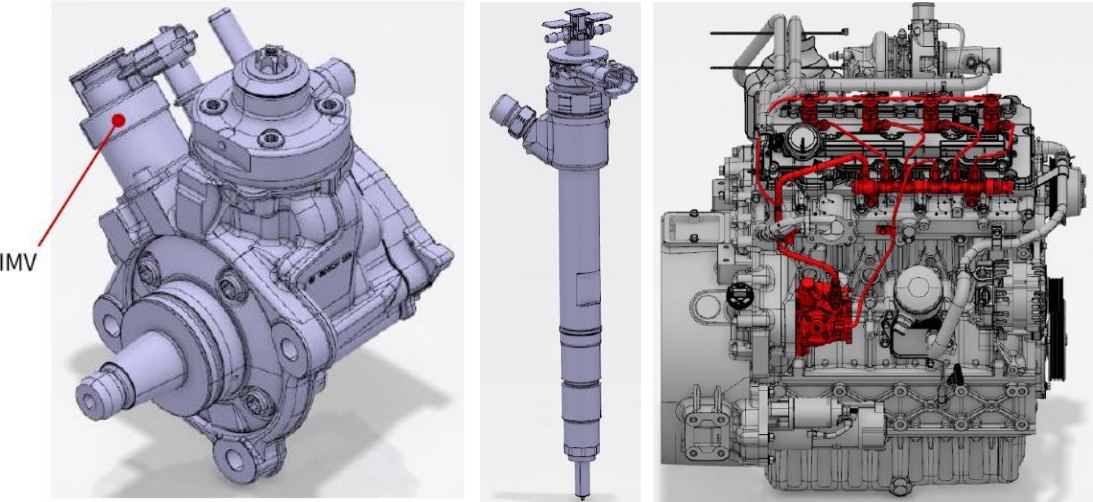
| Fault Code | Fault Name |
|-----------------------|--------------------------------|
| P190B | Maximum rail pressure exceeded |

1) Overview

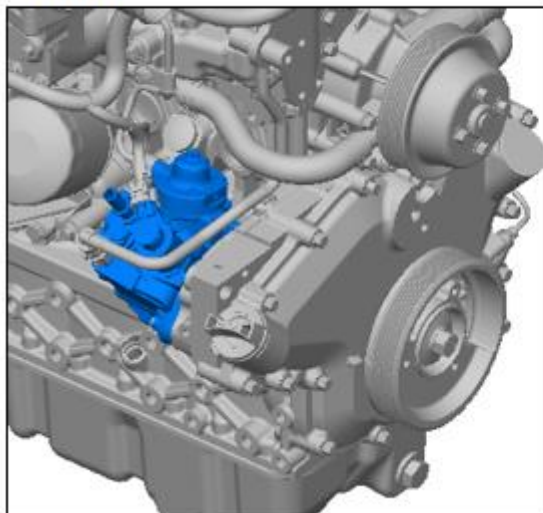
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000157-27 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector close stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

|  | | |
|---|---------|----------------------------------|
| No | ECU Pin | Description (Fuel metering unit) |
| 1 | A7 | Fuel metering unit supply |
| 2 | A6 | Fuel metering unit signal |

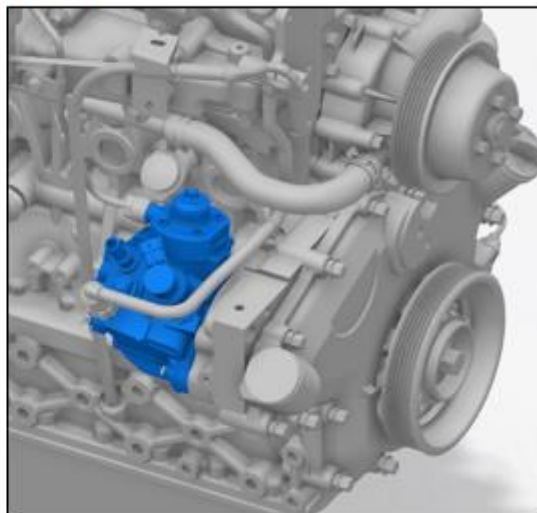
2) Component Location



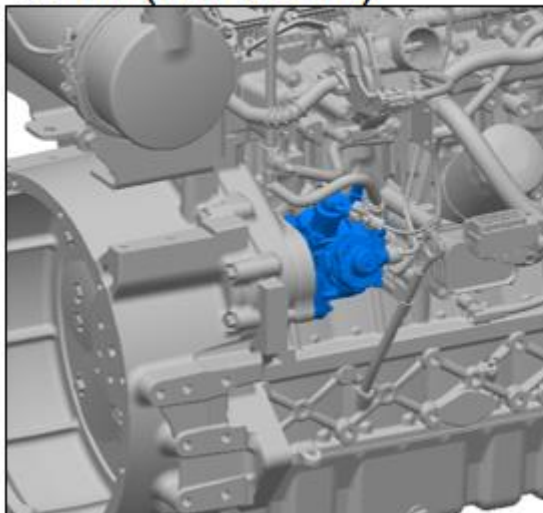
1.8L



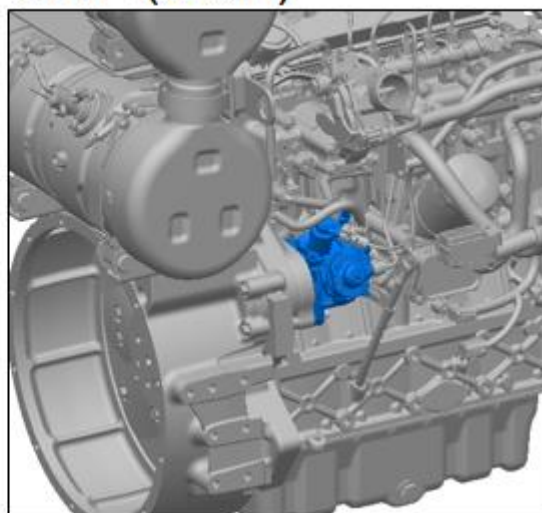
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If the rail pressure exceeds the limiting value (Normally 1950bar), an error will be detected.

5) Condition for Clearing the Fault Code

The rail pressure is controlled within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P190B is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |


| | | | | |
|----------|---|--------------------------|--------------------------------|-----------------------------|
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 7 |
| 7 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 8 | Step 9 |
| 8 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 9 |
| 9 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

* The service tool supports the "Rail pressure test" function for related checking.

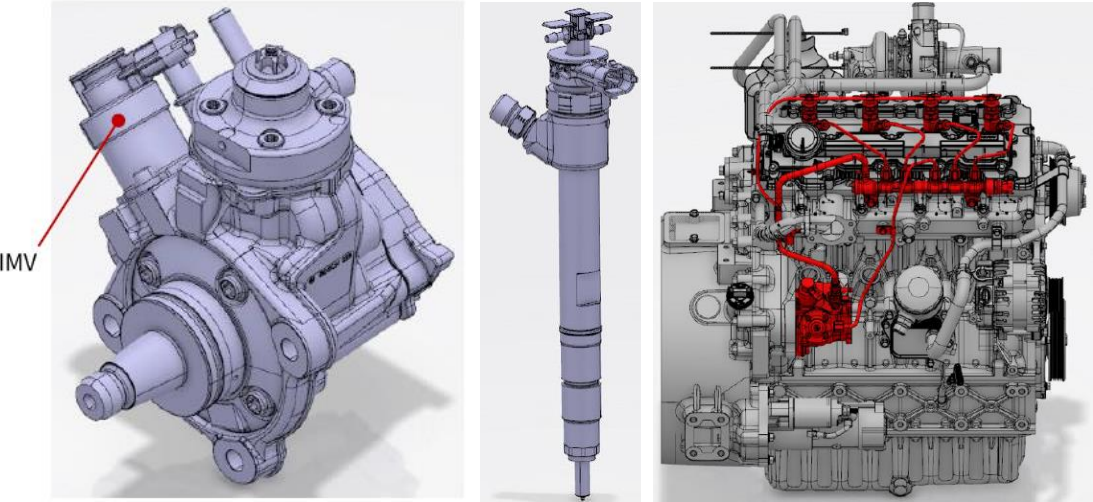
| Fault Code | Fault Name |
|-----------------------|---|
| P0004 | Fuel Metering unit plausibility error in overrun mode |

1) Overview

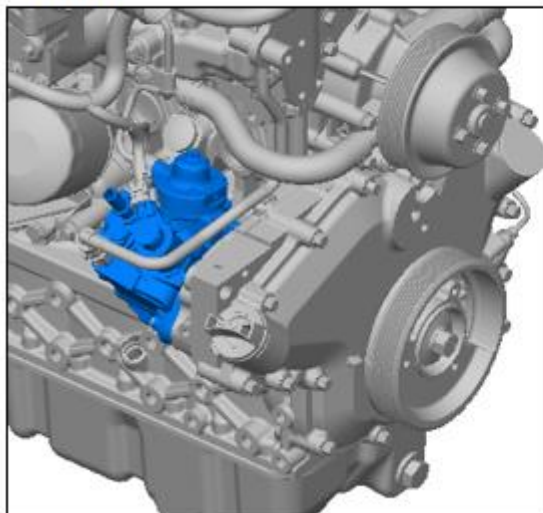
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E001076-03 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector open stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

| | | | |
|---|----|---------|----------------------------------|
|  | No | ECU Pin | Description (Fuel metering unit) |
| | 1 | A7 | Fuel metering unit supply |
| | 2 | A6 | Fuel metering unit signal |

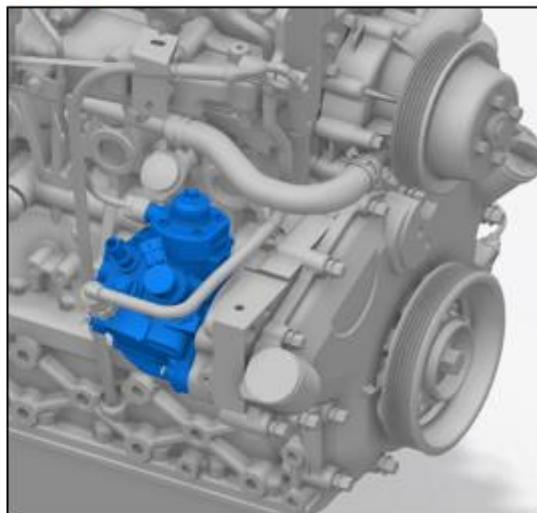
2) Component Location



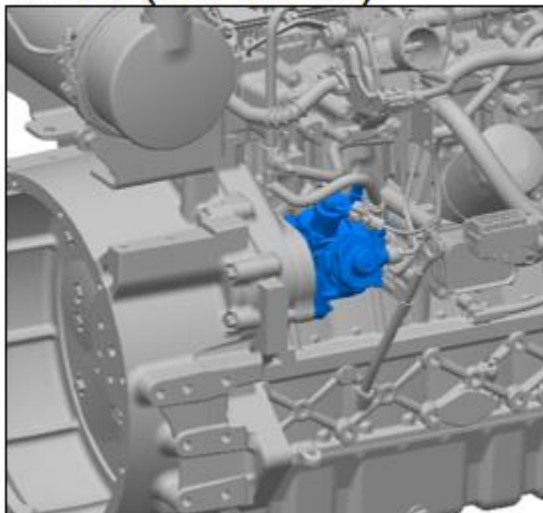
1.8L



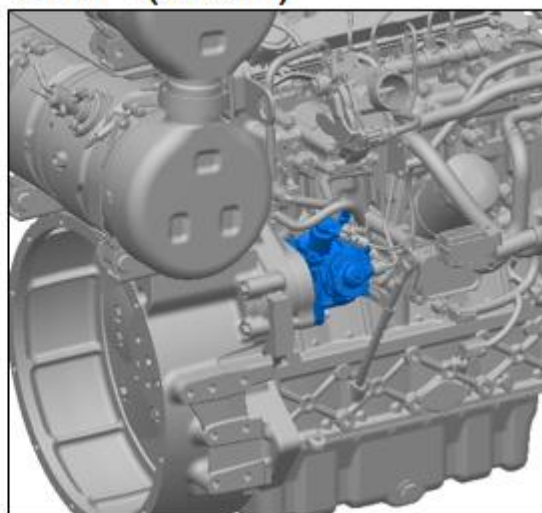
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If the high pressure pump delivery quantity exceeds the threshold (Normally 5000mm³/s) based on the pressure at overrun mode, an error will be detected.

5) Condition for Clearing the Fault Code

The rail pressure is controlled within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P0004 is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |


| | | | | |
|----------|---|---------------------------------|--------------------------------|-----------------------------|
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 7 |
| 7 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 8 | Step 9 |
| 8 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 9 |
| 9 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

* The service tool supports the "Rail pressure test" function for related checking.

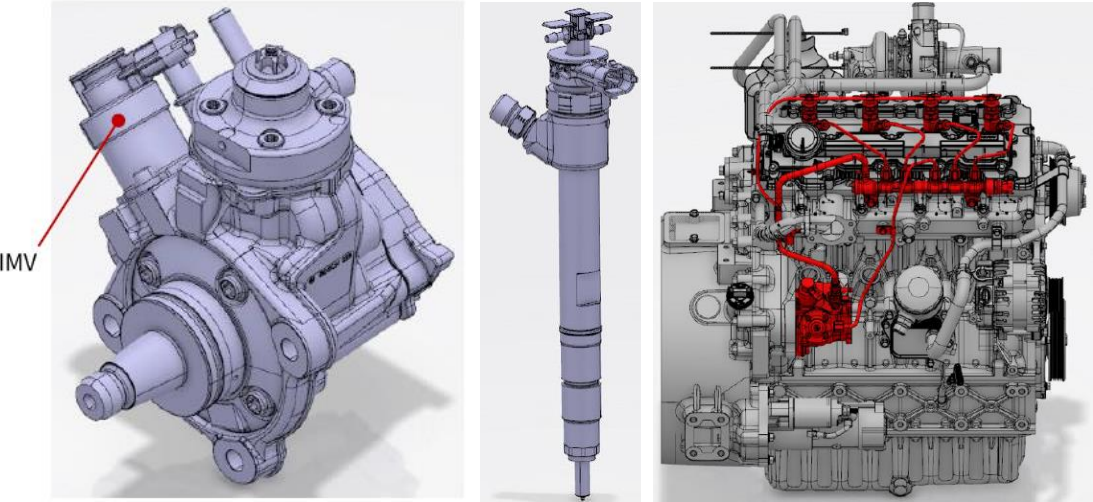
| Fault Code | Fault Name |
|-----------------------|--|
| P0003 | Fuel Metering unit plausibility error in idle mode |

1) Overview

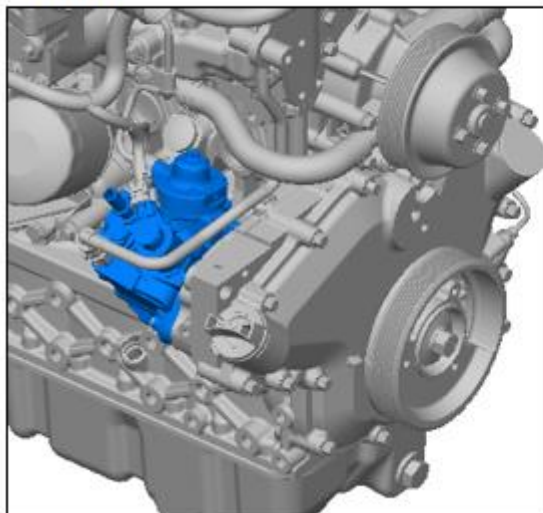
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E001076-04 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector open stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON Torque Reduction 1(Mild) Max engine speed limit (<1500rpm) DPF regeneration inhibit by Active and Forced |

| | | | |
|---|----|---------|----------------------------------|
|  | No | ECU Pin | Description (Fuel metering unit) |
| | 1 | A7 | Fuel metering unit supply |
| | 2 | A6 | Fuel metering unit signal |

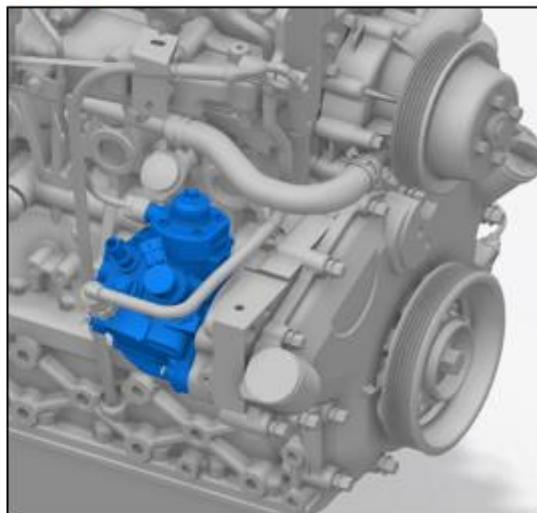
2) Component Location



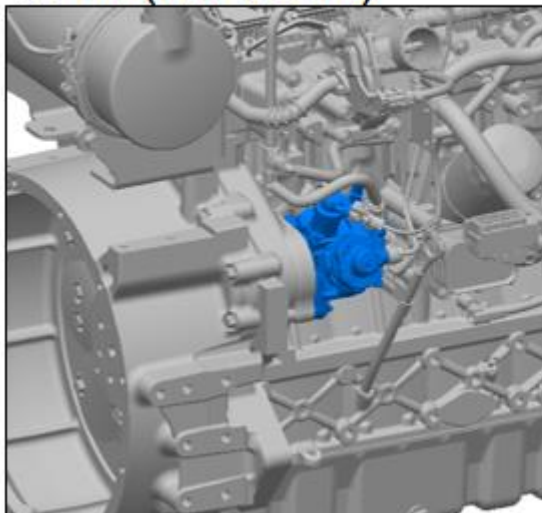
1.8L



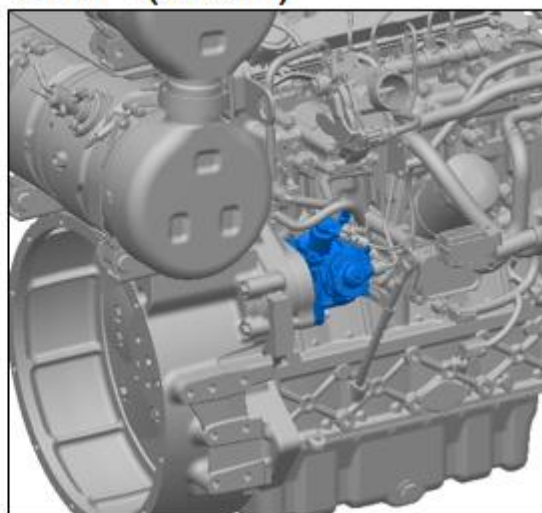
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If the high pressure pump delivery quantity exceeds the threshold (Normally 4500mm³/s) based on the pressure at idle mode, an error will be detected.

5) Condition for Clearing the Fault Code

The rail pressure is controlled within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P0003 is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |


| | | | | |
|----------|---|---------------------------------|--------------------------------|-----------------------------|
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 7 |
| 7 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 8 | Step 9 |
| 8 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 9 |
| 9 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

* The service tool supports the "Rail pressure test" function for related checking.

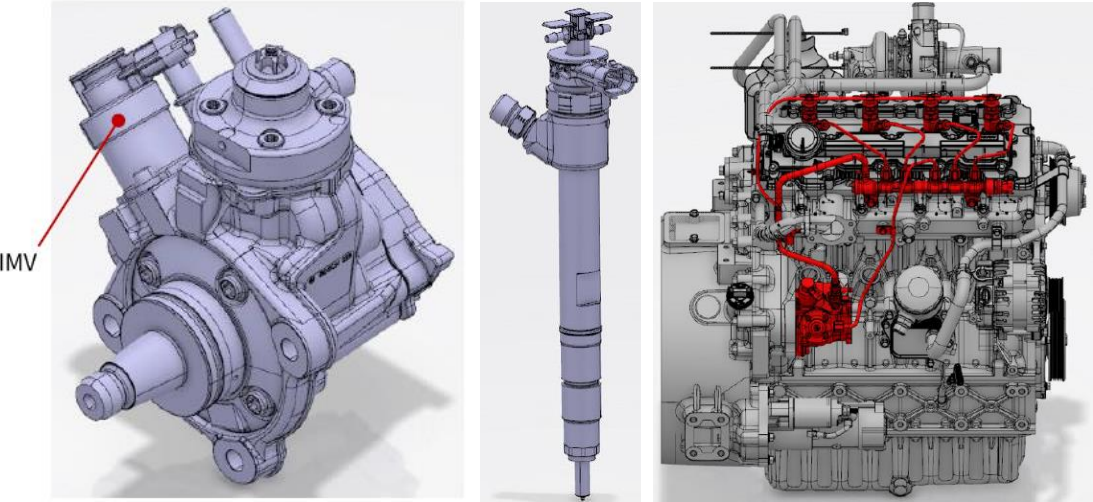
| Fault Code | Fault Name |
|-----------------------|-------------------------------------|
| P0252 | Rail pressure too low for injection |

1) Overview

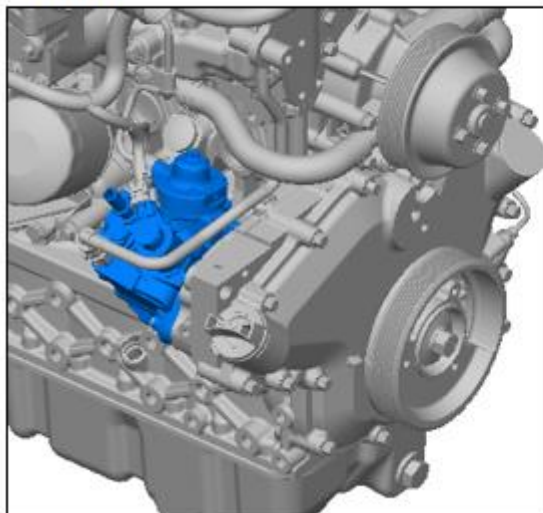
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E001076-20 | 1. Fuel LPC problem (No fuel in tank, Fuel leakage before HP pump, Fuel filter plugged, fuel return line clogging) 2. Fuel HPC problem (Injector open stuck, Faulty HP pump, Metering unit sticking, leaking) 3. Electrical problem (Metering unit connector, Wiring harness from Metering unit to ECU) * LPC (Low pressure circuit) / HPC (High pressure circuit) | CE lamp ON |

| | | | |
|---|----|---------|----------------------------------|
|  | No | ECU Pin | Description (Fuel metering unit) |
| | 1 | A7 | Fuel metering unit supply |
| | 2 | A6 | Fuel metering unit signal |

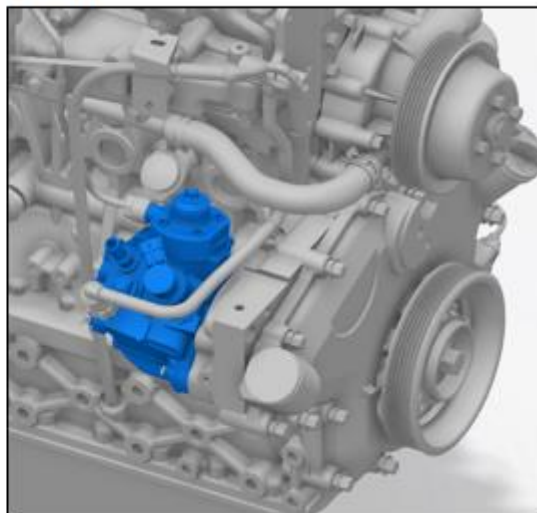
2) Component Location



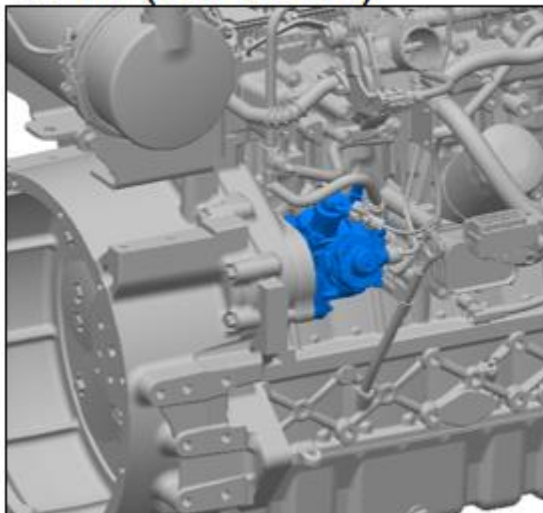
1.8L



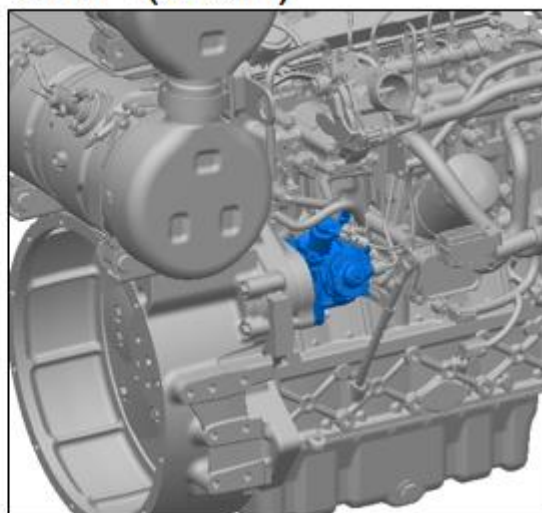
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running (included cranking mode)

4) Condition for Setting the Fault Code

The rail pressure falls below the minimum threshold for injection. (100bar)

5) Condition for Clearing the Fault Code

The rail pressure is controlled within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-------|----|
| 1 | P0252 is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |

| | | | | |
|----------|---|---------------------------------|--------------------------------|-----------------------------|
| 3 | Do visual inspection throughout all fuel line 1) Fuel feed circuit is in good condition 2) There is diesel fuel present in the system 3) There is no air (no bubbles or emulsion in the pipes) 4) There is enough fuel pressure in inlet pump 5) There are no high pressure circuit leaks 6) there is diesel fuel of the correct quality and type Low pressure circuit faulty? | | Repair Fuel circuit | Step 4 |
| 4 | Check the Fuel Metering unit connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Step 6 |
| 6 | Perform Metering unit actuator test? (by service tool) Measure Fuel Metering unit electrical resistance? (Pin#1 & #2) Change Fuel Metering unit. Fault code is cleared? | 2.6~3.15 Ω at 20 degC | Problem Solved | Step 7 |
| 7 | Do the Shut off test for detecting which injector has fault or not. Do you find faulty injector? | | Step 8 | Step 9 |
| 8 | Change the faulty injector as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Problem Solved | Step 9 |
| 9 | Change the high pressure system Fault code is cleared? | | Problem Solved | Contact Helpdesk |

* The service tool supports the "Rail pressure test" function for related checking.

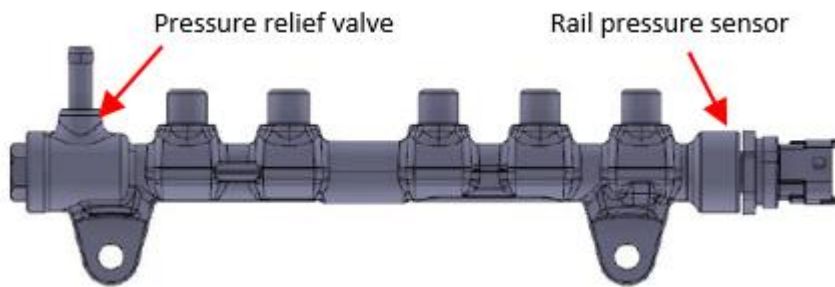
| Fault Code | Fault Name |
|-----------------------|------------------------------------|
| P1934 | Pressure relief valve(PRV) failure |

1) Overview

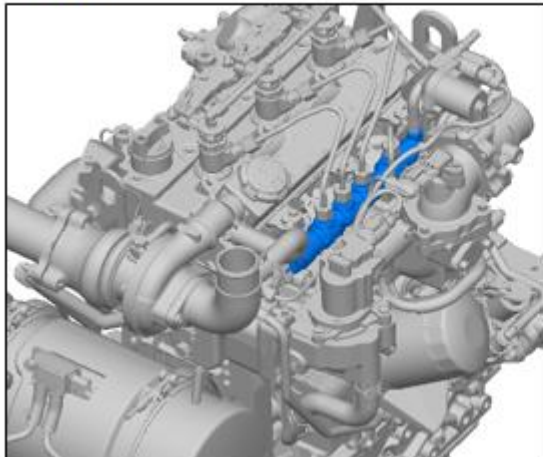
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000157-28 | 1. Common rail pressure relief valve(PRV) is not opened at overpressure condition. (PRV failure) | CE lamp Blink Torque Reduction 2(Severe) Max engine speed limit (<1500rpm) Engine stop immediately DPF regeneration inhibit by Active and Forced |

2) Component Location

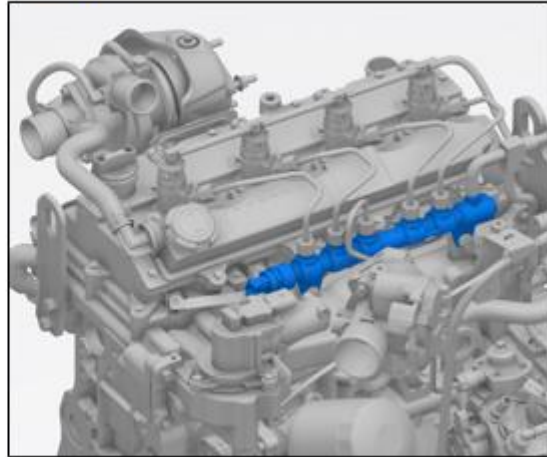
Common rail pressure relief valve is located on opposite to rail pressure sensor.



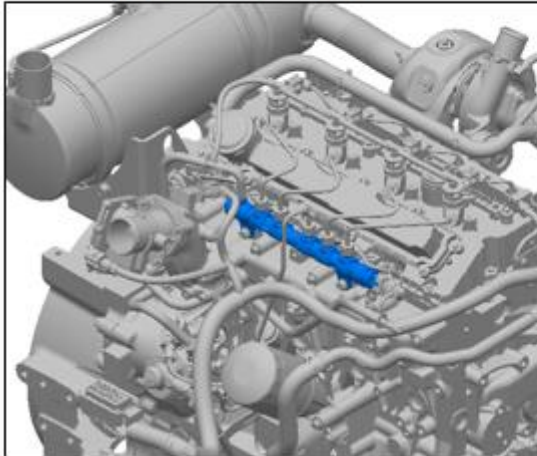
1.8L



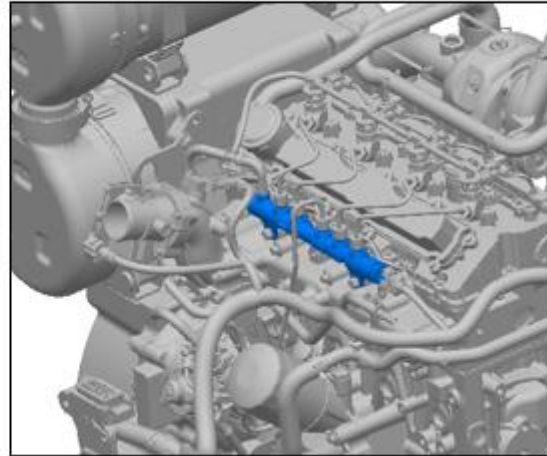
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The fault is occurred when If PRV (Pressure relief valve) open fault (P000F) occurs but rail pressure does not decrease. There can be a problem with PRV itself.

The PRV open occurs when the rail pressure rises above 1950 bar, so if the fault recurs within a short time, a low pressure circuit (LPC) and high pressure circuit (HPC) check is required.

* LPC : Whole system from Fuel tank to Fuel high pressure pump

* HPC : Whole system from high pressure pump to Injector

If there is no problem with the LPC/HPC and other electric faults, and PRV open fault is only occurred, it could be an ECU power supply issue during very short time(<~30ms). Therefore, it should be checked the ECU power supply electric wire (including the connectivity of the ECU electric connector, battery electric connector) and determine the cause of the unstable ECU power supply.

5) Condition for Clearing the Fault Code

The PRV(Pressure relief valve) is opened normally at overpressure condition(1950bar).

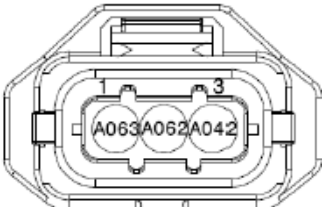
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------|----|
| 1 | P1934 is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |
| 3 | Change the PRV Reset the PRV open counter value by service tool. * If the fault recurs within a short time, the pressure circuit (LPC/HPC) and ECU power supply electric connection problem check should be required. | | Problem solved | |

| Fault Code | Fault Name |
|-----------------------|---------------------------------|
| P0193 | Rail pressure sensor High fault |

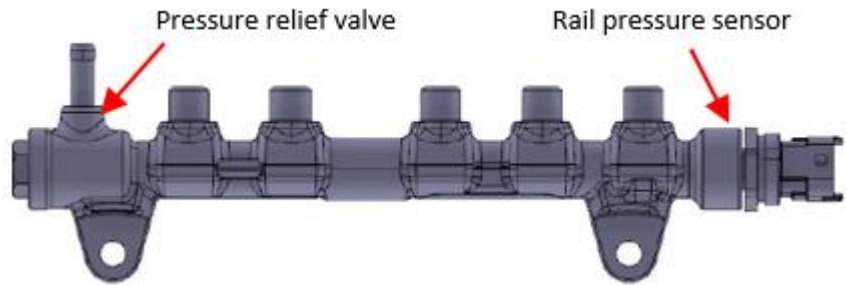
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E005313-03 | 1. Electrical problem (Rail pressure sensor connector) 2. Electrical problem (Wiring harness from Rail pressure sensor to ECU, Rail pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

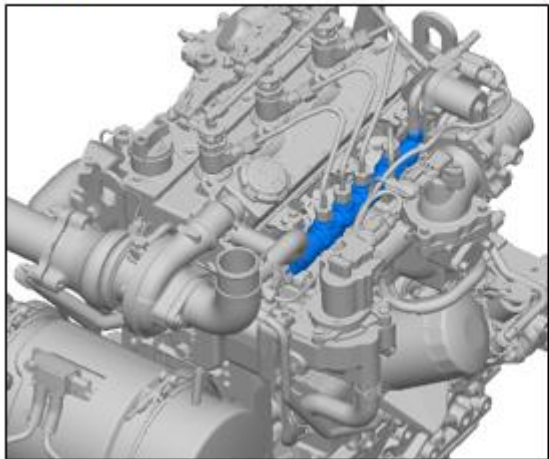
|  | No | ECU Pin | Description (Rail pressure sensor) |
|---|----|---------|---------------------------------------|
| | 1 | A42 | Rail pressure Sensor Supply (5V) (5V) |
| | 2 | A62 | Rail pressure sensor signal |
| | 2 | A63 | Rail pressure sensor ground |

2) Component Location

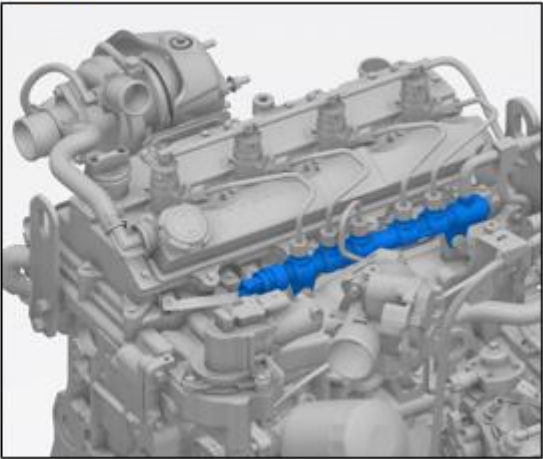
Common rail pressure relief valve is located on opposite to rail pressure sensor.



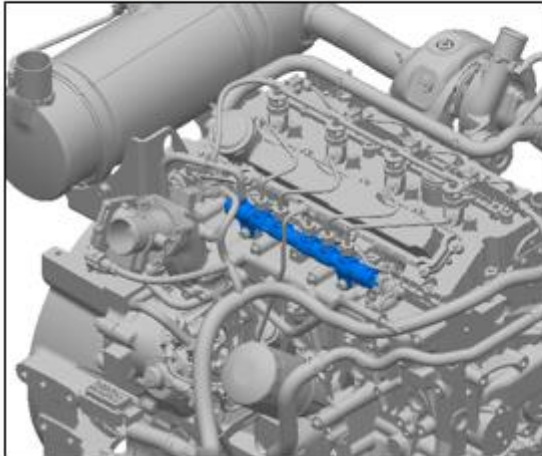
1.8L



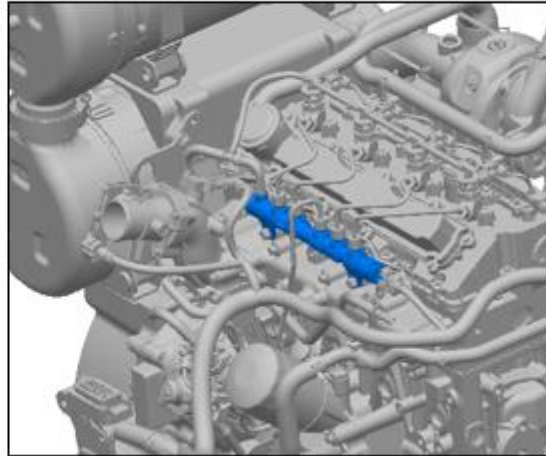
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The rail pressure sensor signal is more than maximum threshold. (4.835V)

5) Condition for Clearing the Fault Code

The rail pressure sensor signal is within normal operation range.

6) Check List

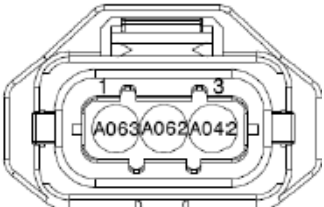
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0193 is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the Rail pressure sensor connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--------------------------------|
| P0192 | Rail pressure sensor Low fault |

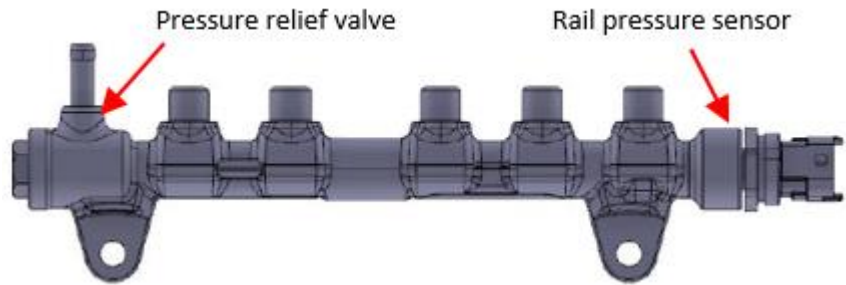
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E005313-04 | 1. Electrical problem (Rail pressure sensor connector) 2. Electrical problem (Wiring harness from Rail pressure sensor to ECU, Rail pressure sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

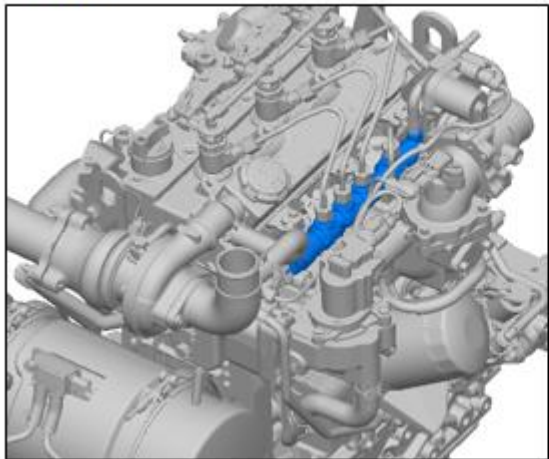
|  | No | ECU Pin | Description (Rail pressure sensor) |
|---|----|---------|---------------------------------------|
| | 1 | A42 | Rail pressure Sensor Supply (5V) (5V) |
| | 2 | A62 | Rail pressure sensor signal |
| | 2 | A63 | Rail pressure sensor ground |

2) Component Location

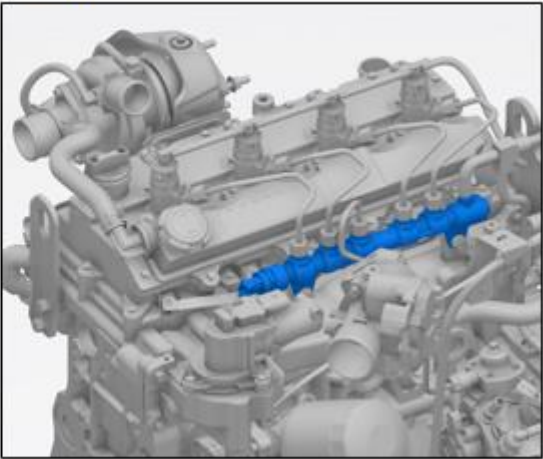
Common rail pressure relief valve is located on opposite to rail pressure sensor.



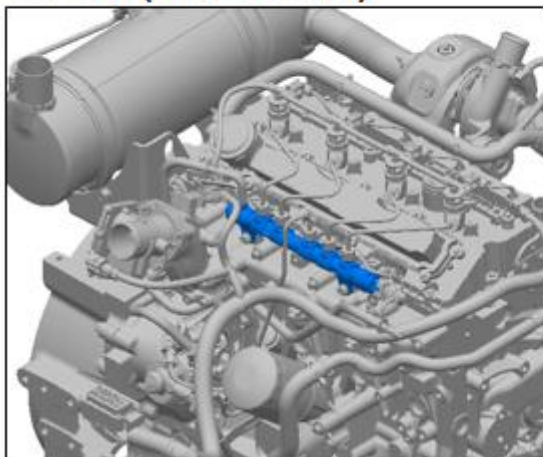
1.8L



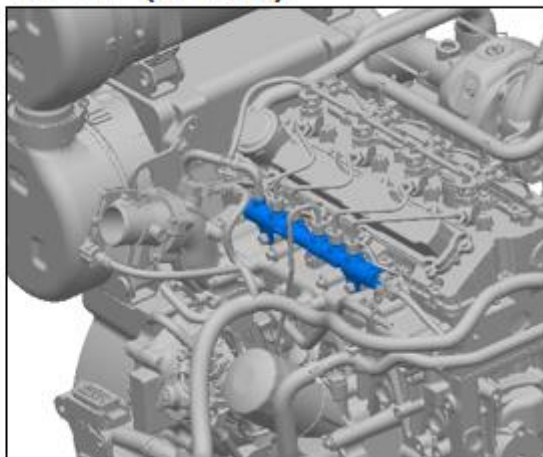
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The rail pressure sensor signal is less than minimum threshold. (0.365V)

5) Condition for Clearing the Fault Code

The rail pressure sensor signal is within normal operation range.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P0192 is detected on service tool? | | Step2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the Rail pressure sensor connection Connection problem? (pin to pin) | | Do necessary repair | Step 5 |
| 5 | Check the ECU Connection. Connection problem? | | Do necessary repair | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P20A5 | DEF Reverting valve Pressure drop plausibility fault |

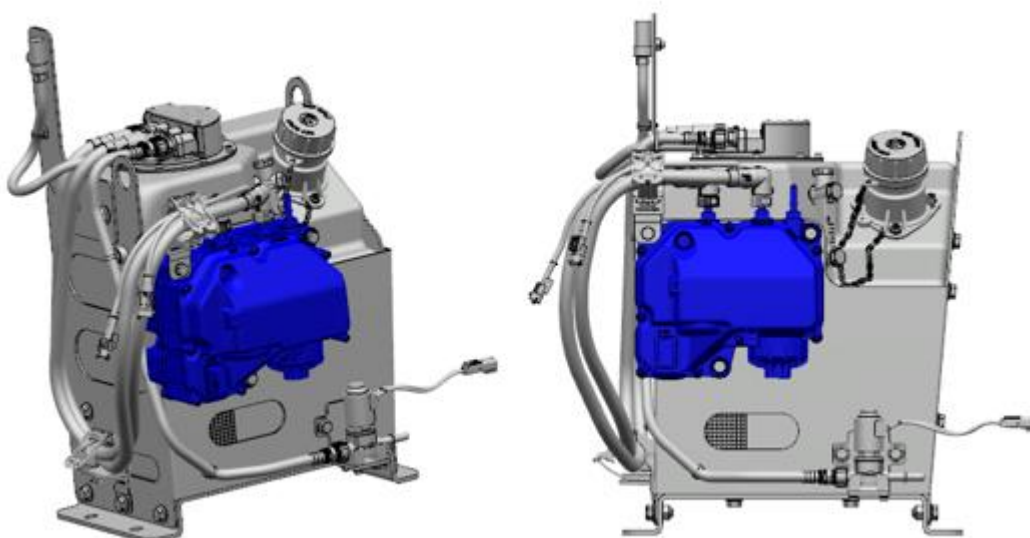
1) Overview

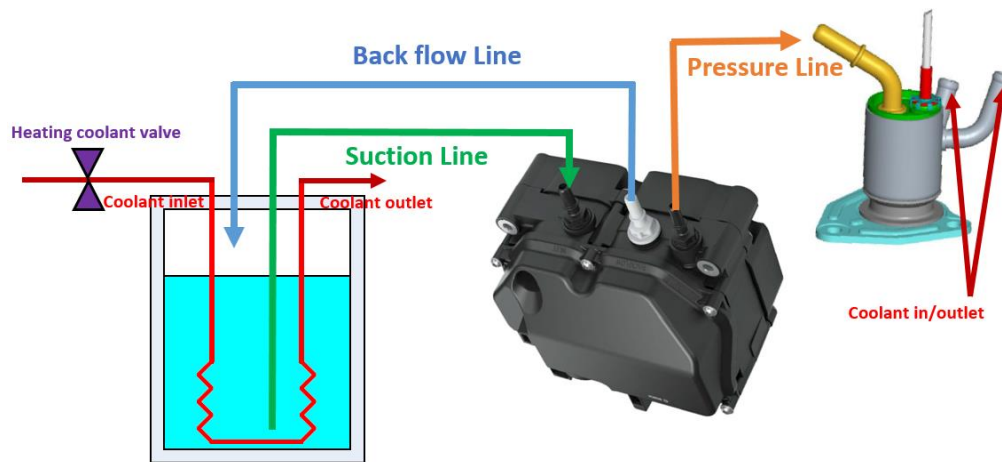
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E005436-11 | 1. The DEF Backflow hose line is clogged. 2. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The DEF pump pressure is not dropped less than 0.9bar in 9sec at pressure reduction control mode.

5) Condition for Clearing the Fault Code

The DEF pump pressure is dropped normally at pressure reduction control mode.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--|------------------|
| 1 | P20A5 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check back flow line of tank side Back flow line of tank side problem? | | Fix or change level sender of DEF tank | Step 4 |
| 4 | Check DEF hose line is clogged or not. (Especially Backflow line) Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 5 |
| 5 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Step 7 |
| 7 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)

* Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)

- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

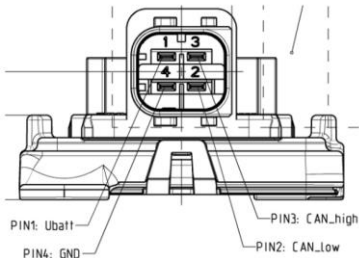
※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|------------------------------|
| P20EE | SCR Efficiency Too low fault |

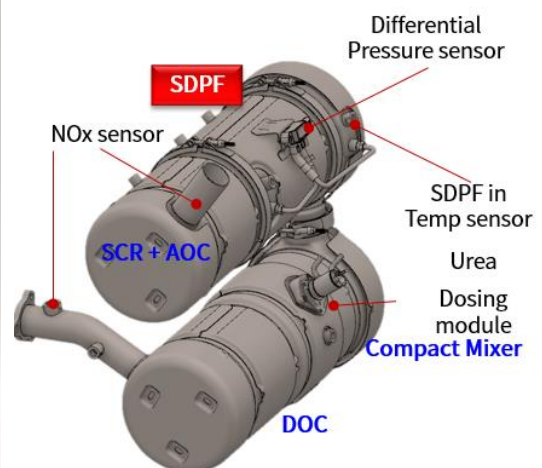
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E004364-14 | <ol style="list-style-type: none"> 1. Electrical problem (When the upstream and downstream NOx sensors are conversely connected) 2. Electrical problem (NOx sensor failure, sensor drift) 3. Bad DEF (Check if DEF concentration fault is occurred at same time) 4. SCR failure (not common, Perform DPF regeneration and data monitor before change SCR system) | CE lamp ON Torque Reduction 1(Mild) |

|  | <table> <tr> <th>No</th><th>Description</th></tr> <tr> <td>1</td><td>Battery supply (+12V)</td></tr> <tr> <td>2</td><td>CAN low</td></tr> <tr> <td>3</td><td>CAN high</td></tr> <tr> <td>4</td><td>Ground</td></tr> </table> | No | Description | 1 | Battery supply (+12V) | 2 | CAN low | 3 | CAN high | 4 | Ground |
|--|--|----|-------------|---|-----------------------|---|---------|---|----------|---|--------|
| No | Description | | | | | | | | | | |
| 1 | Battery supply (+12V) | | | | | | | | | | |
| 2 | CAN low | | | | | | | | | | |
| 3 | CAN high | | | | | | | | | | |
| 4 | Ground | | | | | | | | | | |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

The SCR average efficiency is below the eta threshold.

It is used to monitor NOx conversion efficiency by using NOx sensor before and after SCR.

Diagnoses when the NOx reduction efficiency drops below about 30%. Calculate the calculated average efficiency during NOx 10g accumulation (time varies according to mode, normally over 30 minutes). And if this value falls below 6th consecutive the diagnosis threshold, the fault is occurred. If the efficiency is higher than the threshold even once in the middle, it heals immediately.

* Do not clear fault only, re-update MAP or change the ECU first without operating test.

The diagnostic criterion must be operated under stable temperature conditions for a certain period of time, which may take a long time to diagnose. Therefore, when exchanging ECU, the values are reset and appear to have improved, but if the root cause is not improved, the fault will be reoccurred.

5) Condition for Clearing the Fault Code

The SCR average efficiency is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------------|
| 1 | P20EE is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | If other codes happened together, check the other codes prior to this code | | Step 4 | Step 4 |
| 4 | Check exhaust pipe line Is there any leakage? | | Do necessary repair | Step 5 |
| 5 | Check after-treatment system (DOC, SCR, Dosing module, NOx sensor and so on) Is there any damage, leakage or install error? | | Do necessary repair | Step 6 |
| 6 | Check value of NOx sensors (up/down stream) at high rpm condition (Wait until NOx sensors wakeup). Is there upstream NOx is higher than downstream value with steady condition. * Variable 1) Upstream NOx sensor (Exh_rNOxNSCDs) 2) Downstream NOx sensor (Exh_rNOxNoCat2Ds) 3) NOx conversion efficiency (SCRChk_etaActAvg1_mp) | | Step7 | Check sensor's swapped |
| 7 | Perform DPF regeneration. You can do DPF regeneration by press DPF Regeneration enable switch in your machine or service tool. * DPF regeneration is performed to remove DEF deposits that may be remaining in the SCR system. DEF deposit may occur depending on the operating conditions of the equipment (low load only use) and ambient conditions (low outside temperature). | | | Step 8 |

| | | | |
|---|--|---------------------|-------------------|
| 8 | Operate machine at high idle more than 30 min. Is fault occurred again? | Contact Helpdesk | Problem solved |
|---|--|---------------------|-------------------|

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ Forced DPF regeneration procedure

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position < 5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step (low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|-------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal | ~ 2300 |
| | | Max | 3000 |

• Service regeneration stop and not start condition

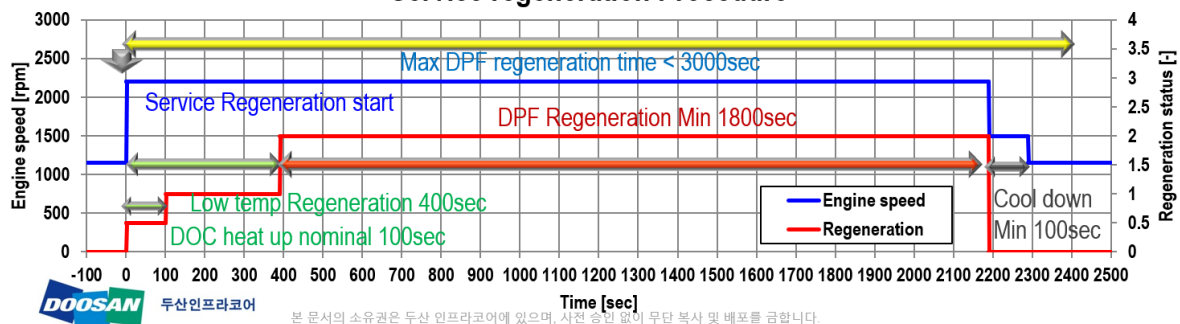
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

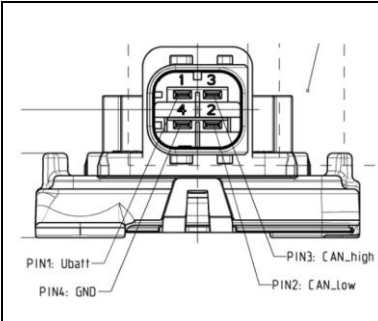
Service regeneration Procedure



| Fault Code | Fault Name |
|-----------------------|--|
| P225D | NOx sensor 1 (Upstream) concentration Low plausibility fault |

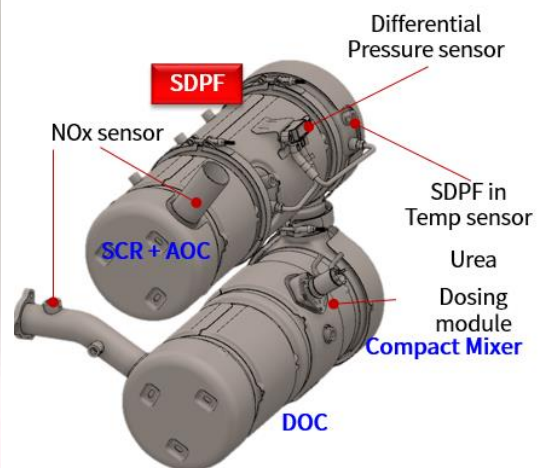
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E003216-18 | <ol style="list-style-type: none"> 1. Electrical problem (NOx sensor failure, sensor drift) 2. Tampering (NOx sensor raw signal tampering for reducing or not-used of DEF consumption) 3. Electrical problem (When the upstream and downstream NOx sensors are conversely connected) | Inducement Group5 (Tampering) |

|  | <table> <tr> <th>No</th><th>Description</th></tr> <tr> <td>1</td><td>Battery supply (+12V)</td></tr> <tr> <td>2</td><td>CAN low</td></tr> <tr> <td>3</td><td>CAN high</td></tr> <tr> <td>4</td><td>Ground</td></tr> </table> | No | Description | 1 | Battery supply (+12V) | 2 | CAN low | 3 | CAN high | 4 | Ground |
|--|--|----|-------------|---|-----------------------|---|---------|---|----------|---|--------|
| No | Description | | | | | | | | | | |
| 1 | Battery supply (+12V) | | | | | | | | | | |
| 2 | CAN low | | | | | | | | | | |
| 3 | CAN high | | | | | | | | | | |
| 4 | Ground | | | | | | | | | | |

2) Component Location

Dependent on machine layout
Upstream NOx sensor – Black connector
Downstream NOx sensor – Grey connector



3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

NOx sensor 1 (Upstream) concentration Low plausibility fault

It is used to monitor upstream NOx sensor concentration.

Diagnoses when the upstream NOx concentration drops below about 70% than model value. And if this value falls below 6th consecutive the diagnosis threshold, the fault is occurred. If the upstream NOx concentration is higher than the threshold even once in the middle, it heals immediately.

* Do not clear fault only, re-update MAP or change the ECU first without operating test.

The diagnostic criterion must be operated under stable temperature conditions for a certain period of time, which may take a long time to diagnose. Therefore, when exchanging ECU, the values are reset and appear to have improved, but if the root cause is not improved, the fault will be reoccurred.

5) Condition for Clearing the Fault Code

The upstream NOx sensor concentration is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|----------------------------------|------------------------|
| 1 | P225D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | If other codes happened together, check the other codes prior to this code | | Step 4 | Step 4 |
| 4 | Check exhaust pipe line Is there any leakage? | | Do necessary repair | Step 5 |
| 5 | Check after-treatment system (DOC, SCR, Dosing module, NOx sensor and so on) Is there any damage, leakage or install error? | | Do necessary repair | Step 6 |
| 6 | Check value of NOx sensors (up/down stream) at high rpm condition (Wait until NOx sensors wakeup). Is there upstream NOx is higher than downstream value with steady condition * Variable 1) Upstream NOx sensor (Exh_rNOxNSCDs) 2) Downstream NOx sensor (Exh_rNOxNoCat2Ds) | | Step7 | Check sensor's swapped |
| 7 | Check value of NOx sensor (upstream) at high rpm condition (Wait until NOx sensors wakeup). Is there upstream NOx model normalized deviation is too lower(<-0.7) with steady condition? * Variable 1) Upstream NOx model normalized deviation (Sensor -Model) / Model (SCRChk_rNOxDiffAvgMinUs_mp) | | Check sensor Tampering equipment | Step 8 |
| 8 | Operate machine at high idle more than 30 min. Is fault occurred again? | | Contact Helpdesk | Problem solved |

| Fault Code | Fault Name |
|-----------------------|---|
| P1460 | DEF underpressure error at AFTERRUN_PRESSURECOMPENSATION |

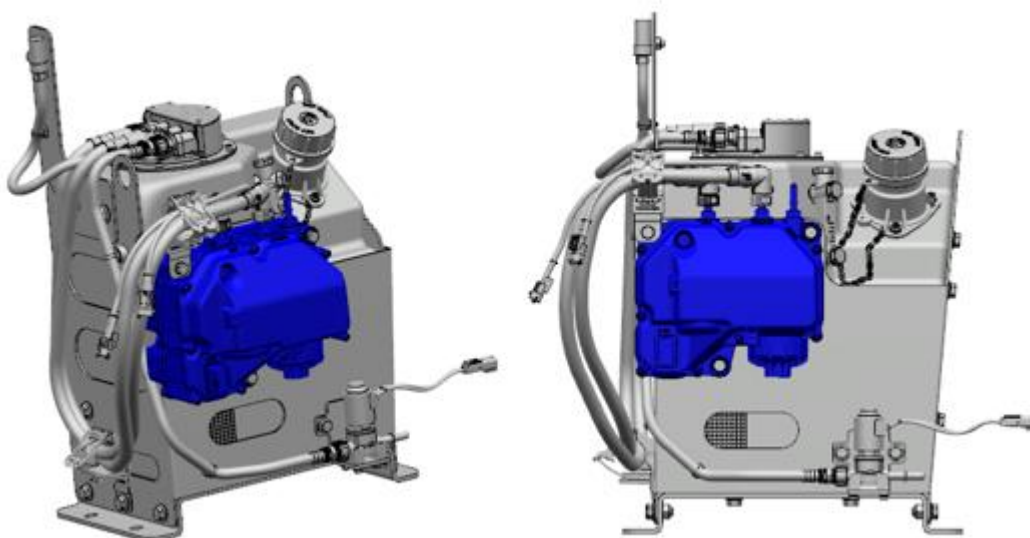
1) Overview

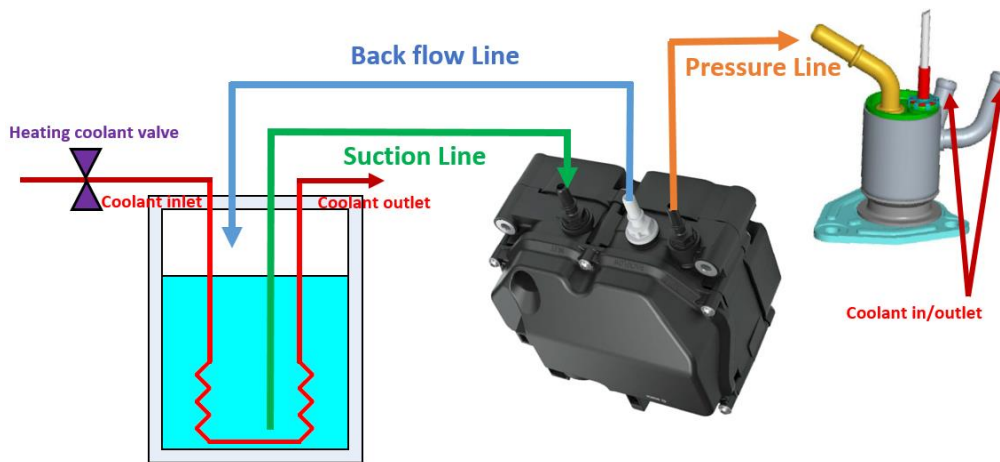
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E004335-16 | 1. DEF was too much filled. (DEF is supplied to the supply module via the backflow line.) 2. The DEF Backflow hose line is clogged. 3. Electrical problem (Supply module connector, Wiring harness ECU to Supply module, Supply module) 4. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

SCR "AFTERRUN_PRESSURECOMPENSATION" state

4) Condition for Setting the Fault Code

The DEF pressure is below the minimum pressure threshold at "AFTERRUN_PRESSURECOMPENSATION" state (-400hPa)

5) Condition for Clearing the Fault Code

The DEF pump pressure is dropped within threshold at "AFTERRUN_PRESSURECOMPENSATION" state.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--|--------|
| 1 | P1460 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF tank level DEF level is filled too much? * If the DEF level is greater than the max guide level, DEF is supplied to the supply module via the backflow line. It means that the DEF is not removed from the SCR system at all, there is a risk of frozen failure, so do not overfill the DEF. | | Drain DEF to below max level | Step 4 |
| 4 | Check back flow line of tank side Back flow line of tank side problem? | | Fix or change level sender of DEF tank | Step 5 |
| 5 | Check DEF hose line is clogged or not. (Especially Backflow line) Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 6 |
| 6 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 7 |

| | | | | |
|---|---|--|------------------------|---------------------|
| 7 | Check ECU connection Connection problem? | | Do necessary repair | Step 8 |
| 8 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)

* Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)

- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),


※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P1893 | DEF backflow Line plausibility error at DETECTIONMODE |

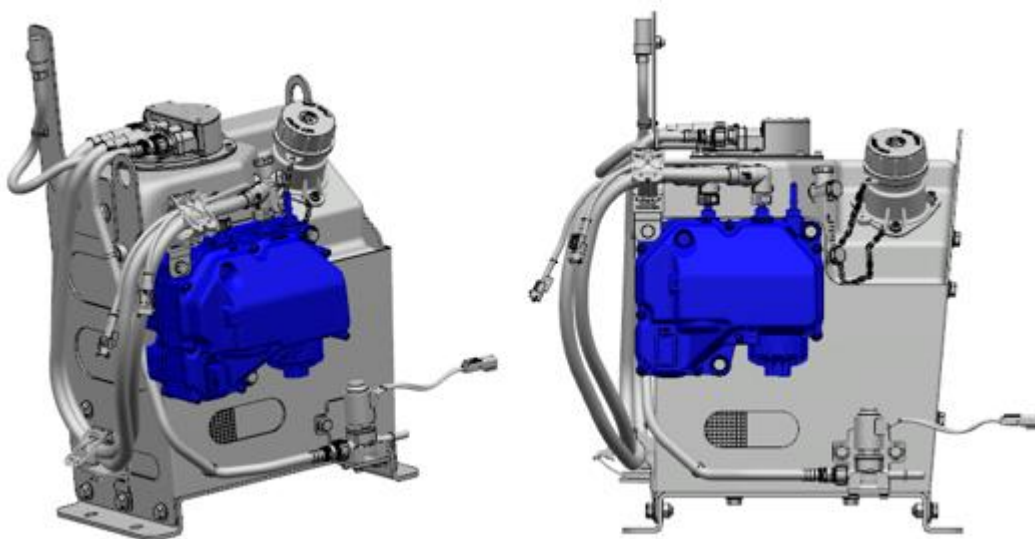
1) Overview

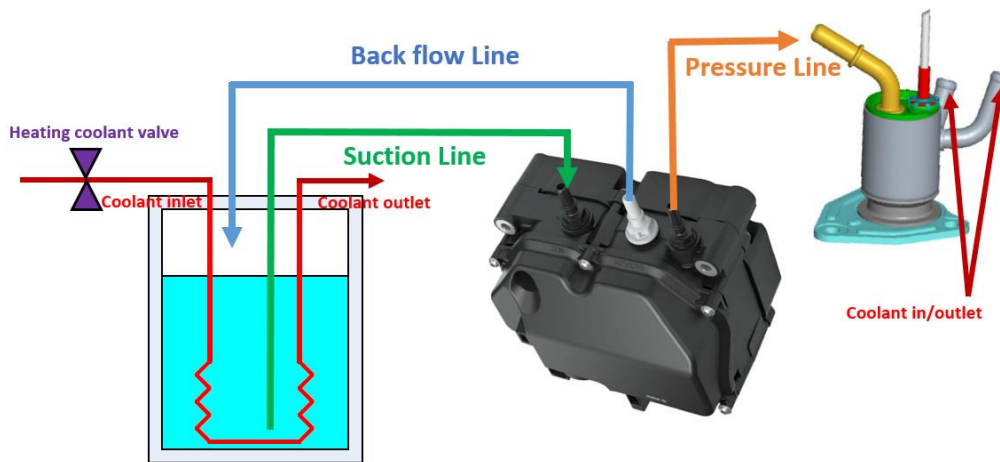
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E004344-02 | 1. The DEF Backflow hose line is clogged. 2. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

Engine running and SCR "DETECTIONMODE" state

4) Condition for Setting the Fault Code

The ECU checks whether the Backflow line is physically blocked by checking whether the pressure exceeds the maximum threshold (11.5bar) for longer 2sec.

If a blockage is detected, the state is left with error and the counter is incremented. If the counter exceeds the maximum acceptable number of repetitions the fault is set.

5) Condition for Clearing the Fault Code

The DEF pump pressure is dropped within threshold at "DETECTIONMODE" state.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--|------------------|
| 1 | P1893 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check back flow line of tank side Back flow line of tank side problem? | | Fix or change level sender of DEF tank | Step 4 |
| 4 | Check DEF hose line is clogged or not. (Especially Backflow line) Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 5 |
| 5 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Step 7 |
| 7 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)

* Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)

- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

※ **SCR related Input/Output function test by service tool**

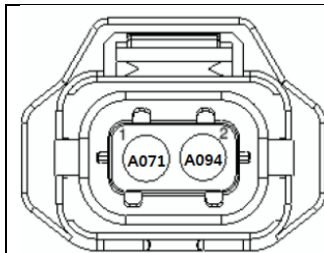
1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P204A | DEF pressure check error at DETECTIONMODE (Detected an insufficient pressure drop) |

1) Overview

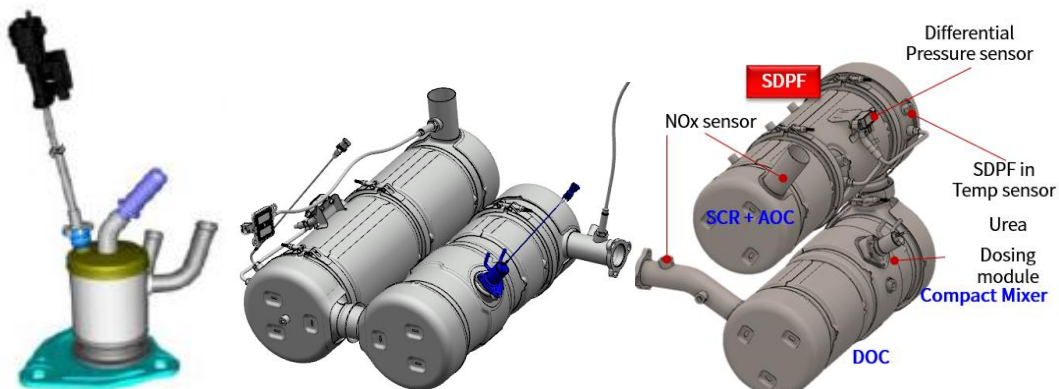
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------------|
| E005435-12 | 1. DEF line problem (DEF hose line or DEF dosing valve is clogged) 2. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

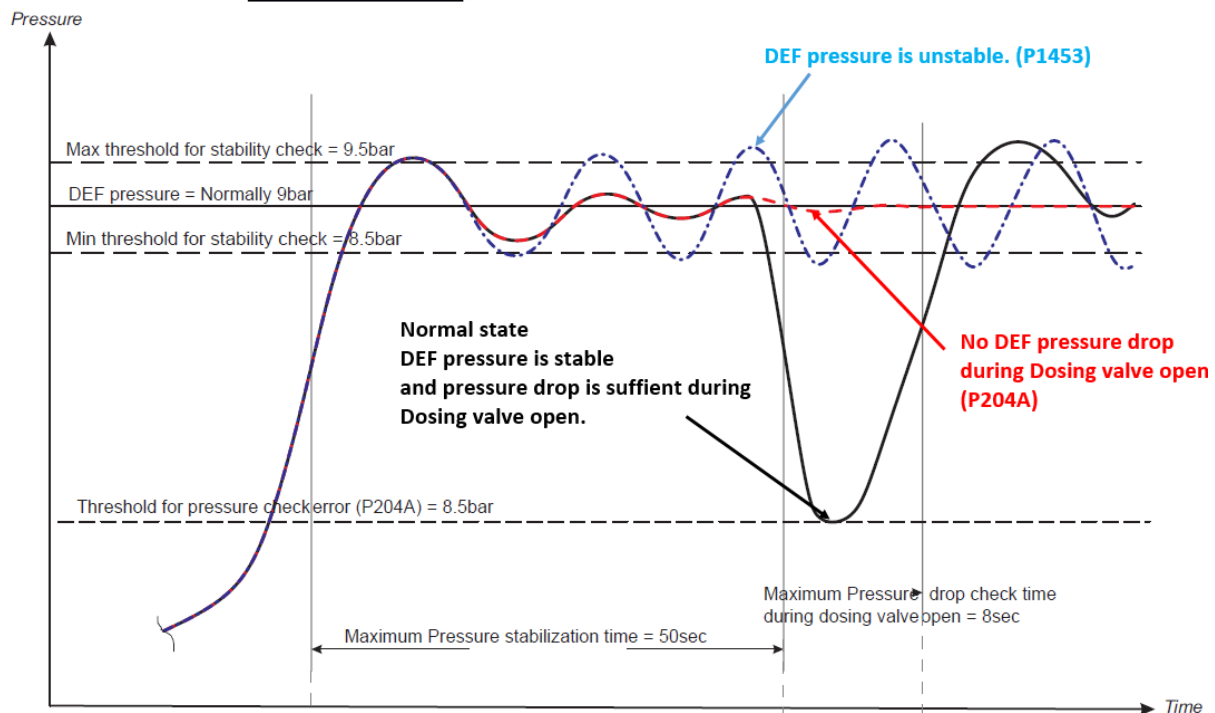
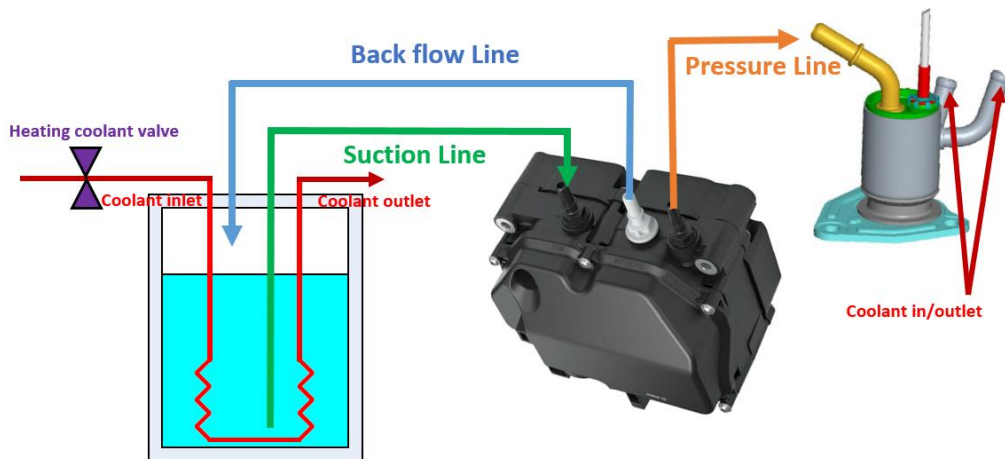
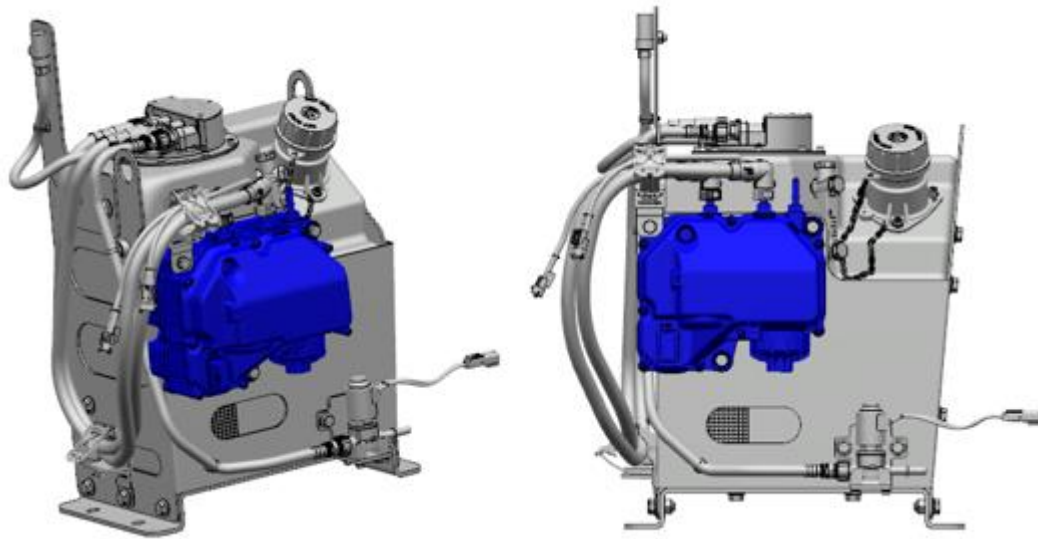
| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |



| No. | ECU Pin | PIN description (DEF dosing valve) |
|-----|---------|------------------------------------|
| 1 | A71 | DEF Dosing valve Low side |
| 2 | A94 | DEF Dosing valve High side |

2) Component Location





3) Condition for Running Diagnostic

Engine running and SCR "DETECTIONMODE" state

4) Condition for Setting the Fault Code

The ECU checks whether the DEF dosing valve is physically blocked by checking whether the pressure drops normally by opening the DEF dosing valve with the pressure in the pressure line at 9 bar.

If the DEF pressure is not dropped below threshold (8.5bar) within 8sec, the DEF dosing valve is considered to blockage.

If a blockage is detected, the state is left with error and the counter is incremented. If the counter exceeds the maximum acceptable number of repetitions the fault is set.

5) Condition for Clearing the Fault Code

The DEF pump pressure is dropped within threshold at "DETECTIONMODE" state.

DEF dosing valve is operated normally.

Since this fault could be healed after confirming that the dosing valve operated properly enough, it should be required about 20 minutes of engine operation time after DEF dosing valve is operated normally.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|-------------------------|--------|
| 1 | P204A is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module pressure by service tool Wait until pump working, need high engine speed Is pressure value abnormal? * Variable 1) DEF pressure (SCR_pUPmpP) | | Do necessary repair | Step 4 |
| 4 | Check DEF hose line is clogged or not. Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 5 |
| 5 | Perform DPF regeneration. You can do DPF regeneration by press DPF Regeneration enable switch in your machine or service tool. Fault is cleared? * DPF regeneration is performed to remove DEF deposits that may be remaining in the SCR system. DEF deposit may occur depending on the operating conditions of the equipment (low load only use) and ambient conditions (low outside temperature). | | Problem Solved | Step 6 |
| 6 | Replace with another normal DEF dosing valve DEF dosing valve problem? | | Change DEF dosing valve | Step 7 |
| 7 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 8 |

| | | | | |
|---|---|--|------------------------|---------------------|
| 8 | Check ECU connection Connection problem? | | Do necessary repair | Step 9 |
| 9 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)
- * Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)
- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

※ **Forced DPF regeneration procedure**

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)

4. Keep machine at low idle. (Pedal position <5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step (low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|-------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal | ~ 2300 |
| | | Max | 3000 |

• Service regeneration stop and not start condition

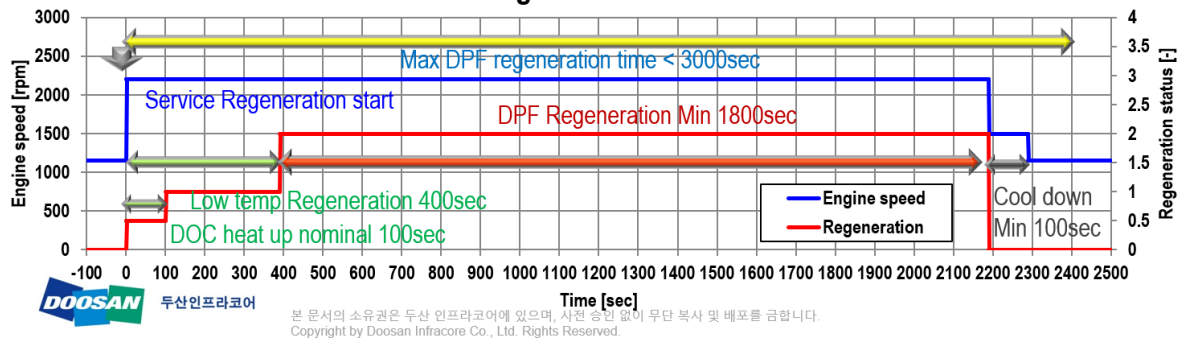
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure

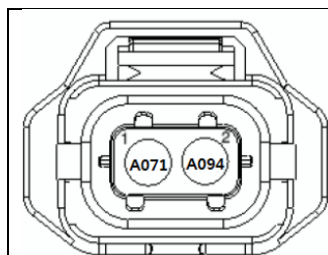


| Fault Code | Fault Name |
|-----------------------|--|
| P1453 | DEF pressure stabilization error at DETECTIONMODE (DEF pump pressure is not stable) |

1) Overview

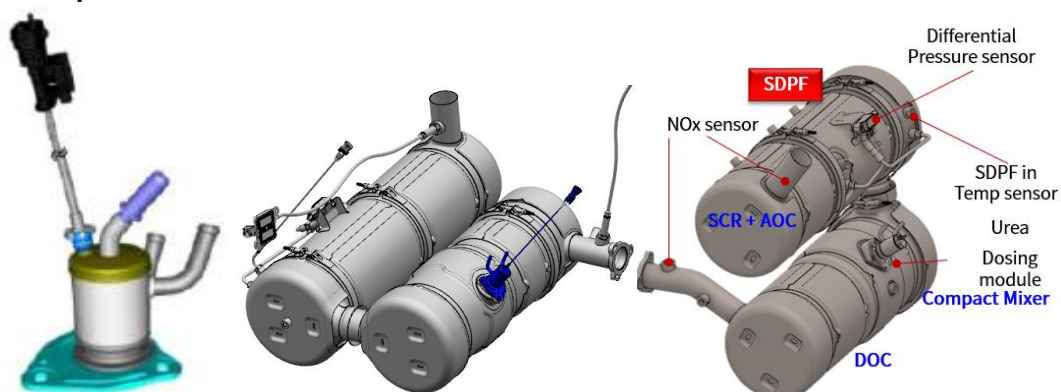
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------------|
| E005435-10 | 1. DEF line problem (DEF hose line or DEF dosing valve is clogged) 2. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

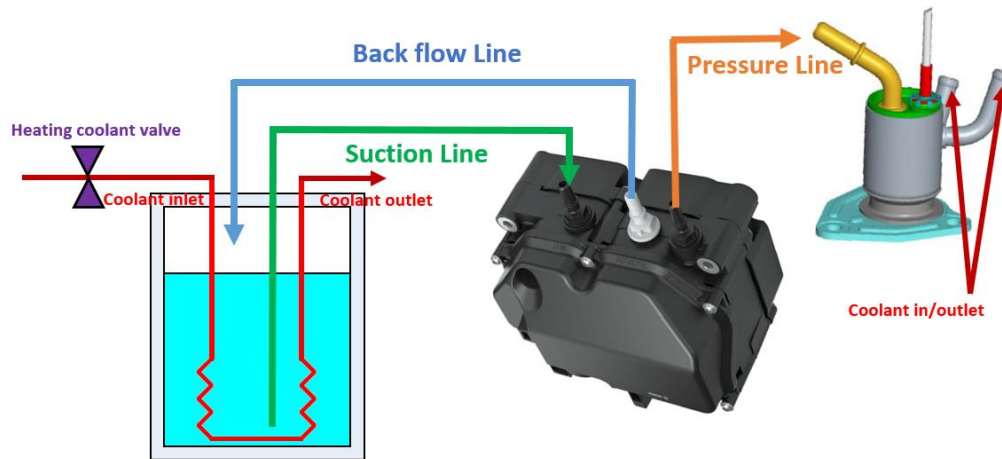
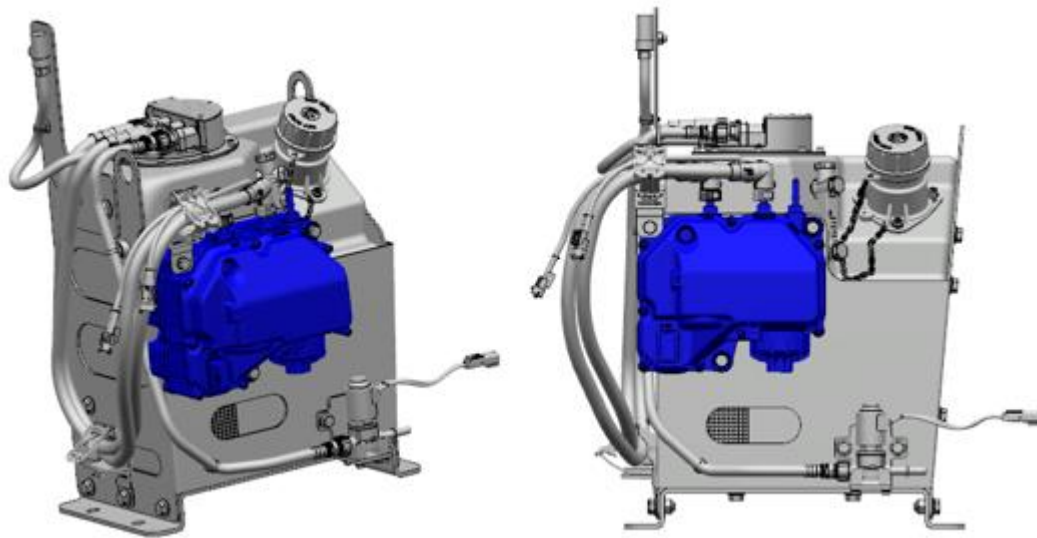
| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

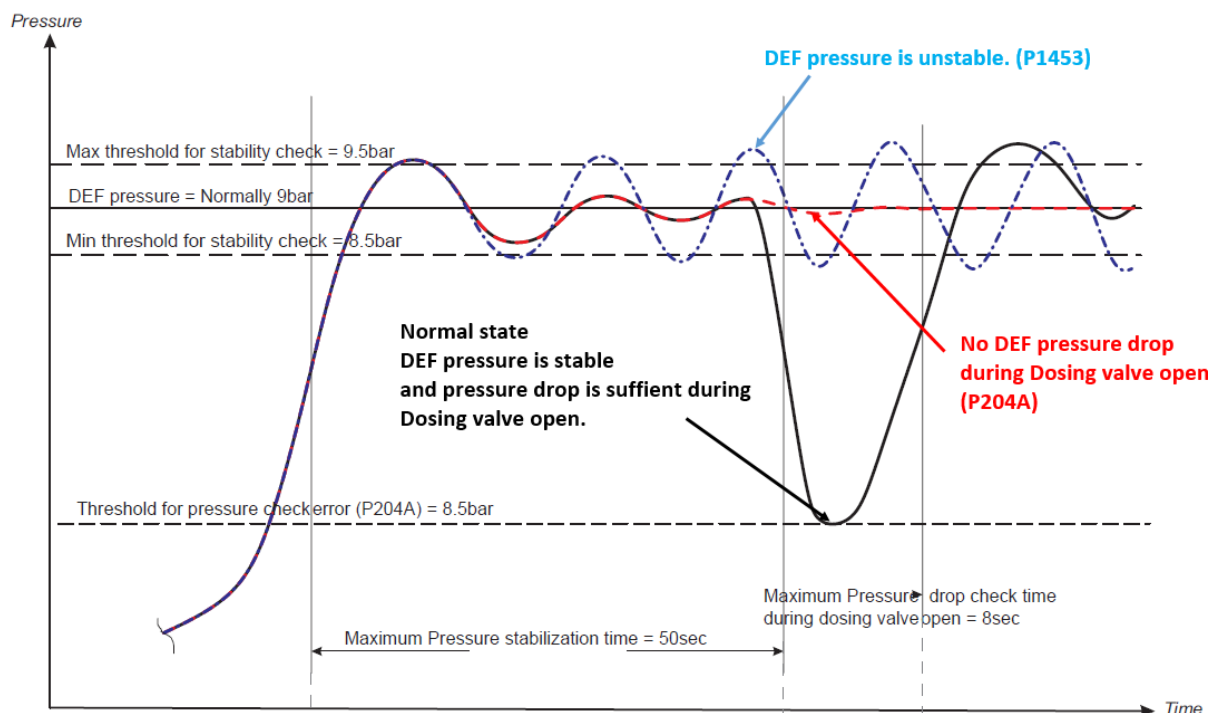


| No. | ECU Pin | PIN description (DEF dosing valve) |
|-----|---------|------------------------------------|
| 1 | A71 | DEF Dosing valve Low side |
| 2 | A94 | DEF Dosing valve High side |

2) Component Location







3) Condition for Running Diagnostic

Engine running and SCR "DETECTIONMODE" state

4) Condition for Setting the Fault Code

If the DEF pressure is not within the admissible limits (± 0.5 bar) for longer than 50sec.

5) Condition for Clearing the Fault Code

The DEF pump pressure is stable within threshold at "DETECTIONMODE" state.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|--------|
| 1 | P1453 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module pressure by service tool Wait until pump working, need high engine speed Is pressure value abnormal? * Variable 1) DEF pressure (SCR_pUPmpP) | | Do necessary repair | Step 4 |
| 4 | Check DEF hose line is clogged or not. Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 5 |
| 5 | Perform DPF regeneration. You can do DPF regeneration by press DPF Regeneration enable switch in your machine or service tool. Fault is cleared? | | Problem Solved | Step 6 |

| | | | | |
|---|--|--|--|-----------------------------|
| | * DPF regeneration is performed to remove DEF deposits that may be remaining in the SCR system. DEF deposit may occur depending on the operating conditions of the equipment (low load only use) and ambient conditions (low outside temperature). | | | |
| 6 | Replace with another normal DEF dosing valve DEF dosing valve problem? | | Change DEF dosing valve | Step 7 |
| 7 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 8 |
| 8 | Check ECU connection Connection problem? | | Do necessary repair | Step 9 |
| 9 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)
- * Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)
- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater

5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

※ Forced DPF regeneration procedure

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position < 5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step (low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|-------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal | ~ 2300 |
| | | Max | 3000 |

• Service regeneration stop and not start condition

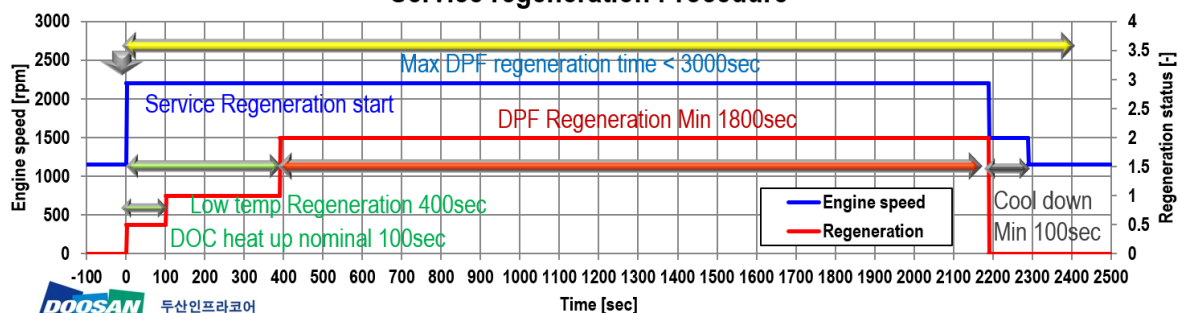
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure



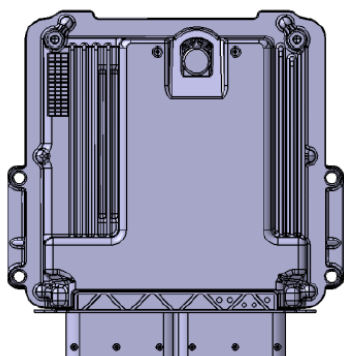
| Fault Code | Fault Name |
|-----------------------|---|
| P2505 | ECU over temperature for SCR Monitoring |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E001867-01 | 1. Engine room cooling problem (The ECU temperature is too high.) 2. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

The ECU temperature sensor is located in ECU.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The ECU temperature is higher than threshold for SCR system monitoring. (114degC)

5) Condition for Clearing the Fault Code

The ECU temperature is within normal operation range.

6) Check List

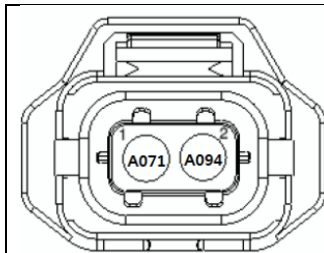
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P2505 is detected on service tool? | | Step2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step3 | |
| 3 | Check the engine room cooling system. Cooling system is problem? | | Do necessary repair | Step 4 |
| 4 | Replace the ECU. Check the fault state by operating in the same as the problem occurrence condition Is fault clear? | | Change ECU | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P1450 | DEF Overpressure error at METERINGCONTROL (DEF pump pressure is too high) |

1) Overview

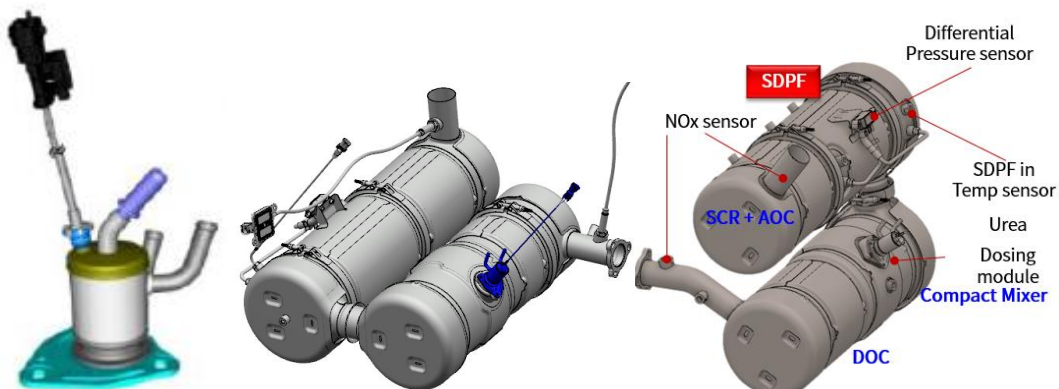
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------------|
| E004335-00 | 1. DEF line problem (DEF hose line or DEF dosing valve is clogged) 2. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

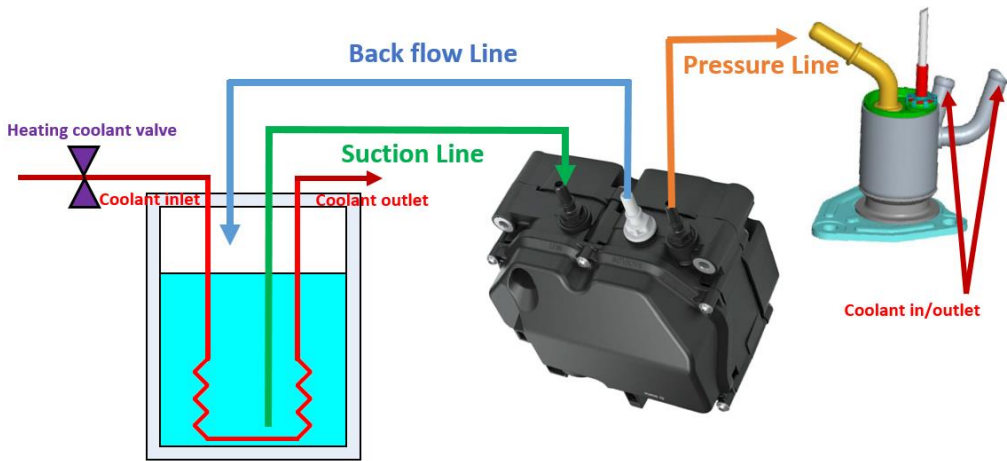
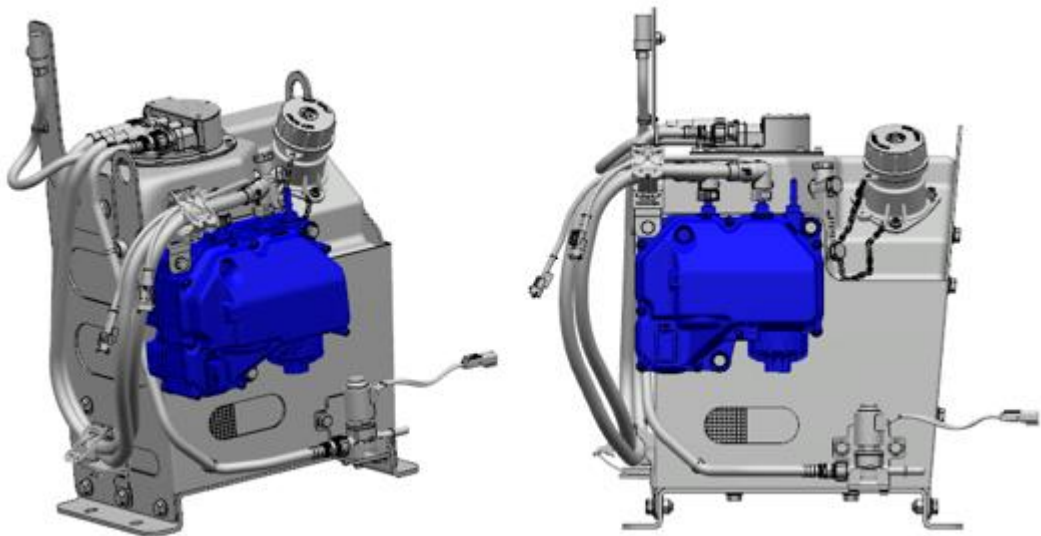
| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |



| No. | ECU Pin | PIN description (DEF dosing valve) |
|-----|---------|------------------------------------|
| 1 | A71 | DEF Dosing valve Low side |
| 2 | A94 | DEF Dosing valve High side |

2) Component Location





3) Condition for Running Diagnostic

Engine running and SCR “METERINGCONTROL” state

4) Condition for Setting the Fault Code

If DEF pressure exceeds the maximum threshold (10.5bar) for longer than 20sec, an error will be set at “METERINGCONTROL” state

5) Condition for Clearing the Fault Code

The DEF pump pressure is within normal operation range at “METERINGCONTROL” state.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P1450 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|---|---|--|-------------------------|------------------|
| 3 | Check Supply module pressure by service tool Wait until pump working, need high engine speed Is pressure value abnormal? * Variable 1) DEF pressure (SCR_pUPmpP) | | Do necessary repair | Step 4 |
| 4 | Check DEF hose line is clogged or not. Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 5 |
| 5 | Perform DPF regeneration. You can do DPF regeneration by press DPF Regeneration enable switch in your machine or service tool. Fault is cleared? * DPF regeneration is performed to remove DEF deposits that may be remaining in the SCR system. DEF deposit may occur depending on the operating conditions of the equipment (low load only use) and ambient conditions (low outside temperature). | | Problem Solved | Step 6 |
| 6 | Replace with another normal DEF dosing valve DEF dosing valve problem? | | Change DEF dosing valve | Step 7 |
| 7 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 8 |
| 8 | Check ECU connection Connection problem? | | Do necessary repair | Step 9 |
| 9 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)
 - * Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)
 - This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

※ **Forced DPF regeneration procedure**

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position <5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|----------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal Max | ~ 2300 3000 |

• Service regeneration stop and not start condition

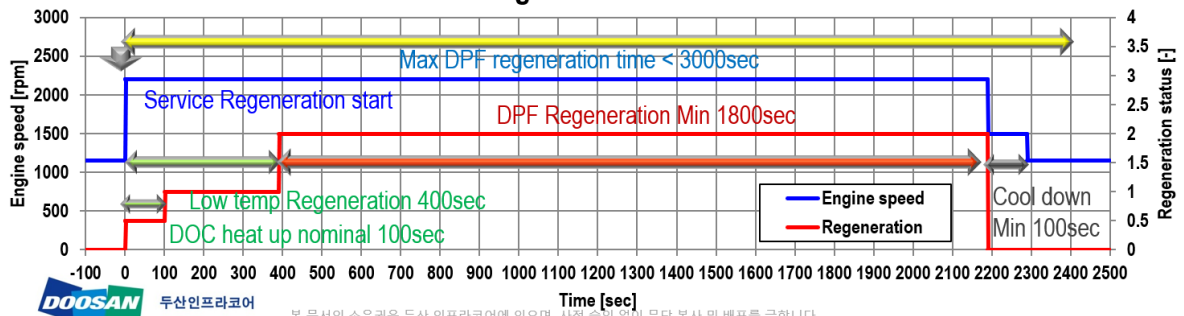
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure




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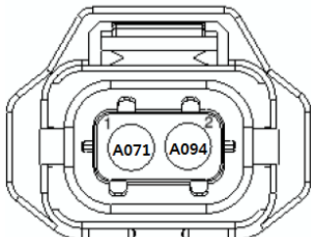
본 문서의 소유권은 두산 인프리카오에 있으며, 사전 승인 없이 무단 복사 및 배포를 금합니다.
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| Fault Code | Fault Name |
|-----------------------|--|
| P1451 | DEF Underpressure error at METERINGCONTROL (DEF pump pressure is too low) |

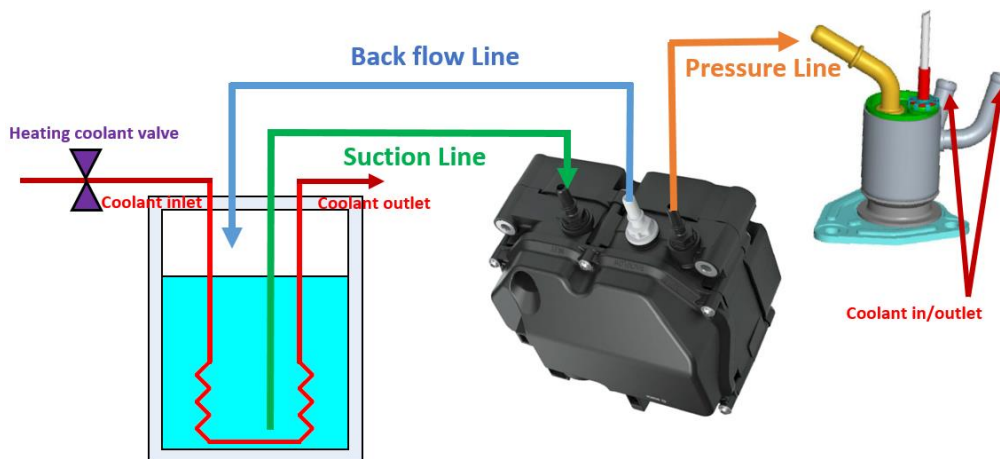
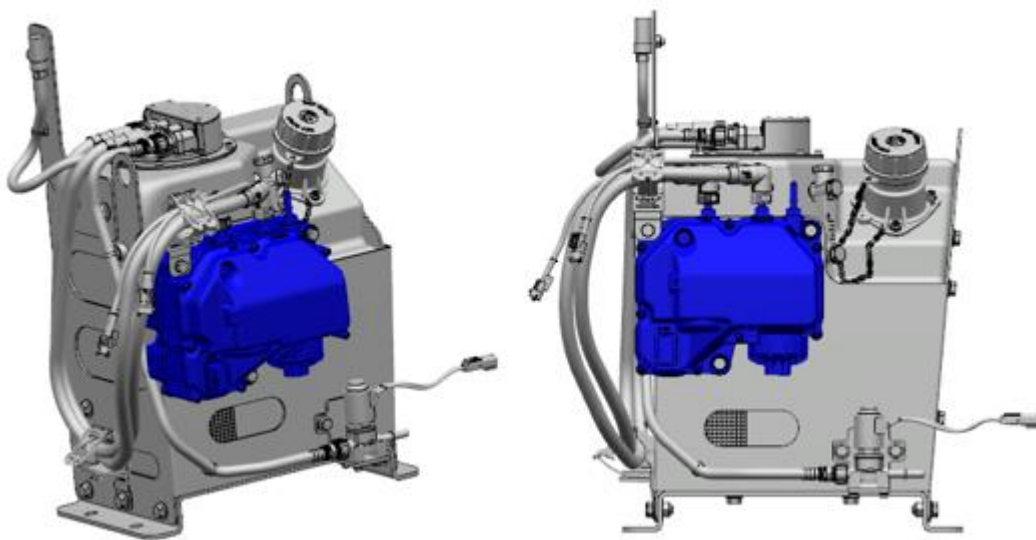
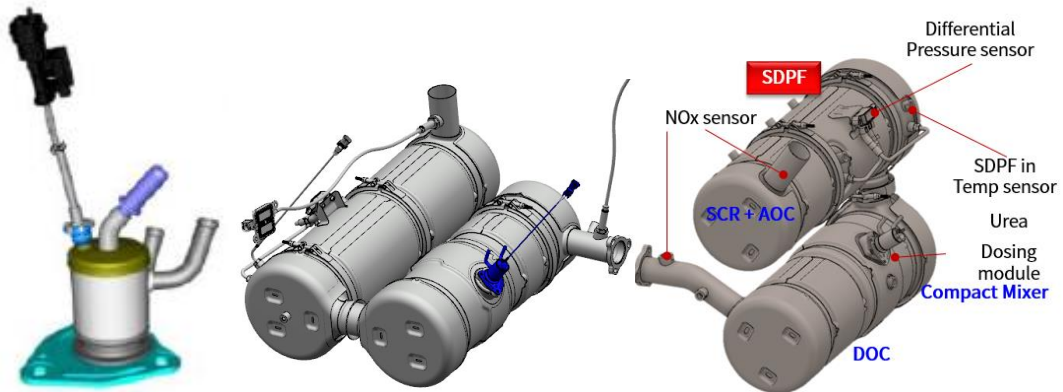
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|----------------------------------|
| E004335-01 | 1. Low DEF level 2. DEF line problem (DEF hose line or DEF dosing valve is opened, Supply module filter is clogged, Hose line are swapped) 3. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 4. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

|  | No. | ECU Pin | PIN description (DEF dosing valve) |
|---|-----|---------|------------------------------------|
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location



3) Condition for Running Diagnostic

Engine running and SCR "METERINGCONTROL" state

4) Condition for Setting the Fault Code

If DEF pressure falls below the first minimum pressure threshold (7.5bar) for longer than 40sec, or the second minimum pressure threshold (0.55bar) for longer than 5sec, an error will be set at "METERINGCONTROL" state.

5) Condition for Clearing the Fault Code

The DEF pump pressure is within normal operation range at “METERINGCONTROL” state.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------------------|------------------|
| 1 | P1451 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module pressure by service tool Wait until pump working, need high engine speed Is pressure value abnormal? * Variable 1) DEF pressure (SCR_pUPmpP) | | Do necessary repair | Step 4 |
| 4 | Check the DEF level DEF level is too low? | | Fill DEF | Step 5 |
| 5 | Check DEF hose line is clogged or not. Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 6 |
| 6 | Check and replace the DEF Supply module filter DEF pressure is controlled normally (8.5~9.5bar)? | | Change DEF Supply module filter | Step 7 |
| 7 | Perform DPF regeneration. You can do DPF regeneration by press DPF Regeneration enable switch in your machine or service tool. Fault is cleared? * DPF regeneration is performed to remove DEF deposits that may be remaining in the SCR system. DEF deposit may occur depending on the operating conditions of the equipment (low load only use) and ambient conditions (low outside temperature). | | Problem Solved | Step 8 |
| 8 | Replace with another normal DEF dosing valve DEF dosing valve problem? | | Change DEF dosing valve | Step 9 |
| 9 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 10 |
| 10 | Check ECU connection Connection problem? | | Do necessary repair | Step 11 |
| 11 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ SCR function test by service tool (Emptying, Leak, Complete test)

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)
 - * Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)
 - This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

※ **Forced DPF regeneration procedure**

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position <5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|----------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal Max | ~ 2300 3000 |

• Service regeneration stop and not start condition

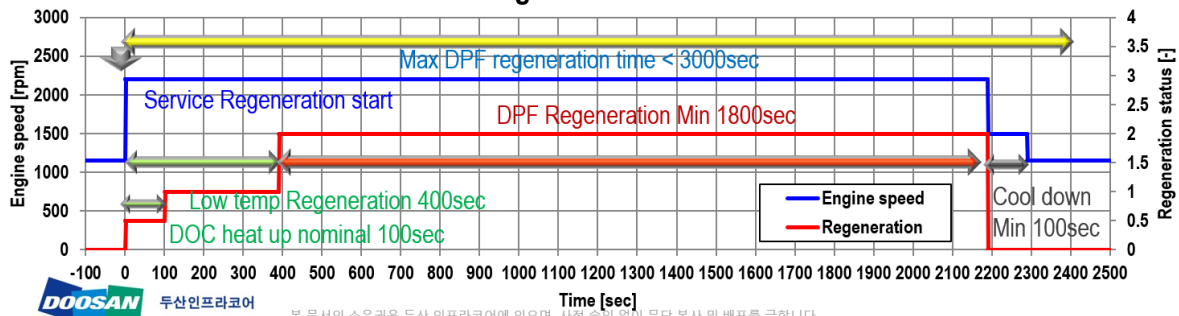
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure

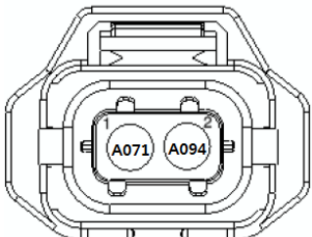


| Fault Code | Fault Name |
|-----------------------|---|
| P1452 | DEF Overpressure error regardless of the state (DEF pump pressure is too high) |

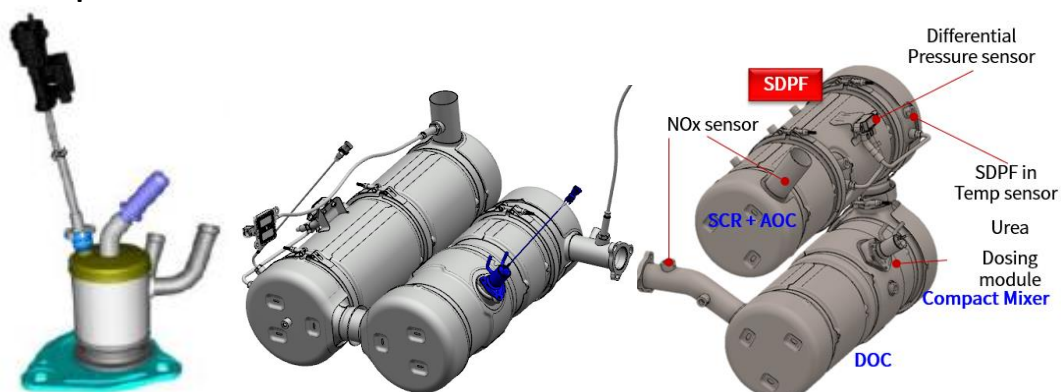
1) Overview

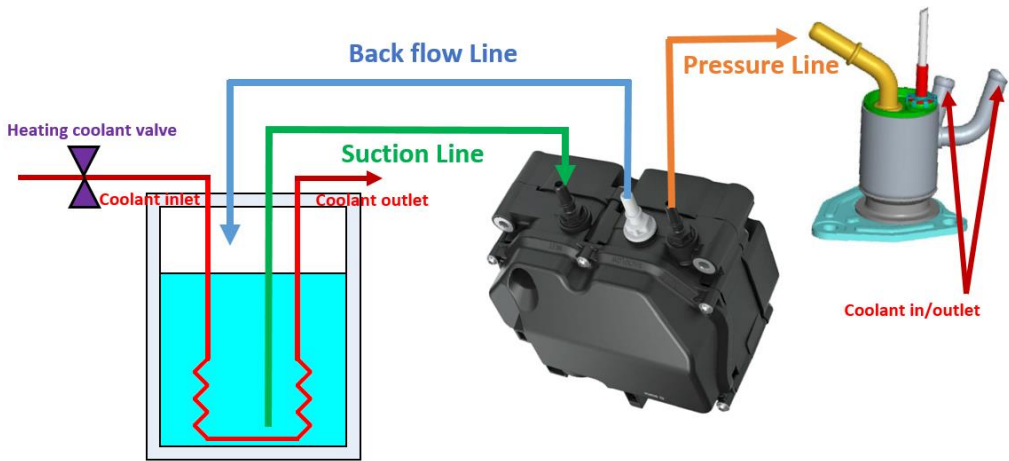
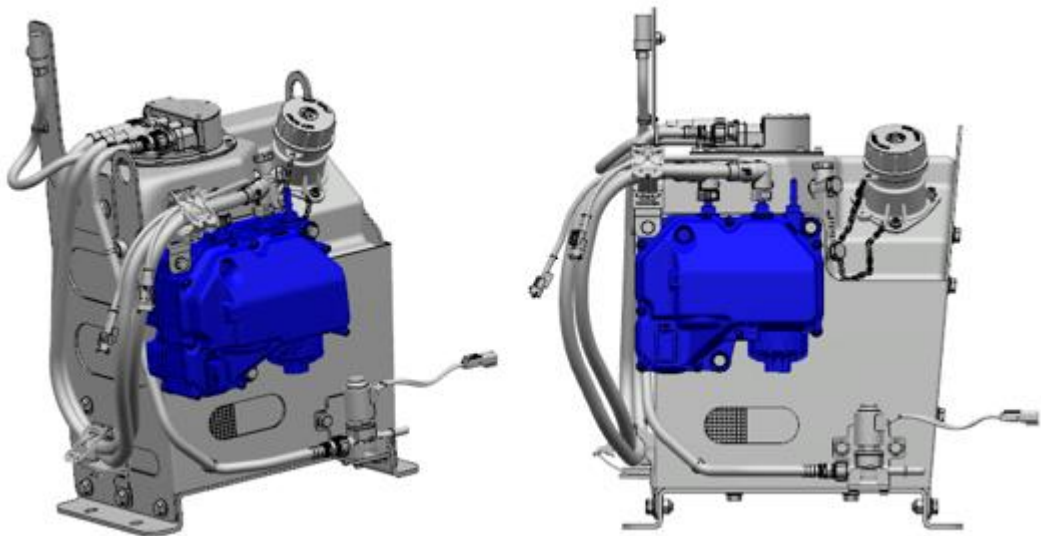
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|----------------------------------|
| E004335-12 | 1. DEF line problem (DEF hose line or DEF dosing valve is clogged.) 2. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

|  | No. | ECU Pin | PIN description (DEF dosing valve) |
|---|-----|---------|------------------------------------|
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location





3) Condition for Running Diagnostic
Engine running

- 4) Condition for Setting the Fault Code**
The DEF pressure is higher than threshold (12.5bar) for longer than 5sec, fault will be set except below condition.
- 1) when the supply module is defrosting.
 - 2) when the DEF Reverting valve is actuated for pressure reduction in the "DETECTIONMODE" state.

5) Condition for Clearing the Fault Code
The DEF pump pressure is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P1452 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|---|---|--|-------------------------|------------------|
| 3 | Check Supply module pressure by service tool Wait until pump working, need high engine speed Is pressure value abnormal? * Variable 1) DEF pressure (SCR_pUPmpP) | | Do necessary repair | Step 4 |
| 4 | Check DEF hose line is clogged or not. Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 5 |
| 5 | Perform DPF regeneration. You can do DPF regeneration by press DPF Regeneration enable switch in your machine or service tool. Fault is cleared? * DPF regeneration is performed to remove DEF deposits that may be remaining in the SCR system. DEF deposit may occur depending on the operating conditions of the equipment (low load only use) and ambient conditions (low outside temperature). | | Problem Solved | Step 6 |
| 6 | Replace with another normal DEF dosing valve DEF dosing valve problem? | | Change DEF dosing valve | Step 7 |
| 7 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 8 |
| 8 | Check ECU connection Connection problem? | | Do necessary repair | Step 9 |
| 9 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)
 - * Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)
 - This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

※ **Forced DPF regeneration procedure**

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position <5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|----------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal Max | ~ 2300 3000 |

• Service regeneration stop and not start condition

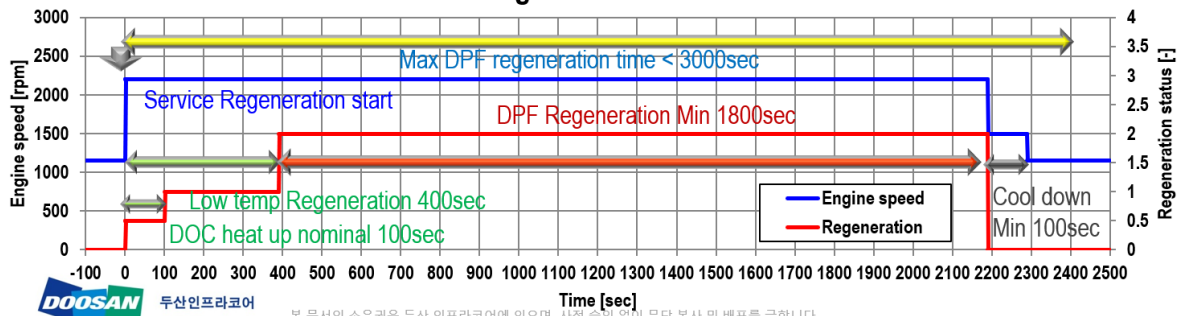
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure




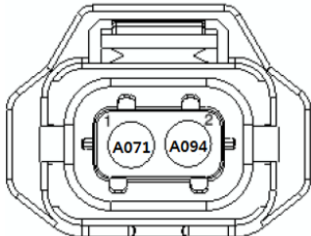
본 문서의 소유권은 두산 인프라코어에 있으며, 사전 승인 없이 무단 복사 및 배포를 금합니다.
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| Fault Code | Fault Name |
|-----------------------|--|
| P1457 | DEF pressure build up error at PRESSUREBUILDUP (DEF pump pressure is too low) |

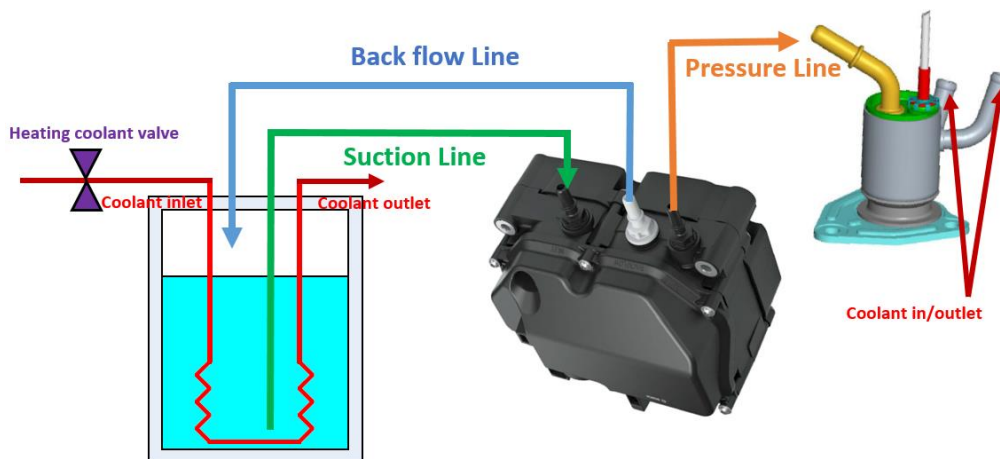
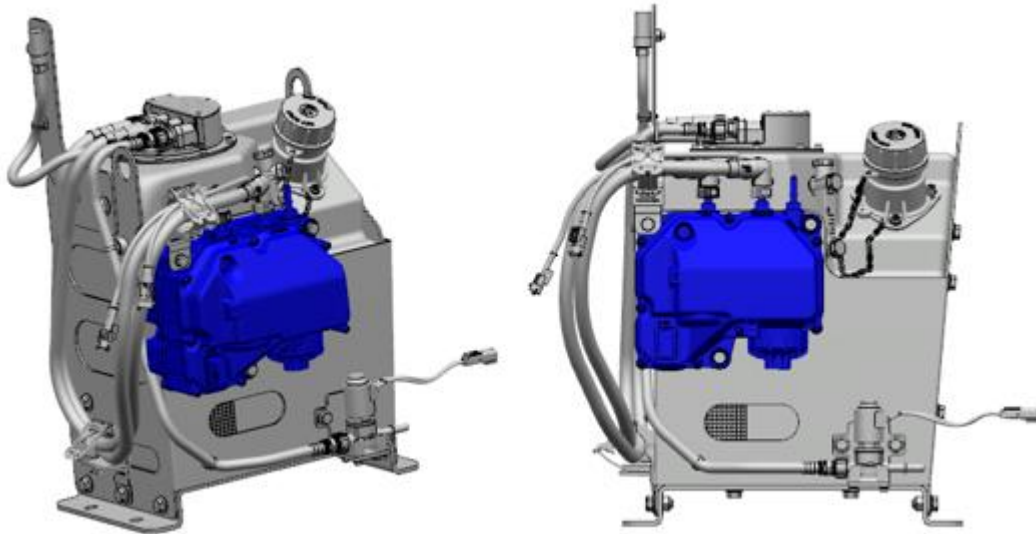
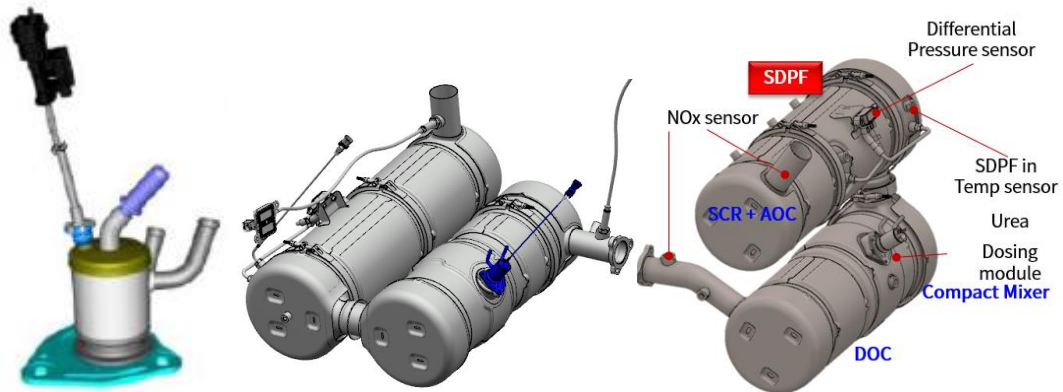
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------------|
| E004335-02 | 1. Low DEF level 2. DEF line problem (DEF hose line or DEF dosing valve is opened, Supply module filter is clogged, Hose line are swapped.) 3. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 4. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| | | | |
|--|-----|---------|--|
| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

| | | | |
|---|-----|---------|------------------------------------|
|  | No. | ECU Pin | PIN description (DEF dosing valve) |
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location



3) Condition for Running Diagnostic

Engine running and SCR "PRESSUREBUILDUP" state

4) Condition for Setting the Fault Code

When system attempts to build up the pressure in the dosing line, if this pressure threshold (5bar) cannot be reached within 25s for longer than maximum number of attempts (3), fault will be set.

5) Condition for Clearing the Fault Code

The DEF pump pressure is built up within normal operation range at “PRESSUREBUILDUP” state.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------------------|------------------|
| 1 | P1457 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module pressure by service tool Wait until pump working, need high engine speed Is pressure value abnormal? * Variable 1) DEF pressure (SCR_pUPmpP) | | Do necessary repair | Step 4 |
| 4 | Check the DEF level DEF level is too low? | | Fill DEF | Step 5 |
| 5 | Check DEF hose line is opened(leakage) or not. Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 6 |
| 6 | Check and replace the DEF Supply module filter DEF pressure is controlled normally (8.5~9.5bar)? | | Change DEF Supply module filter | Step 7 |
| 7 | Perform DPF regeneration. You can do DPF regeneration by press DPF Regeneration enable switch in your machine or service tool. Fault is cleared? * DPF regeneration is performed to remove DEF deposits that may be remaining in the SCR system. DEF deposit may occur depending on the operating conditions of the equipment (low load only use) and ambient conditions (low outside temperature). | | Problem Solved | Step 8 |
| 8 | Replace with another normal DEF dosing valve DEF dosing valve problem? | | Change DEF dosing valve | Step 9 |
| 9 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 10 |
| 10 | Check ECU connection Connection problem? | | Do necessary repair | Step 11 |
| 11 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ SCR function test by service tool (Emptying, Leak, Complete test)

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)
 - * Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)
- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

※ Forced DPF regeneration procedure

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position <5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|----------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal Max | ~ 2300 3000 |

• Service regeneration stop and not start condition

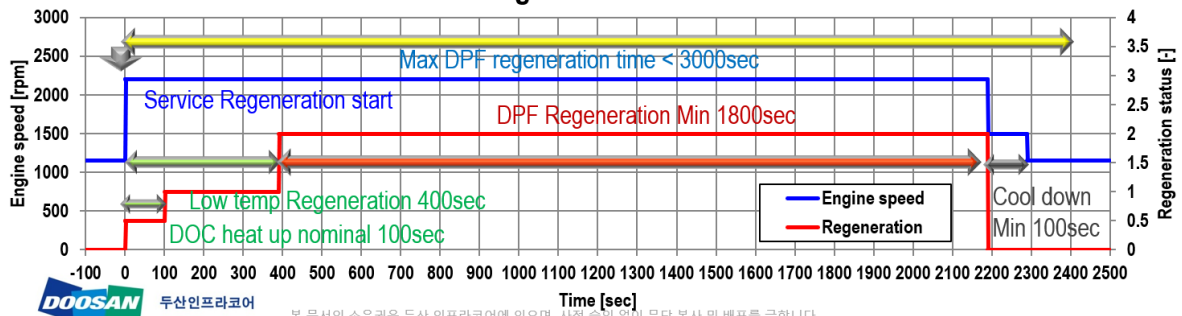
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure



| Fault Code | Fault Name |
|-----------------------|---|
| P1459 | DEF Pressure reduction error at PRESSUREREDUCTION (Detected an insufficient pressure drop) |

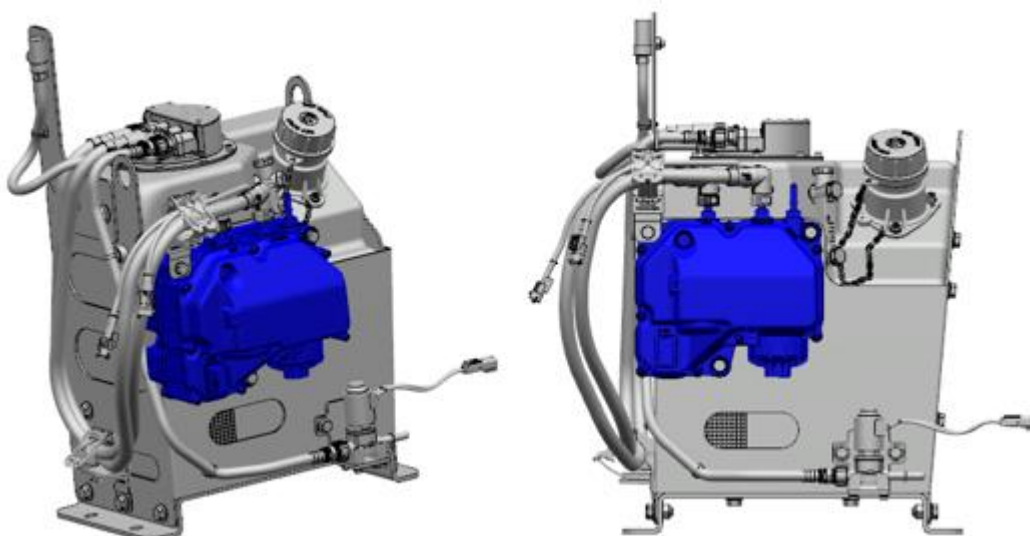
1) Overview

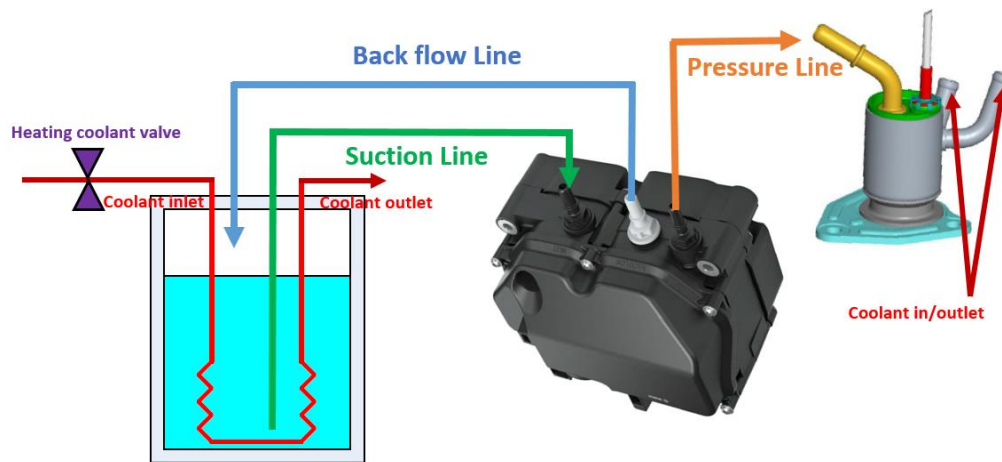
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|----------------------------------|
| E004335-15 | 1. The DEF Backflow hose line is clogged. 2. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

Engine running and SCR "PRESSUREREDUCTION" state

4) Condition for Setting the Fault Code

The desired DEF pressure reduction (<0.5bar) could not be achieved within 40sec at "PRESSUREREDUCTION" state

5) Condition for Clearing the Fault Code

The DEF pump pressure is dropped than threshold at "PRESSUREREDUCTION" state.
DEF in the line was normally returned to the tank.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--|------------------|
| 1 | P1459 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check back flow line of tank side Back flow line of tank side problem? | | Fix or change level sender of DEF tank | Step 4 |
| 4 | Check DEF hose line is clogged or not. (Especially Backflow line) Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 5 |
| 5 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Step 7 |
| 7 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)

* Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)

- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),


※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P202D | DEF Leakage detection at METERINGCONTROL |

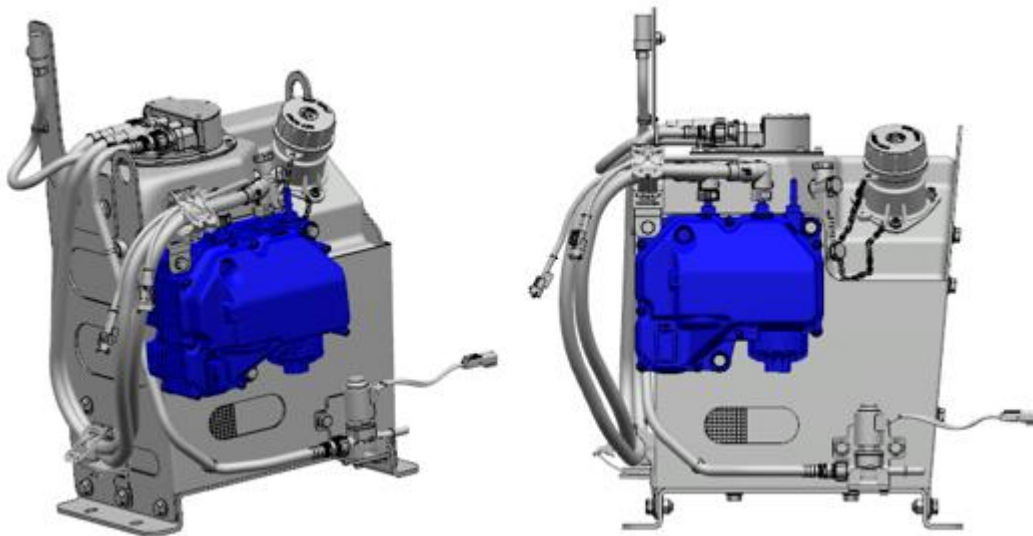
1) Overview

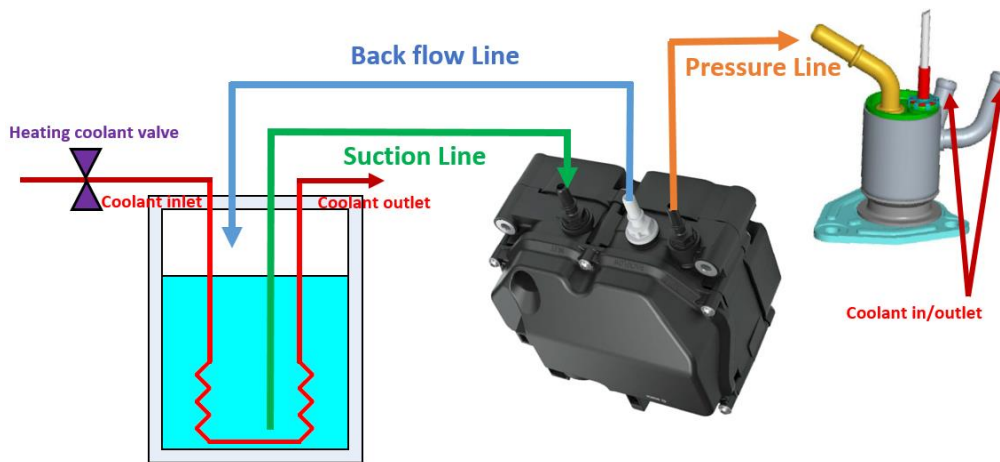
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E004335-07 | 1. DEF line problem (DEF hose line leakage) 2. Dosing valve failure (Open stuck, etc.) 3. Supply module failure | CE Lamp ON |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

Engine running and SCR "METERINGCONTROL" state

4) Condition for Setting the Fault Code

The DEF leakage is suspected at "METERINGCONTROL" state.

It means that the control duty of the supply pump is too high than nominal value for keeping pressure line to 9bar at no dosing condition.

5) Condition for Clearing the Fault Code

The DEF supply pump control duty is within normal range at "METERINGCONTROL" state.
There is no DEF leakage.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------------------|--------|
| 1 | P202D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF hose line is opened(leakage) or not. Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 4 |
| 4 | Check and replace the DEF Supply module filter DEF pressure is controlled normally (8.5~9.5bar)? | | Change DEF Supply module filter | Step 5 |
| 5 | Perform DPF regeneration. You can do DPF regeneration by press DPF Regeneration enable switch in your machine or service tool. Fault is cleared? * DPF regeneration is performed to remove DEF deposits that may be remaining in the SCR system. DEF deposit may occur depending on the operating conditions of the equipment (low load only use) and ambient conditions (low outside temperature). | | Problem Solved | Step 6 |

| | | | | |
|---|---|--|--|-----------------------------|
| 6 | Replace with another normal DEF dosing valve DEF dosing valve problem? | | Change DEF dosing valve | Step 7 |
| 7 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)
- * Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)
- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

※ **Forced DPF regeneration procedure**

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)

4. Keep machine at low idle. (Pedal position <5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|-------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal | ~ 2300 |
| | | Max | 3000 |

• Service regeneration stop and not start condition

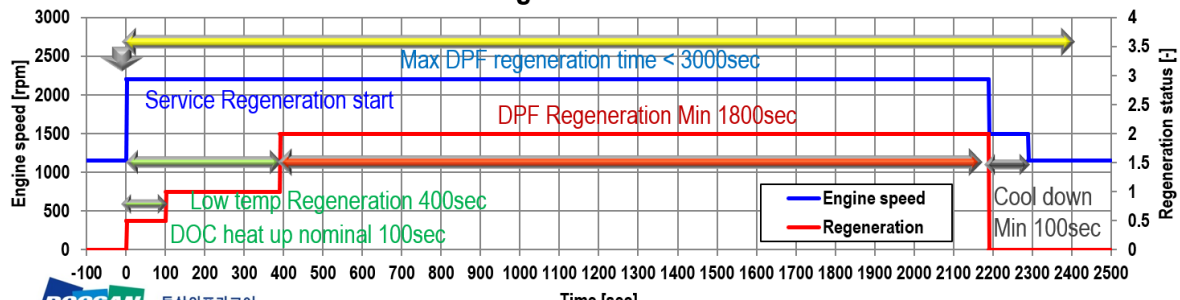
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure



본 문서의 소유권은 두산 인프라코어에 있으며, 사전 승인 없이 무단 복사 및 배포를 금합니다.
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| Fault Code | Fault Name |
|------------|---------------------------------|
| P205E | DEF Tank temperature overheated |

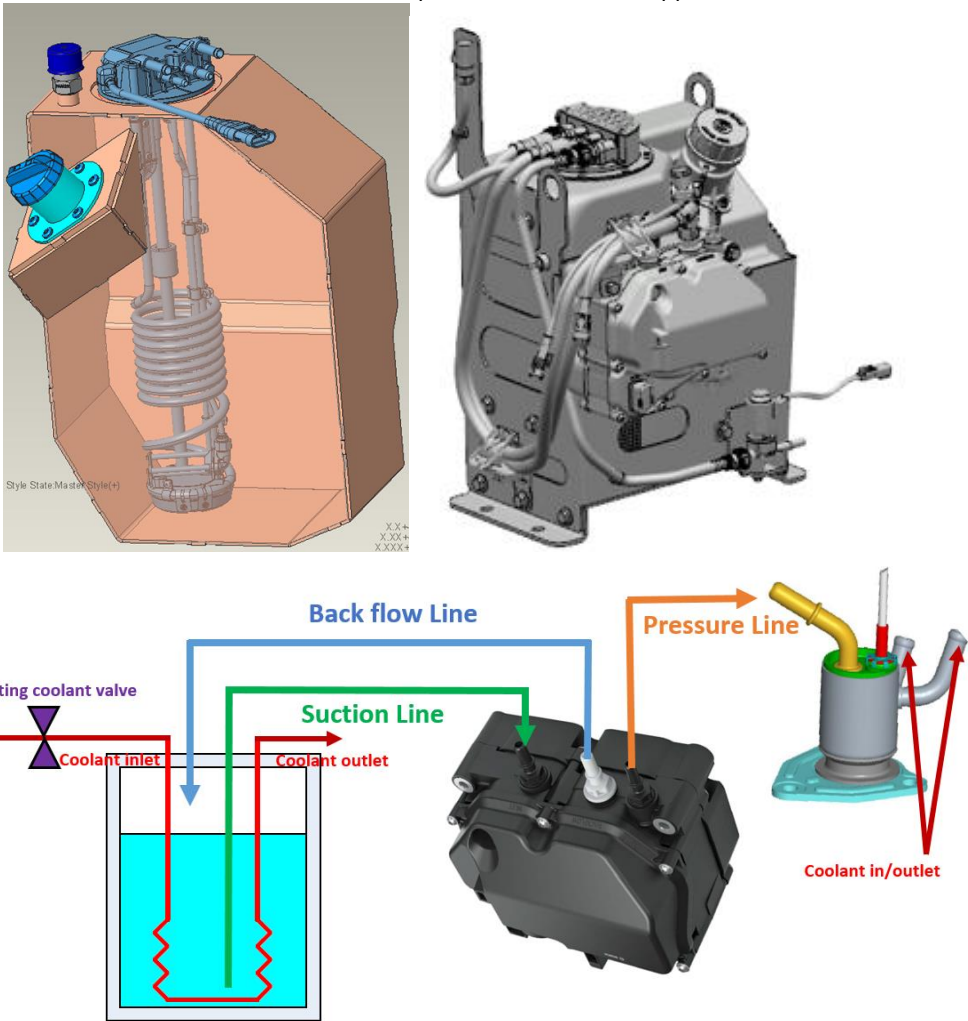
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E003031-14 | 1. DEF temperature is really high due to high ambient temperature and continuous high load operation 2. Electrical problem (DEF tank coolant valve connector, Wiring harness from ECU to DEF tank coolant valve, DEF Coolant valve) 3. Electrical problem (ECU connector, Faulty ECU) | CE Lamp ON |

| The pin definition is dependent on the DEF tank type. | No | Description |
|---|----|--------------|
| | 1 | Battery +12V |
| | 2 | Ground |
| | 3 | CAN Low |
| | 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF tank temperature is more than threshold (70°C).

* DEF temperature is really high due to high ambient temperature and continuous high load operation.

Therefore, in case of this fault, only the alarm is done.

However, if the fault occurs even though the machine is not working continuously and the ambient temperature are not high, a cooling line check is required. In general, the fault had not been occurred during 1~2hrs consecutive machine operating in hot ambient conditions (>40degC).

5) Condition for Clearing the Fault Code

The DEF tank temperature is lower than threshold. (65°C).

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|------------------------|------------------|
| 1 | P205E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the coolant valve Coolant valve problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF temperature Temperature it really too high? | | Check cooling system | Step 5 |
| 5 | Check sensor connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Step 7 |
| 7 | Replace DEF Tank module DEF Tank module problem? | | Change DEF Tank Module | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

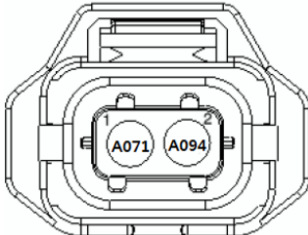
1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|-----------------------------|
| P208E | DEF Dosing valve is blocked |

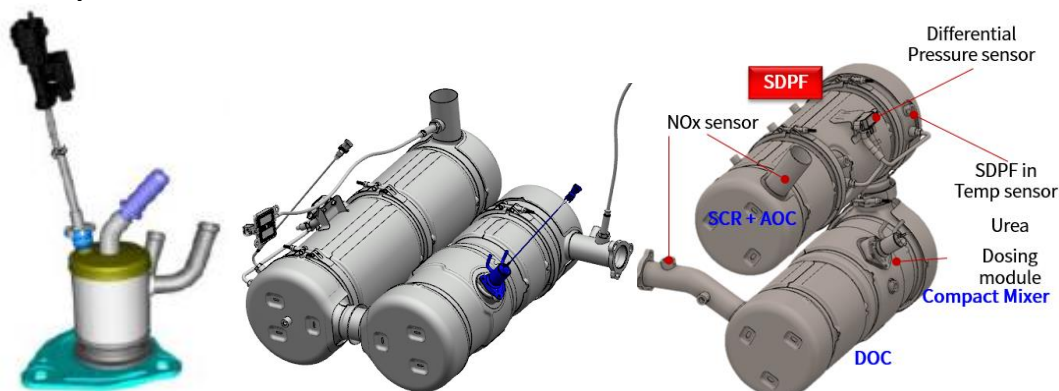
1) Overview

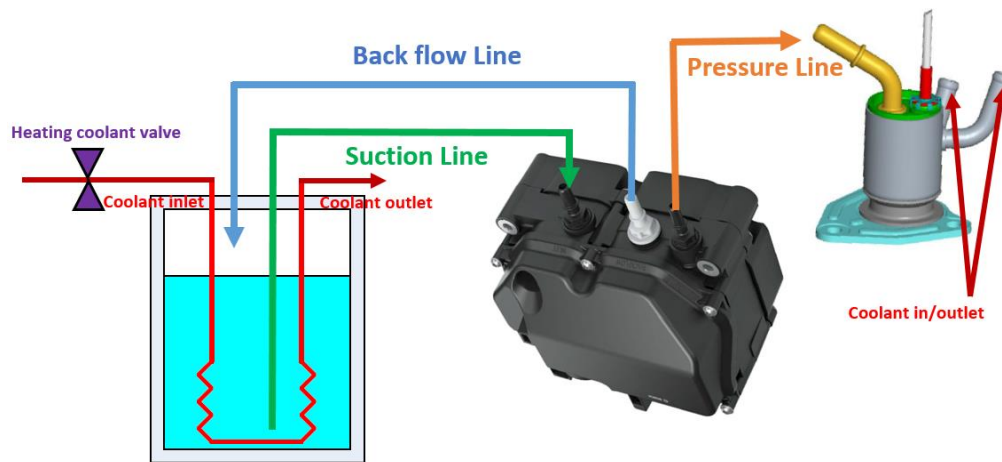
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E003361-27 | 1. DEF line problem (DEF hose line or DEF dosing valve is clogged) 2. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

|  | No. | ECU Pin | PIN description (DEF dosing valve) |
|---|-----|---------|------------------------------------|
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location





3) Condition for Running Diagnostic

Engine running and SCR "METERINGCONTROL" state

4) Condition for Setting the Fault Code

The DEF dosing valve will be blocked if no opening process is detected by the DEF dosing valve driver and the operating conditions are within the evaluation range.

It is a similar fault to judge the clogging of the DEF dosing valve as P204A (DEF pressure check error at DETECTIONMODE).

However, the diagnosis condition is different. The P204A diagnoses at DETECTIONMODE, P208E diagnoses at "METERINGCONTROL" state

5) Condition for Clearing the Fault Code

The DEF dosing valve is operated normally at "METERINGCONTROL" state.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|--------|
| 1 | P208E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module pressure by service tool Wait until pump working, need high engine speed Is pressure value abnormal? * Variable 1) DEF pressure (SCR_pUPmpP) | | Do necessary repair | Step 4 |
| 4 | Check DEF hose line is clogged or not. Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 5 |
| 5 | Perform DPF regeneration. You can do DPF regeneration by press DPF Regeneration enable switch in your machine or service tool. Fault is cleared? * DPF regeneration is performed to remove DEF deposits that may be remaining in the SCR system. | | Problem Solved | Step 6 |

| | | | | |
|---|--|--|--|-----------------------------|
| | DEF deposit may occur depending on the operating conditions of the equipment (low load only use) and ambient conditions (low outside temperature). | | | |
| 6 | Replace with another normal DEF dosing valve DEF dosing valve problem? | | Change DEF dosing valve | Step 7 |
| 7 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 8 |
| 8 | Check ECU connection Connection problem? | | Do necessary repair | Step 9 |
| 9 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF regeneration is replaced by the DeSOx (Desulfurization) function.

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)
- * Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)
- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),

※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater

8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

※ Forced DPF regeneration procedure

1. Engine full warm-up (at least Coolant temperature > 40degC)
2. If possible, Machine are located to outdoor. (HC odor due to post injection may be occurred during regeneration.)
3. Remove combustible material from around machine, especially around muffler. (The exhaust gas is kept at a high temperature during regeneration, typically DPF in temperature = 580 ~ 620 degC)
4. Keep machine at low idle. (Pedal position < 5%)
5. Operate the machine parking brake.
6. Press DPF regeneration demand switch on the Switch or Service tool to start. (Normally, DPF regeneration switch needs to be pressed for more than 3 seconds.)
7. Engine speed is increased during DPF regeneration, and it is returned to low idle when it is completed.

Below is a general Forced DPF regeneration mode. It could be different dependent on machine application.

DPF regeneration strategy – Service regeneration by Service tool

There are 5 steps for DPF regeneration by Service tool as below. For robust DPF regeneration, the DPF mode is divided with two step(low temperature and high temperature).

| Mode | Engine speed [rpm] | Temperature [degC] | Time [sec] |
|-------------------------------------|--------------------|-------------------------------------|-------------|
| Normal | Low idle | - | - |
| Forced Switch on DOC Heat-up | High idle | DOC inlet > 260°C | Nominal 100 |
| Forced Regeneration (Low temp.) | High idle | DPF inlet Low temp. = 520~530°C | 400 |
| Forced Regeneration (High temp.) | | DPF inlet High temp. = 580~640°C | Min 1800 |
| Cool down | 1500 | - | Min 100 |
| Normal | Low idle | - | - |
| Total Time [sec] | | Nominal | ~ 2300 |
| | | Max | 3000 |

• Service regeneration stop and not start condition

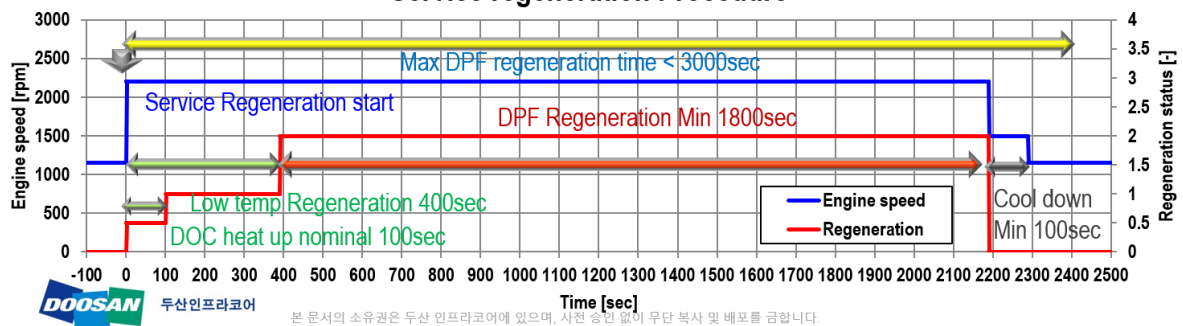
1. Coolant temperature is under 40degC
2. Parking brake is disengage
3. Pedal position is over 5%
4. Soot load mass over 150%

• Regeneration notice

1. Do not stop the engine
2. High exhaust gas temperature

- For effective DPF regeneration, high idle is recommended.
- Inhibit switch is designed as disabled when Service DPF regeneration is active. If serviceman want to disable Service DPF regeneration, press pedal over 5% or disengage parking brake or Key off are possible. But not recommended without special reason.

Service regeneration Procedure



| Fault Code | Fault Name |
|-----------------------|--|
| P1461 | DEF Reverting valve is blocked (Detected an insufficient pressure drop) |

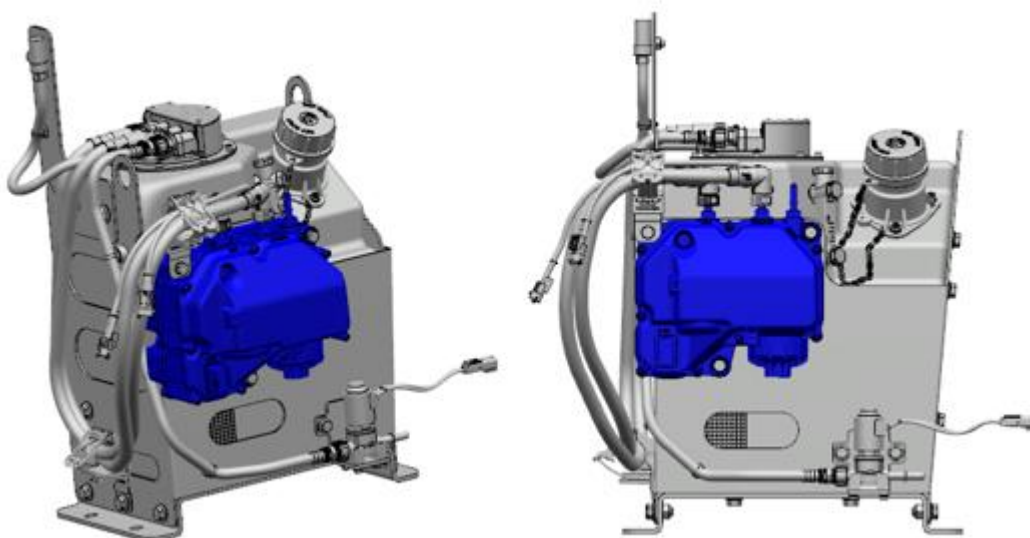
1) Overview

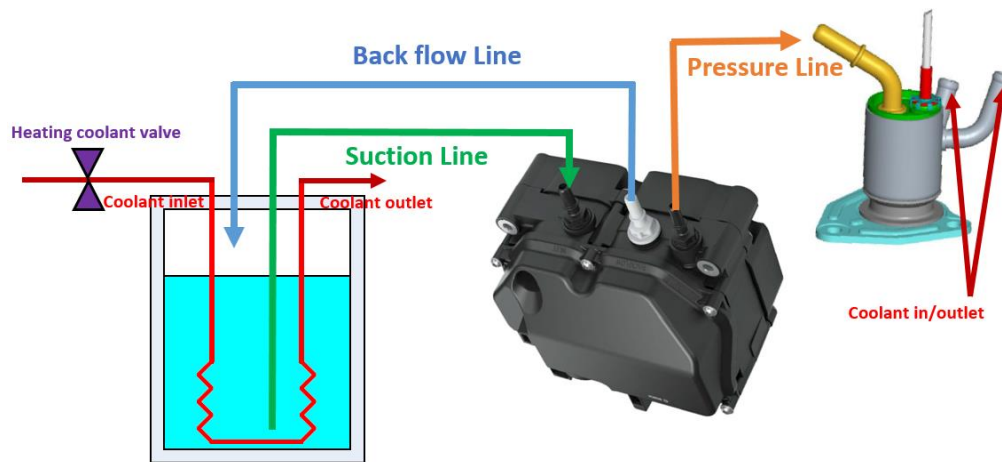
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|----------------------------------|
| E005436-14 | 1. The DEF Backflow hose line is clogged. 2. Electrical problem (Supply module connector, Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

Engine running and SCR "PRESSUREREDUCTION" state

4) Condition for Setting the Fault Code

The DEF pressure difference is lower than threshold (3bar) at "PRESSUREREDUCTION" state

It is a similar fault to judge the clogging back flow line as P1459 (DEF Pressure reduction error at PRESSUREREDUCTION). However, this fault is especially focused on judge of the DEF Reverting valve operation.

5) Condition for Clearing the Fault Code

The DEF pressure is dropped than threshold at "PRESSUREREDUCTION" state.

DEF in the line was normally returned to the tank.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--|------------------|
| 1 | P1461 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check back flow line of tank side Back flow line of tank side problem? | | Fix or change level sender of DEF tank | Step 4 |
| 4 | Check DEF hose line is clogged or not. (Especially Backflow line) Perform the SCR function test more than twice and then recheck the fault is occurred or not. * For the SCR function test : Don't need to check DEF quantity, this test is for checking SCR system. DEF hose line problem? | | Do necessary repair | Step 5 |
| 5 | Check Supply module connection (included DEF reverting valve) Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Step 7 |
| 7 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ **SCR function test by service tool (Emptying, Leak, Complete test)**

1. Test condition (Common)

- Only Key on status (Engine speed < 100rpm)
- SCR inlet temperature is low. (SCR inlet temperature < 300degC)
- DEF level is enough for test. (at least higher than warning step. Normally >25%)

2. SCR Emptying test

- Purpose : Emptying remain DEF of SCR system
- Test Procedure : Emptying (50sec)
- Normally use for the purpose of removing residual DEF for SCR system inspection and so on.

3. SCR Leak test by visual inspection

- Purpose : Perform a leak test by visual inspection
- Test Procedure : Pressure reduction (30sec), Pressure build up (Max 40sec), Leak test (60sec)
- There is no DEF emptying status. Therefore, if the Leak test is performed and the issue is closed, perform the Emptying test to remove the residual DEF.

4. SCR Complete test (incl. Dosing quantity test)

- Purpose : Perform full SCR control status included Dosing test
- Test Procedure : Emptying (30sec), Pressure build up (Max 40sec), Dosing test (Max 60sec), Emptying (50sec)

* Total injected DEF quantity (SCRPOD_qDosMeasAct) = 20g (400mg/s during 50sec)

- This test is used to verify that the SCR system normally has no problems in the sequence of pressure build-up, dosing injection, and emptying. Therefore, the DEF dosing quantity, please use to the reference only except the amount of DEF dosing is too small(<10g) or too large(>40g),


※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

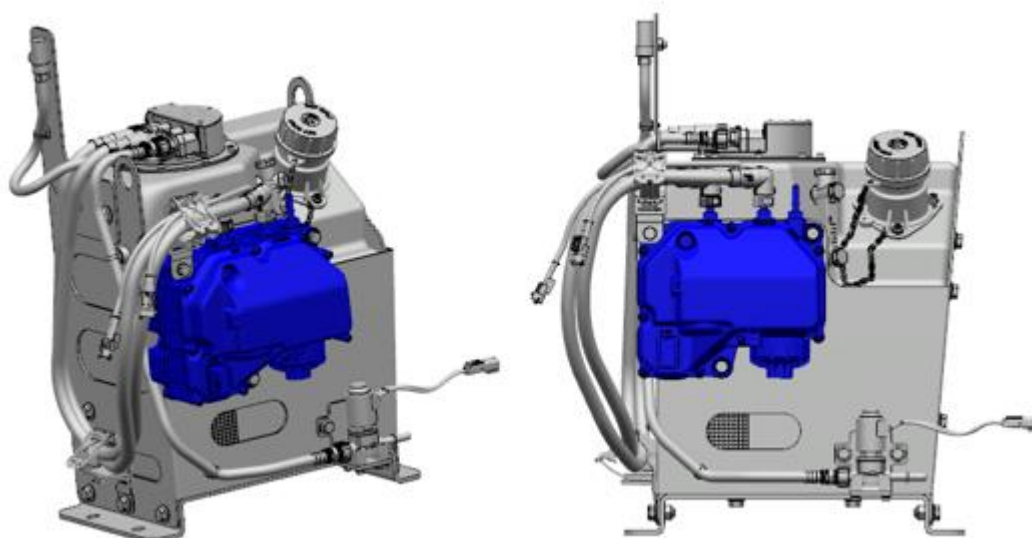
| Fault Code | Fault Name |
|-----------------------|---|
| P23B2 | DEF Supply module heater plausibility fault (Insufficient temperature increment) |

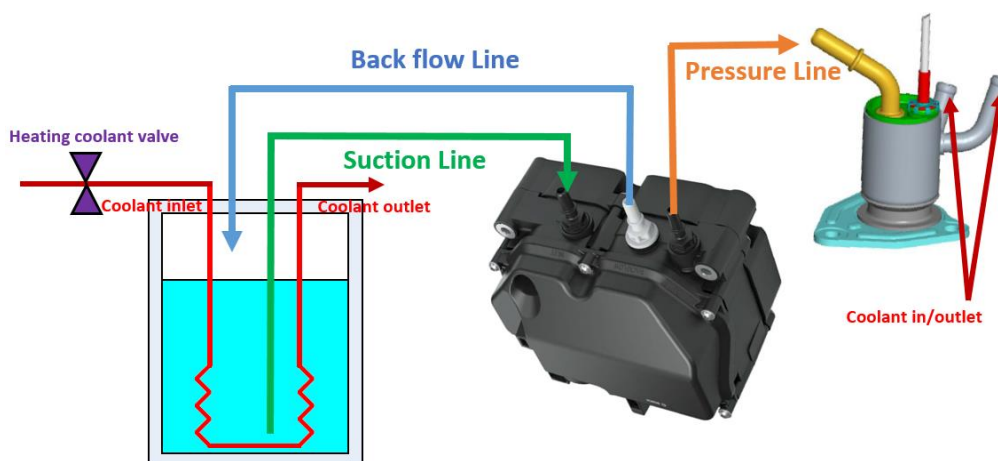
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------------|
| E005706-22 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location





3) Condition for Running Diagnostic

Supply module is defrosted and enabling conditions are fulfilled

- The supply module heater is switched on.
- The release state of DEF supply module heating is released.
- If the supply module is heated by engine coolant, then the coolant temperature has to exceed an threshold plus hysteresis (54.96°C)

4) Condition for Setting the Fault Code

After defrosting of the supply module the temperature of the supply module heater has not risen by the threshold (3°C) and the temperature of the supply module has not risen by the threshold (3°C).

5) Condition for Clearing the Fault Code

After defrosting of the supply module the temperature of the supply module heater and the temperature of supply module has risen by the threshold.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P23B2 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check relay & fuses Relay or fuses problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool


1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor

3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

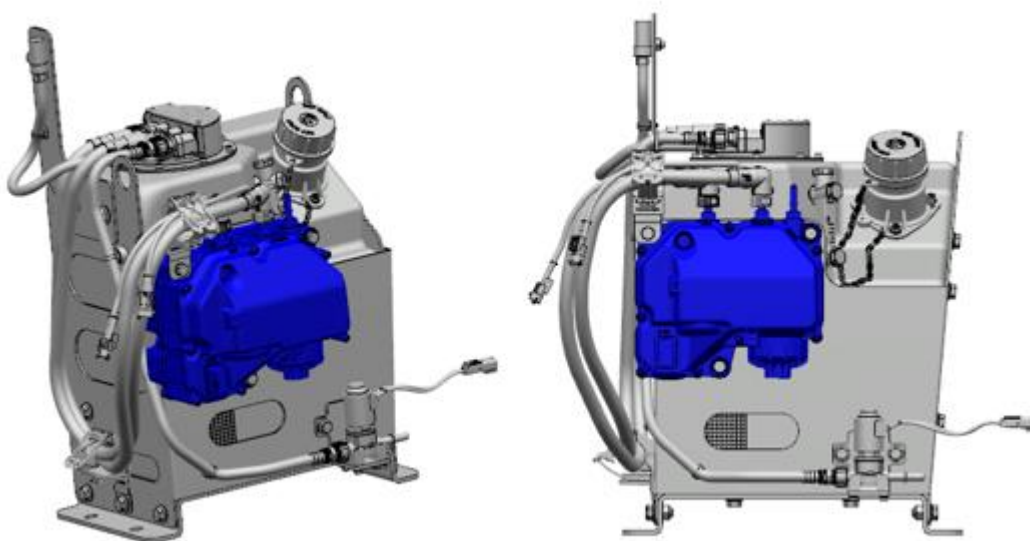
| Fault Code | Fault Name |
|-----------------------|---|
| P23B3 | DEF Supply module heater temperature plausibility fault (Insufficient temperature increment) |

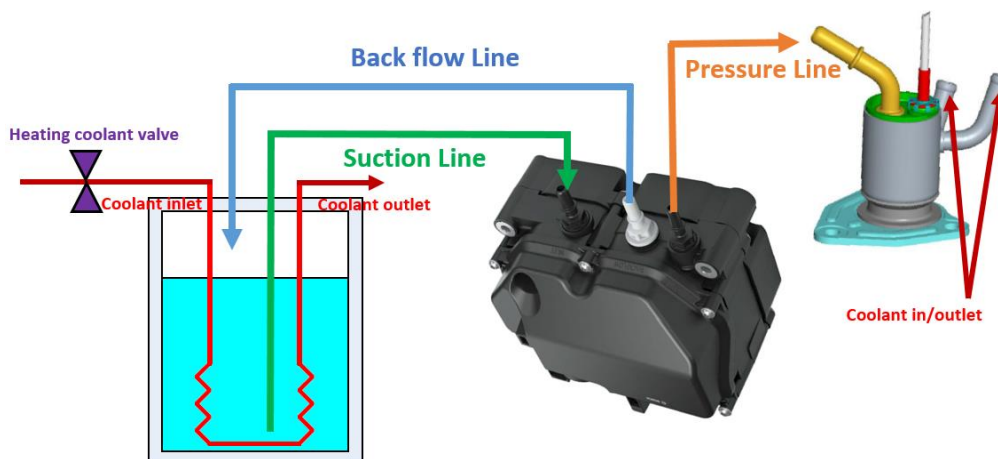
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------------|
| E005706-12 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location





3) Condition for Running Diagnostic

Supply module is defrosted and enabling conditions are fulfilled

- The supply module heater is switched on.
- The release state of DEF supply module heating is released.
- If the supply module is heated by engine coolant, then the coolant temperature has to exceed an threshold plus hysteresis (54.96°C)

4) Condition for Setting the Fault Code

After defrosting of the supply module the temperature of the supply module heater has not risen by the value (3°C) but the temperature of the supply module has risen.

5) Condition for Clearing the Fault Code

After defrosting of the supply module the temperature of the supply module heater and the temperature of supply module has risen by the threshold.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P23B3 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check relay & fuses Relay or fuses problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor

3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P23B4 | DEF Supply module heater temperature plausibility fault at cold start (Insufficient temperature increment) |

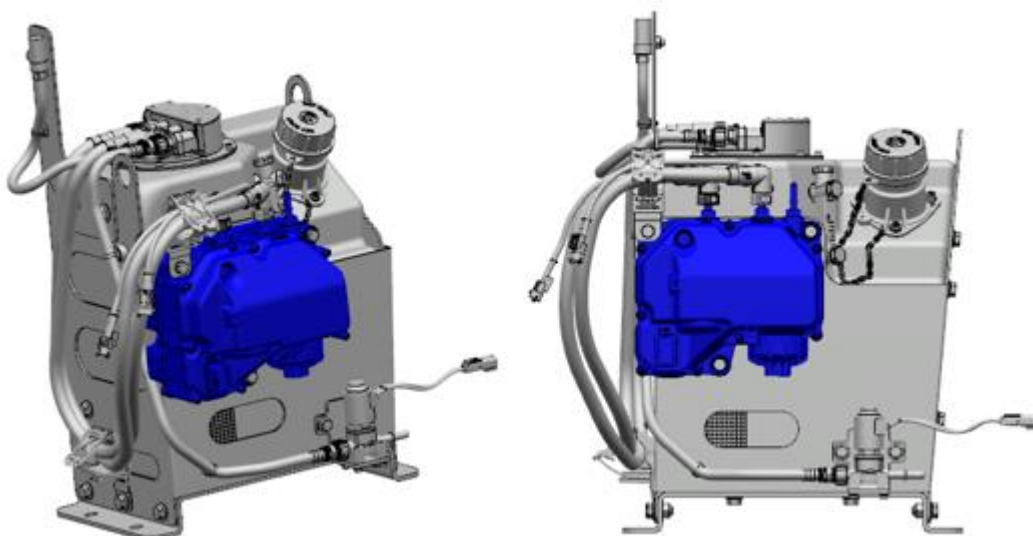
1) Overview

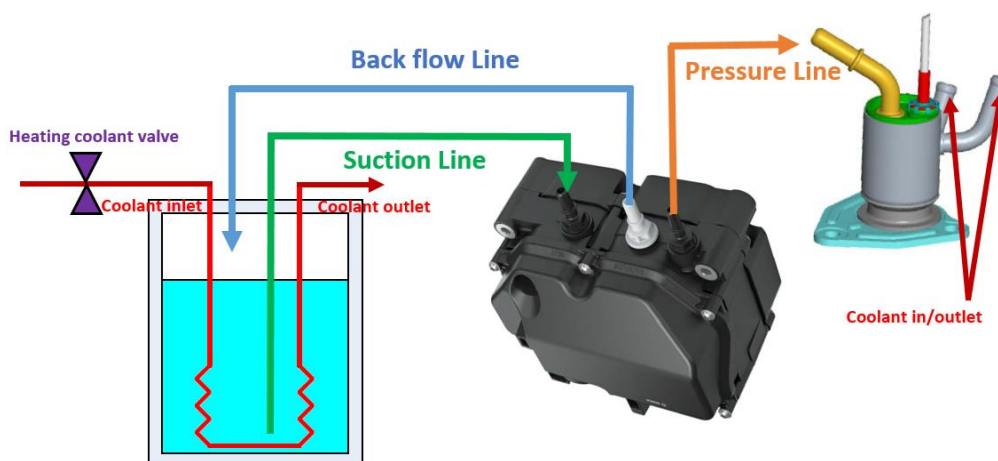
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E005706-14 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |



2) Component Location





3) Condition for Running Diagnostic

Engine cold start is detected and enabling conditions are fulfilled

- A cold start is detected. (The max difference of Coolant temp, SCR inlet temp, Environment temperature is within 5degC.)
- The DEF supply module heater is switched off
- The release state of DEF supply module heating is locked.

4) Condition for Setting the Fault Code

The difference between the supply module heater temperature and the ambient air temperature is greater than a threshold (10°C).

It means that check the sensor drift when the machine is at cold soaking condition.

5) Condition for Clearing the Fault Code

The difference between the supply module heater temperature and the ambient air temperature is within a threshold (10°C).

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P23B4 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check relay & fuses Relay or fuses problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P23B5 | DEF Supply module temperature plausibility fault (Insufficient temperature increment) |

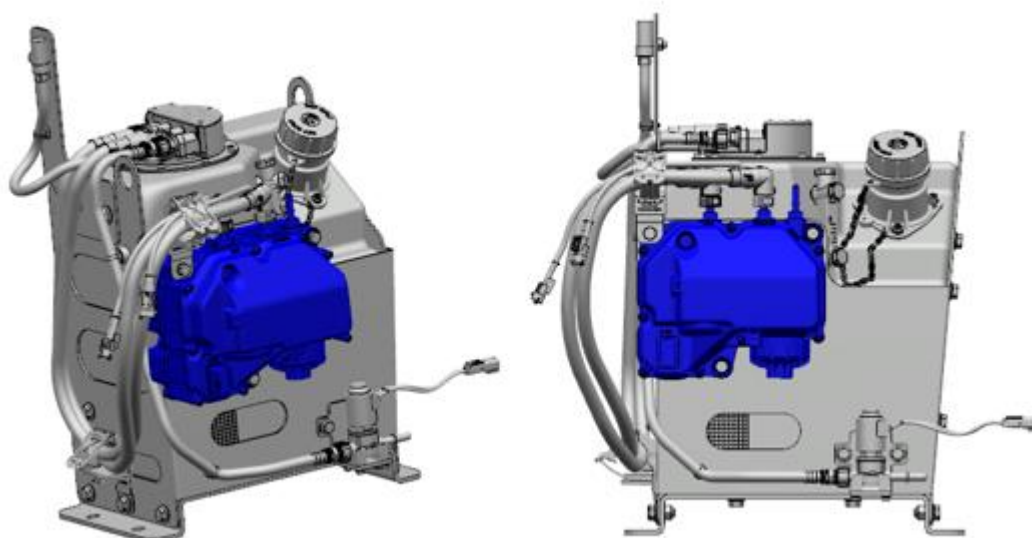
1) Overview

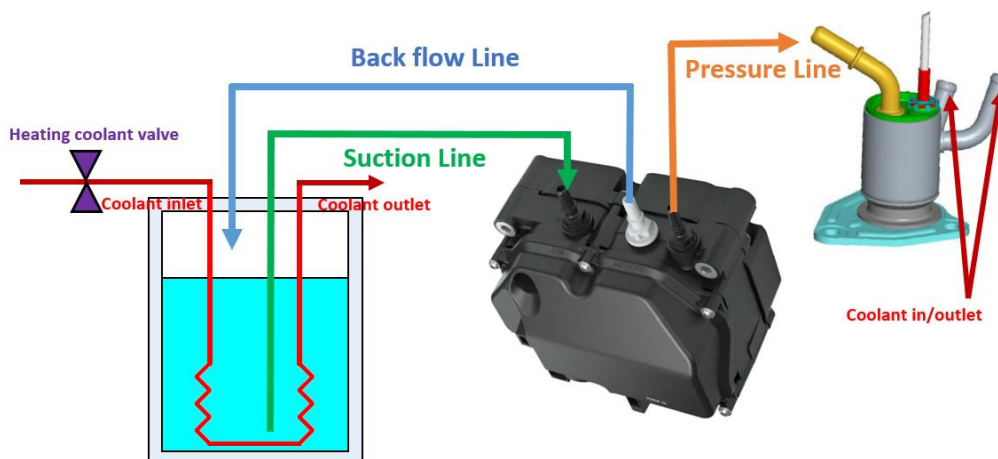
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------------|
| E007107-12 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |



2) Component Location





3) Condition for Running Diagnostic

Supply module is defrosted and enabling conditions are fulfilled

- The supply module heater is switched on.
- The release state of DEF supply module heating is released.
- If the supply module is heated by engine coolant, then the coolant temperature has to exceed an threshold plus hysteresis (54.96°C)

4) Condition for Setting the Fault Code

After defrosting of the supply module the temperature of the supply module has not risen by the value (3°C) but the temperature of the supply module heater has risen.

5) Condition for Clearing the Fault Code

After defrosting of the supply module the temperature of the supply module and the temperature of supply module heater has risen by the threshold.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P23B5 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check relay & fuses Relay or fuses problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool


1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor

3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

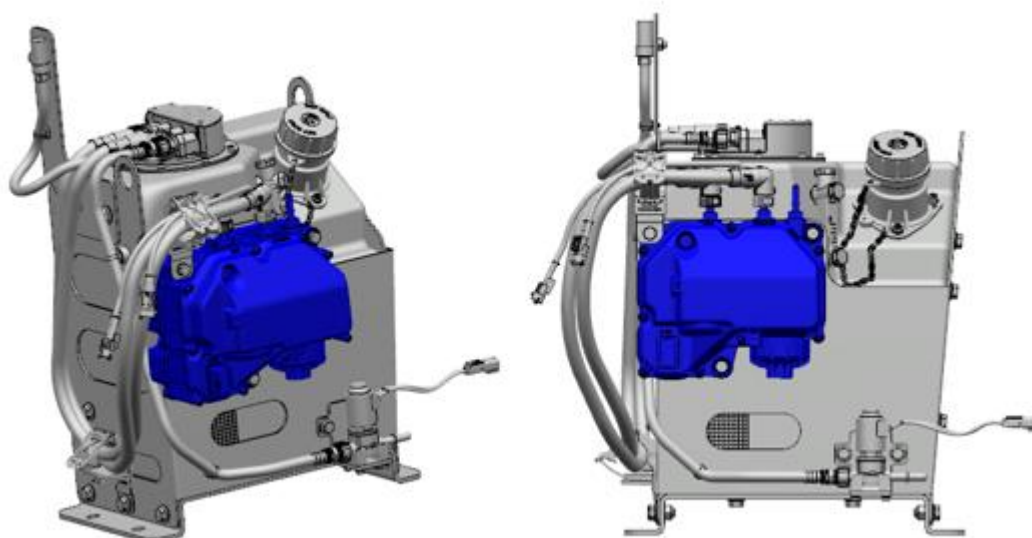
| Fault Code | Fault Name |
|-----------------------|---|
| P23B6 | DEF Supply module temperature plausibility fault at cold start (Insufficient temperature increment) |

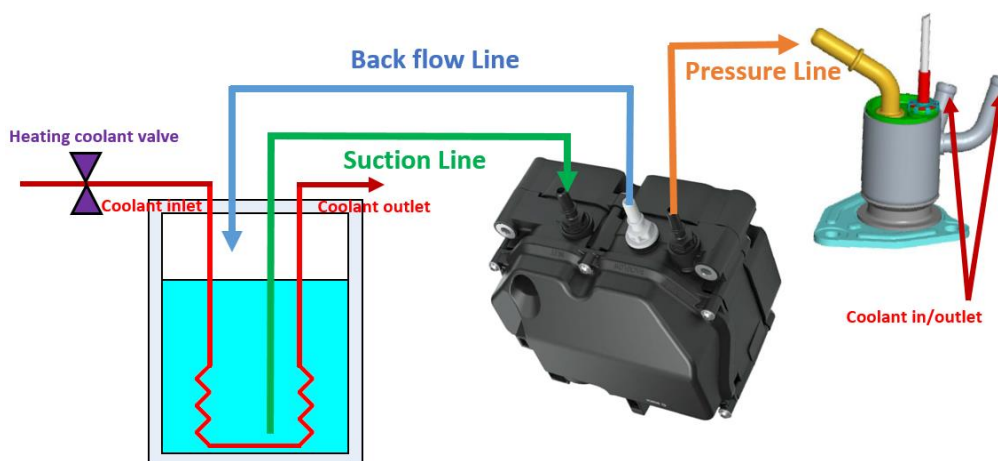
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E007107-14 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location





3) Condition for Running Diagnostic

Engine cold start is detected and enabling conditions are fulfilled

- A cold start is detected. (The max difference of Coolant temp, SCR inlet temp, Environment temperature is within 5degC.)
- The supply module heater is switched off
- The release state of DEF supply module heating is locked.

4) Condition for Setting the Fault Code

The difference between the supply module temperature and the ambient air temperature is greater than a threshold (10°C).

It means that check the sensor drift when the machine is at cold soaking condition.

5) Condition for Clearing the Fault Code

The difference between the supply module temperature and the ambient air temperature is within a threshold (10°C).

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P23B6 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check relay & fuses Relay or fuses problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

P1227

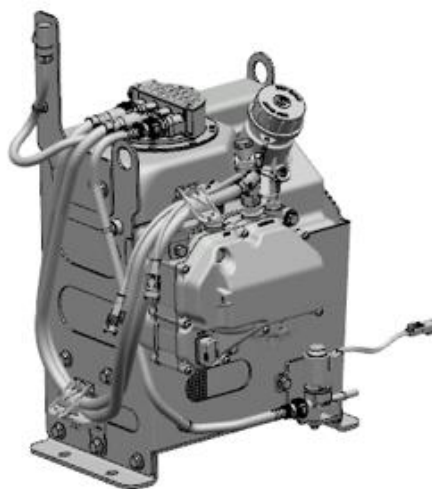
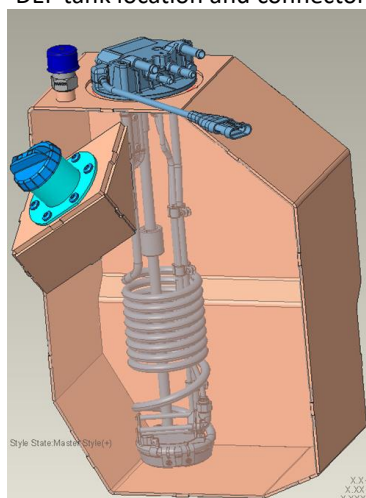
1) Overview

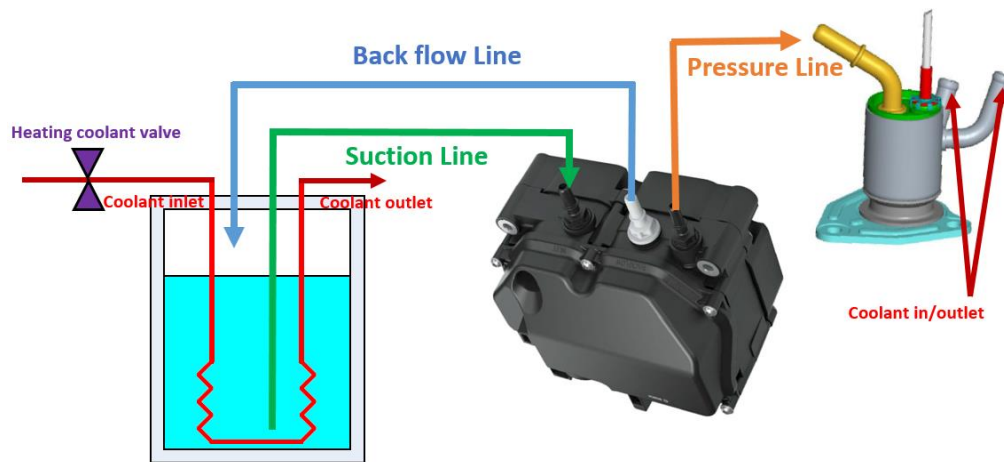
E004365-14

The pin definition is dependent on the DEF tank type.

2) Component Location

DEF tank location and connector is dependent on machine application.





3) Condition for Running Diagnostic

This monitoring will run only under the following condition:

- DEF Tank heater(Coolant valve) is activated
- The remaining DEF tank level is higher than threshold (20%)
- DEF Tank temperature is lower than -16°C. or higher than -8°C
- DEF Tank temperature is lower than 20degC.
- The engine coolant temperature is greater than 49.96 °C

4) Condition for Setting the Fault Code

The DEF tank temperature has not risen by the threshold(3degC) and within 1000~3000sec.

(dependent on DEF Tank temperature)

The DEF tank temperature is not risen as expected.

5) Condition for Clearing the Fault Code

The DEF tank temperature is risen as expected.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|------------------------|------------------|
| 1 | P1227 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the coolant valve Coolant valve problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF temperature Temperature it really too high? | | Check cooling system | Step 5 |
| 5 | Check sensor connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Check ECU connection Connection problem? | | Do necessary repair | Step 7 |
| 7 | Replace DEF Tank module DEF Tank module problem? | | Change DEF Tank Module | Contact Helpdesk |

※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|------------------------------------|
| P21C7 | SCR system Main relay open circuit |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E005965-05 | 1. Electrical problem (Battery supply into the SCR Main relay) 2. Electrical problem (Faulty SCR main relay, Wiring harness related SCR Main relay) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| No | ECU Pin | Description |
|----|---------|-----------------------|
| 1 | K18 | SCR system Main relay |

2) Component Location



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The relay control output is opened.

5) Condition for Clearing the Fault Code

The relay control output wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|--------|
| 1 | P21C7 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check relay connection (included fuse) Connection problem? | | Do necessary repair | Step 4 |

| | | | | |
|----------|---|--|--------------------------------|-----------------------------|
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace the relay Relay problem? | | Do necessary repair | Step 6 |
| 6 | Replace the ECU. Is fault clear? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P21C9 | SCR system Main relay short circuit to battery |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E005965-03 | 1. Electrical problem (Battery supply into the SCR Main relay) 2. Electrical problem (Faulty SCR main relay, Wiring harness related SCR Main relay) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| No | ECU Pin | Description |
|----|---------|-----------------------|
| 1 | K18 | SCR system Main relay |

2) Component Location



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The relay control output is shorted to battery.

5) Condition for Clearing the Fault Code

The relay control output wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|--------|
| 1 | P21C9 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check relay connection (included fuse) Connection problem? | | Do necessary repair | Step 4 |

| | | | | |
|----------|---|--|--------------------------------|-----------------------------|
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace the relay Relay problem? | | Do necessary repair | Step 6 |
| 6 | Replace the ECU. Is fault clear? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P21C8 | SCR system Main relay short circuit to ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E005965-04 | 1. Electrical problem (Battery supply into the SCR Main relay) 2. Electrical problem (Faulty SCR main relay, Wiring harness related SCR Main relay) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| No | ECU Pin | Description |
|----|---------|-----------------------|
| 1 | K18 | SCR system Main relay |

2) Component Location



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The relay control output is shorted to ground.

5) Condition for Clearing the Fault Code

The relay control output wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|--------|
| 1 | P21C8 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check relay connection (included fuse) Connection problem? | | Do necessary repair | Step 4 |

| | | | | |
|----------|---|--|--------------------------------|-----------------------------|
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace the relay Relay problem? | | Do necessary repair | Step 6 |
| 6 | Replace the ECU. Is fault clear? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-----------------------------|
| P1230 | DEF Tank Level Signal error |

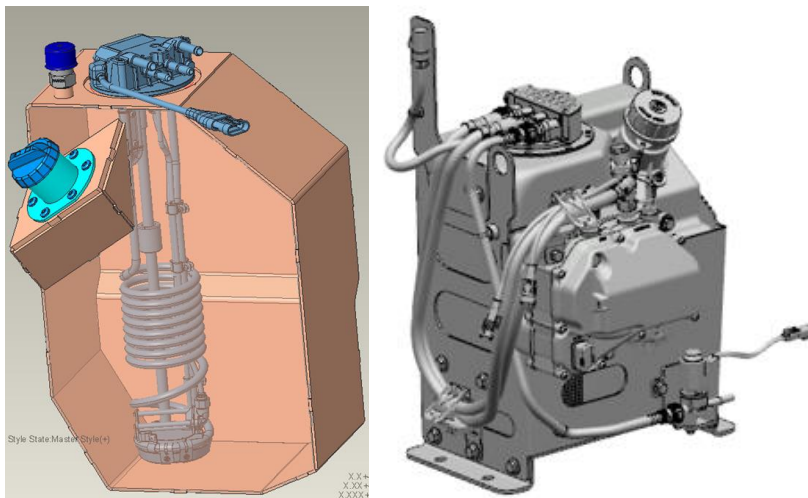
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E001761-19 | 1. Electrical problem (DEF level sensor, Wiring harness in the DEF module) 2. Electrical problem (CAN wiring harness-insulation, Resistance) | Inducement Group5 (Tampering) |

| The pin definition is dependent on the DEF tank type. | No | Description |
|---|----|--------------|
| | 1 | Battery +12V |
| | 2 | Ground |
| | 3 | CAN Low |
| | 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

The signal source is configured to be coming from CAN module. The frequency of testing depends on the scheduling time of the process

4) Condition for Setting the Fault Code

The signal from CAN of DEF tank level is equal to 0x7FFF(0xFFFF). (Not available)

5) Condition for Clearing the Fault Code

The signal from CAN of DEF tank level is working normally.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|------------|----------------|-----|----|
|------|------------|----------------|-----|----|

| | | | | |
|----------|---|--|---------------------------------------|-----------------------------|
| 1 | P1230 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace DEF Tank module DEF Tank module problem? | | Change DEF Tank Module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P20AC | DEF Supply module heater temperature duty cycle in failure range |

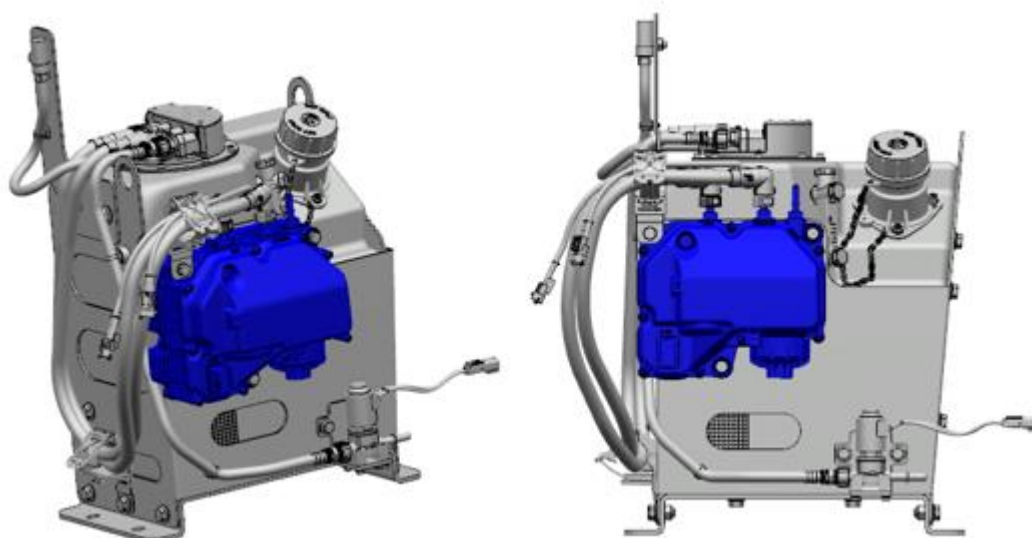
1) Overview

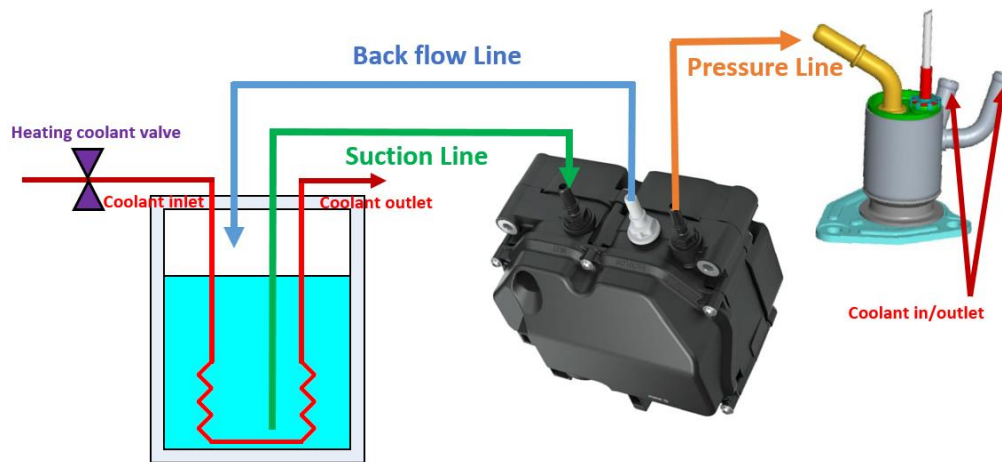
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E007538-22 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |



2) Component Location





3) Condition for Running Diagnostic

The DEF Supply module temperature measurement is enabled and received PWM signal is working normally.

4) Condition for Setting the Fault Code

The received DEF supply module heater temperature duty cycle is in the failure range (90~95%).

5) Condition for Clearing the Fault Code

The received DEF supply module heater temperature duty cycle is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20AC is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P20AD | DEF Supply module heater temperature duty cycle in invalid range |

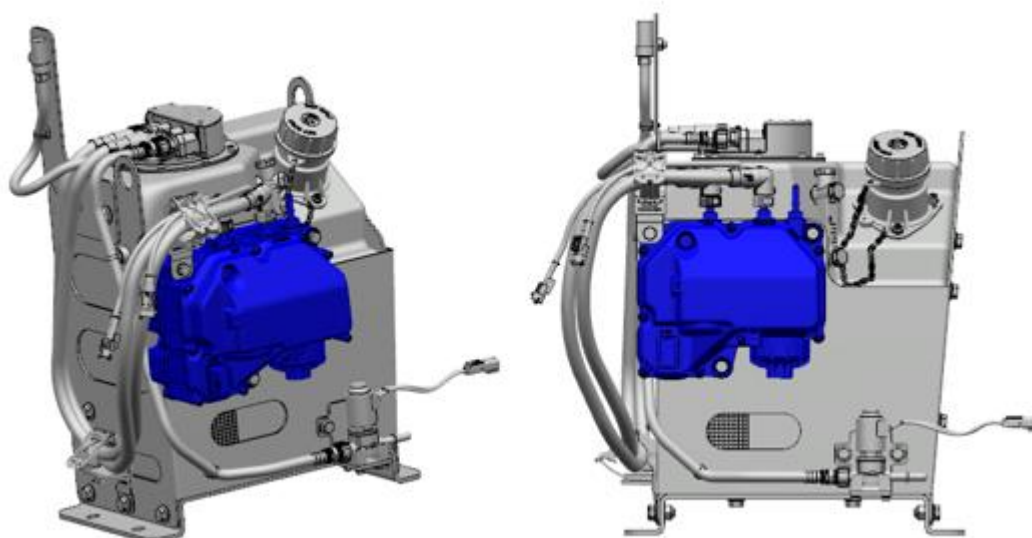
1) Overview

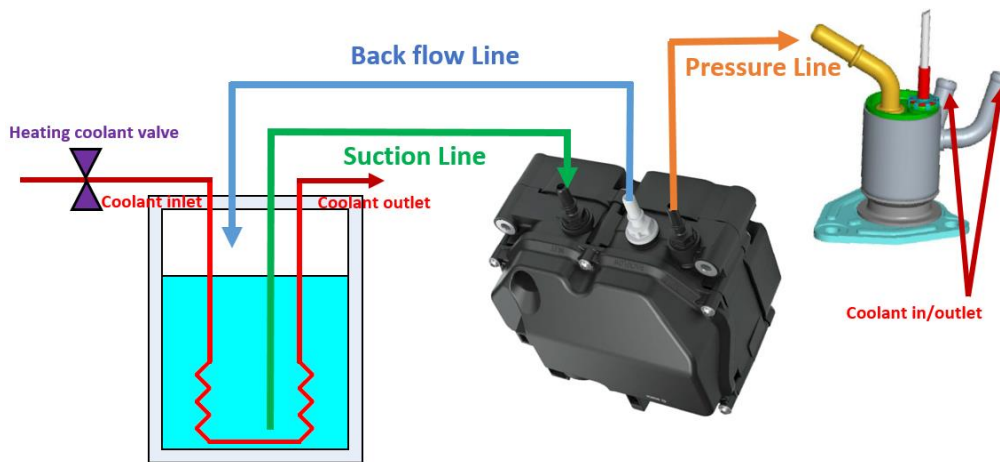
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--------------------------------------|
| E007538-23 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |



2) Component Location





3) Condition for Running Diagnostic

The DEF Supply module temperature measurement is enabled and received PWM signal is working normally.

4) Condition for Setting the Fault Code

The received DEF supply module heater temperature duty cycle is in the invalid range.

- 1) DEF supply module heater temperature duty cycle < 15% or
- 2) DEF supply module heater temperature duty cycle (85~90%) or
- 3) DEF supply module heater temperature duty cycle > 95%

5) Condition for Clearing the Fault Code

The received DEF supply module heater temperature duty cycle is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20AD is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P20B0 | DEF Supply module temperature measurement non availability fault |

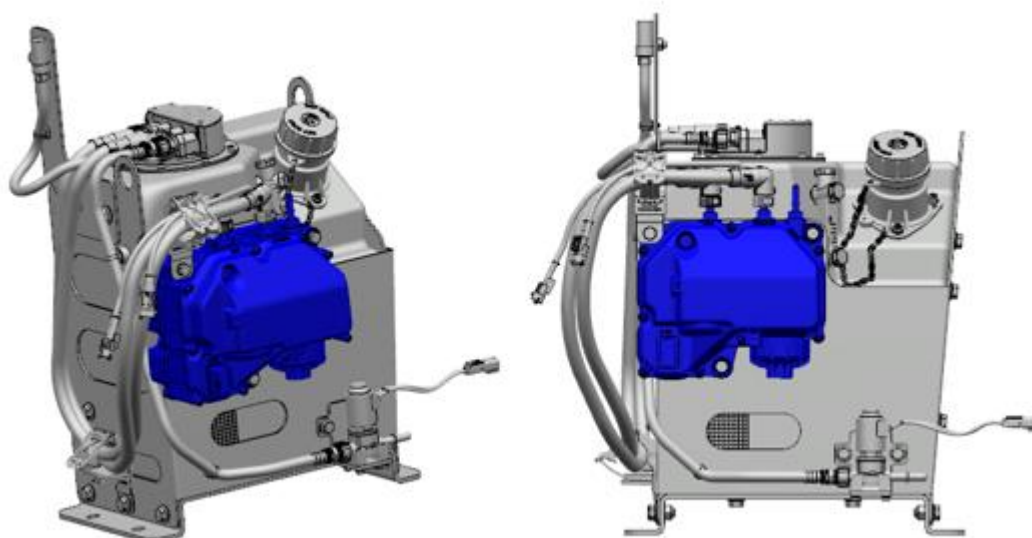
1) Overview

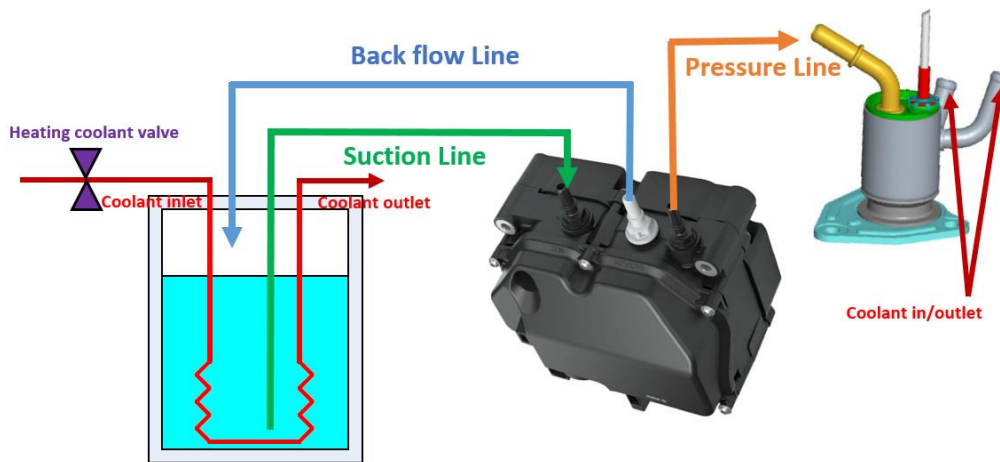
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E007538-24 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |



2) Component Location





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF supply module temperature measurement is not enabled even after sending start sequence for maximum number of times.

5) Condition for Clearing the Fault Code

The DEF supply module temperature duty cycle is enabled within threshold times.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20B0 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P20FF | DEF Supply module time period outside specified range |

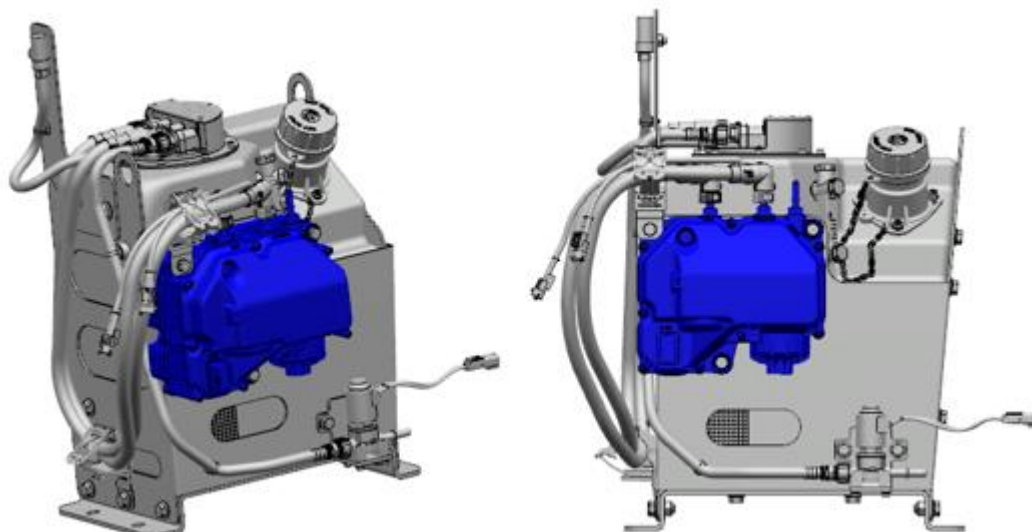
1) Overview

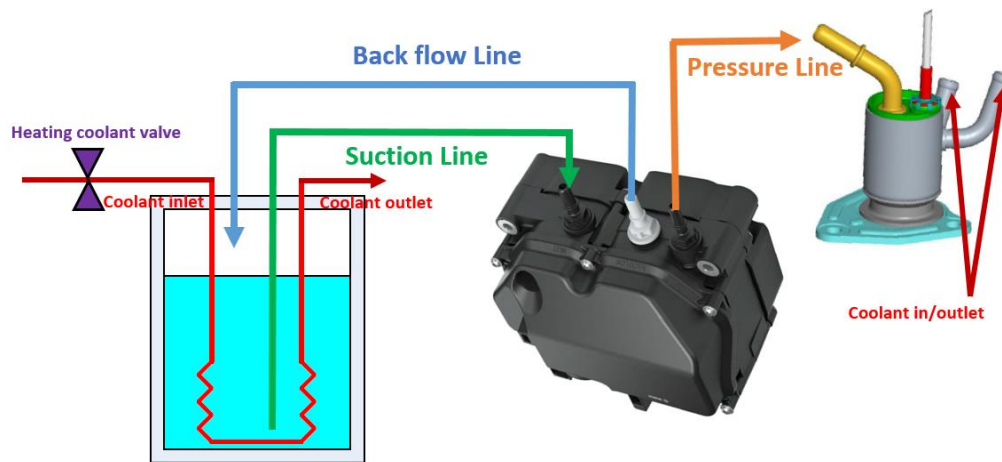
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E007538-25 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side | No. | ECU Pin | Description (DEF Supply module) |
|------------------------|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |



2) Component Location





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The time period of the received DEF supply module PWM signal is out of the specified range of 150ms to 250ms.

5) Condition for Clearing the Fault Code

The time period of the received DEF supply module PWM signal is within normal operation range.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20FF is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

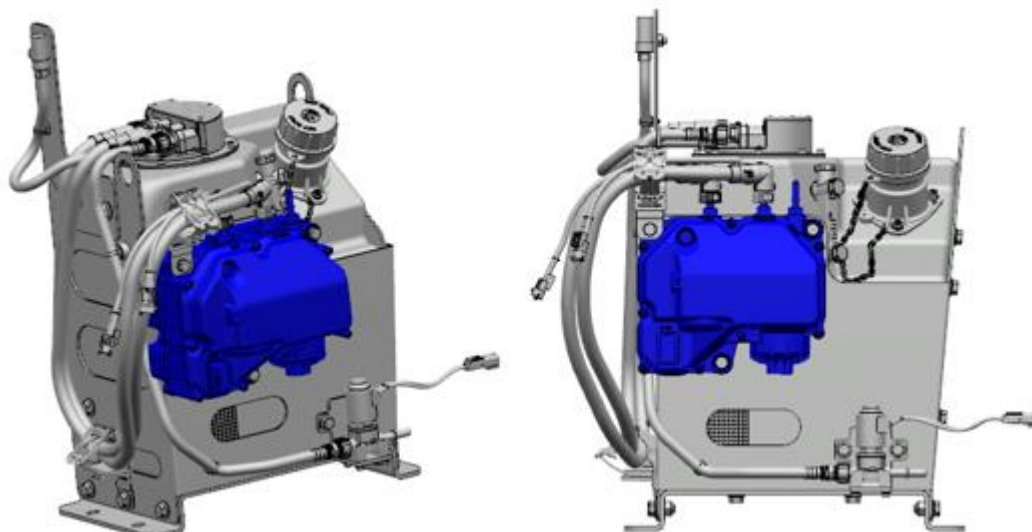
| Fault Code | Fault Name |
|-----------------------|------------------------------------|
| P056D | DEF Supply module PWM signal fault |

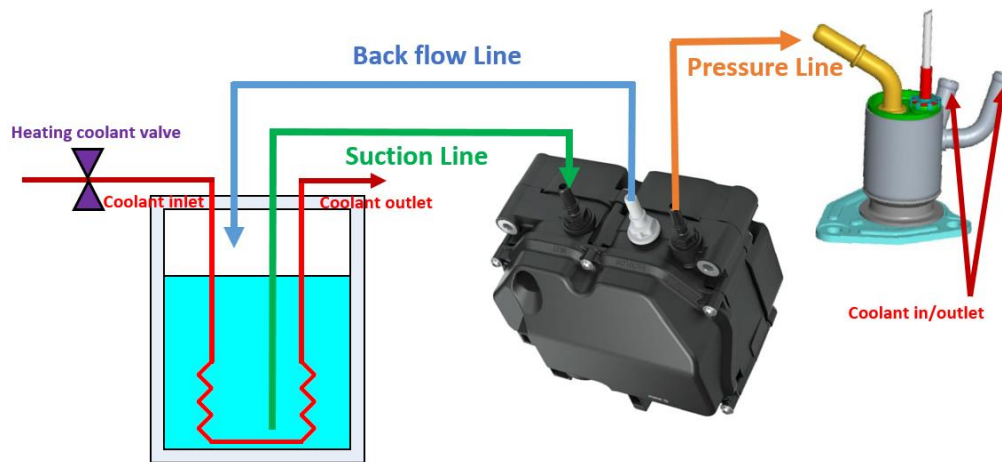
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E007538-26 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF supply module PWM signal is not valid.

- 1) The valid sync is not received. or
- 2) The two sync signals or two temperature information signals are received consecutively. or
- 3) The valid sync and temperature signal for only one information is received consecutively .

5) Condition for Clearing the Fault Code

The DEF supply module PWM signal is valid.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P056D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

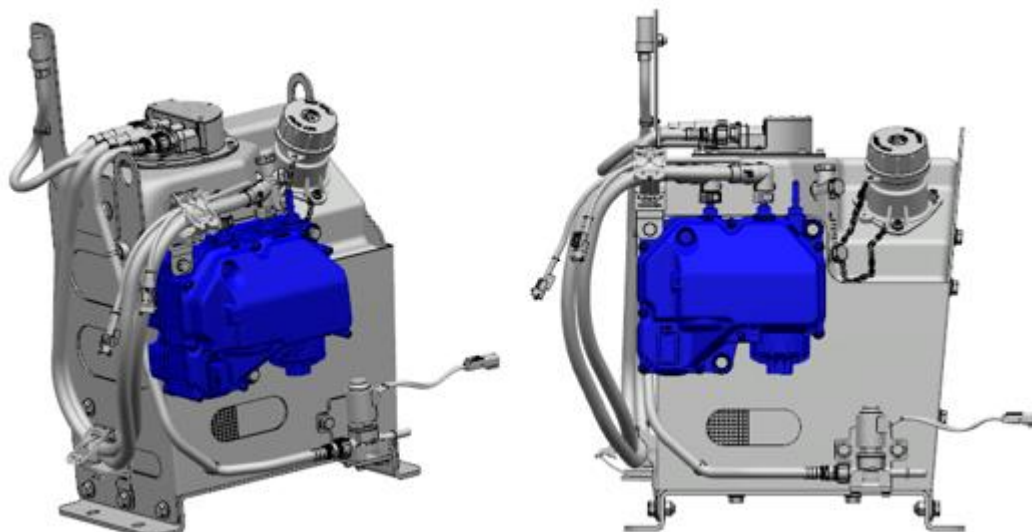
| Fault Code | Fault Name |
|-----------------------|---|
| P06F0 | DEF Supply module temperature duty cycle in failure range |

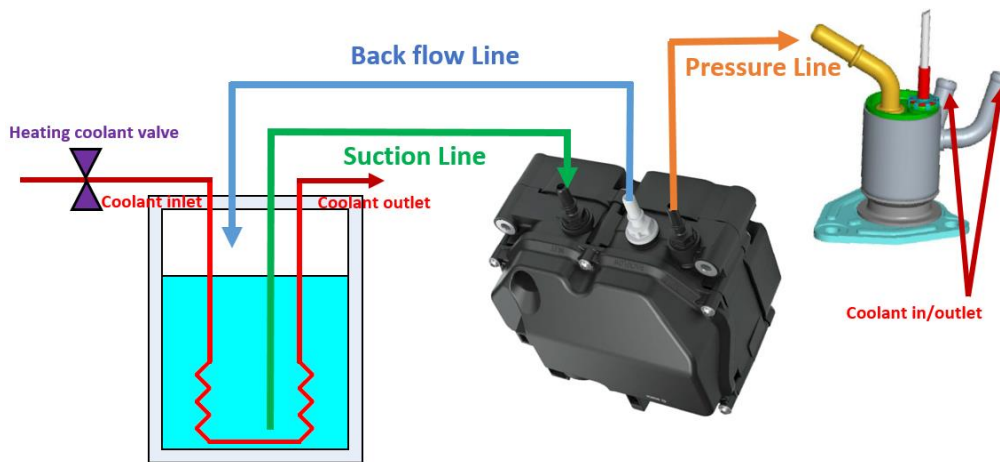
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E007538-12 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| | | | |
|--|-----|---------|--|
| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location





3) Condition for Running Diagnostic

The DEF Supply module temperature measurement is enabled and received PWM signal is working normally.

4) Condition for Setting the Fault Code

The received DEF supply module temperature duty cycle is in the failure range (90~95%).

5) Condition for Clearing the Fault Code

The received DEF supply module temperature duty cycle is within normal operation range.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P06F0 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

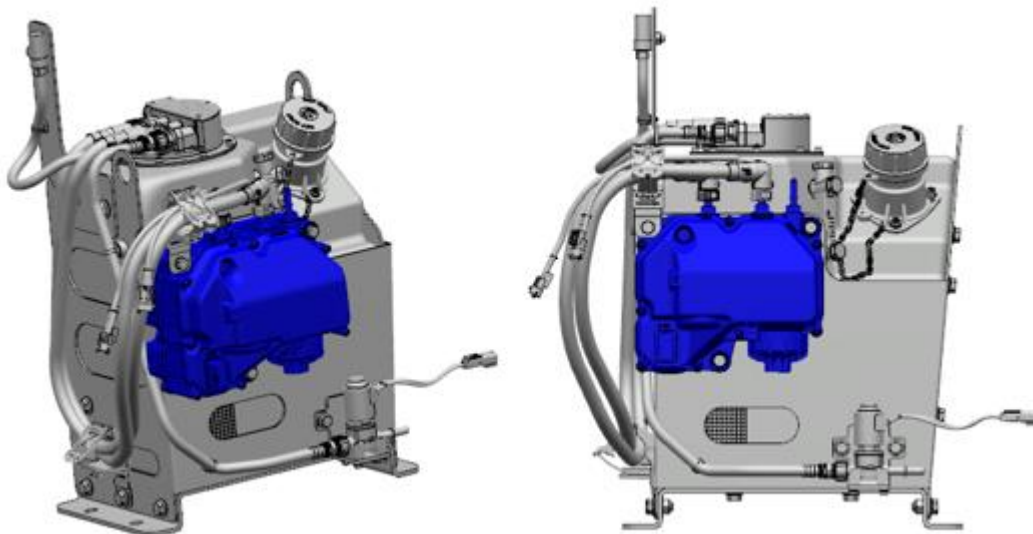
| Fault Code | Fault Name |
|-----------------------|---|
| P06F1 | DEF Supply module temperature duty cycle in invalid range |

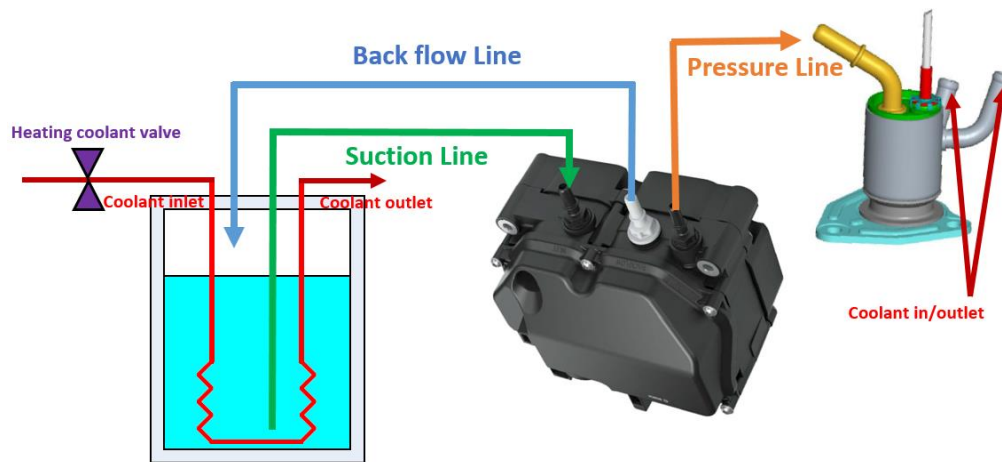
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E007538-13 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location





3) Condition for Running Diagnostic

The DEF Supply module temperature measurement is enabled and received PWM signal is working normally.

4) Condition for Setting the Fault Code

The received DEF supply module temperature duty cycle is in the invalid range.

- 1) DEF supply module temperature duty cycle < 15% or
- 2) DEF supply module temperature duty cycle (85~90%) or
- 3) DEF supply module temperature duty cycle > 95%

5) Condition for Clearing the Fault Code

The received DEF supply module temperature duty cycle is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | 06F1 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0123 | Accel pedal position track1 sensor High fault |

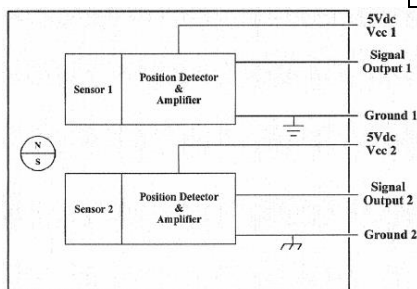
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000091-03 | 1. Electrical problem (Faulty Pedal track1 sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector , Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type

| No | ECU Pin | Description |
|----|---------|---------------------------------------|
| 1 | K41 | Accel Pedal Sensor track1 Supply (5V) |
| 2 | K25 | Accel Pedal Sensor track1 Signal |
| 3 | K24 | Accel Pedal Sensor track1 Ground |
| 4 | K07 | Accel Pedal Sensor track2 Supply (5V) |
| 5 | K27 | Accel Pedal Sensor track2 Signal |
| 6 | K26 | Accel Pedal Sensor track2 Ground |



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The accel pedal position track1 sensor signal is higher than maximum threshold. (5V)

5) Condition for Clearing the Fault Code

The accel pedal position sensor signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0123 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|---|-------------------------|
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool.. Input values have difference? (based on characteristic) * Variables 1) Accel Pedal Track1 signal (APP_uRaw1) 2) Accel Pedal Track2 signal (APP_uRaw2) 3) Accel Pedal Position (APP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check connection between ECU and Accel pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P0223 | Accel pedal position track2 sensor High fault |

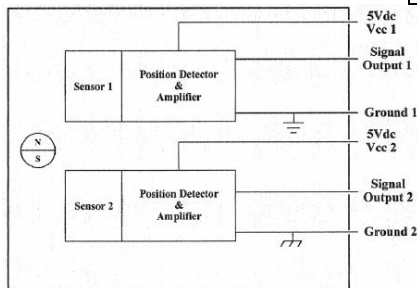
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000029-03 | 1. Electrical problem (Faulty Pedal track2 sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector , Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type

| No | ECU Pin | Description |
|----|---------|---------------------------------------|
| 1 | K41 | Accel Pedal Sensor track1 Supply (5V) |
| 2 | K25 | Accel Pedal Sensor track1 Signal |
| 3 | K24 | Accel Pedal Sensor track1 Ground |
| 4 | K07 | Accel Pedal Sensor track2 Supply (5V) |
| 5 | K27 | Accel Pedal Sensor track2 Signal |
| 6 | K26 | Accel Pedal Sensor track2 Ground |



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The accel pedal position track2 sensor signal is higher than maximum threshold. (5V)

5) Condition for Clearing the Fault Code

The accel pedal position sensor signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0223 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|---|-------------------------|
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool.. Input values have difference? (based on characteristic) * Variables 1) Accel Pedal Track1 signal (APP_uRaw1) 2) Accel Pedal Track2 signal (APP_uRaw2) 3) Accel Pedal Position (APP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check connection between ECU and Accel pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P0121 | Hand pedal position track1 sensor High fault |

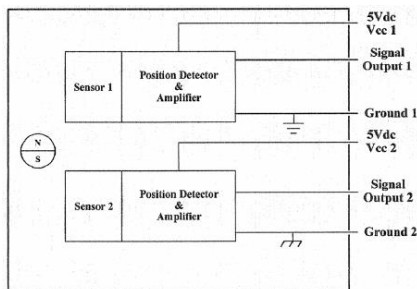
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000091-15 | 1. Electrical problem (Faulty Pedal track1 sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type

| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A19 | Hand Pedal Sensor track1 Supply (5V) |
| 2 | A77 | Hand Pedal Sensor track1 Signal |
| 3 | A28 | Hand Pedal Sensor track1 Ground |
| 4 | A41 | Hand Pedal Sensor track2 Supply (5V) |
| 5 | A13 | Hand Pedal Sensor track2 Signal |
| 6 | A12 | Hand Pedal Sensor track2 Ground |



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The hand pedal position track1 sensor signal is higher than maximum threshold. (5V)

5) Condition for Clearing the Fault Code

The hand pedal position sensor signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0121 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|--|---|-------------------------|
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool. Input values have difference? (based on characteristic) * Variables 1) Hand Pedal Track1 signal (RmtAPP_uRaw1) 2) Hand Pedal Track2 signal (RmtAPP_uRaw2) 3) Hand Pedal Position (RmtAPP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check connection between ECU and hand pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

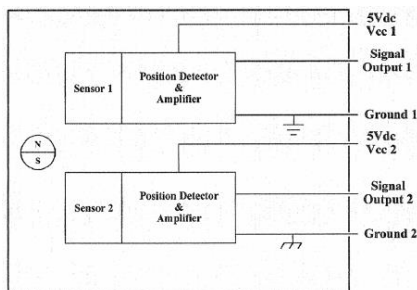
| Fault Code | Fault Name |
|-----------------------|--|
| P0221 | Hand pedal position track2 sensor High fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000029-15 | 1. Electrical problem (Faulty Pedal track2 sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type



| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A19 | Hand Pedal Sensor track1 Supply (5V) |
| 2 | A77 | Hand Pedal Sensor track1 Signal |
| 3 | A28 | Hand Pedal Sensor track1 Ground |
| 4 | A41 | Hand Pedal Sensor track2 Supply (5V) |
| 5 | A13 | Hand Pedal Sensor track2 Signal |
| 6 | A12 | Hand Pedal Sensor track2 Ground |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The hand pedal position track2 sensor signal is higher than maximum threshold. (5V)

5) Condition for Clearing the Fault Code

The hand pedal position sensor signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------------------|----------------|
| 1 | P0221 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool. Input values have difference? (based on characteristic) * Variables 1) Hand Pedal Track1 signal (RmtAPP_uRaw1) 2) Hand Pedal Track2 signal (RmtAPP_uRaw2) 3) Hand Pedal Position (RmtAPP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 | | Fix the fault based on its | Step 5 |

| | | | | |
|----------|---|--|----------------------------------|-----------------------------|
| | 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | troubleshooting guide | |
| 5 | Check connection between ECU and hand pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P0122 | Accel pedal position track1 sensor Low fault |

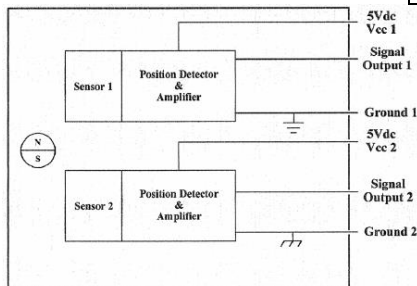
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000091-04 | 1. Electrical problem (Faulty Pedal track1 sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector , Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type

| No | ECU Pin | Description |
|----|---------|---------------------------------------|
| 1 | K41 | Accel Pedal Sensor track1 Supply (5V) |
| 2 | K25 | Accel Pedal Sensor track1 Signal |
| 3 | K24 | Accel Pedal Sensor track1 Ground |
| 4 | K07 | Accel Pedal Sensor track2 Supply (5V) |
| 5 | K27 | Accel Pedal Sensor track2 Signal |
| 6 | K26 | Accel Pedal Sensor track2 Ground |



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The accel pedal position track1 sensor signal is lower than minimum threshold. (0V)

5) Condition for Clearing the Fault Code

The accel pedal position sensor signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0122 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|---|-------------------------|
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool.. Input values have difference? (based on characteristic) * Variables 1) Accel Pedal Track1 signal (APP_uRaw1) 2) Accel Pedal Track2 signal (APP_uRaw2) 3) Accel Pedal Position (APP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check connection between ECU and Accel pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P0222 | Accel pedal position track2 sensor Low fault |

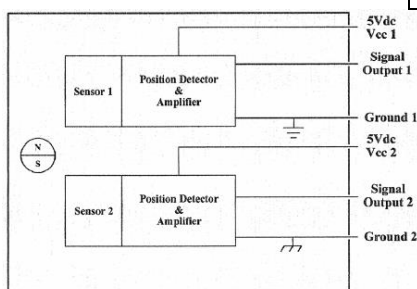
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000029-04 | 1. Electrical problem (Faulty Pedal track2 sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector , Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type

| No | ECU Pin | Description |
|----|---------|---------------------------------------|
| 1 | K41 | Accel Pedal Sensor track1 Supply (5V) |
| 2 | K25 | Accel Pedal Sensor track1 Signal |
| 3 | K24 | Accel Pedal Sensor track1 Ground |
| 4 | K07 | Accel Pedal Sensor track2 Supply (5V) |
| 5 | K27 | Accel Pedal Sensor track2 Signal |
| 6 | K26 | Accel Pedal Sensor track2 Ground |



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The accel pedal position track2 sensor signal is lower than minimum threshold. (0V)

5) Condition for Clearing the Fault Code

The accel pedal position sensor signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0222 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|---|-------------------------|
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool.. Input values have difference? (based on characteristic) * Variables 1) Accel Pedal Track1 signal (APP_uRaw1) 2) Accel Pedal Track2 signal (APP_uRaw2) 3) Accel Pedal Position (APP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check connection between ECU and Accel pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P0124 | Hand pedal position track1 sensor Low fault |

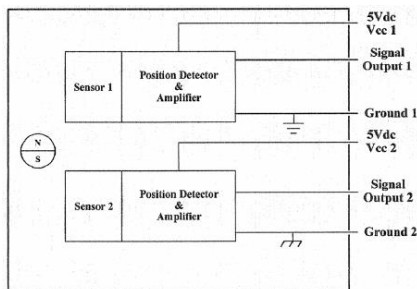
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000091-17 | 1. Electrical problem (Faulty Pedal track1 sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type

| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A19 | Hand Pedal Sensor track1 Supply (5V) |
| 2 | A77 | Hand Pedal Sensor track1 Signal |
| 3 | A28 | Hand Pedal Sensor track1 Ground |
| 4 | A41 | Hand Pedal Sensor track2 Supply (5V) |
| 5 | A13 | Hand Pedal Sensor track2 Signal |
| 6 | A12 | Hand Pedal Sensor track2 Ground |



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The hand pedal position track1 sensor signal is lower than minimum threshold. (0V)

5) Condition for Clearing the Fault Code

The hand pedal position sensor signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0124 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|--|---|-------------------------|
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool. Input values have difference? (based on characteristic) * Variables 1) Hand Pedal Track1 signal (RmtAPP_uRaw1) 2) Hand Pedal Track2 signal (RmtAPP_uRaw2) 3) Hand Pedal Position (RmtAPP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check connection between ECU and hand pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

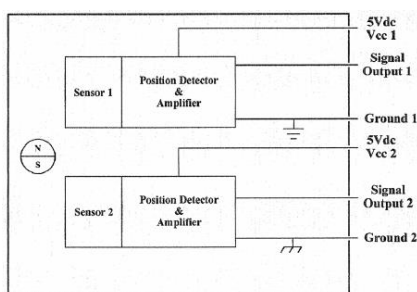
| Fault Code | Fault Name |
|-----------------------|---|
| P0224 | Hand pedal position track2 sensor Low fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000029-17 | 1. Electrical problem (Faulty Pedal track2 sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type



| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A19 | Hand Pedal Sensor track1 Supply (5V) |
| 2 | A77 | Hand Pedal Sensor track1 Signal |
| 3 | A28 | Hand Pedal Sensor track1 Ground |
| 4 | A41 | Hand Pedal Sensor track2 Supply (5V) |
| 5 | A13 | Hand Pedal Sensor track2 Signal |
| 6 | A12 | Hand Pedal Sensor track2 Ground |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The hand pedal position track2 sensor signal is lower than minimum threshold. (0V)

5) Condition for Clearing the Fault Code

The hand pedal position sensor signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------------------|----------------|
| 1 | P0224 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool. Input values have difference? (based on characteristic) * Variables 1) Hand Pedal Track1 signal (RmtAPP_uRaw1) 2) Hand Pedal Track2 signal (RmtAPP_uRaw2) 3) Hand Pedal Position (RmtAPP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 | | Fix the fault based on its | Step 5 |

| | | | | |
|----------|---|--|----------------------------------|-----------------------------|
| | 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | troubleshooting guide | |
| 5 | Check connection between ECU and hand pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P1657 | ECU Sensor Supply (5V)1 voltage fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003509-05 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)1 voltage lies outside of the threshold.

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)1 voltage is within normal operation range (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P1657 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|------------------------|---------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0659 | ECU Sensor Supply (5V)1 Over voltage fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003509-03 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)1 voltage is higher than maximum threshold. (5.2V)

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)1 voltage is within normal operation range. (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P0659 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|------------------------|---------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0657 | ECU Sensor Supply (5V)1 Short circuit to ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003509-06 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)1 voltage is shorted to ground.

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)1 voltage is within normal operation range. (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|-------------------------|---------------------|--------|
| 1 | P0657 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|------------------------|---------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0658 | ECU Sensor Supply (5V)1 Under voltage fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003509-04 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)1 voltage is lower than minimum threshold. (4.8V)

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)1 voltage is within normal operation range. (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P0658 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|---------------------------------|------------------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P1669 | ECU Sensor Supply (5V)2 voltage fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003510-05 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)2 voltage lies outside of the threshold.

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)2 voltage is within normal operation range (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------------------|-------------------|--------|
| 1 | P1669 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |

| | | | | |
|----------|--|--|----------------------------|-------------------------|
| 3 | Check service tool value of battery with engine running. Voltage problem? *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | Do necessary repair | Step 4 |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P2671 | ECU Sensor Supply (5V)2 Over voltage fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003510-03 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)2 voltage is higher than maximum threshold. (5.2V)

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)2 voltage is within normal operation range. (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P2671 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|------------------------|---------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P2669 | ECU Sensor Supply (5V)2 Short circuit to ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003510-06 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)2 voltage is shorted to ground.

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)2 voltage is within normal operation range. (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|-------------------------|---------------------|--------|
| 1 | P2669 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|------------------------|---------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P2670 | ECU Sensor Supply (5V)2 Under voltage fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003510-04 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)2 voltage is lower than minimum threshold. (4.8V)

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)2 voltage is within normal operation range. (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P2670 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|---------------------------------|------------------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P1684 | ECU Sensor Supply (5V)3 voltage fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003511-05 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)3 voltage lies outside of the threshold.

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)3 voltage is within normal operation range (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P1684 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|------------------------|---------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P2686 | ECU Sensor Supply (5V)3 Over voltage fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003511-03 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)3 voltage is higher than maximum threshold. (5.2V)

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)3 voltage is within normal operation range. (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|-------------------------|---------------------|--------|
| 1 | P2686 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|------------------------|---------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P2684 | ECU Sensor Supply (5V)3 Short circuit to ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003511-06 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)3 voltage is shorted to ground.

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)3 voltage is within normal operation range. (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P2684 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|---------------------------------|------------------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P2685 | ECU Sensor Supply (5V)3 Under voltage fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003511-04 | 1. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 2. Electrical problem ((Sensor or actuator failure used by ECU 5V supply) 3. Electrical problem (Wiring harness related ECU 5V supply) 4. Electrical problem (Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| Supply1 | | Supply2 | | Supply3 | |
|---------|---------------------------------|---------|----------------------------------|---------|---------------------------------------|
| ECU Pin | Description | ECU Pin | Description | ECU Pin | Description |
| A37 | CAM Shaft Position sensor | K41 | Accel Pedal sensor track1 | K07 | Accel Pedal Sensor track2 |
| A38 | Intake manifold pressure sensor | K42 | DPF differential pressure sensor | A14 | Engine oil pressure sensor |
| A39 | - | K43 | - | A15 | DEF pressure sensor |
| A40 | EGR Position sensor | K58 | Fuel filter pressure sensor | A16 | Throttle valve Position sensor |
| A41 | Hand Pedal sensor track2 | K59 | - | A17 | - |
| A42 | Rail pressure sensor | K62 | Multi torque switch | A18 | Turbine in pressure sensor (Dev only) |
| K08 | Auto fan speed sensor | K79 | Air Mass Flow Sensor | A19 | Hand Pedal Sensor track1 |

2) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

3) Condition for Setting the Fault Code

The ECU Sensor Supply (5V)3 voltage is lower than minimum threshold. (4.8V)

4) Condition for Clearing the Fault Code

The ECU Sensor Supply (5V)3 voltage is within normal operation range. (4.8~5.2V)

5) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------------------|------------------------|--------|
| 1 | P2685 is detected on service tool? | | Step 2 | |
| 2 | Check battery voltage at Key On Battery problem? | > 11V @ Glowplug off | Change battery | Step 3 |
| 3 | Check service tool value of battery with engine running. Voltage problem? | | Do necessary repair | Step 4 |

| | | | | |
|---|--|--|------------------------|---------------------|
| | *Variables 1) Engine speed(Epm_nEng) 2) Battery voltage(BattU_u) | | | |
| 4 | Check battery connection Battery connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Fault code of all corresponding sensors connection to this Sensor Supply (5V) voltage is occurred? Problem with one of these sensors causing loss of supply voltage. Disconnect sensors one by one checking if fault disappear to find which one is faulty. If None is found faulty, check short circuit and isolation of supply voltage lines on the harness. | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0615 | Starter relay power stage output open circuit |

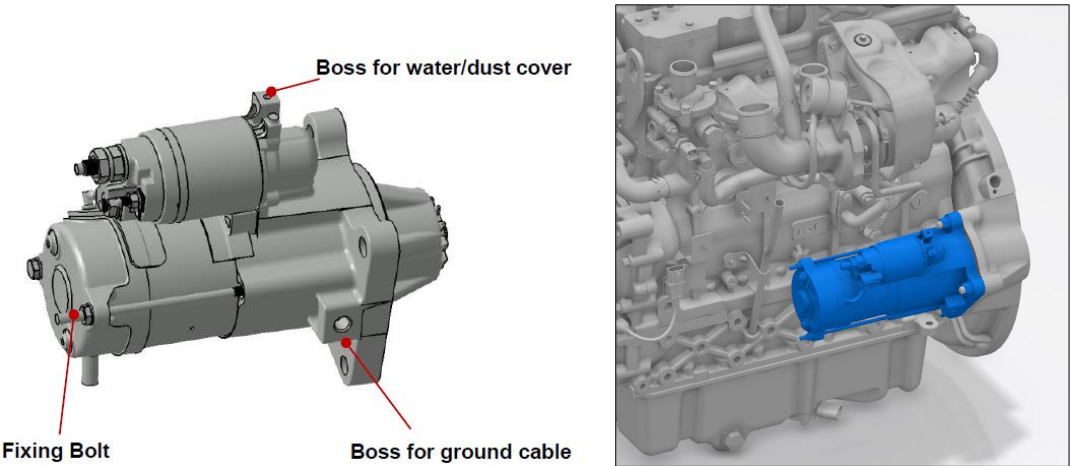
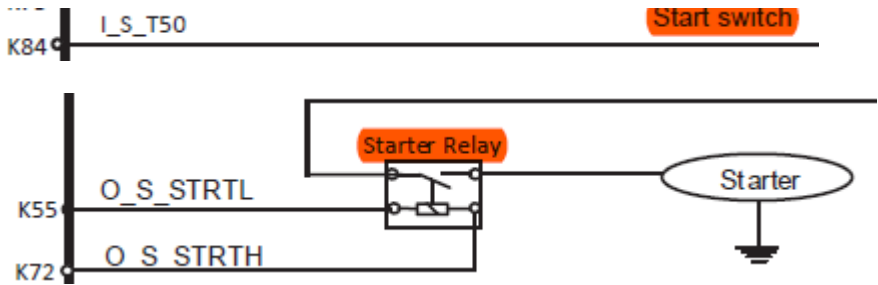
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E007748-05 | 1. Electrical problem (Starter connector, Poor battery) 2. Electrical problem (Wiring harness from ECU to Starter, Starter) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------|
| 1 | K84 | Starter switch (T50) |
| 2 | K72 | Starter relay HS (High side) |
| 3 | K55 | Starter relay LS (Low side) |

2) Component Location

The starter relay location is dependent on machine variant.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The starter relay HS/LS power stage output is opened.

*HS = High side, LS = Low side

This fault could be diagnosed even when the starter control status of the ECU and the actual starter operation (determined by battery voltage drop) do not match as shown below.

- 1) In case the starter does not operate even though the ECU operates the starter relay
(the battery voltage was not drop sufficiently)
- 2) In case the starter operates even though the ECU does not operate the starter relay
(the battery voltage drop was occurred)

5) Condition for Clearing the Fault Code

The starter relay HS/LS power stage output wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P0615 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the wiring harness connection between ECU and starter. Fault code is cleared? | | Problem solved. | Step 4 |
| 4 | Check relay & fuses Relay or fuses problem? | | Do necessary repair | Step 5 |
| 5 | Check visually outside of the starter. Any damaged starter? Change the starter Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0617 | Starter relay power stage output short circuit to battery |

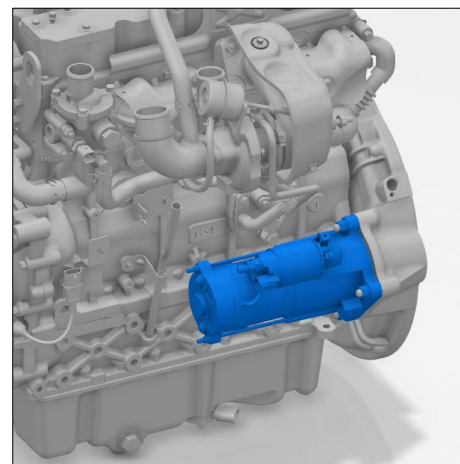
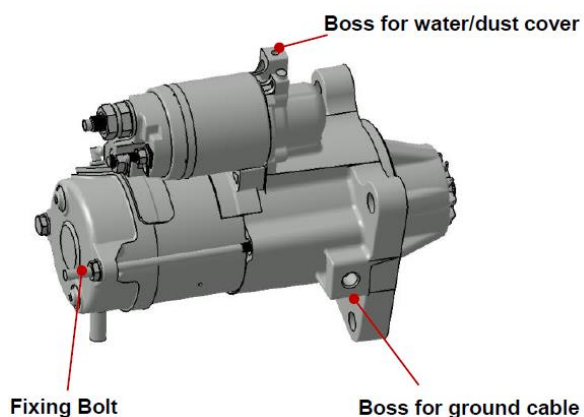
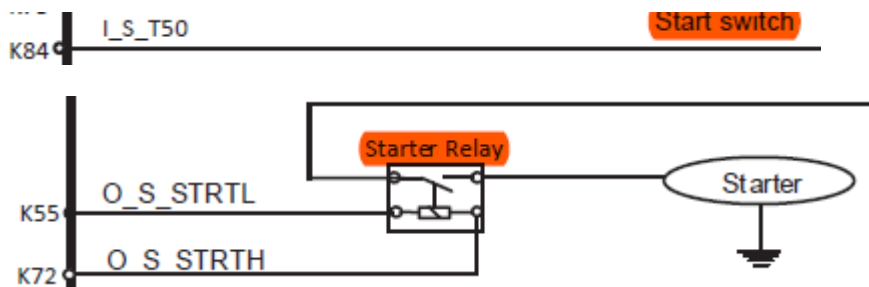
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E007748-03 | 1. Electrical problem (Starter connector, Poor battery) 2. Electrical problem (Wiring harness from ECU to Starter, Starter) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------|
| 1 | K84 | Starter switch (T50) |
| 2 | K72 | Starter relay HS (High side) |
| 3 | K55 | Starter relay LS (Low side) |

2) Component Location

The starter relay location is dependent on machine variant.



3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

The starter relay HS/LS power stage output is shorted to battery.

*HS = High side, LS = Low side

This fault could be diagnosed even when the starter control status of the ECU and the actual starter operation (determined by battery voltage drop) do not match as shown below.

- 1) In case the starter does not operate even though the ECU operates the starter relay (the battery voltage was not drop sufficiently)
- 2) In case the starter operates even though the ECU does not operate the starter relay (the battery voltage drop was occurred)

5) Condition for Clearing the Fault Code

The starter relay HS/LS power stage output wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P0617 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the wiring harness connection between ECU and starter. Fault code is cleared? | | Problem solved. | Step 4 |
| 4 | Check relay & fuses Relay or fuses problem? | | Do necessary repair | Step 5 |
| 5 | Check visually outside of the starter. Any damaged starter? Change the starter Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0616 | Starter relay power stage output short circuit to ground |

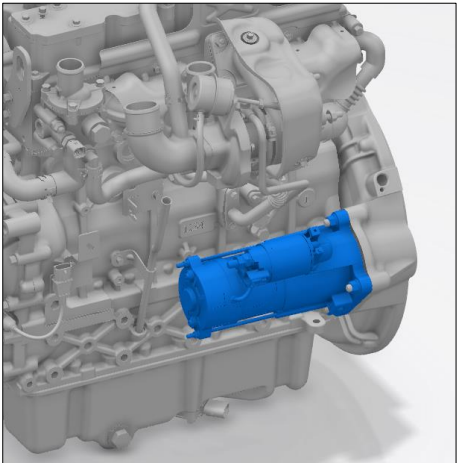
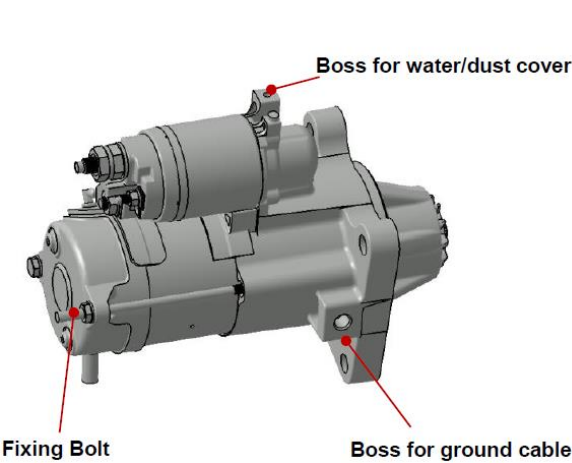
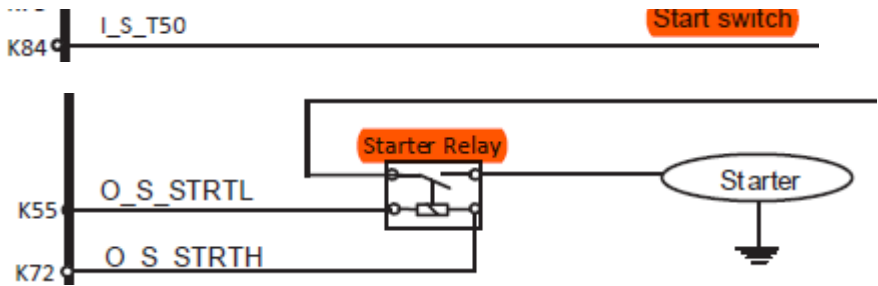
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E007748-04 | 1. Electrical problem (Starter connector, Poor battery) 2. Electrical problem (Wiring harness from ECU to Starter, Starter) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------|
| 1 | K84 | Starter switch (T50) |
| 2 | K72 | Starter relay HS (High side) |
| 3 | K55 | Starter relay LS (Low side) |

2) Component Location

The starter relay location is dependent on machine variant.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The starter relay HS/LS power stage output is opened or the starter relay LS power stage output is shorted to battery.

*HS = High side, LS = Low side

This fault could be diagnosed even when the starter control status of the ECU and the actual starter operation (determined by battery voltage drop) do not match as shown below.

- 1) In case the starter does not operate even though the ECU operates the starter relay (the battery voltage was not drop sufficiently)
- 2) In case the starter operates even though the ECU does not operate the starter relay (the battery voltage drop was occurred)

5) Condition for Clearing the Fault Code

The starter relay HS/LS power stage output wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P0616 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the wiring harness connection between ECU and starter. Fault code is cleared? | | Problem solved. | Step 4 |
| 4 | Check relay & fuses Relay or fuses problem? | | Do necessary repair | Step 5 |
| 5 | Check visually outside of the starter. Any damaged starter? Change the starter Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|------------------------------------|
| P192E | CE(Check engine) Lamp Open circuit |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000987-05 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|-----------------------|
| 1 | K73 | CE(Check engine) Lamp |

2) Component location

Check engine lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is opened.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P192E is detected on service tool? | | Step 2 | |
| 2 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 3 |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* The service tool supports the "Input/Output - Signal test of SVS lamp" function for related checking.
it can be used only hardwire type.

| Fault Code | Fault Name |
|-----------------------|--|
| P1931 | CE(Check engine) Lamp Short to Battery |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000987-03 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|-----------------------|
| 1 | | CE(Check engine) Lamp |

2) Component location

Check engine lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to battery.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P1931 is detected on service tool? | | Step 2 | |
| 2 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 3 |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* The service tool supports the "Input/Output - Signal test of SVS lamp" function for related checking.
it can be used only hardwire type.

| Fault Code | Fault Name |
|-----------------------|---------------------------------------|
| P192F | CE(Check engine) Lamp Short to Ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000987-04 | 1. Electrical problem (Lamp connector) 2. Electrical problem (Wiring harness Lamp to ECU, Faulty Lamp) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|-----------------------|
| 1 | K73 | CE(Check engine) Lamp |

2) Component location

Check engine lamp location is dependent on machine application.

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Lamp wiring is shorted to ground.

5) Condition for Clearing the Fault Code

Lamp wiring problem is restored.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P192F is detected on service tool? | | Step 2 | |
| 2 | Check the wire harness? Connection problem? (pin to pin) | | Do necessary repair | Step 3 |
| 3 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

* The service tool supports the "Input/Output - Signal test of SVS lamp" function for related checking.
it can be used only hardwire type.

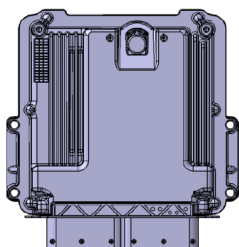
| Fault Code | Fault Name |
|-----------------------|----------------------------|
| P2506 | ECU Software Reset 0 fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001867-22 | <ol style="list-style-type: none"> 1. After ECU Map modified (reflash, IQA, SCANTOOL variant coding, Part replacement, etc...) 2. Electrical problem (Abnormal engine shut down (The battery is removed at engine running or Key ON condition, Battery out<6V)) 3. Electrical problem (Wiring harness related ECU power and ground, ECU connector) 4. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU inside



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The reset system provides a mechanism to transfer the ECU from a faulty state into a safety state. This is done by resetting the controller, this fault is set for alarm purpose.

Check the other faults that have occurred together to determine why the ECU was reset.

* For reference, this fault occurs after ECU Map modified (reflash, IQA, SCANTOOL variant coding, Part replacement, etc...) and heals after power latch. This is normal.

* Power latch (time required for ECU to learn and store memory after key off, normally 30~60sec)

5) Condition for Clearing the Fault Code

This root cause of ECU reset problem is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|--------|
| 1 | P2506 is detected on service tool? | | Step 2 | |
| 2 | Key OFF to cease ECU power. (after Key Off, wait for 30sec) | | Step 3 | |
| 3 | After Key On, check the fault state. Fault is cleared? | | Problem solved | Step 4 |

| | | | | |
|----------|---|--|-----------------------|-------------------------|
| 4 | Check the other faults that have occurred together to determine why the ECU was reset. Fault is cleared? | | Problem solved | Step 5 |
| 5 | Replace the ECU. Check the fault state. Is fault clear? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P2135 | Accel pedal position sensor plausibility fault (Not synchronism between track1 and track2) |

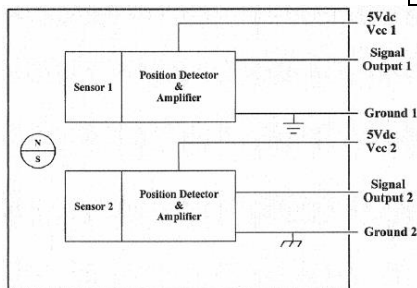
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000091-11 | 1. Electrical problem (Faulty Pedal sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector , Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type

| No | ECU Pin | Description |
|----|---------|---------------------------------------|
| 1 | K41 | Accel Pedal Sensor track1 Supply (5V) |
| 2 | K25 | Accel Pedal Sensor track1 Signal |
| 3 | K24 | Accel Pedal Sensor track1 Ground |
| 4 | K07 | Accel Pedal Sensor track2 Supply (5V) |
| 5 | K27 | Accel Pedal Sensor track2 Signal |
| 6 | K26 | Accel Pedal Sensor track2 Ground |



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The difference between values of dual track pedals are bigger than maximum threshold. (Normally 9%)

5) Condition for Clearing the Fault Code

The difference between values of dual track pedal is within allowable range (Normally 9%)

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|------------------------------------|----------------|-------|----|
| 1 | P2135 is detected on service tool? | | Step2 | |

| | | | | |
|----------|---|--|---|-------------------------|
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool.. Input values have difference? (based on characteristic) * Variables 1) Accel Pedal Track1 signal (APP_uRaw1) 2) Accel Pedal Track2 signal (APP_uRaw2) 3) Accel Pedal Position (APP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check connection between ECU and Accel pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P2136 | Hand pedal position sensor plausibility fault (Not synchronism between track1 and track2) |

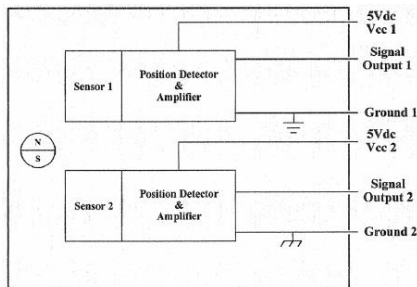
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E000091-12 | 1. Electrical problem (Faulty Pedal sensor, pedal sensor connector) 2. Electrical problem (Wiring harness pedal to ECU) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) |

2) Component Location

The characteristic of Pedal position sensor is dependent on machine type

| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A19 | Hand Pedal Sensor track1 Supply (5V) |
| 2 | A77 | Hand Pedal Sensor track1 Signal |
| 3 | A28 | Hand Pedal Sensor track1 Ground |
| 4 | A41 | Hand Pedal Sensor track2 Supply (5V) |
| 5 | A13 | Hand Pedal Sensor track2 Signal |
| 6 | A12 | Hand Pedal Sensor track2 Ground |



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The difference between values of dual track pedals are bigger than maximum threshold. (Normally 9%)

5) Condition for Clearing the Fault Code

The difference between values of dual track pedal is within allowable range (Normally 9%)

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P2136 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|--|---|-------------------------|
| 3 | Check ECU input value (0 to 100%) of pedal track 1 and pedal track 2 by service tool. Input values have difference? (based on characteristic) * Variables 1) Hand Pedal Track1 signal (RmtAPP_uRaw1) 2) Hand Pedal Track2 signal (RmtAPP_uRaw2) 3) Hand Pedal Position (RmtAPP_r) | | Step 4 | Problem solved |
| 4 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 5 |
| 5 | Check connection between ECU and hand pedal. Wire harness or connector is abnormal connection or damaged? | | Do necessary repair | Step 6 |
| 6 | Change Pedal module Fault is cleared? | | Problem solved | Contact Helpdesk |

* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P12E5 | NCD inducement Fault Level1 (Group1 - EGR Block) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520723-12 | 1. NCD inducement Fault Level1 (Group1 – EGR Block) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 1 is activated by EGR valve blocked group fault and the fault is currently present. This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--------|------------------|
| 1 | P12E5 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (EGR Block) with this P12E5. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12E5 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P12E6 | NCD inducement Fault Level2 (Group1 - EGR Block) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520724-12 | 1. NCD inducement Fault Level2 (Group1 – EGR Block) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 2 is activated by EGR valve blocked group fault and the fault is currently present. This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--------|------------------|
| 1 | P12E6 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (EGR Block) with this P12E6. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12E6 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P12E7 | NCD inducement Fault Level3 Final inducement (Group1 - EGR Block) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520725-12 | 1. NCD inducement Fault Level3 (Group1 – EGR Block) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 3 is activated by EGR valve blocked group fault and the fault is currently present.
This fault is only intended to inform about the NCD inducement status.
Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P12E7 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|-----------------------|-------------------------|
| 3 | Key ON and find other fault code belonging to the inducement group (EGR Block) with this P12E7. Is any other fault code present? | | Step 4 | Contact Helpdesk |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12E7 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P12E8 | NCD inducement Fault Warning (Group1 - EGR Block) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E520726-12 | 1. NCD inducement Fault Warning (Group1 – EGR Block) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Warning is activated by EGR valve blocked group fault and the fault is currently present. This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--------|------------------|
| 1 | P12E8 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (EGR Block) with this P12E8. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12E8 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P12E9 | NCD inducement Fault Level1 (Group2 – Dosing Interrupt) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E520727-12 | 1. NCD inducement Fault Level1 (Group2 – Dosing Interrupt) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 1 is activated by Dosing interrupt group fault and the fault is currently present. This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|------------------|
| 1 | P12E9 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (Dosing Interrupt) with this P12E9. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12E9 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P12EA | NCD inducement Fault Level2 (Group2 – Dosing Interrupt) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E520728-12 | 1. NCD inducement Fault Level2 (Group2 – Dosing Interrupt) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 2 is activated by Dosing interrupt group fault and the fault is currently present. This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|------------------|
| 1 | P12EA is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (Dosing Interrupt) with this P12EA. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12EA also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P12EB | NCD inducement Fault Level3 Final inducement (Group2 – Dosing Interrupt) |

1) Overview

| “E” SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E520729-12 | 1. NCD inducement Fault Level3 (Group2 – Dosing Interrupt) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 3 is activated by Dosing interrupt group fault and the fault is currently present. This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P12EB is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| 3 | Key ON and find other fault code belonging to the inducement group (Dosing Interrupt) with this P12EB. Is any other fault code present? | | Step 4 | Contact Helpdesk |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12EB also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P12EC | NCD inducement Fault Warning (Group2 – Dosing Interrupt) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520730-12 | 1. NCD inducement Fault Warning (Group2 – Dosing Interrupt) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Warning is activated by Dosing interrupt group fault and the fault is currently present. This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|------------------|
| 1 | P12EC is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (Dosing Interrupt) with this P12EC. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12EC also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P12F2 | NCD inducement Fault Level1 (Group4 – DEF Quality) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520736-12 | 1. NCD inducement Fault Level1 (Group4 – DEF Quality) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 1 is activated by DEF quality group fault and the fault is currently present.

This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--------|------------------|
| 1 | P12F2 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (DEF Quality) with this P12F2. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12F2 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P12F3 | NCD inducement Fault Level2 (Group4 – DEF Quality) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520737-12 | 1. NCD inducement Fault Level2 (Group4 – DEF Quality) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 2 is activated by DEF quality group fault and the fault is currently present.

This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--------|------------------|
| 1 | P12F3 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (DEF Quality) with this P12F3. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12F3 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P12F4 | NCD inducement Fault Level3 Final inducement (Group4 – DEF Quality) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520738-12 | 1. NCD inducement Fault Level3 (Group4 – DEF Quality) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 3 is activated by DEF quality group fault and the fault is currently present.

This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P12F4 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|-----------------------|-------------------------|
| 3 | Key ON and find other fault code belonging to the inducement group (DEF Quality) with this P12F4. Is any other fault code present? | | Step 4 | Contact Helpdesk |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12F4 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P12F5 | NCD inducement Fault Warning (Group4 – DEF Quality) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E520739-12 | 1. NCD inducement Fault Warning (Group4 – DEF Quality) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Warning is activated by DEF quality group fault and the fault is currently present.

This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--------|------------------|
| 1 | P12F5 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (DEF Quality) with this P12F5. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12F5 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P12F6 | NCD inducement Fault Level1 (Group5 – Tampering) |

1) Overview

| “E” SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520740-12 | 1. NCD inducement Fault Level1 (Group5 – Tampering) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 1 is activated by Tampering group fault and the fault is currently present.

This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--------|------------------|
| 1 | P12F6 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (Tampering) with this P12F6. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12F6 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P12F7 | NCD inducement Fault Level2 (Group5 – Tampering) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520741-12 | 1. NCD inducement Fault Level2 (Group5 – Tampering) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 2 is activated by Tampering group fault and the fault is currently present.

This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--------|------------------|
| 1 | P12F7 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (Tampering) with this P12F7. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12F7 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P12F8 | NCD inducement Fault Level3 Final inducement (Group5 – Tampering) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520742-12 | 1. NCD inducement Fault Level3 (Group5 – Tampering) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level 3 is activated by Tampering group fault and the fault is currently present.

This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P12F8 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|---|--|-----------------------|-------------------------|
| 3 | Key ON and find other fault code belonging to the inducement group (Tampering) with this P12F8. Is any other fault code present? | | Step 4 | Contact Helpdesk |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12F8 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P12F9 | NCD inducement Fault Warning (Group5 – Tampering) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E520743-12 | 1. NCD inducement Fault Warning (Group5 – Tampering) | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Warning is activated by Tampering group fault and the fault is currently present.

This fault is only intended to inform about the NCD inducement status.

Check the other faults that have occurred together to determine why the NCD inducement was active.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--------|------------------|
| 1 | P12F9 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Key ON and find other fault code belonging to the inducement group (Tampering) with this P12F9. | | Step 4 | Contact Helpdesk |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| | Is any other fault code present? | | | |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P12F9 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------------|
| P1303 | NCD inducement Repeat offense Level1 |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520790-12 | 1. NCD inducement Repeat offense Level1 | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level1 is activated by Repeat offense condition.

For discourage repeat tampering and repeat use of poor DEF, The NCD inducement fault is monitored during 40hrs after healing the NCD inducement fault. If the NCD inducement fault is occurred within 40hrs, the time of engine speed and torque de-rate process is shorten than normal NCD inducement process.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P1303 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| 3 | The fault is activated by Repeat offense condition. Key ON and find the root cause the inducement group and belonging fault code. Is any other fault code present? | | Step 4 | Contact Helpdesk |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P1303 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------------|
| P1304 | NCD inducement Repeat offense Level2 |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520791-12 | 1. NCD inducement Repeat offense Level2 | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level2 is activated by Repeat offense condition.

For discourage repeat tampering and repeat use of poor DEF, The NCD inducement fault is monitored during 40hrs after healing the NCD inducement fault. If the NCD inducement fault is occurred within 40hrs, the time of engine speed and torque de-rate process is shorten than normal NCD inducement process.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P1304 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| 3 | The fault is activated by Repeat offense condition. Key On and find the root cause the inducement group and belonging fault code. Is any other fault code present? | | Step 4 | Contact Helpdesk |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P1304 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P1305 | NCD inducement Repeat offense Level3 Final inducement |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E520792-12 | 1. NCD inducement Repeat offense Level3 | Torque reduction according to NCD inducement strategy |

2) Component Location

The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The inducement Level3 is activated by Repeat offense condition.

For discourage repeat tampering and repeat use of poor DEF, The NCD inducement fault is monitored during 40hrs after healing the NCD inducement fault. If the NCD inducement fault is occurred within 40hrs, the time of engine speed and torque de-rate process is shorten than normal NCD inducement process.

5) Condition for Clearing the Fault Code

The root cause of NCD inducement group fault is healed.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P1305 is detected on service tool? | | Step2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|--|-----------------------|-------------------------|
| 3 | The fault is activated by Repeat offense condition. Key On and find the root cause the inducement group and belonging fault code. Is any other fault code present? | | Step 4 | Contact Helpdesk |
| 4 | Diagnose the other fault according to the corresponding Trouble shooting guide. Is the other fault cleared? | | Step 5 | Contact Helpdesk |
| 5 | Key ON and check the fault status. Is P1305 also cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0512 | Starter switch stuck fault (Cranking request is too long.) |

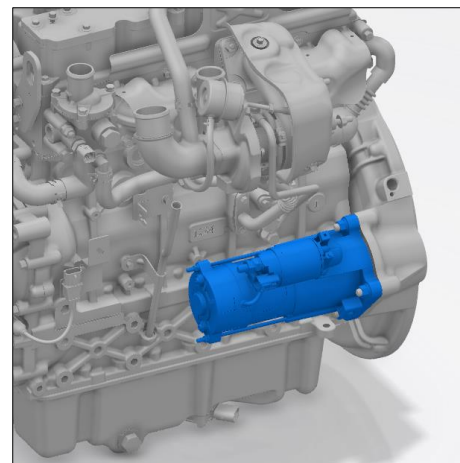
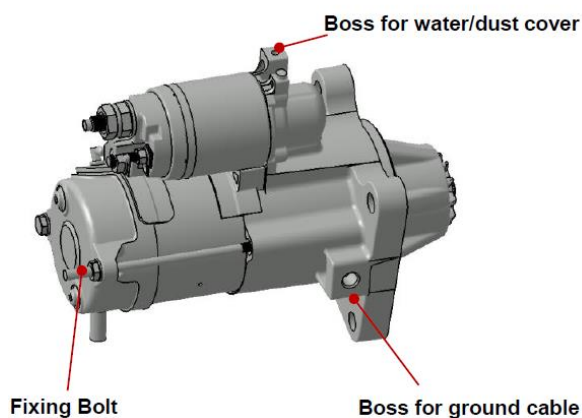
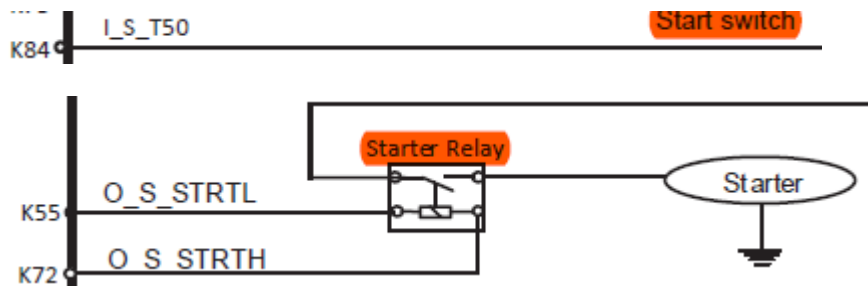
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000626-12 | 1. Electrical problem (Starter switch connector) 2. Electrical problem (Wiring harness from ECU to Starter switch, Starter switch) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

| No | ECU Pin | Description |
|----|---------|------------------------------|
| 1 | K84 | Starter switch (T50) |
| 2 | K72 | Starter relay HS (High side) |
| 3 | K55 | Starter relay LS (Low side) |

2) Component Location

The starter relay location is dependent on machine variant.



3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

The activated time of starter switch is longer than threshold. (300sec)

If the cranking request time is too long, the switch can be considered to stuck.

5) Condition for Clearing the Fault Code

The activated time of starter switch is lower than maximum threshold. (300sec)

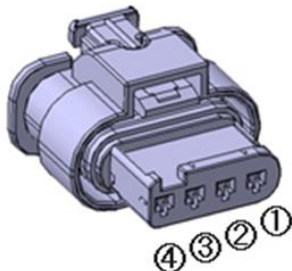
6) Check List

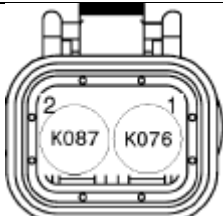
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P0512 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the wiring harness connection between ECU and starter switch. Fault code is cleared? | | Problem solved. | Step 4 |
| 4 | Check relay & fuses Relay or fuses problem? | | Do necessary repair | Step 5 |
| 5 | Check visually outside of the starter switch. Any damaged starter switch? Change the starter switch Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|----------------------------------|
| P107D | Inlet air temperature High fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E000172-00 | 1. Inlet air temperature is exceeded than engine limit 2. Electrical problem (Inlet air temperature sensor connector, Wiring harness from ECU to Inlet air temperature sensor, Faulty Inlet air temperature sensor, ECU connector, Faulty ECU) | CE lamp ON |

| | | | |
|--|----|---------|---|
|  | No | ECU Pin | Description |
| | 1 | K86 | Air Mass Flow Sensor, frequency signal |
| | 2 | K79 | Air Mass Flow Sensor Supply (5V) |
| | 3 | K87 | Air mass flow & temperature Sensor Ground |
| | 4 | K76 | Inlet air temperature sensor signal |

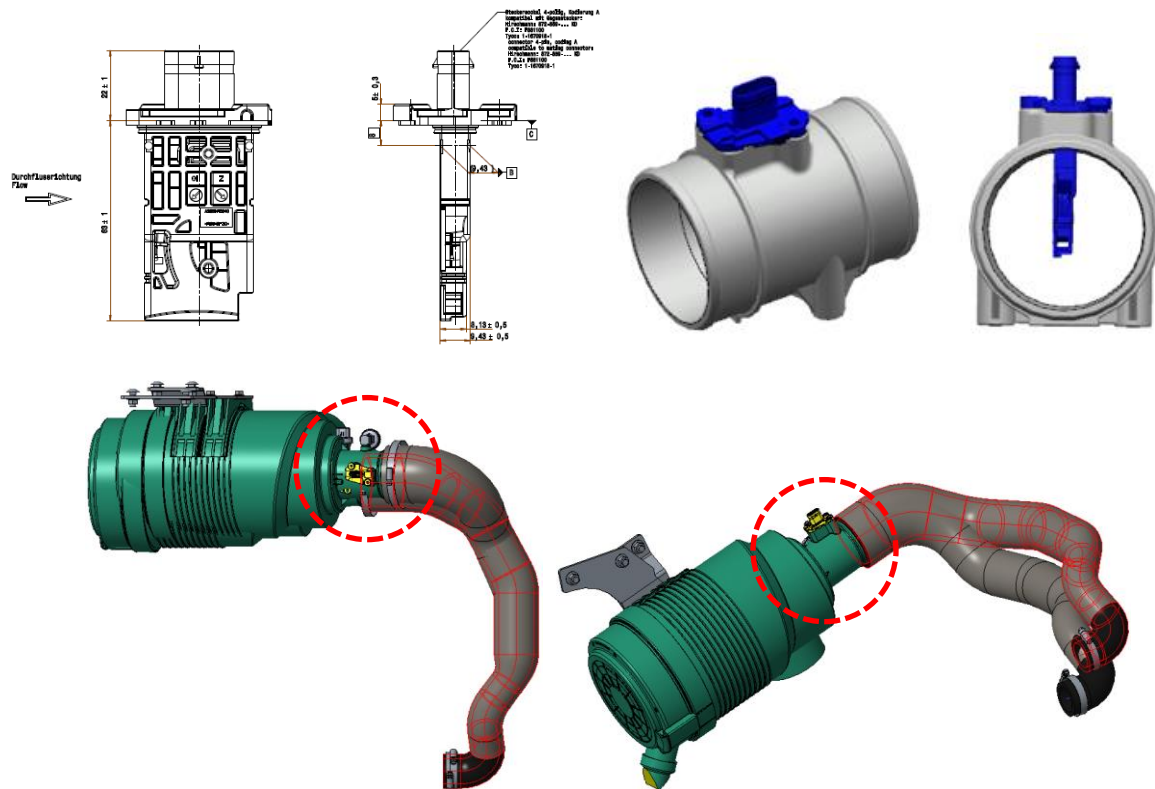
| | | | |
|---|----|---------|-------------------------------------|
|  | No | ECU Pin | Description |
| | 1 | K76 | Inlet air temperature sensor signal |
| | 2 | K87 | Inlet air temperature sensor ground |

2) Component Location

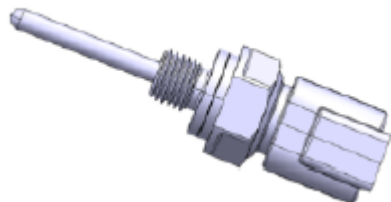
Air mass flow sensor location is dependent on machine application.

If an air mass flow sensor is installed, it is integrated with the air mass flow sensor. If there is no Air mass flow sensor, separate temperature sensor is installed at after air cleaner.

* Air mass flow sensor type



* Non Air mass flow sensor type



| Inlet air temperature sensor | | | | | | | |
|------------------------------|--------|--|-----------|-----------------|-----------|--------------------|-----------|
| Temperature | | Located in Air mass flow sensor (Conti.) | | Sensor (VISHAY) | | Sensor (Honeywell) | |
| | | R nominal | V nominal | R nominal | V nominal | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] | [ohm] | [mV] | [ohm] | [mV] |
| -40 | -40 | 44980 | 4818 | 44296 | 4815 | 48032 | 4830 |
| 0 | 32 | 5706 | 3819 | 5623 | 3806 | 5846 | 3841 |
| 25 | 77 | 2000 | 2655 | 2000 | 2656 | 2057 | 2688 |
| 100 | 212 | 181 | 469 | 198 | 509 | 187 | 484 |
| 150 | 302 | 56 | 162 | 66 | 187 | 56 | 161 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Inlet air temperature is higher than normal operation threshold. (125degC)

5) Condition for Clearing the Fault Code

Inlet air temperature is below the threshold

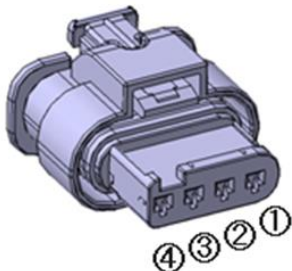
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P107D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check cooling system. - Engine cooling system (Cooling FAN & Radiator, etc...) - Inlet air system (Whether hot air in the engine room can enter the air cleaner again.) (Information : With very hot condition, this fault can be occurred without any engine trouble.) | | Do necessary repair | Step 4 |
| 4 | Change the Inlet air temperature sensor. Start the engine and set the RPM in high idle, 10minutes. After that set the RPM in low idle. Fault code is cleared? | | Problem Solved | Contact Helpdesk |

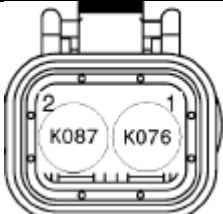
| Fault Code | Fault Name |
|-----------------------|---|
| P007D | Inlet air temperature sensor High fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000172-03 | 1. Electrical problem (Inlet air temperature sensor connector) 2. Electrical problem (Wiring harness Inlet air temperature sensor to ECU, Faulty Inlet air temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |



| No | ECU Pin | Description |
|----|---------|---|
| 1 | K86 | Air Mass Flow Sensor, frequency signal |
| 2 | K79 | Air Mass Flow Sensor Supply (5V) |
| 3 | K87 | Air mass flow & temperature Sensor Ground |
| 4 | K76 | Inlet air temperature sensor signal |



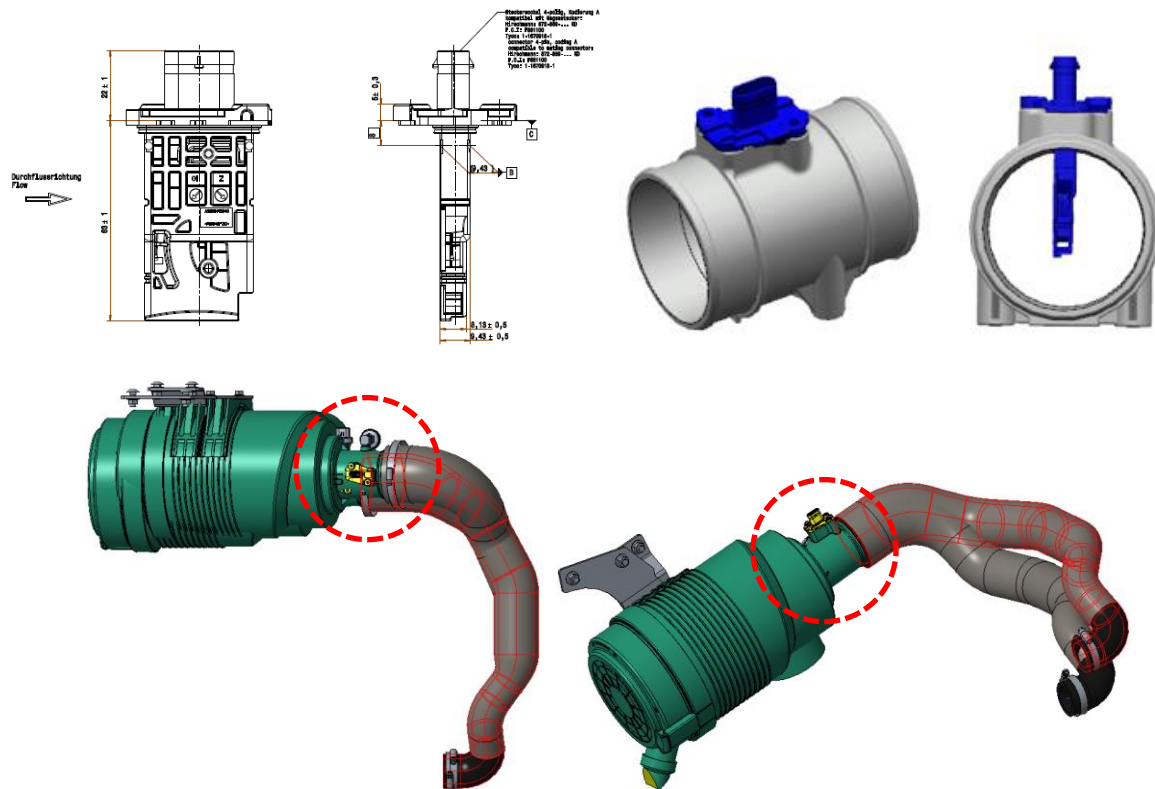
| No | ECU Pin | Description |
|----|---------|-------------------------------------|
| 1 | K76 | Inlet air temperature sensor signal |
| 2 | K87 | Inlet air temperature sensor ground |

2) Component Location

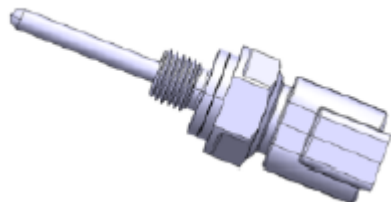
Air mass flow sensor location is dependent on machine application.

If an air mass flow sensor is installed, it is integrated with the air mass flow sensor. If there is no Air mass flow sensor, separate temperature sensor is installed at after air cleaner.

* Air mass flow sensor type



* Non Air mass flow sensor type



| Inlet air temperature sensor | | | | | | | |
|------------------------------|--------|--|-----------|-----------------|-----------|--------------------|-----------|
| Temperature | | Located in Air mass flow sensor (Conti.) | | Sensor (VISHAY) | | Sensor (Honeywell) | |
| | | R nominal | V nominal | R nominal | V nominal | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] | [ohm] | [mV] | [ohm] | [mV] |
| -40 | -40 | 44980 | 4818 | 44296 | 4815 | 48032 | 4830 |
| 0 | 32 | 5706 | 3819 | 5623 | 3806 | 5846 | 3841 |
| 25 | 77 | 2000 | 2655 | 2000 | 2656 | 2057 | 2688 |
| 100 | 212 | 181 | 469 | 198 | 509 | 187 | 484 |
| 150 | 302 | 56 | 162 | 66 | 187 | 56 | 161 |

3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Inlet air temperature signal is more than maximum operation threshold. (4.911V)

5) Condition for Clearing the Fault Code

Inlet air temperature signal is within normal operation range.

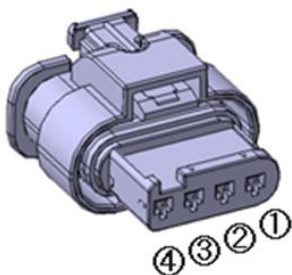
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|---------------------|------------------|
| 1 | P007D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor resistance (remove sensor connector and measure the resistance across pins K76 and K87 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

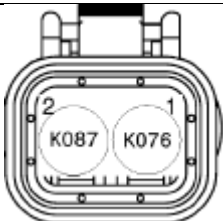
| Fault Code | Fault Name |
|-----------------------|--|
| P007C | Inlet air temperature sensor Low fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000172-04 | 1. Electrical problem (Inlet air temperature sensor connector) 2. Electrical problem (Wiring harness Inlet air temperature sensor to ECU, Faulty Inlet air temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |



| No | ECU Pin | Description |
|----|---------|---|
| 1 | K86 | Air Mass Flow Sensor, frequency signal |
| 2 | K79 | Air Mass Flow Sensor Supply (5V) |
| 3 | K87 | Air mass flow & temperature Sensor Ground |
| 4 | K76 | Inlet air temperature sensor signal |



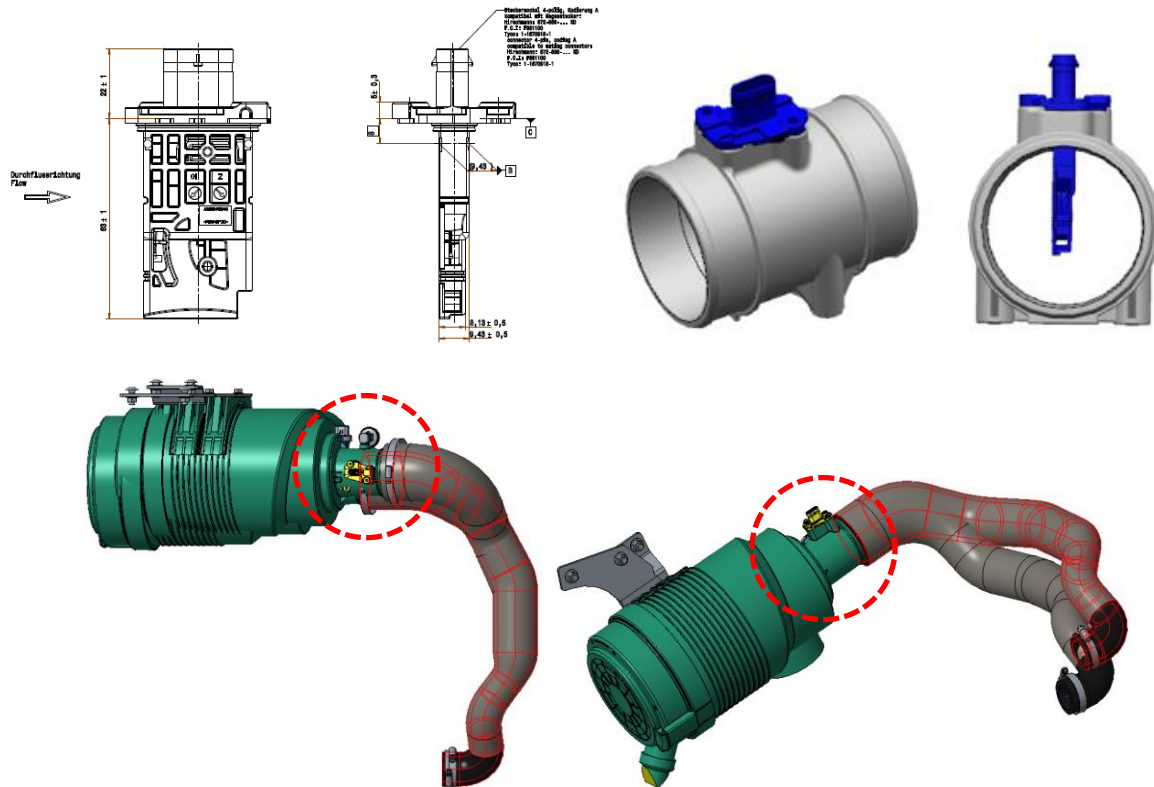
| No | ECU Pin | Description |
|----|---------|-------------------------------------|
| 1 | K76 | Inlet air temperature sensor signal |
| 2 | K87 | Inlet air temperature sensor ground |

2) Component Location

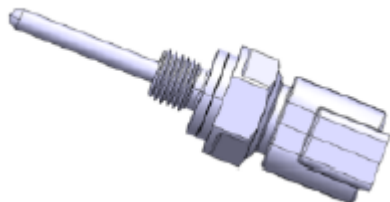
Air mass flow sensor location is dependent on machine application.

If an air mass flow sensor is installed, it is integrated with the air mass flow sensor. If there is no Air mass flow sensor, separate temperature sensor is installed at after air cleaner.

* Air mass flow sensor type



* Non Air mass flow sensor type



| Inlet air temperature sensor | | | | | | | |
|------------------------------|--------|--|-----------|-----------------|-----------|--------------------|-----------|
| Temperature | | Located in Air mass flow sensor (Conti.) | | Sensor (VISHAY) | | Sensor (Honeywell) | |
| | | R nominal | V nominal | R nominal | V nominal | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] | [ohm] | [mV] | [ohm] | [mV] |
| -40 | -40 | 44980 | 4818 | 44296 | 4815 | 48032 | 4830 |
| 0 | 32 | 5706 | 3819 | 5623 | 3806 | 5846 | 3841 |
| 25 | 77 | 2000 | 2655 | 2000 | 2656 | 2057 | 2688 |
| 100 | 212 | 181 | 469 | 198 | 509 | 187 | 484 |
| 150 | 302 | 56 | 162 | 66 | 187 | 56 | 161 |

3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Inlet air temperature signal is less than minimum operation threshold. (0.068V)

5) Condition for Clearing the Fault Code

Inlet air temperature signal is within normal operation range.

6) Check List

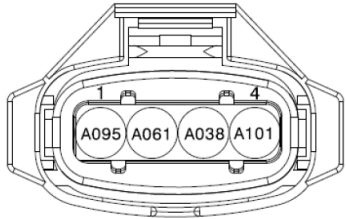
| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|---------------------|------------------|
| 1 | P007C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor resistance (remove sensor connector and measure the resistance across pins K76 and K87 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P10AD | Intake manifold temperature High fault |

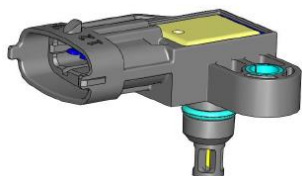
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000105-16 | 1. Intake manifold temperature is exceeded than engine limit 2. Electrical problem (Intake manifold temperature sensor connector, Wiring harness from ECU to Intake manifold temperature sensor, Faulty Intake manifold temperature sensor) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON DPF regeneration inhibit by Active and Forced |

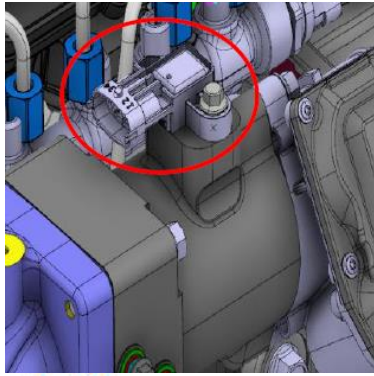
| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A95 | Intake manifold press/temp Ground |
| 2 | A61 | Intake manifold temperature Signal |
| 3 | A38 | Intake manifold pressure Supply (5V) |
| 4 | A101 | Intake Manifold Pressure Signal |



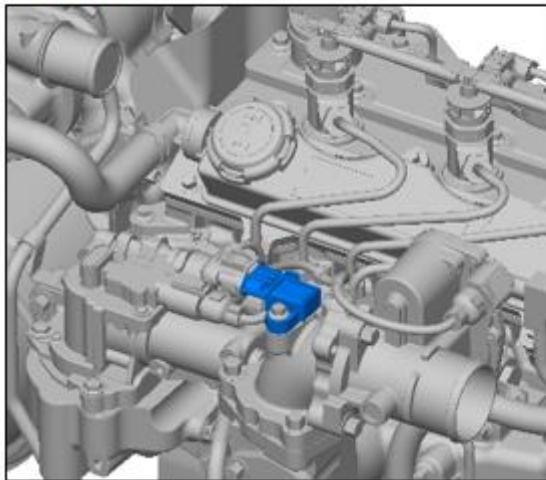
2) Component Location



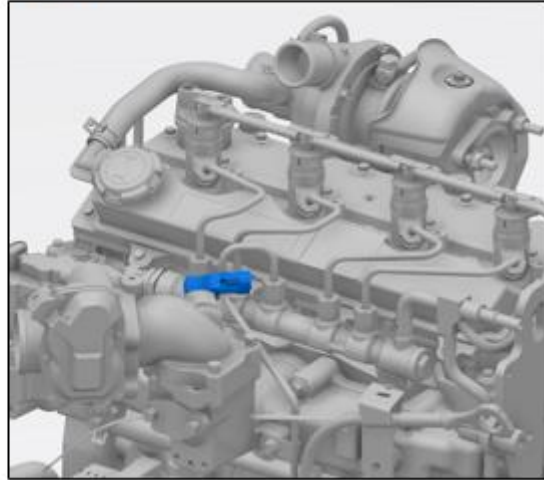
| Intake manifold Temperature sensor | | | |
|------------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 45303 | 4860 |
| 0 | 32 | 5895 | 4093 |
| 20 | 68 | 2499 | 3059 |
| 40 | 104 | 1174 | 2391 |
| 80 | 176 | 322 | 990 |
| 130 | 266 | 89 | 327 |



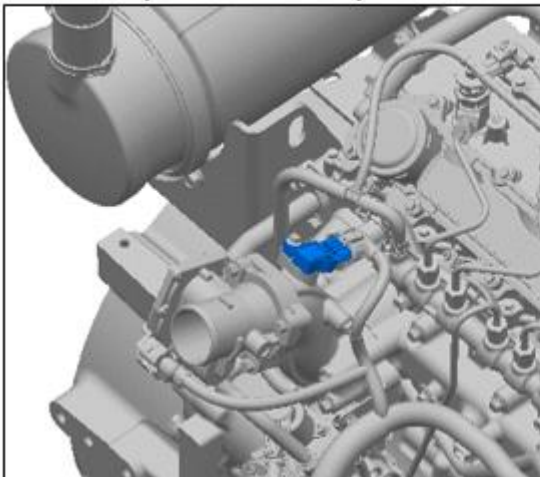
1.8L



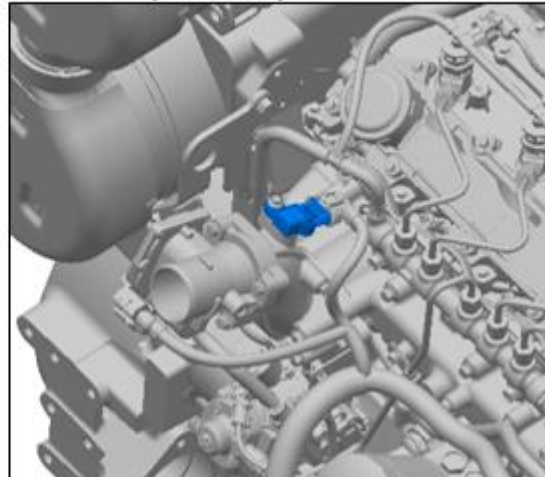
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Intake manifold temperature is higher than normal operation threshold. (128degC)

5) Condition for Clearing the Fault Code

Intake manifold temperature is below the threshold

6) Check List

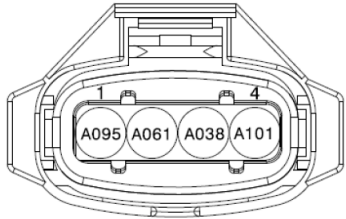
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P10AD is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check cooling system. - Engine cooling system (Cooling FAN & Radiator, Intercooler(CAC), etc...) - Inlet air system (Whether hot air in the engine room can enter the air cleaner again.) | | Do necessary repair | Step 4 |
| 4 | Change the Intake manifold temperature sensor. Start the engine and set the RPM in high idle, 10minutes. After that set the RPM in low idle. Fault code is cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P00AD | Intake manifold temperature sensor High fault |

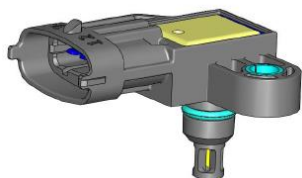
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000105-03 | 1. Electrical problem (Intake manifold temperature sensor connector) 2. Electrical problem (Wiring harness Intake manifold temperature sensor to ECU, Faulty Intake manifold temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

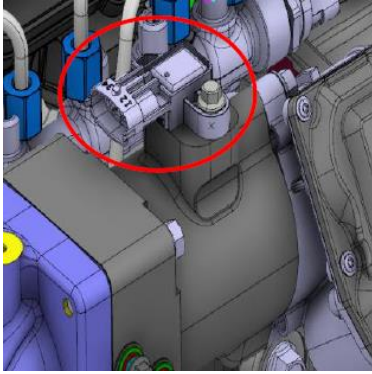
| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A95 | Intake manifold press/temp Ground |
| 2 | A61 | Intake manifold temperature Signal |
| 3 | A38 | Intake manifold pressure Supply (5V) |
| 4 | A101 | Intake Manifold Pressure Signal |



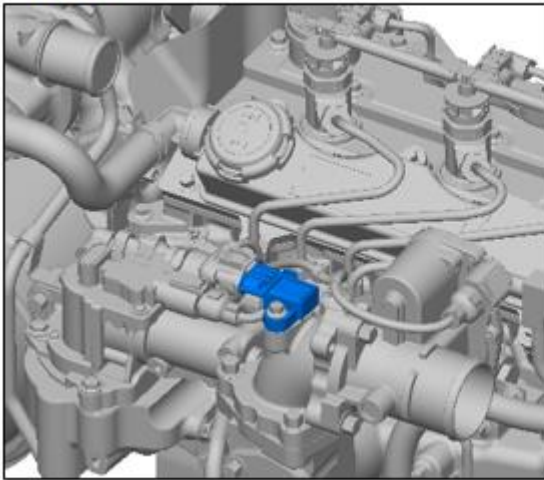
2) Component Location



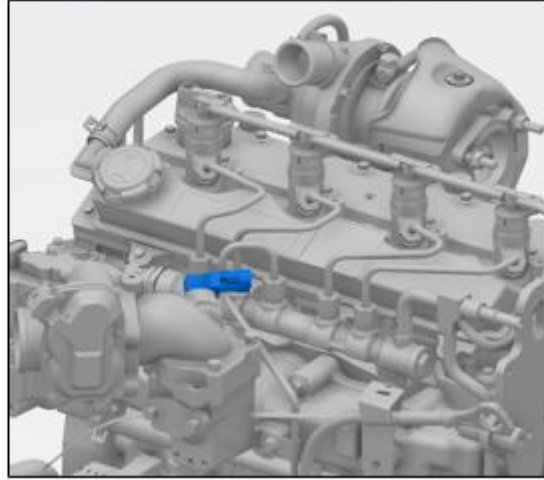
| Intake manifold Temperature sensor | | | |
|------------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 45303 | 4860 |
| 0 | 32 | 5895 | 4093 |
| 20 | 68 | 2499 | 3059 |
| 40 | 104 | 1174 | 2391 |
| 80 | 176 | 322 | 990 |
| 130 | 266 | 89 | 327 |



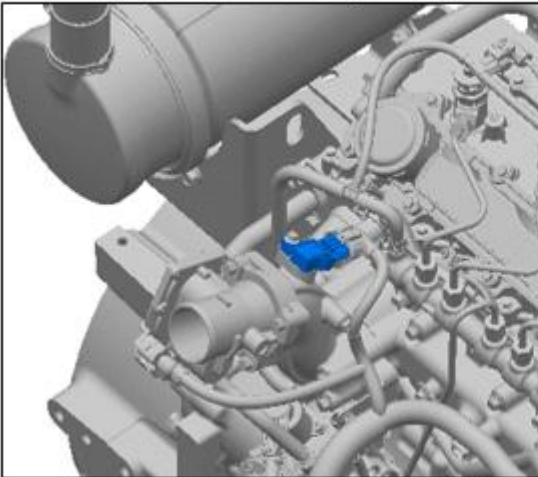
1.8L



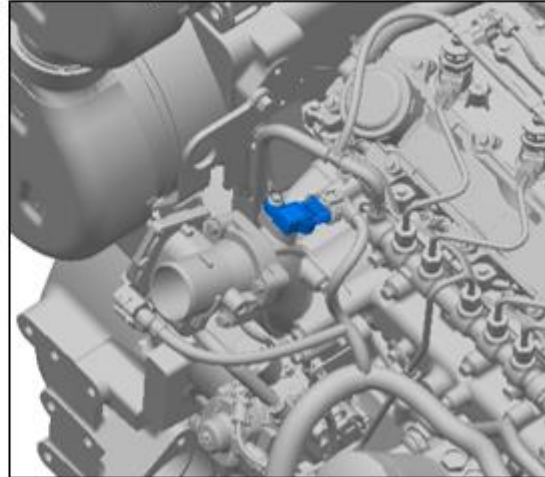
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Intake manifold temperature signal is more than maximum threshold (4.935V)

5) Condition for Clearing the Fault Code

Intake manifold temperature signal is in operation range.

6) Check List

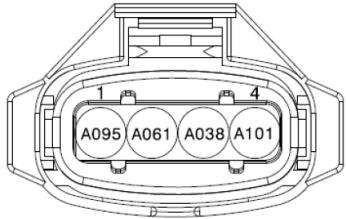
| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|---------------------|------------------|
| 1 | P00AD is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor resistance (remove sensor connector and measure the resistance across pins A95 and A61 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P00AC | Intake manifold temperature sensor Low fault |

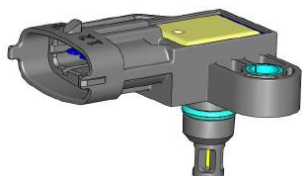
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E000105-04 | 1. Electrical problem (Intake manifold temperature sensor connector) 2. Electrical problem (Wiring harness Intake manifold temperature sensor to ECU, Faulty Intake manifold temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

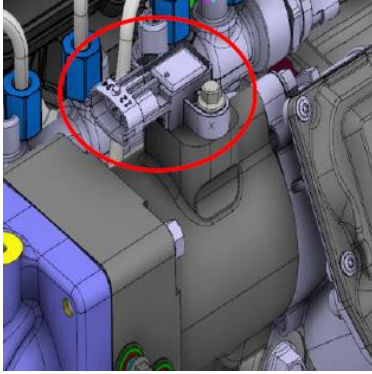
| No | ECU Pin | Description |
|----|---------|--------------------------------------|
| 1 | A95 | Intake manifold press/temp Ground |
| 2 | A61 | Intake manifold temperature Signal |
| 3 | A38 | Intake manifold pressure Supply (5V) |
| 4 | A101 | Intake Manifold Pressure Signal |



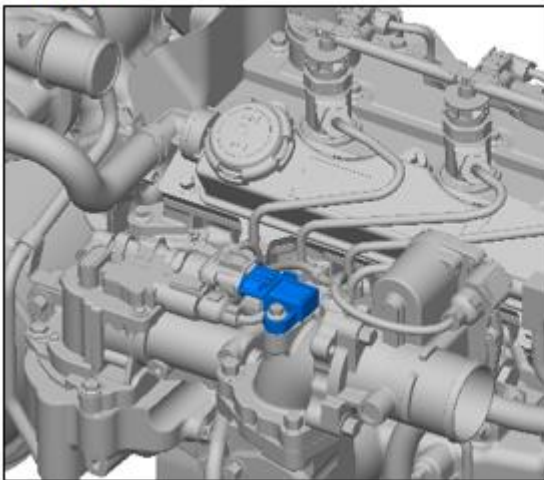
2) Component Location



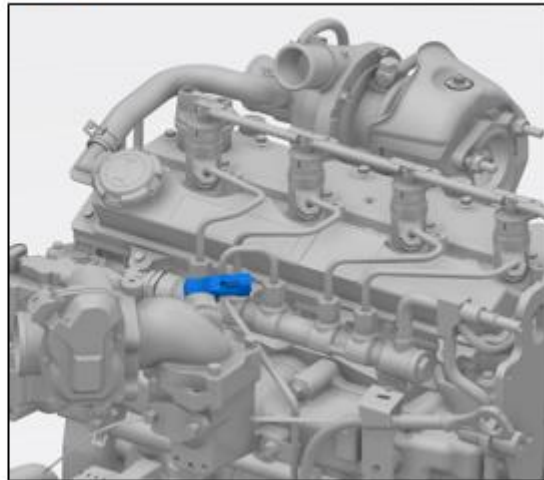
| Intake manifold Temperature sensor | | | |
|------------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 45303 | 4860 |
| 0 | 32 | 5895 | 4093 |
| 20 | 68 | 2499 | 3059 |
| 40 | 104 | 1174 | 2391 |
| 80 | 176 | 322 | 990 |
| 130 | 266 | 89 | 327 |



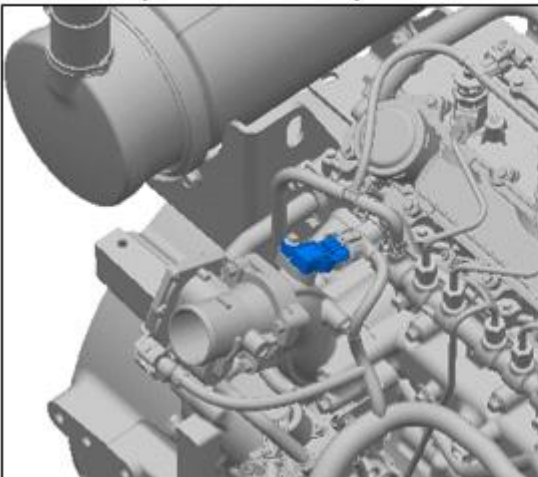
1.8L



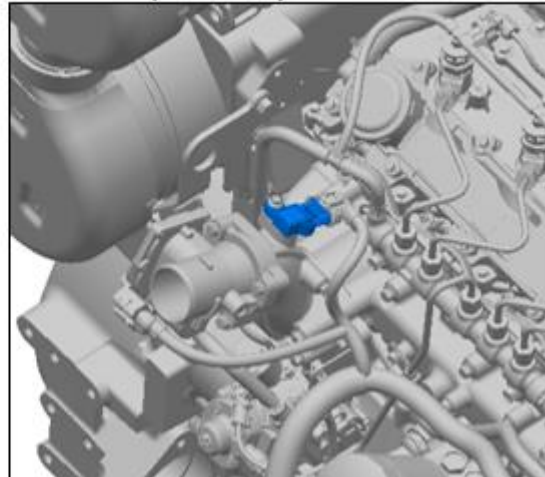
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Intake manifold temperature signal is less than minimum threshold (0.151V)

5) Condition for Clearing the Fault Code

Intake manifold temperature signal is in operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|---------------------|------------------|
| 1 | P00AC is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor resistance (remove sensor connector and measure the resistance across pins A95 and A61 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

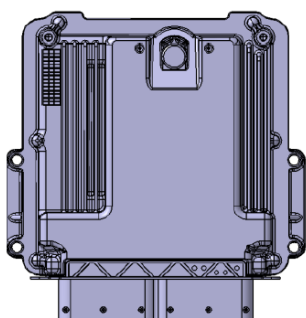
| Fault Code | Fault Name |
|-----------------------|----------------------------|
| P0669 | ECU temperature High fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001207-00 | 1. ECU temperature is exceeded than engine limit 2. Electrical problem (Faulty ECU) | CE lamp ON |

2) Component Location

ECU temperature sensor is located in ECU.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

ECU temperature is higher than normal operation threshold. (>105degC)

5) Condition for Clearing the Fault Code

ECU temperature is below the threshold

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P0669 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check cooling system. - Engine cooling system (Cooling FAN & Radiator, etc...) (Information : With very hot condition, this fault can be occurred without any engine trouble.) | | Do necessary repair | Step 4 |
| 4 | Change the ECU. Start the engine and set the RPM in high idle, 10minutes. After that set the RPM in low idle. Fault code is cleared? | | Problem Solved | Contact Helpdesk |

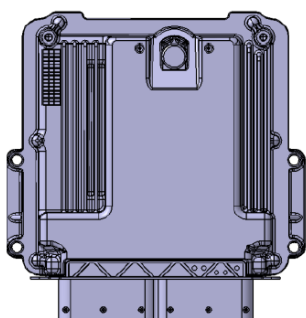
| Fault Code | Fault Name |
|-----------------------|--|
| P06AE | ECU temperature sensor High fault (Short circuit to battery) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001207-03 | 1. Electrical problem (ECU temperature sensor - inner part of ECU, Faulty ECU) | CE lamp ON |

2) Component Location

ECU temperature sensor is located in ECU.



3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

ECU temperature signal is shorted to battery.

5) Condition for Clearing the Fault Code

ECU temperature signal is in operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P06AE is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Change the ECU. Fault code is cleared? | | Problem Solved | Contact Helpdesk |

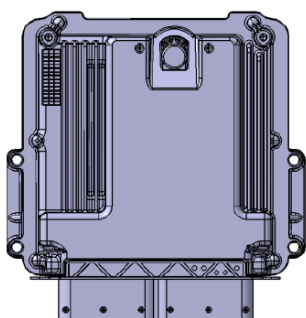
| Fault Code | Fault Name |
|-----------------------|--|
| P06AD | ECU temperature sensor Low fault (Short circuit to ground) |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E001207-04 | 1. Electrical problem (ECU temperature sensor - inner part of ECU, Faulty ECU) | CE lamp ON |

2) Component Location

ECU temperature sensor is located in ECU.



3) Condition for Running Diagnostic

Key on or Engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

ECU temperature signal is shorted to ground.

5) Condition for Clearing the Fault Code

ECU temperature signal is in operation range.

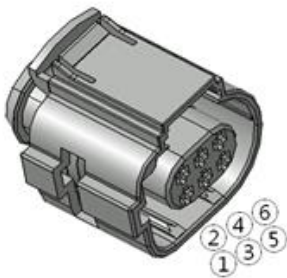
6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|----------------|------------------|
| 1 | P06AD is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Change the ECU. Fault code is cleared? | | Problem Solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P02E7 | Throttle valve Close Position Learning Range Over Fault |

1) Overview

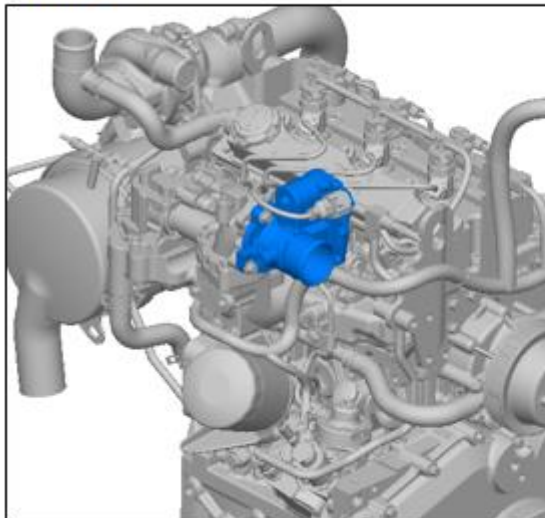
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E000051-30 | 1. Actuator problem (Valve sticking, Foreign material) 2. Electrical problem (Faulty Throttle Valve) 3. Electrical problem (Throttle valve connector, Wiring harness, Faulty ECU, ECU connector) | CE lamp ON |

| | | | |
|--|----|---------|--|
|  | No | ECU Pin | Description |
| | 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| | 2 | A09 | Throttle valve (H-Bridge Neg) |
| | 3 | A97 | Throttle valve Position Sensor Ground |
| | 4 | - | Not used |
| | 5 | A98 | Throttle valve Position Sensor Signal |
| | 6 | A08 | Throttle valve (H-Bridge Pos) |

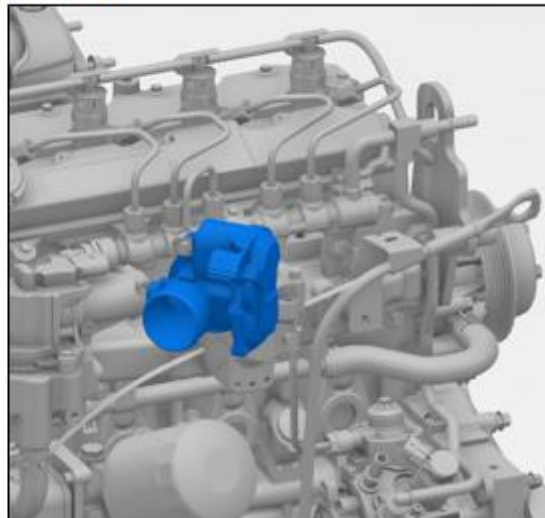
2) Component Location



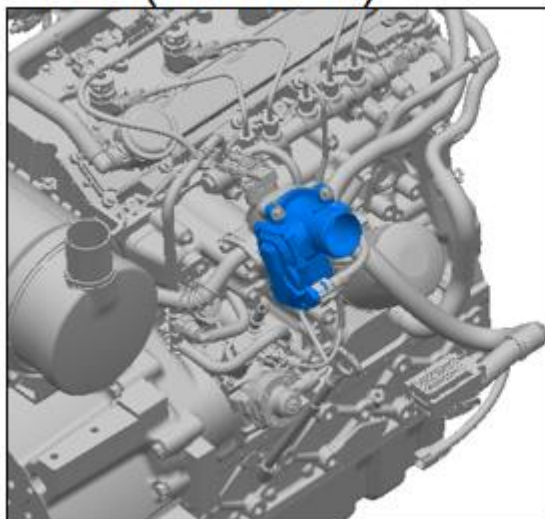
1.8L



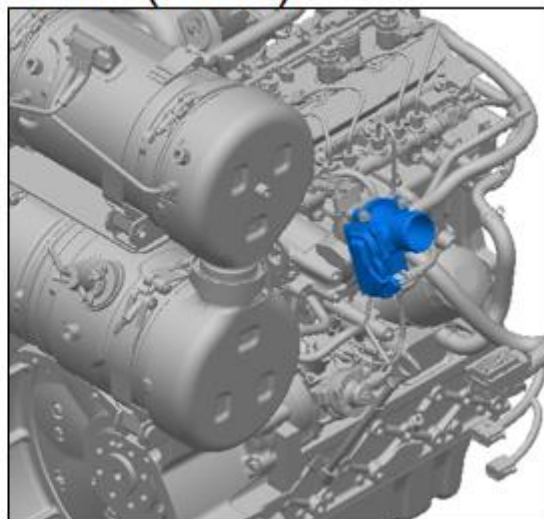
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If Throttle valve position feedback in the closed stop is not within the limits. (4.3~4.55V)

5) Condition for Clearing the Fault Code

If Throttle valve position feedback in the closed stop is within the limits.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P02E7 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

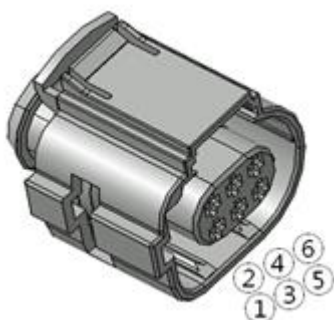
| | | | | |
|---|---|--|----------------|------------------|
| 3 | Check connection between ECU and Throttle valve. Wire harness is damaged? Check that the supply voltage is incorrect? | | Step 6 | Step 4 |
| 4 | Check the throttle valve. If there is any foreign materials (carbon, etc...) at closed position, clean and re-performed throttle valve learning. The throttle valve learning value is updated when key off & power latch after operating with engine warm-up condition (coolant temperature > 60degC). Is the learning value within the normally new throttle valve closed position range? * Variables 1) Throttle valve close position latest learning value (ThrVlv_uRelPosClsd_mp) | Normally New Throttle valve closed value 4500±50mV | Problem solved | Step 5 |
| 5 | Check that the valve position can reach demand position by service tool. (30%/50%/70%) ("Input/Output Test – Actuator test of TVA" function of the service tool) * Variables 1) Throttle valve position feedback (ThrVlv_rAct) Throttle valve position cannot reach to demand? | | Step 6 | Problem solved |
| 6 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P02E0 | Throttle valve H-Bridge Driver Open Circuit Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E005419-05 | 1. Electrical problem (Throttle valve connector, Faulty Throttle valve motor) 2. Electrical problem (Wiring harness Throttle valve to ECU) 3. Electrical problem (Faulty ECU) | CE lamp ON DPF regeneration inhibit by Active and Forced |

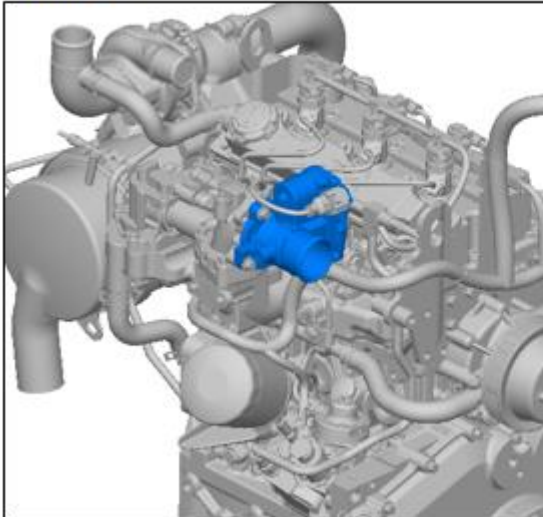
| No | ECU Pin | Description |
|----|---------|--|
| 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| 2 | A09 | Throttle valve (H-Bridge Neg) |
| 3 | A97 | Throttle valve Position Sensor Ground |
| 4 | - | Not used |
| 5 | A98 | Throttle valve Position Sensor Signal |
| 6 | A08 | Throttle valve (H-Bridge Pos) |



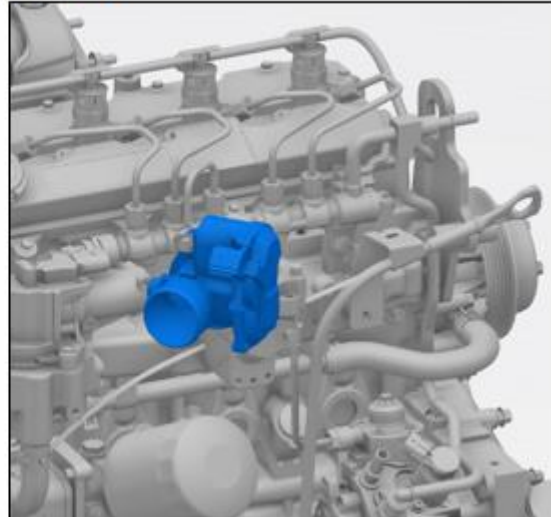
2) Component Location



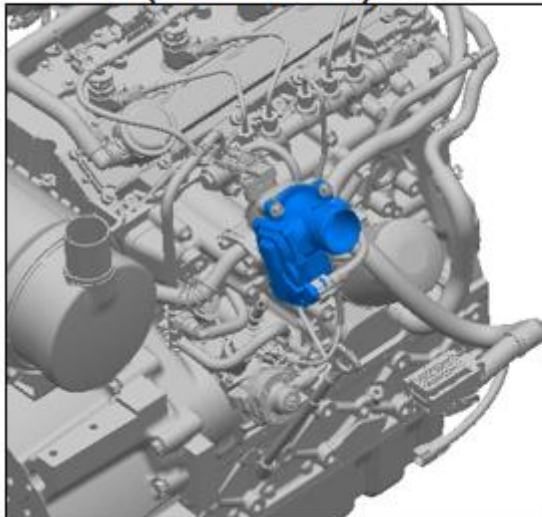
1.8L



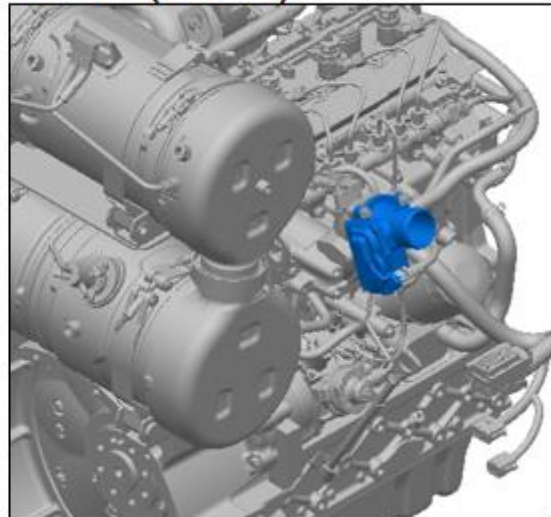
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the pins of Throttle valve H-bridge have been opened or H-Bridge circuit included Throttle valve is damaged.

5) Condition for Clearing the Fault Code

If the pins of Throttle valve H-bridge is connected or H-Bridge circuit included Throttle valve is corrected.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P02E0 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the Throttle valve harness connection between ECU and Throttle valve. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the Throttle valve. Any damaged Throttle valve? Change the Throttle valve Fault code is cleared? | | Problem solved | Contact Helpdesk |

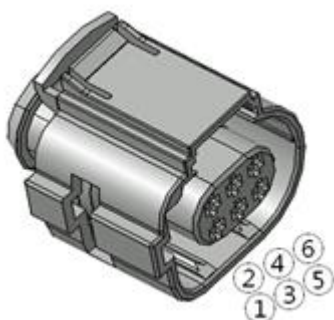
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P02E3 | Throttle valve H-Bridge Driver Short circuit to battery |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E005419-03 | 1. Electrical problem (Throttle valve connector, Faulty Throttle valve motor) 2. Electrical problem (Wiring harness Throttle valve to ECU) 3. Electrical problem (Faulty ECU) | CE lamp ON DPF regeneration inhibit by Active and Forced |

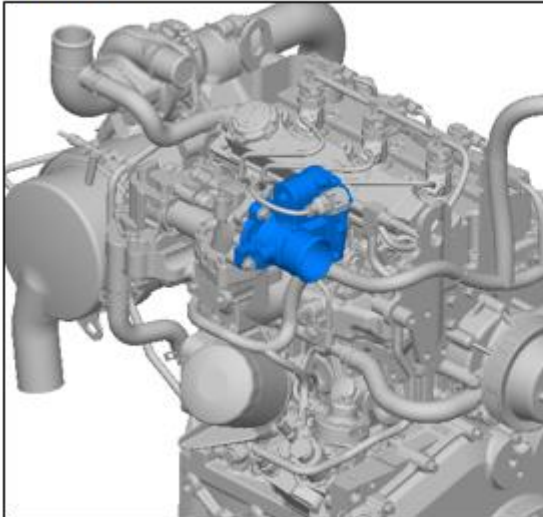
| No | ECU Pin | Description |
|----|---------|--|
| 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| 2 | A09 | Throttle valve (H-Bridge Neg) |
| 3 | A97 | Throttle valve Position Sensor Ground |
| 4 | - | Not used |
| 5 | A98 | Throttle valve Position Sensor Signal |
| 6 | A08 | Throttle valve (H-Bridge Pos) |



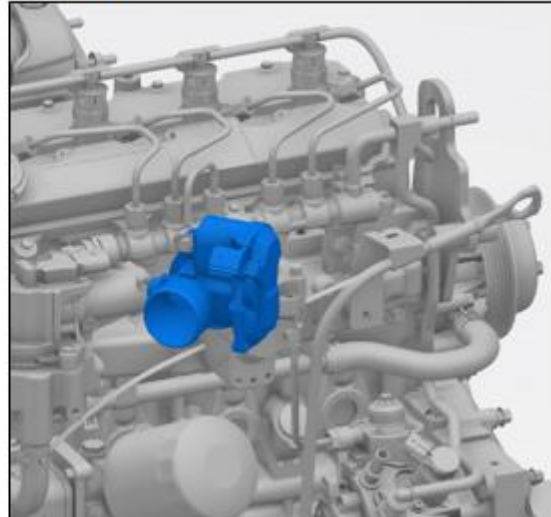
2) Component Location



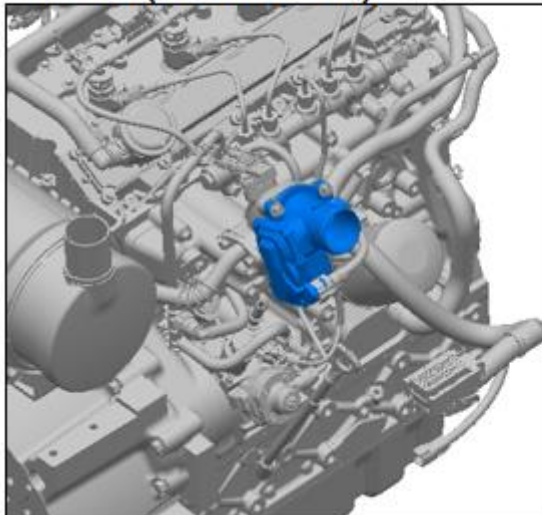
1.8L



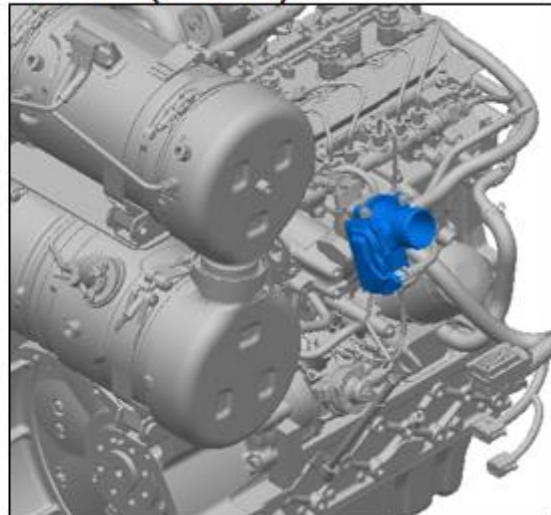
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the pins of Throttle valve H-bridge have been shorted to battery or H-Bridge circuit included Throttle valve is damaged.

5) Condition for Clearing the Fault Code

If the pins of Throttle valve H-bridge is connected or H-Bridge circuit included Throttle valve is corrected.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P02E3 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the Throttle valve harness connection between ECU and Throttle valve. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the Throttle valve. Any damaged Throttle valve? Change the Throttle valve Fault code is cleared? | | Problem solved | Contact Helpdesk |

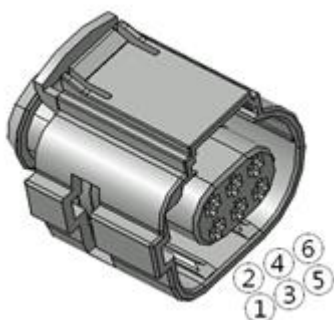
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|--|
| P02E2 | Throttle valve H-Bridge Driver Short circuit to ground |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E005419-04 | 1. Electrical problem (Throttle valve connector, Faulty Throttle valve motor) 2. Electrical problem (Wiring harness Throttle valve to ECU) 3. Electrical problem (Faulty ECU) | CE lamp ON DPF regeneration inhibit by Active and Forced |

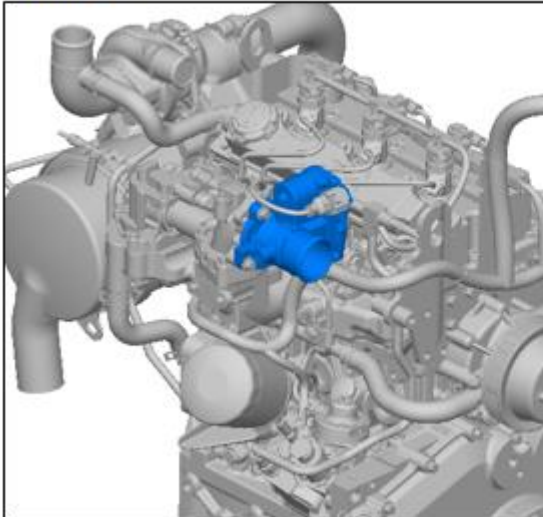
| No | ECU Pin | Description |
|----|---------|--|
| 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| 2 | A09 | Throttle valve (H-Bridge Neg) |
| 3 | A97 | Throttle valve Position Sensor Ground |
| 4 | - | Not used |
| 5 | A98 | Throttle valve Position Sensor Signal |
| 6 | A08 | Throttle valve (H-Bridge Pos) |



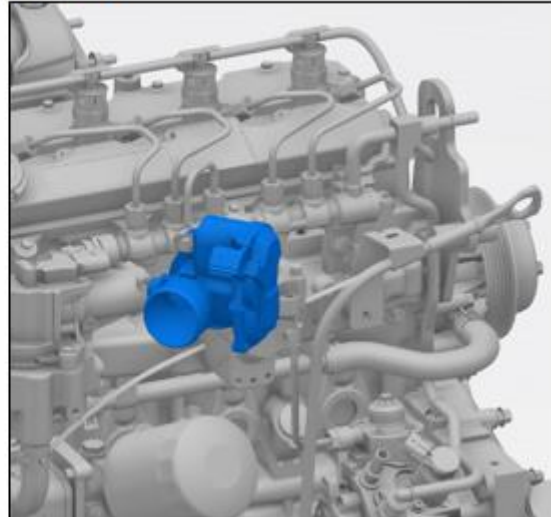
2) Component Location



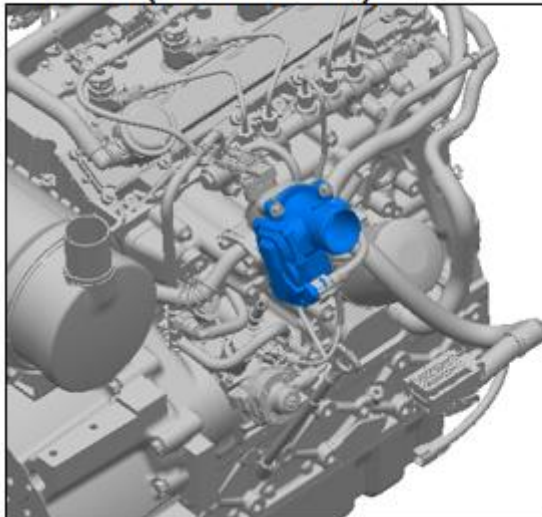
1.8L



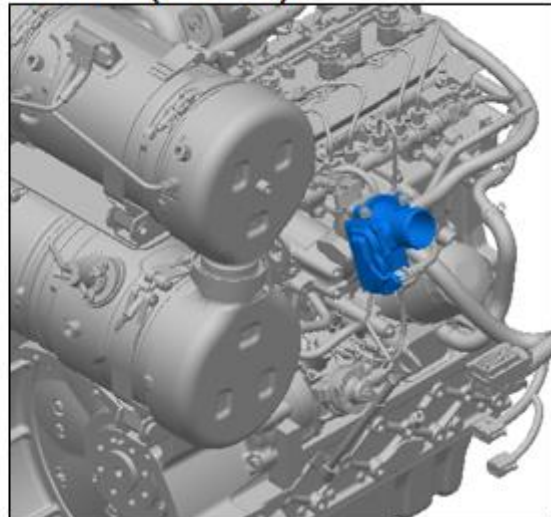
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the pins of Throttle valve H-bridge have been shorted to ground or H-Bridge circuit included Throttle valve is damaged.

5) Condition for Clearing the Fault Code

If the pins of Throttle valve H-bridge is connected or H-Bridge circuit included Throttle valve is corrected.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P02E2 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Sensor Supply (5V) (SSpMon1/2/3) fault present? 1) SSpMon1 : P0657/P0658/P0659/P1657 2) SSpMon2 : P1669/P2669/P2670/P2671 3) SSpMon3 : P1684/P2684/P2685/P2686 | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check the Throttle valve harness connection between ECU and Throttle valve. Fault code is not cleared? | | Step5 | Problem solved. |
| 5 | Check visually outside of the Throttle valve. Any damaged Throttle valve? Change the Throttle valve Fault code is cleared? | | Problem solved | Contact Helpdesk |

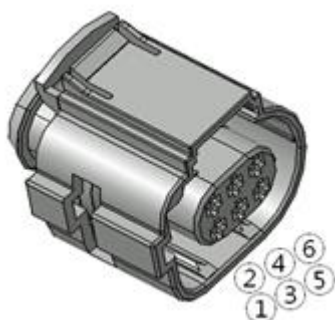
* In the case of a sensor using a 5V supply, the ECU supplies power directly and consists of three supplies. Therefore, if a sensor related fault occurs, check whether sensor power supply problem (SSpMon1 or SSpMon2 or SSpMon3 fault occurred together) and fixed them first.

| Fault Code | Fault Name |
|-----------------------|---|
| P02E5 | Throttle valve Position Closed jammed fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000051-01 | 1. Actuator problem (Faulty Throttle valve motor, Throttle valve sticking, Carbon or foreign material, Faulty Throttle valve position sensor) 2. Electrical problem (Wiring harness Throttle valve to ECU) | CE lamp ON DPF regeneration inhibit by Active and Forced |

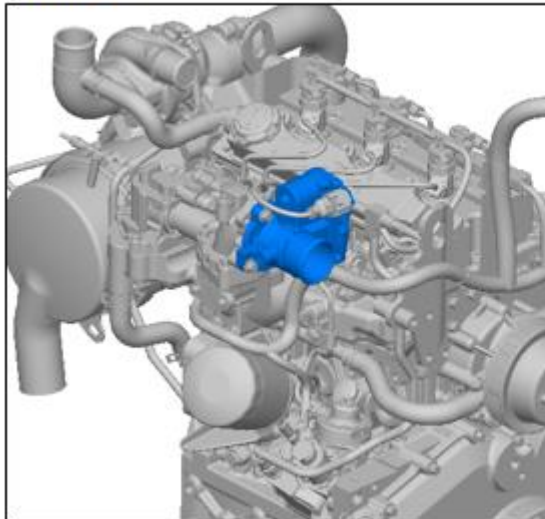
| No | ECU Pin | Description |
|----|---------|--|
| 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| 2 | A09 | Throttle valve (H-Bridge Neg) |
| 3 | A97 | Throttle valve Position Sensor Ground |
| 4 | - | Not used |
| 5 | A98 | Throttle valve Position Sensor Signal |
| 6 | A08 | Throttle valve (H-Bridge Pos) |



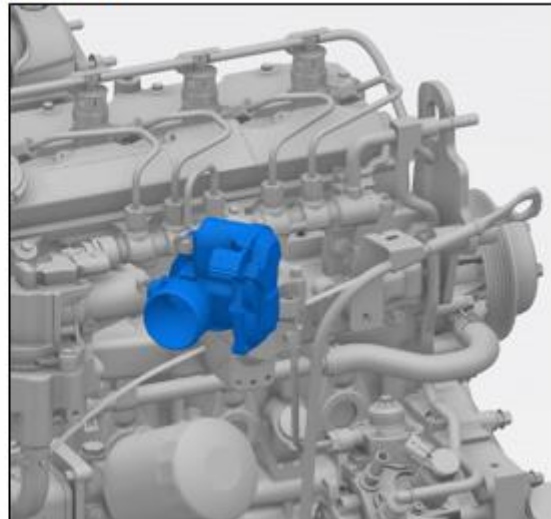
2) Component Location



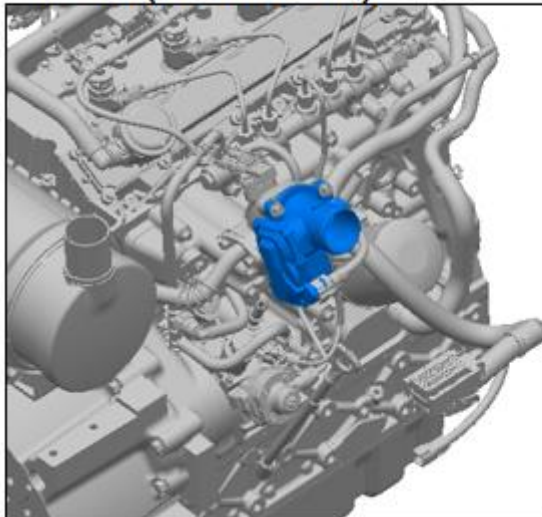
1.8L



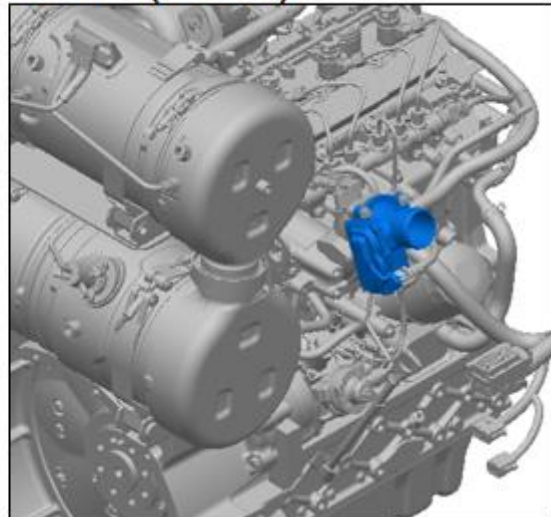
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on), coolant temperature > 60 degC.

4) Condition for Setting the Fault Code

If the difference between Throttle valve position demand and Throttle valve position feedback is over the threshold.

5) Condition for Clearing the Fault Code

If the difference between Throttle valve position demand and Throttle valve position feedback is within the threshold.

6) Check List

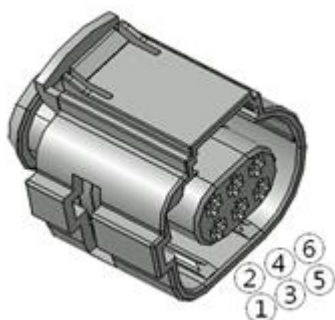
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|--|
| 1 | P02E5 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the Throttle valve position learning status Did reset the learning value using the "Part replacement" function of the service tool when changing new Throttle valve? Or did input the previous learned value using the "Part replacement" function of the service tool when replacing new ECU? | | Step 4 | Perform the Part replacement guideline |
| 4 | Check connection between ECU and Throttle valve. Wire harness is damaged? | | Do necessary repair | Step 5 |
| 5 | Check that the supply voltage is correct Voltage problem? | | Do necessary repair | Step 6 |
| 6 | Check that the valve position can reach demand position by service tool. (30%/50%/70%) ("Input/Output Test – Actuator test of TVA" function of the service tool) * Variables 1) Throttle valve position feedback (ThrVlv_rAct) Throttle valve position cannot reach to demand? | | Step 7 | Problem solved |
| 7 | Replace Throttle valve. Run the engine with high RPM and load. Fault code is cleared? | | Problem Solved. | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P02E4 | Throttle valve Position Open jammed fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E000051-00 | 1. Actuator problem (Faulty Throttle valve motor, Throttle valve sticking, Carbon or foreign material, Faulty Throttle valve position sensor) 2. Electrical problem (Wiring harness Throttle valve to ECU) | CE lamp ON DPF regeneration inhibit by Active and Forced |

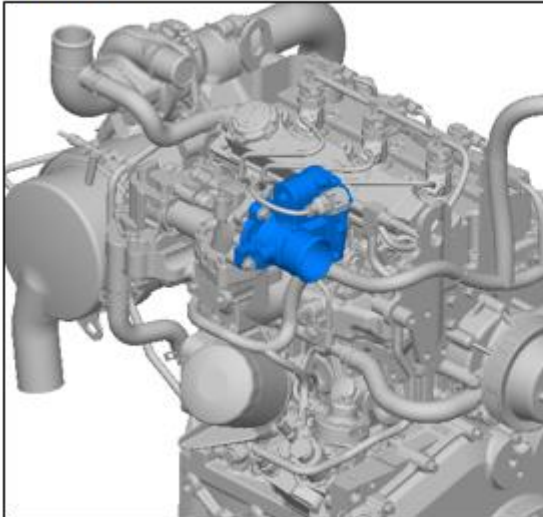
| No | ECU Pin | Description |
|----|---------|--|
| 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| 2 | A09 | Throttle valve (H-Bridge Neg) |
| 3 | A97 | Throttle valve Position Sensor Ground |
| 4 | - | Not used |
| 5 | A98 | Throttle valve Position Sensor Signal |
| 6 | A08 | Throttle valve (H-Bridge Pos) |



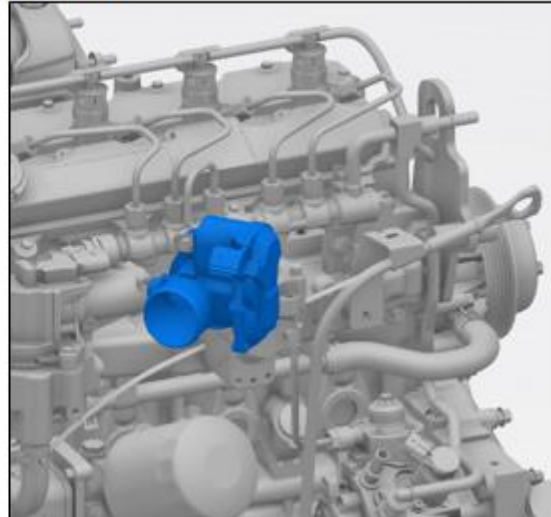
2) Component Location



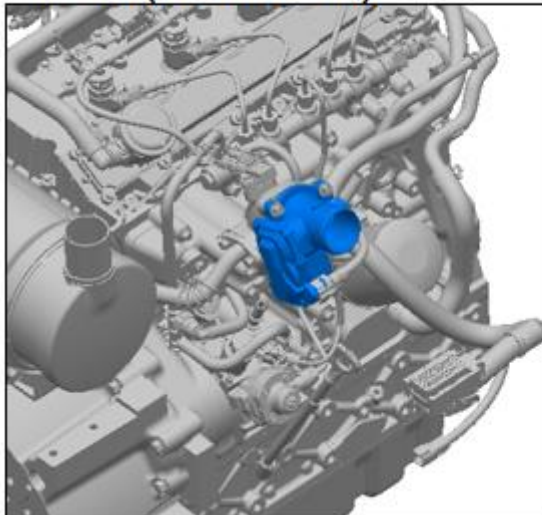
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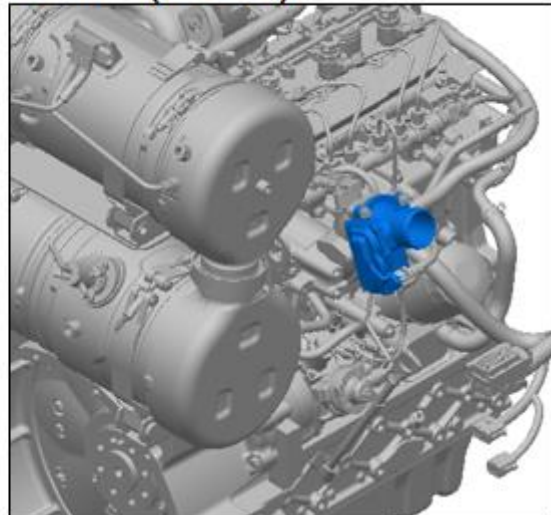
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on), coolant temperature > 60 degC.

4) Condition for Setting the Fault Code

If the difference between Throttle valve position demand and Throttle valve position feedback is over the threshold.

5) Condition for Clearing the Fault Code

If the difference between Throttle valve position demand and Throttle valve position feedback is within the threshold.

6) Check List

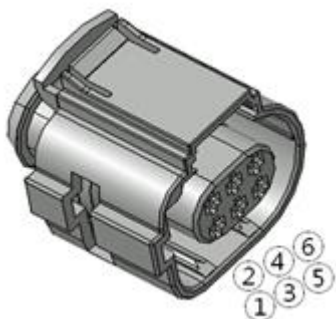
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|--|
| 1 | P02E4 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the Throttle valve position learning status Did reset the learning value using the "Part replacement" function of the service tool when changing new Throttle valve? Or did input the previous learned value using the "Part replacement" function of the service tool when replacing new ECU? | | Step 4 | Perform the Part replacement guideline |
| 4 | Check connection between ECU and Throttle valve. Wire harness is damaged? | | Do necessary repair | Step 5 |
| 5 | Check that the supply voltage is correct Voltage problem? | | Do necessary repair | Step 6 |
| 6 | Check that the valve position can reach demand position by service tool. (30%/50%/70%) ("Input/Output Test – Actuator test of TVA" function of the service tool) * Variables 1) Throttle valve position feedback (ThrVlv_rAct) Throttle valve position cannot reach to demand? | | Step 7 | Problem solved |
| 7 | Replace Throttle valve. Run the engine with high RPM and load. Fault code is cleared? | | Problem Solved. | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P02EA | Throttle valve Close Position Learning Drift Fault for long time |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000051-22 | 1. Actuator problem (Valve sticking, Foreign material) 2. Electrical problem (Faulty Throttle Valve) 3. Electrical problem (Throttle valve connector, Wiring harness, Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

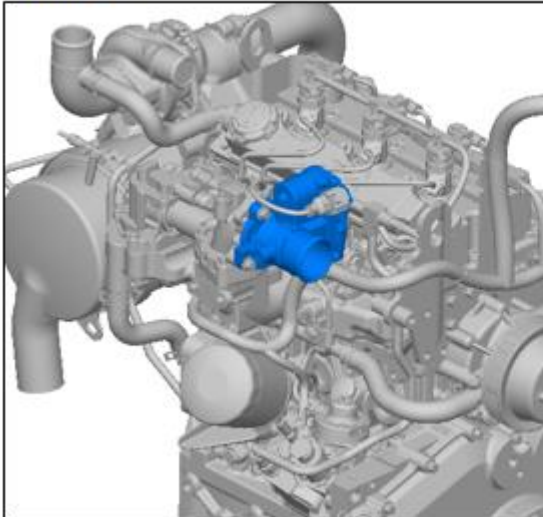
| No | ECU Pin | Description |
|----|---------|--|
| 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| 2 | A09 | Throttle valve (H-Bridge Neg) |
| 3 | A97 | Throttle valve Position Sensor Ground |
| 4 | - | Not used |
| 5 | A98 | Throttle valve Position Sensor Signal |
| 6 | A08 | Throttle valve (H-Bridge Pos) |



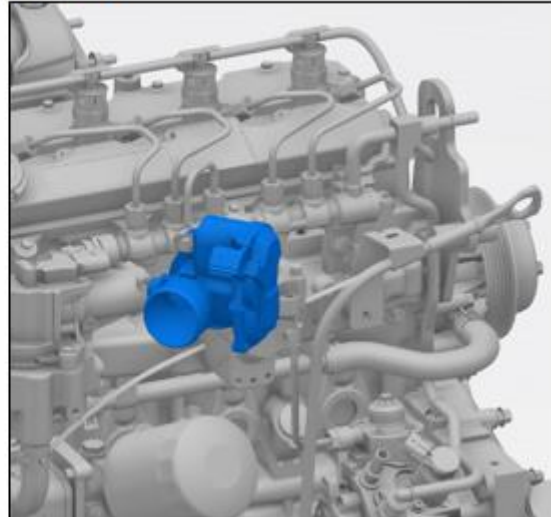
2) Component Location



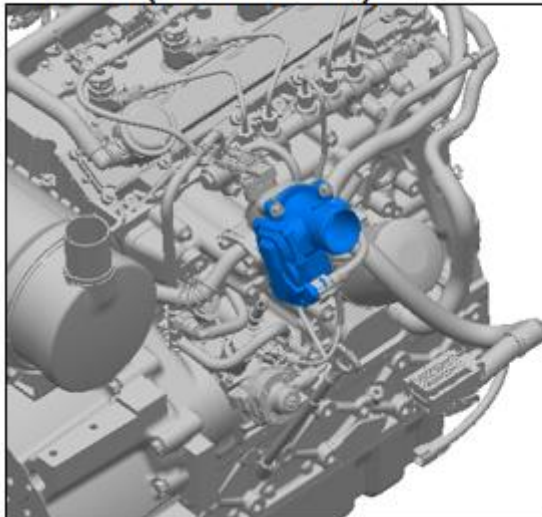
1.8L



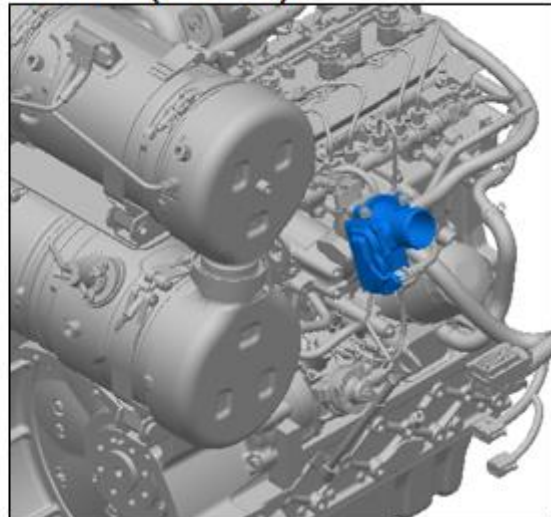
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The difference of the learned voltage values in the mechanical end stops and the first learned voltage value is greater than 0.3V for long time.

5) Condition for Clearing the Fault Code

The difference of the learned voltage values in the mechanical end stops and the first learned voltage value is within threshold.

6) Check List

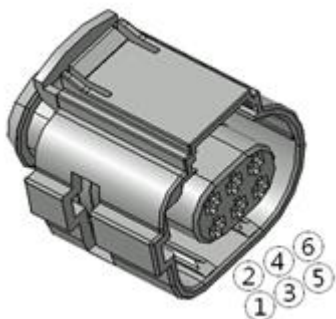
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-----------------|------------------|
| 1 | P02EA is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check connection between ECU and Throttle valve. Wire harness is damaged? Check that the supply voltage is incorrect? | | Step 5 | Step4 |
| 4 | Check that the valve position can reach demand position by service tool. (30%/50%/70%) ("Input/Output Test – Actuator test of TVA" function of the service tool) * Variables 1) Throttle valve position feedback (ThrVlv_rAct) Throttle valve position cannot reach to demand? | | Step 5 | Problem solved |
| 5 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem Solved. | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P02EB | Throttle valve Close Position Learning Drift Fault for short time |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000051-23 | 1. Actuator problem (Valve sticking, Foreign material) 2. Electrical problem (Faulty Throttle Valve) 3. Electrical problem (Throttle valve connector, Wiring harness, Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

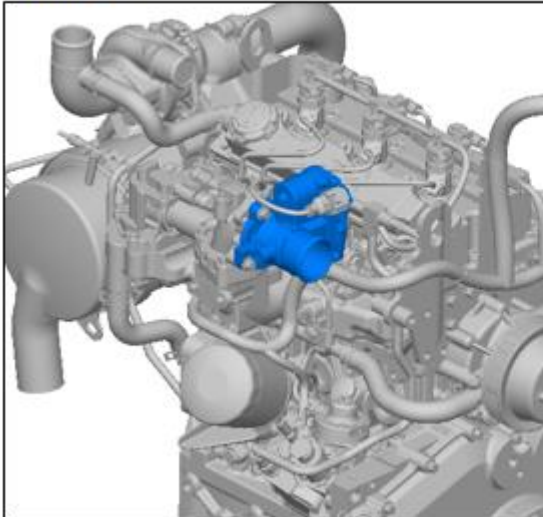
| No | ECU Pin | Description |
|----|---------|--|
| 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| 2 | A09 | Throttle valve (H-Bridge Neg) |
| 3 | A97 | Throttle valve Position Sensor Ground |
| 4 | - | Not used |
| 5 | A98 | Throttle valve Position Sensor Signal |
| 6 | A08 | Throttle valve (H-Bridge Pos) |



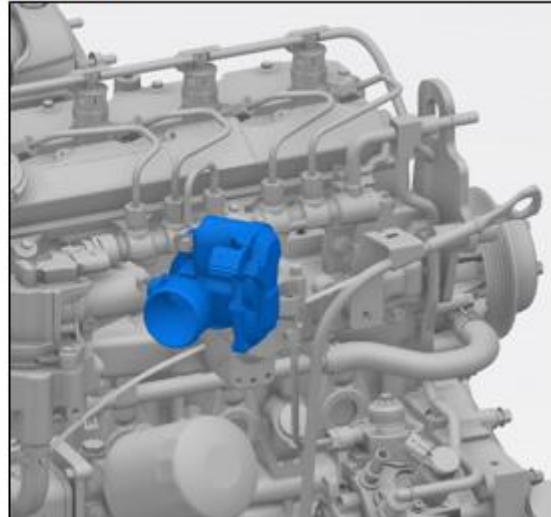
2) Component Location



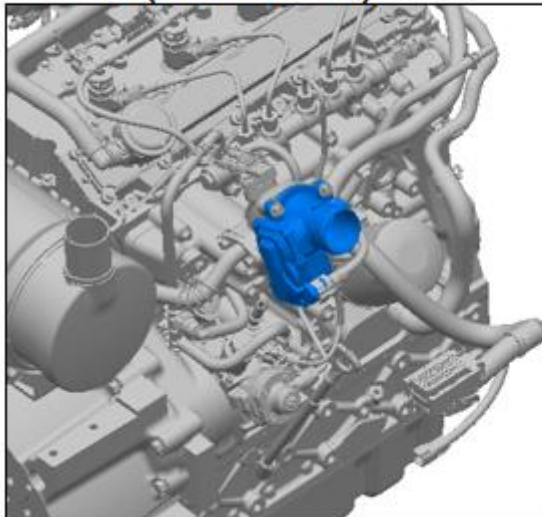
1.8L



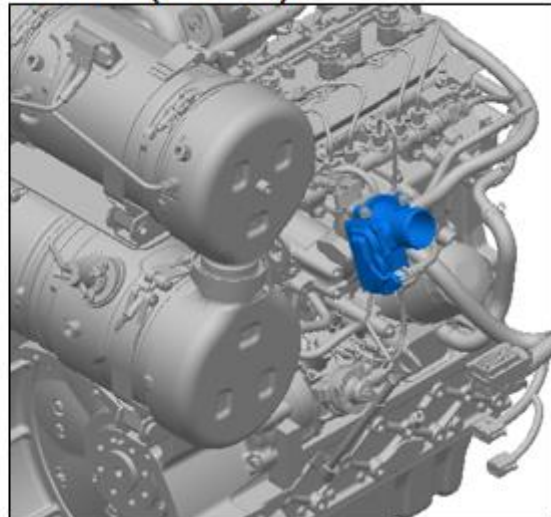
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The difference of the learned voltage values in the mechanical end stops and the last learned voltage value is greater than 0.3V for short time.

5) Condition for Clearing the Fault Code

The difference of the learned voltage values in the mechanical end stops and the last learned voltage value is within threshold.

6) Check List

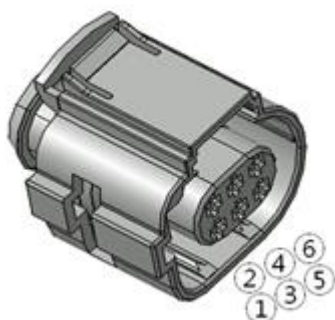
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-----------------|------------------|
| 1 | P02EB is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check connection between ECU and Throttle valve. Wire harness is damaged? Check that the supply voltage is incorrect? | | Step 5 | Step4 |
| 4 | Check that the valve position can reach demand position by service tool. (30%/50%/70%) ("Input/Output Test – Actuator test of TVA" function of the service tool) * Variables 1) Throttle valve position feedback (ThrVlv_rAct) Throttle valve position cannot reach to demand? | | Step 5 | Problem solved |
| 5 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem Solved. | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P02E9 | Throttle valve Position Sensor High Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000051-03 | 1. Electrical problem (Faulty Throttle valve, Throttle valve connector, Wiring harness Throttle valve to ECU) 2. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

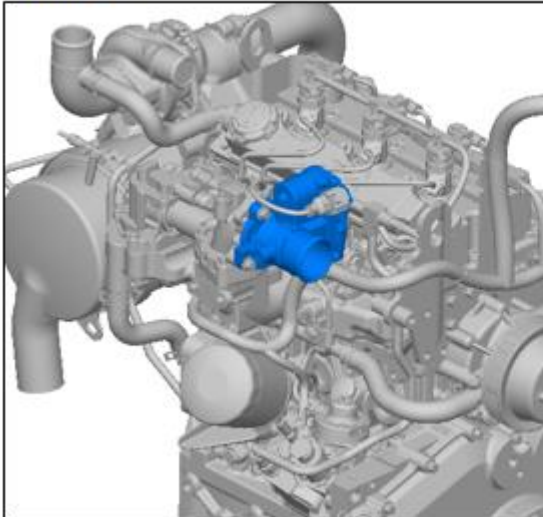
| No | ECU Pin | Description |
|----|---------|--|
| 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| 2 | A09 | Throttle valve (H-Bridge Neg) |
| 3 | A97 | Throttle valve Position Sensor Ground |
| 4 | - | Not used |
| 5 | A98 | Throttle valve Position Sensor Signal |
| 6 | A08 | Throttle valve (H-Bridge Pos) |



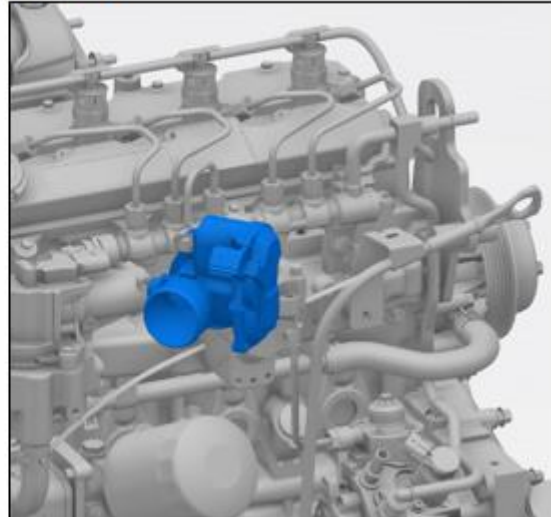
2) Component Location



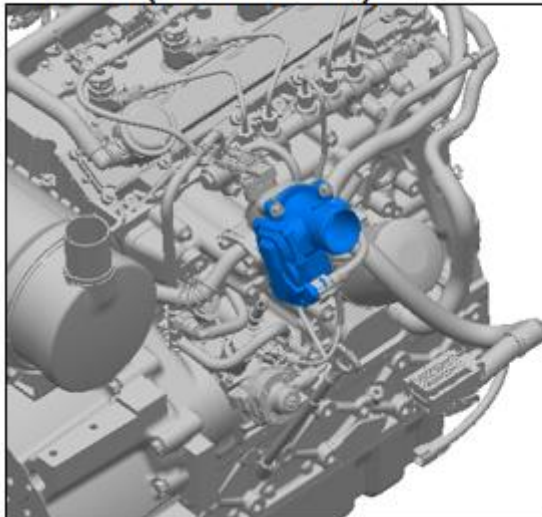
1.8L



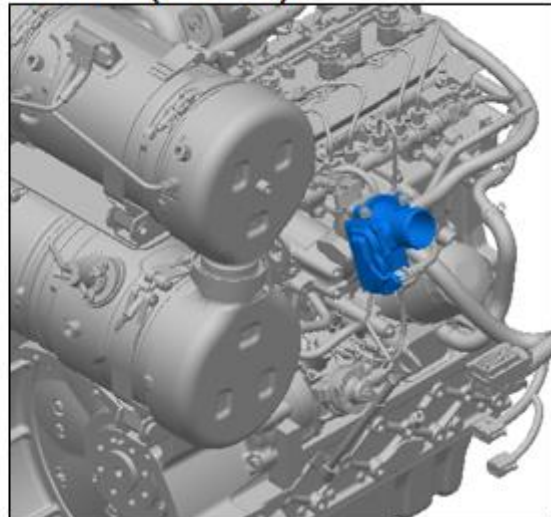
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

Throttle valve Feedback Position value is more than maximum operation range (4.75V).

5) Condition for Clearing the Fault Code

Throttle valve Feedback Position value is in operation range.

6) Check List

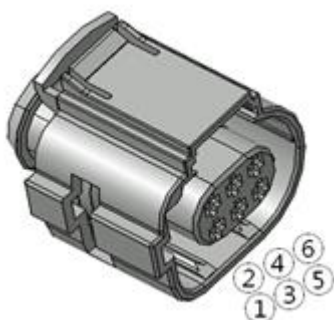
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-----------------|------------------|
| 1 | P02E9 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check connection between ECU and Throttle valve. Wire harness is damaged? Check that the supply voltage is incorrect? | | Step 5 | Step4 |
| 4 | Check that the valve position can reach demand position by service tool. (30%/50%/70%) ("Input/Output Test – Actuator test of TVA" function of the service tool) * Variables 1) Throttle valve position feedback (ThrVlv_rAct) Throttle valve position cannot reach to demand? | | Step 5 | Problem solved |
| 5 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem Solved. | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P02E8 | Throttle valve Position Sensor Low Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E000051-04 | 1. Electrical problem (Faulty Throttle valve, Throttle valve connector, Wiring harness Throttle valve to ECU) 2. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

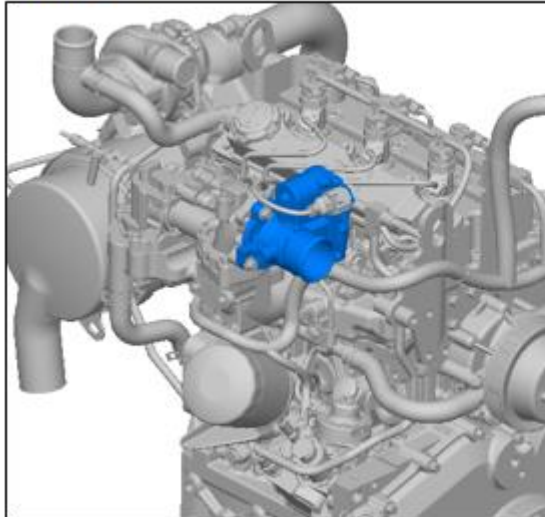
| No | ECU Pin | Description |
|----|---------|--|
| 1 | A16 | Throttle valve Position Sensor Supply (5V) |
| 2 | A09 | Throttle valve (H-Bridge Neg) |
| 3 | A97 | Throttle valve Position Sensor Ground |
| 4 | - | Not used |
| 5 | A98 | Throttle valve Position Sensor Signal |
| 6 | A08 | Throttle valve (H-Bridge Pos) |



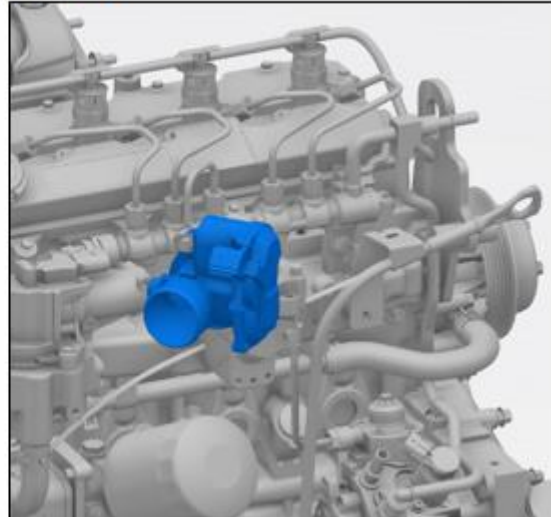
2) Component Location



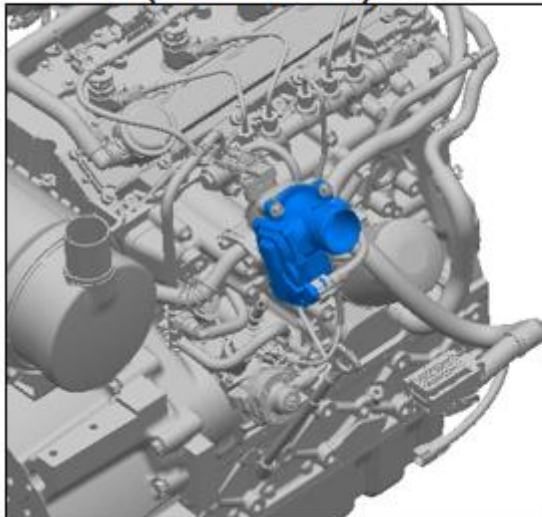
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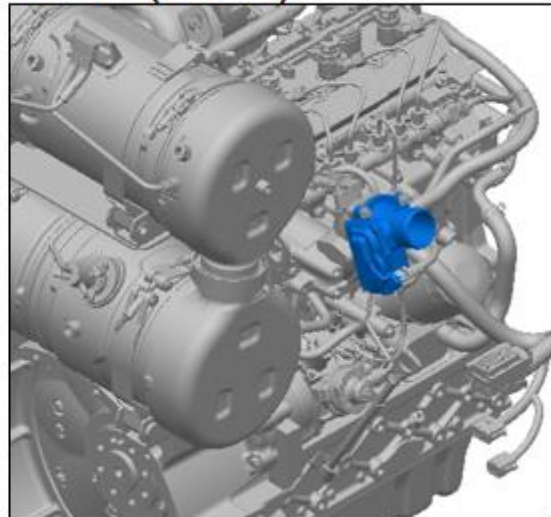
2.4L



3.4L (No-SCR)



3.4L (SCR)



3) Condition for Running Diagnostic

Key on or engine running or Key off (ECU on)

4) Condition for Setting the Fault Code

Throttle valve Feedback Position value is less than minimum operation range (0.25V).

5) Condition for Clearing the Fault Code

Throttle valve Feedback Position value is in operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|-----------------|------------------|
| 1 | P02E8 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check connection between ECU and Throttle valve. Wire harness is damaged? Check that the supply voltage is incorrect? | | Step 5 | Step4 |
| 4 | Check that the valve position can reach demand position by service tool. (30%/50%/70%) ("Input/Output Test – Actuator test of TVA" function of the service tool) * Variables 1) Throttle valve position feedback (ThrVlv_rAct) Throttle valve position cannot reach to demand? | | Step 5 | Problem solved |
| 5 | Change the suspected parts After change the parts, start the engine and change the RPM from low idle to high idle. Keep the RPM as high idle at least 30 seconds. Fault code is cleared? | | Problem Solved. | Contact Helpdesk |

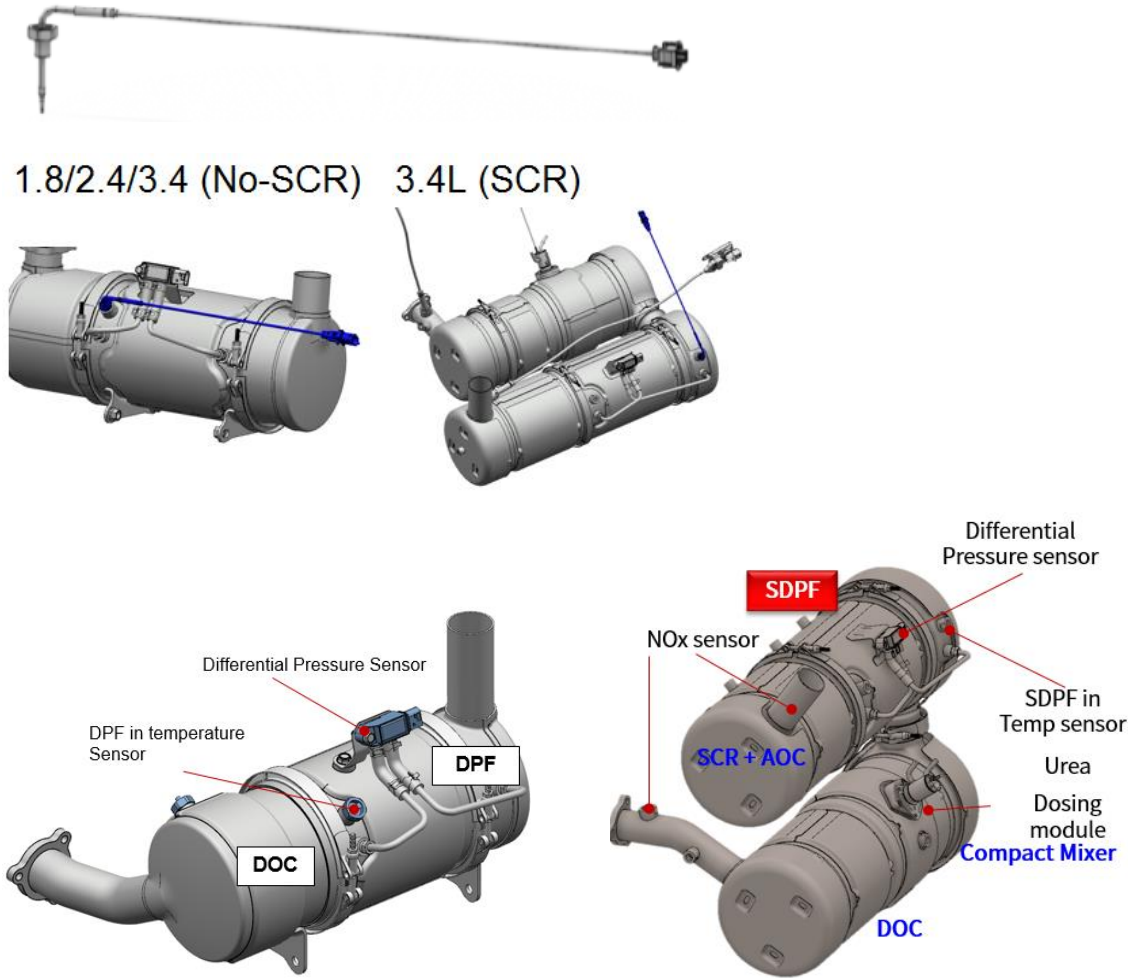
| Fault Code | Fault Name |
|-----------------------|--|
| P2034 | DPF(SDPF) inlet temperature Plausibility Fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E003242-11 | 1. Electrical problem (DPF(SDPF) in temperature sensor connector) 2. Tampering (DPF(SDPF) in temperature sensor is not installed well for tampering, reduced DEF consumption) 3. Electrical problem (Faulty DPF(SDPF) in temperature sensor) 4. Air path problem (Intake/Exhaust gas leakage, Air cleaner clogged, etc...) | CE lamp ON Inducement Group5 (Tampering) DPF regeneration inhibit by Active and Forced |

| No. | ECU Pin | PIN description |
|-----|---------|---|
| 1 | K50 | DPF(SDPF) inlet temperature sensor ground |
| 2 | K47 | DPF(SDPF) inlet temperature sensor signal |

2) Component Location



| DPF(SDPF) in Temperature sensor | | | |
|---------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 170 | 683 |
| 0 | 32 | 201 | 787 |
| 50 | 122 | 239 | 909 |
| 100 | 212 | 276 | 1022 |
| 200 | 392 | 349 | 1226 |
| 400 | 752 | 488 | 1562 |
| 600 | 1112 | 618 | 1825 |
| 800 | 1472 | 738 | 2036 |

3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If the DPF(SDPF) in temperature is out of the threshold during restricted condition, fault code is raised.
(Sensor-Model < -150degC)

* DPF regeneration is inhibited because the value of the DPF (SCRF) inlet temperature sensor is not valid.

5) Condition for Clearing the Fault Code

DPF(SDPF) inlet temperature is within normal operation range.

6) Check List

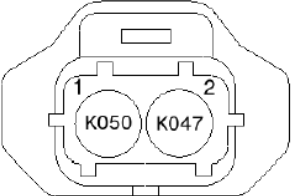
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|--------|
| 1 | P2034 is detected on service tool? | | Step 2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step 3 | |
| 3 | Do visual inspection throughout all intake/exhaust air path and sensor installation. (included air cleaner) Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. Are all sensors correctly installed? | | Step 4 | Step 5 |
| 4 | Fix the leakage or sensor installation. After fix the problem, start the engine and change the RPM from low idle to high idle. Keep the RPM as a high idle at least 10 minutes. Fault code is cleared? | | Do necessary repair | Step 5 |

| | | | | |
|---|---|--|---------------|------------------|
| 5 | Change the DPF(SDPF) in temperature sensor as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Change sensor | Contact Helpdesk |
|---|---|--|---------------|------------------|

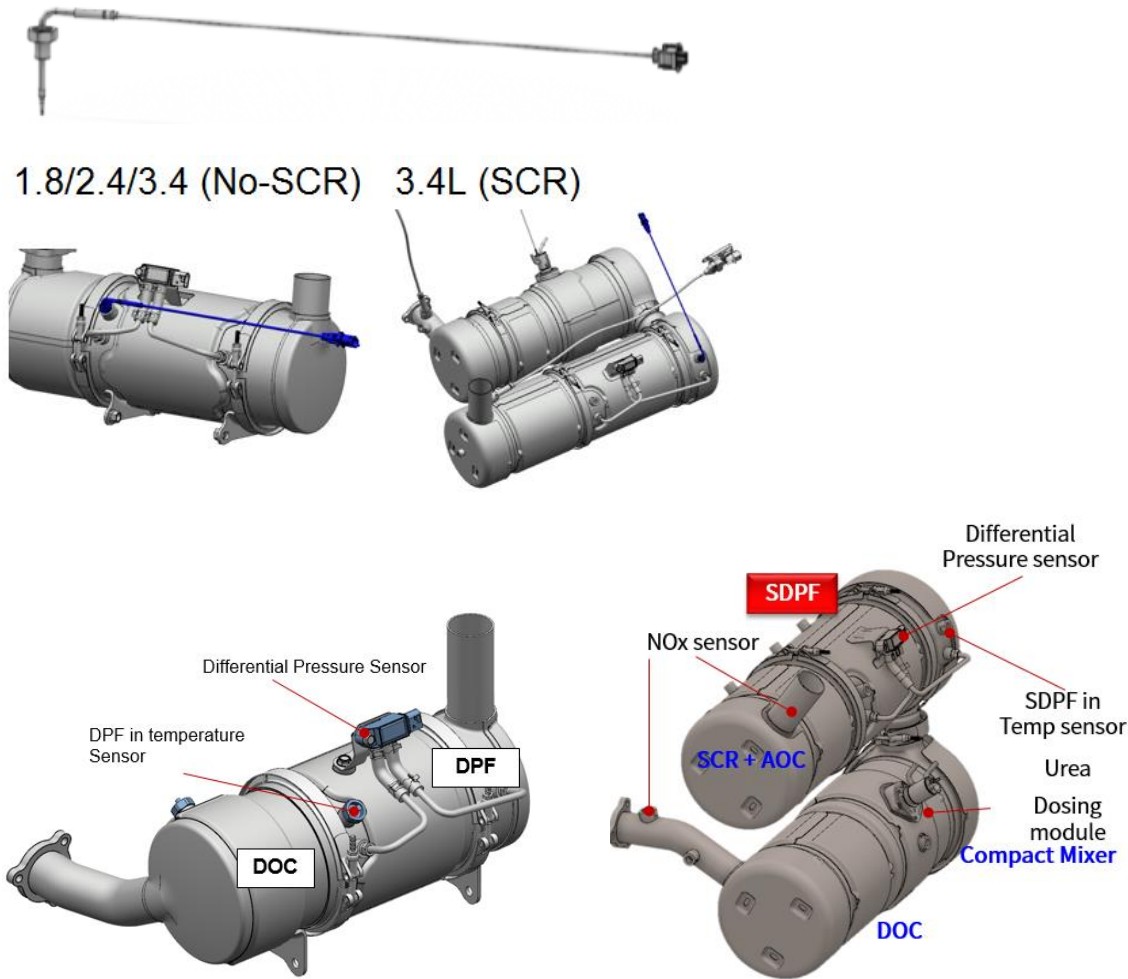
| Fault Code | Fault Name |
|-----------------------|---|
| P2035 | DPF(SCRf) inlet temperature Drift fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E003242-20 | 1. Electrical problem (DPF(SDPF) in temperature sensor connector) 2. Tampering (DPF(SDPF) in temperature sensor is not installed well for tampering, reduced DEF consumption) 3. Electrical problem (Faulty DPF(SDPF) in temperature sensor) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

| | | | |
|---|-----|---------|---|
|  | No. | ECU Pin | PIN description |
| | 1 | K50 | DPF(SDPF) inlet temperature sensor ground |
| | 2 | K47 | DPF(SDPF) inlet temperature sensor signal |
| | | | |

2) Component Location



| DPF(SDPF) in Temperature sensor | | | |
|---------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 170 | 683 |
| 0 | 32 | 201 | 787 |
| 50 | 122 | 239 | 909 |
| 100 | 212 | 276 | 1022 |
| 200 | 392 | 349 | 1226 |
| 400 | 752 | 488 | 1562 |
| 600 | 1112 | 618 | 1825 |
| 800 | 1472 | 738 | 2036 |

3) Condition for Running Diagnostic

Engine key on after 12hrs soaking.

* The engine soaking time is calculated based on real timer from CAN signal of machine controller or GPS. And this fault diagnosis is only performed when the CAN signal is valid.

4) Condition for Setting the Fault Code

The DPF(SCRf) in temperature is compared with all other temperature sensors (Inlet air, Intake manifold, Turbine in, Coolant) at 12hrs soaking condition and if the difference of value is higher than all other sensors, fault code is raised. (>20degC)

* DPF regeneration is inhibited because the value of the DPF (SCRf) inlet temperature sensor is not valid.

* If any heating or cooling system is used in engine body and intake / exhaust system, misdiagnosis could be occurred. Therefore, first check if there is a cause of temperature change when engine soaking condition. (Heating system, Cooling system, etc...)

5) Condition for Clearing the Fault Code

DPF(SDPF) inlet temperature is within normal operation range.

* Even though the root cause problem is fixed, the fault code is remains until to re-diagnosis at 12hrs soaking condition. Therefore, it is necessary to clear the fault code using by the service tool after fixed the problem.

6) Check List

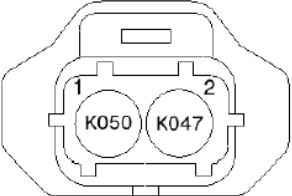
| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|--------|
| 1 | P2035 is detected on service tool? | | Step 2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step 3 | |
| 3 | Do visual inspection throughout all engine body and intake/exhaust air path. Is there any heating or cooling system? | | Contact Helpdesk (If any heating or cooling system is used) | Step 4 |

| | | | | |
|----------|--|--|--|-------------------------|
| | | | in engine body and intake / exhaust system, misdiagnosis could be occurred.) | |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Change the DPF(SDPF) in temperature sensor as a normal one. Is there any temperature drift? (Even though the root cause problem is fixed, the fault code is remains until to re-diagnosis at 12hrs soaking condition. Therefore, it is necessary to clear the fault code using by the service tool after fixed the problem.) | | Change sensor | Contact Helpdesk |

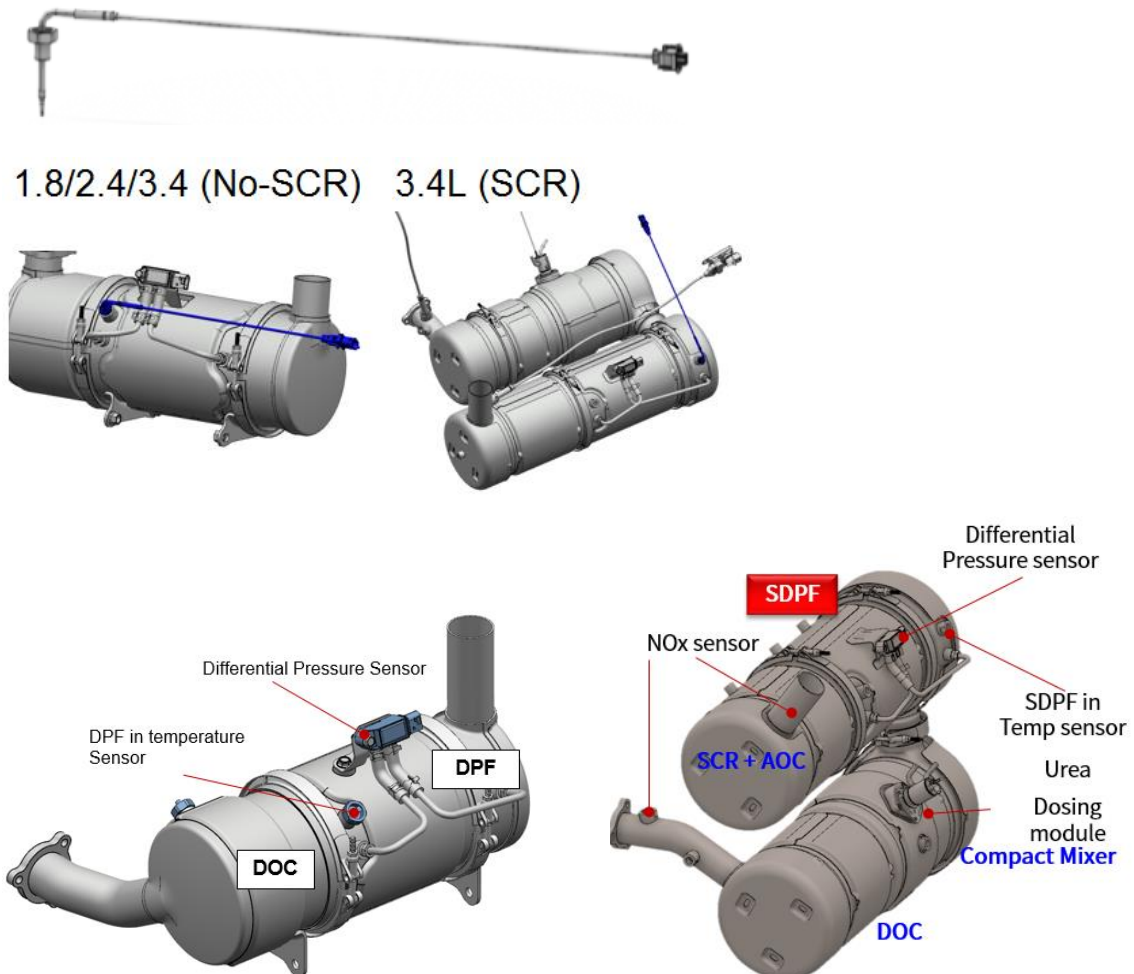
| Fault Code | Fault Name |
|-----------------------|--|
| P1033 | DPF(SDPF) inlet temperature High fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E003242-00 | 1. DPF(SDPF) inlet temperature is exceeded than engine limit 2. Electrical problem (DPF(SDPF) inlet temperature sensor connector, Wiring harness from ECU to DPF(SDPF) inlet temperature sensor, DPF(SDPF) inlet temperature sensor) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON DPF regeneration inhibit by Active and Forced |

|  | No. | ECU Pin | PIN description |
|---|-----|---------|---|
| | 1 | K50 | DPF(SDPF) inlet temperature sensor ground |
| | 2 | K47 | DPF(SDPF) inlet temperature sensor signal |
| | | | |

2) Component Location



| DPF(SDPF) in Temperature sensor | | | |
|---------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 170 | 683 |
| 0 | 32 | 201 | 787 |
| 50 | 122 | 239 | 909 |
| 100 | 212 | 276 | 1022 |
| 200 | 392 | 349 | 1226 |
| 400 | 752 | 488 | 1562 |
| 600 | 1112 | 618 | 1825 |
| 800 | 1472 | 738 | 2036 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

DPF(SDPF) inlet temperature is higher than normal operation threshold. (800degC)

5) Condition for Clearing the Fault Code

DPF(SDPF) inlet temperature is within normal operation range.

6) Check List


| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P1033 is detected on service tool? | | Step 2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step 3 | |
| 3 | Do visual inspection throughout all exhaust air path and sensor installation. Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. Are all sensors correctly installed? | | Do necessary repair | Step 4 |
| 4 | Change the DPF(SDPF) in temperature sensor as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Change sensor | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF(SDPF) inlet temperature sensor is replaced by the SCR inlet temperature sensor.

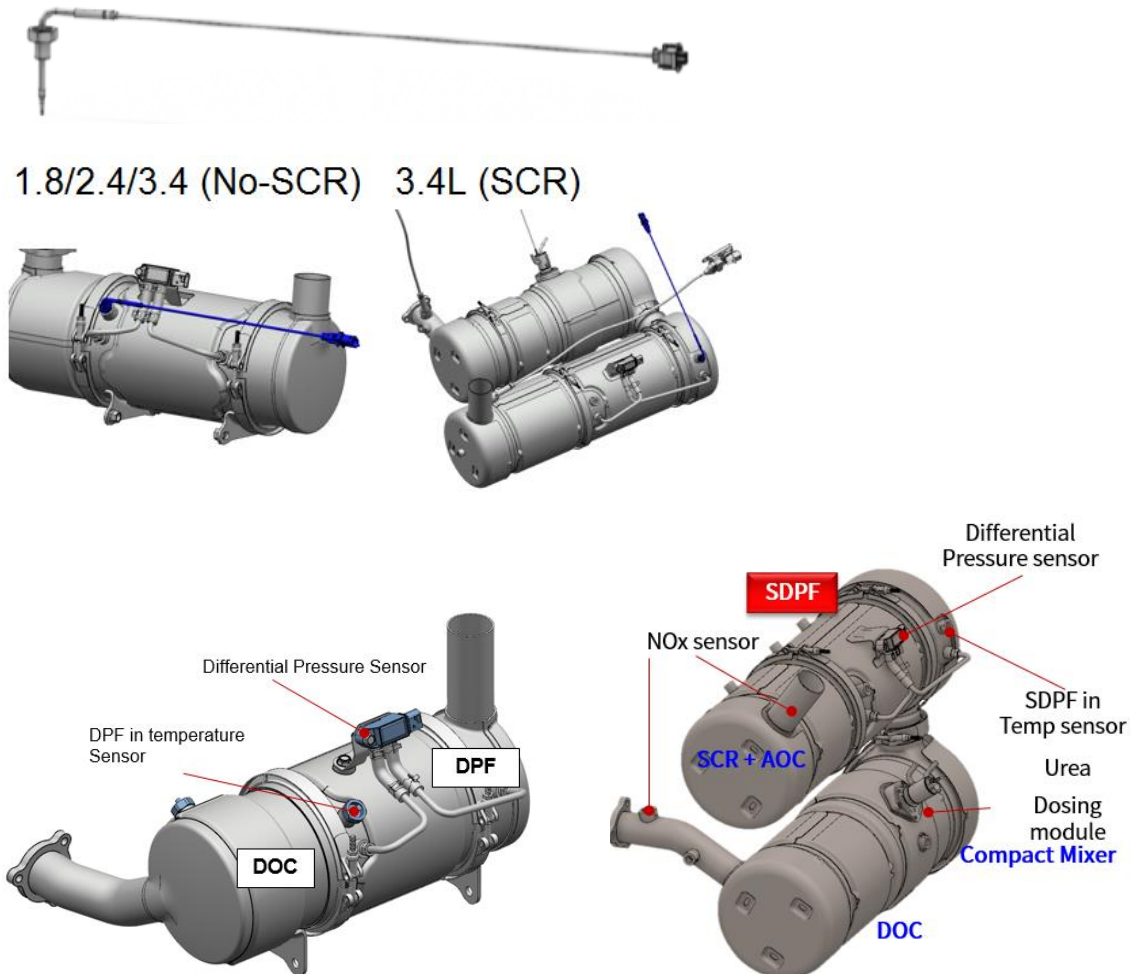
| Fault Code | Fault Name |
|-----------------------|---|
| P2033 | DPF(SDPF) inlet temperature sensor High fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E003242-03 | 1. Electrical problem (DPF(SDPF) inlet temperature sensor connector) 2. Electrical problem (Wiring harness DPF(SDPF) inlet temperature sensor to ECU, Faulty DPF(SDPF) inlet temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Inducement Group5 (Tampering) DPF regeneration inhibit by Active and Forced |

|  | No. | ECU Pin | PIN description |
|---|-----|---------|---|
| | 1 | K50 | DPF(SDPF) inlet temperature sensor ground |
| | 2 | K47 | DPF(SDPF) inlet temperature sensor signal |
| | | | |

2) Component Location



| DPF(SDPF) in Temperature sensor | | | |
|---------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 170 | 683 |
| 0 | 32 | 201 | 787 |
| 50 | 122 | 239 | 909 |
| 100 | 212 | 276 | 1022 |
| 200 | 392 | 349 | 1226 |
| 400 | 752 | 488 | 1562 |
| 600 | 1112 | 618 | 1825 |
| 800 | 1472 | 738 | 2036 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

DPF(SDPF) inlet temperature signal is more than maximum threshold (3.548V)

5) Condition for Clearing the Fault Code

DPF(SDPF) inlet temperature is within normal operation range.

6) Check List

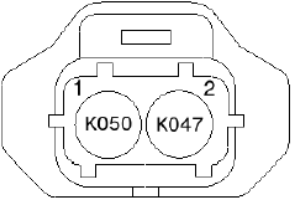
| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|---------------------|------------------|
| 1 | P2033 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor resistance (remove sensor connector and measure the resistance across pins K50 and K47 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF(SDPF) inlet temperature sensor is replaced by the SCR inlet temperature sensor.

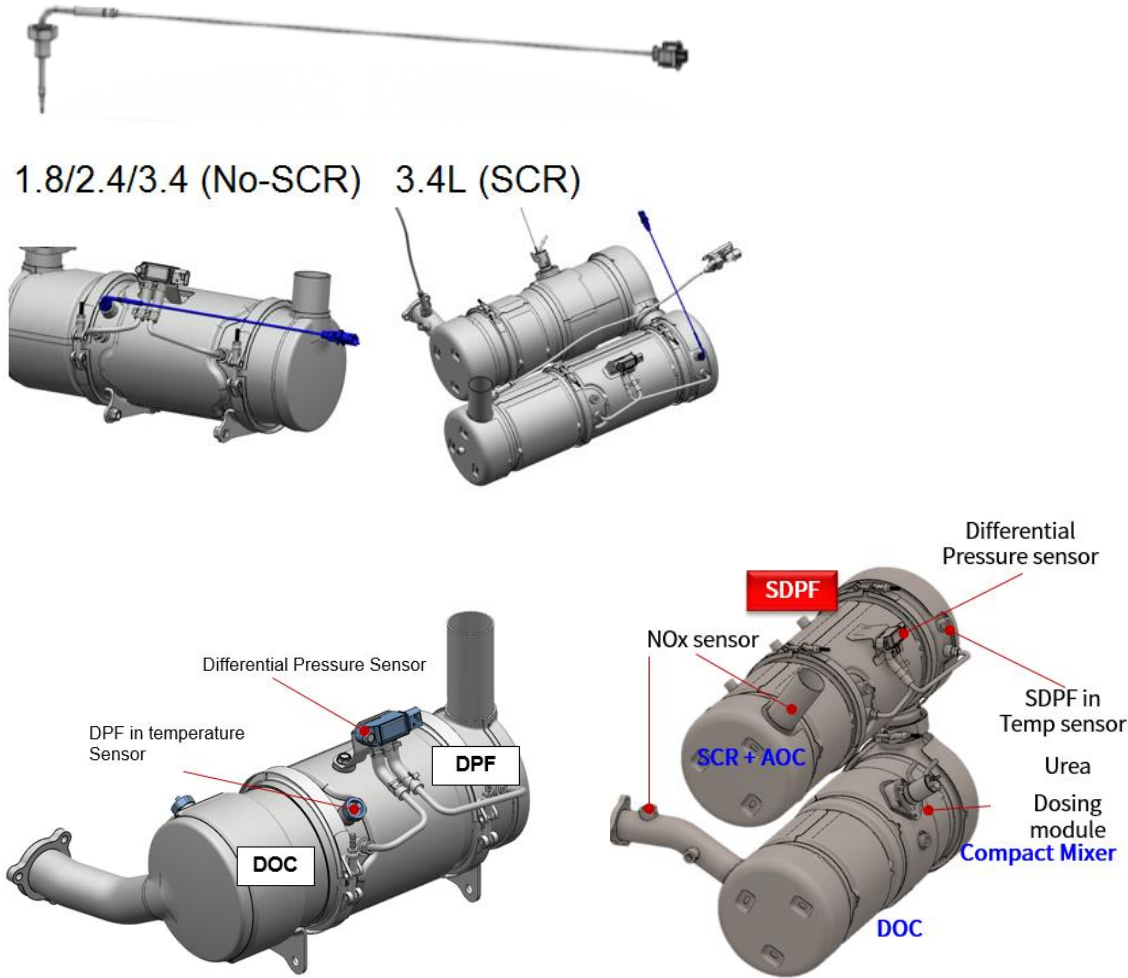
| Fault Code | Fault Name |
|-----------------------|--|
| P2032 | DPF(SDPF) inlet temperature sensor Low fault |

1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E003242-04 | 1. Electrical problem (DPF(SDPF) inlet temperature sensor connector) 2. Electrical problem (Wiring harness DPF(SDPF) inlet temperature sensor to ECU, Faulty DPF(SDPF) inlet temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Inducement Group5 (Tampering) DPF regeneration inhibit by Active and Forced |

|  | No. | ECU Pin | PIN description |
|---|-----|---------|---|
| | 1 | K50 | DPF(SDPF) inlet temperature sensor ground |
| | 2 | K47 | DPF(SDPF) inlet temperature sensor signal |
| | | | |

2) Component Location



| DPF(SDPF) in Temperature sensor | | | |
|---------------------------------|--------|-----------|-----------|
| Temperature | | R nominal | V nominal |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 170 | 683 |
| 0 | 32 | 201 | 787 |
| 50 | 122 | 239 | 909 |
| 100 | 212 | 276 | 1022 |
| 200 | 392 | 349 | 1226 |
| 400 | 752 | 488 | 1562 |
| 600 | 1112 | 618 | 1825 |
| 800 | 1472 | 738 | 2036 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

DPF(SDPF) inlet temperature signal is less than minimum threshold (0.331V)

5) Condition for Clearing the Fault Code

DPF(SDPF) inlet temperature is within normal operation range.

6) Check List

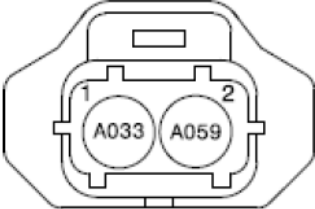
| Step | Inspection | Standard Value | YES | NO |
|------|--|--------------------|---------------------|------------------|
| 1 | P2032 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor resistance (remove sensor connector and measure the resistance across pins K50 and K47 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

※ For systems with only SCR without DPF (or SDPF), the DPF(SDPF) inlet temperature sensor is replaced by the SCR inlet temperature sensor.

| Fault Code | Fault Name |
|-----------------------|--|
| P0544 | Turbine inlet temperature Plausibility Fault |

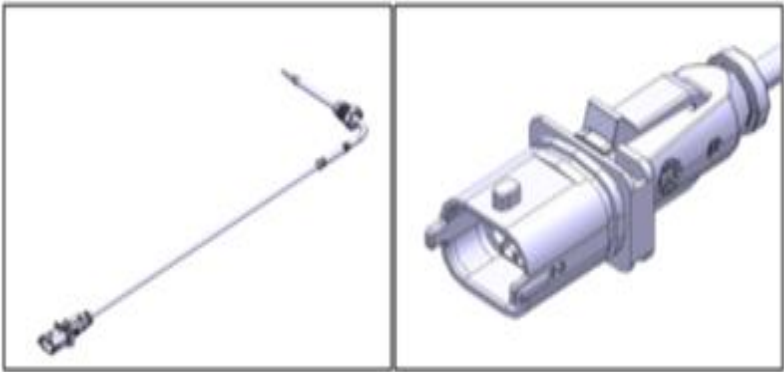
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E002789-11 | 1. Air path problem (Exhaust leakage (exhaust manifold, EGR path)) 2. Air path problem (Faulty Turbocharger) 3. Air path problem (Intake air restriction too high (Air filter plugged)) 4. Injector problem (Injector open stuck) 5. Electrical problem (Faulty Turbine inlet temperature sensor) 6. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON DPF regeneration inhibit by Active and Forced |

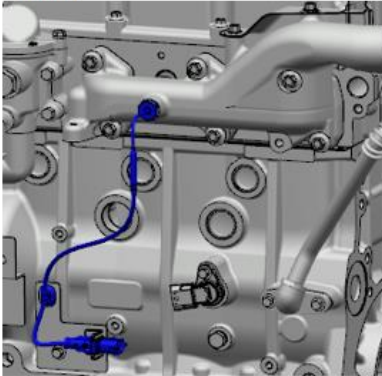


| No. | ECU Pin | PIN description |
|-----|---------|---|
| 1 | A33 | Turbine inlet temperature sensor ground |
| 2 | A59 | Turbine inlet temperature sensor signal |

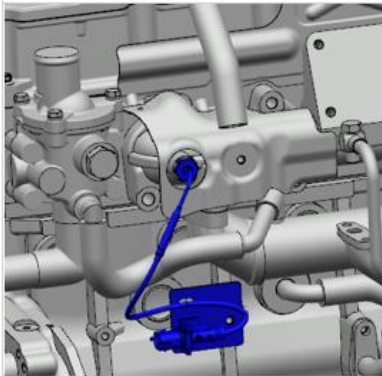
2) Component Location



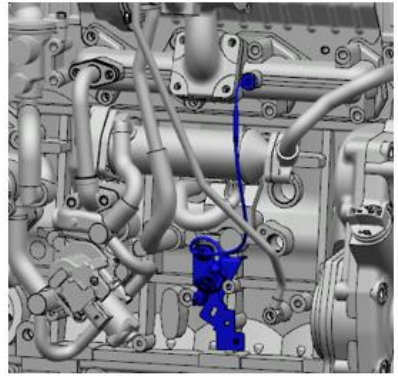
1.8L



2.4L



3.4L



| Turbine In Temperature sensor | | | |
|-------------------------------|--------|----------------------|----------------------|
| Temperature | | R _{nominal} | V _{nominal} |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 170 | 584 |
| 0 | 32 | 201 | 674 |
| 25 | 77 | 220 | 728 |
| 100 | 212 | 276 | 881 |
| 200 | 392 | 349 | 1064 |
| 400 | 752 | 488 | 1370 |
| 600 | 1112 | 618 | 1615 |
| 800 | 1472 | 738 | 1815 |

3) Condition for Running Diagnostic

Engine running

4) Condition for Setting the Fault Code

If the Turbine in temperature is out of the threshold during restricted condition, fault code is raised.
($\pm 300\text{degC}$)

5) Condition for Clearing the Fault Code

Turbine inlet temperature is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0544 is detected on service tool? | | Step 2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step 3 | |

| | | | | |
|----------|---|--|----------------------------|-------------------------|
| 3 | Do visual inspection throughout all air path and sensor installation. (From air cleaner to exhaust manifold including EGR passage) Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Step 4 | Step 5 |
| 4 | Fix the leakage. After fix the problem, start the engine and change the RPM from low idle to high idle. Keep the RPM as a high idle at least 10 minutes. Fault code is cleared? | | Do necessary repair | Step 5 |
| 5 | Change the Turbine in temperature sensor as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Change sensor | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--------------------------------------|
| P1546 | Turbine inlet temperature High fault |

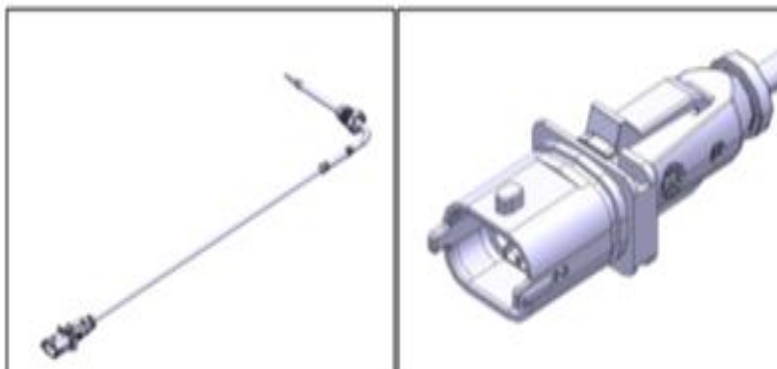
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--|
| E002789-00 | 1. Turbine inlet temperature is exceeded than engine limit 2. Electrical problem (Turbine inlet temperature sensor connector, Wiring harness from ECU to Turbine inlet temperature sensor, Faulty Turbine inlet temperature sensor) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON Torque Reduction 1(Mild) DPF regeneration inhibit by Active and Forced |

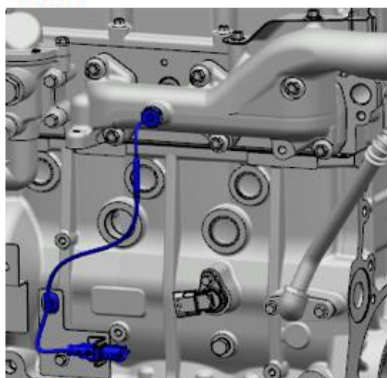
A technical diagram of a two-pin electrical connector. The connector has a rectangular body with two circular pin sockets. The left socket is labeled 'A033' and '1', and the right socket is labeled 'A059' and '2'. The connector is shown from a top-down perspective.

| No. | ECU Pin | PIN description |
|-----|---------|---|
| 1 | A33 | Turbine inlet temperature sensor ground |
| 2 | A59 | Turbine inlet temperature sensor signal |

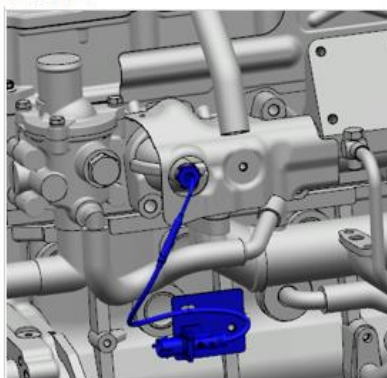
2) Component Location



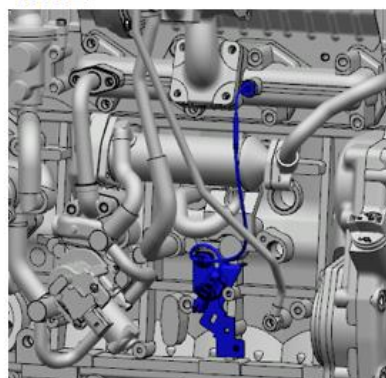
1.8L



2.4L



3.4L



| Turbine in Temperature sensor | | | |
|-------------------------------|--------|----------------------|----------------------|
| Temperature | | R _{nominal} | V _{nominal} |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 170 | 584 |
| 0 | 32 | 201 | 674 |
| 25 | 77 | 220 | 728 |
| 100 | 212 | 276 | 881 |
| 200 | 392 | 349 | 1064 |
| 400 | 752 | 488 | 1370 |
| 600 | 1112 | 618 | 1615 |
| 800 | 1472 | 738 | 1815 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Turbine inlet temperature is higher than normal operation threshold. (790degC)

5) Condition for Clearing the Fault Code

Turbine inlet temperature is within normal operation range.

6) Check List

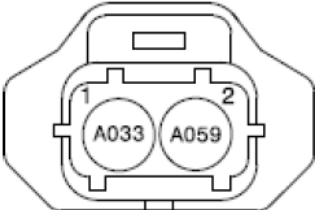
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P1546 is detected on service tool? | | Step 2 | |
| 2 | After let the machine be in safety area and turn-off the key switch. | | Step 3 | |

| | | | | |
|----------|---|--|----------------------------|-------------------------|
| 3 | Do visual inspection throughout all air path and sensor installation. (From air cleaner to exhaust manifold including EGR passage) Is there any leakage? If no leakage is found visually, Start up the engine and check the leakage again in machine stationary condition. | | Do necessary repair | Step 4 |
| 4 | Change the Turbine in temperature sensor as a normal one. Start the engine and set the RPM in high idle at least 10 minutes. Fault code is cleared? | | Change sensor | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P0546 | Turbine inlet temperature sensor High fault |

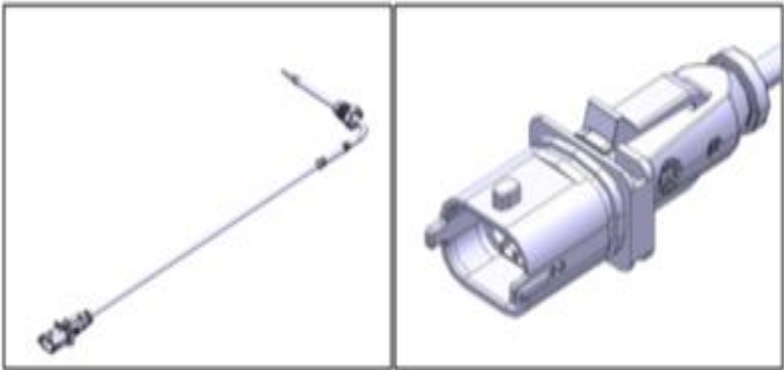
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E002789-03 | 1. Electrical problem (Turbine inlet temperature sensor connector) 2. Electrical problem (Wiring harness Turbine inlet temperature sensor to ECU, Faulty Turbine inlet temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

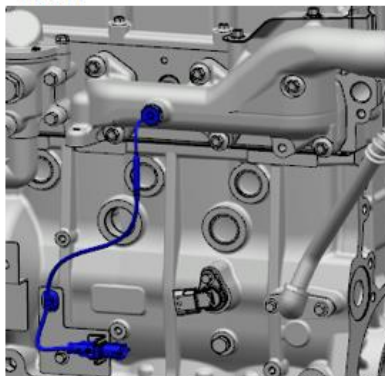


| No. | ECU Pin | PIN description |
|-----|---------|---|
| 1 | A33 | Turbine inlet temperature sensor ground |
| 2 | A59 | Turbine inlet temperature sensor signal |

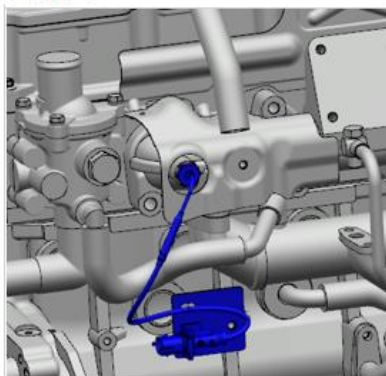
2) Component Location



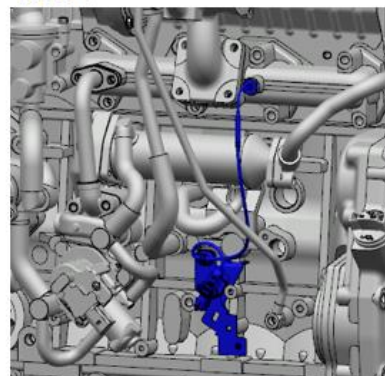
1.8L



2.4L



3.4L



| Turbine in Temperature sensor | | | |
|-------------------------------|--------|----------------------|----------------------|
| Temperature | | R _{nominal} | V _{nominal} |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 170 | 584 |
| 0 | 32 | 201 | 674 |
| 25 | 77 | 220 | 728 |
| 100 | 212 | 276 | 881 |
| 200 | 392 | 349 | 1064 |
| 400 | 752 | 488 | 1370 |
| 600 | 1112 | 618 | 1615 |
| 800 | 1472 | 738 | 1815 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Turbine inlet temperature signal is more than maximum threshold (3.457V)

5) Condition for Clearing the Fault Code

Turbine inlet temperature is within normal operation range.

6) Check List

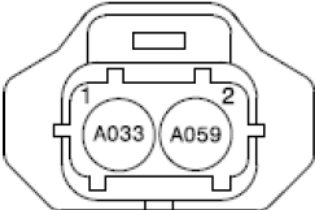
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0546 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|-----------------------|--------------------------------|-----------------------------|
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor resistance (remove sensor connector and measure the resistance across pins A33 and A59 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P0545 | Turbine inlet temperature sensor Low fault |

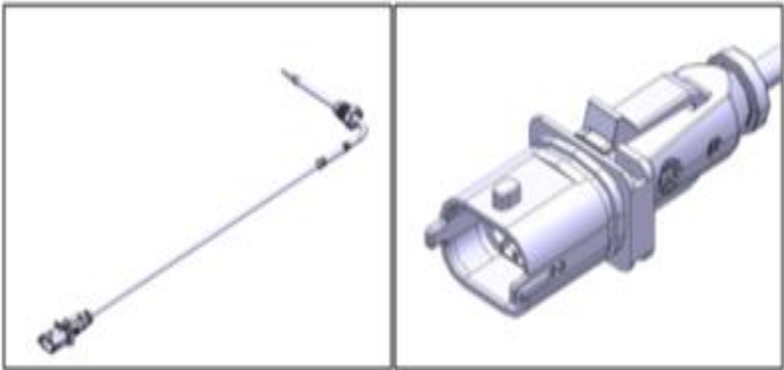
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--|
| E002789-04 | 1. Electrical problem (Turbine inlet temperature sensor connector) 2. Electrical problem (Wiring harness Turbine inlet temperature sensor to ECU, Faulty Turbine inlet temperature sensor) 3. Electrical problem (Faulty ECU, ECU connector) | CE lamp ON Inducement Group1 (EGR Block) – with EGR only DPF regeneration inhibit by Active and Forced |

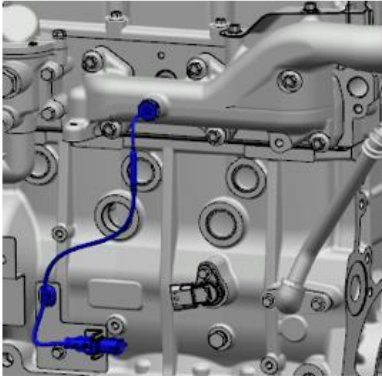


| No. | ECU Pin | PIN description |
|-----|---------|---|
| 1 | A33 | Turbine inlet temperature sensor ground |
| 2 | A59 | Turbine inlet temperature sensor signal |

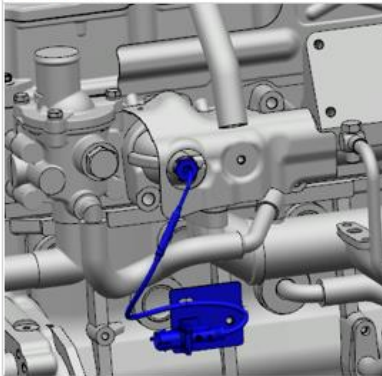
2) Component Location



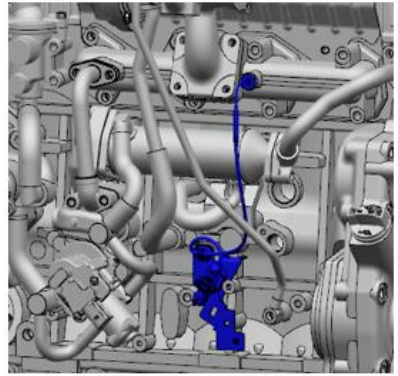
1.8L



2.4L



3.4L



| Turbine in Temperature sensor | | | |
|-------------------------------|--------|----------------------|----------------------|
| Temperature | | R _{nominal} | V _{nominal} |
| [degC] | [degF] | [ohm] | [mV] |
| -40 | -40 | 170 | 584 |
| 0 | 32 | 201 | 674 |
| 25 | 77 | 220 | 728 |
| 100 | 212 | 276 | 881 |
| 200 | 392 | 349 | 1064 |
| 400 | 752 | 488 | 1370 |
| 600 | 1112 | 618 | 1615 |
| 800 | 1472 | 738 | 1815 |

3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

Turbine inlet temperature signal is less than minimum threshold (0.270V)

5) Condition for Clearing the Fault Code

Turbine inlet temperature signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P0545 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|-----------------------|--------------------------------|-----------------------------|
| 3 | Check sensor connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check sensor resistance (remove sensor connector and measure the resistance across pins A33 and A59 of the sensor) If the resistance value is infinite, it can be judged as an internal circuit error of the sensor. | Refer to the table | Change sensor | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|-------------------------|
| P203F | DEF Tank level is empty |

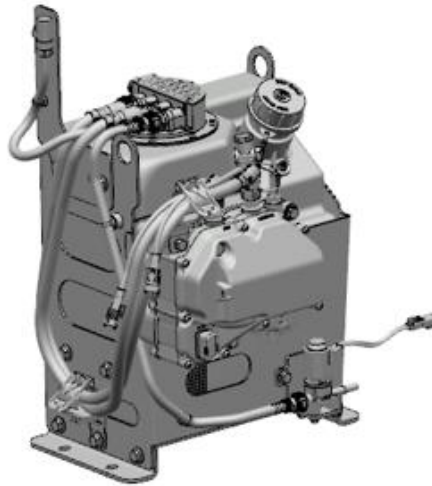
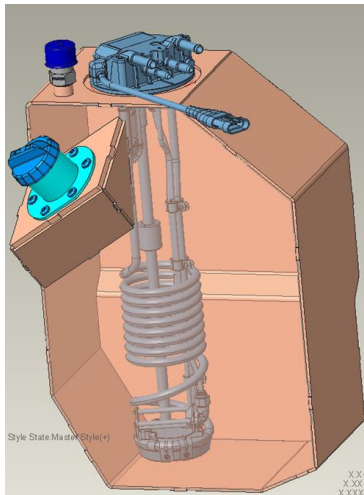
1) Overview

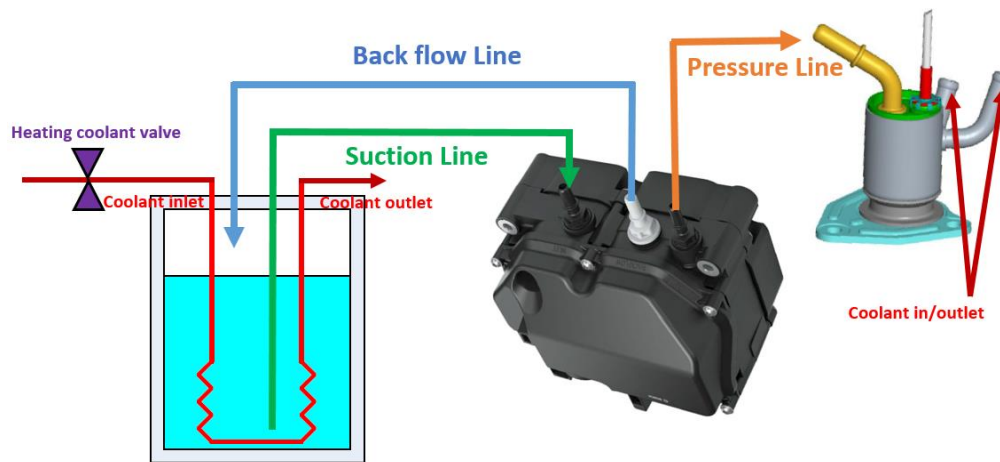
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|----------------------------|
| E003517-18 | 1. Refill problem (DEF level is low : Normally <2.5% dependent on DEF tank level strategy) 2. Electrical problem (DEF level sensor, Wiring harness in the DEF module) 3. Electrical problem (CAN wiring harness-insulation, resistance) | NCD inducement (DEF level) |

| | | |
|---|----|--------------|
| The pin definition is dependent on the DEF tank type. | No | Description |
| | 1 | Battery +12V |
| | 2 | Ground |
| | 3 | CAN Low |
| | 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.





The NCD inducement strategy is dependent on machine variant. (Below table is base strategy.)

1. EU (Stage5)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|--------------------------|--------------------------|---------------------|----------------------------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Severe level | < 2.5% | - | - Torque limit 50% & 60% of Rated speed |
| 2 | DEF Q & Dosing interrupt | Warning | Error occur | ≥90% of counter value for severe | - Warning |
| | | Level 1 | +10hours | inducement (18hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +10hours (20hours) | inducement (18hours) | - Torque limit 50% & 60% of Rated speed |
| 3 | Impeded EGR & Tampering | Warning | Error occur | ≥95% of counter value for severe | - Warning |
| | | Level 1 | +36hours | inducement (95hours) | - Torque limit 25% |
| | | Severe level (Level 2/3) | +64hours (100hours) | inducement (95hours) | - Torque limit 50% & 60% of Rated speed |

2. US (De-tier = T4F)

| No. | Item | Inducement Level | Event | Rep. offense | Inducement strategy |
|-----|------------------------|----------------------------|---------------------|--------------|---|
| 1 | DEF level | Warning | < 25% | - | - Warning |
| | | Level 1 | < 10% | - | - Torque limit 25% |
| | | Level 2 (Final inducement) | < 2.5% | - | - Low idle only |
| 2 | Other Inducement group | Warning | Error occur | - | - Warning |
| | | Level 1 | + 30min | - | - Torque limit 25% |
| | | Level 2 | + 2hours (2.5hours) | Immediately | - Torque limit 50% & 60% of Rated speed |
| | | Level 3 (Final inducement) | + 1hours (3.5hours) | + 25min | - Low idle only |

3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

If the remaining DEF is less than the empty threshold (Normally 2.5%)

5) Condition for Clearing the Fault Code

The DEF level is higher than empty threshold.

6) Check List

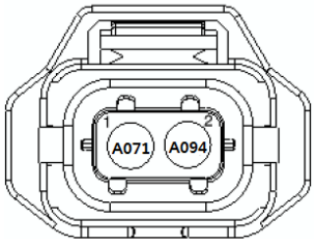
| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|--------|----|
| 1 | P203F is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |

| | | | | |
|----------|--|---------------------------|--------------------------------|-----------------------------|
| 3 | Check the DEF level DEF level is too low? * Variable 1) DEF level (UDC_rCalcTnkLvl) | Normally ≥2.5% | Step 4 | Fill the DEF |
| 4 | Check sensor connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Clear the fault and re-check the fault Is this fault detected continuously? | | Do necessary repair | Step 7 |
| 7 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P2049 | DEF dosing valve actuator Open Circuit Fault |

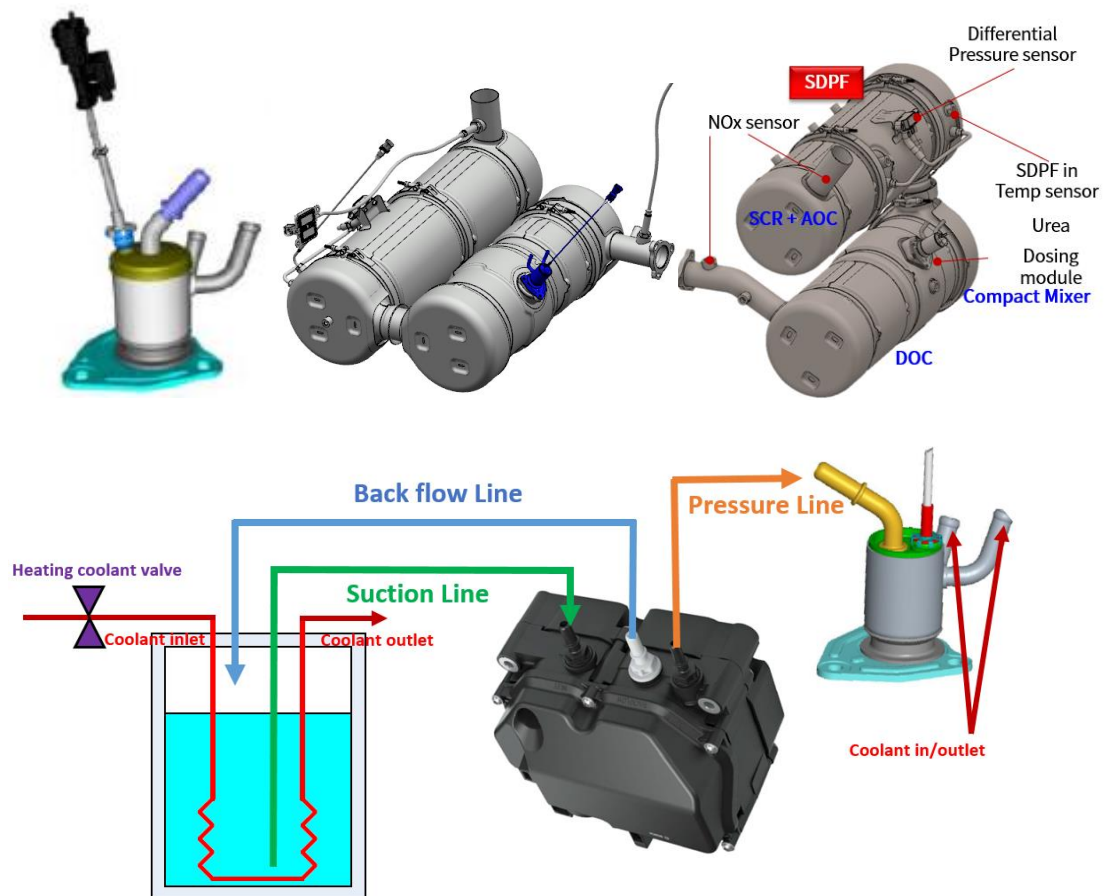
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E003361-05 | 1. Electrical problem (DEF dosing valve connector) 2. Electrical problem (Wiring harness DEF dosing valve to ECU, Faulty DEF dosing valve) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| | | | |
|---|-----|---------|------------------------------------|
|  | No. | ECU Pin | PIN description (DEF dosing valve) |
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location

Muffler Layout can be different according to Machine but the position of DEF dosing valve is same.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF dosing valve actuator power stage output is opened.

5) Condition for Clearing the Fault Code

The DEF dosing valve actuator power stage output wiring problem is restored

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-----------------------|-------------------------|------------------|
| 1 | P2049 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF dosing valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check DEF dosing valve resistance (key off & disconnect ECU) (Pin#1 & #2) Resistance problem? | 12 Ω @ 20 degC | Change DEF dosing valve | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

P202E

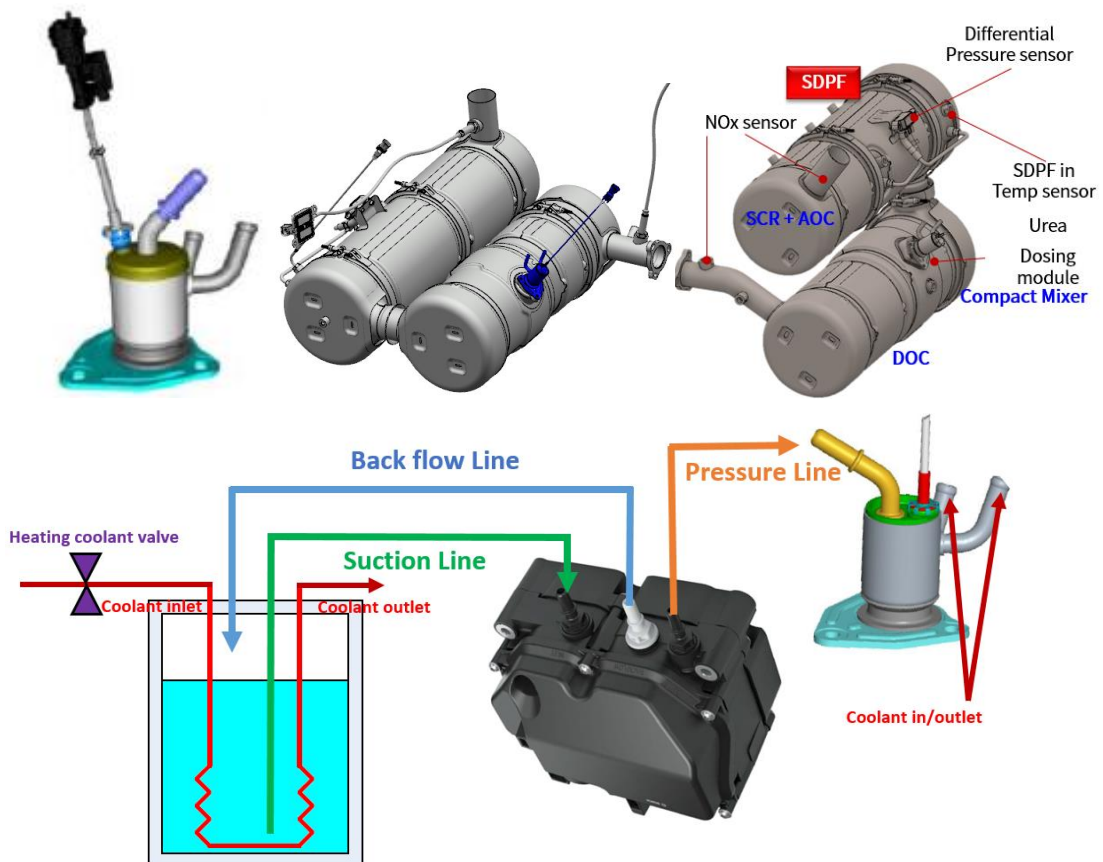
1) Overview

E003361-13

| No. | ECU Pin | PIN description (DEF dosing valve) |
|-----|---------|------------------------------------|
| 1 | A71 | DEF Dosing valve Low side |
| 2 | A94 | DEF Dosing valve High side |

2) Component Location

Muffler Layout can be different according to Machine but the position of DEF dosing valve is same.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF dosing valve actuator power stage is over temperature.

5) Condition for Clearing the Fault Code

The DEF dosing valve actuator power stage output wiring problem is restored

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-----------------------|-------------------------|------------------|
| 1 | P202E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF dosing valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check DEF dosing valve resistance (key off & disconnect ECU) (Pin#1 & #2) Resistance problem? | 12 Ω @ 20 degC | Change DEF dosing valve | Contact Helpdesk |

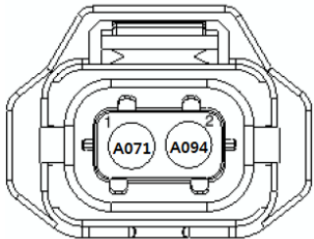
※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P2047 | DEF dosing valve actuator Short circuit to battery Fault |

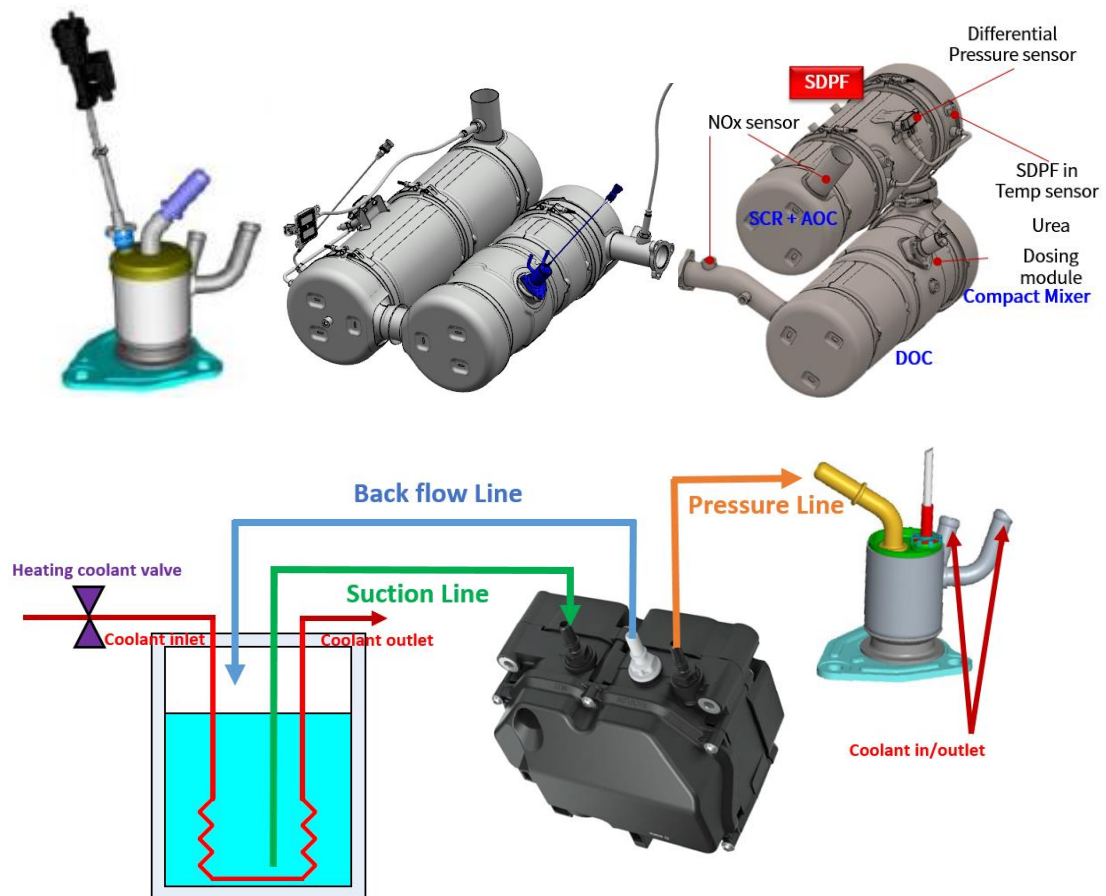
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E003361-03 | 1. Electrical problem (DEF dosing valve connector) 2. Electrical problem (Wiring harness from DEF dosing valve to ECU, Faulty Dosing valve) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| | | | |
|---|-----|---------|------------------------------------|
|  | No. | ECU Pin | PIN description (DEF dosing valve) |
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location

Muffler Layout can be different according to Machine but the position of DEF dosing valve is same.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF dosing valve actuator power stage is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF dosing valve actuator power stage output wiring problem is restored

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-----------------------|-------------------------|------------------|
| 1 | P2047 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF dosing valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check DEF dosing valve resistance (key off & disconnect ECU) (Pin#1 & #2) Resistance problem? | 12 Ω @ 20 degC | Change DEF dosing valve | Contact Helpdesk |

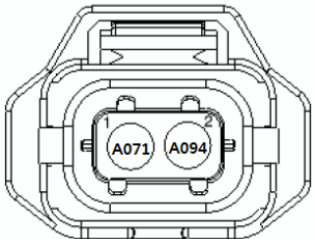
※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P2050 | DEF dosing valve actuator HS(High side) Short circuit to battery Fault |

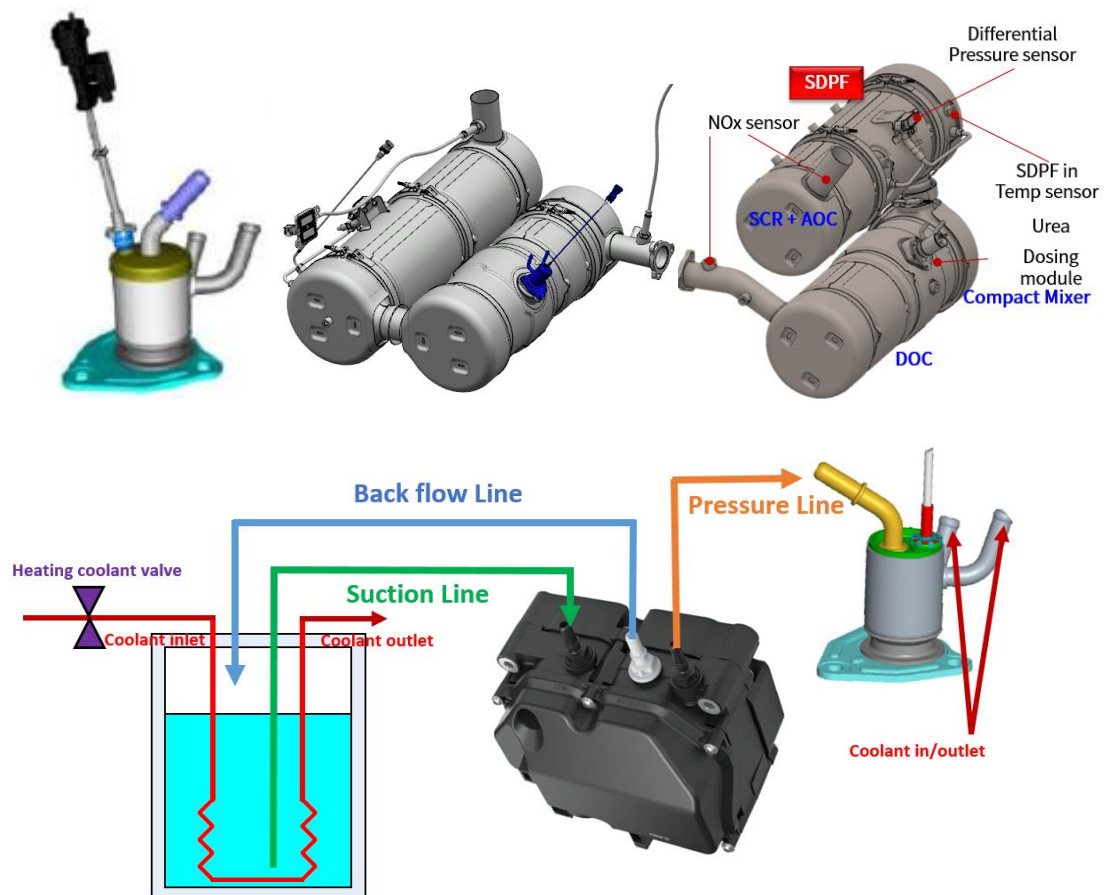
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E003361-22 | 1. Electrical problem (DEF dosing valve connector) 2. Electrical problem (Wiring harness from DEF dosing valve to ECU, Faulty DEF dosing valve) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| | | | |
|---|-----|---------|------------------------------------|
|  | No. | ECU Pin | PIN description (DEF dosing valve) |
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location

Muffler Layout can be different according to Machine but the position of DEF dosing valve is same.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF dosing valve actuator HS(High side) power stage is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF dosing valve actuator power stage output wiring problem is restored

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-----------------------|-------------------------|------------------|
| 1 | P2050 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF dosing valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check DEF dosing valve resistance (key off & disconnect ECU) (Pin#1 & #2) Resistance problem? | 12 Ω @ 20 degC | Change DEF dosing valve | Contact Helpdesk |

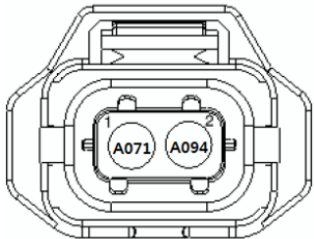
※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P2048 | DEF dosing valve actuator Short circuit to ground Fault |

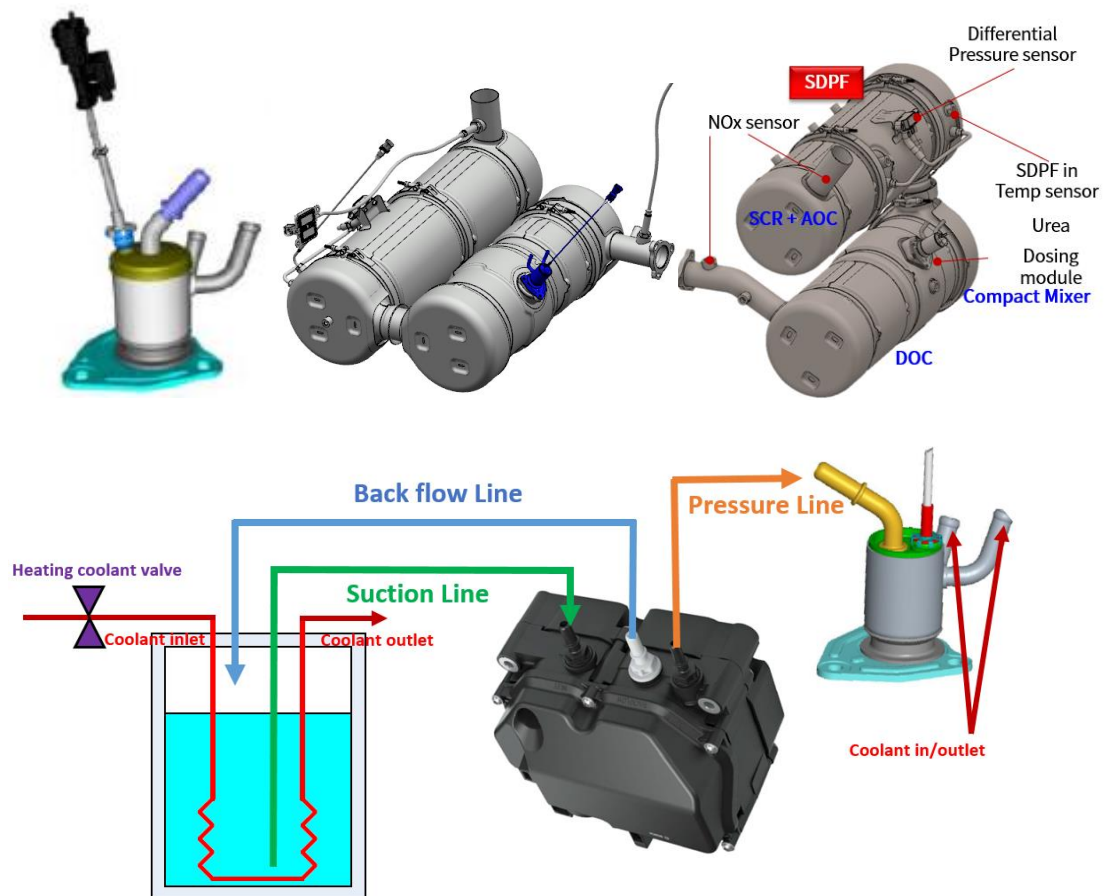
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E003361-04 | 1. Electrical problem (DEF dosing valve connector) 2. Electrical problem (Wiring harness from DEF dosing valve to ECU, Faulty DEF dosing valve) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| | | | |
|---|-----|---------|------------------------------------|
|  | No. | ECU Pin | PIN description (DEF dosing valve) |
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location

Muffler Layout can be different according to Machine but the position of DEF dosing valve is same.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF dosing valve actuator power stage is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF dosing valve actuator power stage output wiring problem is restored

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-----------------------|-------------------------|------------------|
| 1 | P2048 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF dosing valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check DEF dosing valve resistance (key off & disconnect ECU) (Pin#1 & #2) Resistance problem? | 12 Ω @ 20 degC | Change DEF dosing valve | Contact Helpdesk |

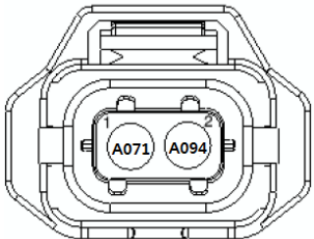
※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P2051 | DEF dosing valve actuator HS(High side) Short circuit to ground Fault |

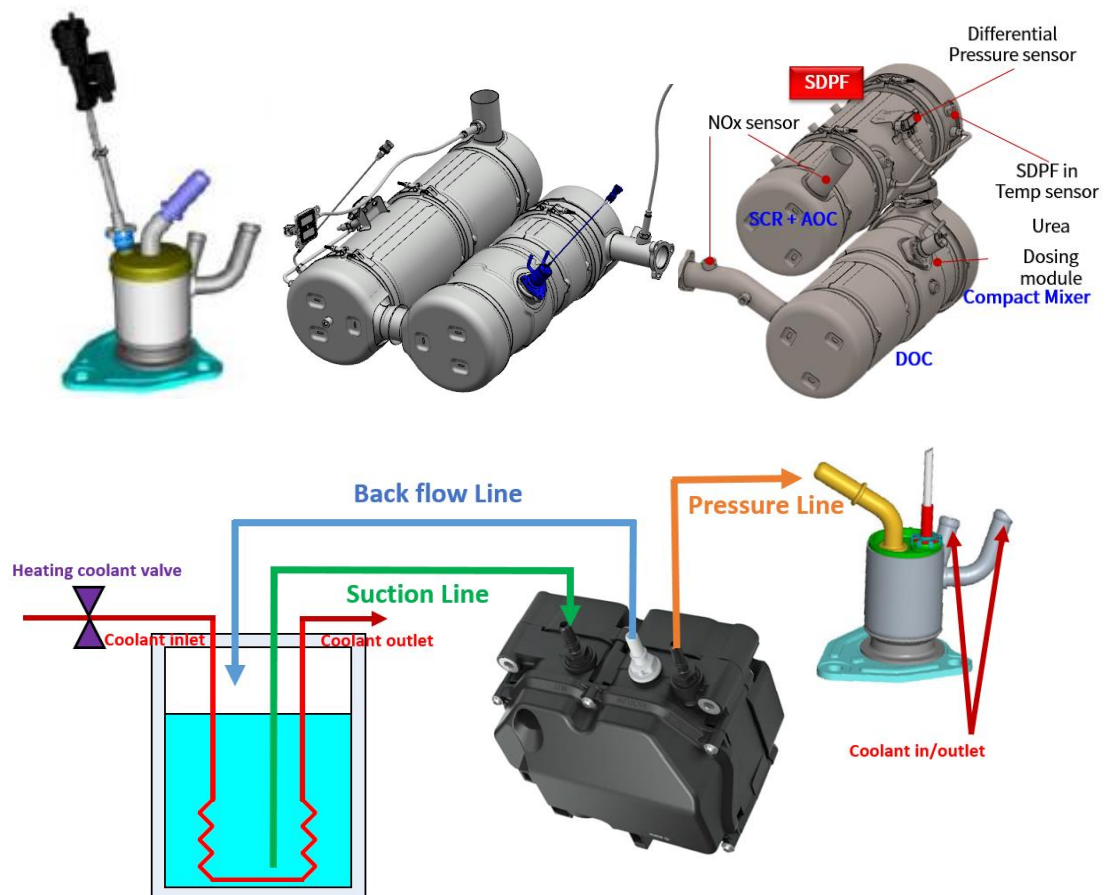
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E003361-23 | 1. Electrical problem (DEF dosing valve connector) 2. Electrical problem (Wiring harness from DEF dosing valve to ECU, Faulty DEF dosing valve) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| | | | |
|---|-----|---------|------------------------------------|
|  | No. | ECU Pin | PIN description (DEF dosing valve) |
| | 1 | A71 | DEF Dosing valve Low side |
| | 2 | A94 | DEF Dosing valve High side |

2) Component Location

Muffler Layout can be different according to Machine but the position of DEF dosing valve is same.



3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF dosing valve actuator HS(High side) power stage is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF dosing valve actuator power stage output wiring problem is restored

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|-----------------------|-------------------------|------------------|
| 1 | P2051 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF dosing valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check DEF dosing valve resistance (key off & disconnect ECU) (Pin#1 & #2) Resistance problem? | 12 Ω @ 20 degC | Change DEF dosing valve | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P263D | DEF pressure line heater error (Perform afterrun) |

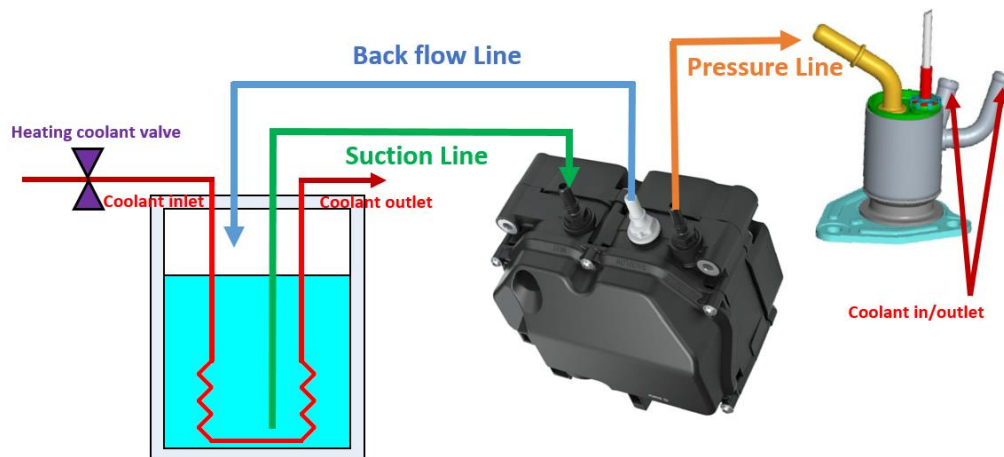
1) Overview

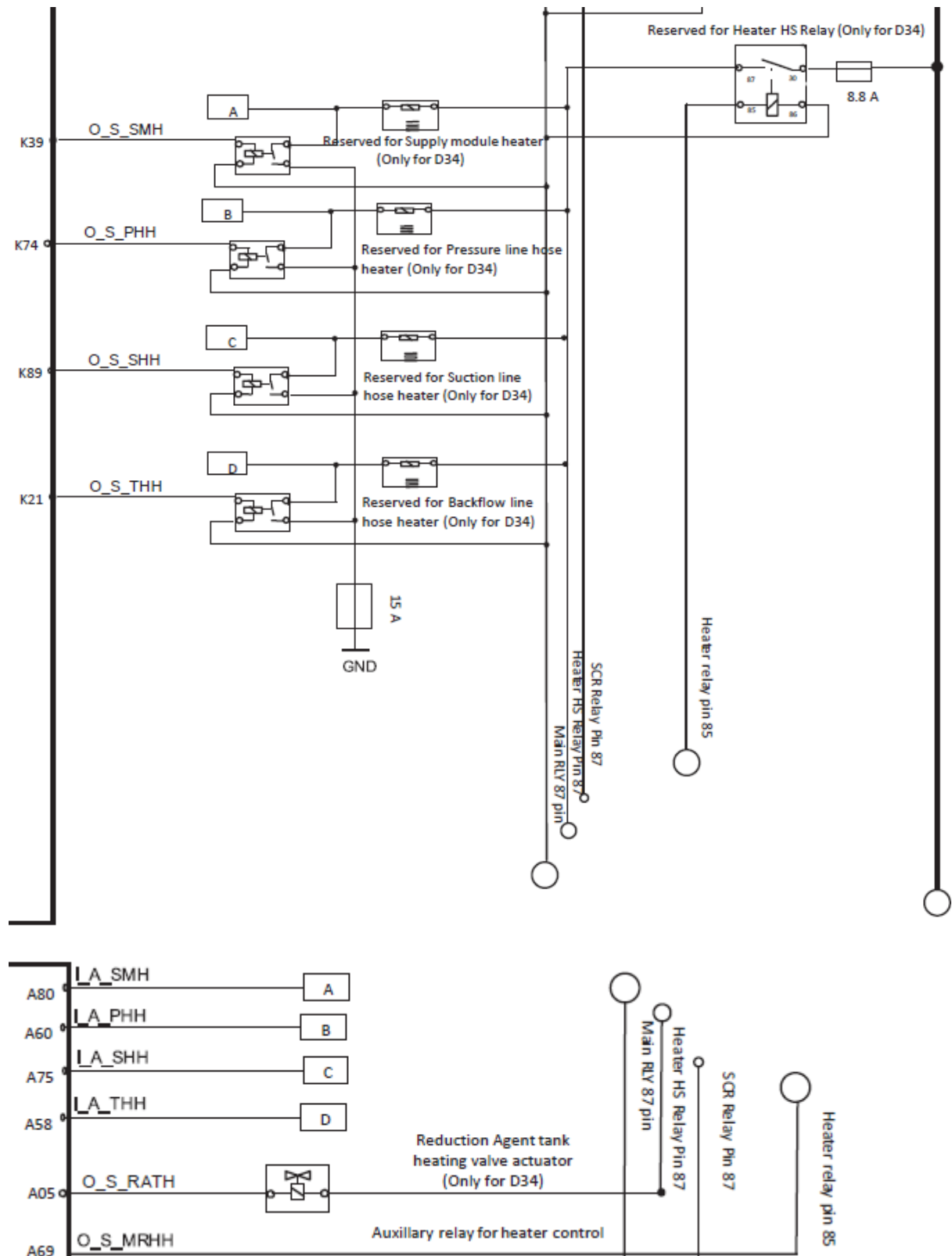
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E003360-14 | 1. Electrical problem (DEF pressure line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF pressure line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF pressure line heating is needed, but it cannot be heated due to some fault or hardware issue.
In this case, the SCR system should be shut off for protecting. ("Afterrun" is performed.)

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P263D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF pressure line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool


1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P214F | DEF Supply module heater circuit Open circuit Fault |

1) Overview

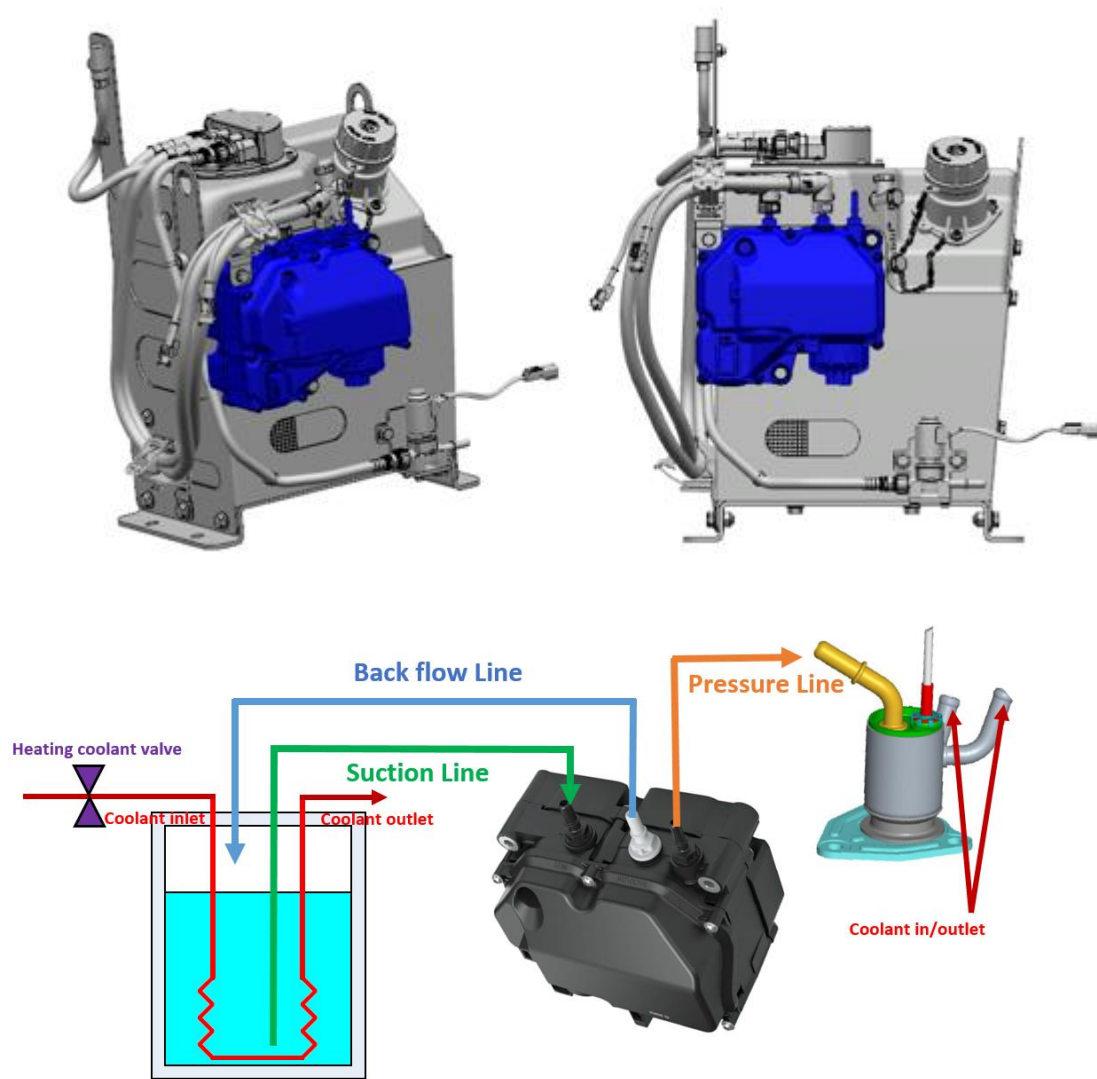
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E005706-05 | 1. Electrical problem (DEF Supply module heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Supply module heater) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

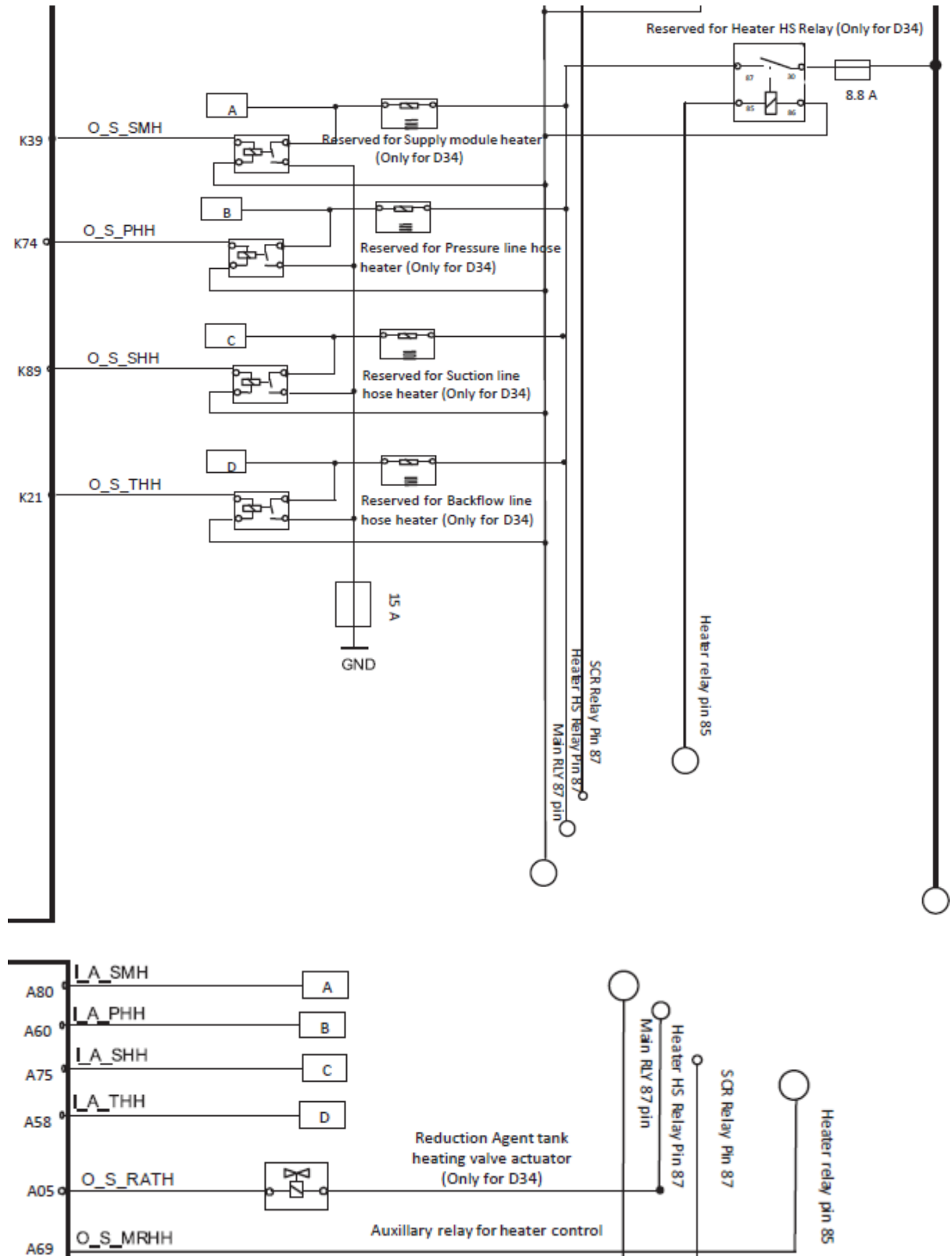
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|---|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply module heater circuit is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P214F is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Supply module heater related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module. DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool


1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P21DD | DEF Supply module heater circuit Open circuit or Short circuit to ground Fault |

1) Overview

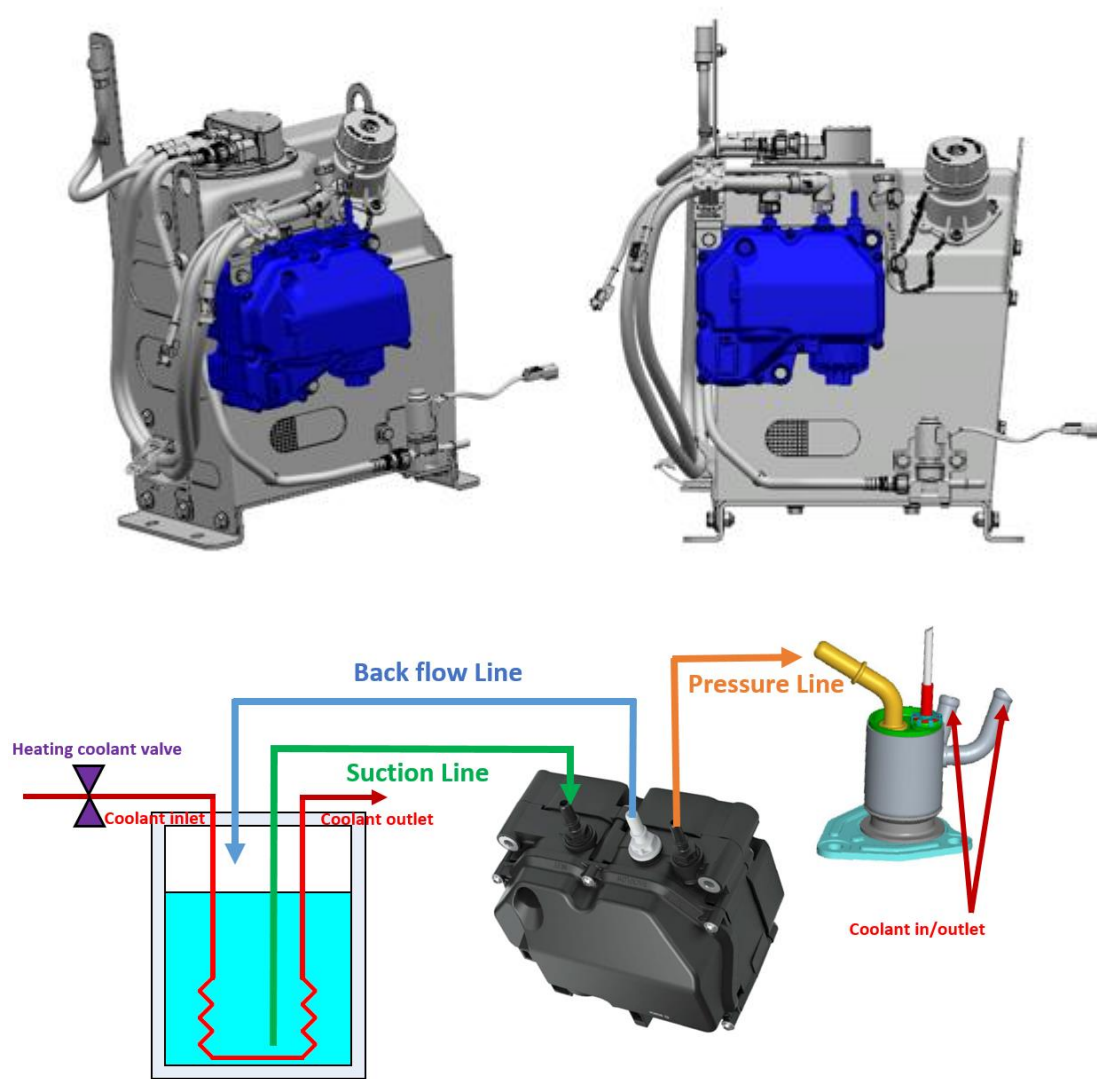
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E005706-06 | 1. Electrical problem (DEF Supply module heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Supply module heater) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

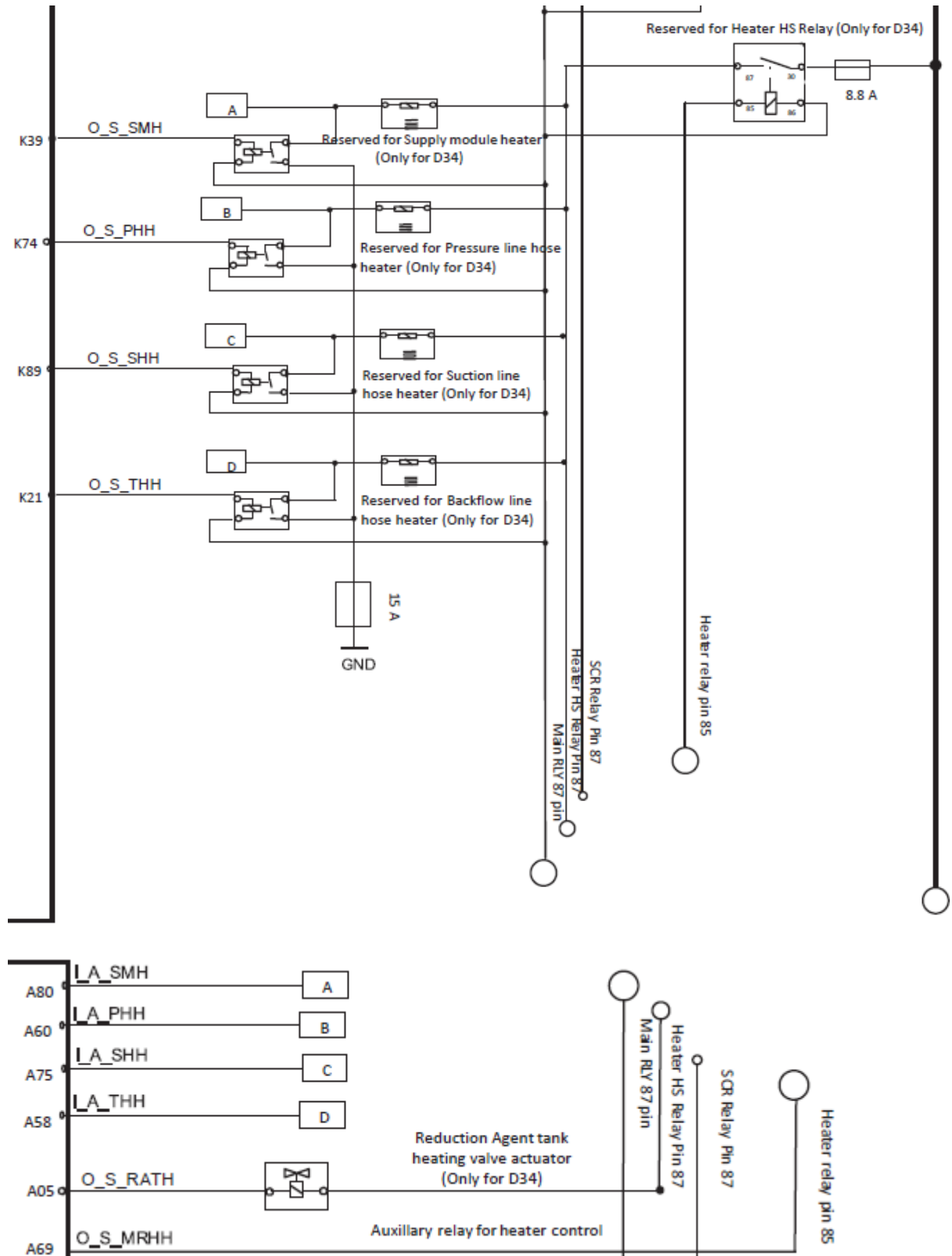
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

| | | | |
|---|-----|---------|--|
| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply module heater circuit is opened or shorted to ground.

It means that is diagnosed when the voltage A is detected even though the DEF Supply module heater relay is not operated.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P21DD is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Supply module heater related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module. DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P221D | DEF Pressure line heater circuit Open circuit Fault |

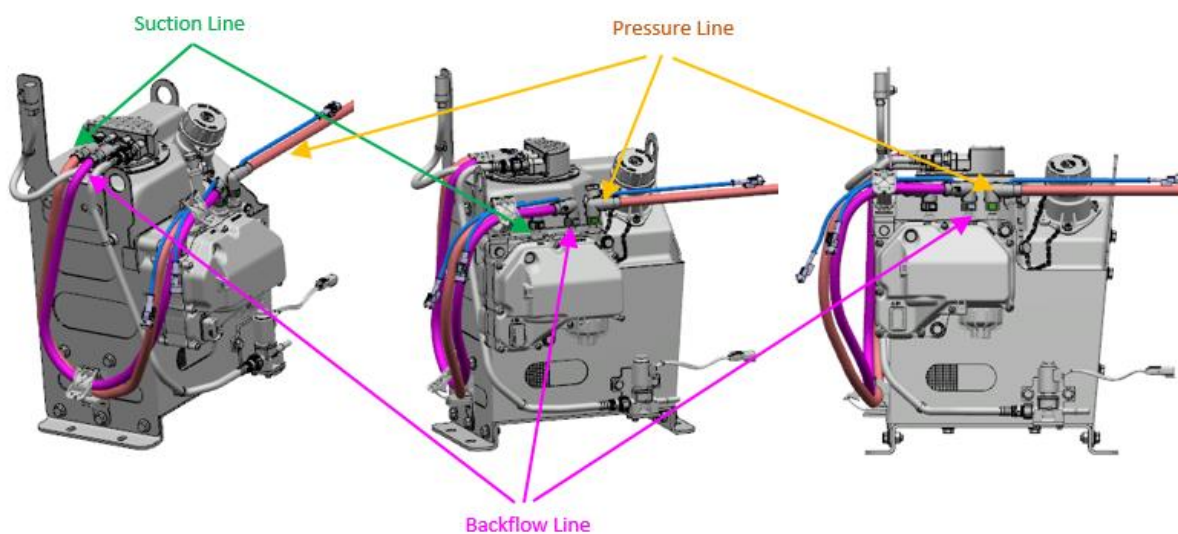
1) Overview

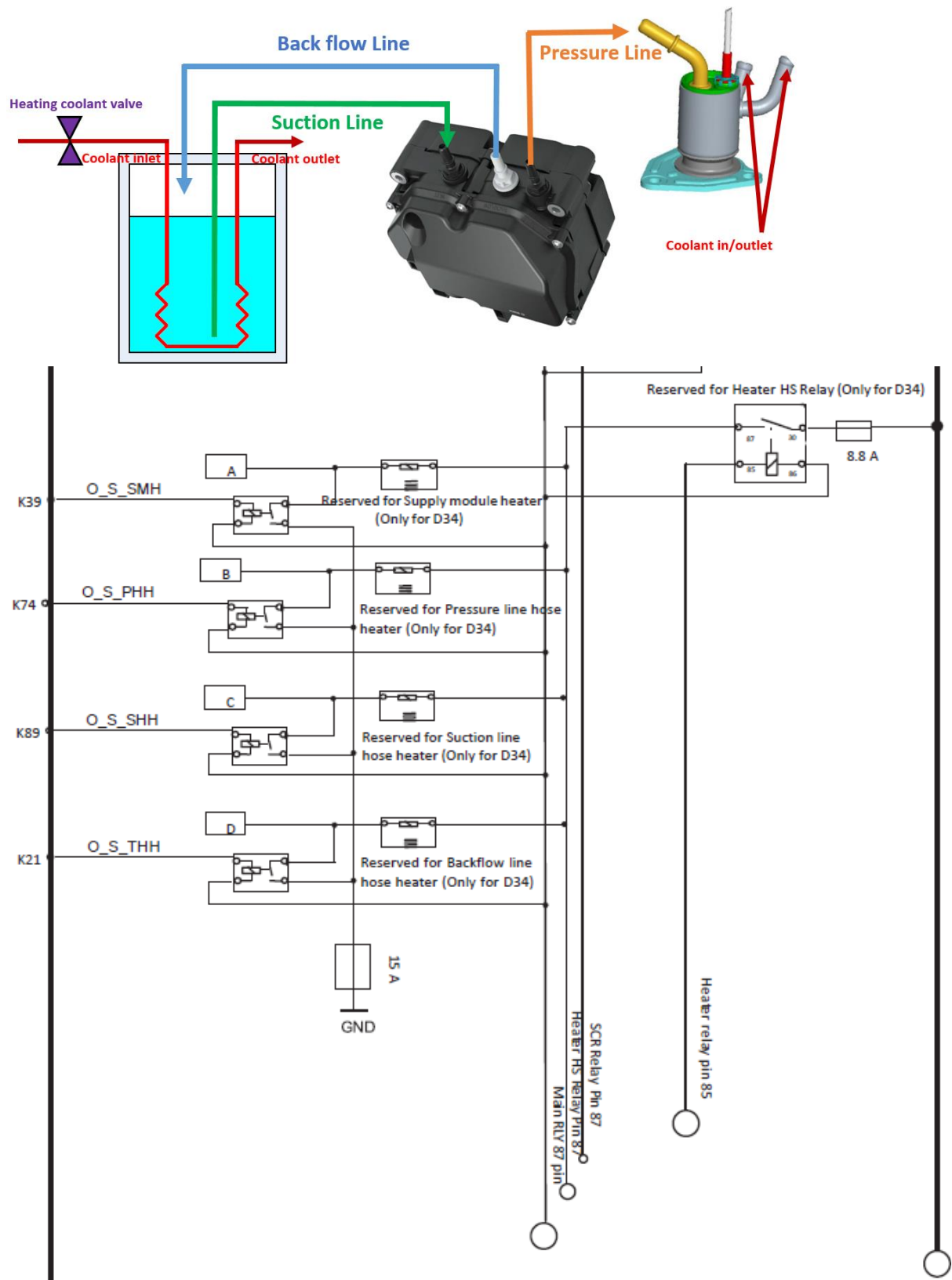
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E004354-05 | 1. Electrical problem (DEF pressure line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF pressure line heater) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

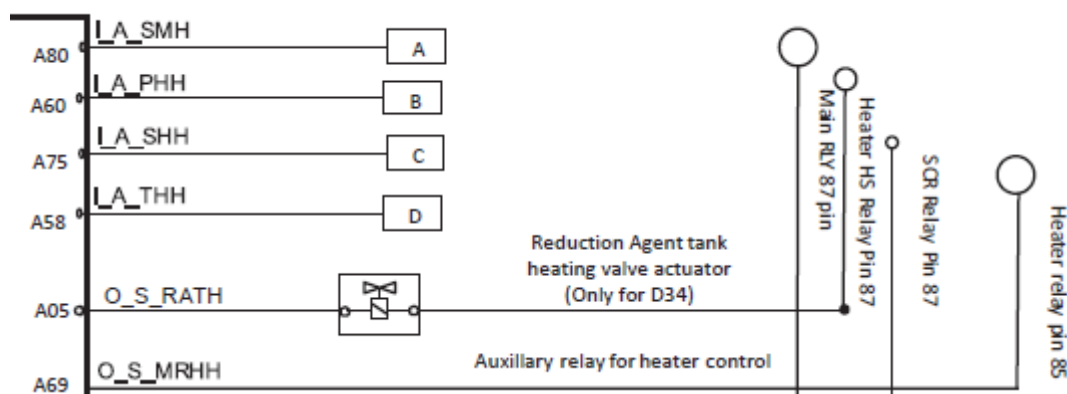
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF pressure line heater circuit is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P221D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF pressure line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P221C | DEF Pressure line heater circuit Open circuit or Short circuit to ground Fault |

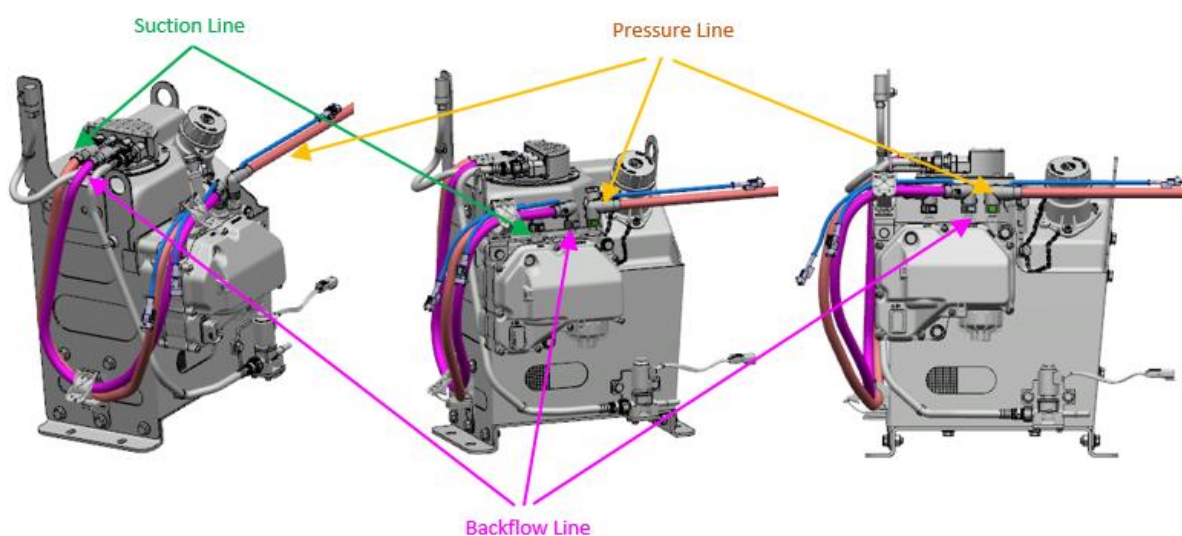
1) Overview

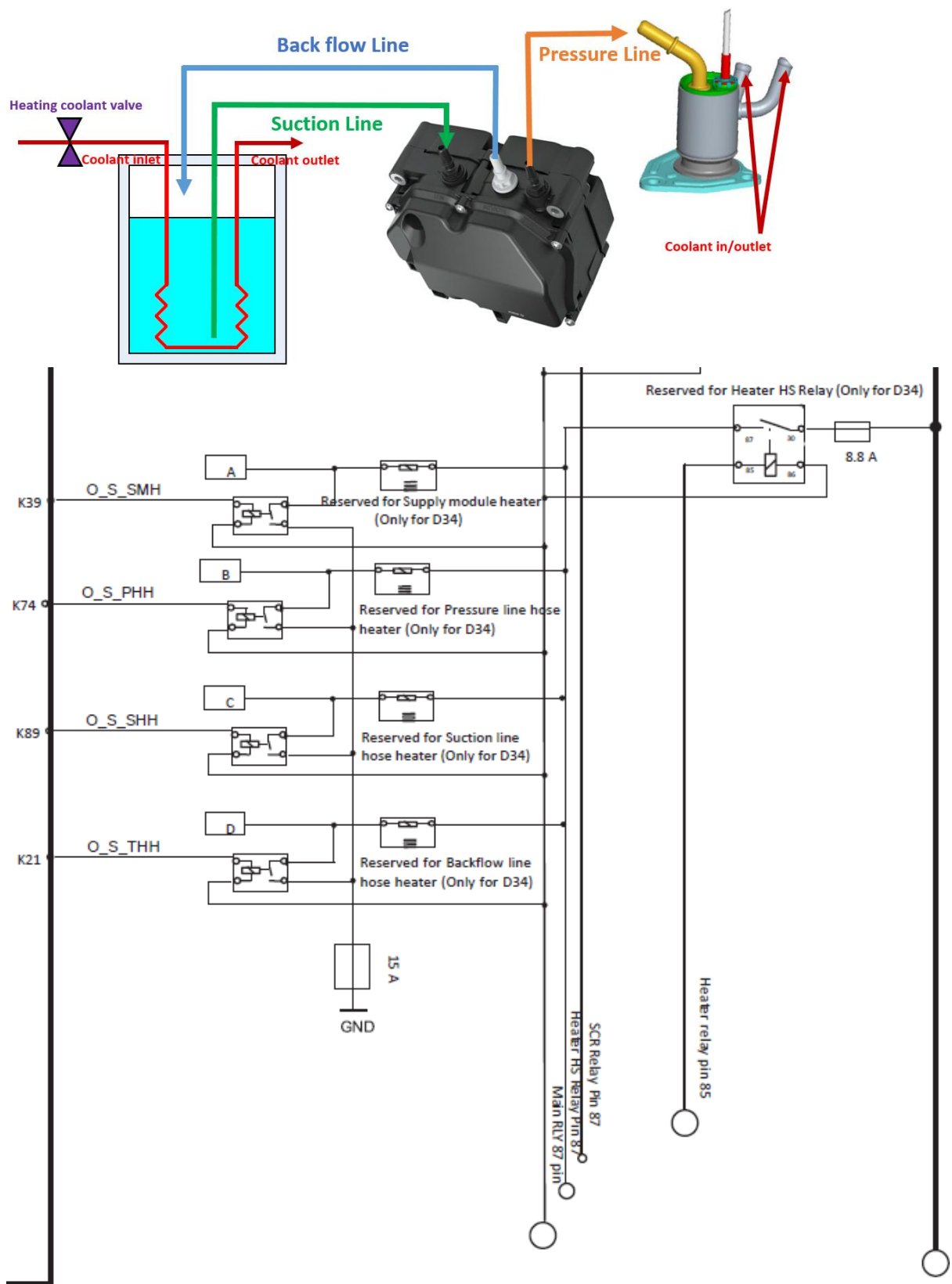
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E004354-06 | 1. Electrical problem (DEF pressure line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF pressure line heater) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

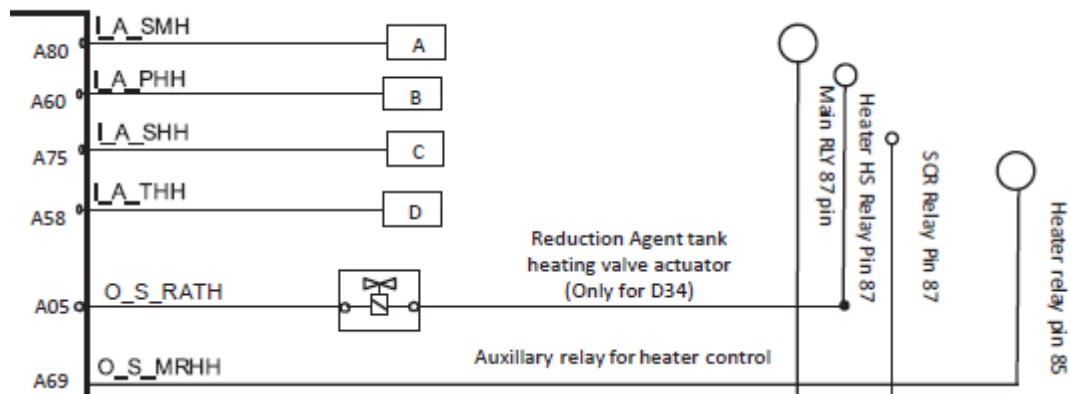
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF pressure line heater circuit is opened or shorted to ground.

It means that is diagnosed when the voltage B is detected even though the DEF Pressure line Hose heater relay is not operated.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P221C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF pressure line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P221F | DEF Backflow line heater circuit Open circuit Fault |

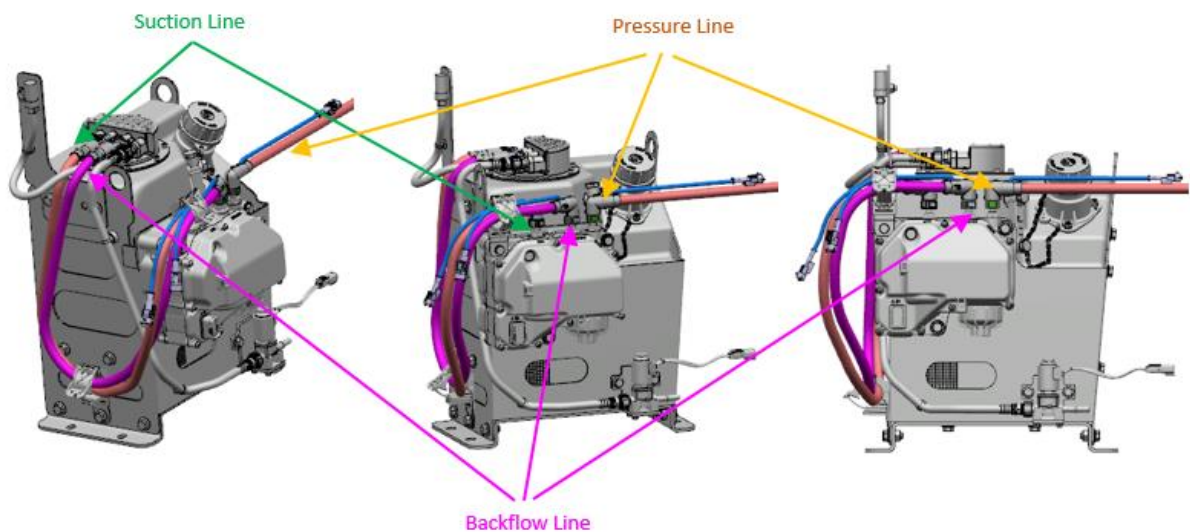
1) Overview

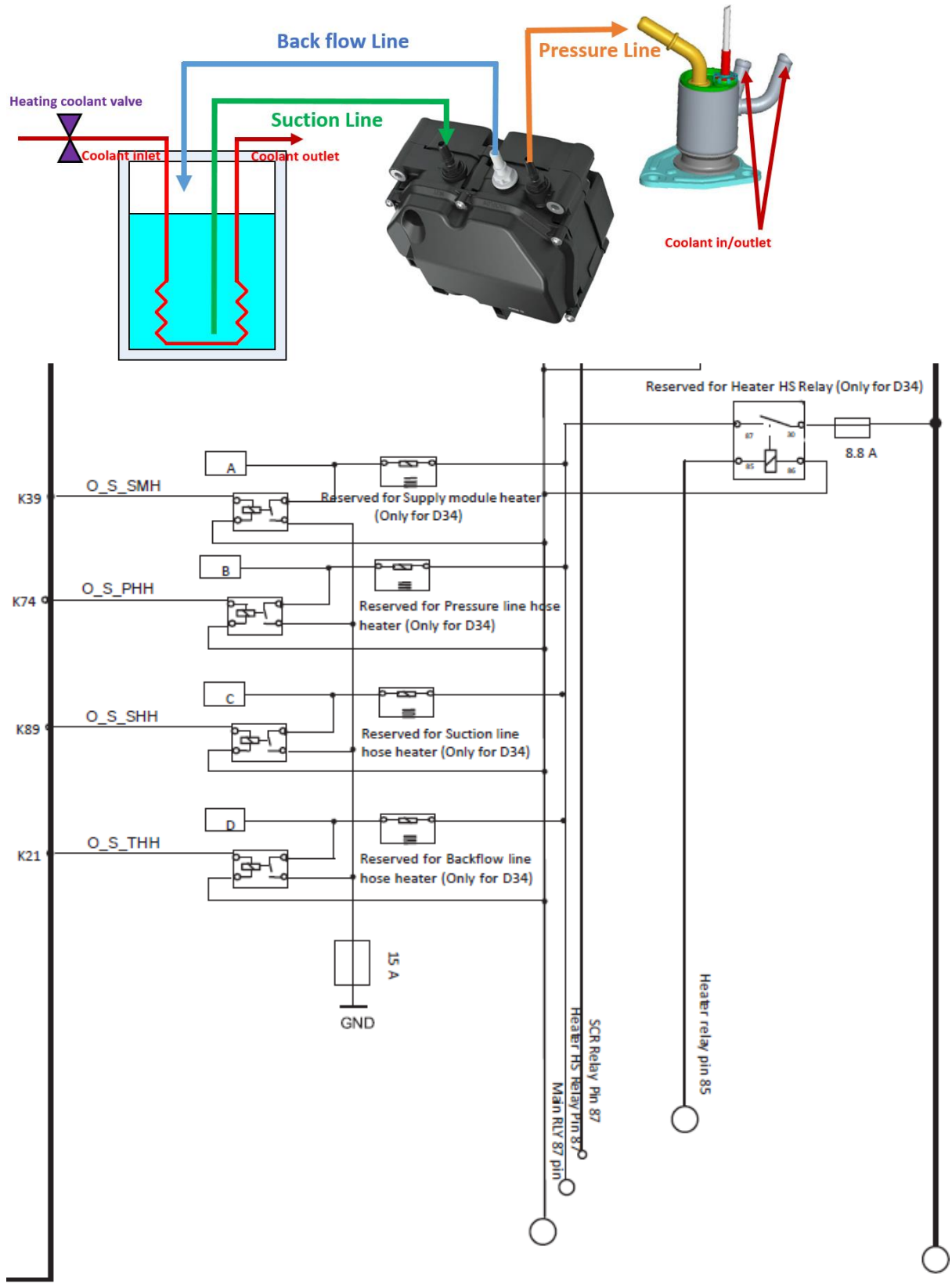
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E004355-05 | 1. Electrical problem (DEF Backflow line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Backflow line heater) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

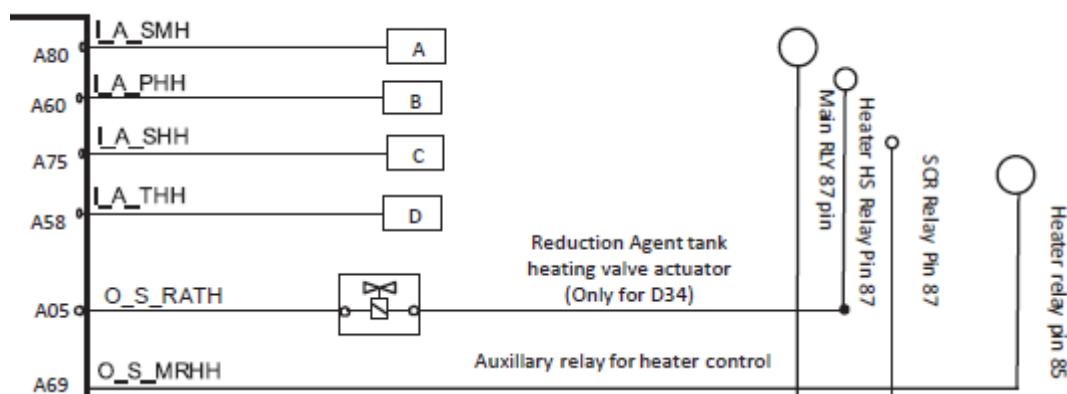
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Backflow line heater circuit is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P221F is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Backflow line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P221E | DEF Backflow line heater circuit Open circuit or Short circuit to ground Fault |

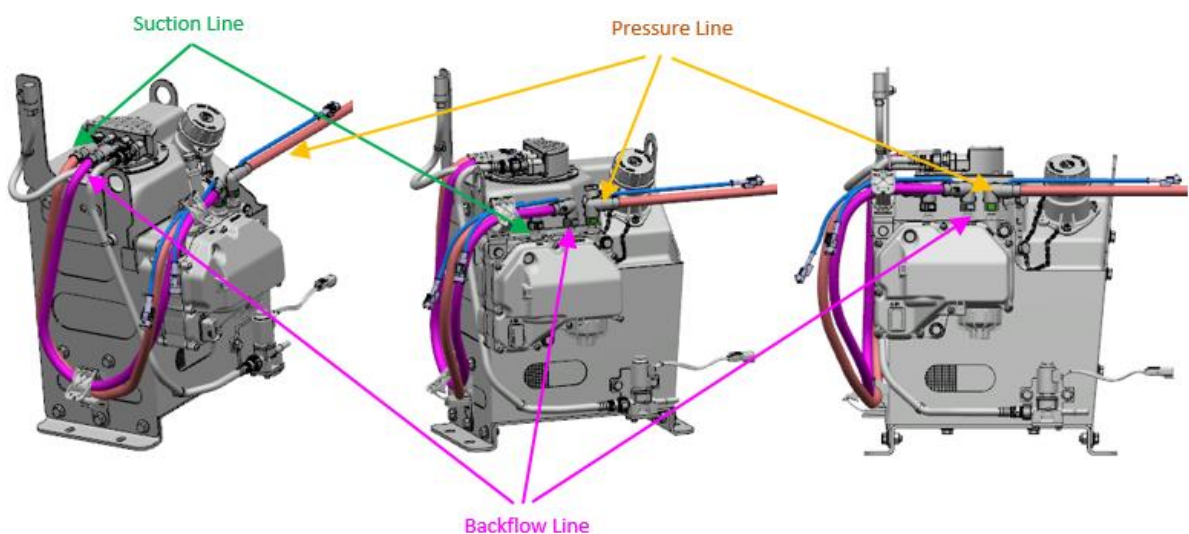
1) Overview

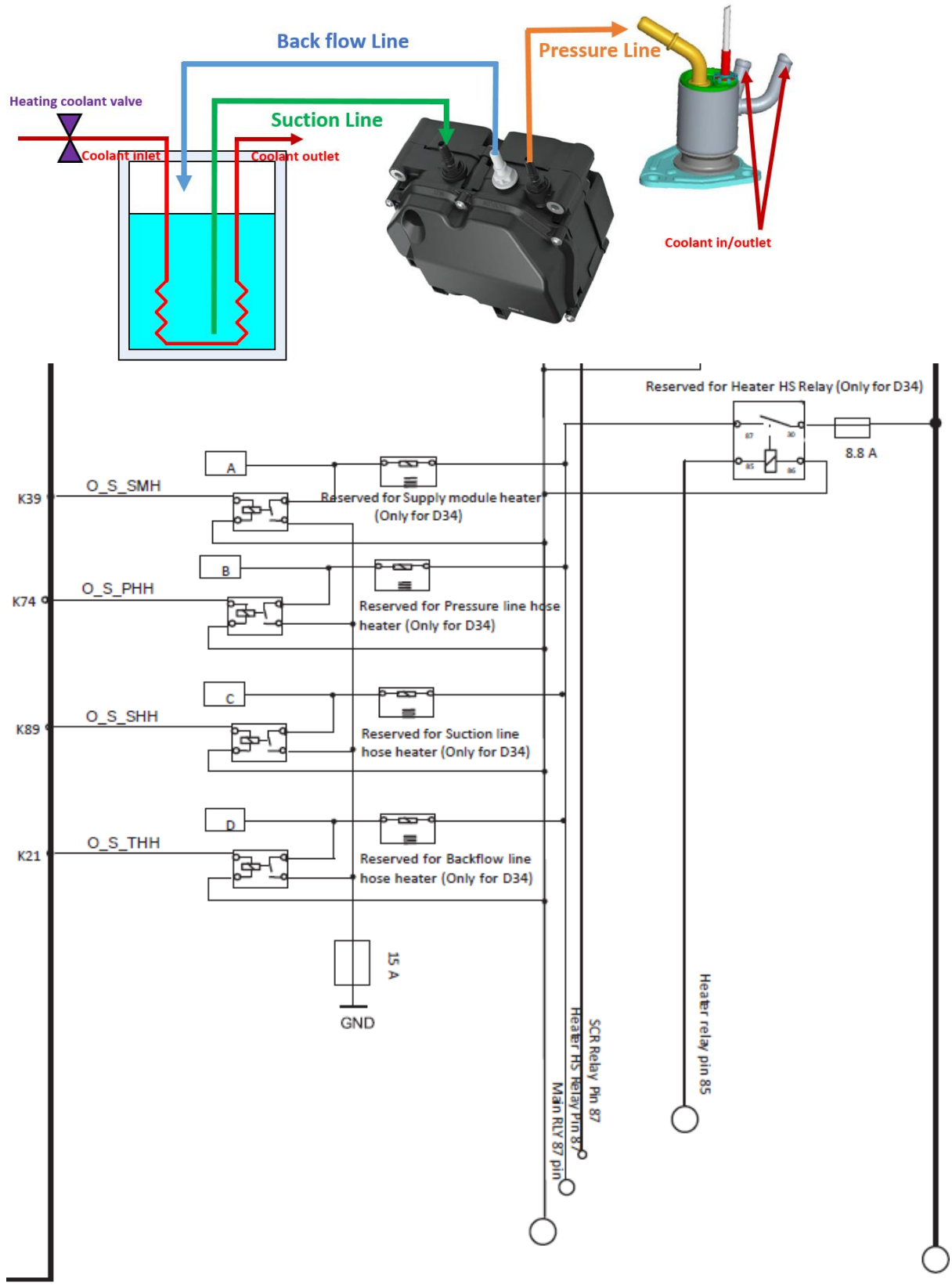
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E004355-06 | 1. Electrical problem (DEF Backflow line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Backflow line heater) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

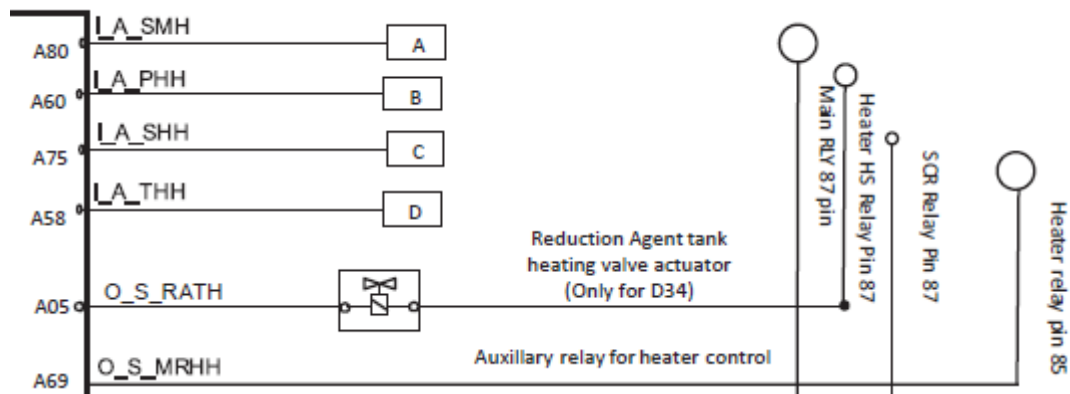
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Backflow line heater circuit is opened or shorted to ground.

It means that is diagnosed when the voltage D is detected even though the DEF Backflow line Hose heater relay is not operated.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P221E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Backflow line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P215F | DEF Suction line heater circuit Open circuit Fault |

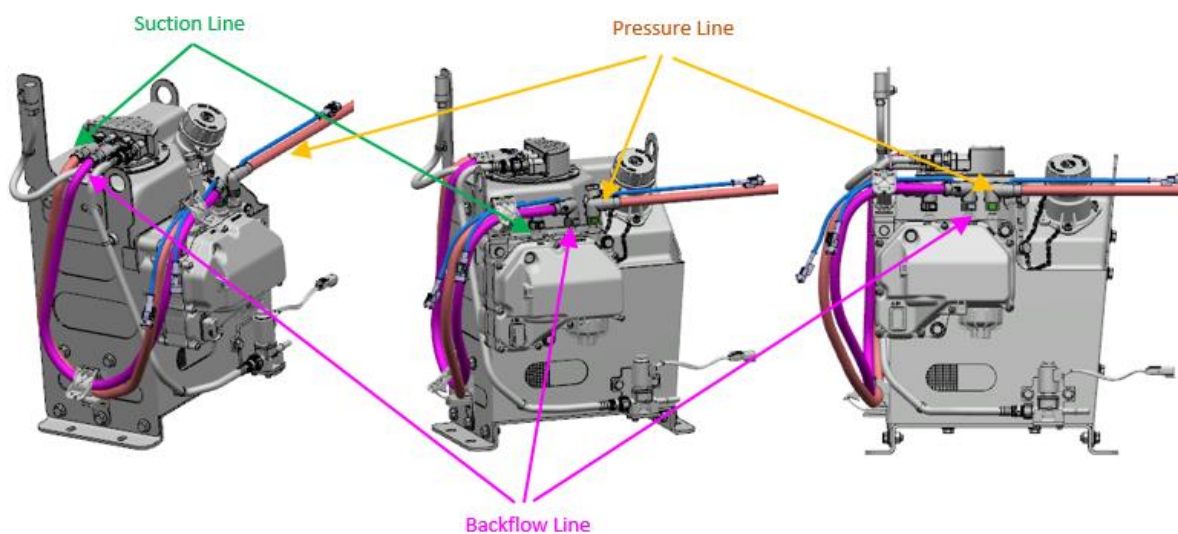
1) Overview

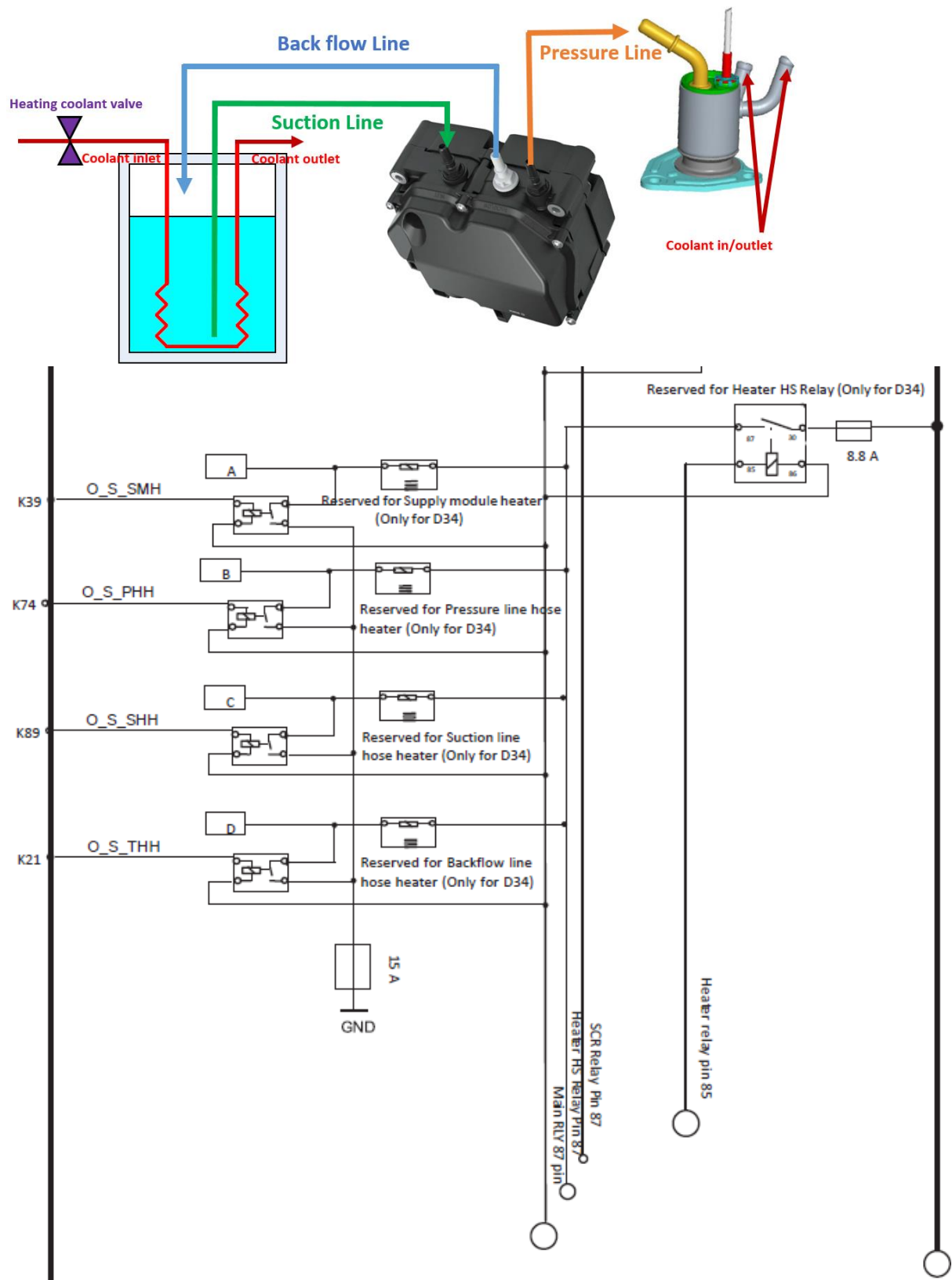
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E004356-05 | 1. Electrical problem (DEF Suction line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Suction line heater) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

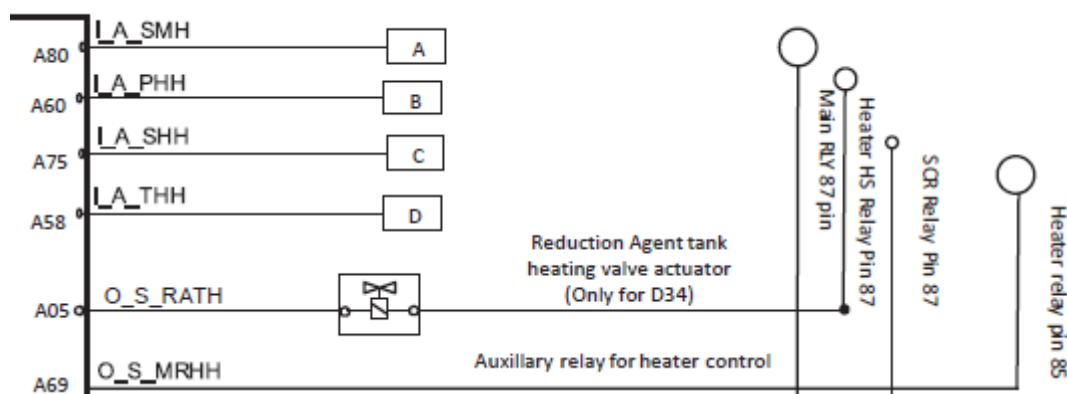
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Suction line heater circuit is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P215F is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Suction line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P215E | DEF Suction line heater circuit Open circuit or Short circuit to ground Fault |

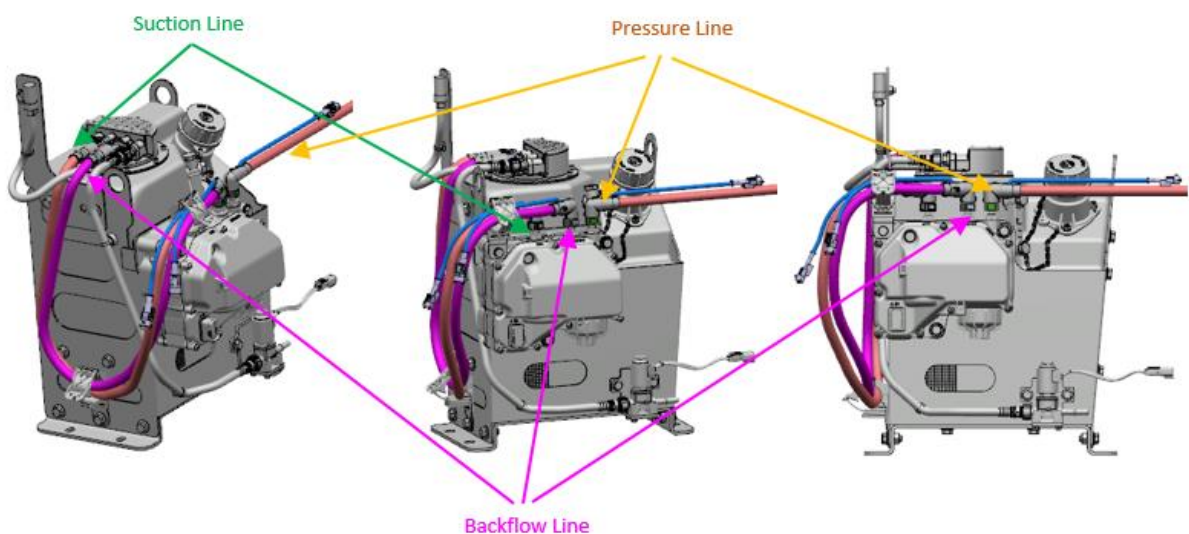
1) Overview

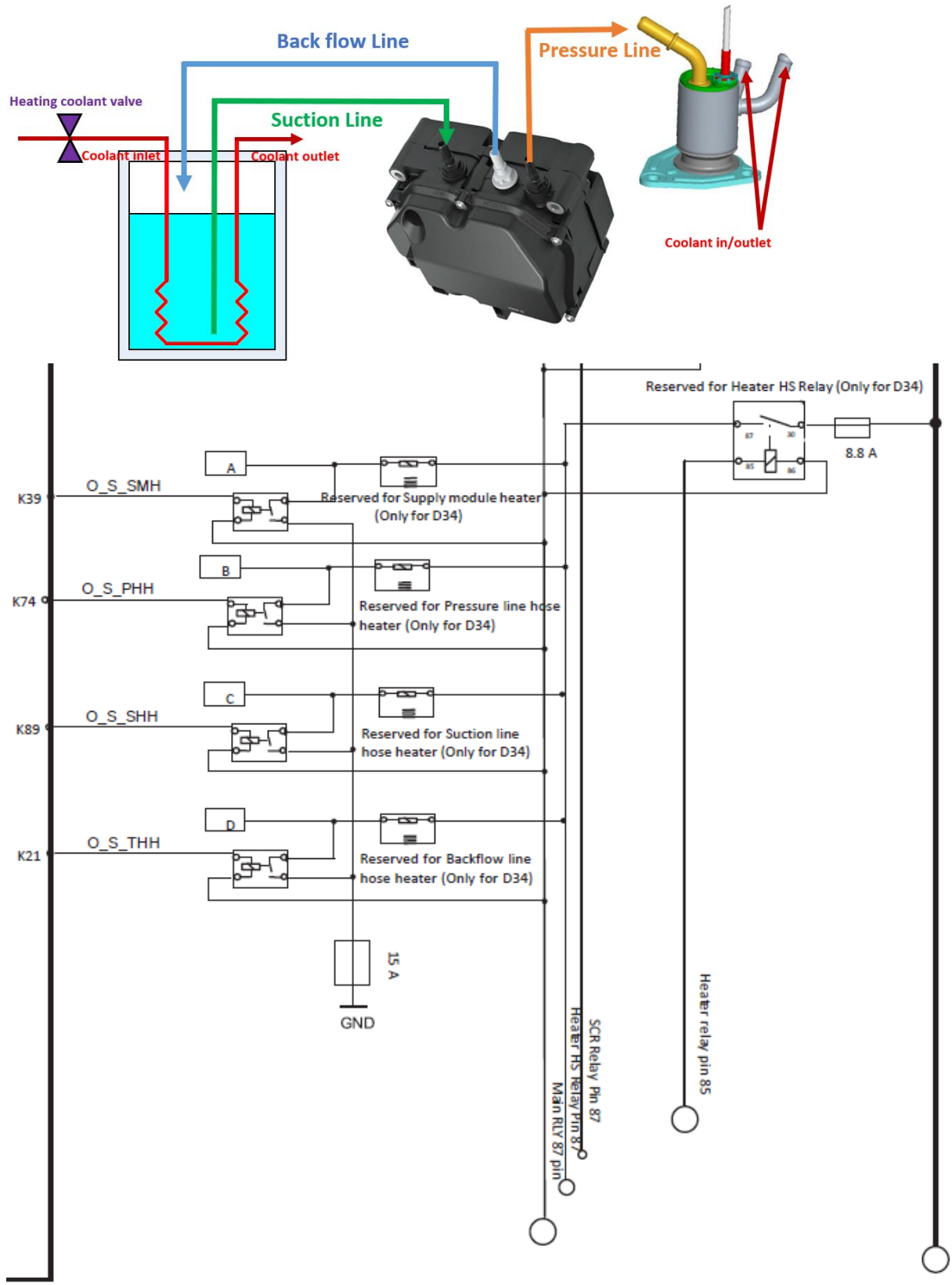
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E004356-06 | 1. Electrical problem (DEF Suction line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Suction line heater) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

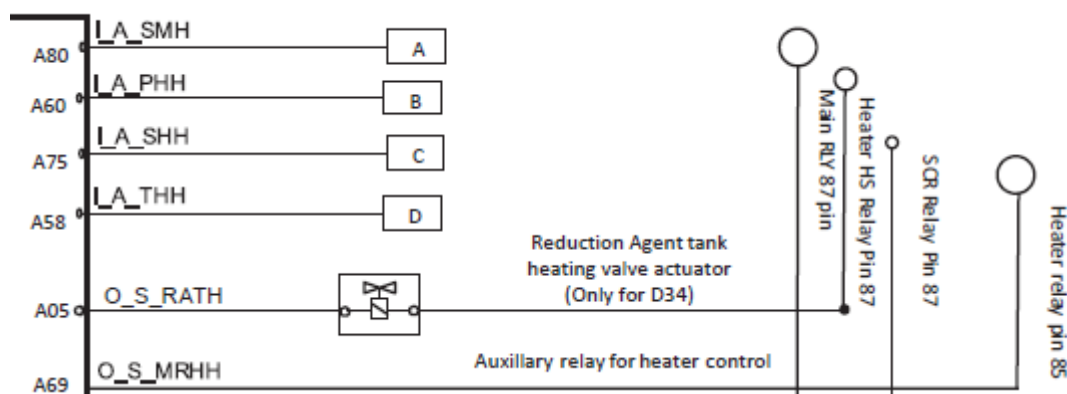
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Suction line heater circuit is opened or shorted to ground.

It means that is diagnosed when the voltage C is detected even though the DEF Suction line Hose heater relay is not operated.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P215E is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Suction line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P05ED | DEF heater line circuit Short circuit to battery Fault |

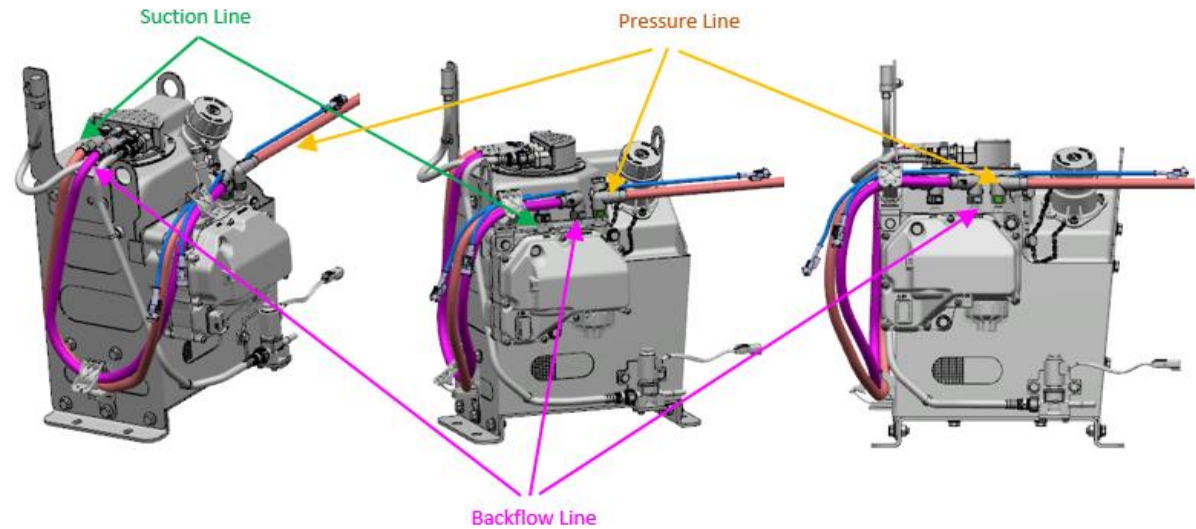
1) Overview

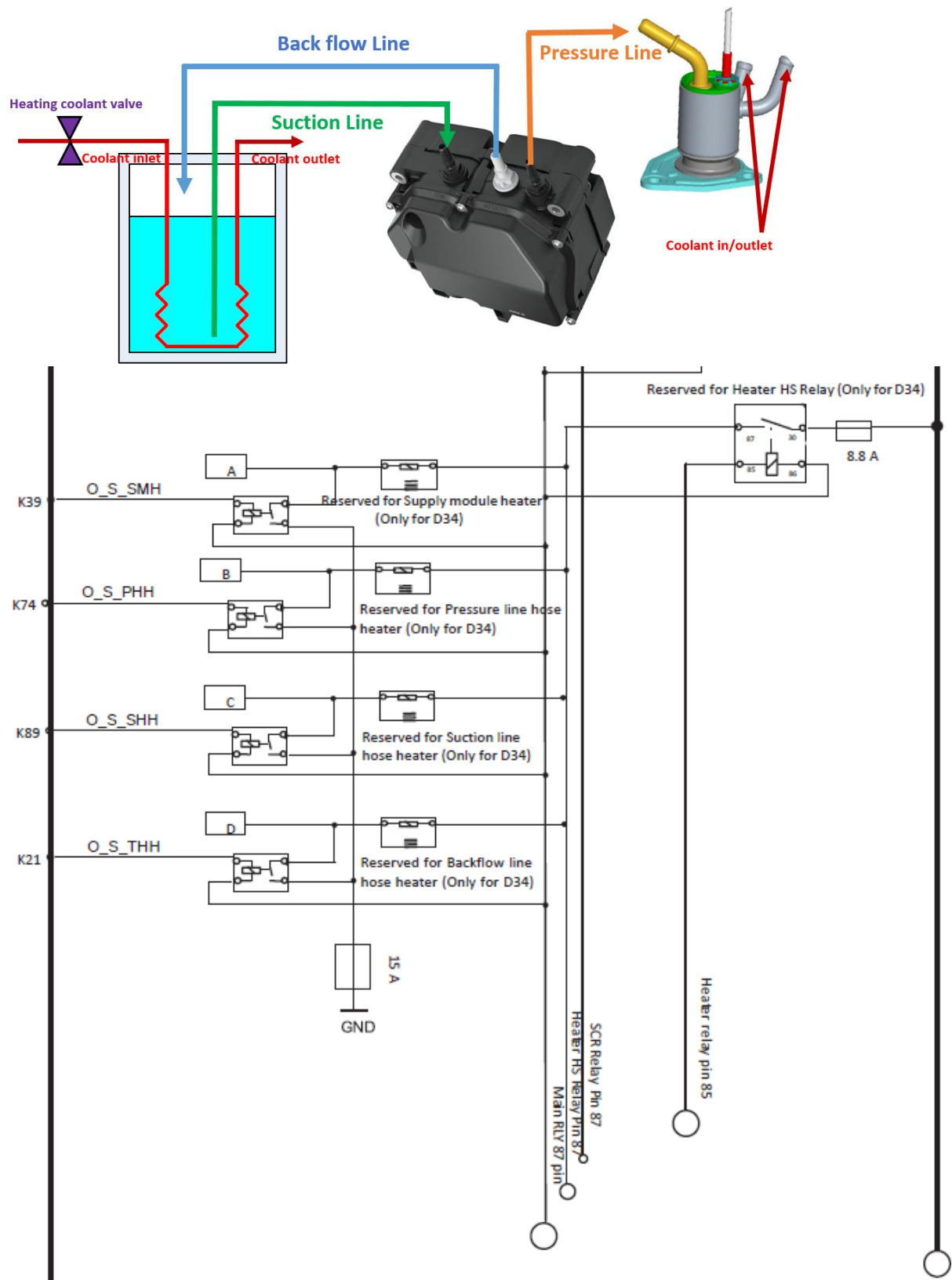
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|------------|
| E005746-06 | 1. Electrical problem (DEF line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF line heater) 3. Electrical problem (ECU connector, Faulty ECU) | CE lamp ON |

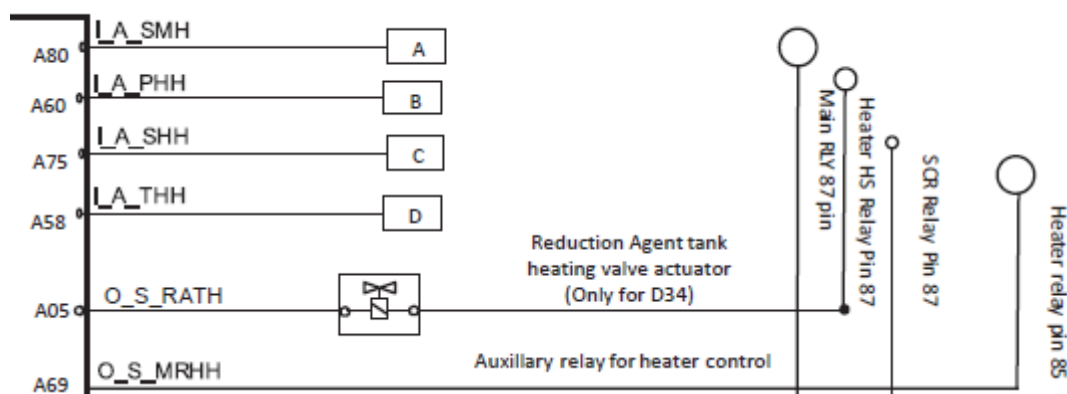
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

At least one DEF line heater circuit is shorted to battery.

It means that is diagnosed when the voltage (A / B / C / D) is detected even though the Main heater relay is not operated.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P05ED is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20C2 | DEF Backflow line heater feedback plausibility Fault |

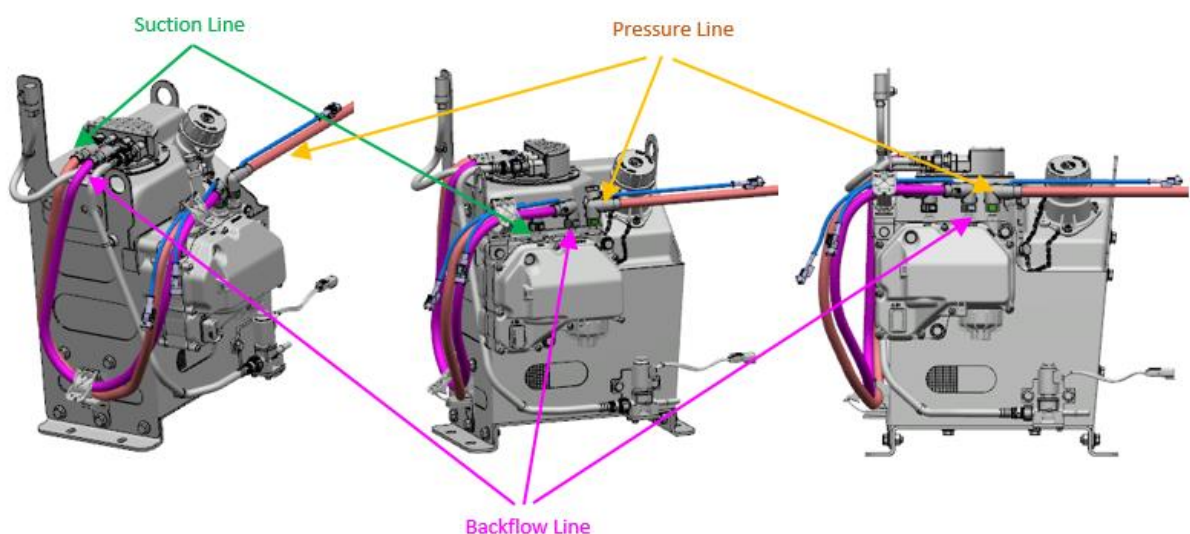
1) Overview

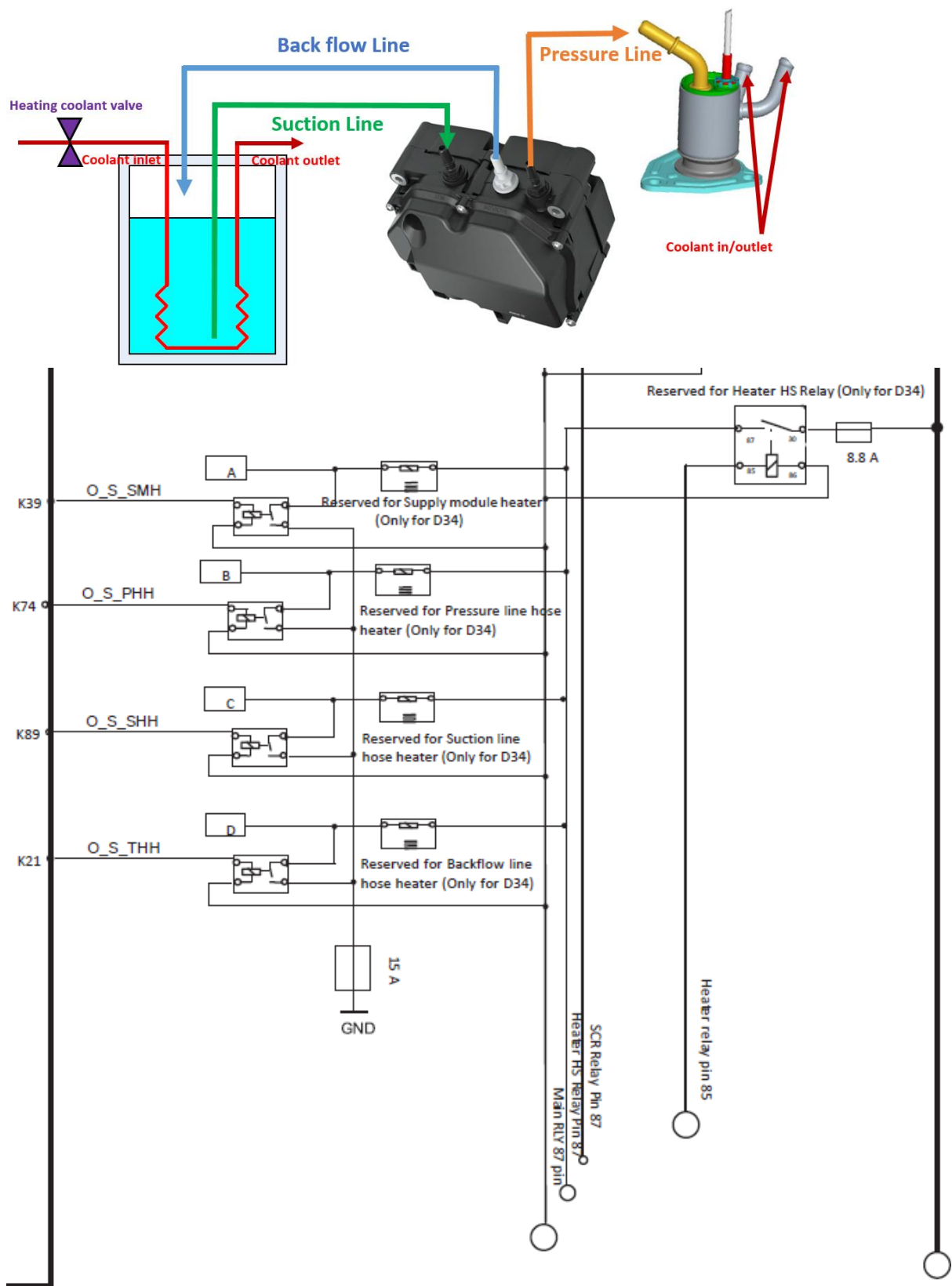
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E007069-12 | 1. Electrical problem (Battery supply into the main relay, DEF Backflow line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Backflow line heater, DEF Backflow line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

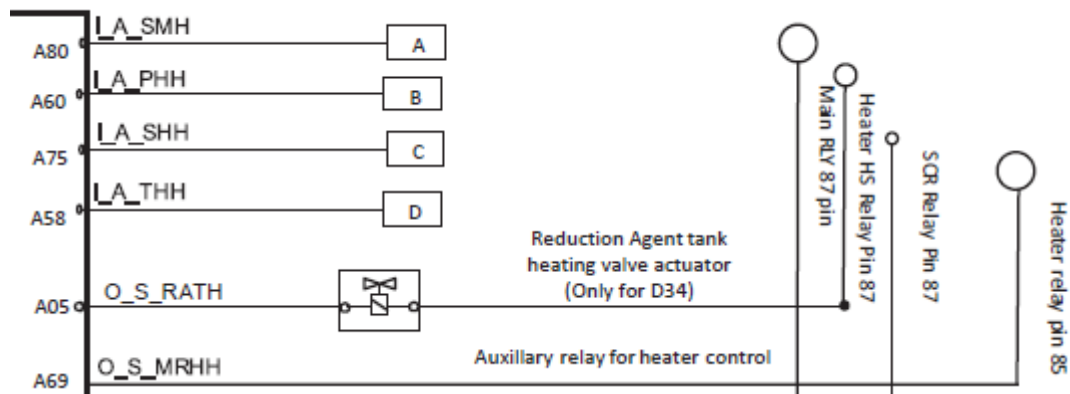
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The Backflow line heater feedback signal is between Low threshold and High threshold (2500mV and 4750mV). 2.5 to 4.75V is the value measured by the ECU internal resistance when the current has not flowed normally in the feedback line.

The hose heater plausibility fault is diagnosed when the current does not flow normally to the hose heating line even though the hose heater relay is operated. Therefore, it is used to check if the actual heater is working when the relay operates.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20C2 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Backflow line heater connection Connection problem? Check value of diagnosis threshold. * Variable 1) Backflow line heater feedback signal (UHTrBLDia_uRawDiag_MP) | 2.50 ~4.75V | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20C1 | DEF Backflow line heater relay output Open circuit Fault |

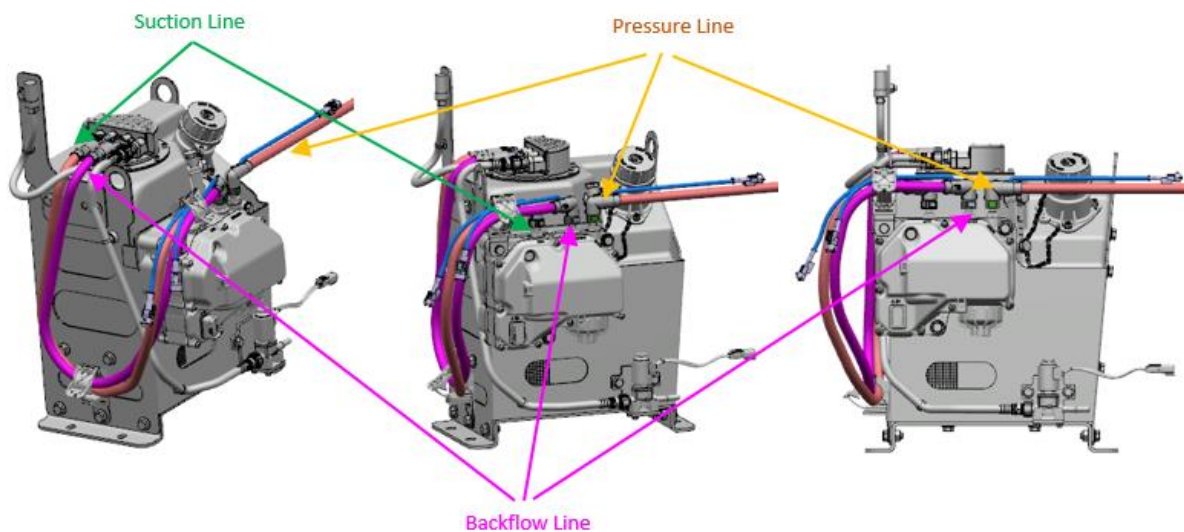
1) Overview

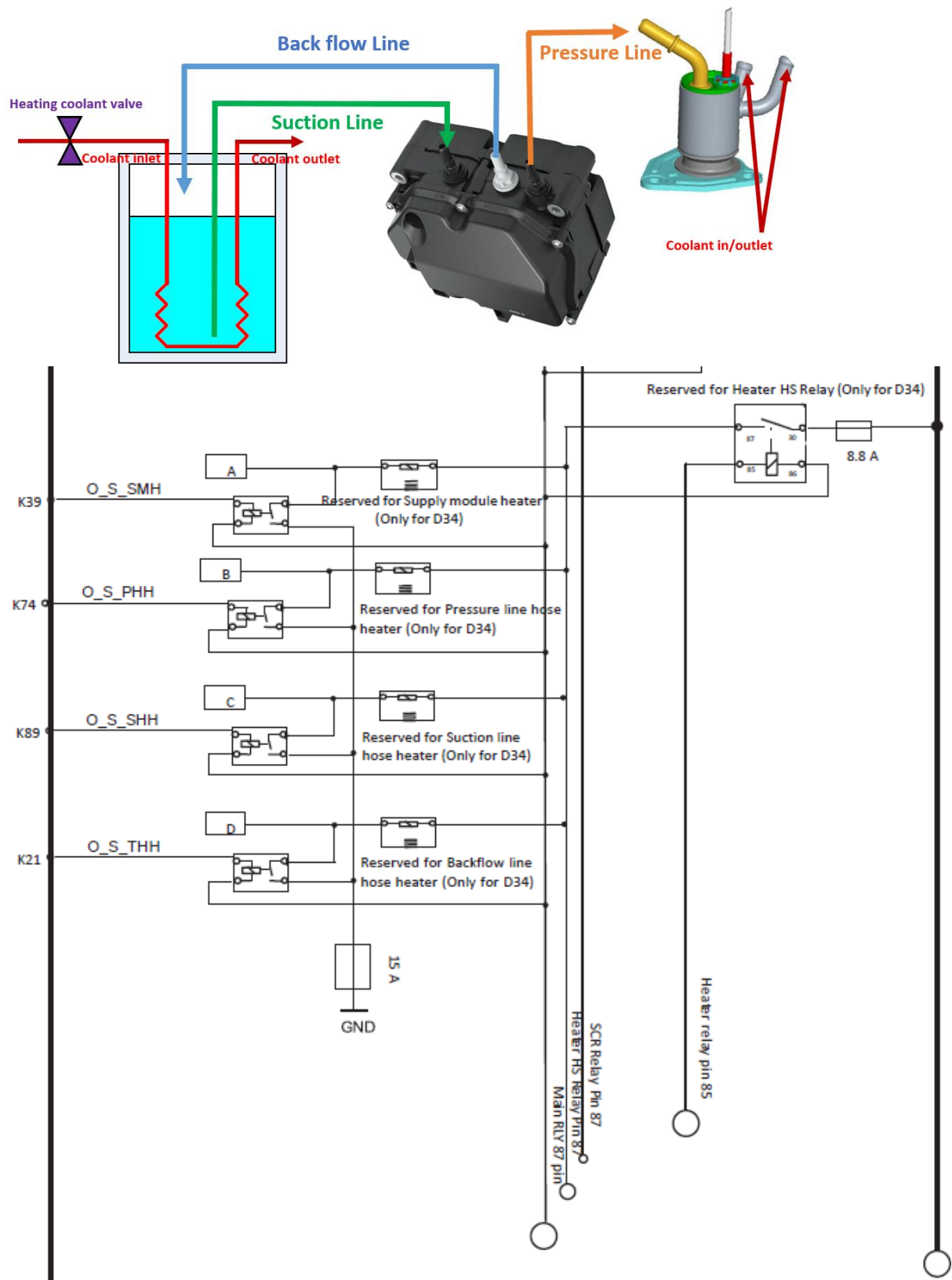
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E007069-05 | 1. Electrical problem (DEF Backflow line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Backflow line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

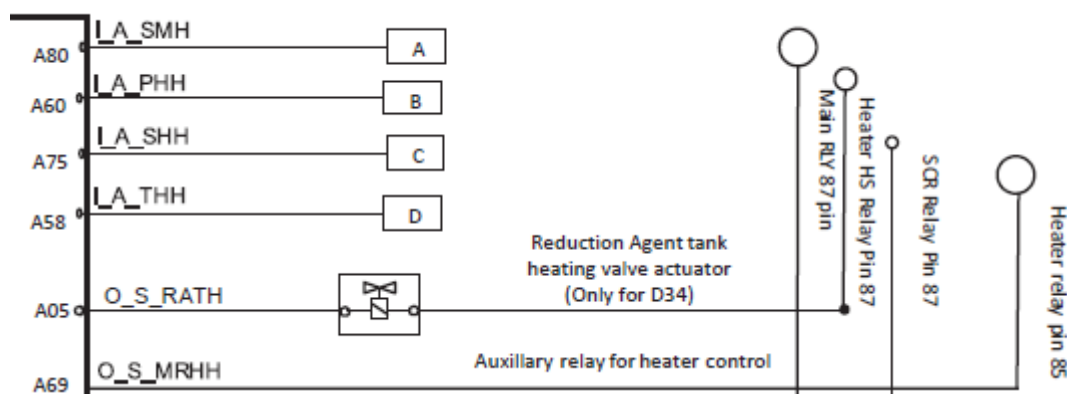
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Backflow line heater relay output is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20C1 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Backflow line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P30C1 | DEF Backflow line heater relay output Over temperature Fault |

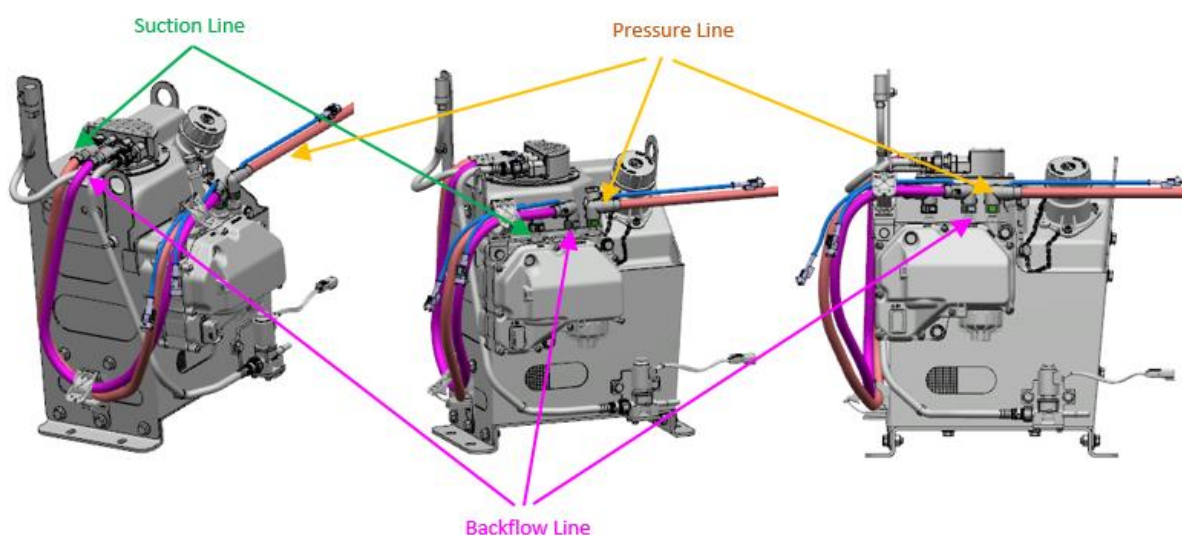
1) Overview

| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E007069-07 | 1. Electrical problem (DEF Backflow line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Backflow line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

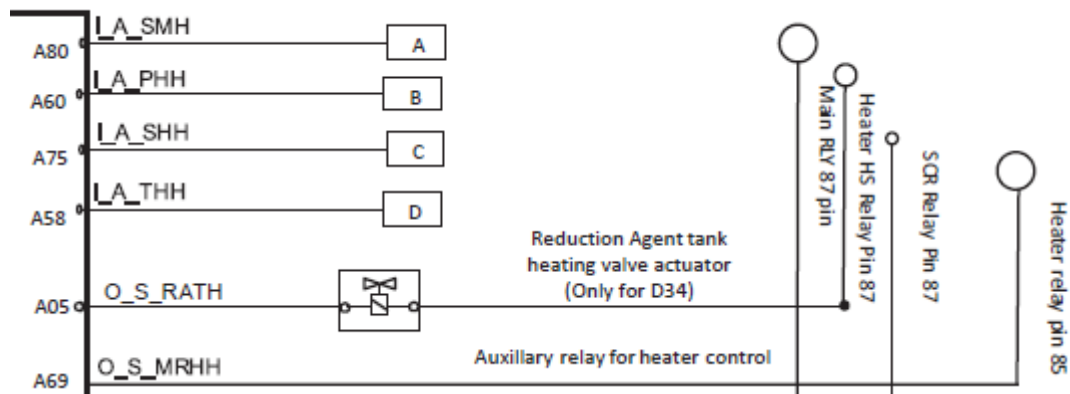
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Backflow line heater relay output is over temperature.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P30C1 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Backflow line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20C4 | DEF Backflow line heater relay output Short circuit to battery Fault |

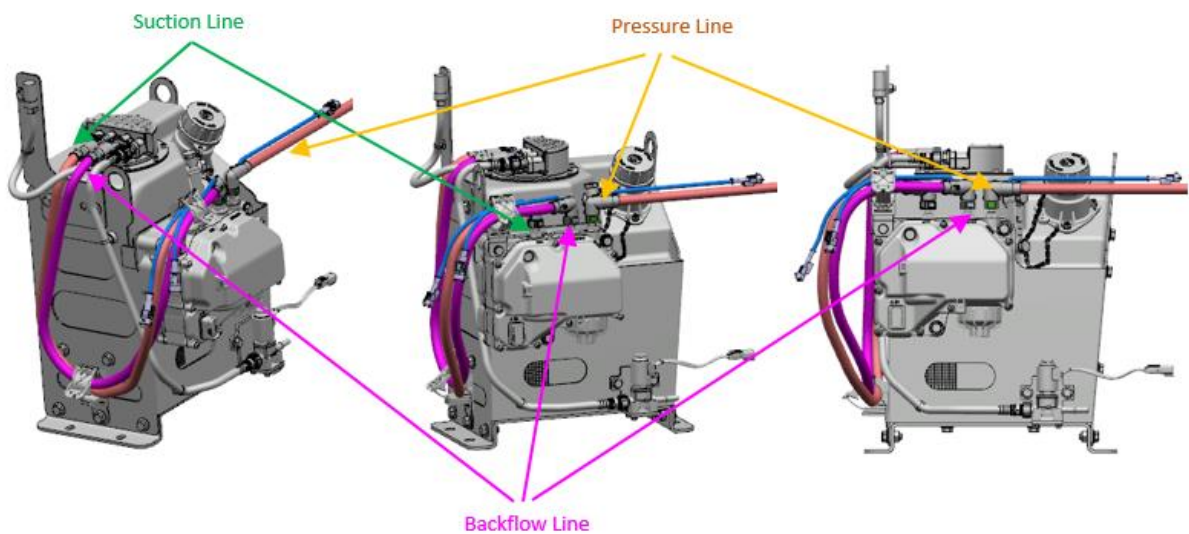
1) Overview

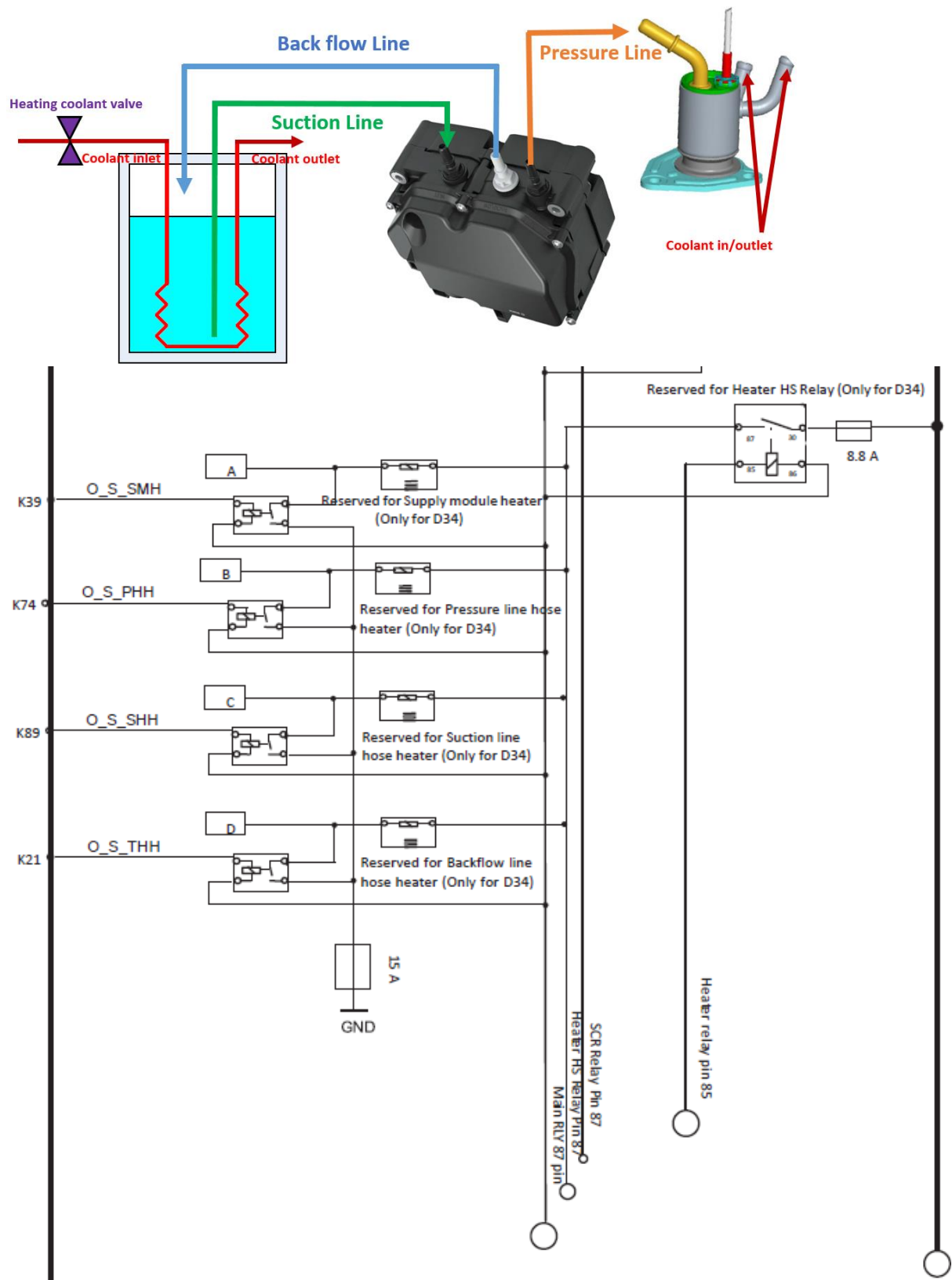
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E007069-03 | 1. Electrical problem (DEF Backflow line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Backflow line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

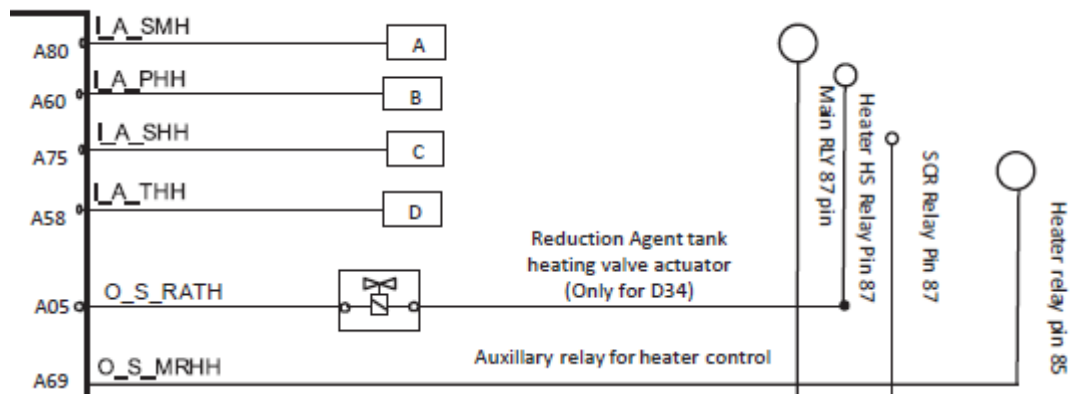
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Backflow line heater relay output is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20C4 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Backflow line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P20C3 | DEF Backflow line heater relay output Short circuit to ground Fault |

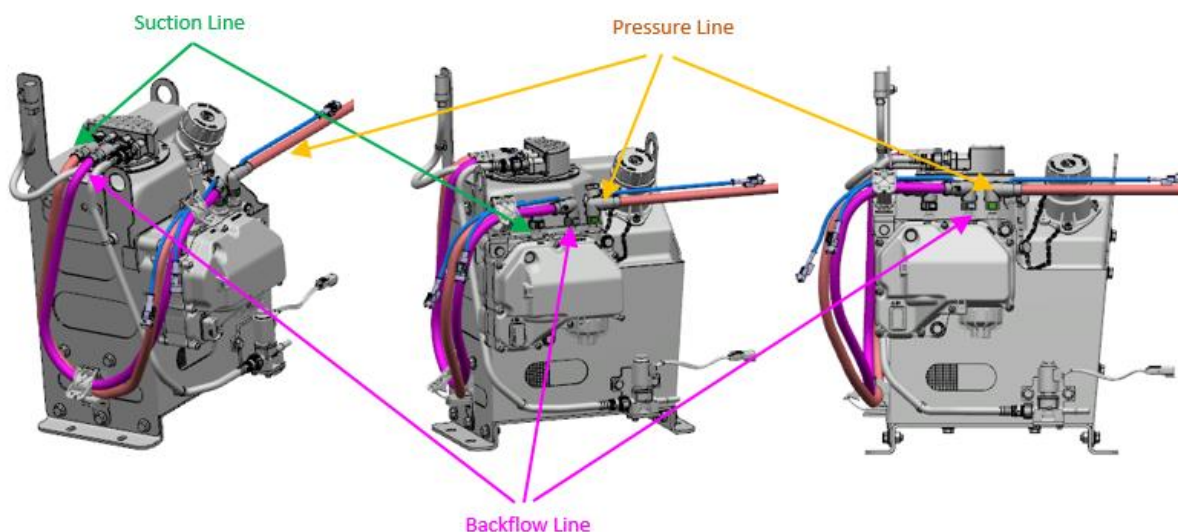
1) Overview

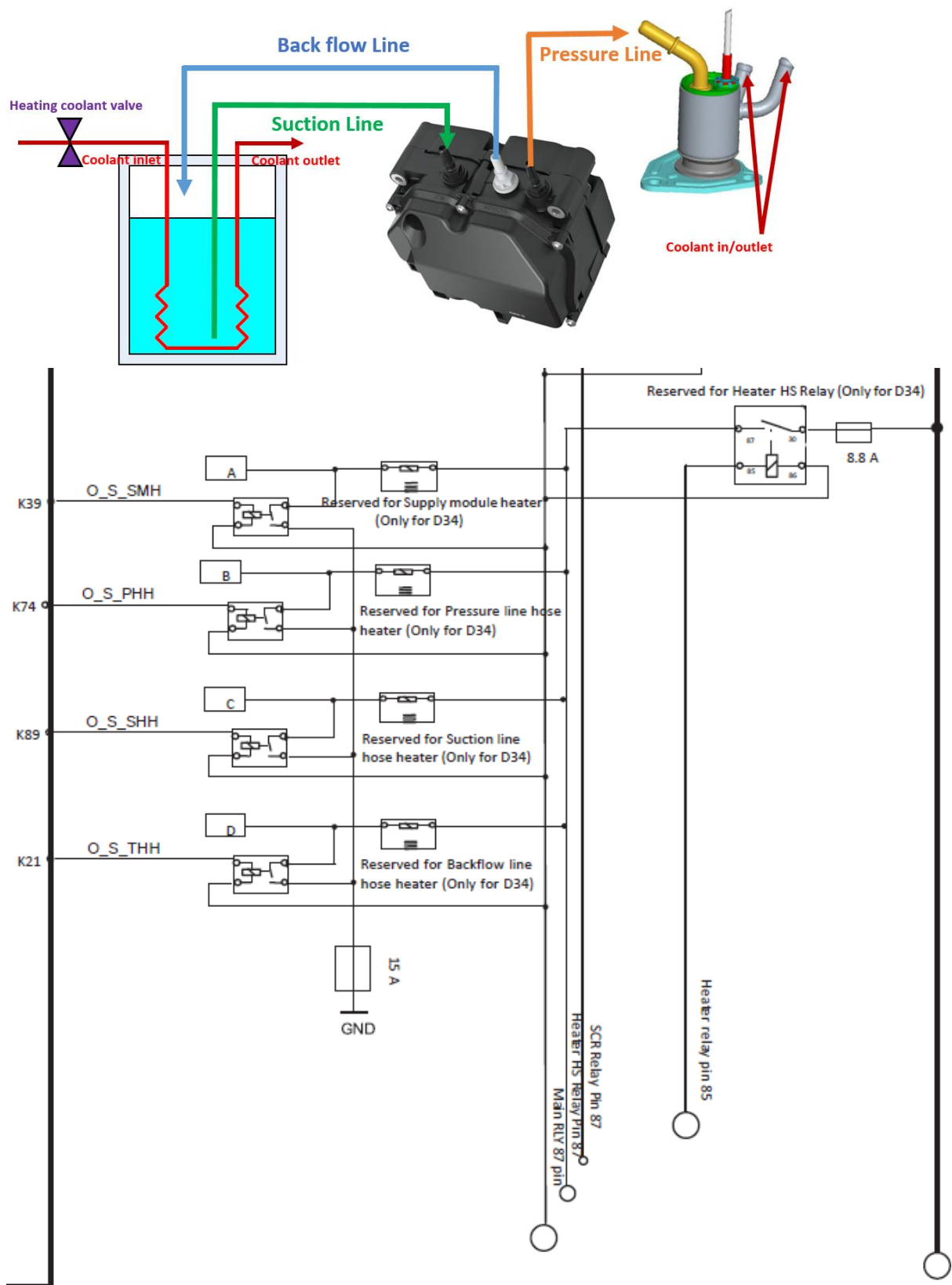
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E007069-04 | 1. Electrical problem (DEF Backflow line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Backflow line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

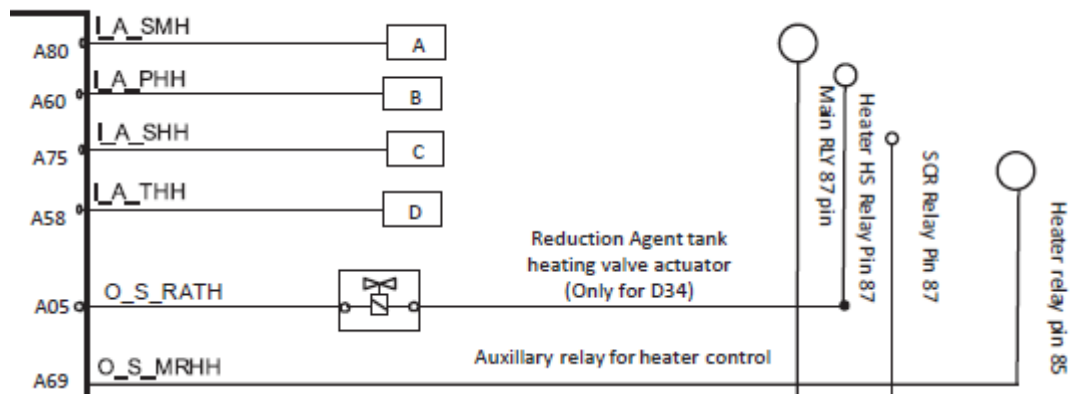
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Backflow line heater relay output is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20C3 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Backflow line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20BE | DEF Pressure line heater feedback plausibility Fault |

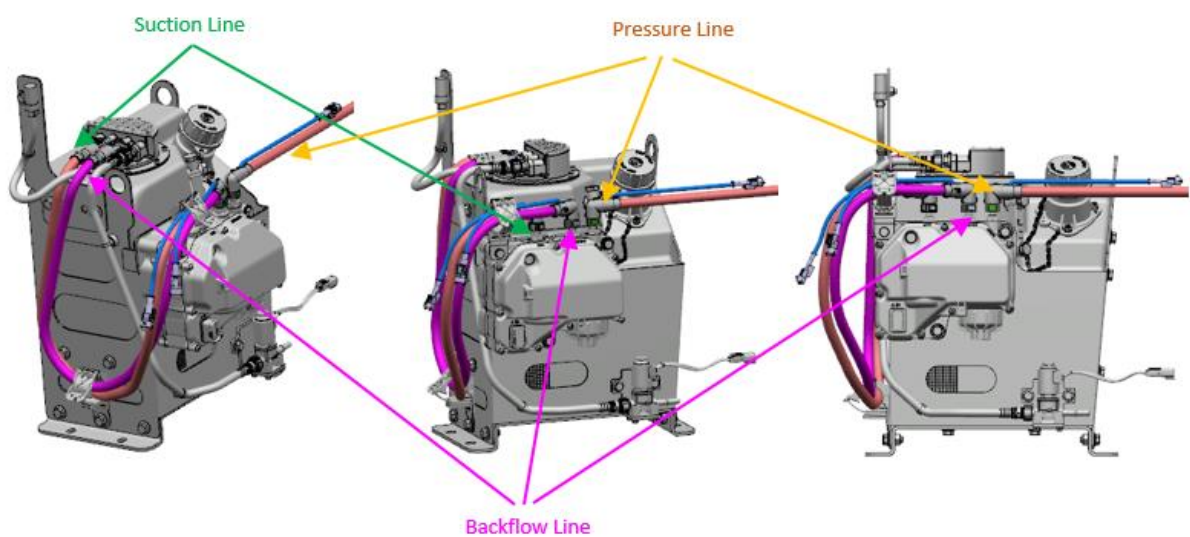
1) Overview

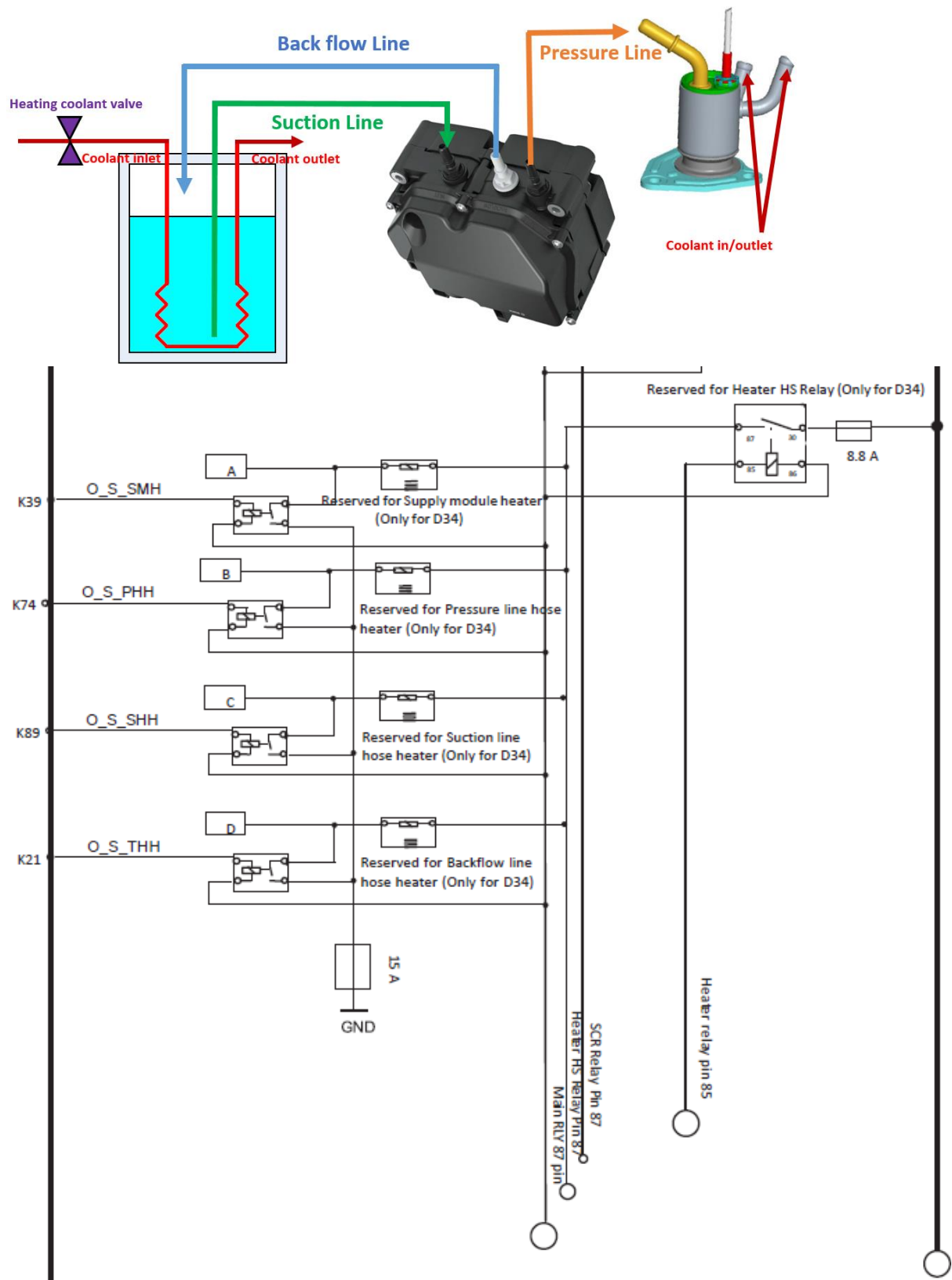
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E005491-12 | 1. Electrical problem (Battery supply into the main relay, DEF Pressure line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Pressure line heater, DEF Pressure line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

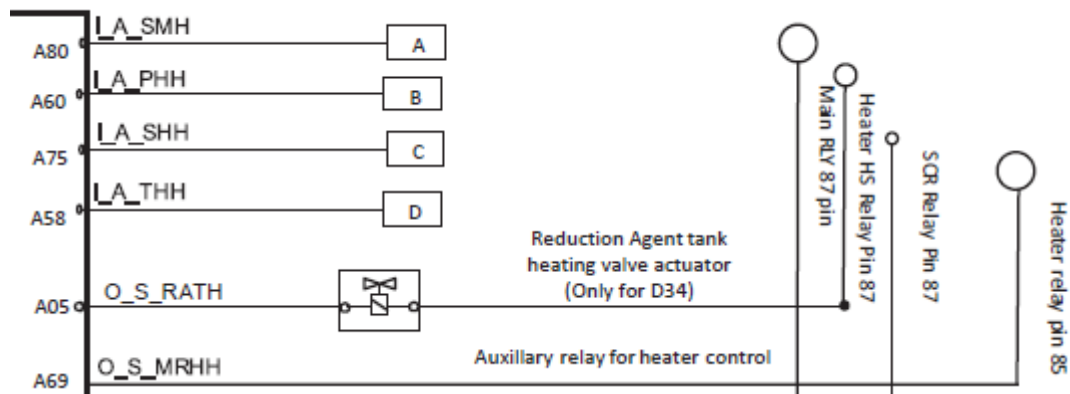
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The Pressure line heater feedback signal is between Low threshold and High threshold (2500mV and 4750mV). 2.5 to 4.75V is the value measured by the ECU internal resistance when the current has not flowed normally in the feedback line.

The hose heater plausibility fault is diagnosed when the current does not flow normally to the hose heating line even though the hose heater relay is operated. Therefore, it is used to check if the actual heater is working when the relay operates.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20BE is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Pressure line heater connection Connection problem? Check value of diagnosis threshold. * Variable 1) Pressure line heater feedback signal (UHtrPLDia_uRawDiag_MP) | 2.50 ~4.75V | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20BD | DEF Pressure line heater relay output Open circuit Fault |

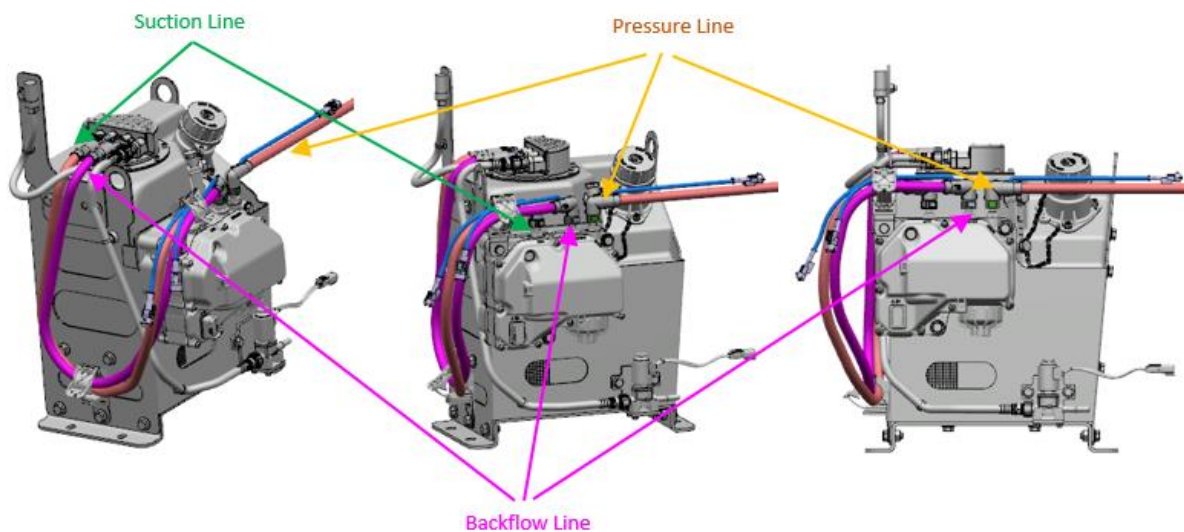
1) Overview

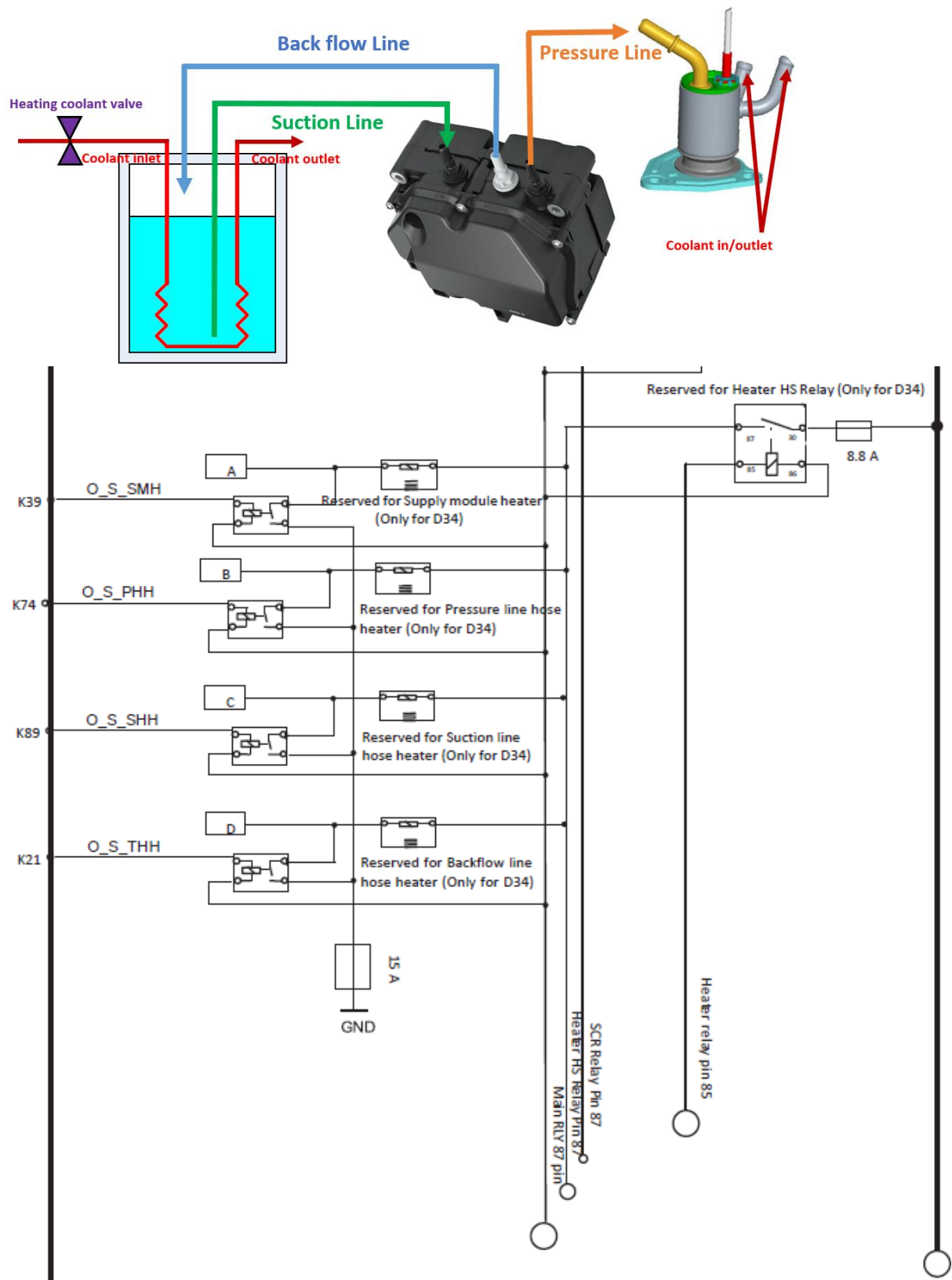
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E005491-05 | 1. Electrical problem (DEF Pressure line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Pressure line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

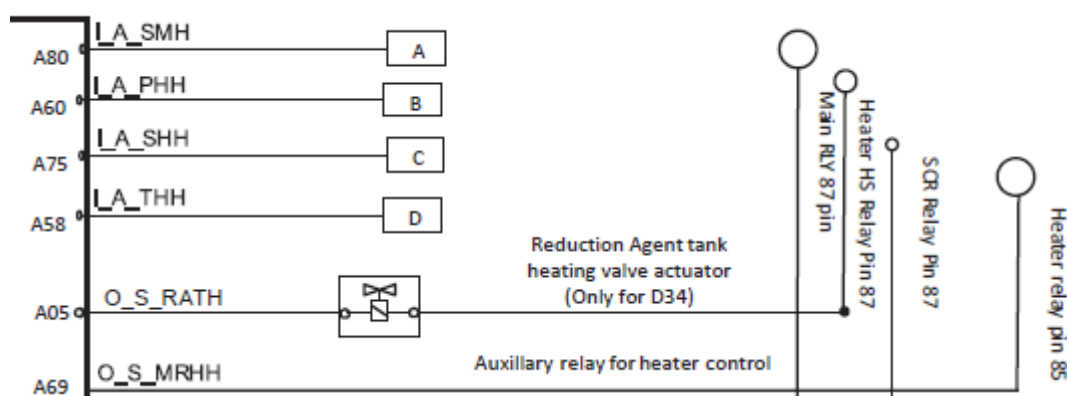
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Pressure line heater relay output is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20BD is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Pressure line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P30BD | DEF Pressure line heater relay output Over temperature Fault |

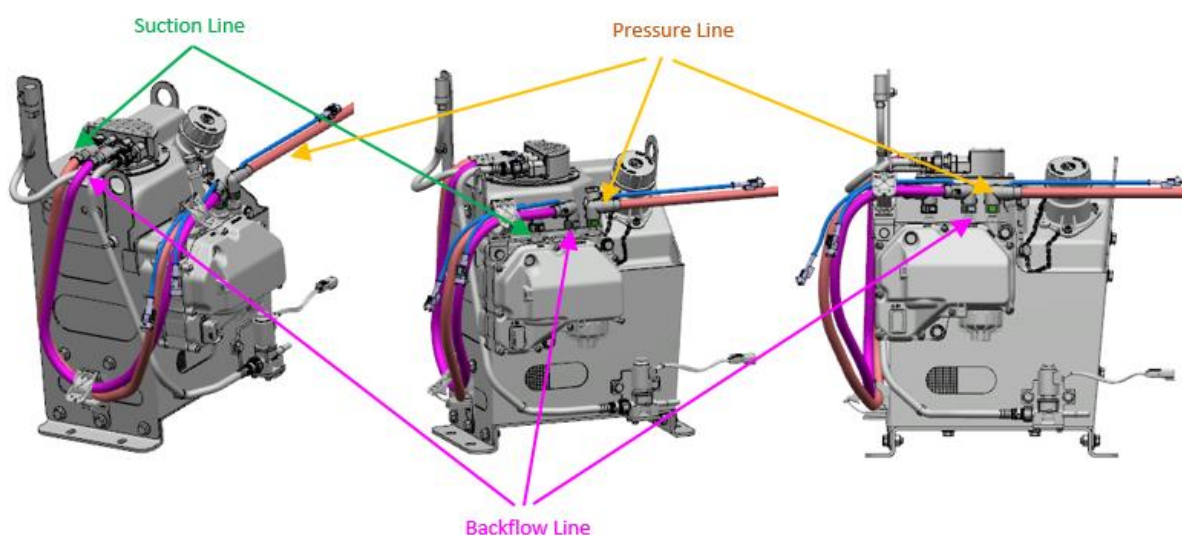
1) Overview

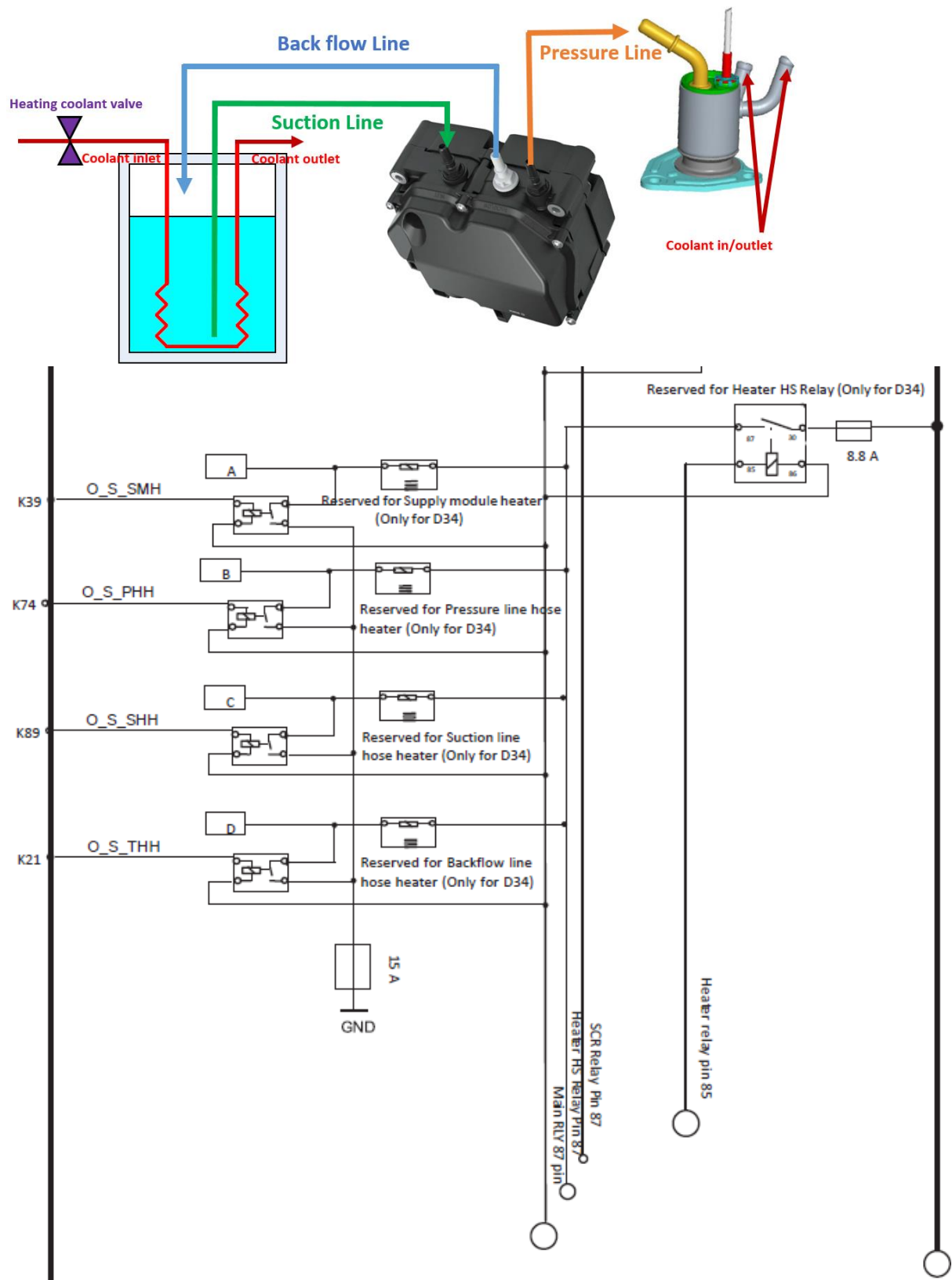
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E005491-07 | 1. Electrical problem (DEF Pressure line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Pressure line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

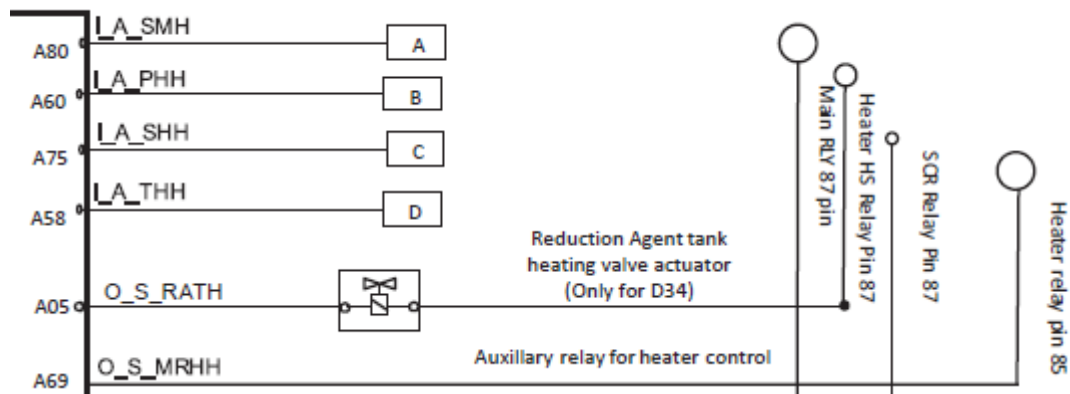
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Pressure line heater relay output is over temperature.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P30BD is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Pressure line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20C0 | DEF Pressure line heater relay output Short circuit to battery Fault |

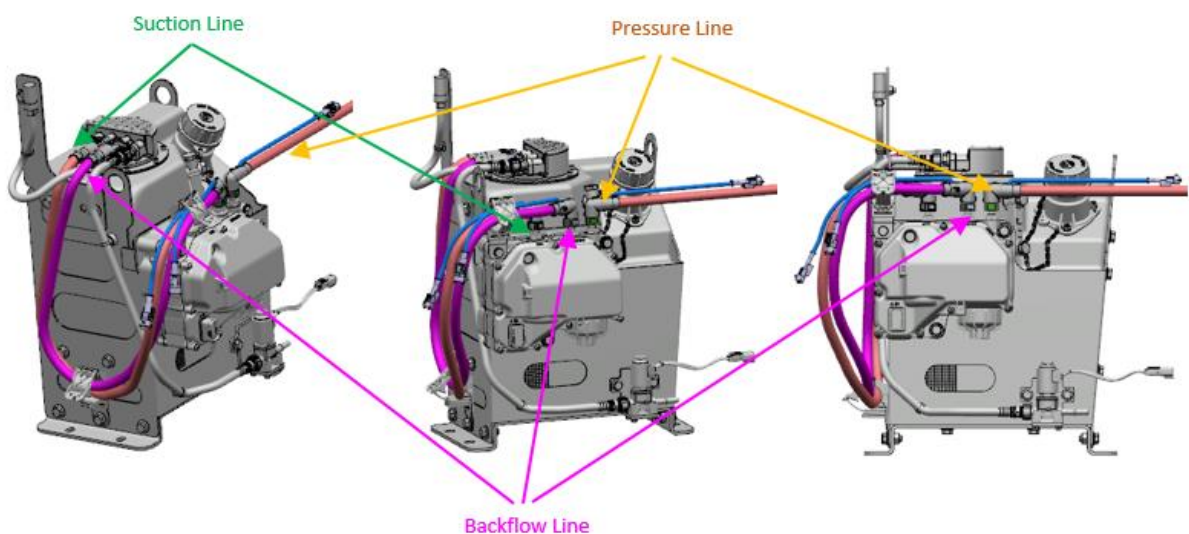
1) Overview

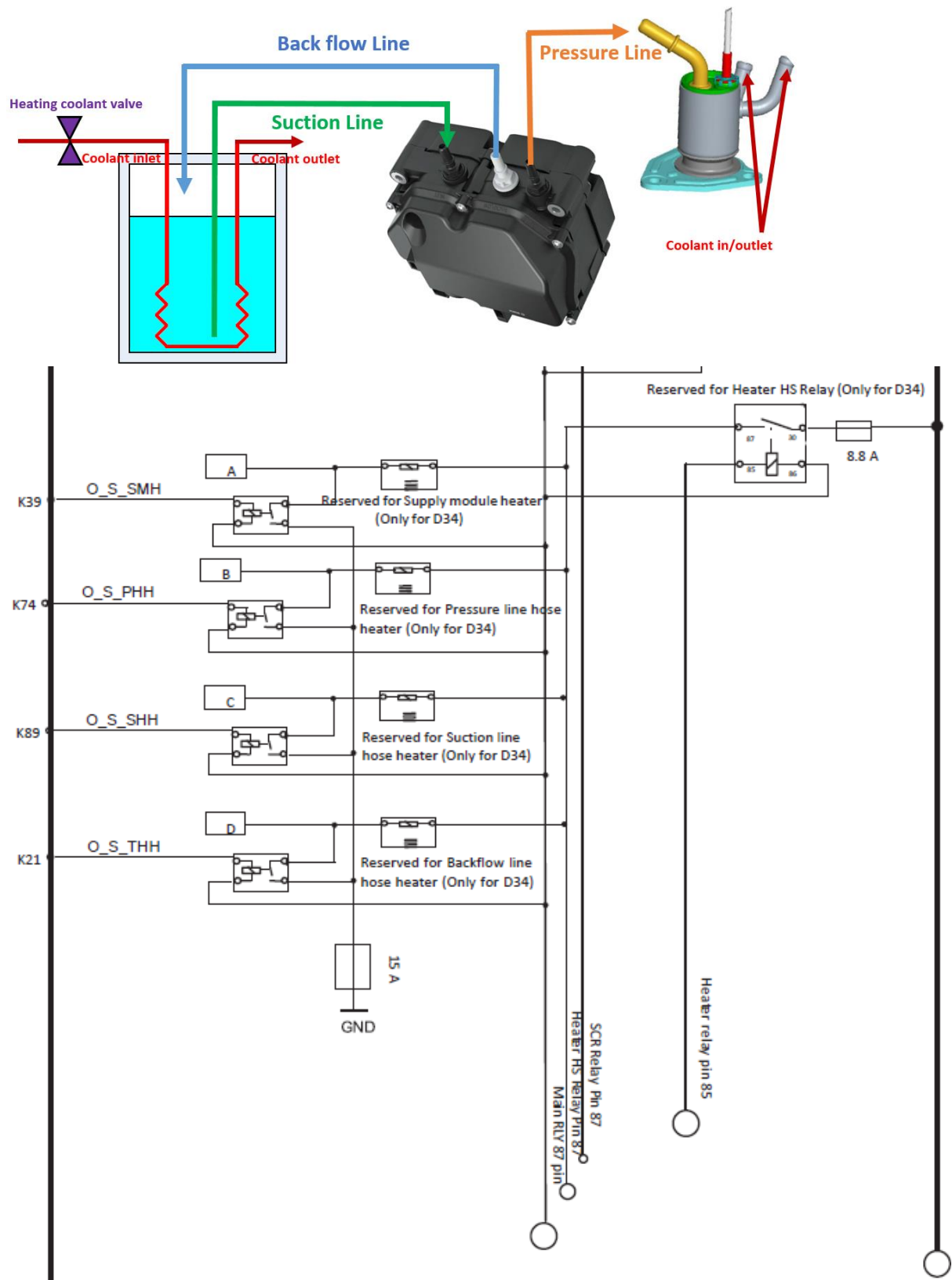
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E005491-03 | 1. Electrical problem (DEF Pressure line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Pressure line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

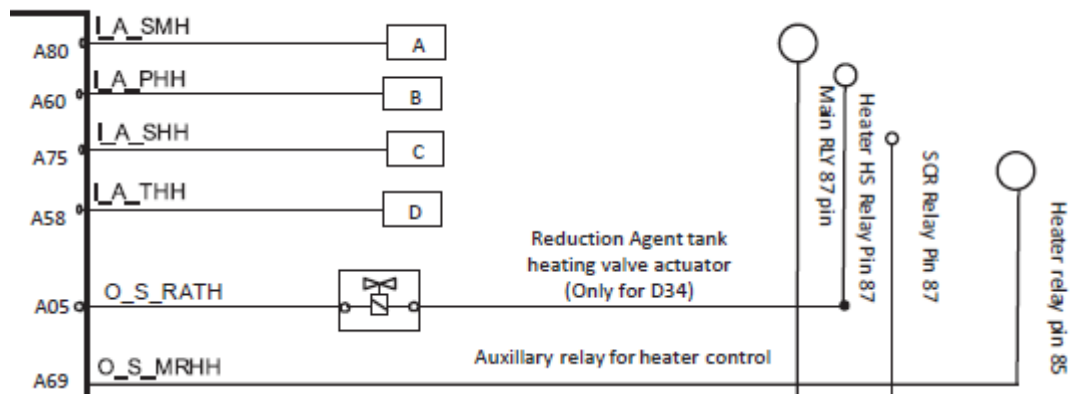
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Pressure line heater relay output is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20C0 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Pressure line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P20BF | DEF Pressure line heater relay output Short circuit to ground Fault |

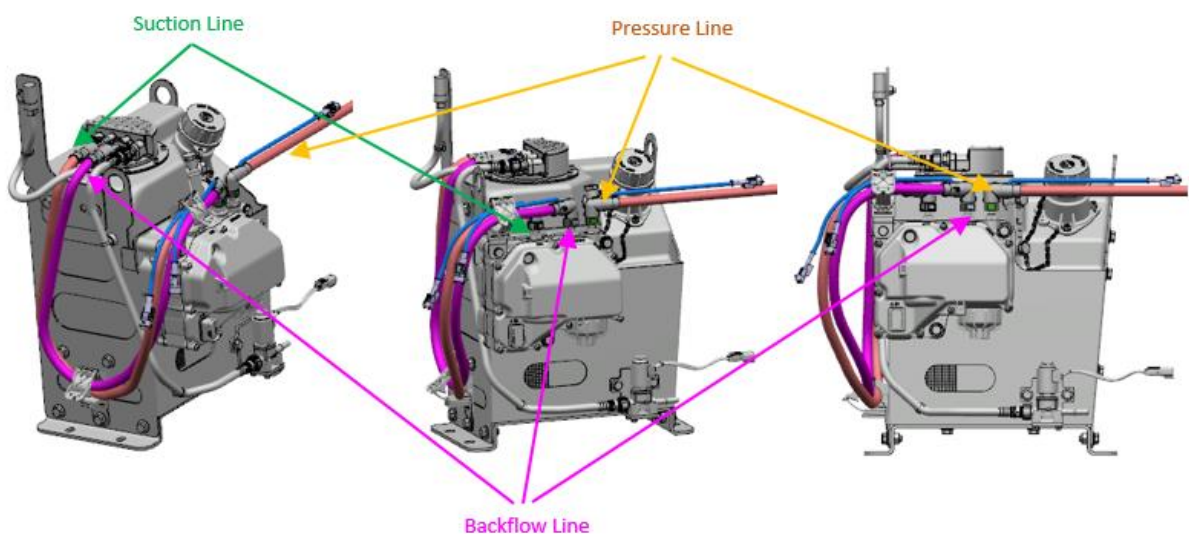
1) Overview

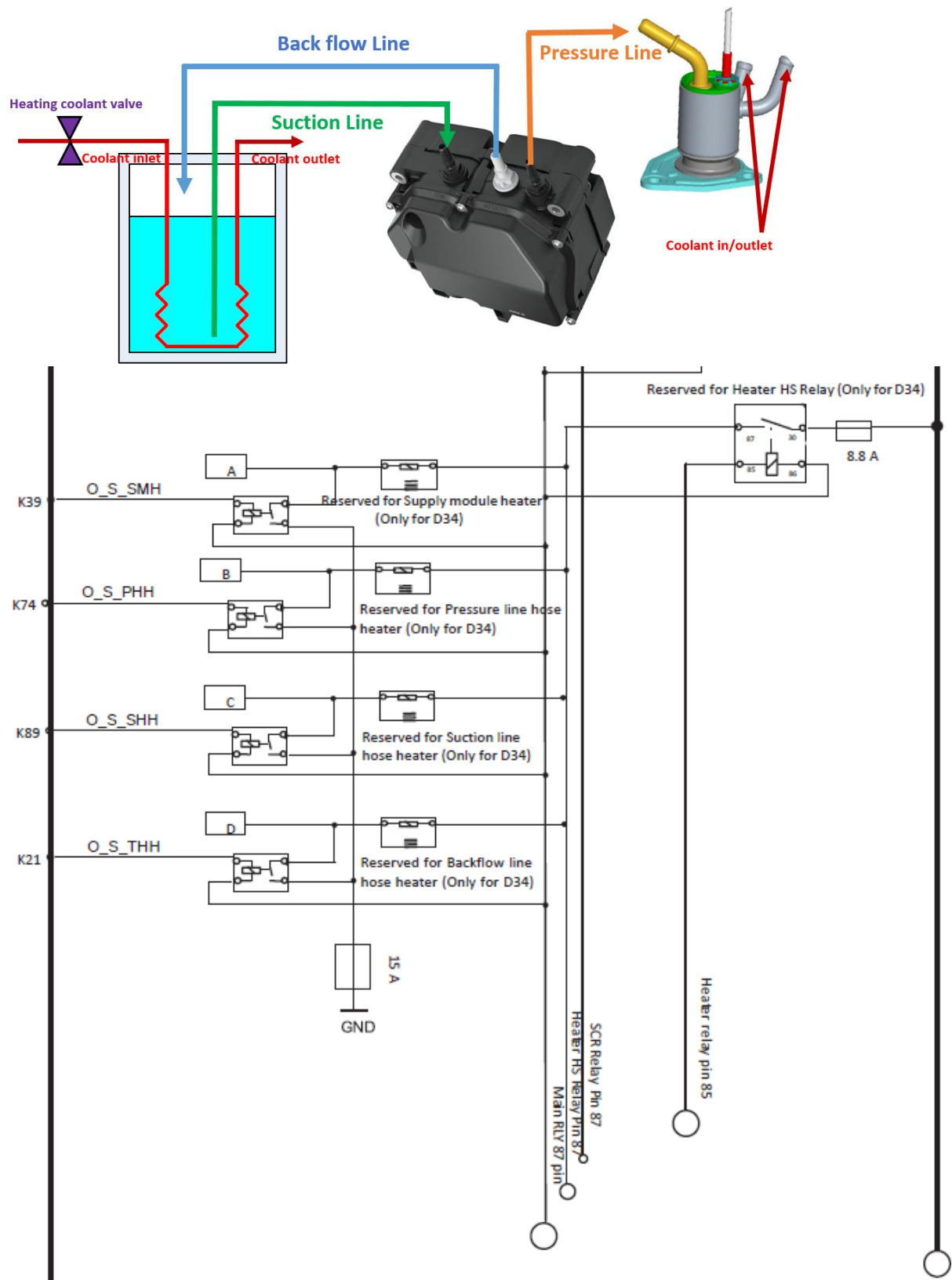
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E005491-04 | 1. Electrical problem (DEF Pressure line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Pressure line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

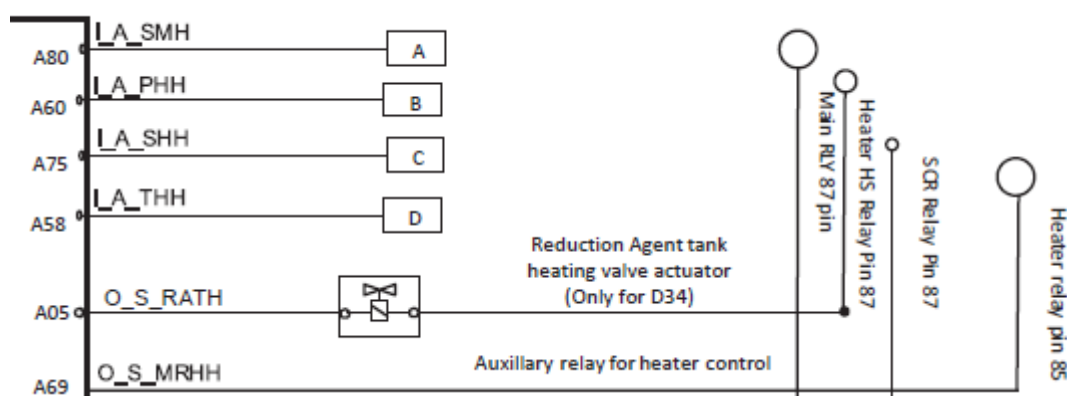
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Pressure line heater relay output is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20BF is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Pressure line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P21C2 | DEF Main heater relay output Open circuit Fault |

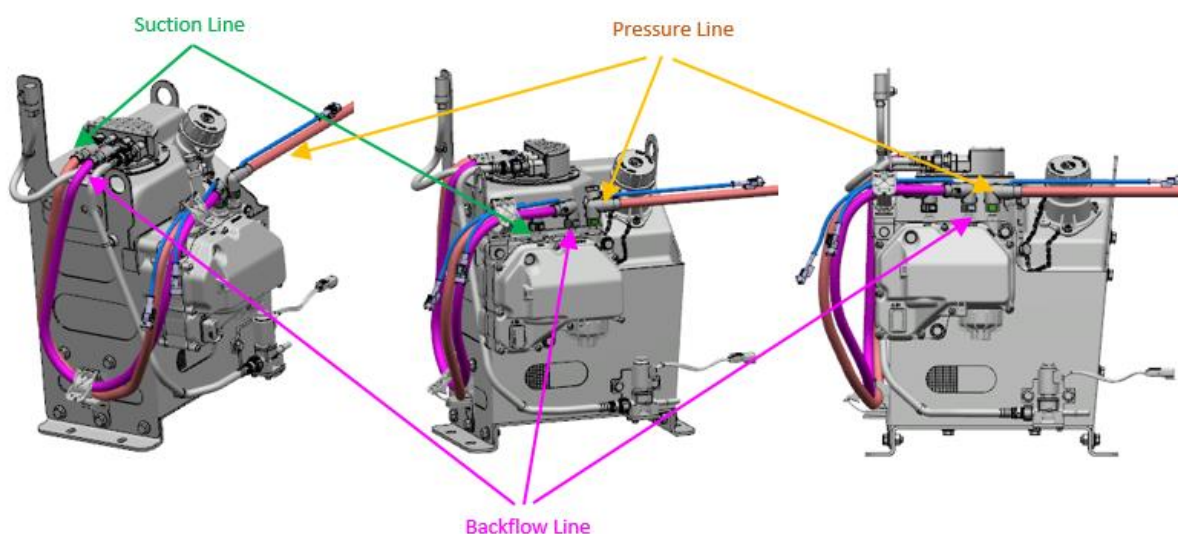
1) Overview

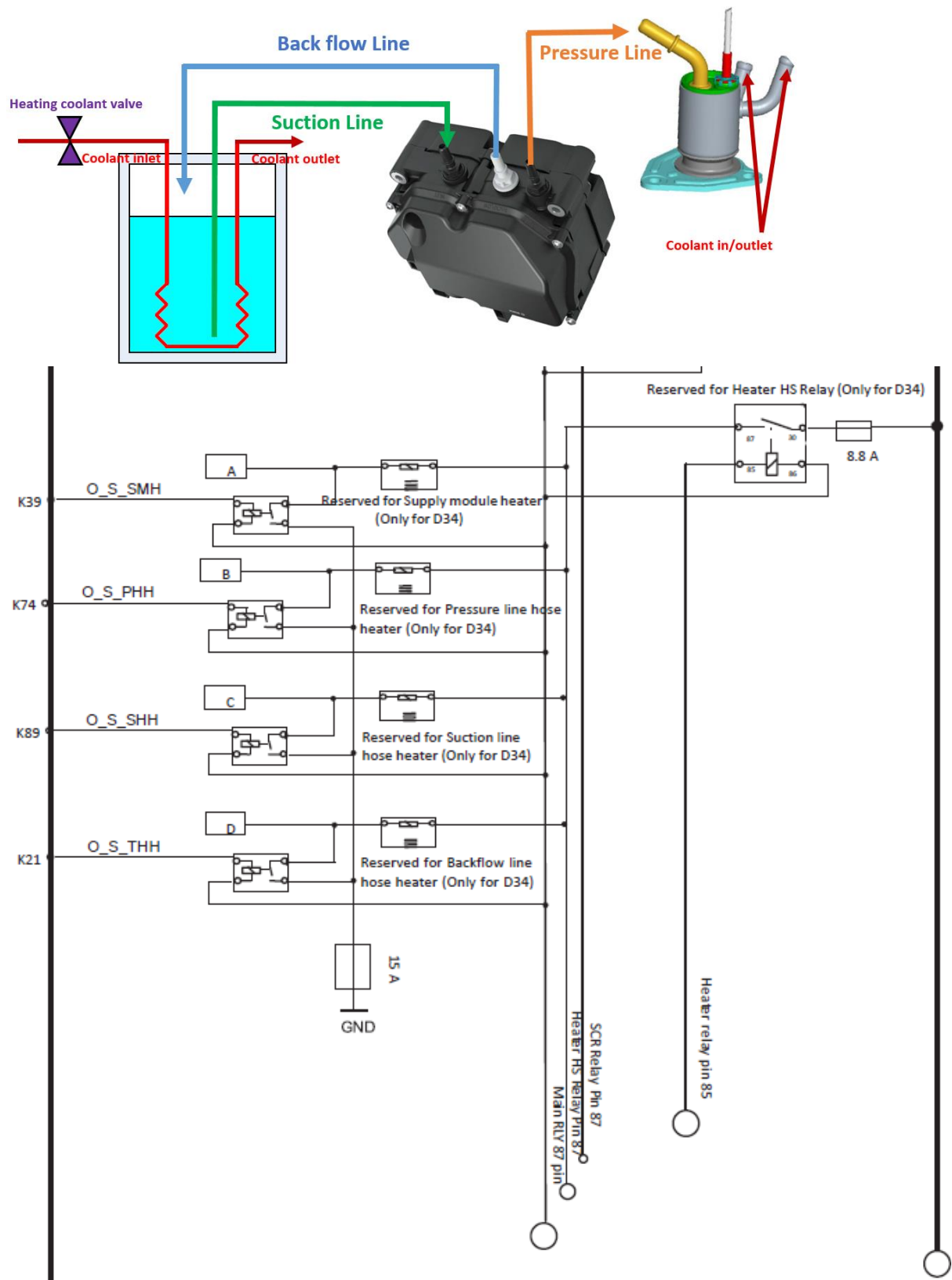
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|-------------------------------|
| E005746-05 | 1. Electrical problem (Battery supply into the Main relay) 2. Electrical problem (Heater relay, Wiring harness related DEF Main heater relay) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

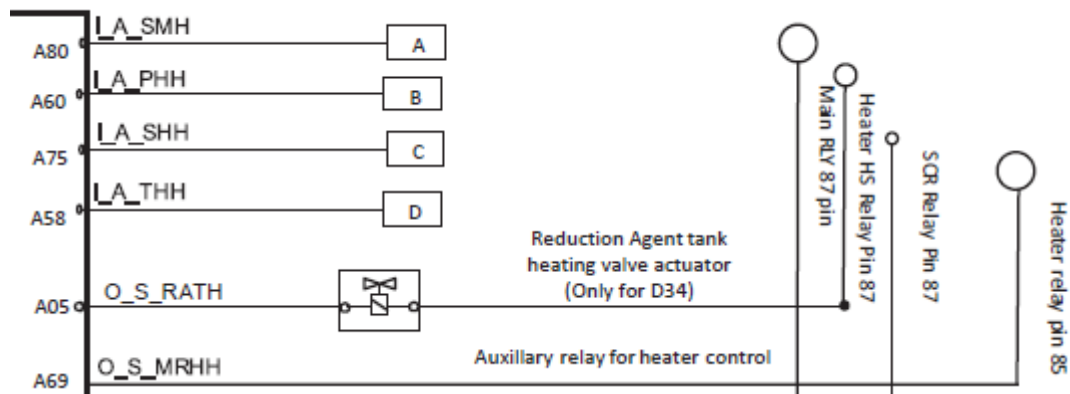
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Main heater relay output is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P21C2 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Main heater relay connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Replace with another normal Main relay Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P31C5 | DEF Main heater relay output Over temperature Fault |

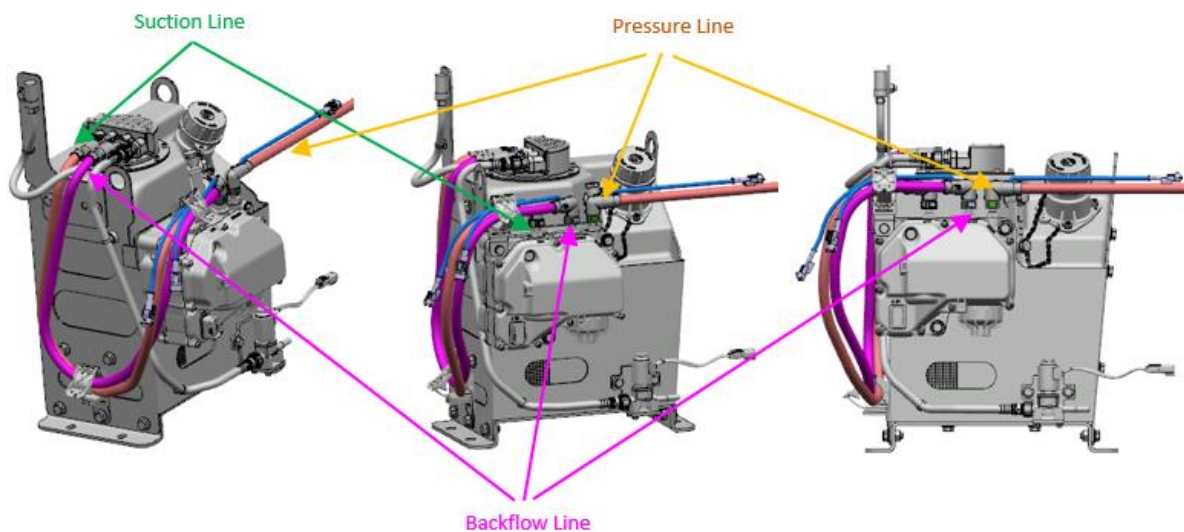
1) Overview

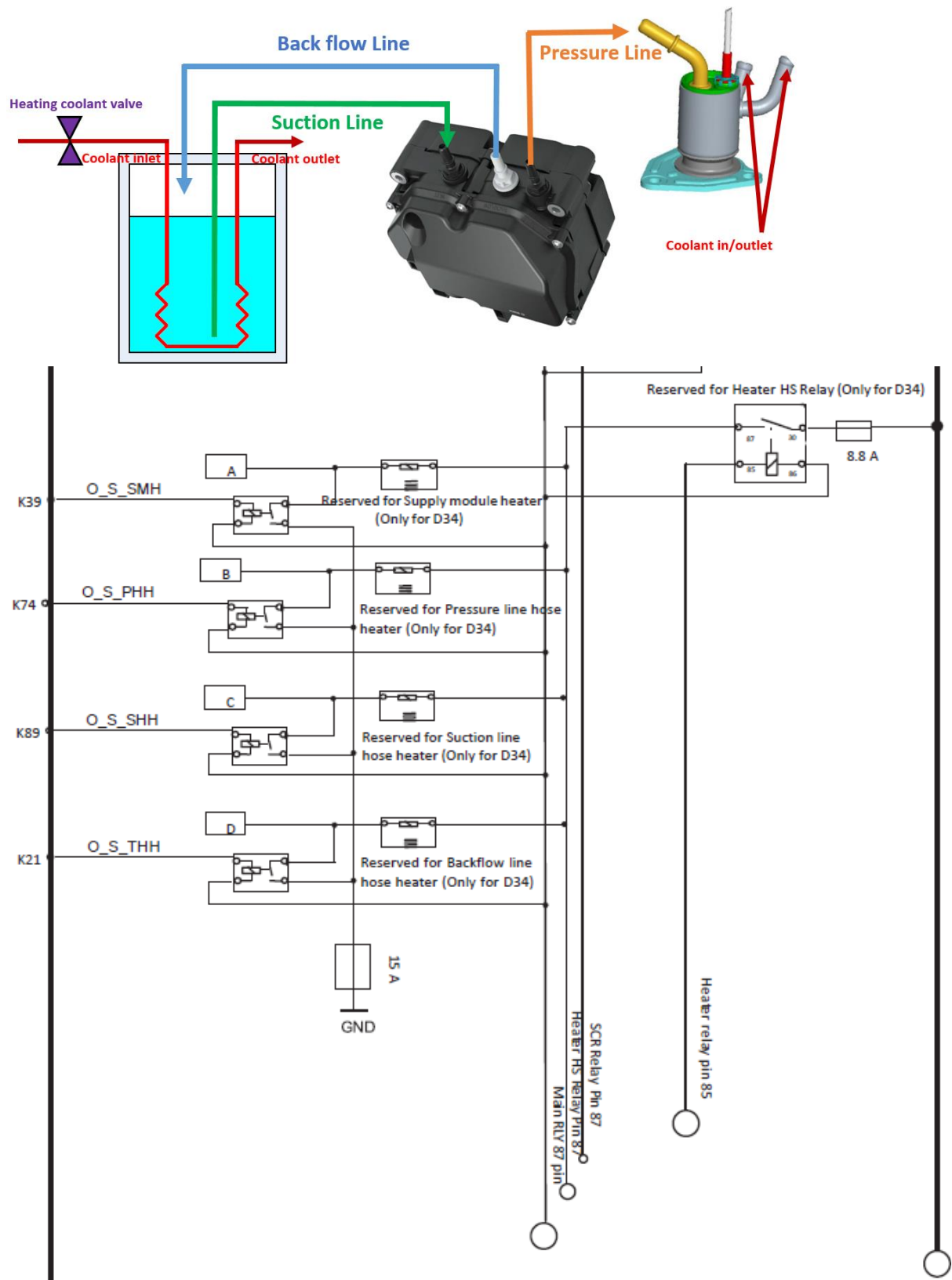
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--------------------------------------|
| E005746-07 | 1. Electrical problem (Battery supply into the Main relay) 2. Electrical problem (Heater relay, Wiring harness related DEF Main heater relay) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

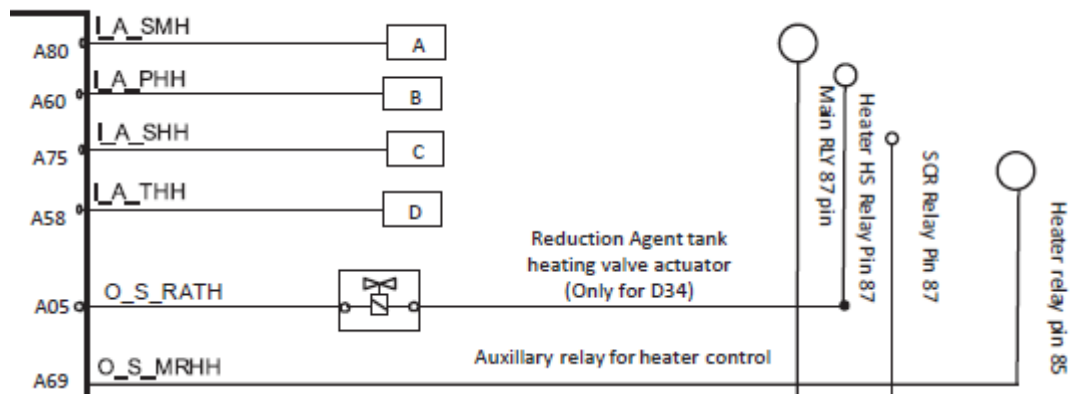
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Main heater relay output is over temperature.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P31C5 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Main heater relay connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Replace with another normal Main relay Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P21C4 | DEF Main heater relay output Short circuit to battery Fault |

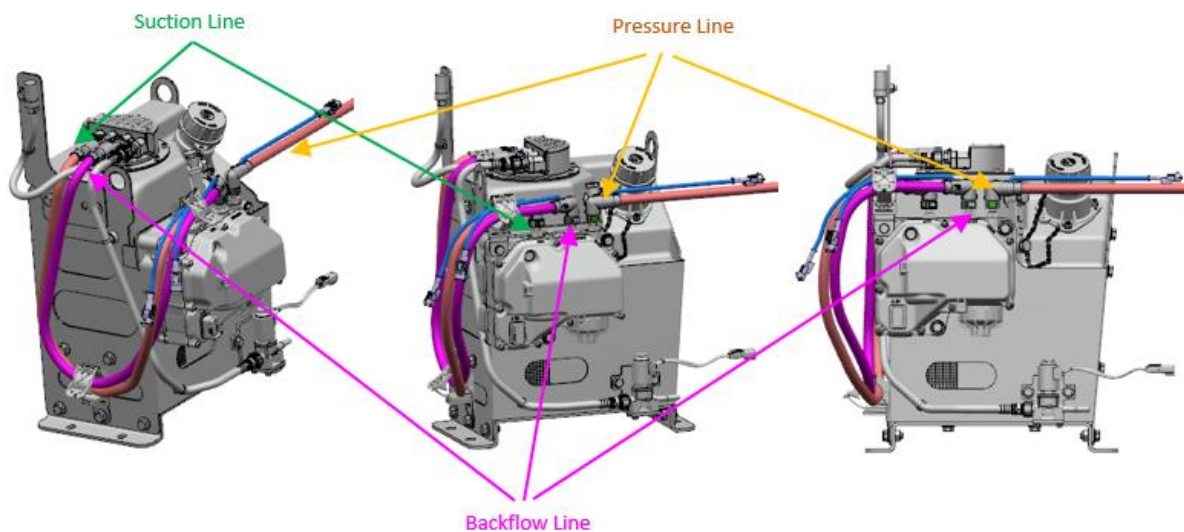
1) Overview

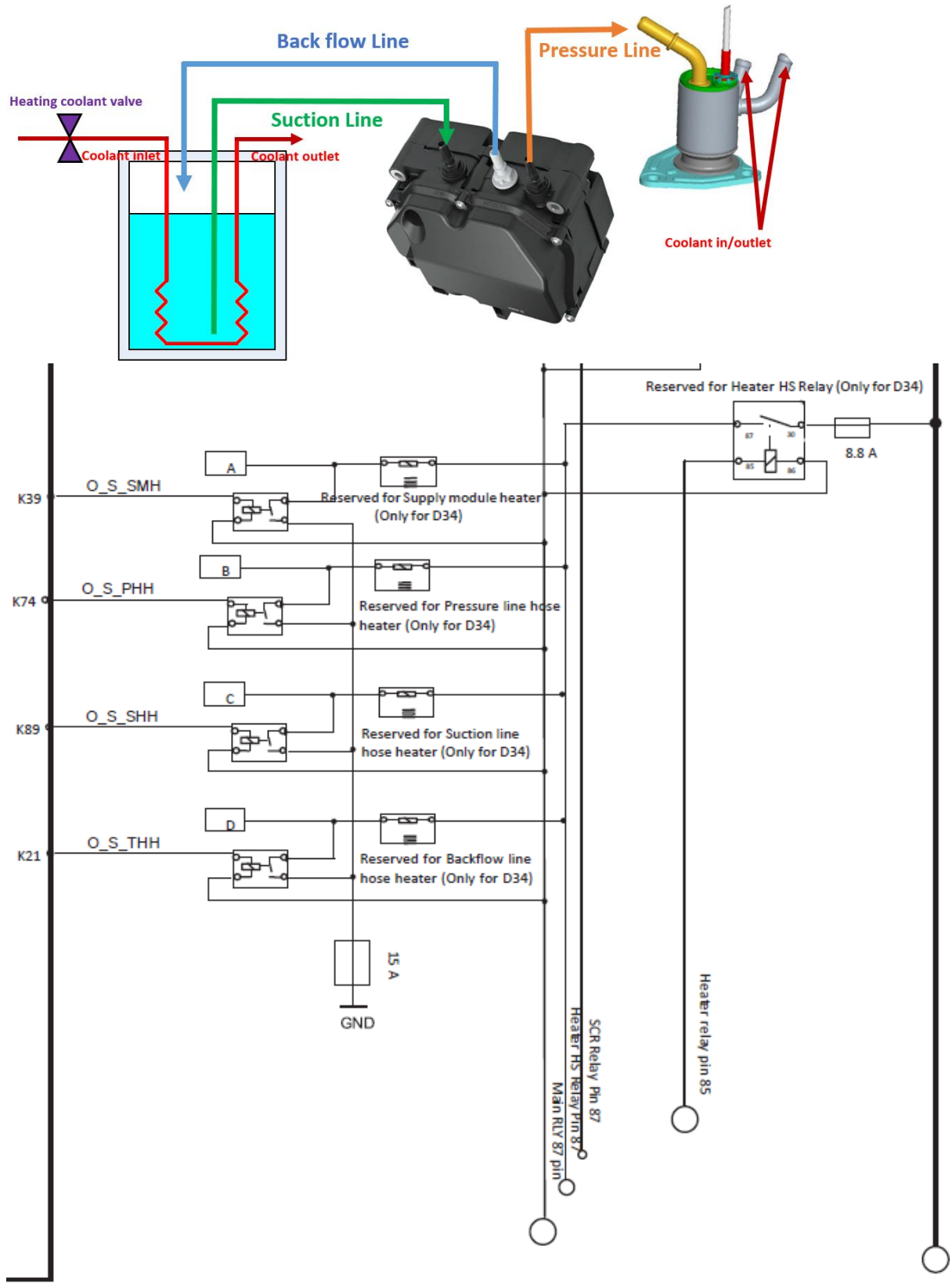
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--------------------------------------|
| E005746-03 | 1. Electrical problem (Battery supply into the Main relay) 2. Electrical problem (Heater relay, Wiring harness related DEF Main heater relay) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

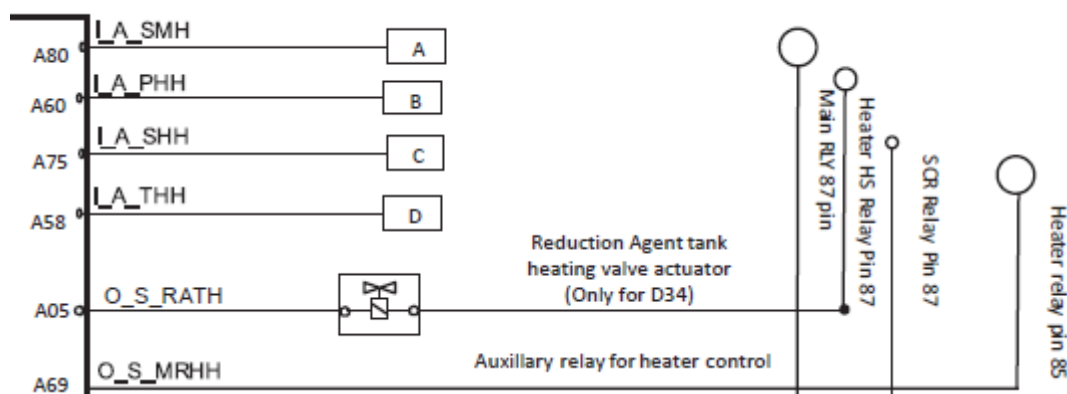
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Main heater relay output is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P21C4 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Main heater relay connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Replace with another normal Main relay Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P21C3 | DEF Main heater relay output Short circuit to ground Fault |

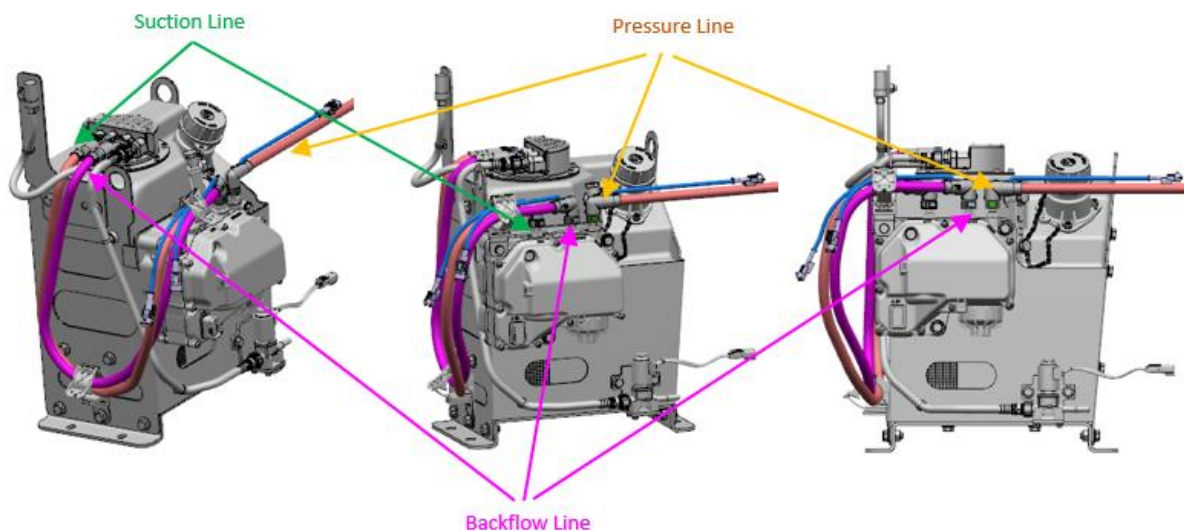
1) Overview

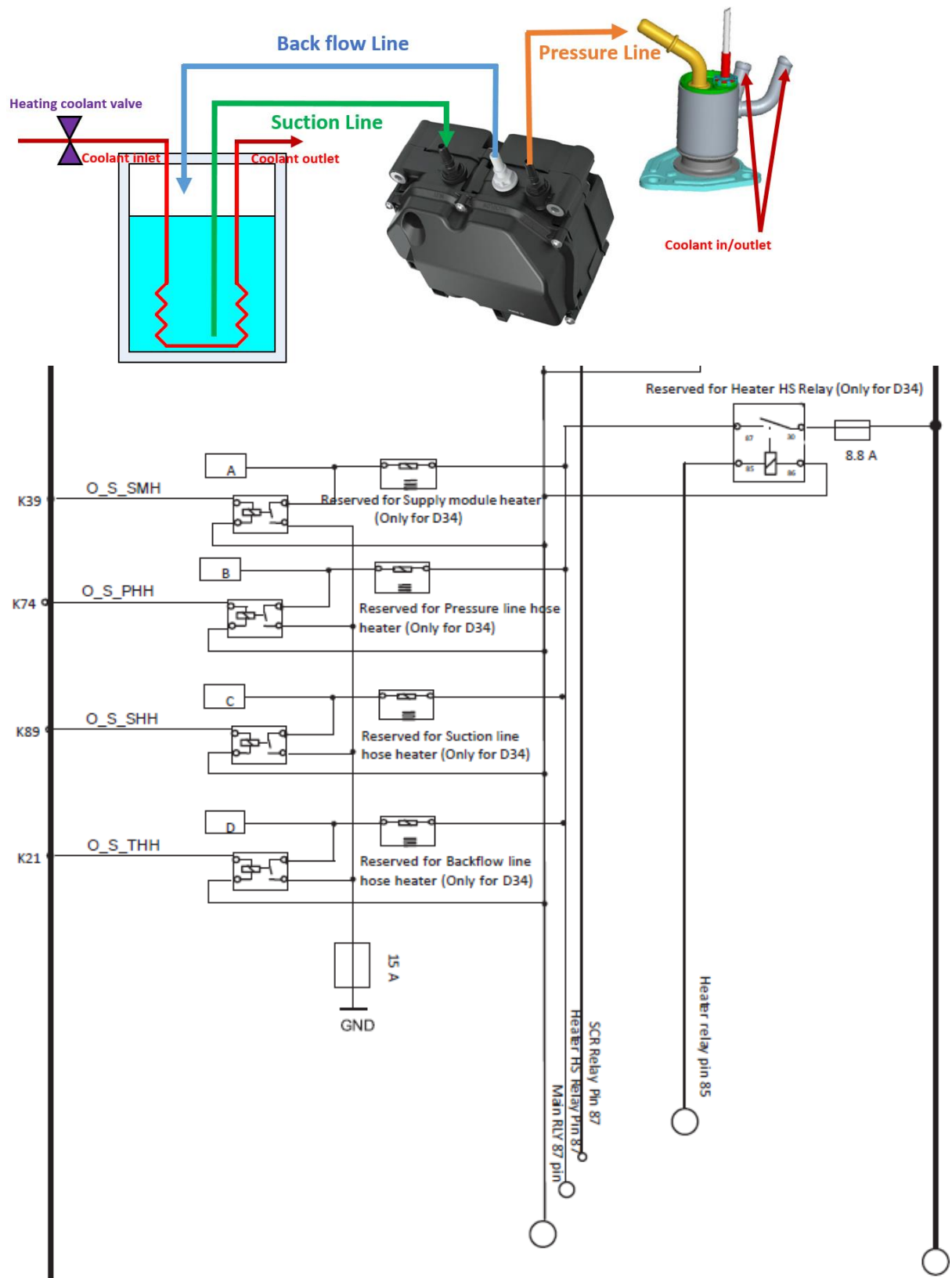
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|--------------------------------------|
| E005746-04 | 1. Electrical problem (Battery supply into the Main relay) 2. Electrical problem (Heater relay, Wiring harness related DEF Main heater relay) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

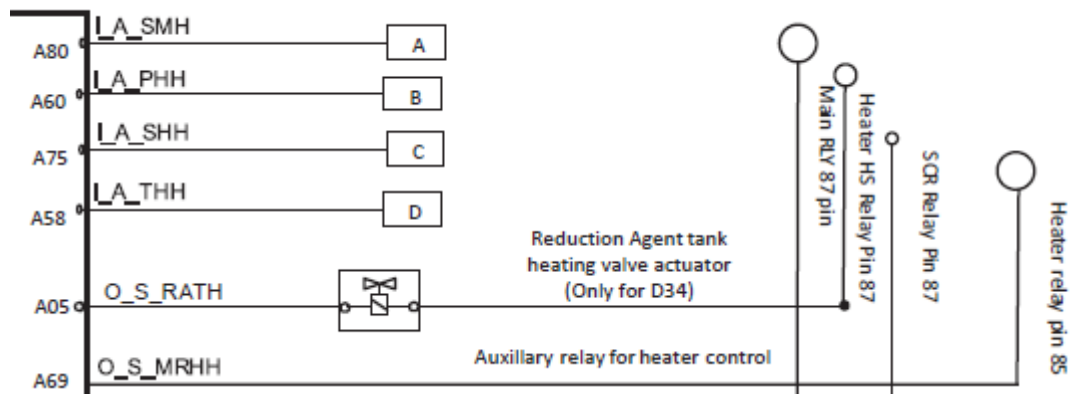
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Main heater relay output is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P21C3 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Main heater relay connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Replace with another normal Main relay Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P20C6 | DEF Suction line heater feedback plausibility Fault |

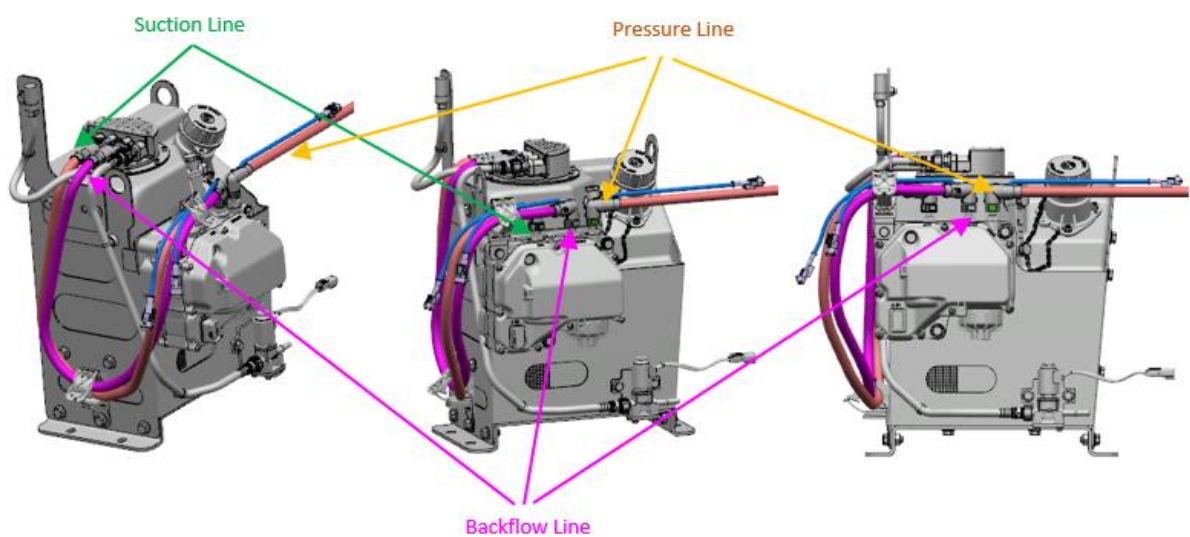
1) Overview

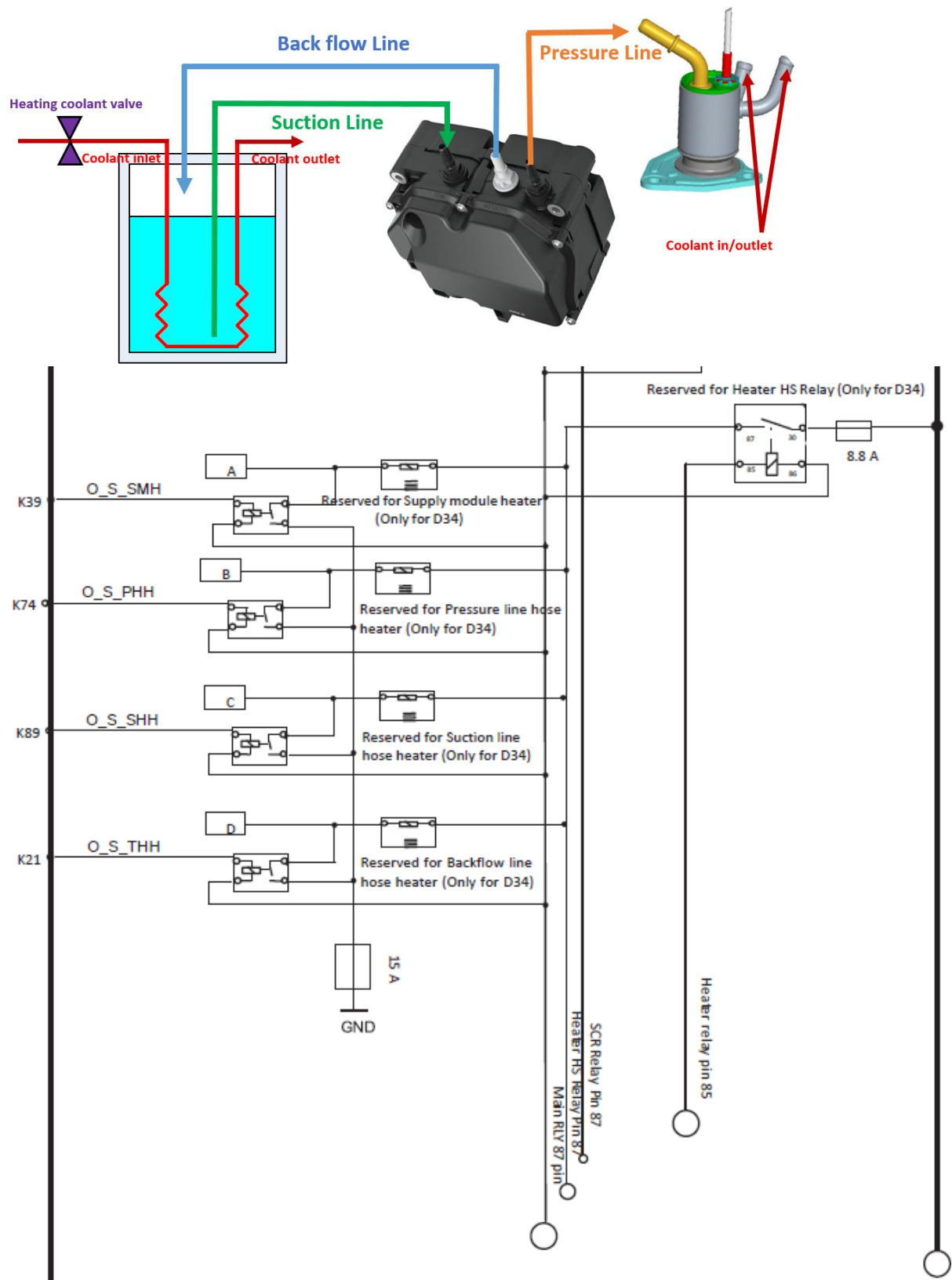
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---|
| E007540-12 | 1. Electrical problem (Battery supply into the main relay, DEF Suction line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Suction line heater, DEF Suction line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

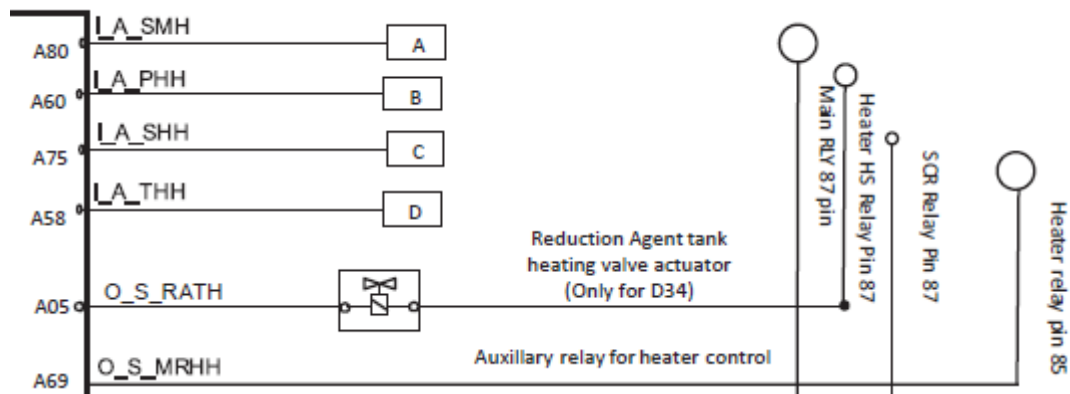
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The Suction line heater feedback signal is between Low threshold and High threshold (2500mV and 4750mV). 2.5 to 4.75V is the value measured by the ECU internal resistance when the current has not flowed normally in the feedback line.

The hose heater plausibility fault is diagnosed when the current does not flow normally to the hose heating line even though the hose heater relay is operated. Therefore, it is used to check if the actual heater is working when the relay operates.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20C6 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Suction line heater connection Connection problem? Check value of diagnosis threshold. * Variable 1) Suction line heater feedback signal (UHtrSLDia_uRawDiag_MP) | 2.50 ~4.75V | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ **SCR related Input/Output function test by service tool**

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P20C5 | DEF Suction line heater relay output Open circuit Fault |

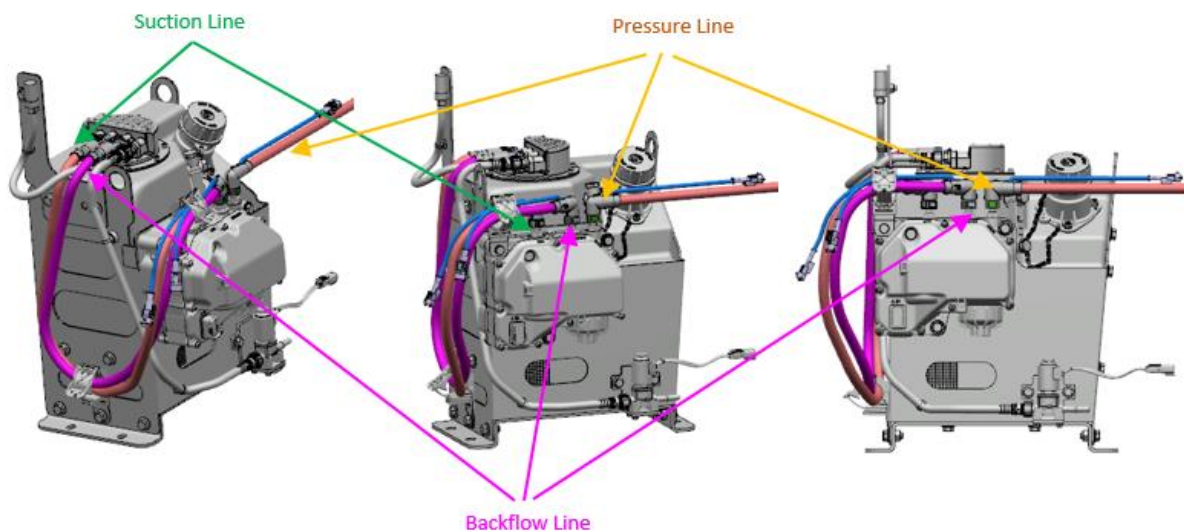
1) Overview

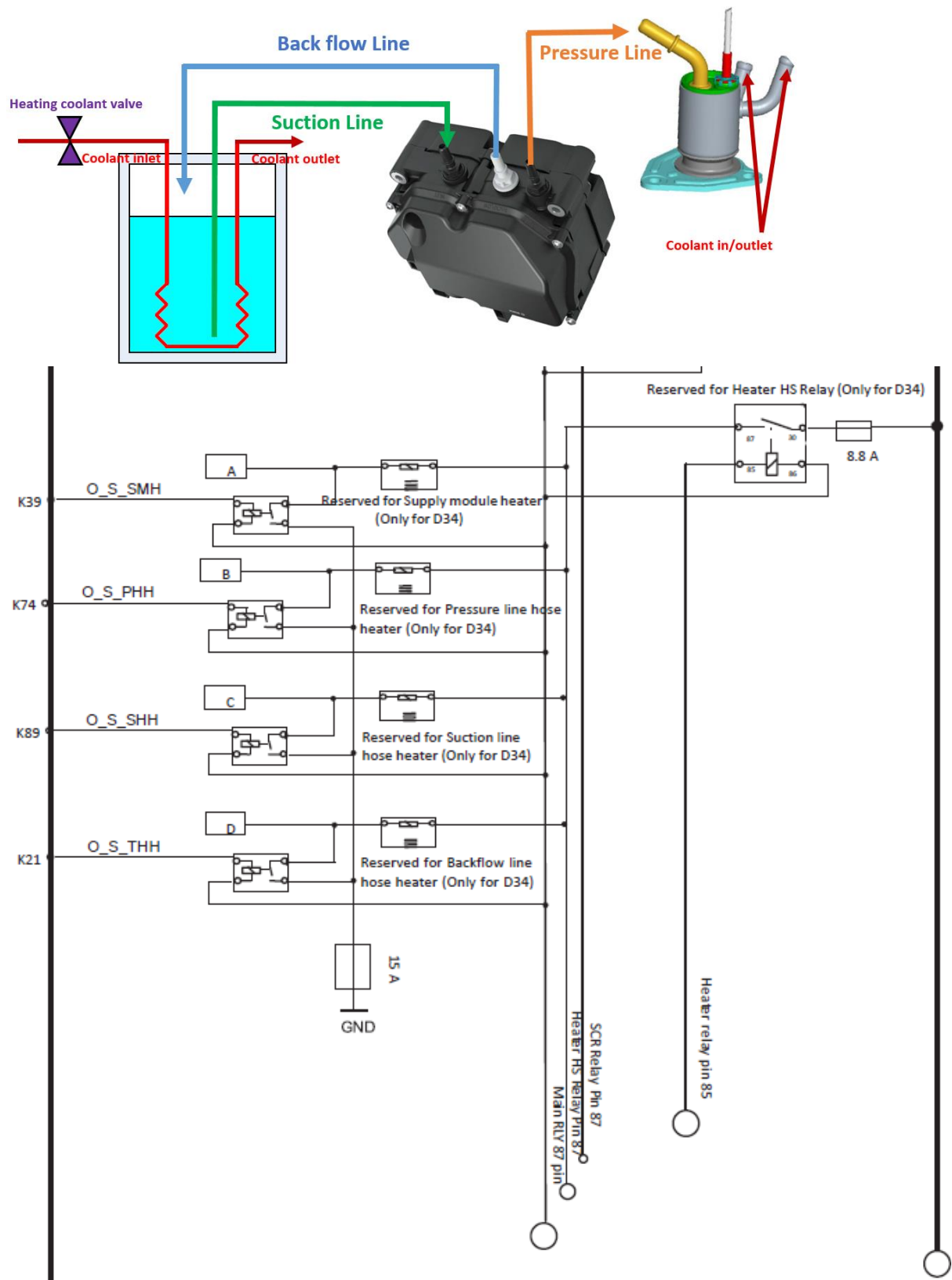
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E007540-05 | 1. Electrical problem (DEF Suction line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Suction line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

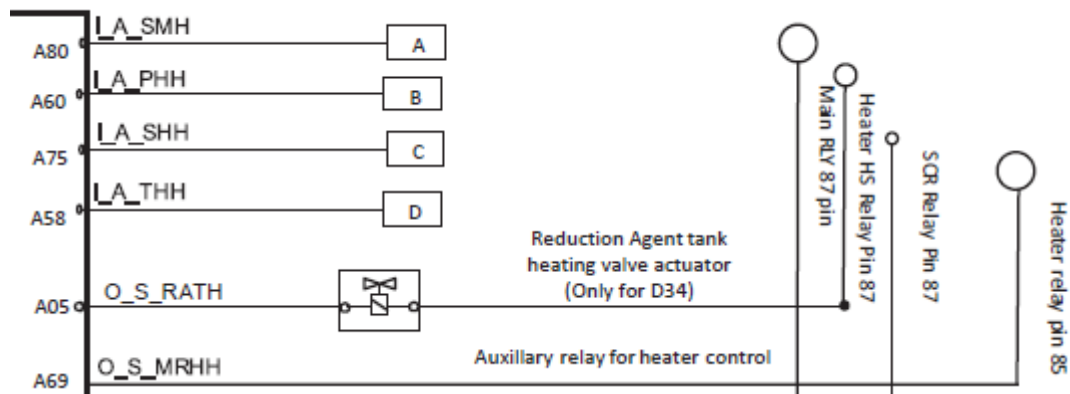
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Suction line heater relay output is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20C5 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Suction line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P30C5 | DEF Suction line heater relay output Over temperature Fault |

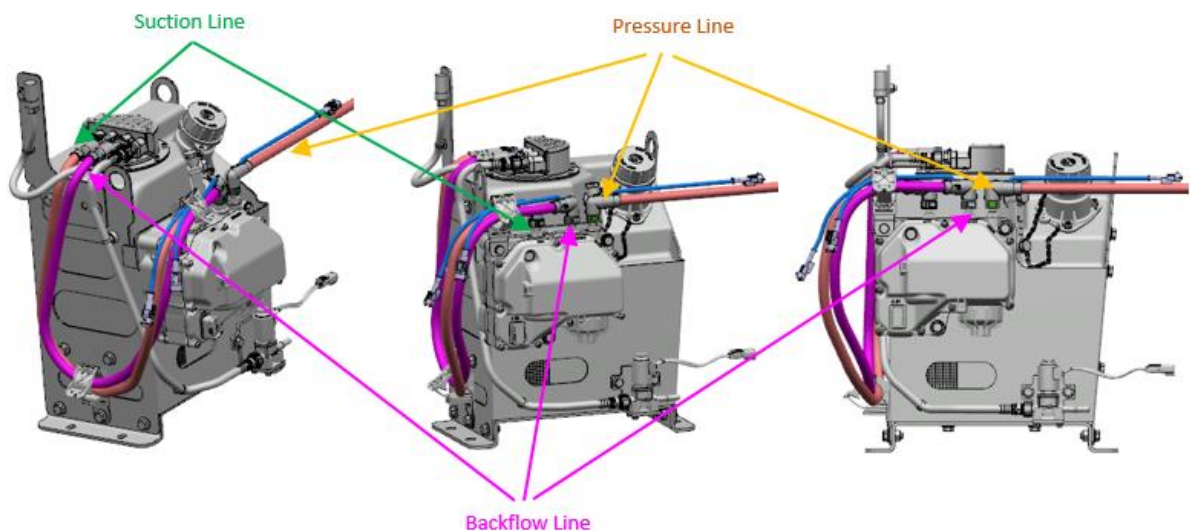
1) Overview

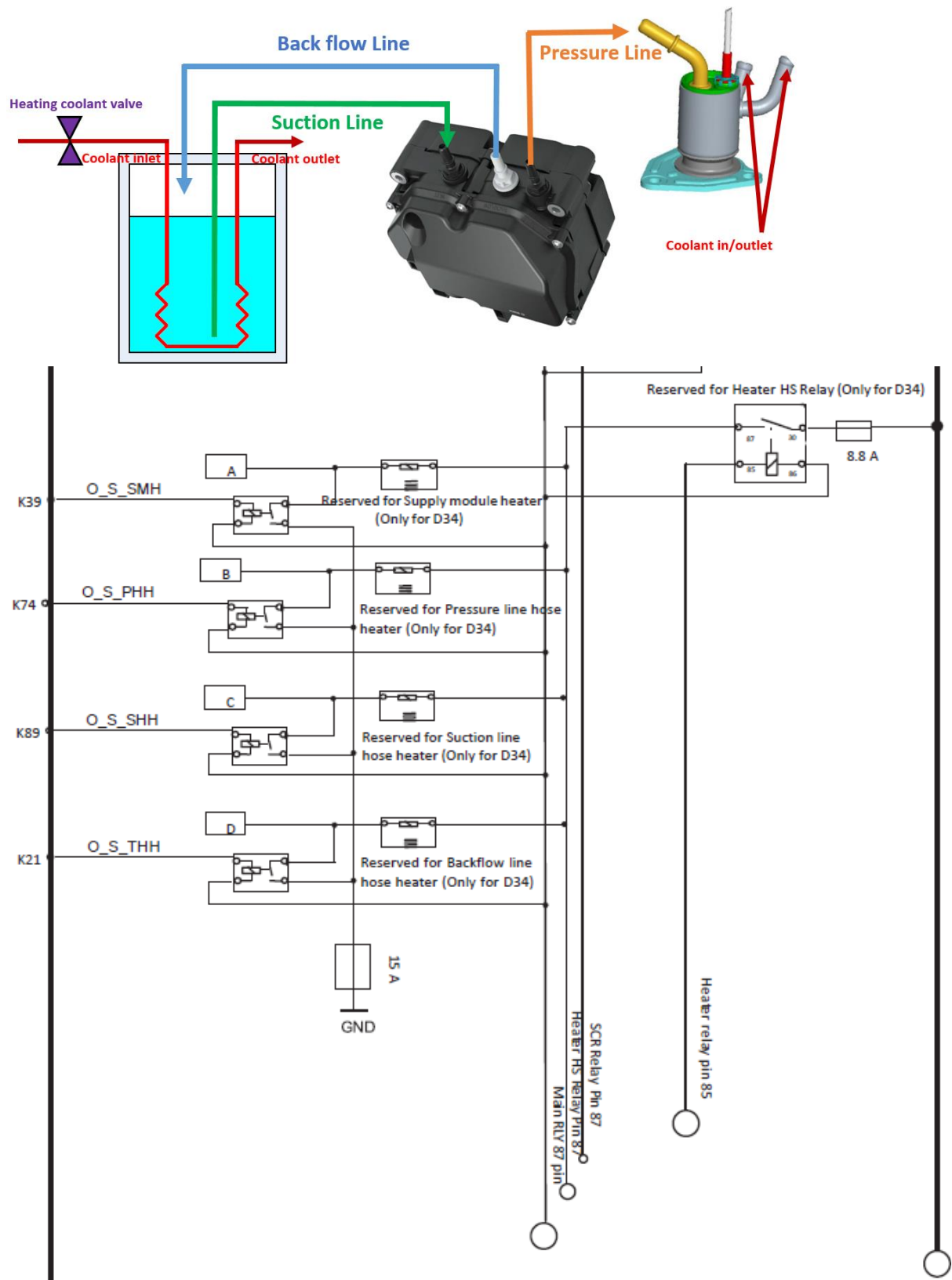
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E007540-07 | 1. Electrical problem (DEF Suction line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Suction line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

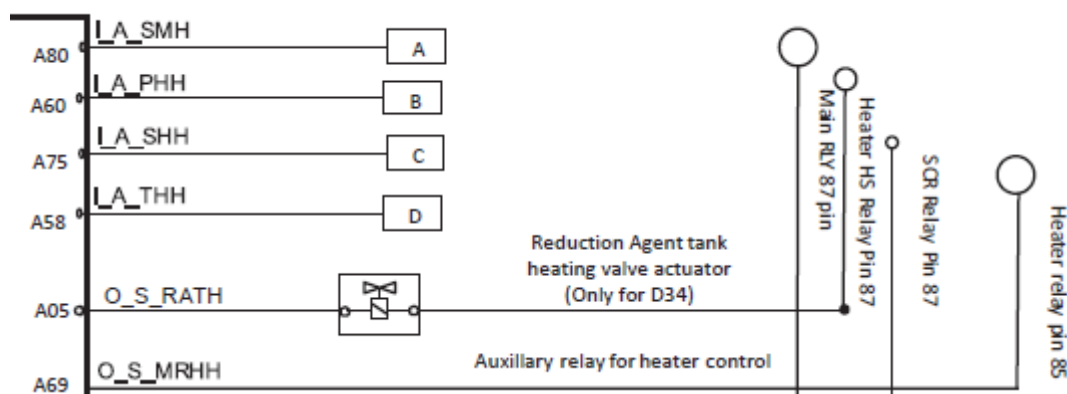
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Suction line heater relay output is over temperature.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P30C5 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Suction line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P20C8 | DEF Suction line heater relay output Short circuit to battery Fault |

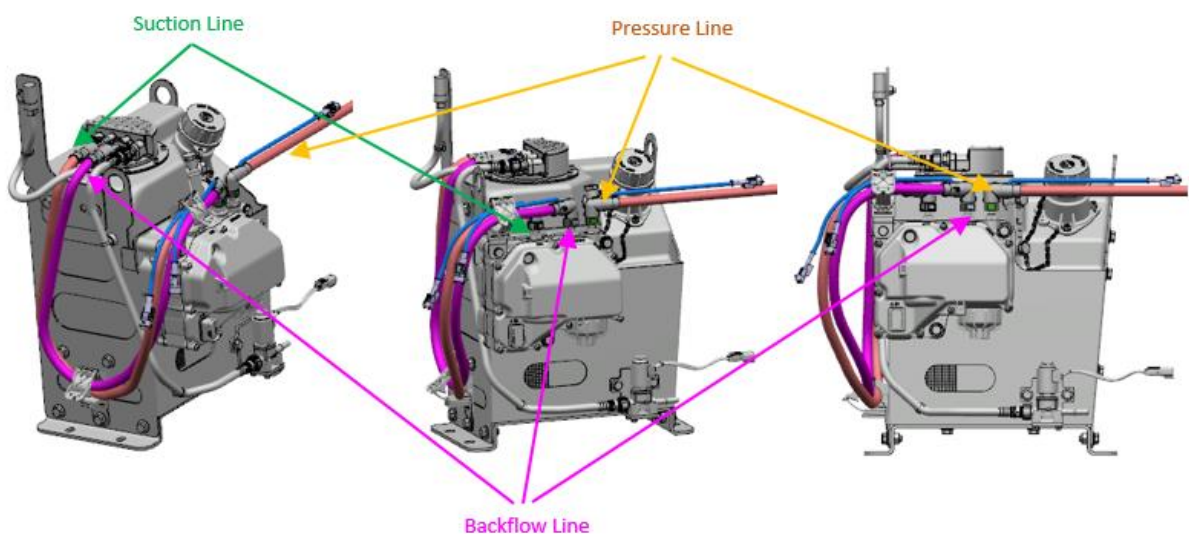
1) Overview

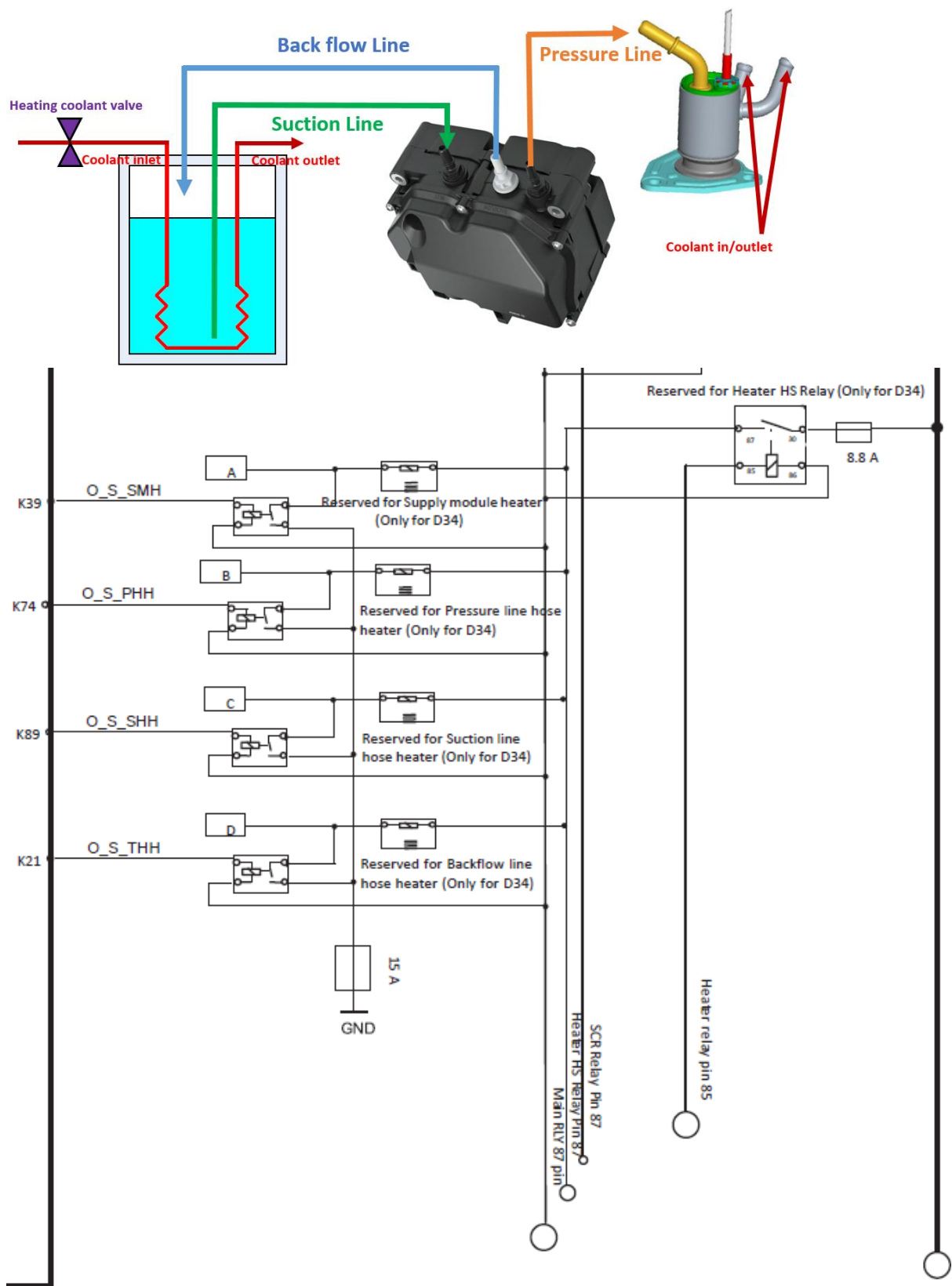
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E007540-03 | 1. Electrical problem (DEF Suction line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Suction line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

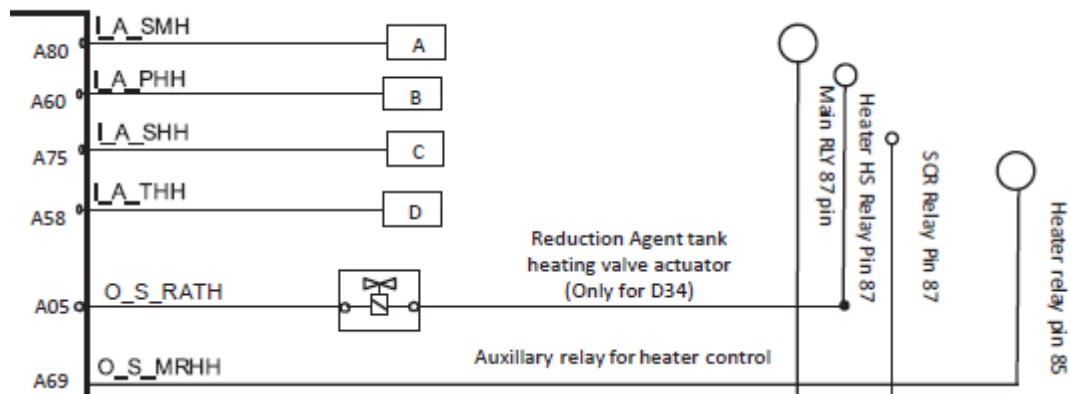
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Suction line heater relay output is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20C8 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Suction line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20C7 | DEF Suction line heater relay output Short circuit to ground Fault |

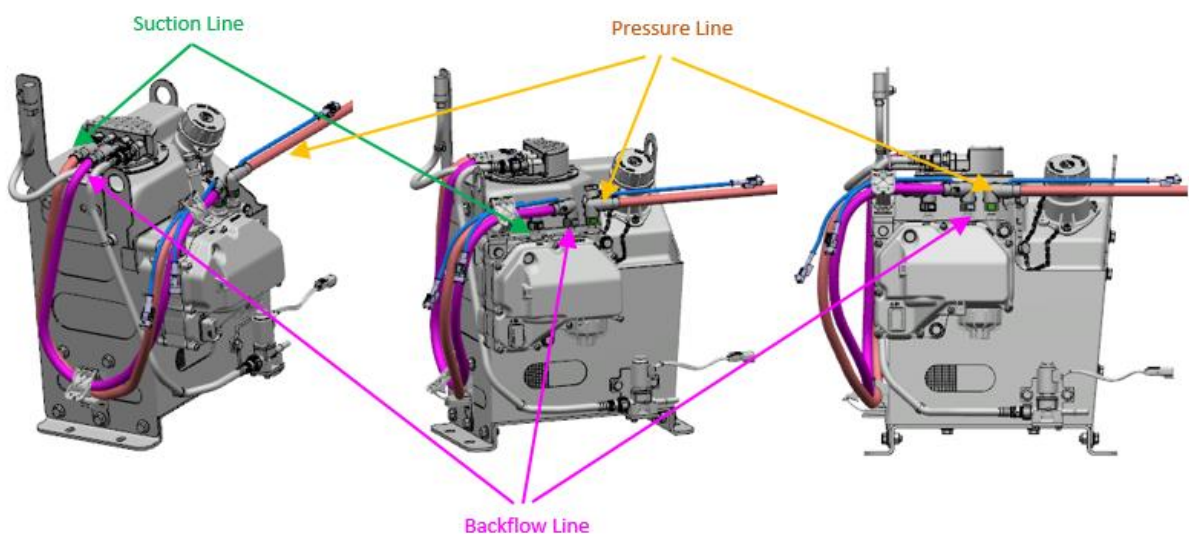
1) Overview

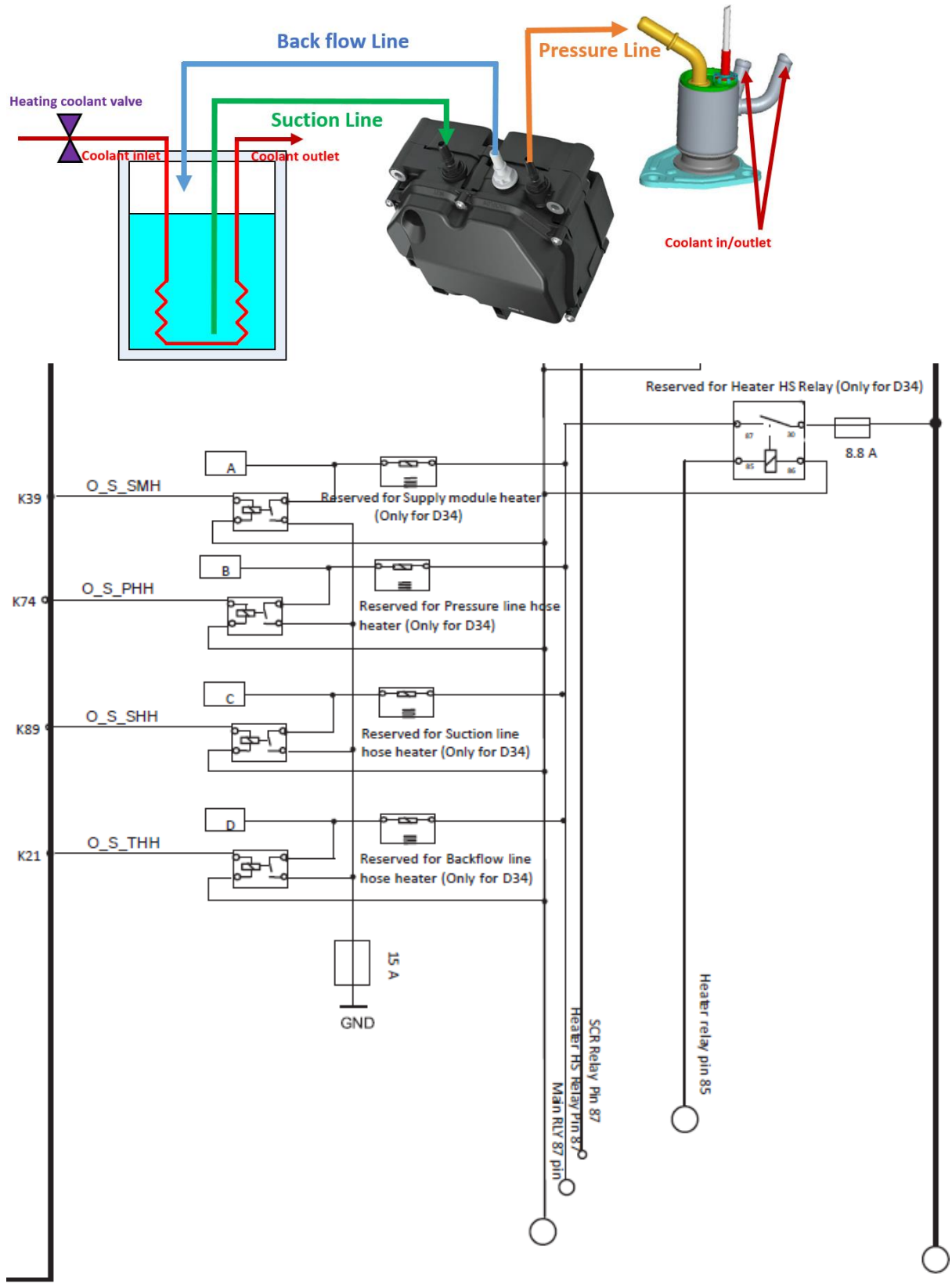
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E007540-04 | 1. Electrical problem (DEF Suction line heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Suction line heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

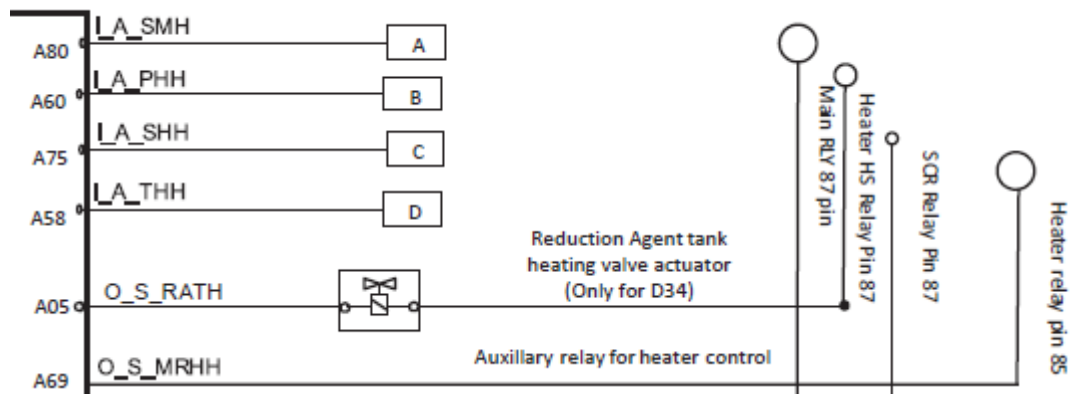
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.







3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Suction line heater relay output is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20C7 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Suction line heater connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF heating line related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF heating line hose DEF heating line hose problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool


1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20BA | DEF Supply module heater feedback plausibility Fault |

1) Overview

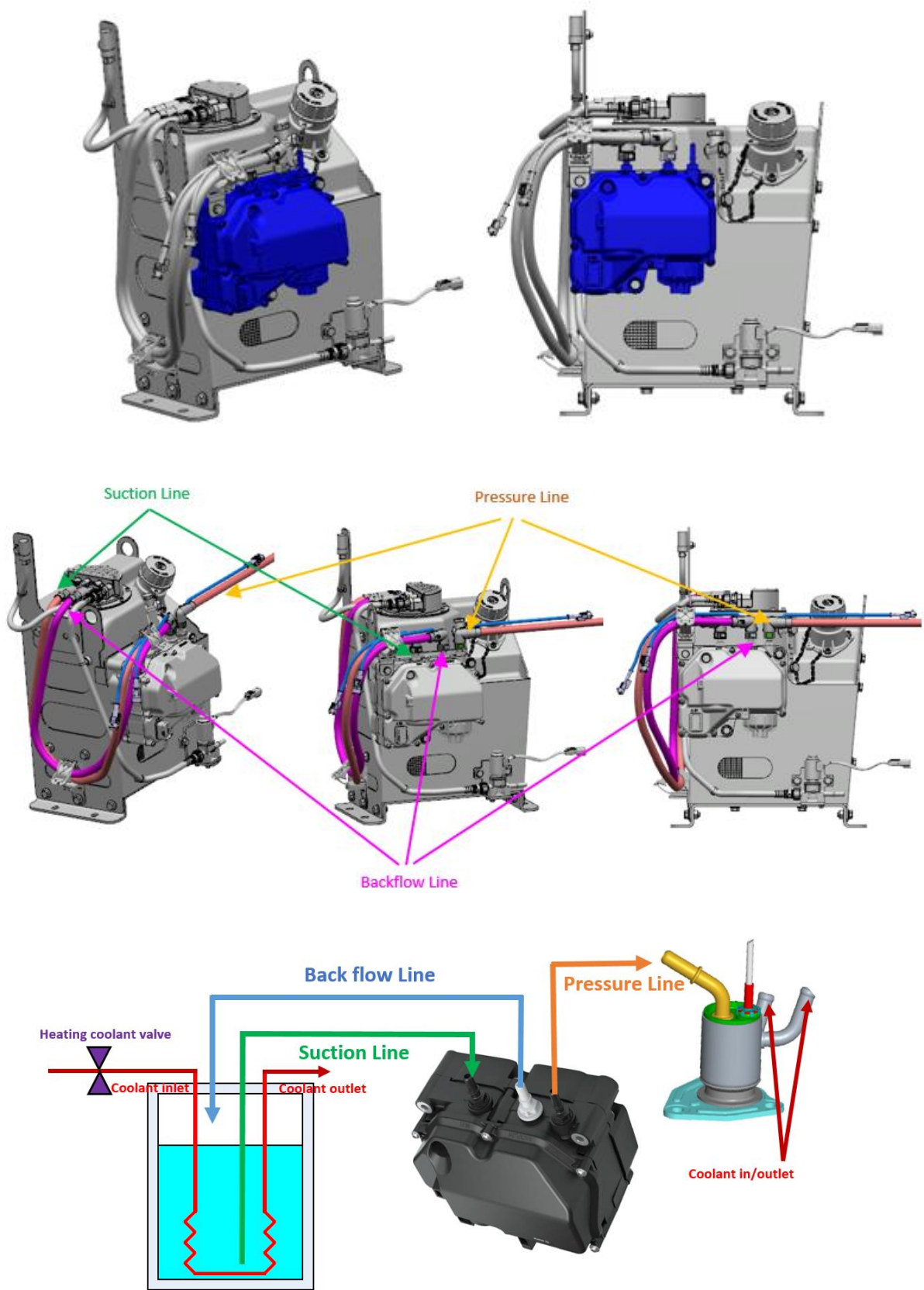
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E007416-12 | 1. Electrical problem (Battery supply into the main relay, DEF Supply module heater connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Supply module heater, DEF Supply module heater) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

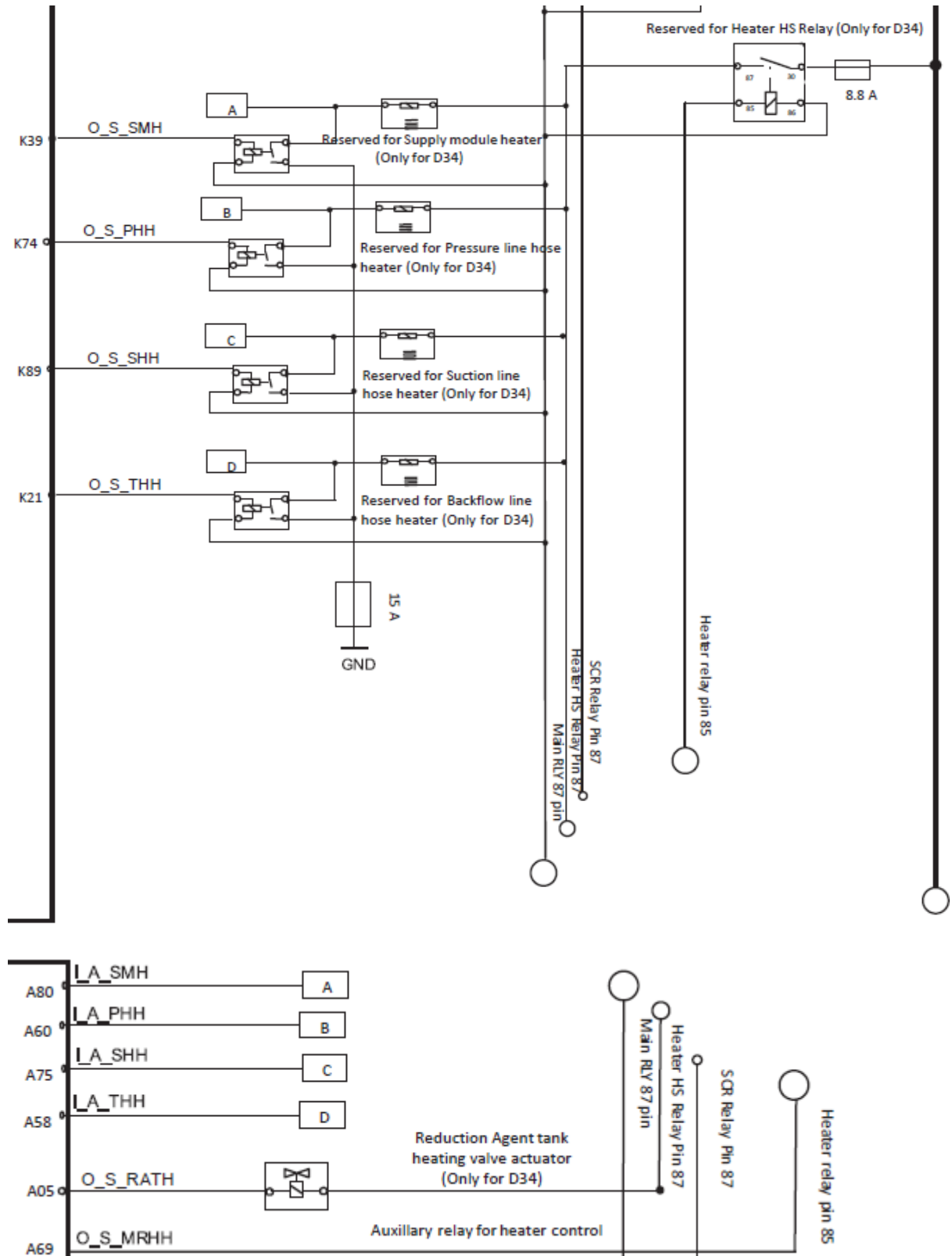
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|---|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The Supply module heater feedback signal is between Low threshold and High threshold (2500mV and 4750mV). 2.5 to 4.75V is the value measured by the ECU internal resistance when the current has not flowed normally in the feedback line.

The hose heater plausibility fault is diagnosed when the current does not flow normally to the hose heating line even though the hose heater relay is operated. Therefore, it is used to check if the actual heater is working when the relay operates.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20BA is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Supply module connection Connection problem? Check value of diagnosis threshold. * Variable 1) Suction line heater feedback signal (UHtrSMDia_uRawDiag_MP) | 2.50 ~4.75V | Do necessary repair | Step 4 |
| 4 | Check DEF Supply module heater related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module. DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool


1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20B9 | DEF Supply module heater relay output Open circuit Fault |

1) Overview

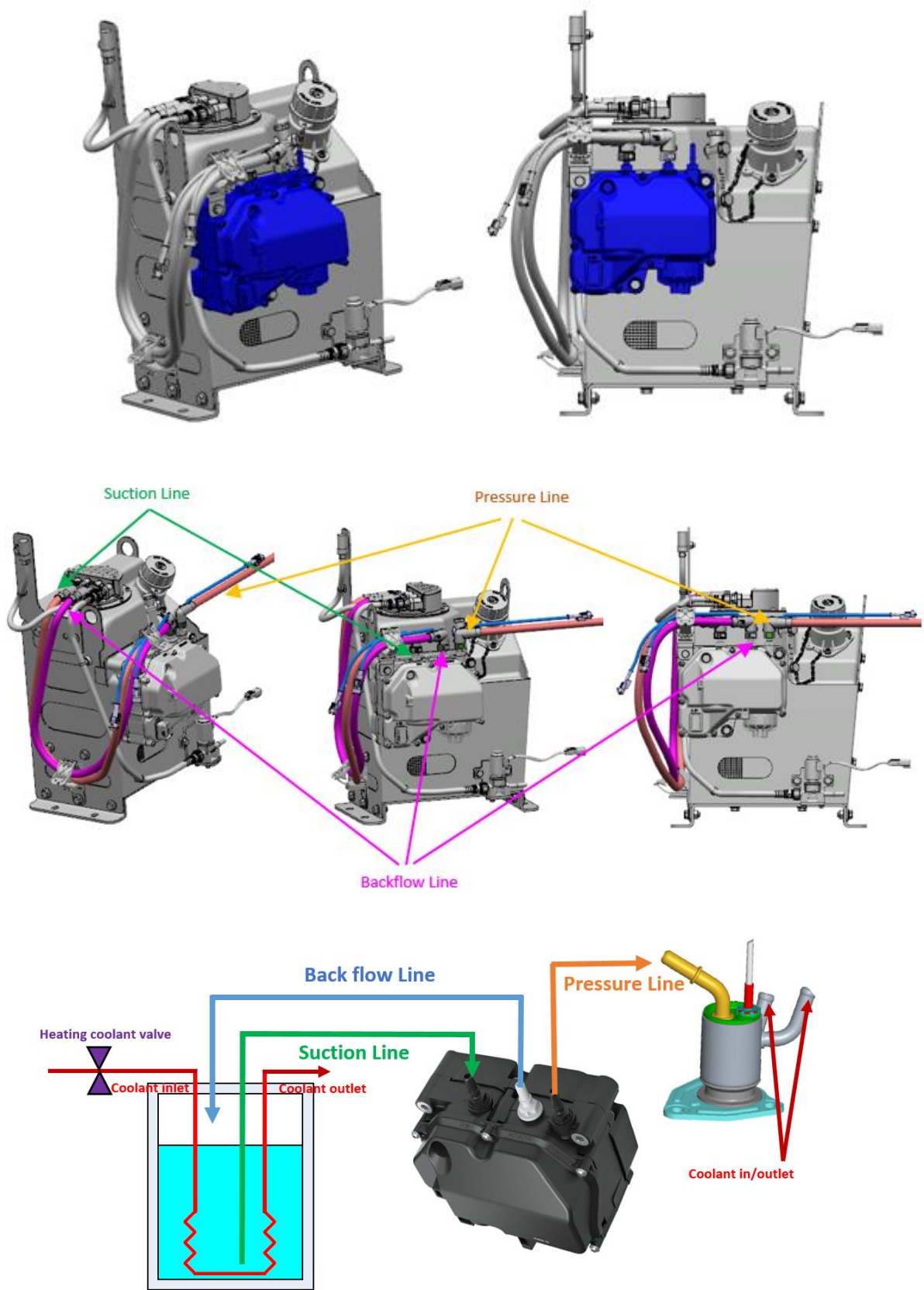
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E007416-05 | 1. Electrical problem (DEF Supply module connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

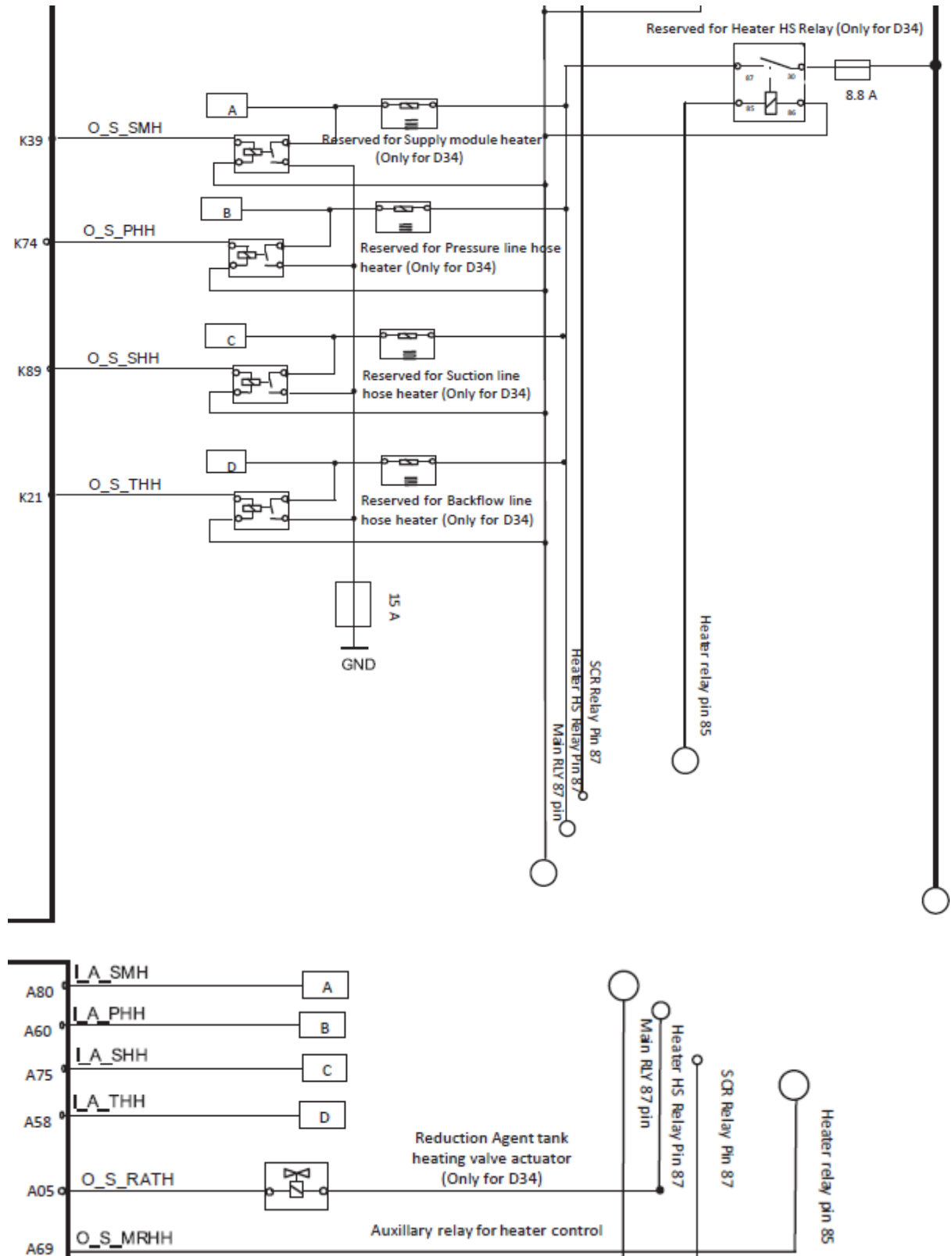
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|---|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply module heater relay output is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P20B9 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Supply module heater related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module. DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool


1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P30B9 | DEF Supply module heater relay output Over temperature Fault |

1) Overview

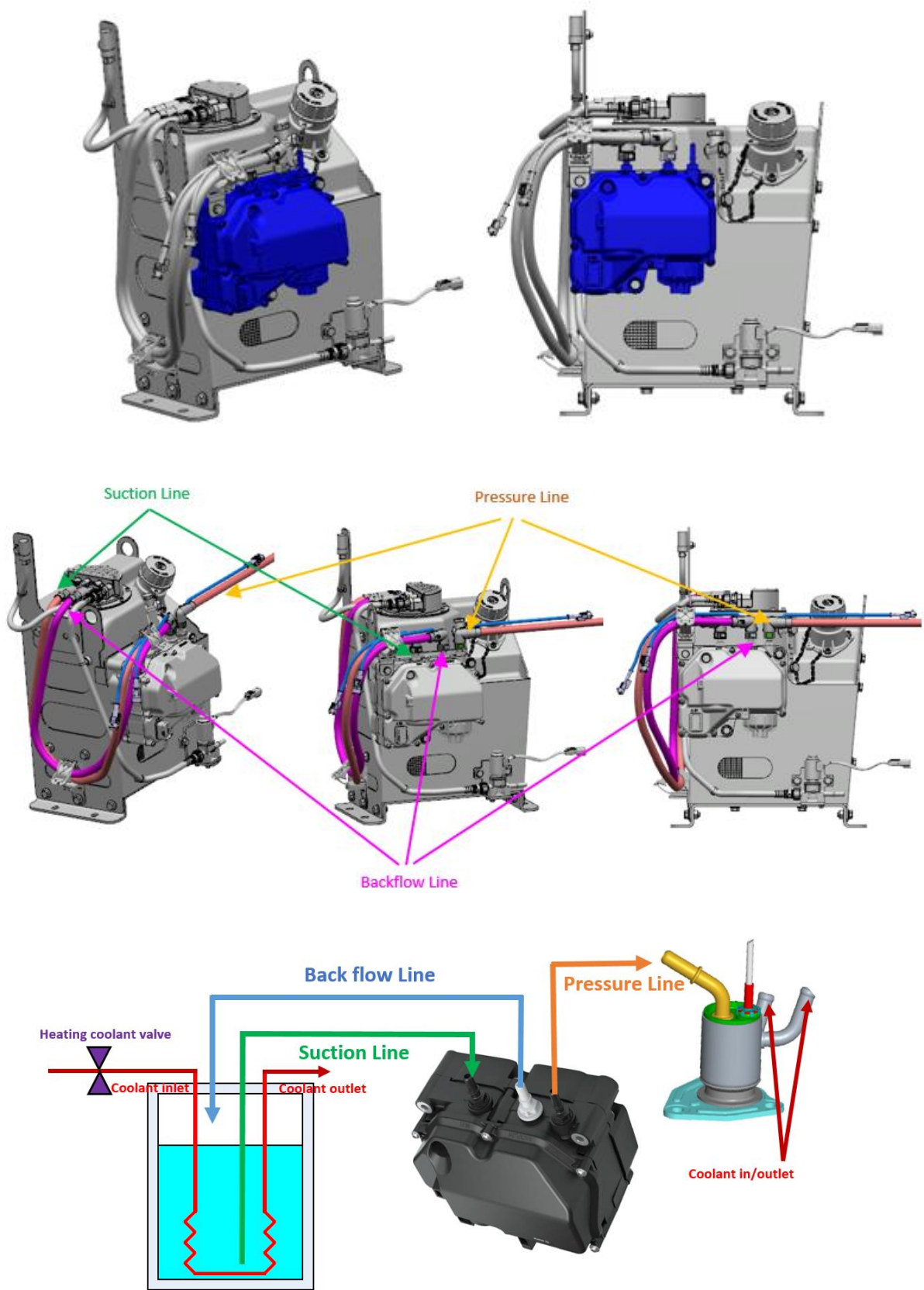
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E007416-07 | 1. Electrical problem (DEF Supply module connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

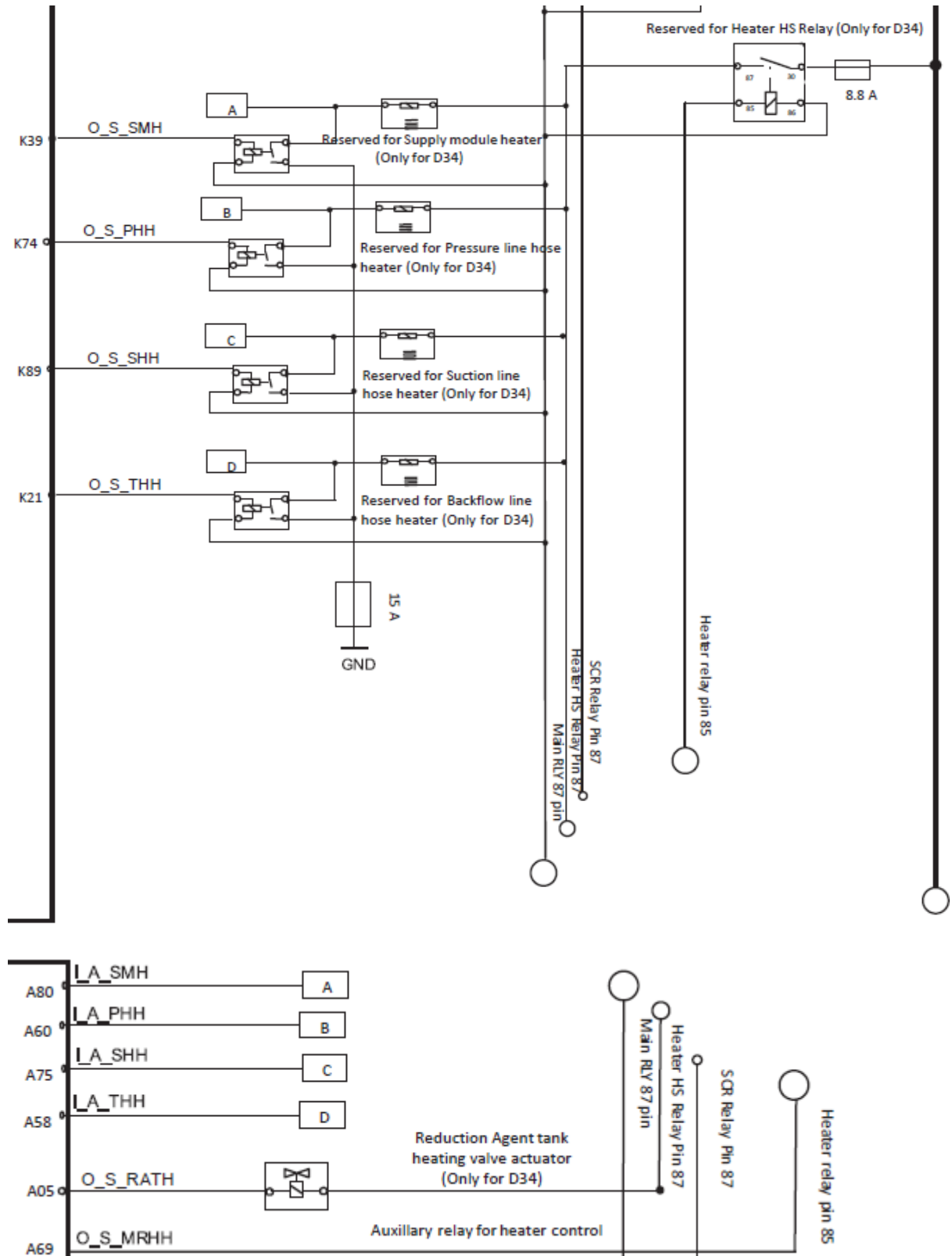
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|---|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply module heater relay output is over temperature.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P30B9 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Supply module heater related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module. DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool


1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20BC | DEF Supply module heater relay output Short circuit to battery Fault |

1) Overview

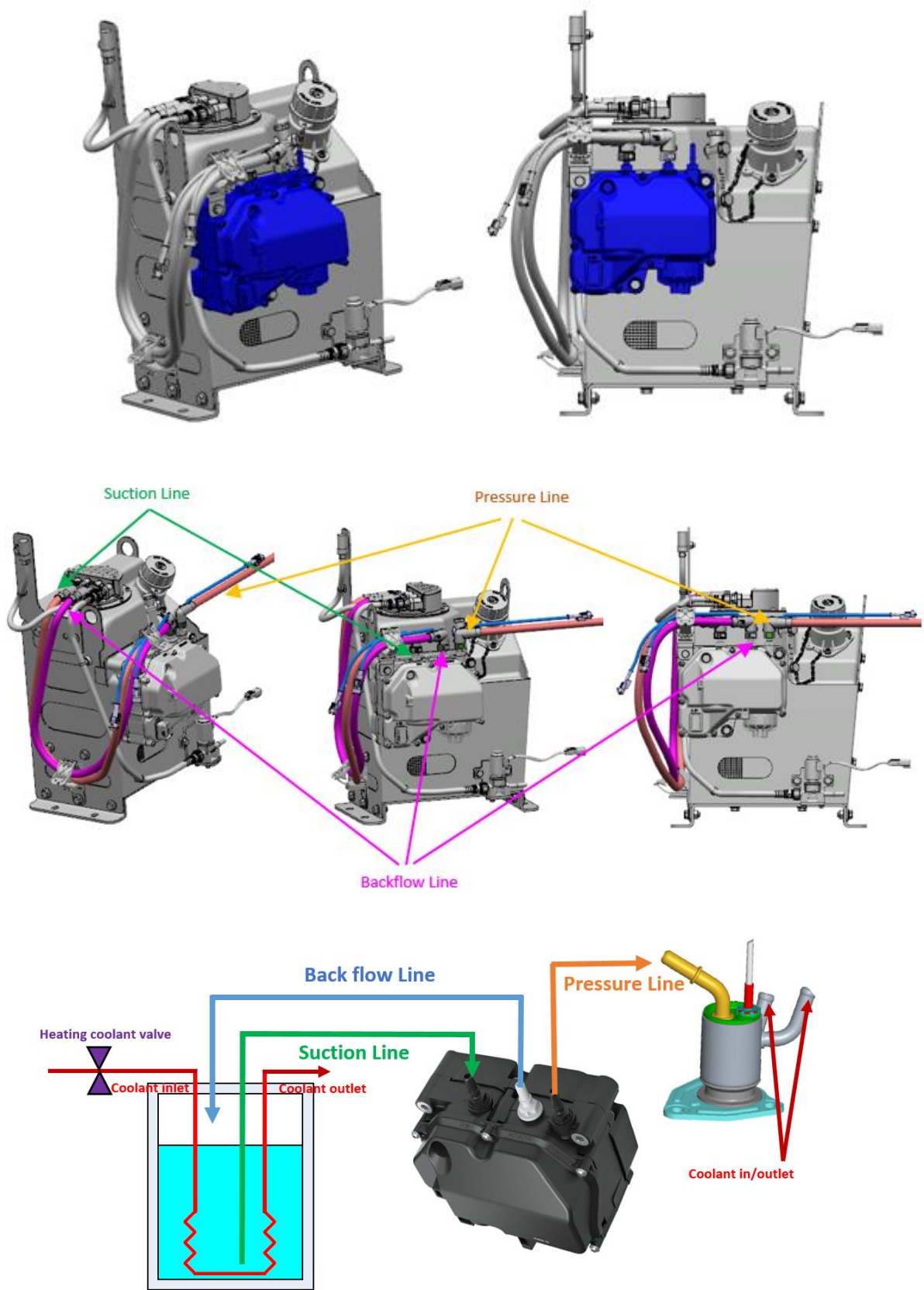
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E007416-03 | 1. Electrical problem (DEF Supply module connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

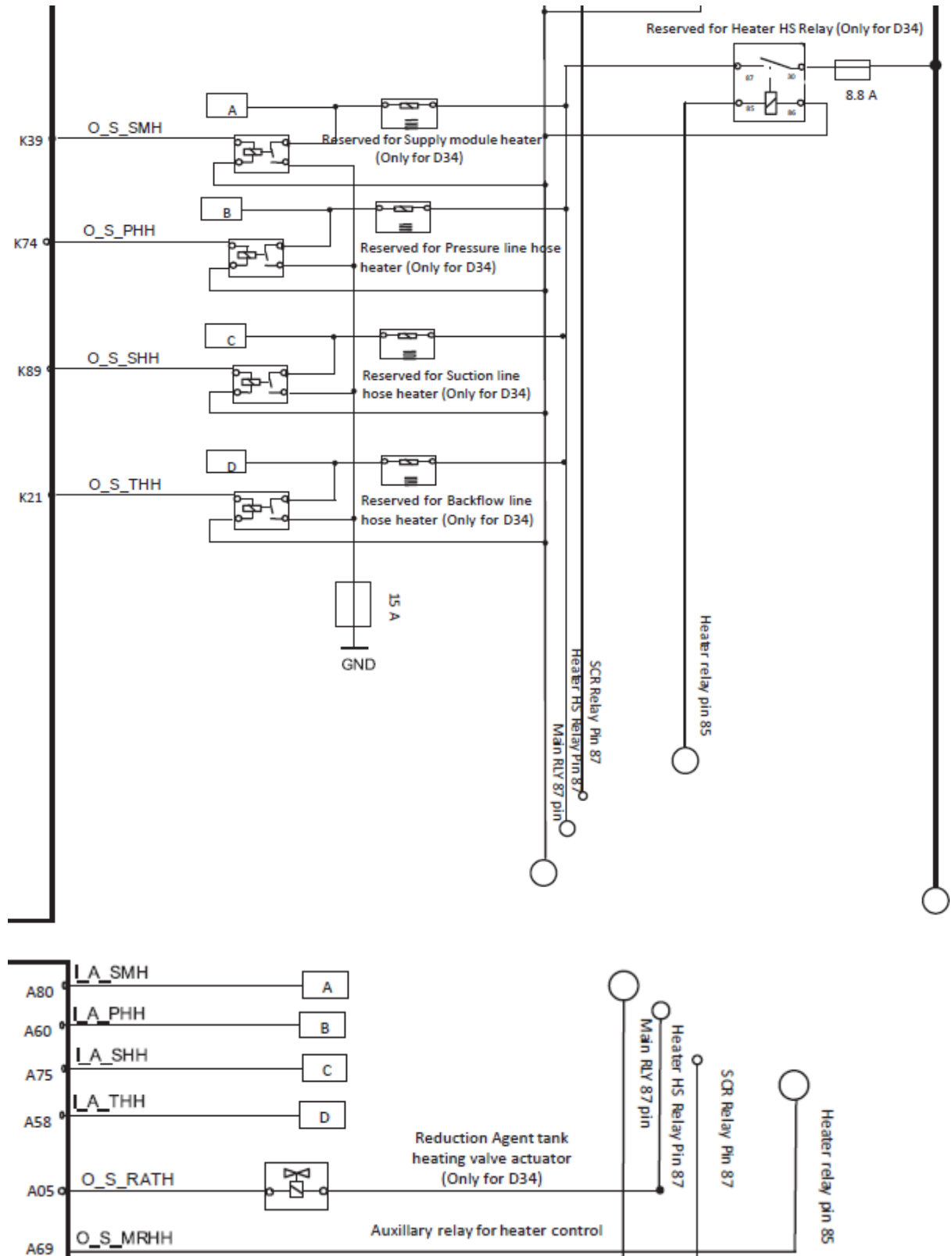
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|---|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply module heater relay output is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P20BC is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Supply module heater related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module. DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool


1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P20BB | DEF Supply module heater relay output Short circuit to ground Fault |

1) Overview

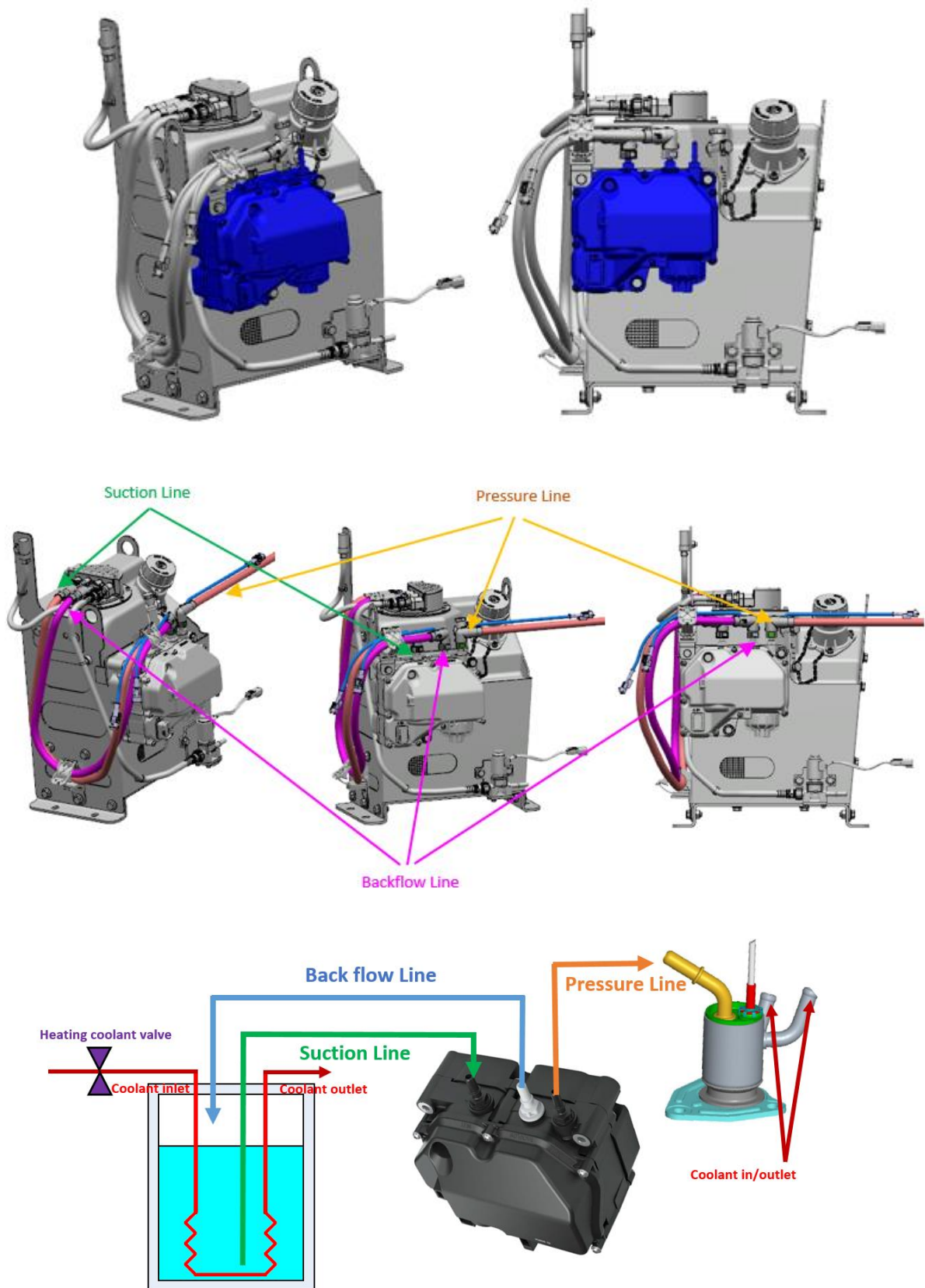
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E007416-04 | 1. Electrical problem (DEF Supply module connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

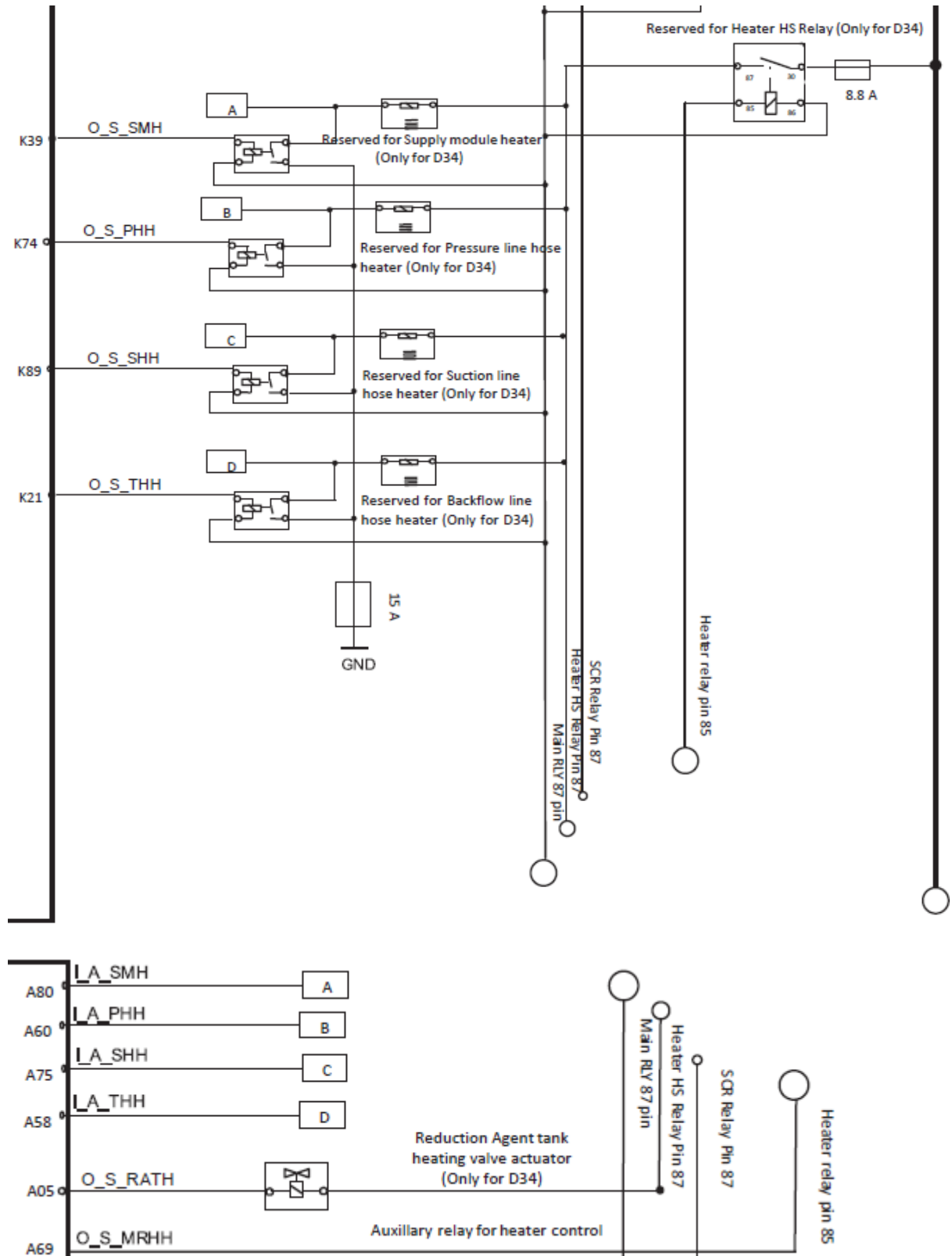
| No. | Heating item | ECU Pin | PIN description (DEF Hose heating) |
|-----|-------------------|---------|---|
| 1 | Main heater relay | A69 | DEF Heater main relay control |
| 2 | Pressure line | K74 | DEF Pressure line Hose heater relay control |
| 3 | | A60 | DEF Pressure line Hose heater feedback |
| 4 | Suction line | K89 | DEF Suction line Hose heater relay control |
| 5 | | A75 | DEF Suction line Hose heater feedback |
| 6 | Backflow line | K21 | DEF Backflow line Hose heater relay control |
| 7 | | A58 | DEF Backflow line Hose heater feedback |
| 8 | Supply module | K39 | DEF Supply module heater relay control |
| 9 | | A80 | DEF Supply module heater feedback |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|---|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

DEF Tank, Valve and DEF Lines is dependent on machine application.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply module heater relay output is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|--|----------------|---------------------|------------------|
| 1 | P20BB is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Supply module heater related relays and fuse. Relays or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module. DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20B1 | DEF Tank heating coolant valve output Open circuit Fault |

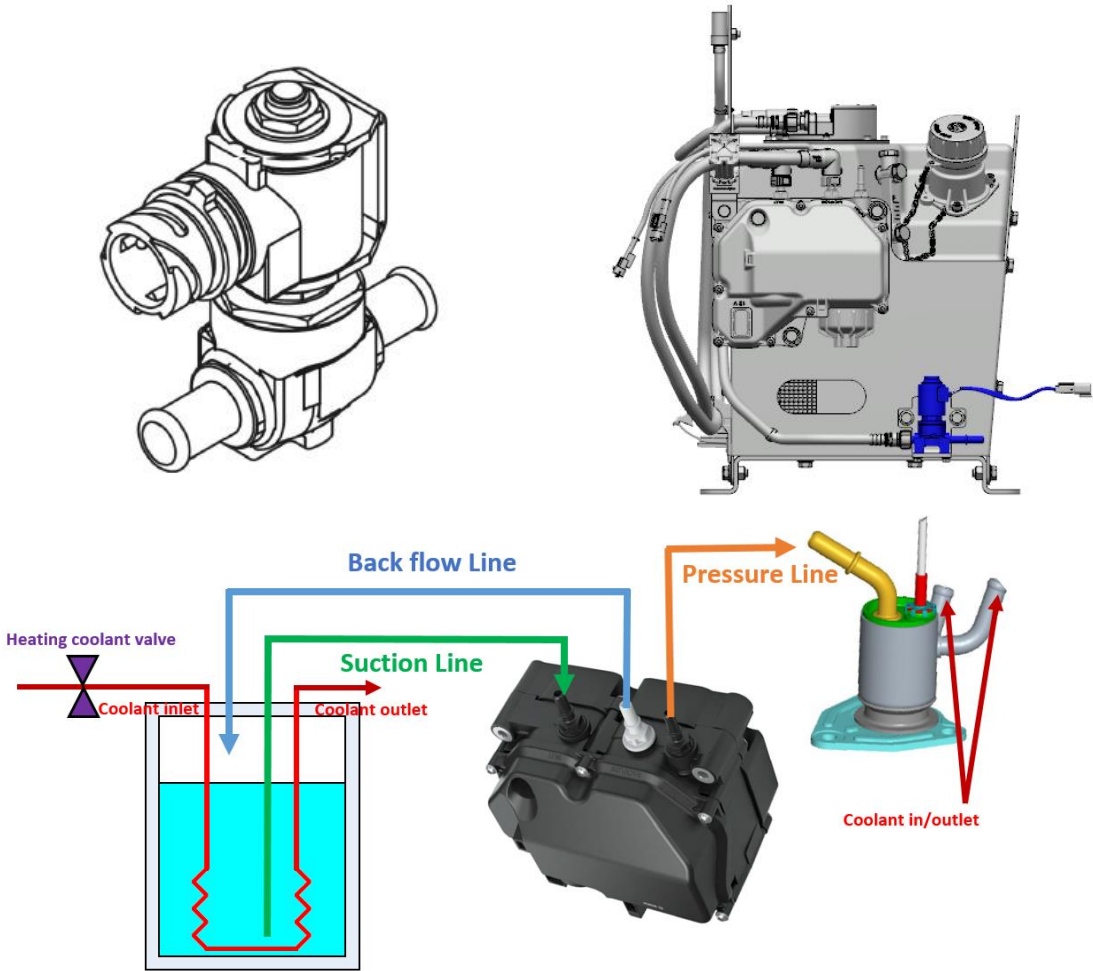
1) Overview

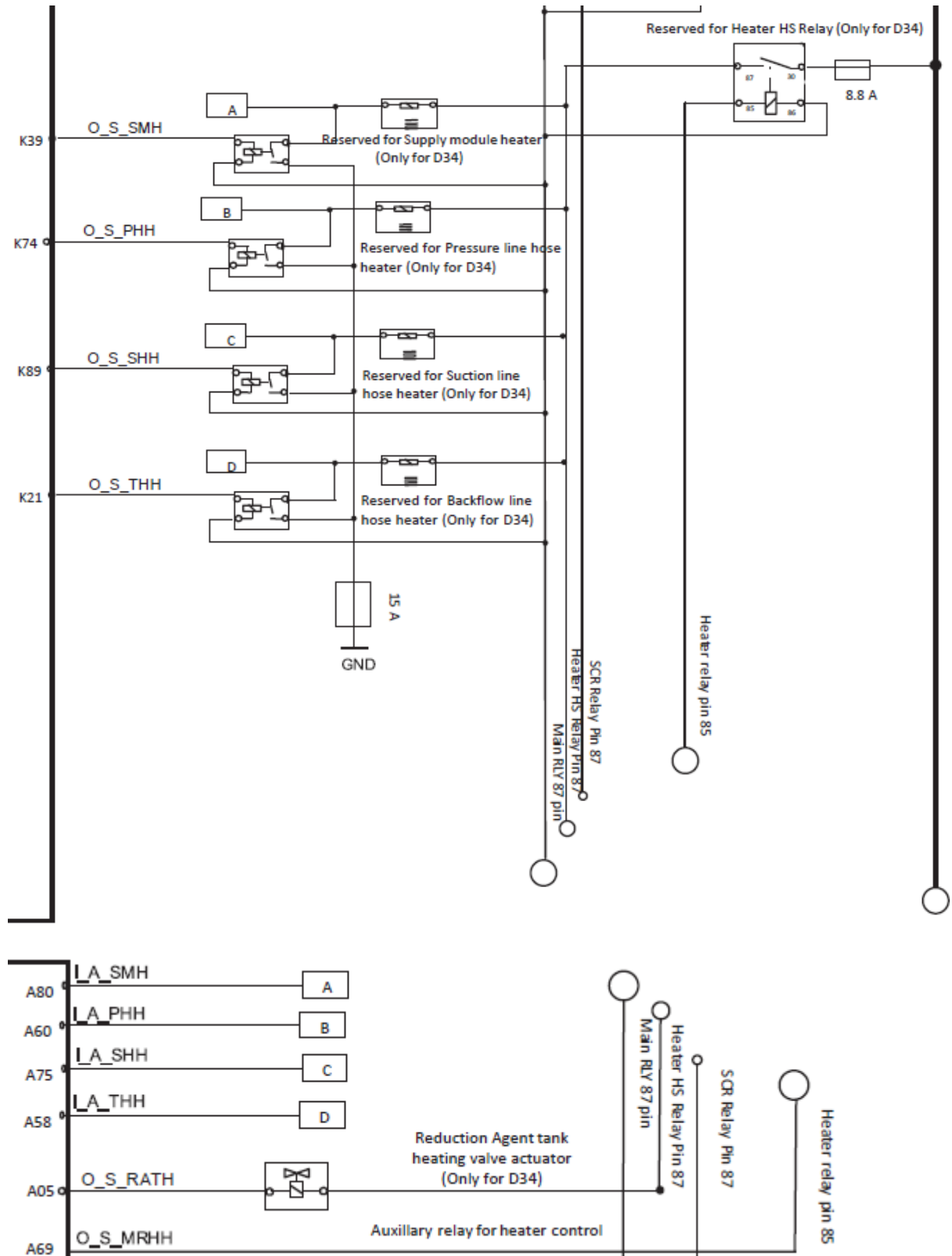
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E003363-05 | 1. Electrical problem (DEF Tank heating coolant valve connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Tank heating coolant valve) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| No. | ECU Pin | Description (DEF Supply module) |
|-----|---------|---|
| 1 | A05 | DEF Tank heating coolant valve control output |

2) Component Location

The DEF Tank heating coolant valve is dependent on machine application.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Tank heating coolant valve output is opened.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20B1 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank heating coolant valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Main heater relay and fuse. Relay or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Tank heating coolant valve DEF Tank heating coolant valve problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P30B1 | DEF Tank heating coolant valve output Over temperature Fault |

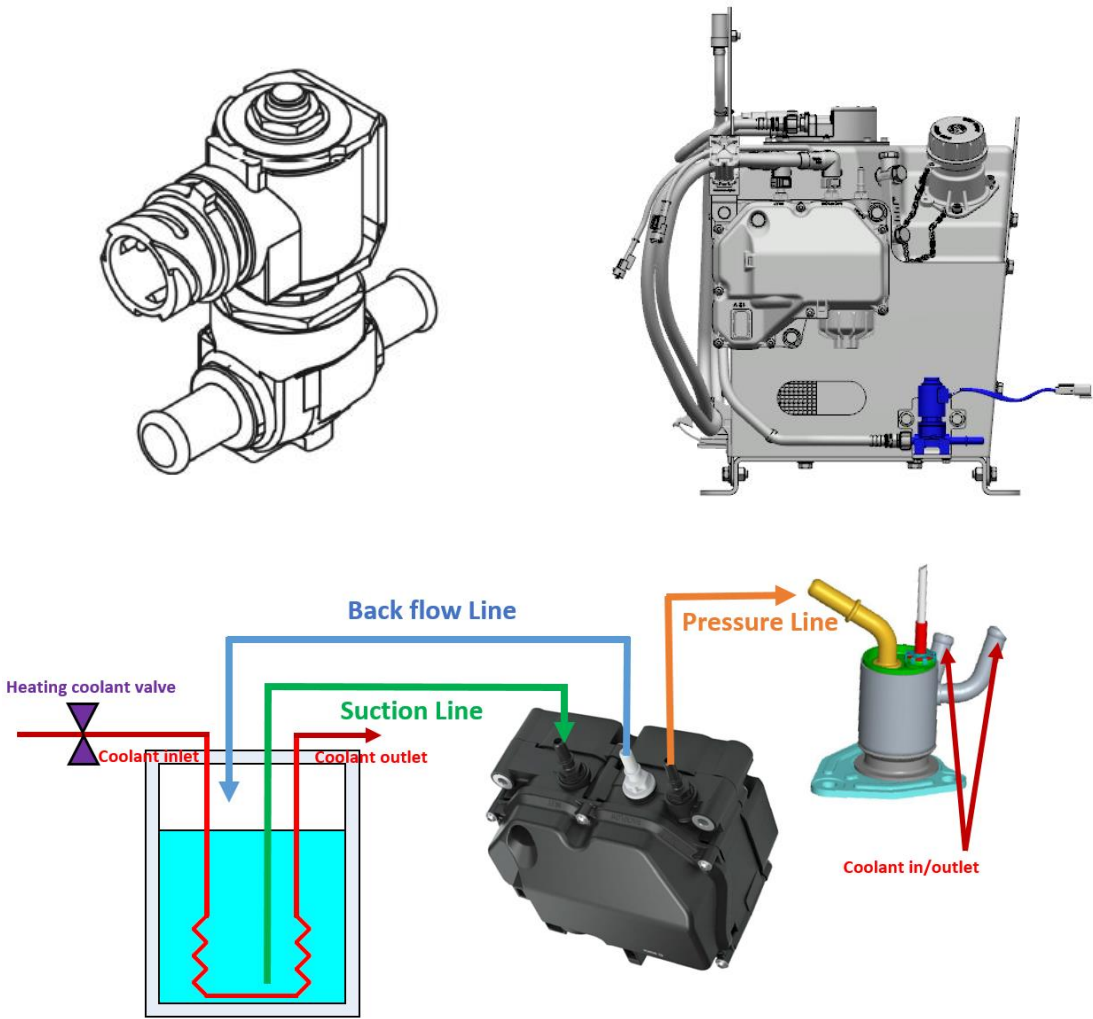
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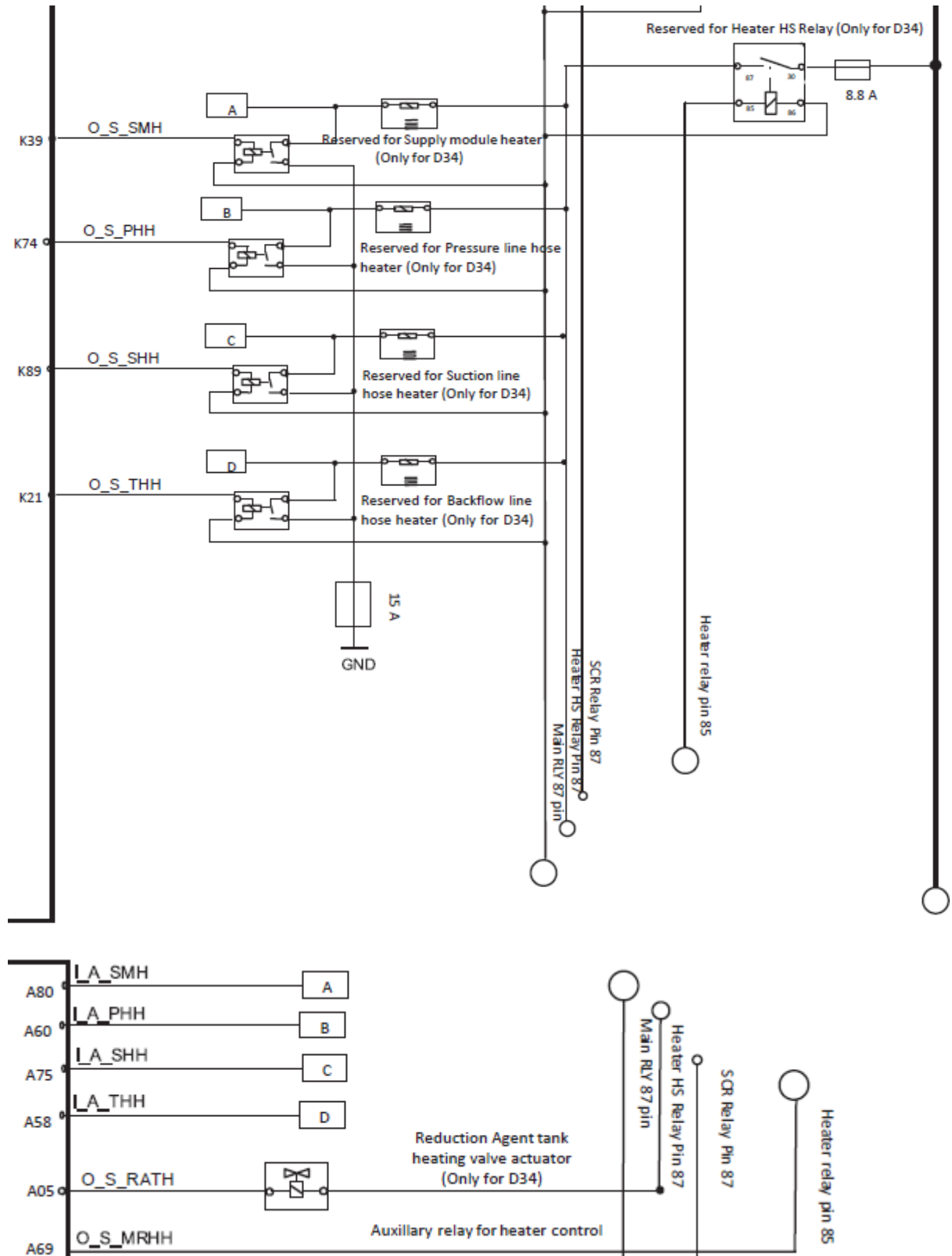
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E003363-07 | 1. Electrical problem (DEF Tank heating coolant valve connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Tank heating coolant valve) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| No. | ECU Pin | Description (DEF Supply module) |
|-----|---------|---|
| 1 | A05 | DEF Tank heating coolant valve control output |

2) Component Location

The DEF Tank heating coolant valve is dependent on machine application.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Tank heating coolant valve output is over temperature.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P30B1 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank heating coolant valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Main heater relay and fuse. Relay or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Tank heating coolant valve DEF Tank heating coolant valve problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20B4 | DEF Tank heating coolant valve output Short circuit to battery Fault |

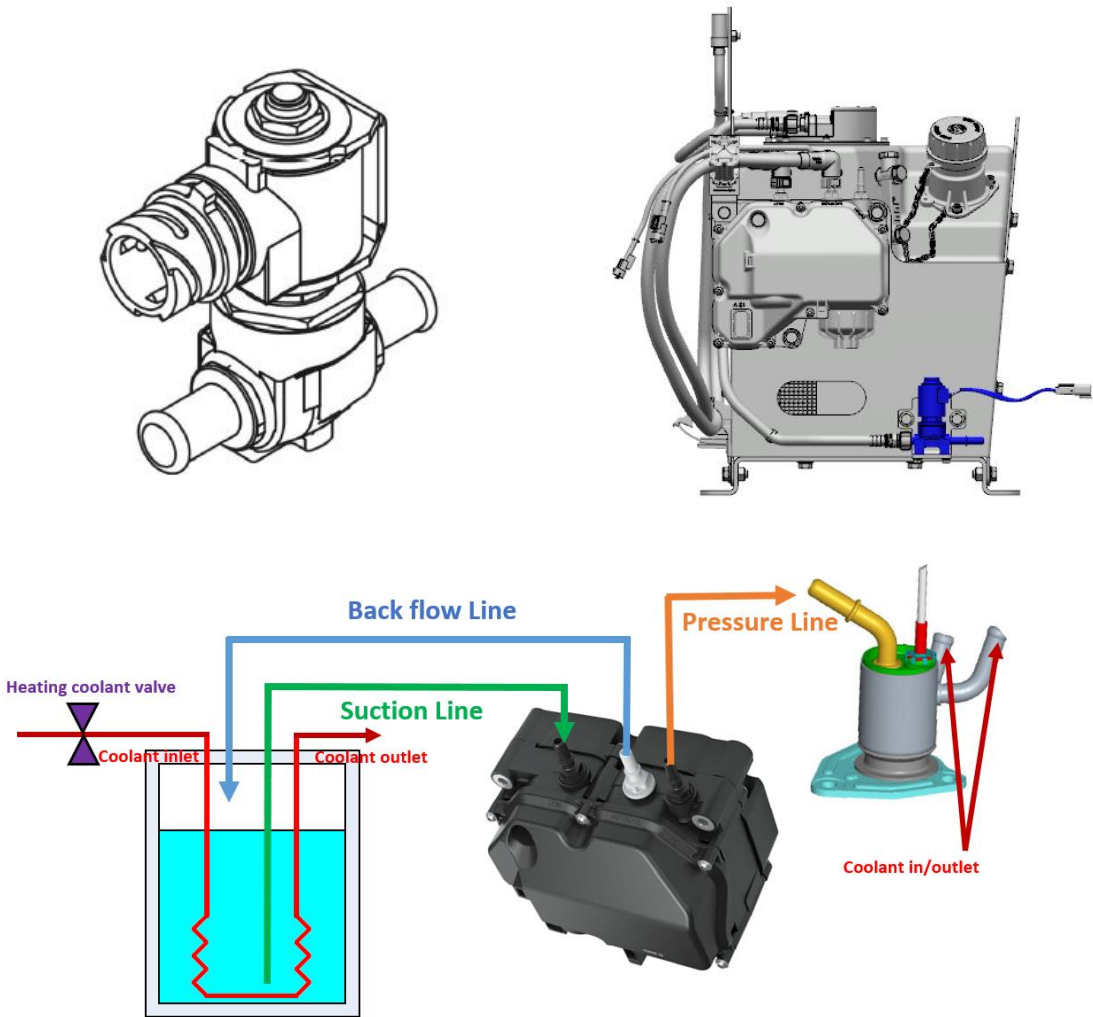
1) Overview

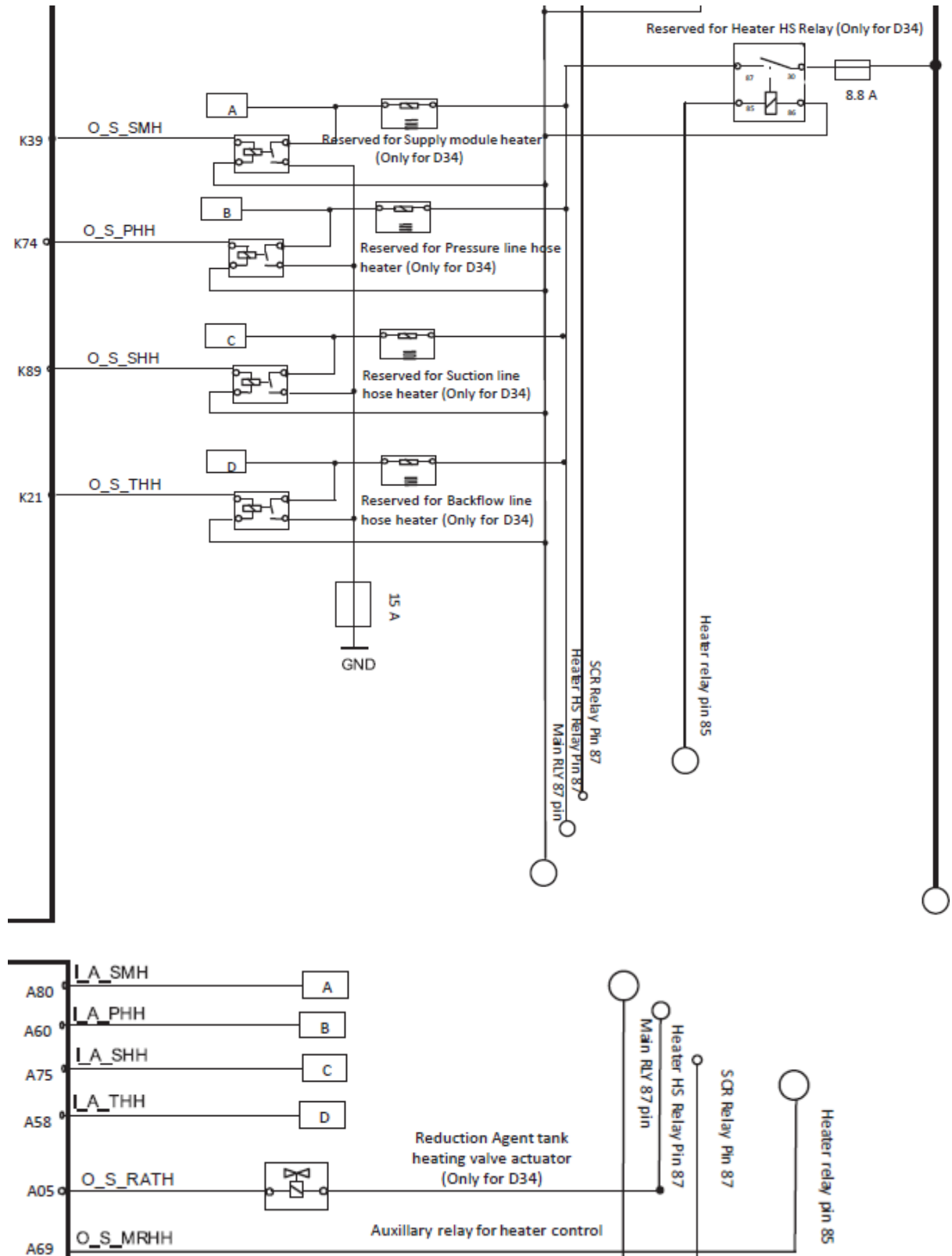
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E003363-03 | 1. Electrical problem (DEF Tank heating coolant valve connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Tank heating coolant valve) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| No. | ECU Pin | Description (DEF Supply module) |
|-----|---------|---|
| 1 | A05 | DEF Tank heating coolant valve control output |

2) Component Location

The DEF Tank heating coolant valve is dependent on machine application.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Tank heating coolant valve output is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20B4 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank heating coolant valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Main heater relay and fuse. Relay or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Tank heating coolant valve DEF Tank heating coolant valve problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P20B3 | DEF Tank heating coolant valve output Short circuit to ground Fault |

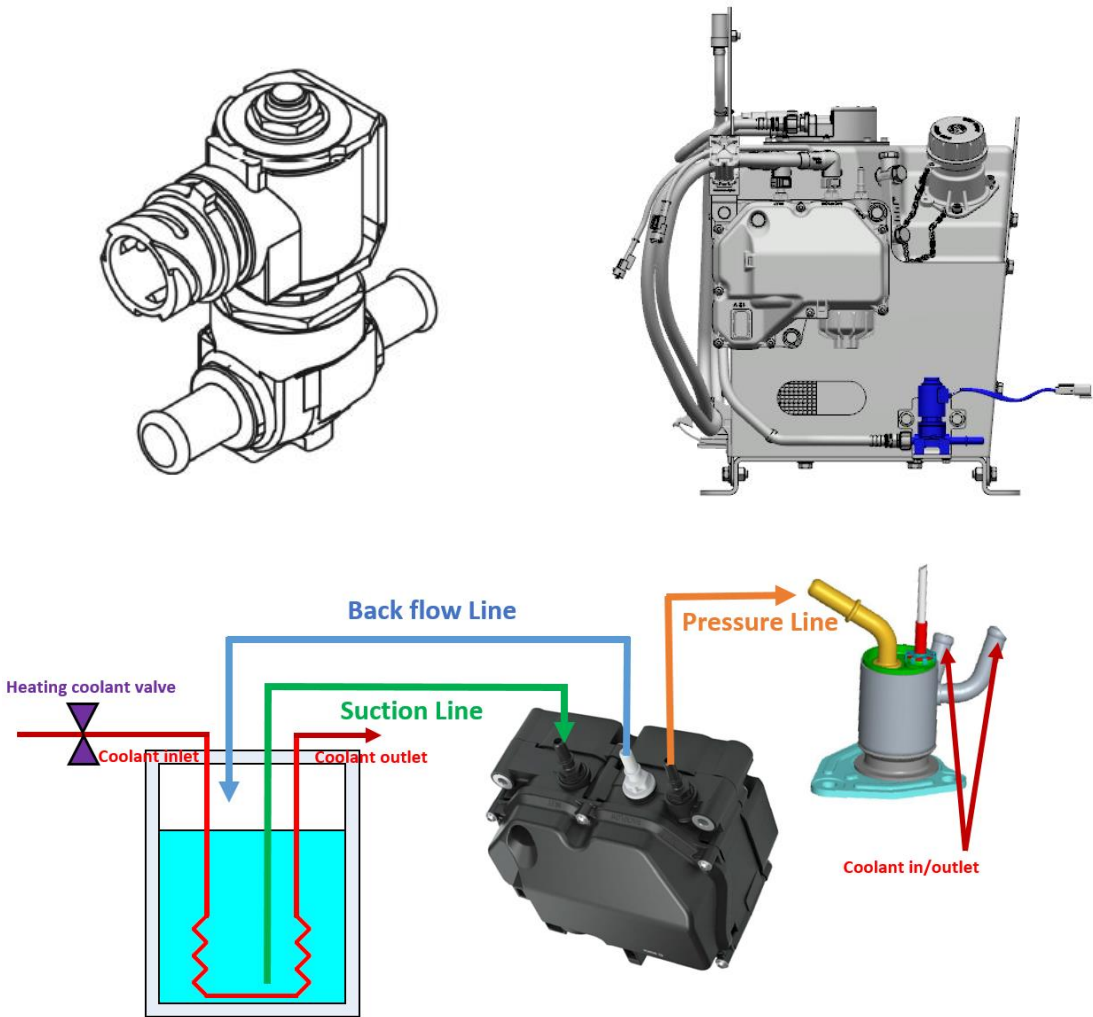
1) Overview

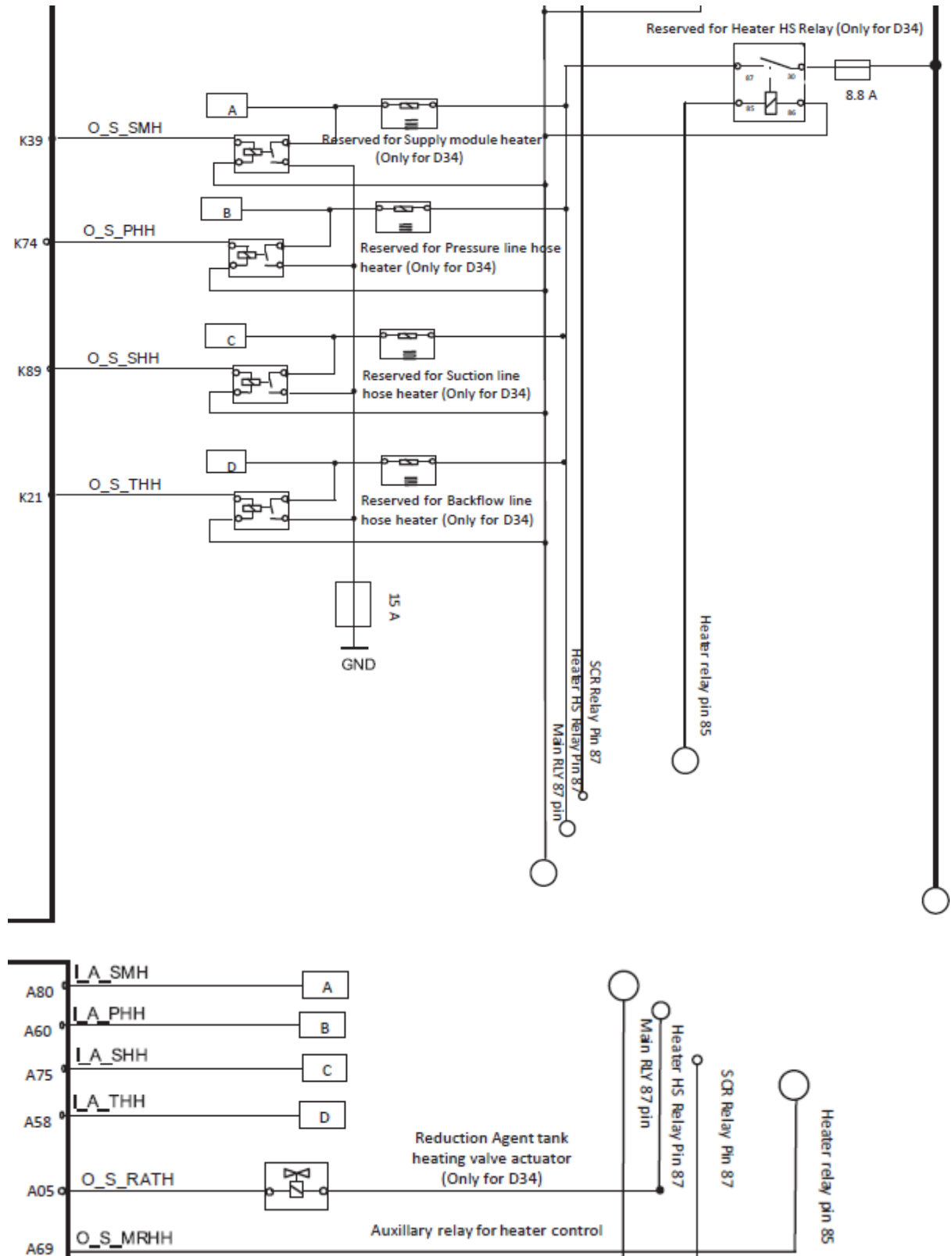
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|--------------------------------------|
| E003363-04 | 1. Electrical problem (DEF Tank heating coolant valve connector) 2. Electrical problem (Heater relay, Wiring harness related DEF Tank heating coolant valve) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| No. | ECU Pin | Description (DEF Supply module) |
|-----|---------|---|
| 1 | A05 | DEF Tank heating coolant valve control output |

2) Component Location

The DEF Tank heating coolant valve is dependent on machine application.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Tank heating coolant valve output is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF heating control is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20B3 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank heating coolant valve connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check DEF Main heater relay and fuse. Relay or fuse problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Tank heating coolant valve DEF Tank heating coolant valve problem? | | Problem solved | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P108A | DEF Supply Pump Motor Speed Deviation Fault |

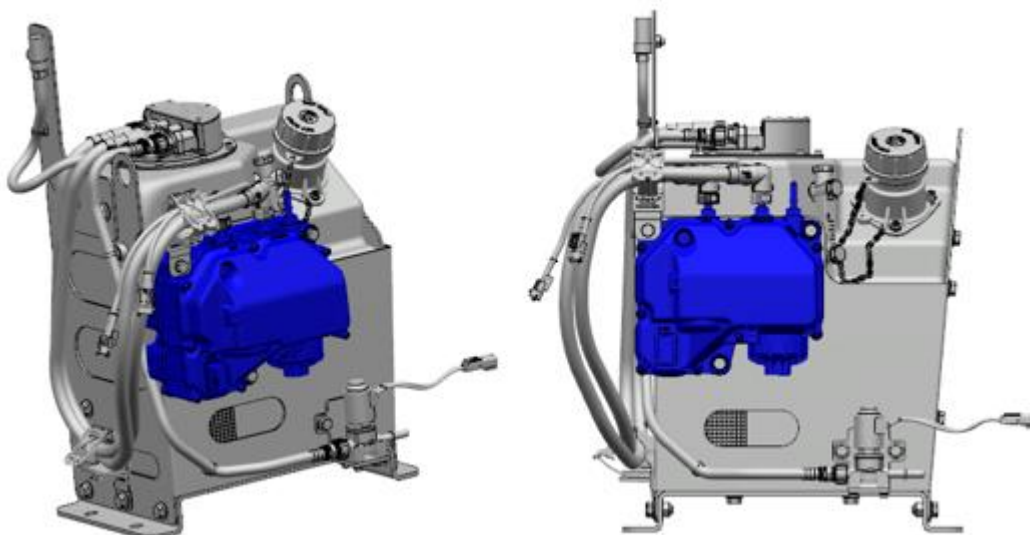
1) Overview

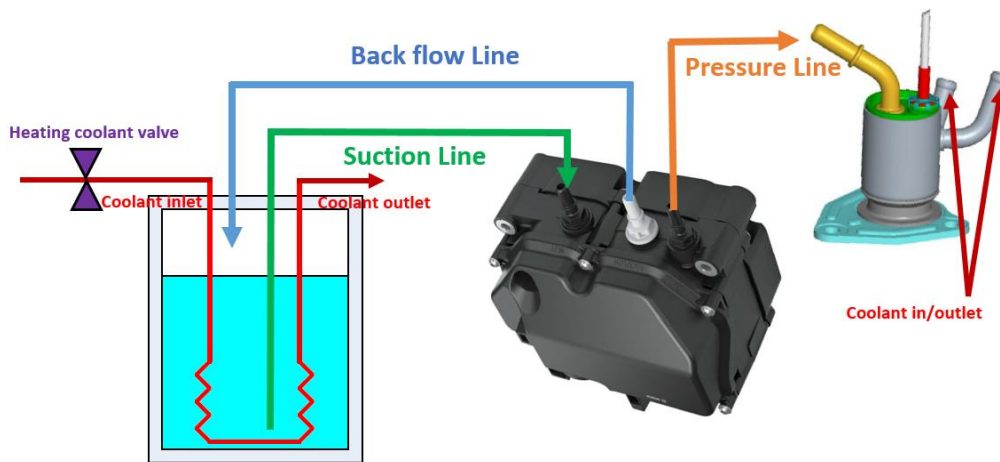
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E004374-08 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| | | | |
|--|-----|---------|--|
| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump motor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The fault is detected when the actual pump motor speed deviates from the set pump motor speed for more than five seconds. The pump speed is calculated by internal electronics.

5) Condition for Clearing the Fault Code

The DEF pump speed deviation is within normal operation range.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P108A is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P108B | DEF Supply Pump Motor Speed Deviation Permanent Fault |

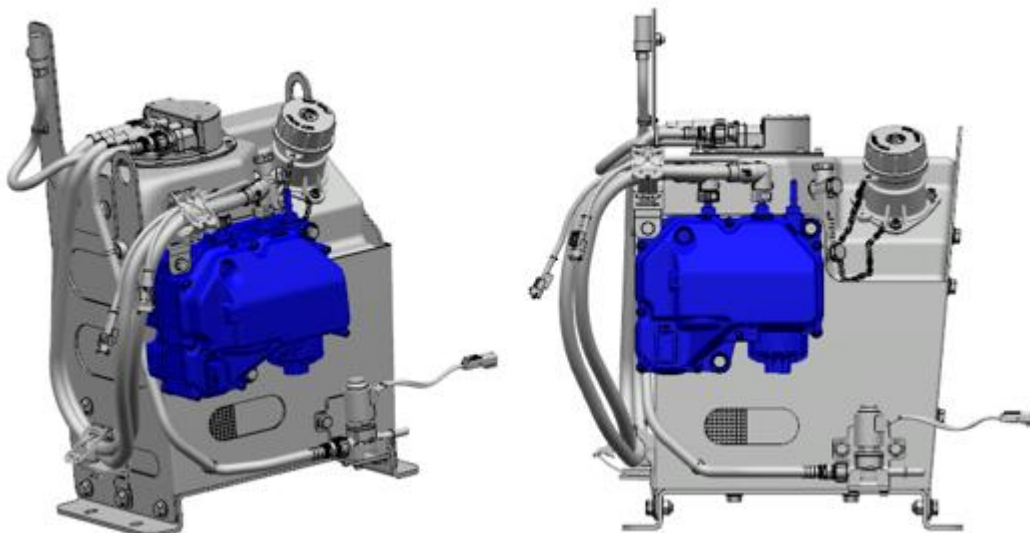
1) Overview

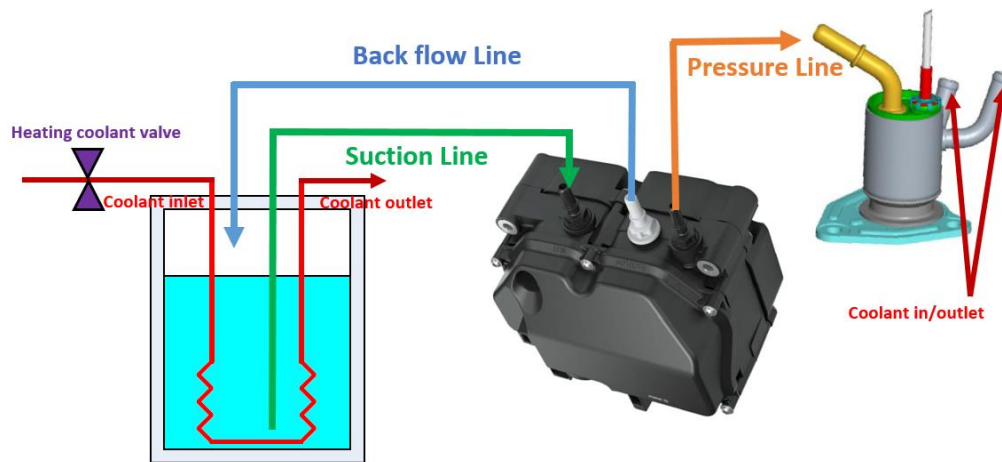
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E004374-09 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump motor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The fault is detected when the actual pump motor speed deviates from the set pump motor speed for more than five seconds. The pump speed is calculated by internal electronics.

If the DEF Supply Pump Motor Speed Deviation Fault has been occurred more than 5 times in the same driving cycle, it is considered to permanent fault.

5) Condition for Clearing the Fault Code

The DEF pump speed deviation is within normal operation range.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P108B is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P108C | DEF Supply Pump Motor No activation Fault |

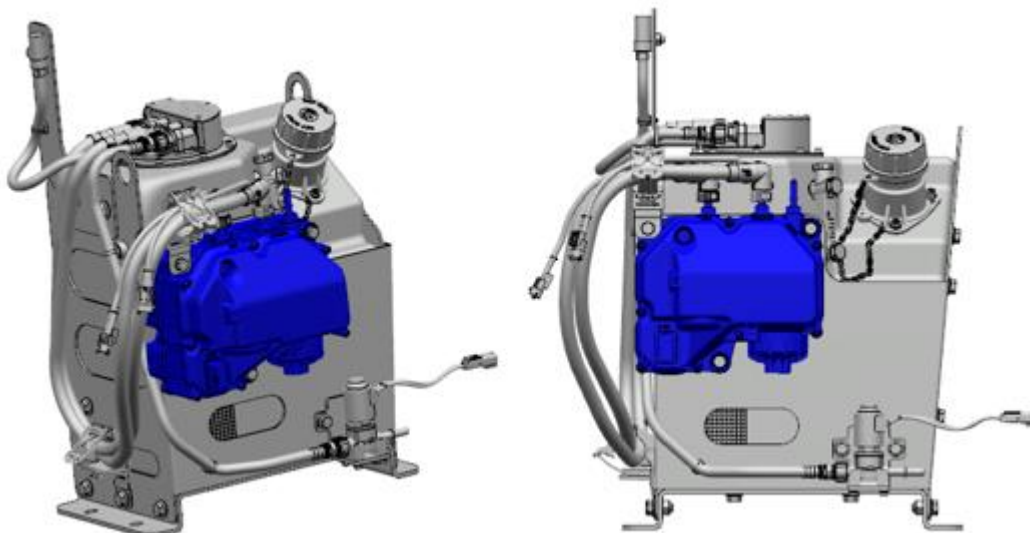
1) Overview

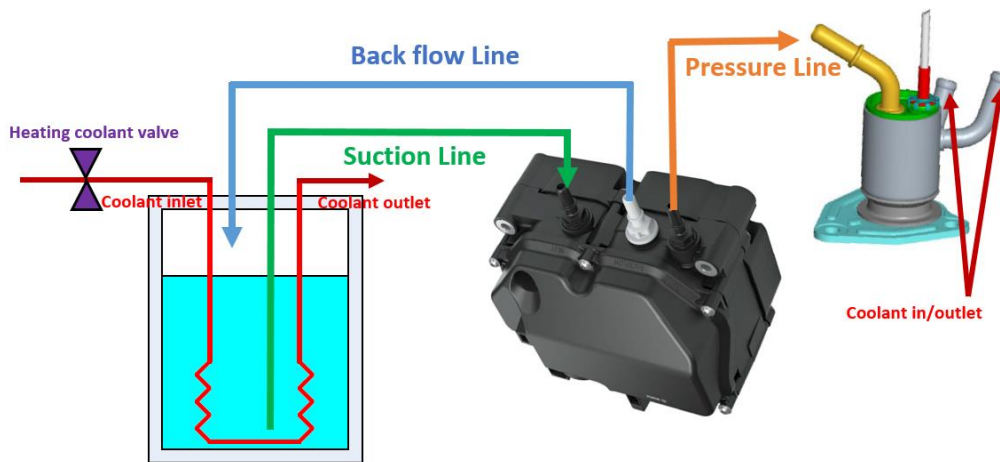
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E004374-12 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump motor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply pump motor does not switch to pump actuation mode.

5) Condition for Clearing the Fault Code

The DEF Supply pump motor is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|--|------------------|
| 1 | P108C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check the other faults related DEF Supply module and fix it in advance. | | Fix the fault based on its troubleshooting guide | Step 4 |
| 4 | Check Supply module connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check ECU connection Connection problem? | | Do necessary repair | Step 6 |
| 6 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P208A | DEF Supply Pump Motor Signal Open circuit Fault |

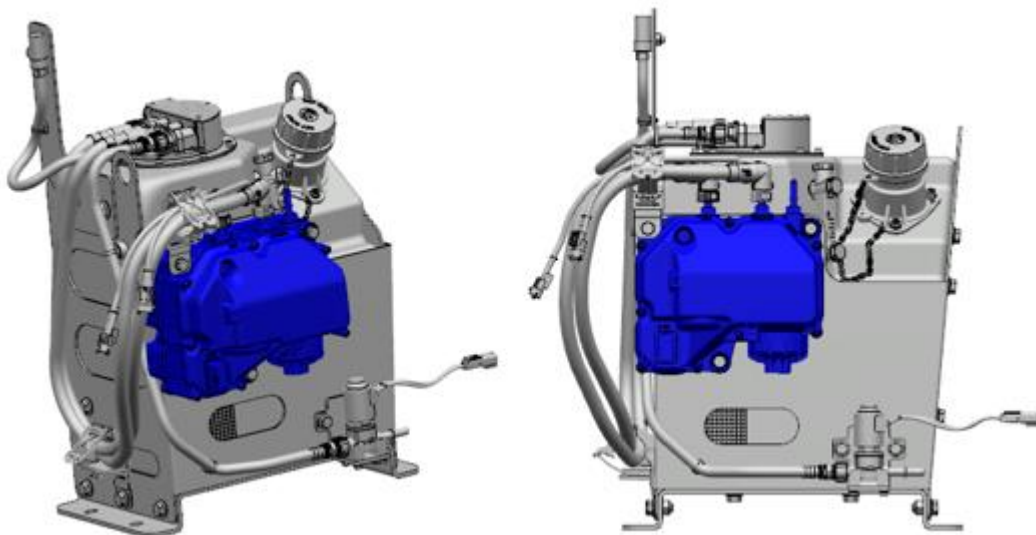
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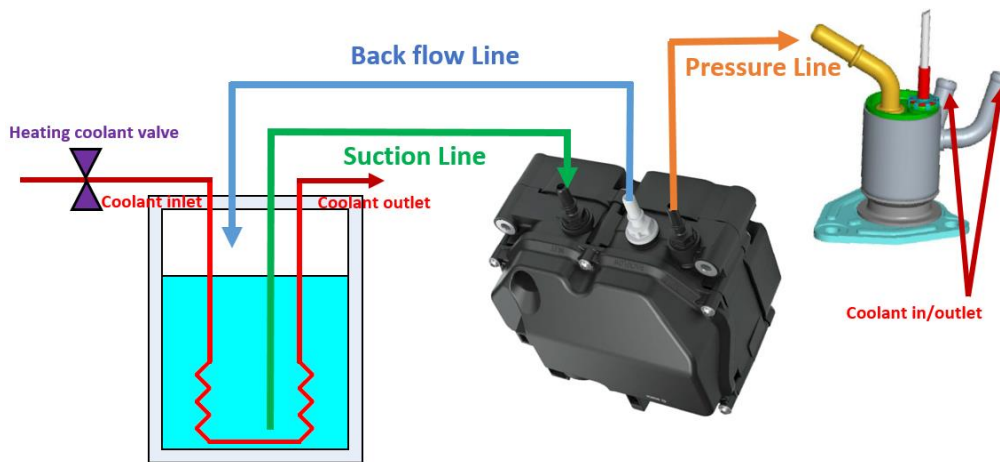
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E004374-05 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| | | | |
|--|-----|---------|--|
| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump motor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply pump motor signal is opened.

5) Condition for Clearing the Fault Code

The DEF Supply pump motor is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P208A is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P208B | DEF Supply Pump Motor Signal Over temperature Fault |

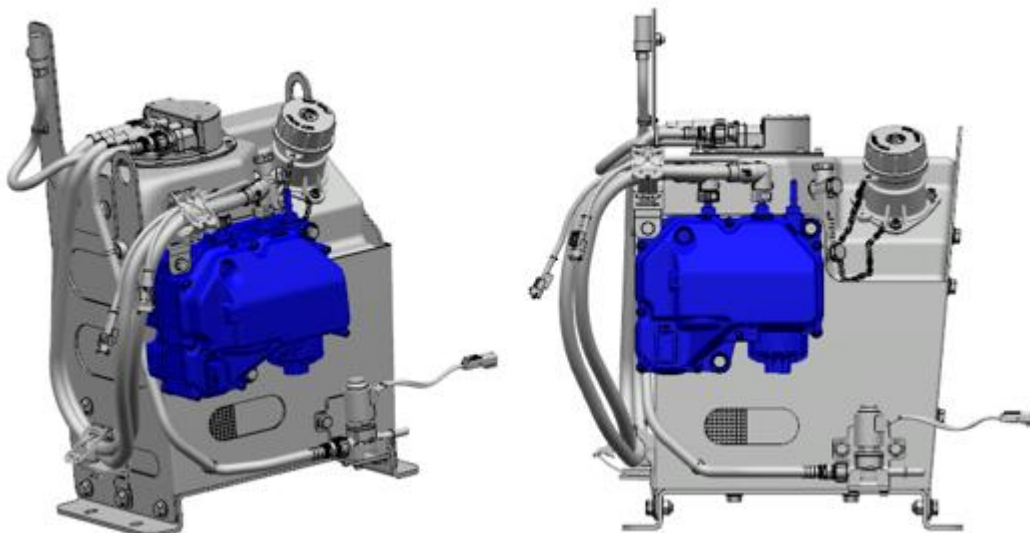
1) Overview

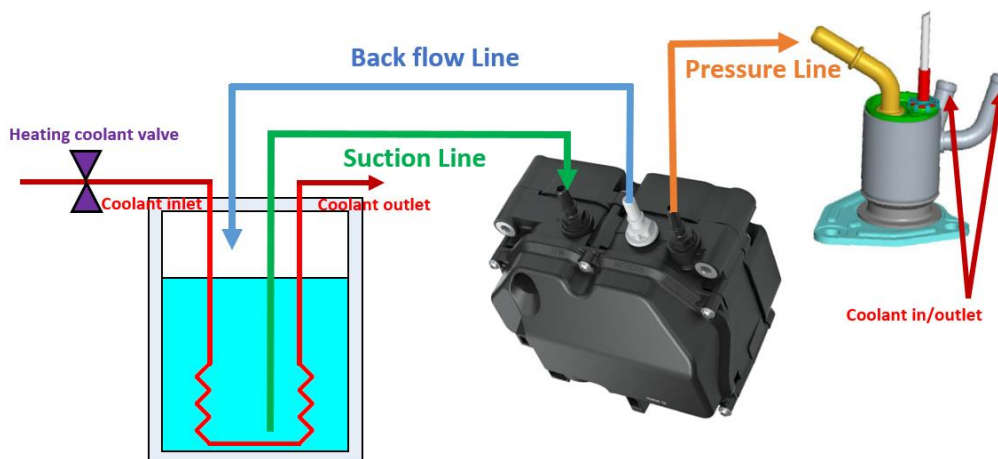
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E004374-07 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump motor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply pump motor signal is over temperature.

5) Condition for Clearing the Fault Code

The DEF Supply pump motor is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P208B is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P208D | DEF Supply Pump Motor Signal Short circuit to battery Fault |

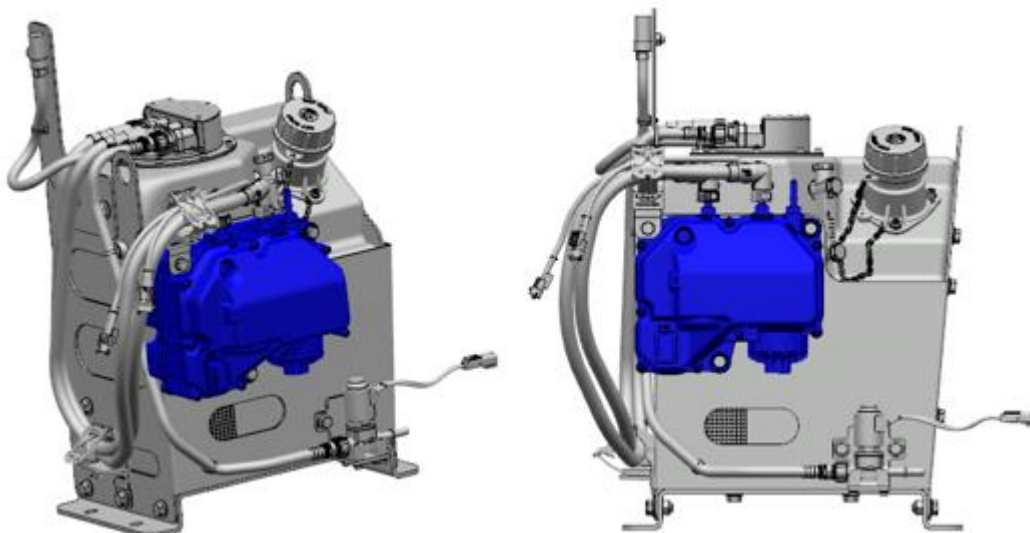
1) Overview

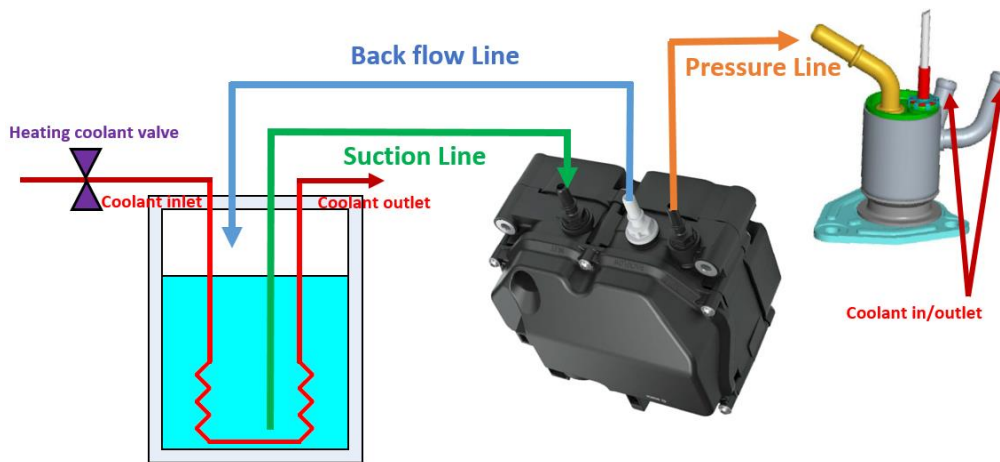
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E004374-03 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump motor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply pump motor signal is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF Supply pump motor is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P208D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P208C | DEF Supply Pump Motor Signal Short circuit to ground Fault |

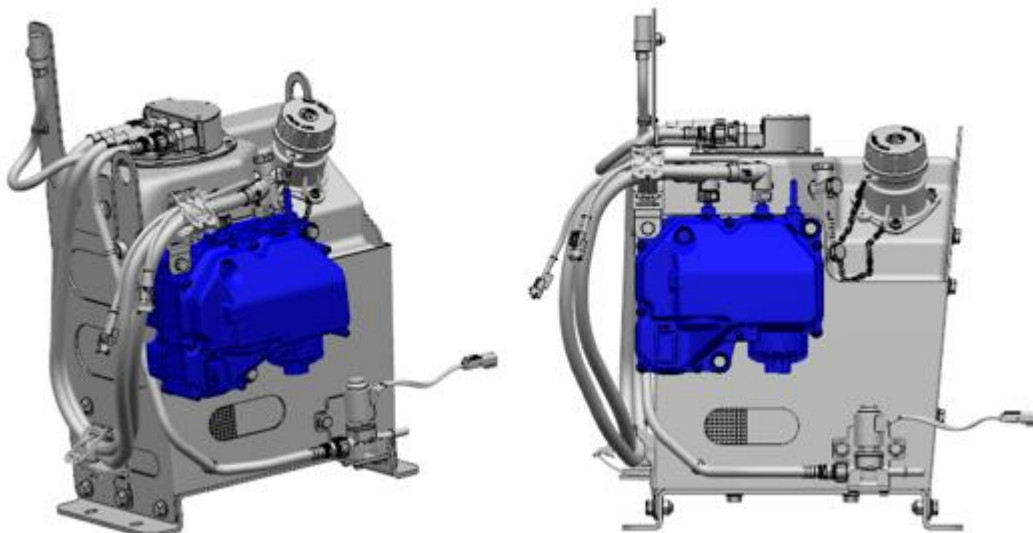
1) Overview

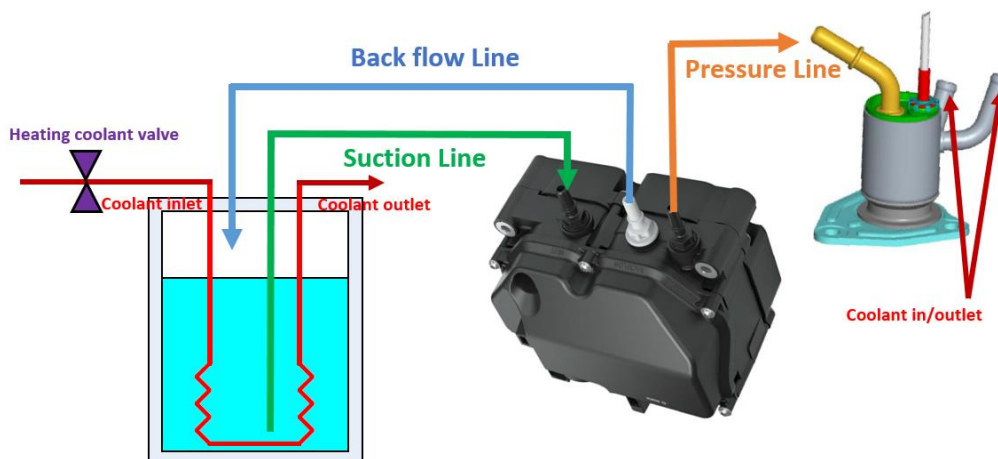
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E004374-04 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump motor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply pump motor signal is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF Supply pump motor is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P208C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P304D | DEF Supply Pump pressure sensor High plausibility fault |

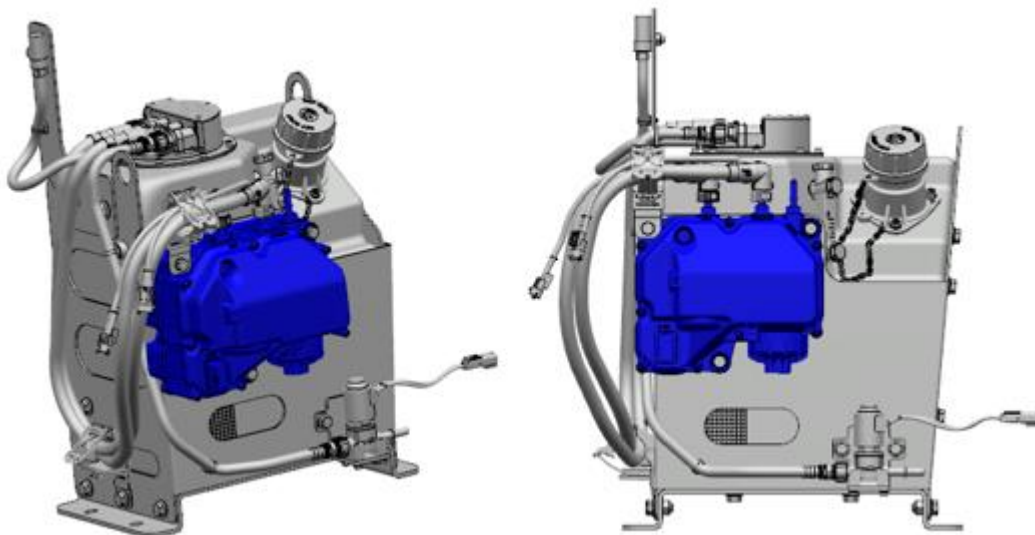
1) Overview

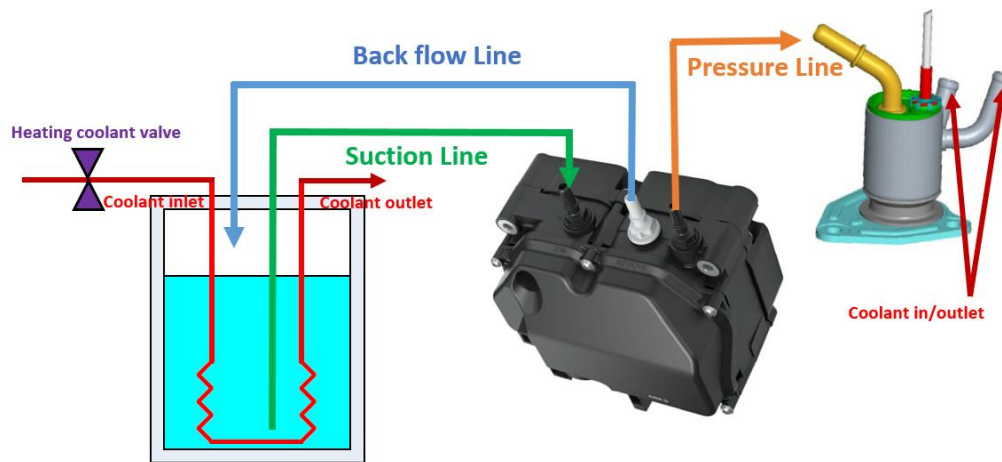
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E006875-16 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump pressure sensor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on, and DEF Supply module at no pressure control status.

4) Condition for Setting the Fault Code

The difference between DEF Supply pump pressure and atmospheric pressure is higher than threshold.
(DEF Supply pump pressure – Atmospheric pressure > 0.5bar)

This fault is used to determine the drift(offset) of DEF Tank temperature sensor.

5) Condition for Clearing the Fault Code

The difference between DEF Supply pump pressure and atmospheric pressure is within allowable guideline.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P304D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P304C | DEF Supply Pump pressure sensor Low plausibility fault |

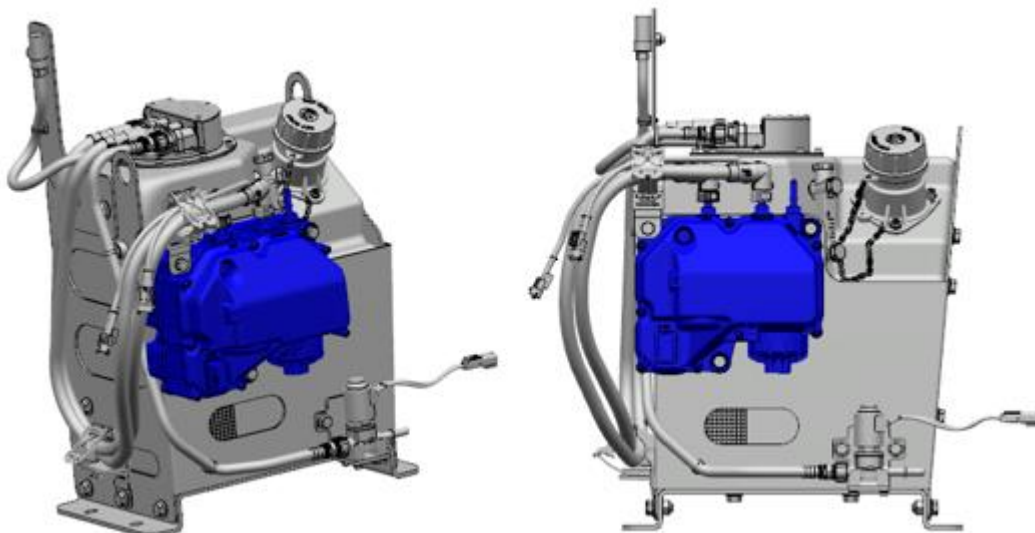
1) Overview

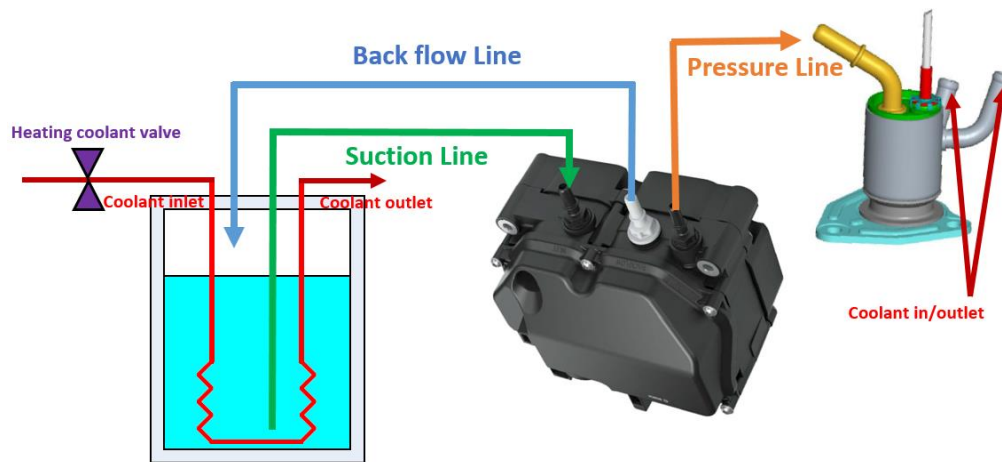
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E006875-18 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump pressure sensor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on, and DEF Supply module at no pressure control status.

4) Condition for Setting the Fault Code

The difference between DEF Supply pump pressure and atmospheric pressure is lower than threshold.
(DEF Supply pump pressure – Atmospheric pressure < -0.5bar)

This fault is used to determine the drift(offset) of DEF Tank temperature sensor.

5) Condition for Clearing the Fault Code

The difference between DEF Supply pump pressure and atmospheric pressure is within allowable guideline.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P304C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P204D | DEF Supply Pump pressure sensor High fault |

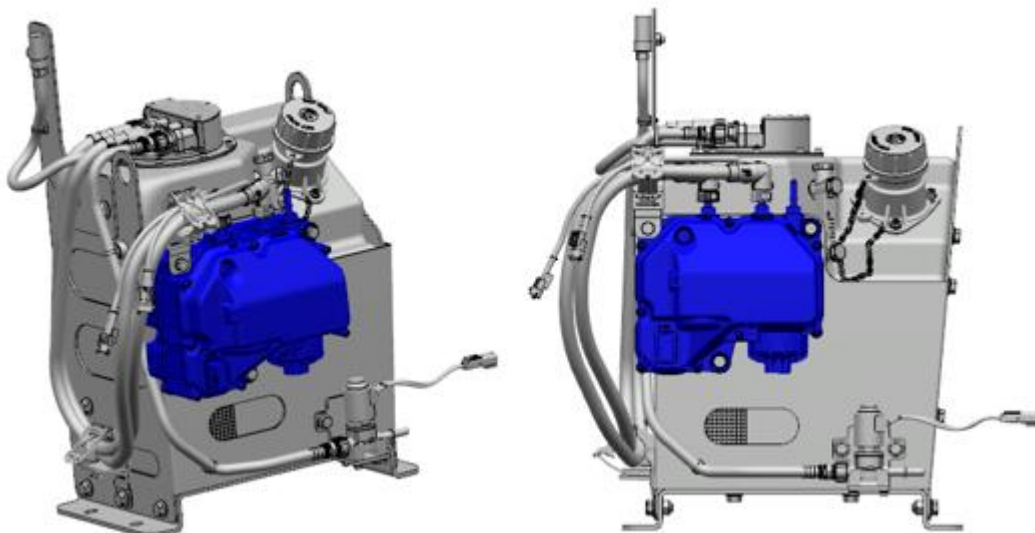
1) Overview

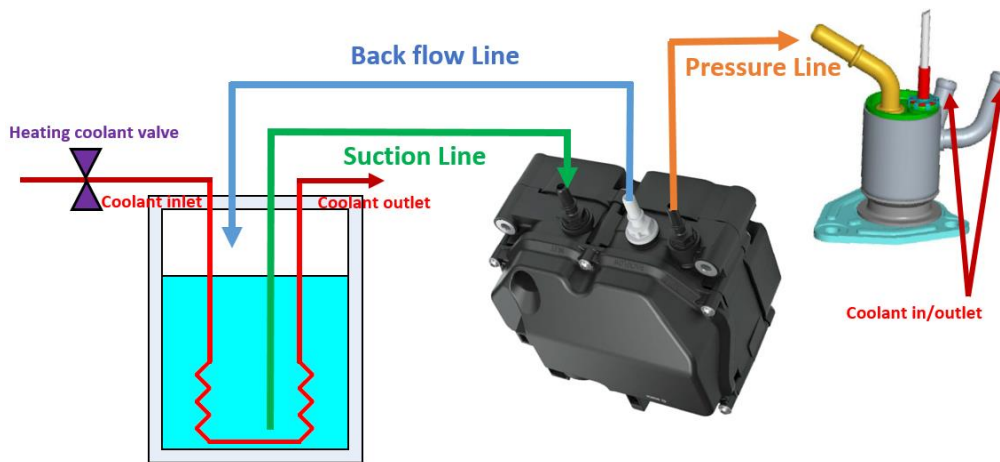
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E006875-03 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump pressure sensor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply pump pressure signal is more than maximum threshold (4.922V)

5) Condition for Clearing the Fault Code

The DEF Supply pump pressure signal is within normal operation range.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P204D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P204C | DEF Supply Pump pressure sensor Low fault |

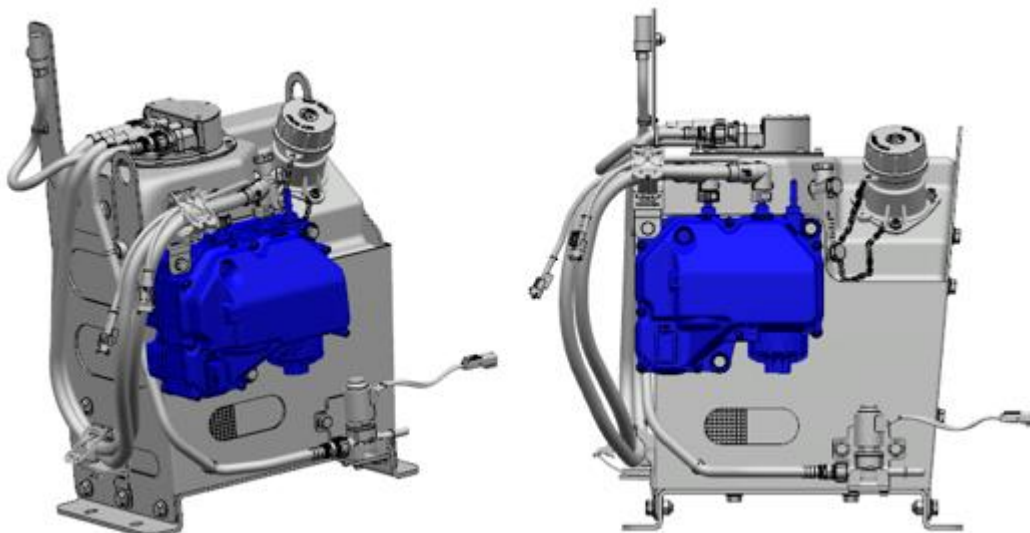
1) Overview

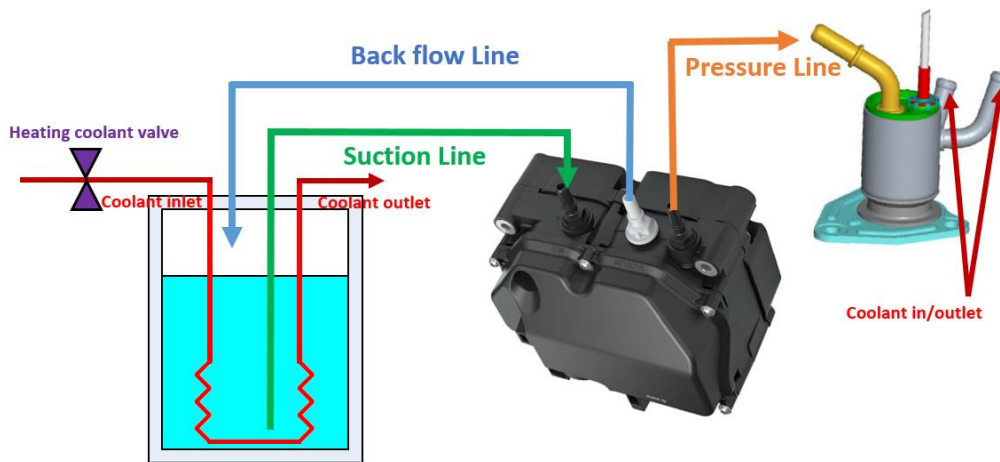
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---|
| E006875-04 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group2 (Dosing interrupt) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Supply pump pressure sensor is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Supply pump pressure signal is less than minimum threshold (0.258V)

5) Condition for Clearing the Fault Code

The DEF Supply pump pressure signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P204C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|----------------------------|
| P106D | DEF Quality Too High fault |

1) Overview

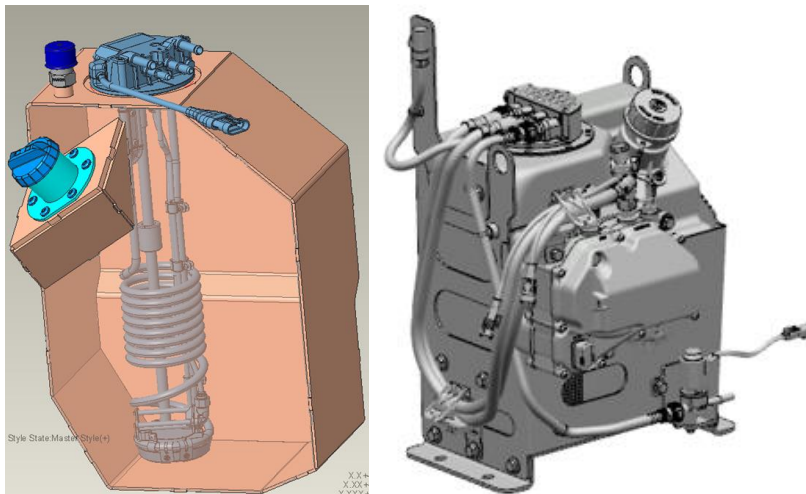
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|---------------------------------|
| E003516-00 | 1. Detecting problem (The signal is distorted by air bubble or Foreign material) 2. Electrical problem (DEF quality sensor, Wiring harness in the DEF module) 3. Bad DEF (But high DEF quality is very unlikely case) 4. Electrical problem (CAN wiring harness-insulation, resistance) | Inducement Group4 (DEF Quality) |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The DEF quality signal exceeds the maximum threshold. (Normally 45%, dependent on Emission)

* This fault can also occur if there is air bubble and foreign material around the DEF quality sensor.

5) Condition for Clearing the Fault Code

The DEF quality signal is within normal operation range.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | P106D is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check DEF quality using by densitometer or Service tool * Variable 1) DEF quality (SCR_rSensULiq) DEF quality problem? | About 32.5% | Change DEF | Step 6 |
| 6 | After change DEF, running engine more than 10 minutes. Is fault code cleared? * This fault can also occur if there is air bubble and foreign material around the DEF quality sensor. | | Problem solved | Step 7 |
| 7 | Replace with another normal DEF Tank module DEF Tank module problem? | | Change DEF Tank module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---------------------------|
| P106C | DEF Quality Too Low fault |

1) Overview

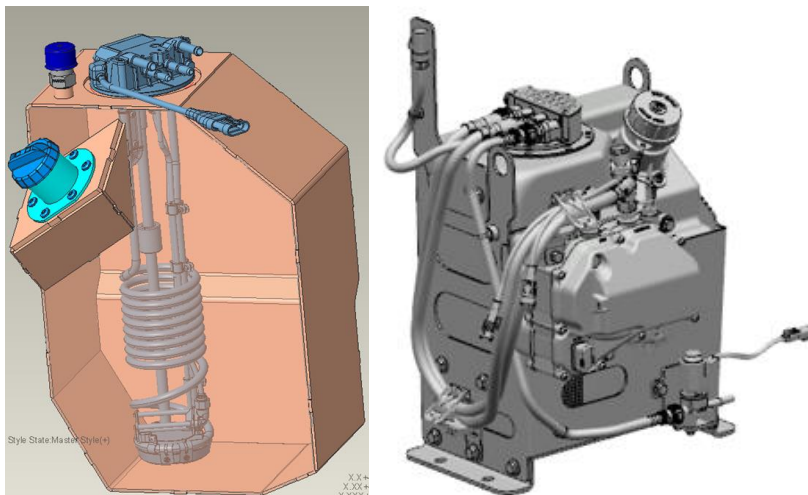
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|---------------------------------|
| E003516-01 | 1. Detecting problem (The signal is distorted by air bubble or Foreign material) 2. Electrical problem (DEF quality sensor, Wiring harness in the DEF module) 3. Bad DEF (Customer dilutes it for reducing the DEF consumption rate) 4. Electrical problem (CAN wiring harness-insulation, resistance) | Inducement Group4 (DEF Quality) |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The DEF quality signal is lower the minimum threshold. (Normally 24%)

* This fault can also occur if there is air bubble and foreign material around the DEF quality sensor.

5) Condition for Clearing the Fault Code

The DEF quality signal is within normal operation range.


6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | P106C is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Check DEF quality using by densitometer or Service tool * Variable 1) DEF quality (SCR_rSensULiq) DEF quality problem? | About 32.5% | Change DEF | Step 6 |
| 6 | After change DEF, running engine more than 10 minutes. Is fault code cleared? * This fault can also occur if there is air bubble and foreign material around the DEF quality sensor. | | Problem solved | Step 7 |
| 7 | Replace with another normal DEF Tank module DEF Tank module problem? | | Change DEF Tank module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|---|
| P20A0 | DEF Reverting valve output Open circuit Fault |

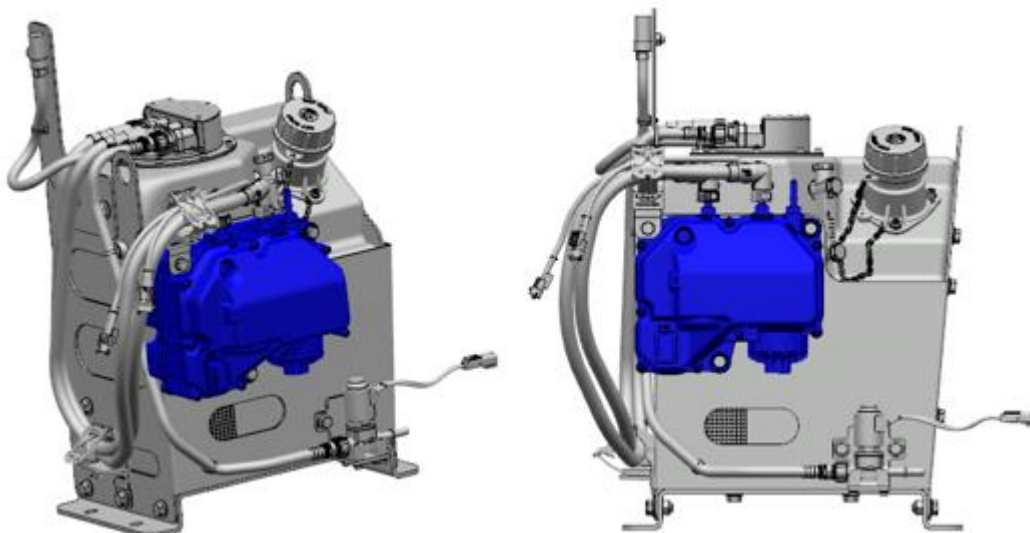
1) Overview

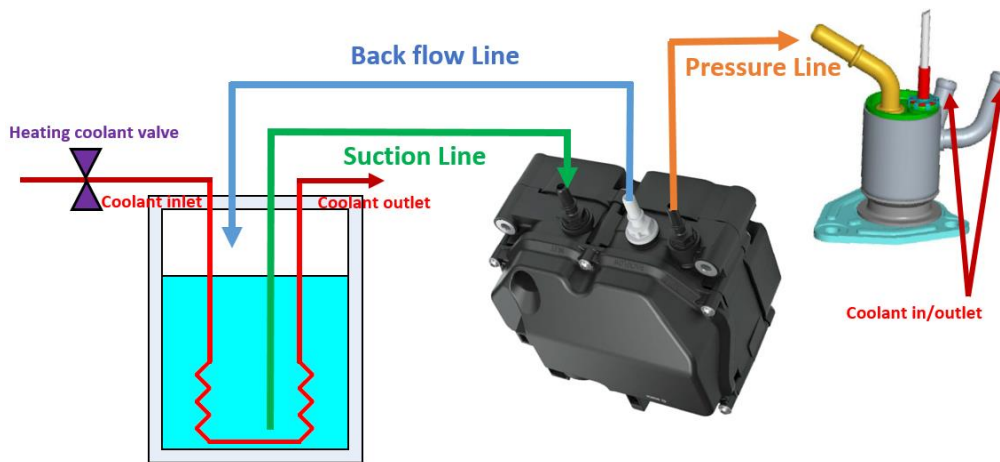
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E005436-05 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| | | | |
|--|-----|---------|--|
| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Reverting valve signal is opened.

5) Condition for Clearing the Fault Code

The DEF Reverting valve is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20A0 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P20A1 | DEF Reverting valve output Over temperature Fault |

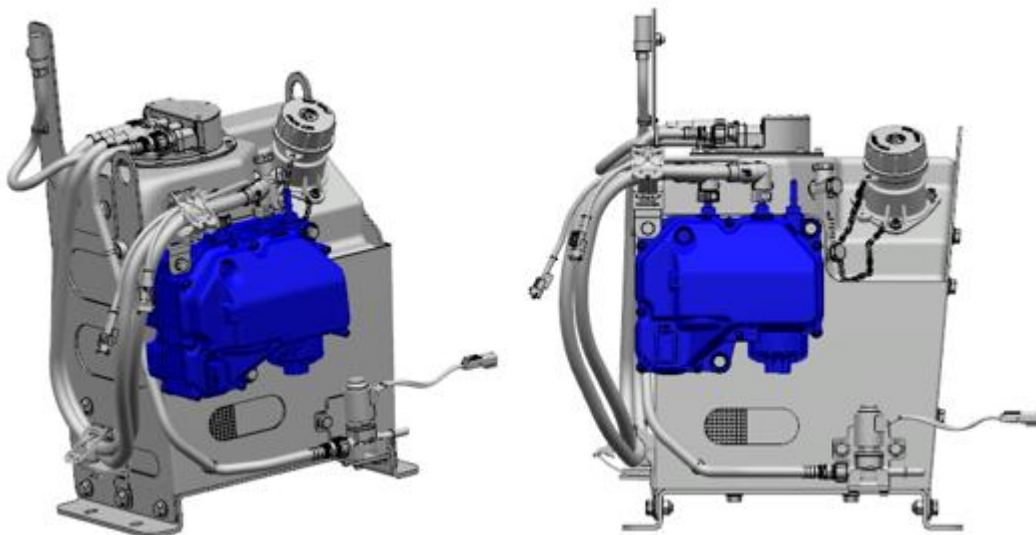
1) Overview

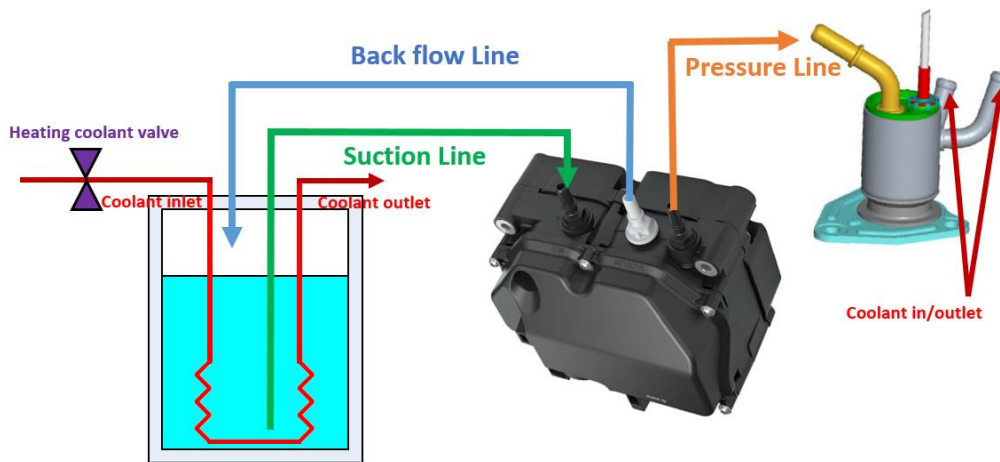
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E005436-07 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| | | | |
|--|-----|---------|--|
| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Reverting valve signal is over temperature.

5) Condition for Clearing the Fault Code

The DEF Reverting valve is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20A1 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P20A3 | DEF Reverting valve output Short circuit to battery Fault |

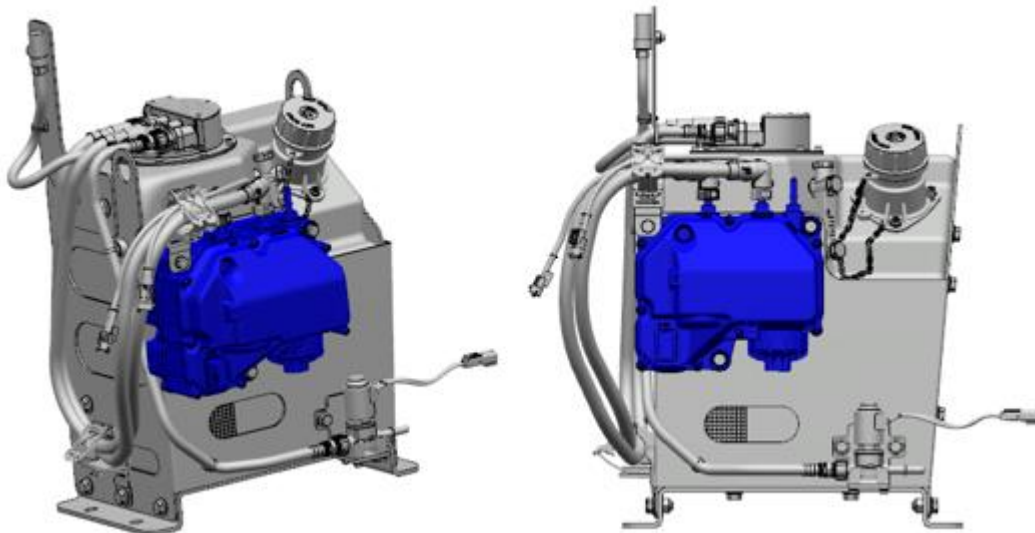
1) Overview

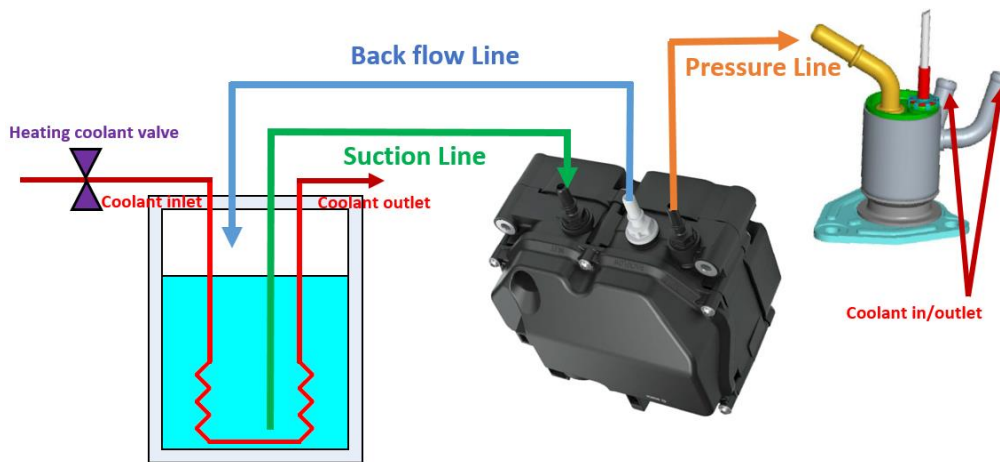
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E005436-03 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| | | | |
|--|-----|---------|--|
| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Reverting valve signal is shorted to battery.

5) Condition for Clearing the Fault Code

The DEF Reverting valve is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20A3 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |


※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|--|
| P20A2 | DEF Reverting valve output Short circuit to ground Fault |

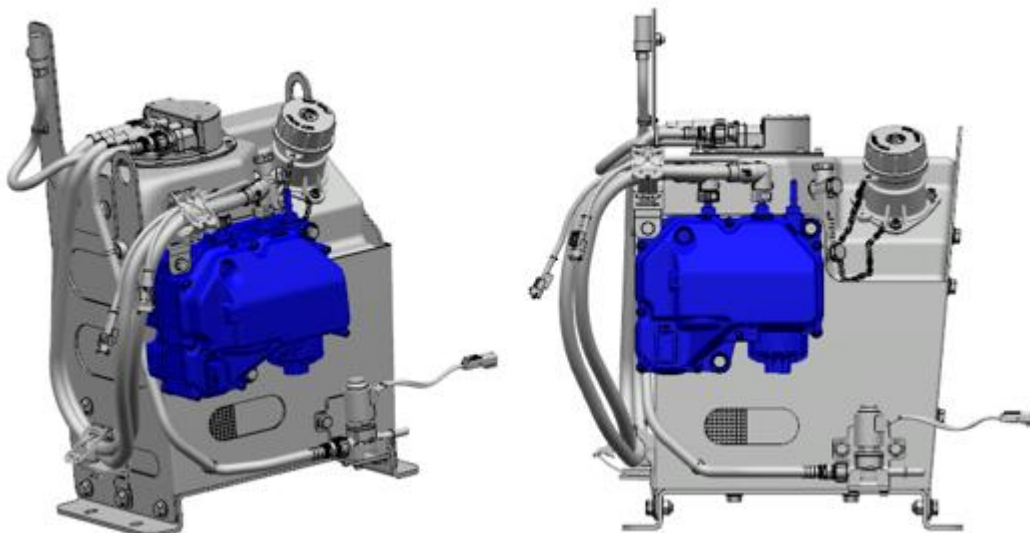
1) Overview

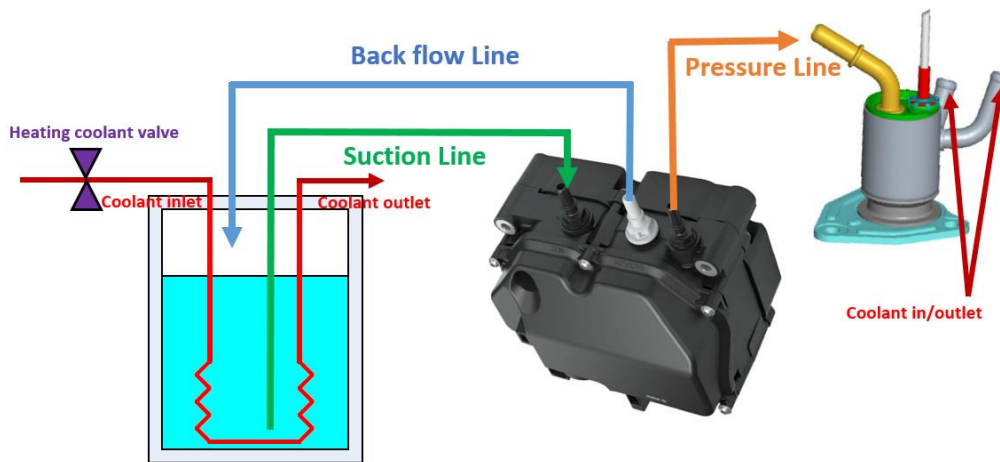
| "E" SPN-FMI | REASON | EFFECT |
|-------------|--|-------------------------------|
| E005436-04 | 1. Electrical problem (Supply module connector) 2. Electrical problem (Wiring harness from ECU to Supply module, Faulty Supply module) 3. Electrical problem (ECU connector, Faulty ECU) | Inducement Group5 (Tampering) |

| DEF Supply module side  | No. | ECU Pin | Description (DEF Supply module) |
|--|-----|---------|--|
| | 1 | - | - |
| | 2 | A15 | DEF pressure Sensor Supply (5V) |
| | 3 | A54 | DEF pressure sensor signal |
| | 4 | A53 | DEF pressure sensor ground |
| | 5 | - | DEF Heater Negative (After DEF Heater relay : 87) |
| | 6 | A80 | DEF Supply module heater feedback |
| | 7 | - | - |
| | 8 | A55 | DEF Pump motor ground |
| | 9 | - | DEF Pump motor supply (After SCR main relay : 87) |
| | 10 | A29/A92 | DEF Pump motor signal input/output (DEF Pump motor signal is basically used for motor PWM control and it could be used for DEF supply module temperature signal before DEF pressure control.) |
| | 11 | - | DEF Reverting valve supply (After SCR main relay : 87) |
| | 12 | A91 | DEF Reverting valve ground |

2) Component Location

The DEF Reverting valve is located inside the DEF supply module.





3) Condition for Running Diagnostic

Key on or Engine running or Key off(ECU on)

4) Condition for Setting the Fault Code

The DEF Reverting valve signal is shorted to ground.

5) Condition for Clearing the Fault Code

The DEF Reverting valve is normally operated.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|---------------------|------------------|
| 1 | P20A2 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check Supply module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Supply module DEF Supply module problem? | | Problem solved | Contact Helpdesk |

※ SCR related Input/Output function test by service tool

1. Actuator test of urea dosing valve
2. Actuator test of urea pump motor
3. Actuator test of reverting valve
4. Signal test of SM(Supply Module) heater
5. Signal test of pressure line heater
6. Signal test of suction line heater
7. Signal test of backflow line heater
8. Signal test of coolant valve (DEF tank heating coolant passage control valve)

| Fault Code | Fault Name |
|-----------------------|---|
| P1045 | DEF Tank Temperature sensor High plausibility fault |

1) Overview

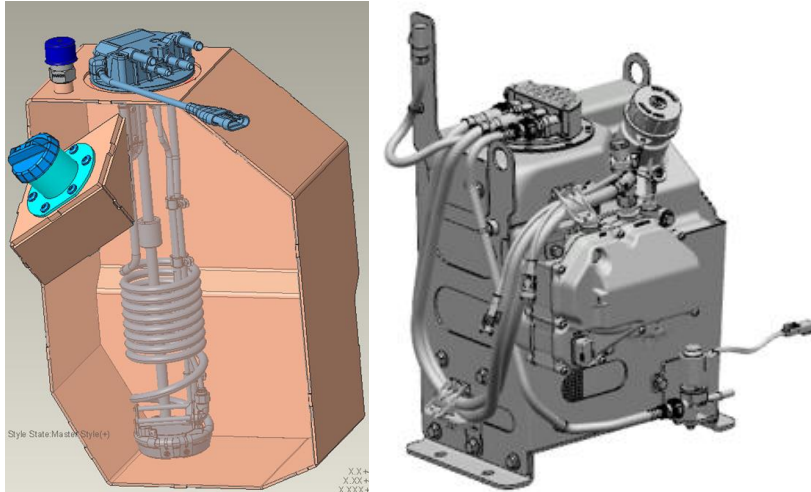
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E003031-16 | 1. Electrical problem (DEF temperature sensor, Wiring harness in the DEF module) 2. Electrical problem (CAN wiring harness-insulation, Resistance) | CE Lamp ON |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The difference between DEF Tank temperature and Environment temperature is higher than threshold. (DEF Tank temperature – Environment temperature > 35degC)
This fault is used to determine the drift(offset) of DEF Tank temperature sensor.

5) Condition for Clearing the Fault Code

The difference between DEF Tank temperature and Environment temperature is within allowable

guideline.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | P1045 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Tank module DEF Tank module problem? | | Change DEF Tank module | Contact Helpdesk |

| Fault Code | Fault Name |
|-----------------------|--|
| P1044 | DEF Tank Temperature sensor Low plausibility fault |

1) Overview

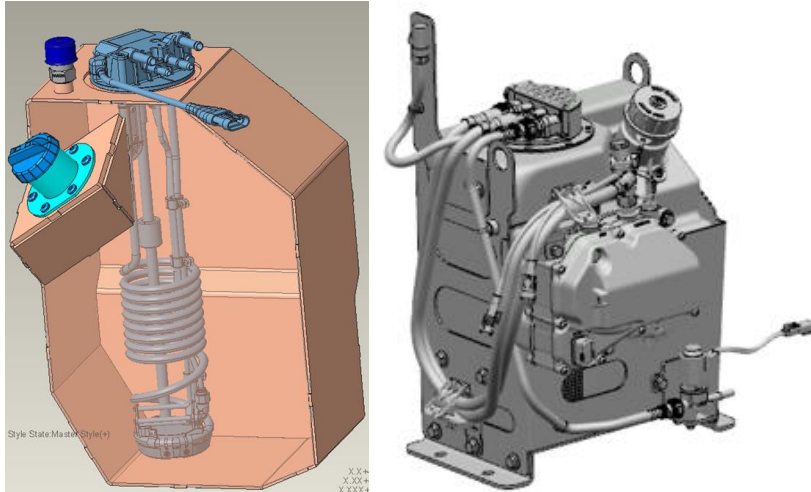
| "E" SPN-FMI | REASON | EFFECT |
|-------------|---|------------|
| E003031-18 | 1. Electrical problem (DEF temperature sensor, Wiring harness in the DEF module) 2. Electrical problem (CAN wiring harness-insulation, Resistance) | CE Lamp ON |

The pin definition is dependent on the DEF tank type.

| No | Description |
|----|--------------|
| 1 | Battery +12V |
| 2 | Ground |
| 3 | CAN Low |
| 4 | CAN High |

2) Component Location

DEF tank location and connector is dependent on machine application.



3) Condition for Running Diagnostic

Continuously checked in every sample time when there is no bus-off and no timeout error

4) Condition for Setting the Fault Code

The difference between DEF Tank temperature and Environment temperature is lower than threshold. (DEF Tank temperature – Environment temperature < -30degC)
This fault is used to determine the drift(offset) of DEF Tank temperature sensor.

5) Condition for Clearing the Fault Code

The difference between DEF Tank temperature and Environment temperature is within allowable

guideline.

6) Check List

| Step | Inspection | Standard Value | YES | NO |
|------|---|----------------|------------------------|------------------|
| 1 | P1044 is detected on service tool? | | Step 2 | |
| 2 | Let the machine be in safety area, and key OFF | | Step 3 | |
| 3 | Check DEF Tank module connection Connection problem? | | Do necessary repair | Step 4 |
| 4 | Check ECU connection Connection problem? | | Do necessary repair | Step 5 |
| 5 | Replace with another normal DEF Tank module DEF Tank module problem? | | Change DEF Tank module | Contact Helpdesk |